MITSUBISHI ELECTRIC

General-Purpose AC Servo

MELSERVO-J3 Series

Built-in Positioning Function
MODEL
MR-J3-□T
SERVO AMPLIFIER
INSTRUCTION MANUAL
(CC-Link)

B

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ WARNING
・ Before wiring or inspection, switch power off and wait for more than 15 minutes. Then, confirm the voltage is safe with voltage tester. Otherwise, you may get an electric shock. ・ Connect the servo amplifier and servo motor to ground. ・ Any person who is involved in wiring and inspection should be fully competent to do the work. ・ Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock. ・ Operate the switches with dry hand to prevent an electric shock. ・ The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock. ・ During power-on or operation, do not open the front cover of the servo amplifier. You may get an electric shock. ・ Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock. ・ Except for wiring or periodic inspection, do not remove the front cover even of the servo amplifier if the power is off. The servo amplifier is charged and you may get an electric shock.

2. To prevent fire, note the following:

⚠ CAUTION
・ Do not install the servo amplifier, servo motor and regenerative resistor on or near combustibles. Otherwise a fire may cause. ・ When the servo amplifier has become faulty, switch off the main servo amplifier power side. Continuous flow of a large current may cause a fire. ・ When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

3. To prevent injury, note the follow

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

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

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

| Environment			Conditions	
			Servo amplifier	Servo motor
Ambient temperature	During operation	[℃]	0 to +55 (non-freezing)	0 to +40 (non-freezing)
		[℉]	32 to 131 (non-freezing)	32 to 104 (non-freezing)
	In storage	[℃]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)
		[℉]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)
Ambient humidity	In operation		90%RH or less (non-condensing)	80%RH or less (non-condensing)
	In storage		90%RH or less (non-condensing)	
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt	
Altitude			Max. 1000m (3280 ft) above sea level	
(Note) Vibration	[m/s²]	5.9 or less	HF-MP Series HF-KP Series	X・Y : 49
			HF-SP 52 to 152 HF-SP 51・81 HC-RP Series HC-UP 72・152	X・Y : 24.5
			HF-SP 202・352 HF-SP 121・201 HC-UP 202 to 502	X : 24.5 Y : 49
			HF-SP 301・421 HF- SP 502・702	X : 24.5 Y : 29.5
			HA-LP601 to12K1 HA-LP701M to 15K1M HA-LP502 to 22K2	X : 11.7 Y : 29.4
			HA-LP15K1 to 25K1 HA-LP22K1M	X・Y : 9.8

Note. Except the servo motor with reduction gear.

・Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
・The servo motor with reduction gear must be installed in the specified direction to prevent oil leakage.
・Take safety measures, e.g. provide covers, to prevent accidental access to the rotating parts of the servo motor during operation.
・Never hit the servo motor or shaft, especially when coupling the servo motor to the machine. The encoder may become faulty.
・Do not subject the servo motor shaft to more than the permissible load. Otherwise, the shaft may break.
・When the equipment has been stored for an extended period of time, consult Mitsubishi.

(2) Wiring

⚠ CAUTION

· Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate.

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

· Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.

· Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.
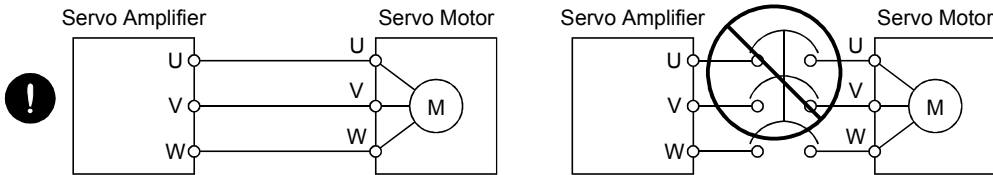
· Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.

· The surge absorbing diode installed on the DC output signal relay of the servo amplifier must be wired in the specified direction. Otherwise, the forced stop (EMG) and other protective circuits may not operate.
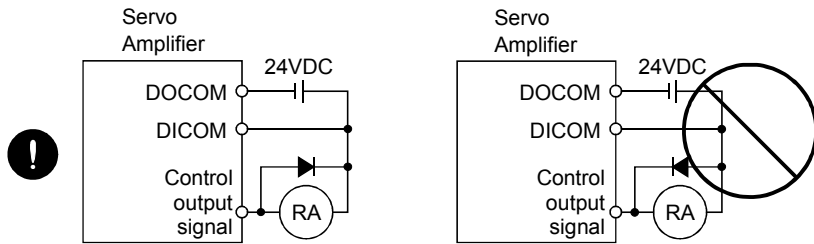
(3) Test run adjustment

⚠ CAUTION

· Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.

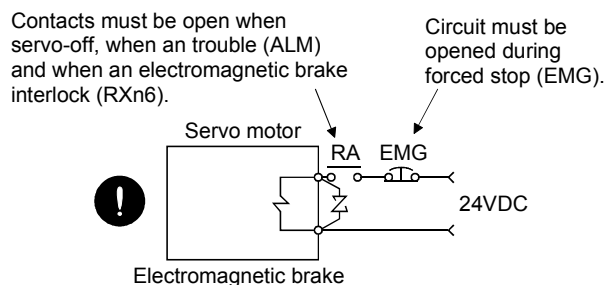· The parameter settings must not be changed excessively. Operation will be insatiable.

(4) Usage

⚠ CAUTION
· Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
· Any person who is involved in disassembly and repair should be fully competent to do the work.
· Before resetting an alarm, make sure that the run signal of the servo amplifier is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
· Do not modify the equipment.
· Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the servo amplifier.
· Burning or breaking a servo amplifier may cause a toxic gas. Do not burn or break a servo amplifier.
· Use the servo amplifier with the specified servo motor.
· The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
· For such reasons as service life and mechanical structure (e.g. where a ballscrew and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

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

Contacts must be open when servo-off, when an trouble (ALM) and when an electromagnetic brake interlock (RXn6).

Circuit must be opened during forced stop (EMG).

Servo motor   RA EMG

24VDC

Electromagnetic brake

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

(6) Maintenance, inspection and parts replacement

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

(7) General instruction

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

● About processing of waste ●

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

⚠ FOR MAXIMUM SAFETY

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

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the servo amplifier and/or converter unit may fail when the EEP-ROM reaches the end of its useful life.
- Write to the EEP-ROM due to parameter setting changes
- Home position setting in the absolute position detection system
- Write to the EEP-ROM due to device changes
- Write to the EEP-ROM due to point table changes

Precautions for Choosing the Products

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

COMPLIANCE WITH EC DIRECTIVES

1. WHAT ARE EC DIRECTIVES?

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

(1) EMC directive

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

(2) Low voltage directive

The low voltage directive applies also to servo units alone. Hence, they are designed to comply with the low voltage directive.
This servo is certified by TUV, third-party assessment organization, to comply with the low voltage directive.

(3) Machine directive

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

2. PRECAUTIONS FOR COMPLIANCE

(1) Servo amplifiers and servo motors used
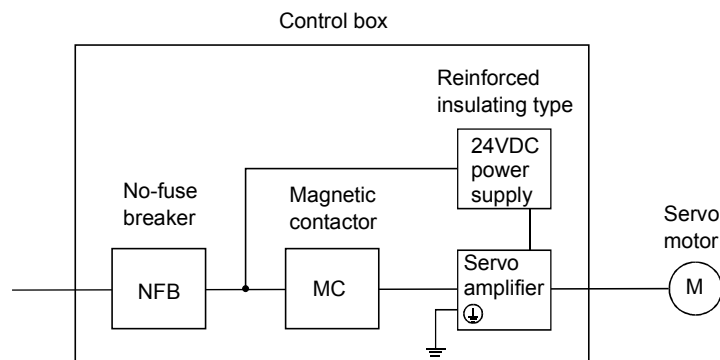
Use the servo amplifiers and servo motors which comply with the standard model.

Servo amplifier   : MR-J3-10T to MR-J3-22KT
                     MR-J3-10T1 to MR-J3-40T1
Servo motor   : HF-MP□
                     HF-KP□
                     HF-SP□
                     HC-RP□
                     HC-UP□
                     HC-LP□
                     HA-LP□

(2) Configuration

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

(3) Environment

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

(4) Power supply

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

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

(5) Grounding

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

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

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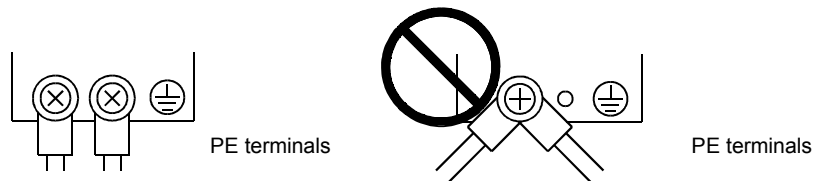
(c) If a leakage current breaker is used to prevent an electric shock, the protective earth (PE) terminals of the servo amplifier must be connected to the corresponding earth terminals.

(6) Wiring

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

Crimping terminal

Insulating tube

Cable
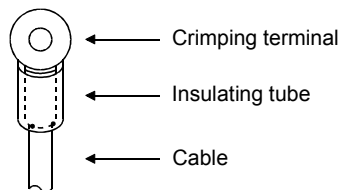
(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard compliant power connector sets are available from us as options. (Refer to section 14.1)

(7) Auxiliary equipment and options

    (a) The no-fuse breaker and magnetic contactor used should be the EN or IEC standard-compliant products of the models described in section 14.10.

       Use a type B (Note) breaker. When it is not used, provide insulation between the servo amplifier and other device by double insulation or reinforced insulation, or install a transformer between the main power supply and servo amplifier.

       Note. Type A: AC and pulse detectable

            Type B: Both AC and DC detectable

    (b) The sizes of the cables described in section 14.9 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204-1.

       ・Ambient temperature: 40 (104) [°C (°F)]

       ・Sheath: PVC (polyvinyl chloride)

       ・Installed on wall surface or open table tray

    (c) Use the EMC filter for noise reduction.

(8) Performing EMC tests

    When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.

    For the other EMC directive guidelines on the servo amplifier, refer to the EMC Installation Guidelines (IB(NA)67310).

CONFORMANCE WITH UL/C-UL STANDARD

(1) Servo amplifiers and servo motors used

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

Servo amplifier   :MR-J3-10T to MR-J3-22KT

                   MR-J3-10T1 to MR-J3-40T1

Servo motor   :HF-MP□

                   HF-KP□

                   HF-SP□

                   HC-RP□

                   HC-UP□

                   HC-LP□

                   HA-LP□

(2) Installation

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

(3) Short circuit rating

This servo amplifier conforms to the circuit whose peak current is limited to 5000A or less. Having been subjected to the short-circuit tests of the UL in the alternating-current circuit, the servo amplifier conforms to the above circuit.

(4) Capacitor discharge time

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

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

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

This servo amplifier is UL/C-UL-listed when using the fuses indicated in the following table. When the servo amplifier must comply with the UL/C-UL Standard, be sure to use these fuses.

Servo amplifier	Fuse		
	Class	Current [A]	Voltage [V]
MR-J3-10T (1) · 20T	T	10	AC250
MR-J3-40T · 20T1		15	
MR-J3-60T to 100T · 40T1		20	
MR-J3-200T		40	
MR-J3-350T		70	
MR-J3-500T		125	
MR-J3-700T		150	
MR-J3-11KT		200	
MR-J3-15KT		250	
MR-J3-22KT		350	

(6) Attachment of a servo motor

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

(7) About wiring protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.

For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

<<About the manuals>>

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

Relevant manuals

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

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MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The MR-J3-□T CC-Link compatible servo amplifier can support the CC-Link communication functions. Up to 42 axes of servo amplifiers can be controlled/monitored from the PLC side.

As the servo, it has the function to perform positioning operation by merely setting the position data (target positions), servo motor speeds, acceleration and deceleration time constants, etc. to point tables as if setting them in parameters. The servo amplifier is the most appropriate to configure a program-free, simple positioning system or to simplify a system, for example.

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

All servo motors are equipped with an absolute position encoder as standard. An absolute position detection system can be configured by merely adding a battery to the servo amplifier. Once the home position has been set, home position return is not required at power on, alarm occurrence, etc.

The MR-J3-T is made easier to use and higher in function by using it with the MR Configurator.

1.1.1 Features of CC-Link communication functions

(1) Fast communication

   Fast communication can be made by cyclic transmission of not only bit data but also word data.

   (a) The highest communication speed is 10Mbps.

   (b) The broadcast polling system ensures as high as 3.9ms to 6.7ms even at the maximum link scan (10Mbps).

(2) Variable communication speed/distance system

   Selection of speed/distance allows use in a wide range of areas from a system requiring high speed to a system requiring long distance.

(3) System fault prevention (station separating function)

   Because of connection in the bus system, any remote or local station that has become faulty due to power-off or the like does not affect communications with normal remote and local stations.

   In addition, use of the two-piece terminal block allows the unit to be changed during data link.

(4) Factory Automation compatible

   As the remote device stations of CC-Link, the servo amplifiers share a link system and can be controlled/monitored with PLC user programs.

   From the PLC side, the running speed, acceleration/deceleration time constant and other settings of servo motors can be changed/checked and the servo motors started and stopped.

1.1.2 Function block diagram

The function block diagram of this servo is shown below.
(1) MR-J3-350T or less

Point table

No.	Position data	Speed	Acceleration time constant	Deceleration time constant	Dwell	Auxiliary
1	1000	1000	80	80	0	0
2	2000	2000	100	100	0	0
3	4000	2000	70	60	500	1
4	− 500	2000	60	70	1000	1
5	1000	2000	80	80	0	0
6	2000	1000	80	80	0	
7	1000	1000	80	80		0
8	1000			100	0	0
		1000	100	100	0	0
255	2000	2000	80	80	0	0
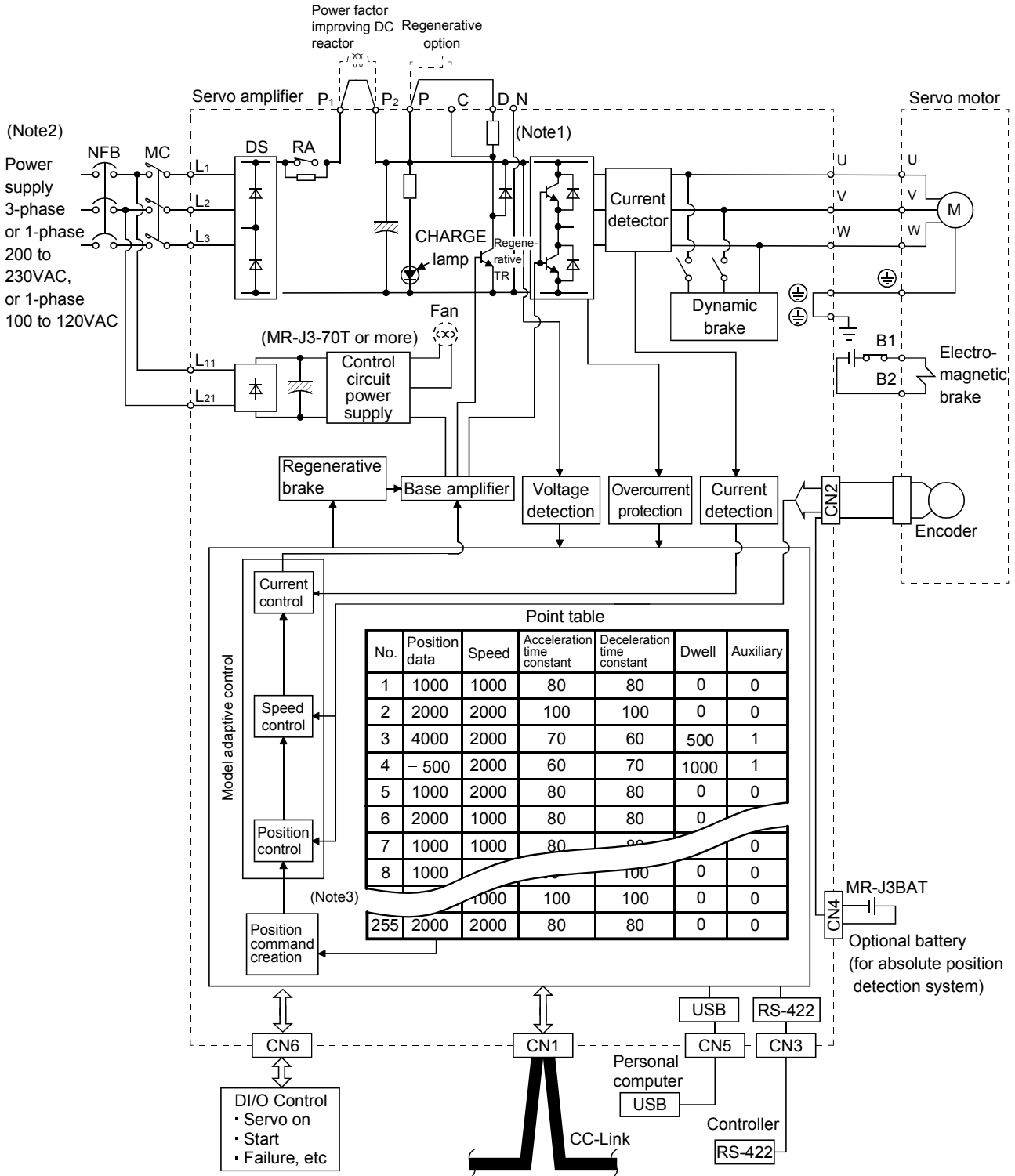
Note 1. The built-in regenerative resistor is not provided for the MR-J3-10T (1).
   2. For 1-phase 200 to 230VAC, connect the power supply to L₁,L₂ and leave L₃ open.
      There is no L₃ for 1-phase 100 to 120VAC power supply.
   3. For the case when 2 stations are occupied. When 1 station is occupied, the point table ends at No. 31.

(2) MR-J3-500T · MR-J3-700T

Point table

No.	Position data	Speed	Acceleration time constant	Deceleration time constant	Dwell	Auxiliary
1	1000	1000	80	80	0	0
2	2000	2000	100	100	0	0
3	4000	2000	70	60	500	1
4	−500	2000	60	70	1000	1
5	1000	2000	80	80	0	0
6	2000	1000	80	80	0	
7	1000	1000	80			0
8	1000			100	0	0
(Note)		1000	100	100	0	0
255	2000	2000	80	80	0	0

Note. For the case when 2 stations are occupied. When 1 station is occupied, the point table ends at No. 31.

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

Point table

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

(Note)

Note. For the case when 2 stations are occupied. When 1 station is occupied, the point table ends at No. 31.

1 - 4
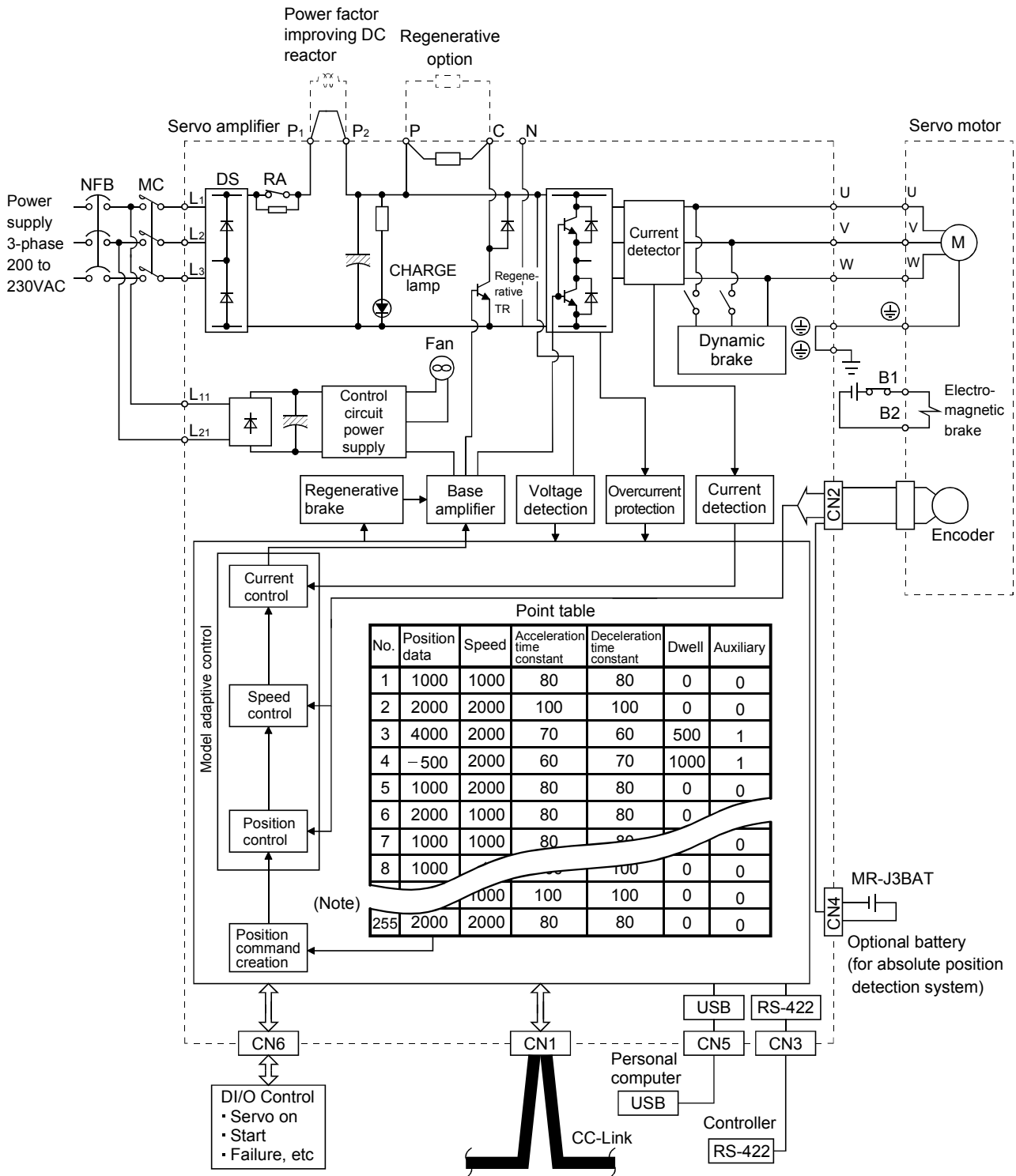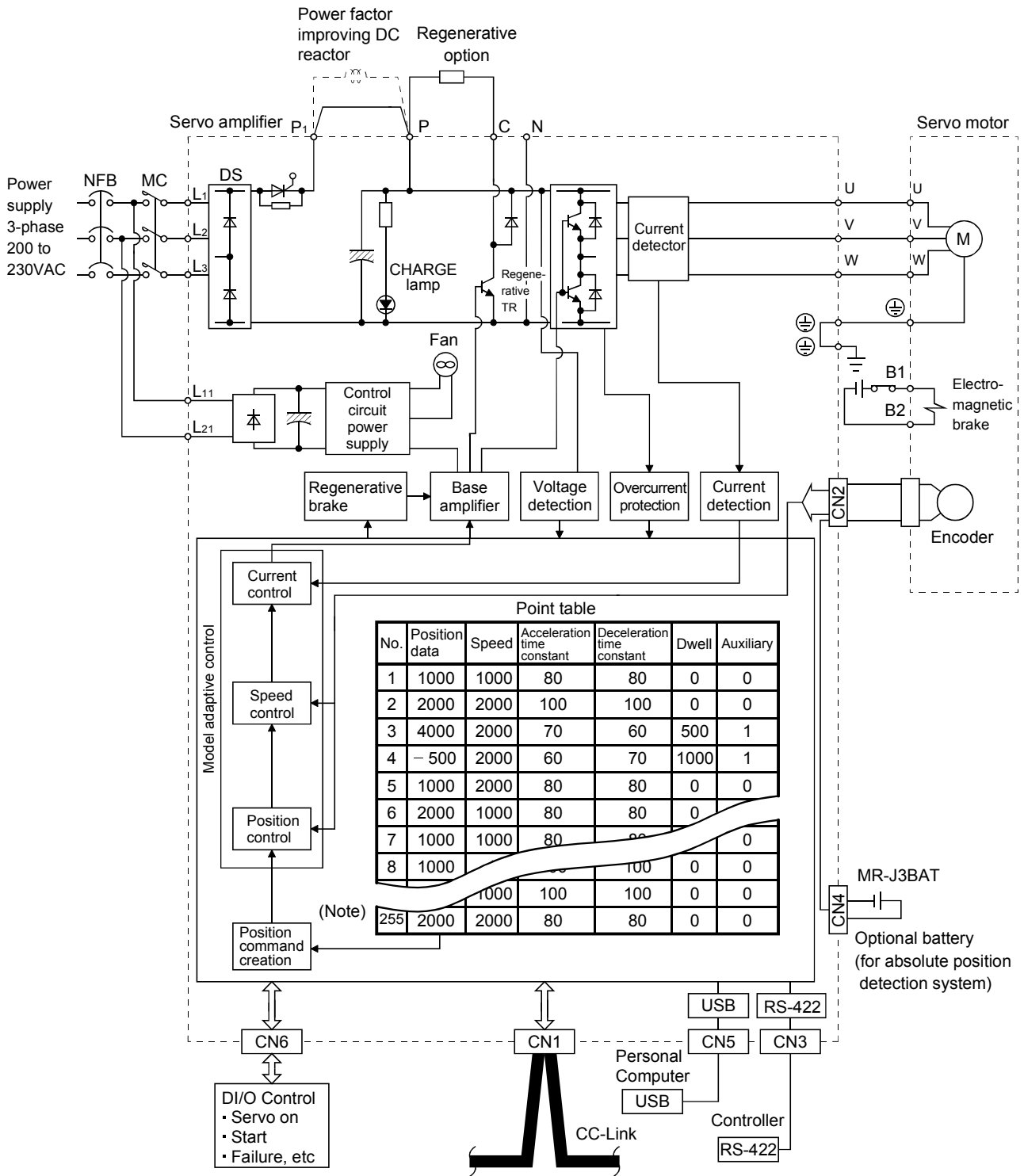
1.1.3 System configuration

This section provides operations using this servo.
Use of CC-Link enables you to freely configure any system from a single-axis system to an up to 42-axis system.
Set the following values to the point table:

Name	Setting range	Unit
Position data	−999999 to 999999	×0.001[mm] × 0.01[mm] × 0.1[mm] × 1[mm]
Servo motor speed	0 to max. speed	[r/min]
Acceleration time constant	0 to 20000	[ms]
Deceleration time constant	0 to 20000	[ms]
Dwell	0 to 20000	[ms]
Auxiliary function	0 to 3 (Refer to section 4.2)	

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

(1) Operation using CC-Link communication functions
    (a) Operation
        All signals can be controlled by CC-Link communication. Also, each point table setting, point table selection, parameter value change, setting, monitor, servo motor operation and others can be performed.
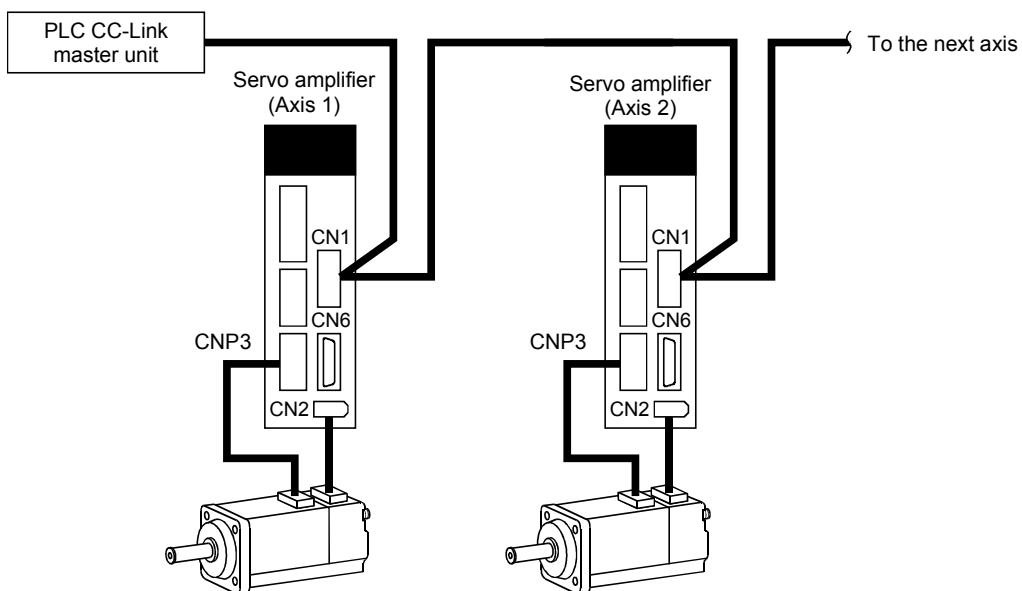
    (b) Configuration

(2) Operation using CC-Link communication functions and external input signals

    (a) Operation

       Using parameter No. PD06 to PD08 and parameter No. PD12, PD14, input signals can be assigned to the external input signals of CN1A and CN1B. The signals assigned to the external input signals cannot be used with the CC-Link communication functions. Output signals can be used with the CN6 connectors and CC-Link communication functions simultaneously.
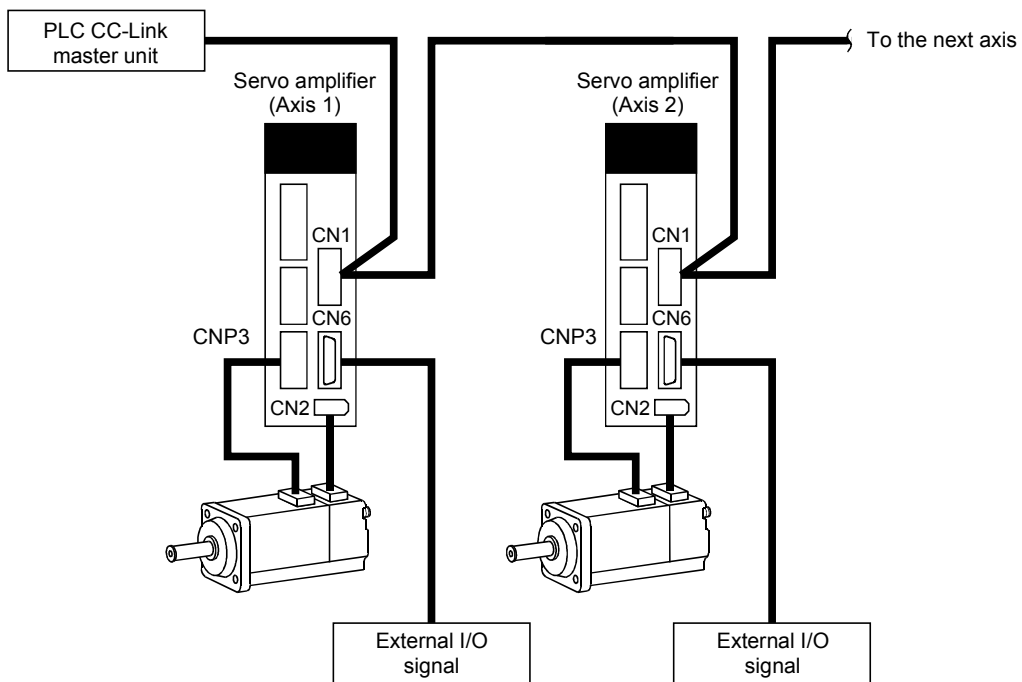
    (b) Configuration

1.2 Servo amplifier standard specifications

	Servo Amplifier MR-J3-□		10T	20T	40T	60T	70T	100T	200T	350T	500T	700T	11KT	15KT	22KT	10T1	20T1	40T1
Item																		
Power supply	Voltage/frequency		3-phase or 1-phase 200 to 230VAC, 50/60Hz					3-phase 200 to 230VAC, 50/60Hz								1-phase 100V to 120VAC, 50/60Hz		
	Permissible voltage fluctuation		3-phase or 1-phase 200 to 230VAC: 170 to 253VAC					3-phase 170 to 253VAC								1-phase 85 to 132VAC		
	Permissible frequency fluctuation		Within ±5%															
	Power supply capacity		Refer to section 13.2															
	Inrush current		Refer to section 13.5															
Control circuit power supply	Voltage, frequency		1-phase 200 to 230VAC, 50/60Hz													1-phase 100 to 120VAC, 50/60Hz		
	Permissible voltage fluctuation		1-phase 170 to 253VAC													1-phase 85 to 132VAC		
	Permissible frequency fluctuation		Within ±5%															
	Input		30W						45W							30W		
	Inrush current		Refer to section 13.5															
Interface power supply	Voltage, frequency		DC24V±10%															
	Power supply capacity		(Note 1) 150mA or more															
Control System			Sine-wave PWM control, current control system															
Dynamic brake			Built-in										External option		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 brake error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection															
Command system	Point table number input	Operational specifications	Positioning by specifying the point table No. (255 points)															
		Position command input	Set in point table. 1-point feed length setting range: ±1[μm] to ±999.999[mm]															
		Speed command input	Set in point table. Acceleration/deceleration time is set in point table. S-pattern acceleration/deceleration time constant is set in parameter No. PC13.															
		System	Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system															
	Position command data input (when 2 stations are occupied)	Operational specifications	Remote register setting is used for positioning.															
		Position command input	▪ Remote register is used to set position command data. ▪ Feed length input setting range: ±1μm to ±999.999m															
		Speed command input	▪ Remote register is used to make selection from point table. ▪ Remote register is used to set speed command data (speed). S-pattern acceleration/deceleration time constant is set in parameter No. PC13.															
		System	Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system															
Operation mode	Automatic operation mode	Point table	Point table number input, position data input system Positioning operation is performed once in accordance with the position and speed commands.															
		Automatic continuous operation	Varied speed operation (2 to 255 speeds), automatic continuous positioning operation (2 to 255 points)															
	Manual operation mode	Jog	Jog operation is performed in accordance with the parameter-set speed command by contact input or through CC-Link communication function.															

Item			Servo Amplifier MR-J3-□	10T	20T	40T	60T	70T	100T	200T	350T	500T	700T	11KT	15KT	22KT	10T1	20T1	40T1
Operation mode	Home position return mode		Dog type	Home position return is made starting with Z-phase pulse after passage of proximity dog. Home position address may be set. Home position shift distance may be set. Home position return direction may be selected. Automatic at-dog home position return return/automatic stroke return function																
			Count type	Home position return is made by counting encoder pulses after contact with proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function																
			Data setting type	Home position return is made without dog. Home position may be set at any position by manual operation, etc. Home position address may be set.																
			Stopper type	Home position return is made by pressing machine part against stroke end. Home position address may be set. Home position return direction may be set.																
			Home position ignorance (Servo-on position as home position)	Position where servo-on (RYn0) is switched on is defined as home position. Home position address may be set.																
			Dog type rear end reference	Home position return is made with respect to the rear end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function																
			Count type front end reference	Home position return is made with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function																
			Dog cradle type	Home position return is made with respect to the front end of a proximity dog by the first Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function																
			Dog type last Z-phase reference	Home position return is made with respect to the front end of a proximity dog by the last Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function																
			Dog type front end reference	Home position return is made to the dog front end with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.																
			Dogless Z-phase reference	Home position return is made with respect to the first Z phase to the Z phase. Home position address may be set. Home position shift value may be set. Home position return direction may be set.																
	Automatic positioning to home position			High-speed automatic return to a defined home position.																
Other functions				Absolute position detection, backlash function Overtravel prevention using external limit switch Software stroke limit																
Structure				Self-cooled, open (IP00)			Force-cooling, open (IP00)											Self-cooled, open (IP00)		

Item				Servo Amplifier MR-J3-□	10T	20T	40T	60T	70T	100T	200T	350T	500T	700T	11KT	15KT	22KT	10T1	20T1	40T1
Environment	Ambient temperature	During operation	[℃]	(Note 2) 0 to +55 (non-freezing)																
			[℉]	32 to +131 (non-freezing)																
		In storage	[℃]	−20 to +65 (non-freezing)																
			[℉]	−4 to +149 (non-freezing)																
	Ambient humidity	In operation		90%RH or less (non-condensing)																
		In storage																			
	Ambient			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt																
	Altitude			Max. 1000m (3280ft) above sea level																
	Vibration			5.9 [m/s²] or less																
Mass			[kg]		0.8	0.8	1.0	1.0	1.4	1.4	2.3	2.3	4.6	6.2	18	18	19	0.8	0.8	1.0
			[lb]		1.8	1.8	2.2	2.2	3.1	3.1	5.071	5.071	10.1	13.7	39.68	39.68	41.88	1.8	1.8	2.2

Note 1. 150mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points.
   2. When closely mounting the servo amplifier of 3.5kW or less, operate them at the ambient temperatures of 0 to 45℃ or at 75% or smaller effective load ratio.

1.3 Function list

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

Function	Description	Reference
Positioning by automatic operation	Select the required ones from among 31 preset point tables and perform operation in accordance with the set values. Use the external input signal or communication function to choose the point tables.	Section 5.4
Varied speed operation	Servo motor speed can be varied continuously until the preset moving distance is reached. (Max. set speeds: 255 speeds)	Section 5.4.2 (4)(b)
Automatic continuous positioning operation	By merely choosing one point table and starting operation, positioning can be executed continuously in accordance with several point tables.	Section 5.4.2 (4)
Home position return	Dog type, count type, data setting type, stopper type, home position ignorance, dog type rear end reference, count type front end reference, dog cradle type	Section 5.6
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	By merely setting the home position once, home position return need not be done at each power on.	Section 5.7
Gain changing function	You can switch between gains during rotation and gains during stop or use an external signal to change gains during operation.	Section 10.6
Advanced vibration suppression control	This function suppresses vibration at the arm end or residual vibration.	Section 10.4
Adaptive filter Ⅱ	Servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 10.2
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 10.5
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a servo configuration software-installed personal computer and servo amplifier. MR Configurator MRZJW3-SETUP221E 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 MRZJW3-SETUP221E is necessary for this function.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time. MR Configurator MRZJW3-SETUP221E is necessary for this function.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	Parameters No. PB24

Function	Description	Reference
Electronic gear	The electronic gear is used to make adjustment so that the servo amplifier setting matches the machine moving distance. Also, changing the electronic gear value allows the machine to be moved at any multiplication ratio to the moving distance using the servo amplifier.	Parameter No. PA06, PA07
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 9.2
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Parameters No. PC13
Regenerative option	Used when the built-in regenerative resistor of the servo amplifier does not have sufficient regenerative capability for the regenerative power generated.	Section 14.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the servo amplifier of 5kW or more.	Section 14.3
Regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the servo amplifier of 5kW or more.	Section 14.4
Alarm history clear	Alarm history is cleared.	Parameter No. PC18
I/O signal selection (Device setting)	Any input signal such as servo-on (SON) can be assigned to any pin of CN6 connector.	Parameter No. PD06 to PD08 PD12・PD14
Torque limit	Servo motor-torque is limited.	Section 4.6.3 Section 6.1.11
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 7.7.4 Section 8.5.7(4)
Test operation mode	JOG operation・positioning operation・DO forced output・singl - step feed.	Section 7.7 Section 8.5.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP)/reverse rotation stroke end (LSN).	Section 4.5.2
Software limit	The travel region is limited using parameters in terms of address. The function similar to that of a limit switch is limited by parameter.	Section 6.3.6

1.4 Model code definition

(1) Rating plate
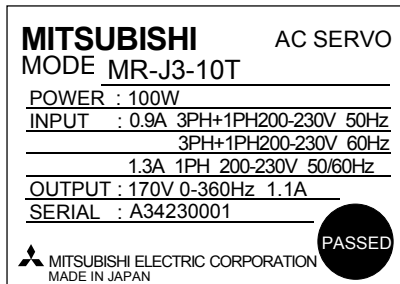
```
MITSUBISHI        AC SERVO
MODE  MR-J3-10T                        ←——— Model
 POWER : 100W                          ←——— Capacity
 INPUT  : 0.9A 3PH+1PH200-230V 50Hz    ←——— Applicable power supply
              3PH+1PH200-230V 60Hz
         1.3A 1PH 200-230V 50/60Hz
 OUTPUT : 170V 0-360Hz 1.1A            ←——— Rated output current
 SERIAL  : A34230001                   ←——— Serial number
                              PASSED
  MITSUBISHI ELECTRIC CORPORATION
  MADE IN JAPAN
```

(2) Model

```
MR－J3－□T□□
```

Series

With no regenerative resistor

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

Power supply

Symbol	Power supply
None (Note 1)	3-phase or 1-phase 200 to 230VAC
(Note 2) 1	1-phase 100 to 120VAC

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

Built-in positioning function

Rated output

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

MR-J3-100T or less
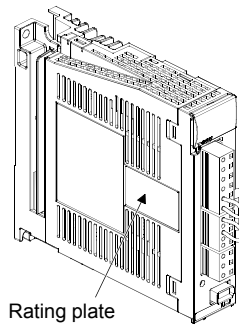
Rating plate

MR-J3-200T・350T
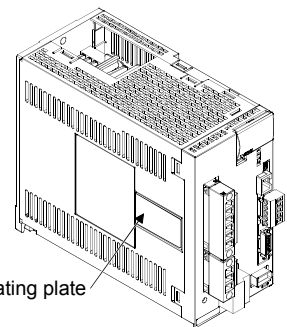
Rating plate

MR-J3-500T
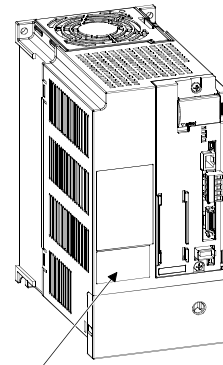
Rating plate

MR-J3-700T
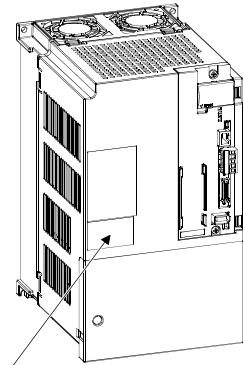
Rating plate

MR-J3-11KT or more
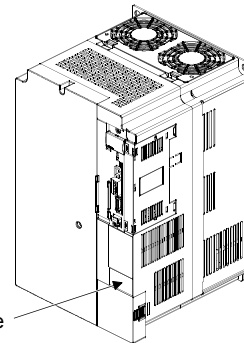
Rating plate

1.5 Combination with servo motor

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

Servo amplifier	Servo motors						
	HF-MP□	HF-KP□	HF-SP□		HC-RP□	HC-UP□	HC-LP□
			1000r/min	2000r/min			
MR-J3-10T (1)	053・13	053・13					
MR-J3-20T (1)	23	23					
MR-J3-40T (1)	43	43					
MR-J3-60T			51	52			52
MR-J3-70T	73	73				72	
MR-J3-100T			81	102			102
MR-J3-200T			121・201	152・202	103・153	152	152
MR-J3-350T			301	352	203	202	202
MR-J3-500T			421	502	353・503	352・502	302
MR-J3-700T				702			
MR-J3-11KT							
MR-J3-15KT							
MR-J3-22KT							
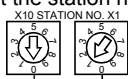
Servo amplifier	Servo motors		
	HA-LP□		
	1000r/min	1500r/min	2000r/min
MR-J3-500T			502
MR-J3-700T	601	701M	702
MR-J3-11KT	801・12K1	11K1M	11K2
MR-J3-15KT	15K1	15K1M	15K2
MR-J3-22KT	20K1・25K1	22K1M	22K2

1.6 Structure

1.6.1 Parts identification

(1) MR-J3-100T or less

Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) MODE Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the servo amplifier. X10 STATION NO. X1 Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) SW1 Set the number of occupied stations.	Section 3.2.5
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 4.1 Section 4.3
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ RD ■ SD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect with the personal computer.	Chapter 7
RS-422 cummunication connector (CN5) Used to connect with the MR-PRU03 parameter unit or personal computer.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative option.	Section 4.1 Section 4.3
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Motor power supply connector (CNP3) Used to connect the servo motor.	Section 4.1 Section 4.3
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.7 Section 14.7
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Battery holder Contains the battery for absolute position data backup.	Section 5.7
Name plate	Section 1.4
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3

Fixed part
(2 places)

1. FUNCTIONS AND CONFIGURATION

(2) MR-J3-200T・MR-J3-350T
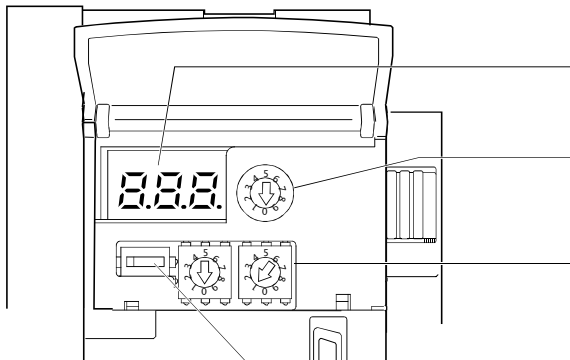
Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the servo amplifier. Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) Set the number of occupied stations.	Section 3.2.5
Main circuit power supply connector (CNP1) Connect the input power supply.	Section 4.1 Section 4.3
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ RD ■ SD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect the personal computer.	Chapter 7
RS-422 cummunication connector (CN5) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
Motor power supply connector (CNP3) Used to connect the servo motor.	Section 4.1 Section 4.3
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.7 Section 14.7
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative option.	Section 4.1 Section 4.3
Battery holder Contains the battery for absolute position data backup.	Section 5.7
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3
Name plate	Section 1.4

Cooling fan

Fixed part (3 places)

(3) MR-J3-500T

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

Cooling fan

Fixed part
(4 places)

Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) MODE Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the servo amplifier. X10 STATION NO. X1 Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) SW1 Set the number of occupied stations.	Section 3.2.5
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ RD ■ SD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect the personal computer.	Chapter 7
RS-422 cummunication connector (CN5) Used to connec the MR-PRU03 parameter unit or personal computer.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Battery holder Contains the battery for absolute position data backup.	Section 5.7
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.7 Section 14.7
DC reactor terminal block (TE3) Used to connect the DC reactor.	Section 4.1 Section 4.3
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 4.1 Section 4.3
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 4.1 Section 4.3
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3
Name plate	Section 1.4

(4) MR-J3-700T

> POINT
>
> ・ The servo amplifier is shown without the front cover. For removal of the front
> cover, refer to section 1.7.2.
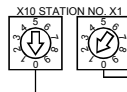
Cooling fan

Fixed part
(4 places)

Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) MODE Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the servo amplifier. X10 STATION NO. X1 Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) SW1 Set the number of occupied stations.	Section 3.2.5
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ RD ■ SD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect the personal computer.	Chapter 7
RS-422 cummunication connector (CN5) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Battery holder Contains the battery for absolute position data backup.	Section 5.7
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.7 Section 14.7
DC reactor terminal block (TE3) Used to connect the DC reactor.	Section 4.1 Section 4.3
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Control circuit terminal block (TE2) Used to connect the control circuit power supply.	Section 4.1 Section 4.3
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 4.1 Section 4.3
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3
Name plate	Section 1.4

(5) MR-J3-11KT or more

POINT
・The servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.7.2.
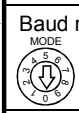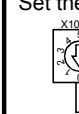
Fixed part
(4 places)

Cooling fan

Name/Application	Detailed Explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) MODE Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the servo amplifier. X10 STATION NO. X1 Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) SW1 Set the number of occupied stations.	Section 3.2.5
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ RD ■ SD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect the personal computer.	Chapter 7
RS-422 cummunication connector (CN3) Used to connect the MR-PRU03 parameter unit or personal computer.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.7 Section 14.7
Battery holder Contains the battery for absolute position data backup.	Section 5.7
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Name plate	Section 1.4
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3

1.6.2 Removal and reinstallation of the front cover

⚠ WARNING	· Before removing or reinstalling the front cover, make sure that the charge lamp is off more than 15 minutes after power off. Otherwise, you may get an electric shock.

(1) For MR-J3-700T or less

Removal of the front cover
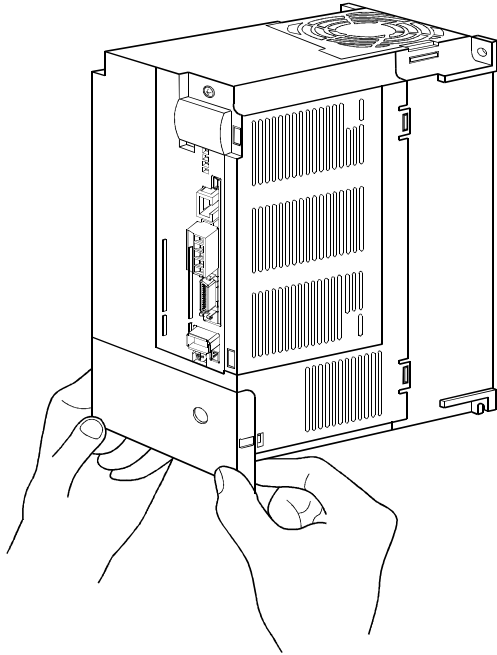
Hold the ends of lower side of the front cover with both hands.
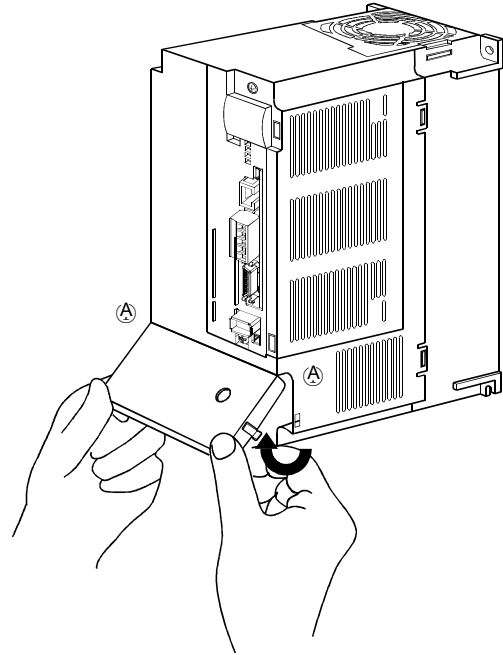
Pull up the cover, supporting at point Ⓐ.
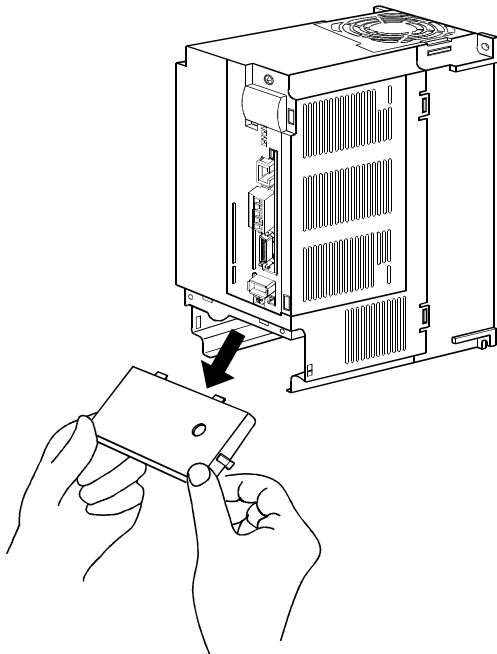
Pull out the front cover to remove.

Reinstallation of the front cover

Front cover
setting tab
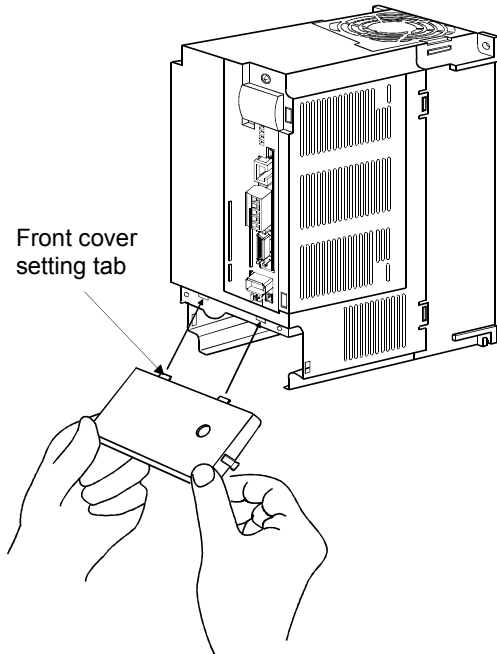
Insert the front cover setting tabs into the sockets of servo amplifier (2 places).
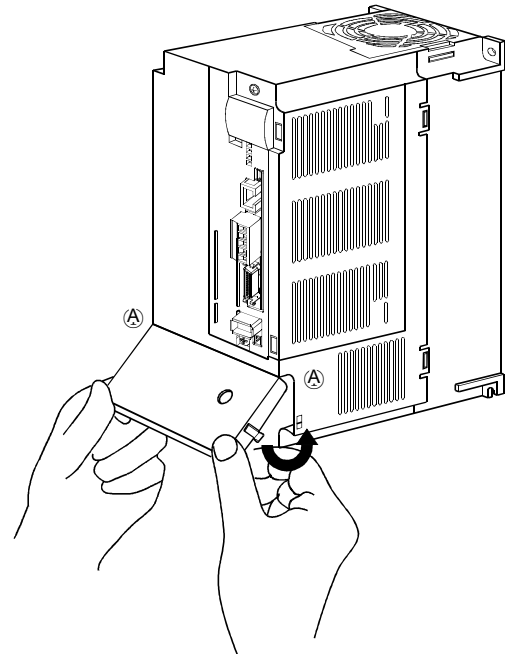
Pull up the cover, supporting at point Ⓐ.
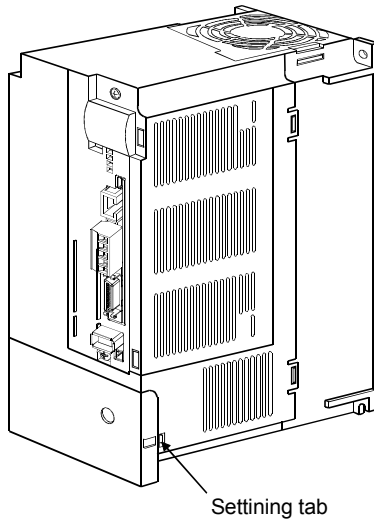
Settining tab

Push the setting tabs until they click.

(2) For MR-J3-11KT or more

Removal of the front cover
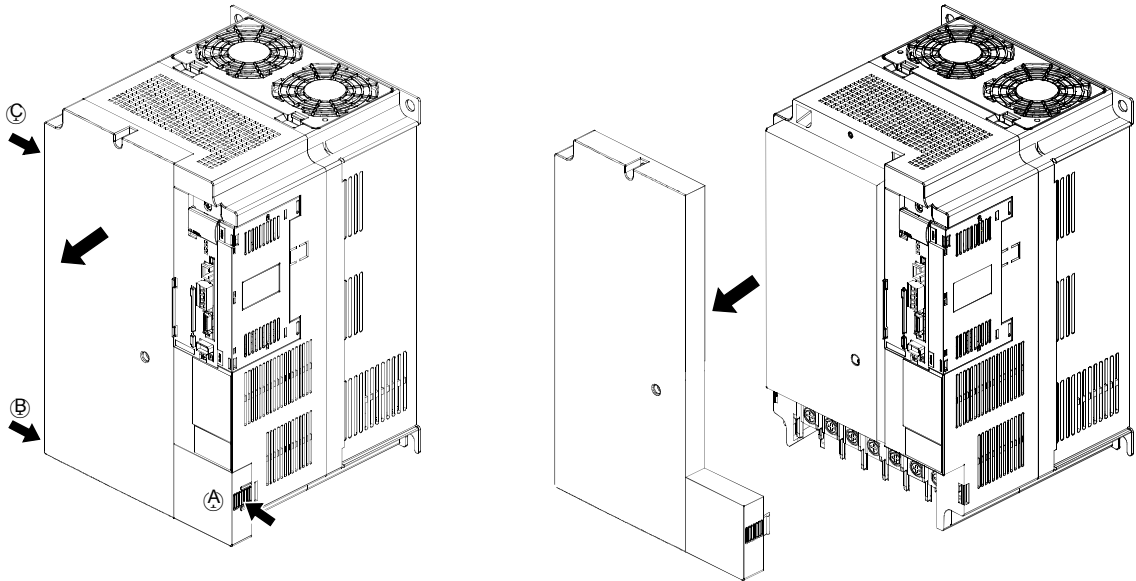
1) Press the removing knob on the lower side of the front cover (Ⓐ and Ⓑ) and release the installation hook.

2) Press the removing knob of Ⓒ and release the external hook.

3) Pull it to remove the front cover.

Reinstallation of the front cover
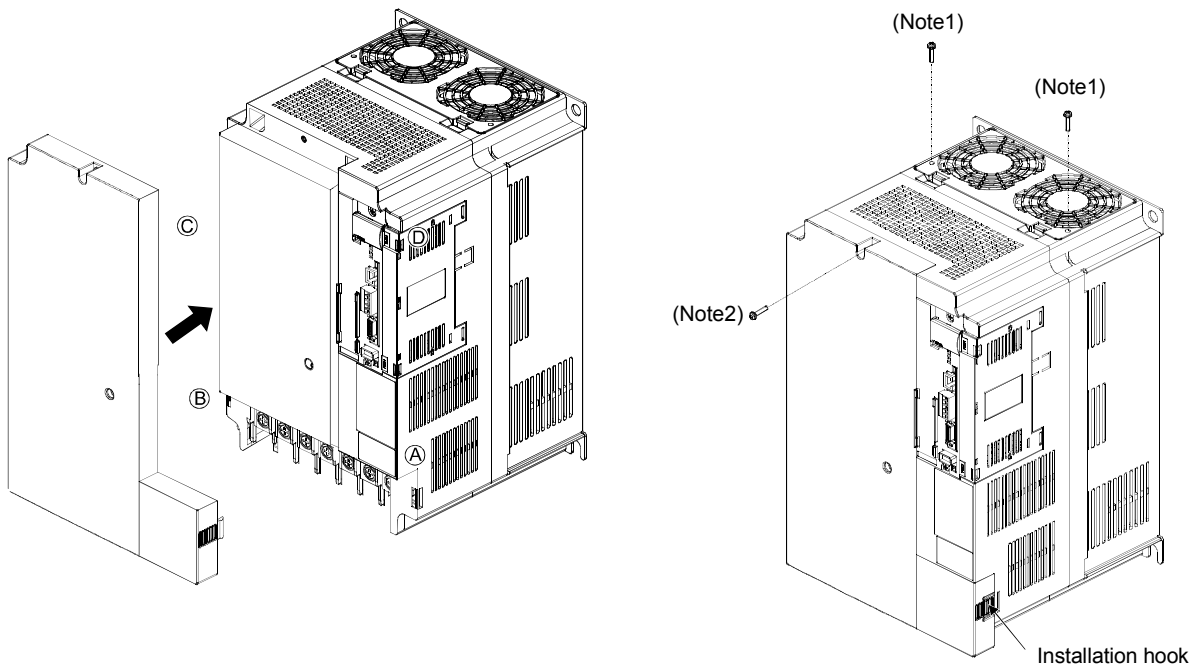
Installation hook

1) Fit the front cover installation hooks on the sockets of body cover (Ⓐ to Ⓓ) to reinstall it.

2) Push the front cover until hearing the clicking noise of the installation hook.

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

2. If drilling approximately φ4 of a hole on the front cover, the front cover can be locked on the body with an enclosed screw (M4 × 40).

1.7 Configuration including auxiliary equipment

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

(1) MR-J3-100T or less

(a) For 3-phase or 1-phase 200V to 230VAC
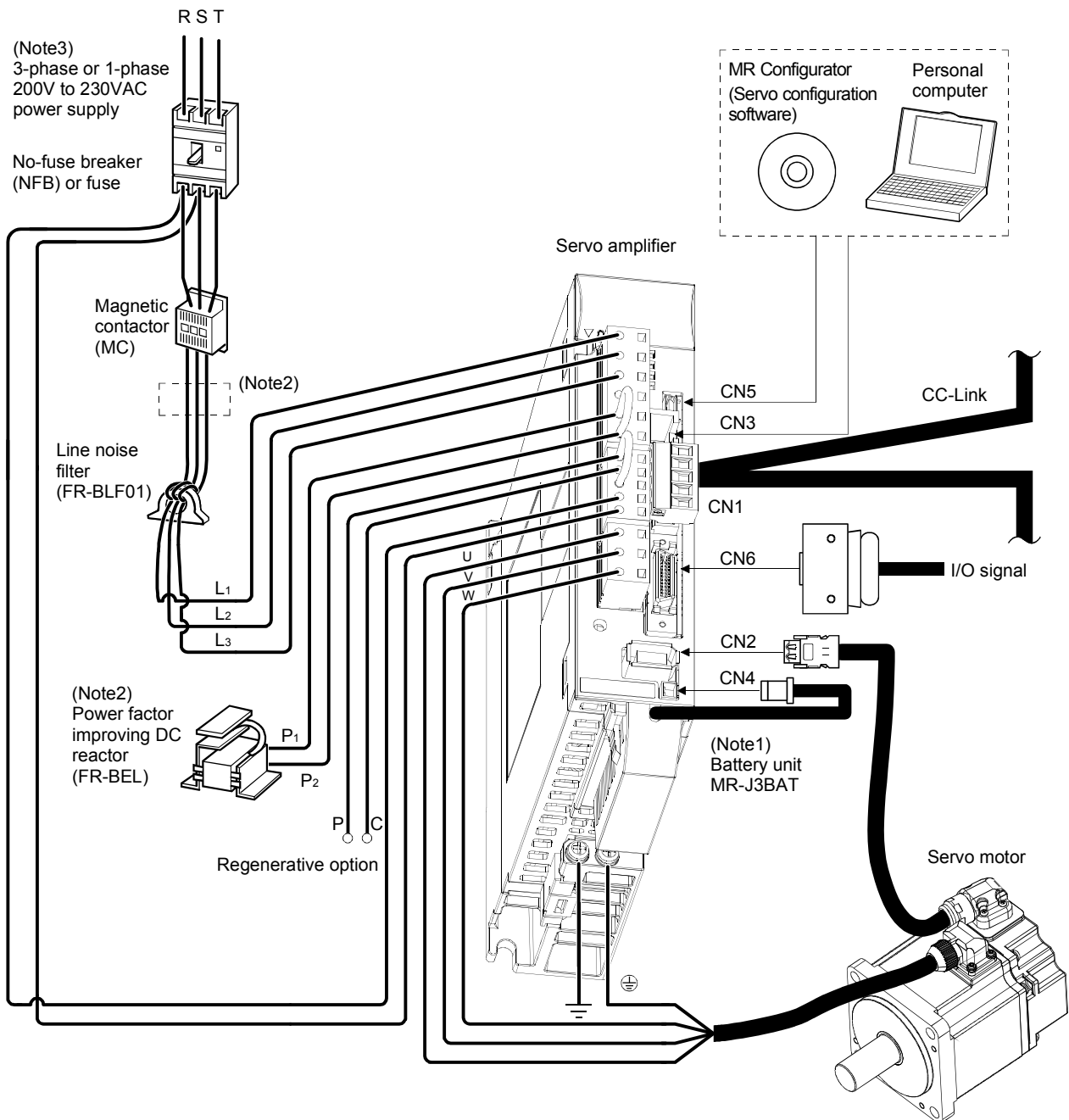
Note 1. The battery unit (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used.

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

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

R S

1-phase
100V to 120VAC
power supply

No-fuse breaker
(NFB) or fuse

Magnetic
contactor
(MC)

Power factor
improving DC
reactor
(FR-BEL)

Line noise
filter
(FR-BLF01)

L₁

L₂

P C

Regenerative option

MR Configurator
(Servo configuration
software)

Personal
computer

Servo amplifier

(Note2)

CN5

CN3

CN1

CN6

CN2

CN4

U
V
W

(Note1)
Battery unit
MR-J3BAT

CC-Link

I/O signal

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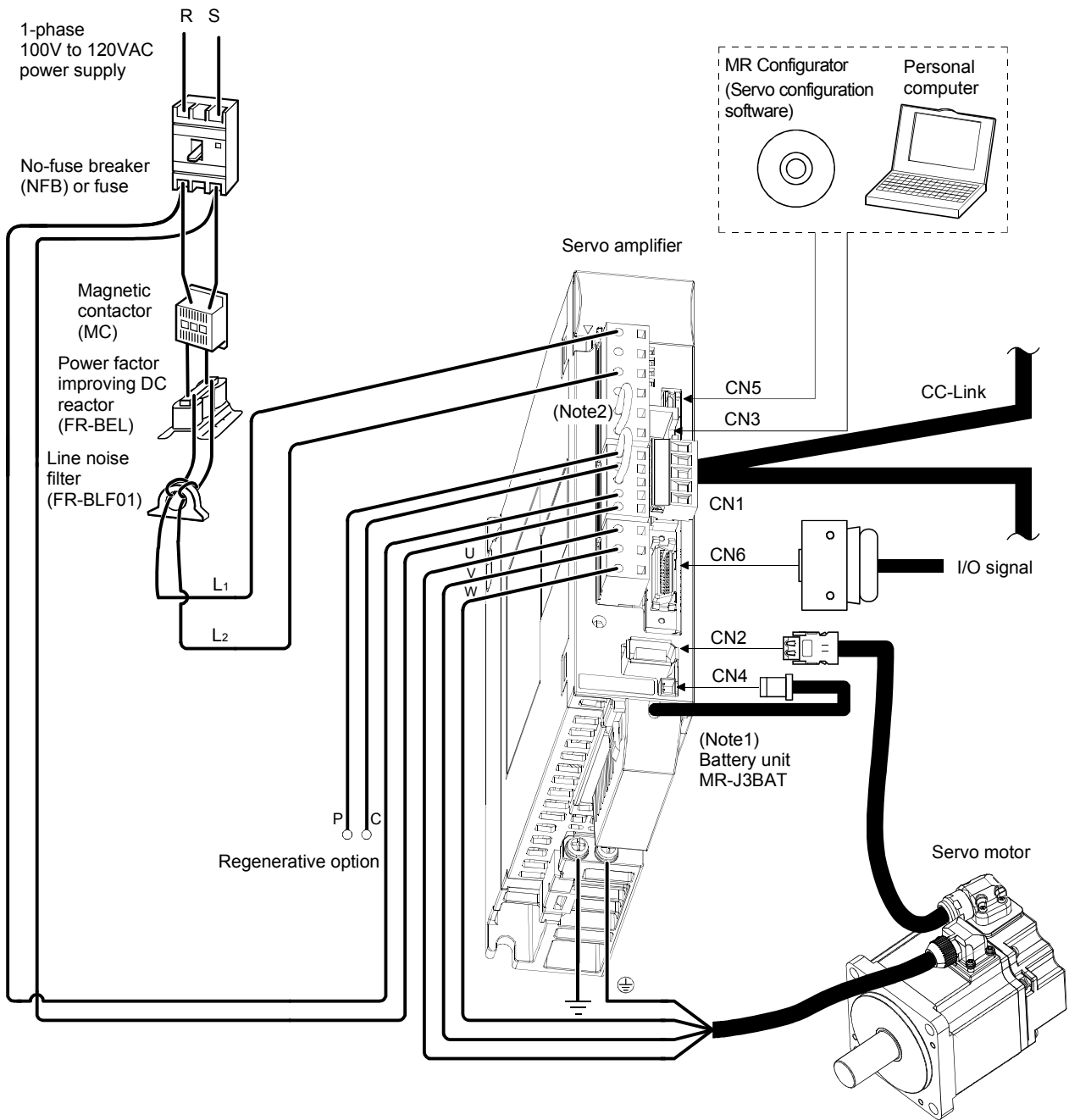
Note 1. The battery unit (option) is used for the absolute position detection system in the position control mode.

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

(2) MR-J3-200T · MR-J3-350T

3-phase
200V to 230VAC
power supply

No-fuse breaker
(NFB) or fuse

Magnetic
contactor
(MC)

(Note2)

(Note3)
Line noise filter
(FR-BLF01)

Servo amplifier

MR Configurator
(Servo configuration
software)

Personal
computer

L₁
L₂
L₃

P₁

P₂

CN5

CN3

CC-Link

(Note2)
Power factor
improving DC
reactor
(FR-BEL)

Regenerative option P
C

CN1

CN6

I/O signal

L₁₁

L₂₁

CN2

CN4

(Note1)
Battery unit
MR-J3BAT

U V W

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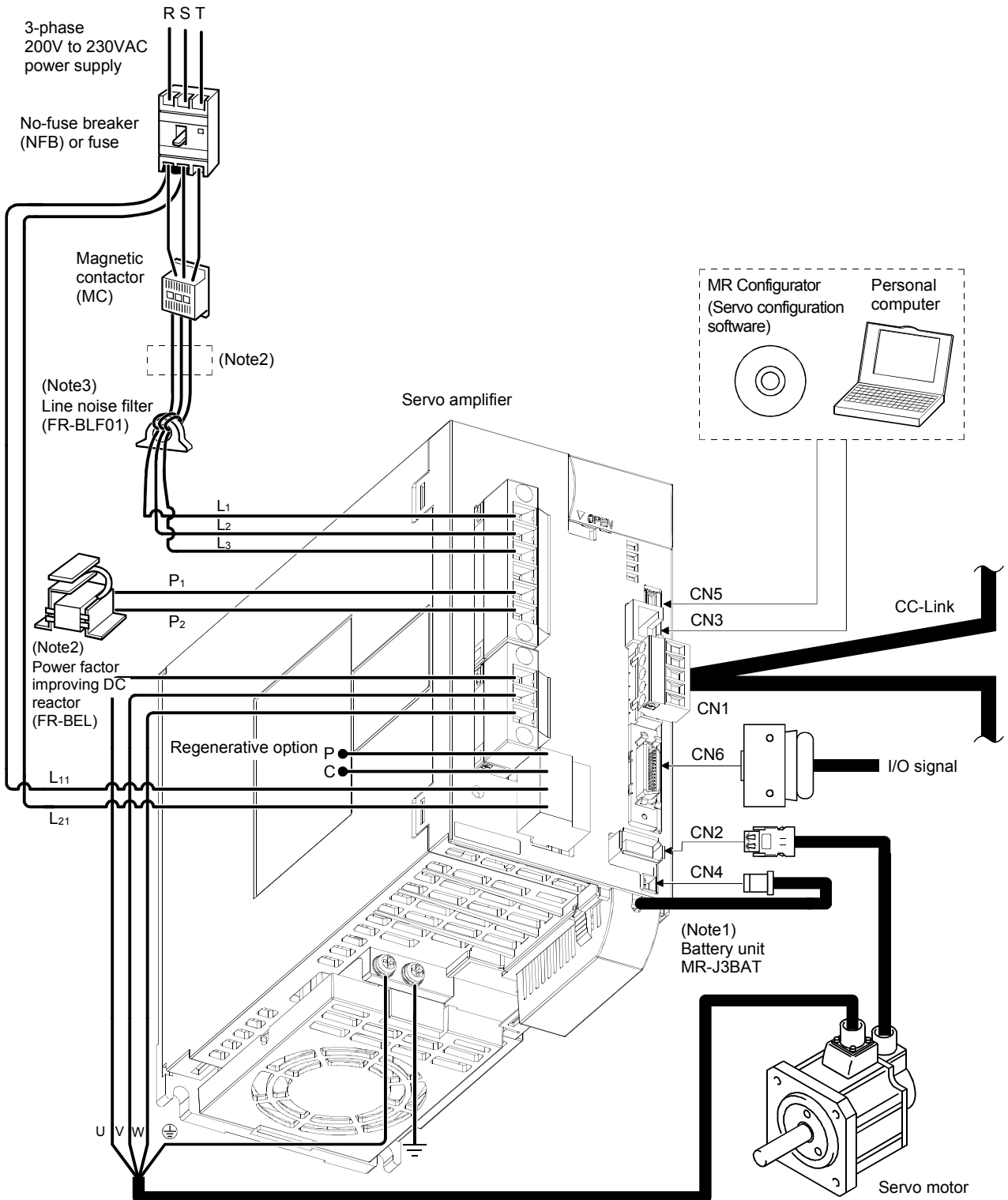
Note 1. The battery unit (option) is used for the absolute position detection system in the position control mode.

2. The AC reactor can also be used. In this case, the DC reactor cannot be used.

3. For MR-J3-350T, use FR-BLF.

1 - 23

(3) MR-J3-500T

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

    2. The AC reactor can also be used. In this case, the DC reactor cannot be used.

(4) MR-J3-700T

3-phase 200V to 230VAC power supply R S T

No-fuse breaker (NFB) or fuse

Magnetic contactor (MC)

(Note2)

Line noise filter (FR-BLF01)

(Note2) Power factor improving DC reactor (FR-BEL)

Servo amplifier

MR Configurator (Servo configuration software)   Personal computer

CN5
CN3

(Note1) Battery unit MR-J3BAT

CC-Link

CN6   I/O signal

CN2
CN4

L11 L21

P2
P1
L3
L2
L1

CHARGE

N P1 P2

P C
Regenerative option

U V W

Servo motor

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

2. The AC reactor can also be used. In this case, the DC reactor cannot be used.

1 - 25

(5) MR-J3-11KT or more

R S T

3-phase
200V to 230VAC
power supply

No-fuse breaker
(NFB) or fuse

L_{21}

L_{11}

Servo amplifier

MR Configurator
(Servo configuration
software)

Personal
computer

Magnetic
contactor
(MC)

(Note2)

Line noise
filter
(FR-BLF01)

(Note1)
Battery unit
MR-J3BAT

CN5

CN3

CC-Link

CN6

I/O signal

CN2

CN4

L_3

L_2

L_1

(Note2)
Power factor
improving DC
reactor
(FR-BEL)

P_1

P

W V U

P   C

Regenerative option

Servo motor

Note 1. The battery unit (option) is used for the absolute position detection system in the position control mode.
　　2. The AC reactor can also be used. In this case, the DC reactor cannot be used.

1.8 Selection of operation method

Using the CC-Link communication functions, this servo enables a wide variety of operation methods. The operation method changes depending on the input signal, parameter and point table setting.
The flow of the operation method that changes depending on the signal and parameter setting status is shown in the chart for your reference.

Point table
auxiliary fanction

Parameter No.PA01

□□□0

□□□1

Absolute value
command
specifying system

0 — Positioning operation is executed once with position data handled as absolute value.

1 — Continuous positioning operation is executed with position data handled as absolute values.

2 — Positioning operation is executed once with position data handled as incremental value.

3 — Continuous positioning operation is executed with position data handled as incremental values.

Point table
auxiliary fanction

Incremental value
command
specifying system

0 — Positioning operation is executed once in incremental value command system.

1 — Continuous positioning operation is executed in incremental value command system.

Remote input absolute value/incremental value selection (RY(n+2)B)

Parameter No.PA01

□□□0

□□□1

Absolute value
command
specifying system

OFF — Positioning operation is executed once with position data handled as absolute value.

ON — Positioning operation is executed once with position data handled as incremental value.

Incremental value
command
specifying system — Positioning operation is executed once in incremental value command system.

Remote input absolute value/incremental value selection (RY(n+2)B)

Parameter No.PA01

□□□0

□□□1

Absolute value
command
specifying system

OFF — Positioning operation is executed once with position data handled as absolute value.

ON — Positioning operation is executed once with position data handled as incremental value.

Incremental value
command
specifying system — Positioning operation is executed once in incremental value command system.

Remote input absolute value/incremental value selection (RY(n+2)B)

Parameter No.PA01

□□□0

□□□1

Absolute value
command
specifying system

OFF — Positioning operation is executed once with position data handled as absolute value.

ON — Positioning operation is executed once with position data handled as incremental value.

Incremental value
command
specifying system — Positioning operation is executed once in incremental value command system.

Reference	Main description
Section 3.8.2 Section 5.4.2 (1)	Positioning is started by making the start signal valid after selection of the point table with the remote input. Using the auxiliary function, automatic continuous operation can be performed with multiple point tables.
Section 3.8.2 Section 5.4.2 (4)(b)1	
Section 3.8.2 Section 5.4.2 (2)	
Section 3.8.2 Section 5.4.2 (4)(b)1	
Section 3.8.2 Section 5.4.2 (1)	
Section 3.8.2 Section 5.2.2 (4)(b)2	
Section 3.6.3 (1) Section 3.7.6 (3)	Positioning is started by making the start signal valid after selection of the point table with the remote register. The auxiliary function cannot be used.
Section 3.6.3 (2)	Set the position data directly with the remote register, and use the settings of the point table selected with the remote register as the servo motor speed and acceleration/deceleration time constants. Positioning is started by making the start signal valid. The auxiliary
Section 3.6.3(3) Section 3.8.4 Section 5.4.3(1)	Set the position data and servo motor speed directly with the remote register.
Section 3.6.3 (3) Section 5.4.3 (2)	Use the settings of the point table No. 1 as the acceleration/deceleration time constants.
Section 3.6.3(3) Section 3.7.6(2) Section 5.4.3(3)	Positioning is started by making the start signal valid. The auxiliary function cannot be used.

2. INSTALLATION

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

2.1 Installation direction and clearances

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

(1) 7kW or less
  (a) Installation of one servo amplifier

(b) Installation of two or more servo amplifiers

> POINT
> ・Mounting closely is available for a combination of servo amplifiers of 3.5kw or less. The servo amplifiers of 5kw or more can not be mounted closely.

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

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

In this case, bring the ambient temperature within 0 to 45℃, or use it at 75% or a smaller effective load ratio.

Leaving clearance   Mounting closely
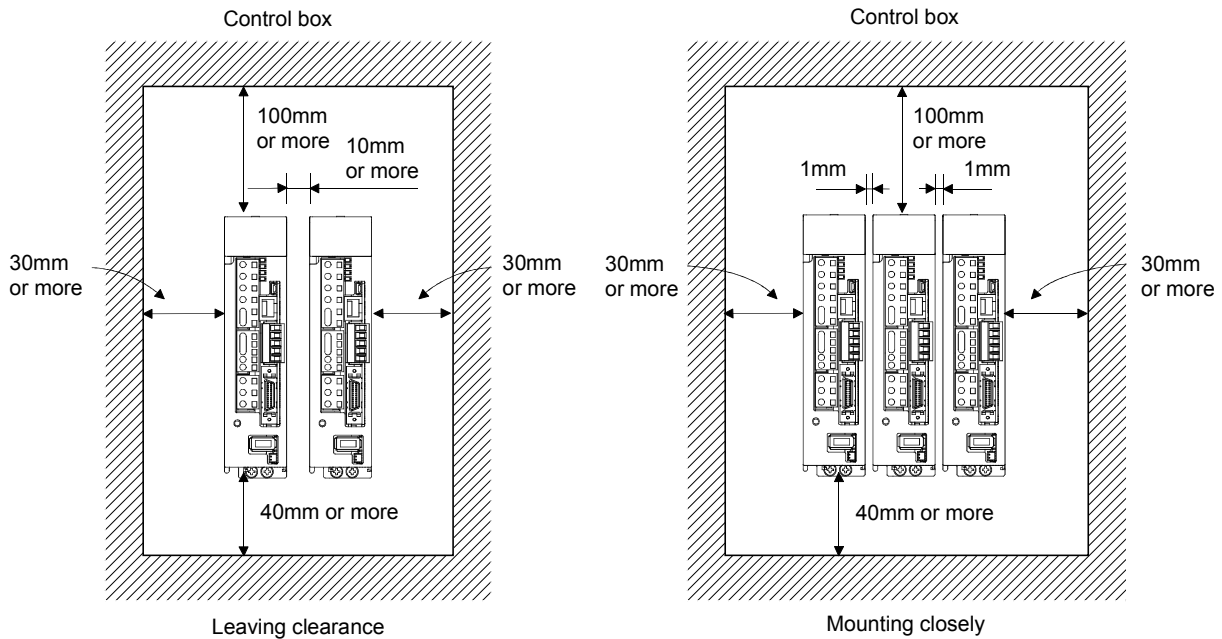
(2) 11kW or more

  (a) Installation of one servo amplifier
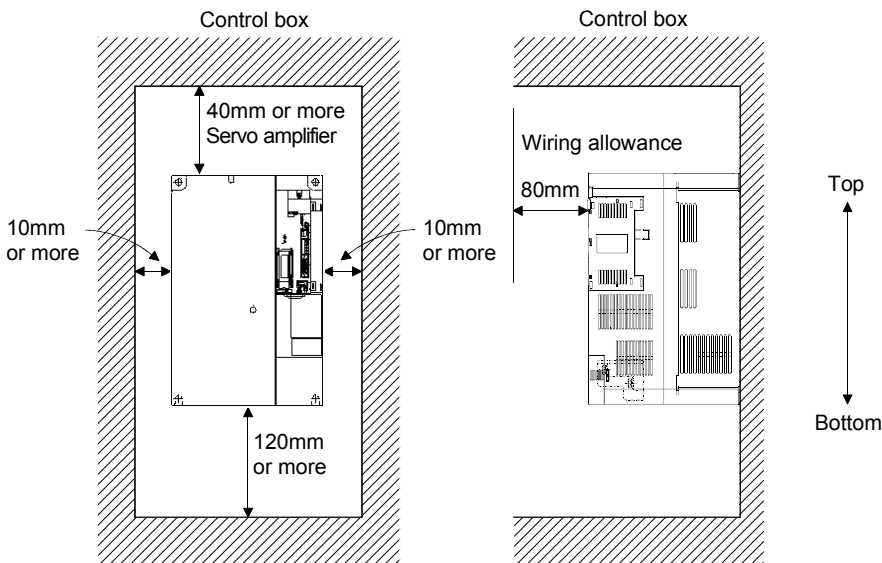
(b) Installation of two or more servo amplifiers

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

Control box
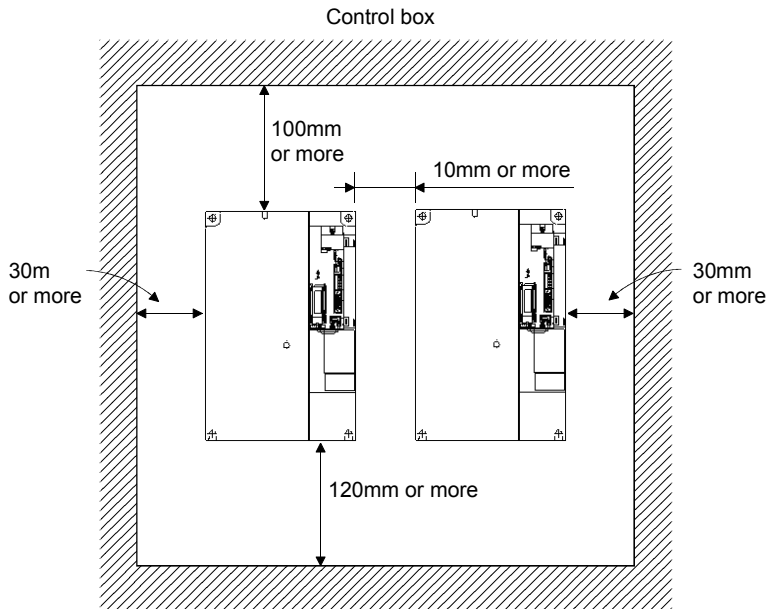
(3) Others

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

2.2 Keep out foreign materials

(1) When installing the unit in a control box, prevent drill chips and wire fragments from entering the servo amplifier.
(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the control box or a fan installed on the ceiling.
(3) When installing the control box in a place where there are much toxic gas, dirt and dust, conduct an air purge (force clean air into the control box from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the control box.

2.3 Cable stress

(1) The way of clamping the cable must be fully examined so that flexing stress and cable's own weight stress are not applied to the cable connection.
(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, brake) supplied with the servo motor, and flex the optional encoder cable or the power supply and brake wiring cables. Use the optional encoder cable within the flexing life range. Use the power supply and brake wiring cables within the flexing life of the cables.
(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.
(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 10.4 for the flexing life.

2.4 Inspection items

⚠WARNING	・Before starting maintenance and/or inspection, make sure that the charge lamp is off more than 15 minutes after power-off. Then, confirm that the voltage is safe in the tester or the like. Otherwise, you may get an electric shock. ・Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

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

It is recommended to make the following checks periodically:

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

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

2.5 Parts having service lives

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

Part name		Life guideline
Servo amplifier	Smoothing capacitor	10 years
	Relay	Number of power-on and number of emergency stop times : 100,000 times
	Cooling fan	10,000 to 30,000hours (2 to 3 years)
	Absolute position battery	Refer to section 5.8

(a) Smoothing capacitor

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

(b) Relays

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

(c) Servo amplifier cooling fan

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

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

3. CC-LINK COMMUNICATION FUNCTIONS

3.1 Communication specifications

POINT
・This servo is equivalent to a remote device station.

For details of the PLC side specifications, refer to the CC-Link system master unit manual.

Item			Specifications				
Power supply			5VDC supplied from servo amplifier				
CC-Link	Applicable CC-Link version		Ver.1.10				
	Communication speed		10M/5M/2.5M/625k/156kbps				
	Communication system		Broadcast polling system				
	Synchronization system		Frame synchronization system				
	Encoding system		MRZI				
	Transmission path format		Bus format (conforming to EIA RS485)				
	Error control system		CRC ($X^{16}+X^{12}+X^5+1$)				
	Connection cable		CC-Link Ver.1.10-compliant cable (Shielded 3-core twisted pair cable)				
	Transmission format		Conforming to HDLC				
	Remote station number		1 to 64				
	(Note) Cable length	Communication speed	156Kbps	625Kbps	2.5Mbps	5Mbps	10Mbps
		Maximum overall cable length	1200m	900m	400m	160m	100m
		Interstation cable length	0.2m or more				
Number of servo amplifiers connected			Max. 42 (when 1 station is occupied by 1 servo amplifier), (max. 32 when 2 stations are occupied by 1 servo amplifier), when there are only remote device stations. Can be used with other equipment.				

Note. If the system comprises of both CC-Link Ver.1.00- and Ver.1.10-compliant cables, Ver.1.00 specifications are applied to the overall cable length and the cable length between stations. For more information, refer to the CC-Link system master/local unit user's manual.

3.2 System configuration

3.2.1 Configuration example

(1) PLC side

Fit "Type QJ61BT11N", "Type A1SJ61BT11" or "Type A1SJ61QBT11" "Control & Communication Link system master/local module" to the main or extension base unit which is loaded with the PLC CPU used as the master station.

(2) Wiring

Connect the PLC CC-Link unit master station and the servo amplifier by a twisted pair cable (3-wire type).

PLC
CC-Link unit

CC-Link Ver.1.10-compliant cable
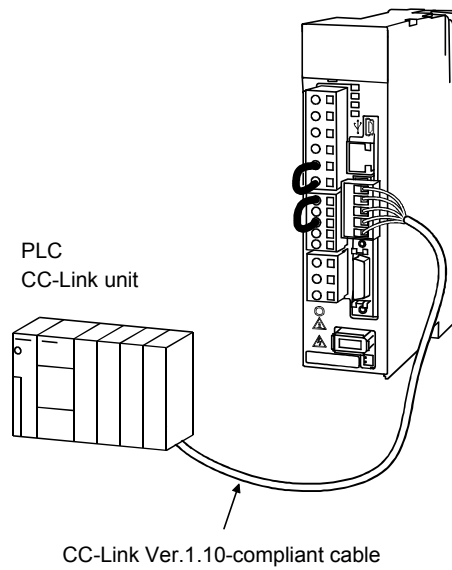
3.2.2 Wiring method

(1) Communication connector

The pin layout of the communication connector CN10 on the servo amplifier unit is shown below.
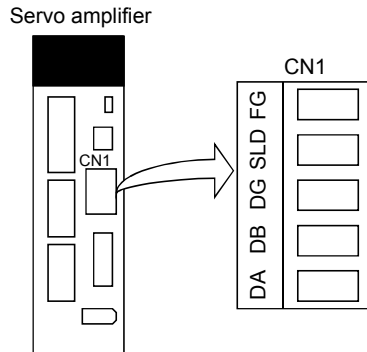
(2) Connection example

The servo amplifier and PLC CC-Link master unit are wired as shown below. Refer to section 14.9 (3) for the CC-Link Ver.1.10-compliant cable used for connection.
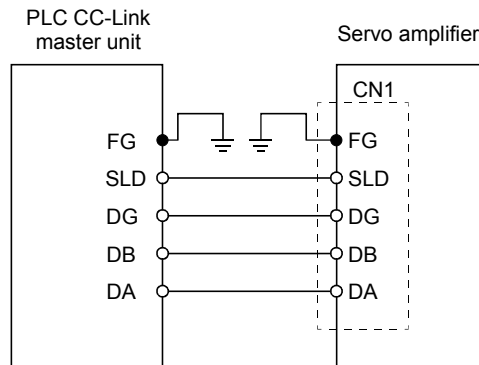
(3) Example of connecting multiple servo units

As the remote I/O stations of CC-Link, servo amplifiers share the link system and can be controlled/monitored using PLC user programs.

(Note 2) CC-Link Ver.1.10-compliant cable
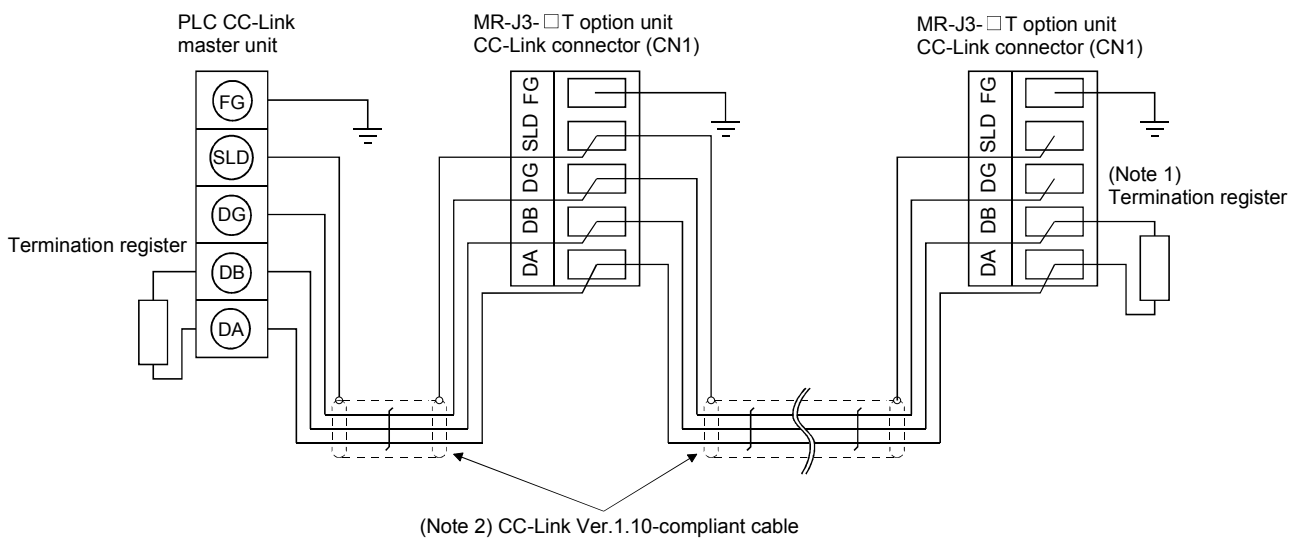
Note 1. Use the termination resistor supplied with the PLC. The resistance of the termination resistor depends on the cable used. For details, refer to the open field network CC-Link catalog (L(NA)74108143).

2. Refer to (4) of this section.

(4) How to wire the CC-Link connector (CN1)

    (a) Strip the sheath of the cable and separate the internal wires and braided shield.

    (b) Strip the sheaths of the braided shield and internal wires and twist the cores.

Braided shield

3-core twisted pair cable

Approx. 10mm (0.394in.)
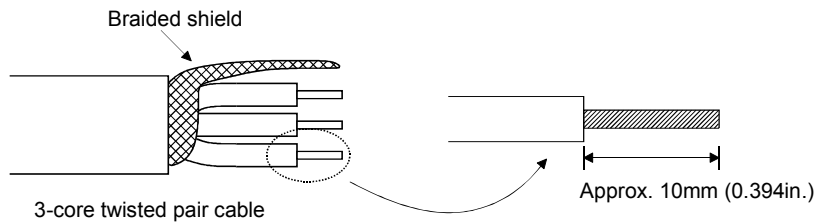
    (c) Match and twist the wires and braided shield of the cable connected to the preceding axis or PLC and the corresponding wires and braided shield of the cable connected to the subsequent axis.

    (d) For the last axis, work the termination resistor supplied to the CC-Link master unit as shown below.

Termination register

(10mm (0.394in.))   (10mm (0.394in.)) Remove sheath Remove sheath Fold lead wire

Cut   Cut
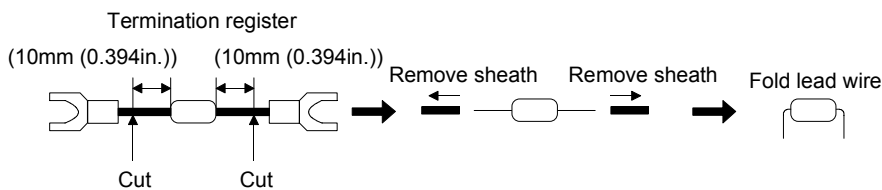
    (e) Insert the core of the cable into the opening and tighten it with a flat-blade screwdriver so that it will not come off. (Tightening torque: 0.5 to 0.6N・m) When inserting the wire into the opening, make sure that the terminal screw is fully loose.

To the preceding station or PLC

To the next station

Loosen   Tighten   CC-Link connector (CN1)

Flat blade screwdriver
• Tip thickness 0.4 to 0.6mm (0.016 to 0.024in.)
• Full wide 2.5 to 3.5mm (0.098 to 0.138in.)
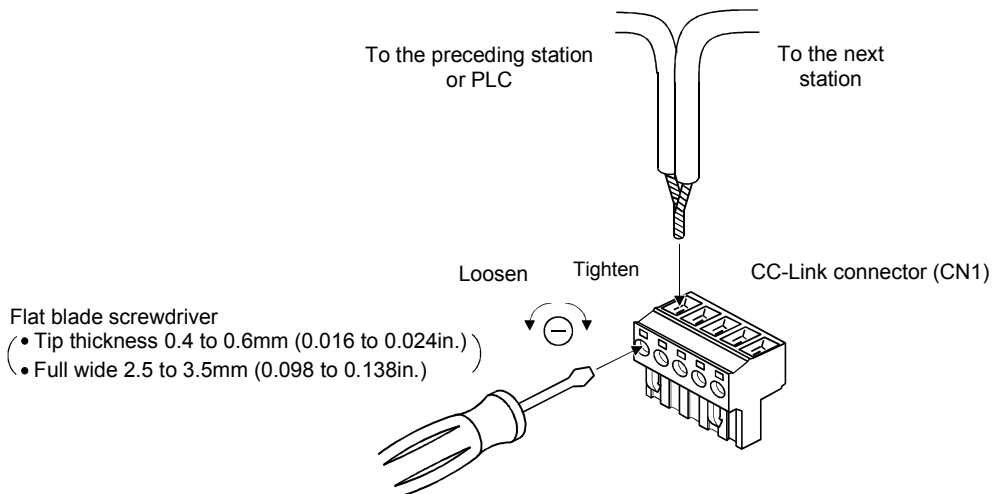
POINT
・Do not solder the cores as it may cause a contact fault.

Use of a flat-blade torque screwdriver is recommended to manage the screw tightening torque. The following table indicates the recommended products of the torque screwdriver for tightening torque management and the flat-blade bit for torque screwdriver. When managing torque with a Phillips bit, please consult us.

Product	Model	Maker/Representative
Torque screwdriver	N6L TDK	Nakamura Seisakusho
Bit for torque screwdriver	B-30, flat-blade, H3.5 X 73L	Shiro Sangyo

3.2.3 Station number setting

```
┌─────────────────────────────────────────────────────────┐
│  ┌──────────┐                                            │
│  │ POINT    │                                            │
│  └──────────┘                                            │
│  ・Be sure to set the station numbers within the range of │
│    1 to 64. Do not set the other values.                 │
└─────────────────────────────────────────────────────────┘
```

(1) How to number the stations

Set the servo station numbers before powering on the servo amplifiers. Note the following points when setting the station numbers:

(a) Station numbers may be set within the range 1 to 64.

(b) One servo amplifier occupies 1 or 2 stations. (One station of PLC remote device station)

(c) Max. number of connected units: 42

Note that the following conditions must be satisfied:

$\{(1 \times a) + (2 \times B) + (3 \times d) + (4 \times d)\} \leq 64$

a: Number of 1-station occupying units

b: Number of 2-station occupying units

c: Number of 3-station occupying units (not available for MR-J3-T)

d: Number of 4-station occupying units (not available for MR-J3-T)

$\{(16 \times A) + (54 \times B) + (88 \times C)\} \leq 2304$

A: Number of remote I/O stations ≤ 64

B: Number of remote device stations ≤ 42

C: Number of local stations ≤ 26

(d) When the number of units connected is 4, station numbers can be set as shown below:

Number of connected units is 4.
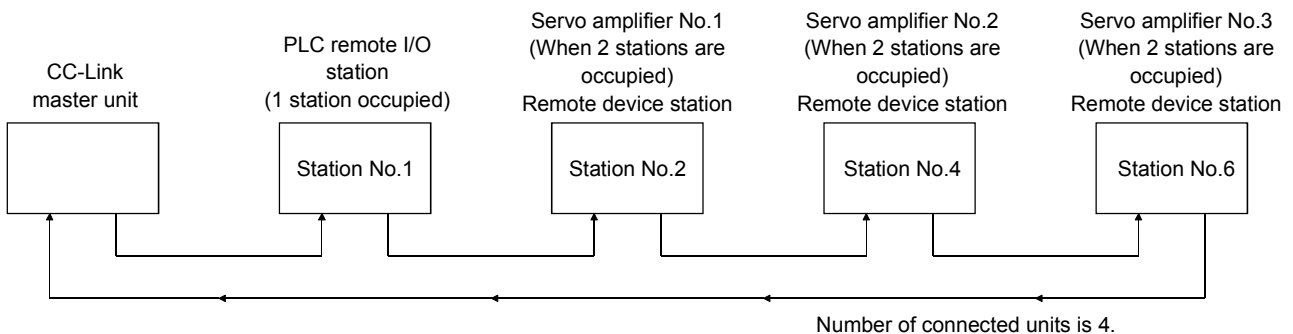
(2) Station number setting method

Set the station number with the station number switches (STATION NO.) on the servo amplifier front. The station number that may be set is any of 1 to 64 in decimal. In the initial status, the station number is set to station 1.
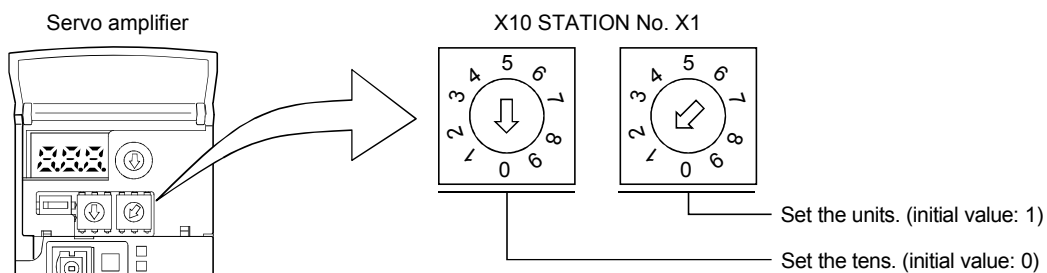
3.2.4 Communication baud rate setting

Set the transfer baud rate of CC-Link with the transfer baud rate switch (MODE) on the servo amplifier front. The initial value is set to 156kbps.

The overall distance of the system changes with the transfer speed setting. For details, refer to the CC-Link system master/local unit user's manual.

Servo amplifier   MODE

No.	Baud rate
0 (initial value)	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps
5 to 9	Not used
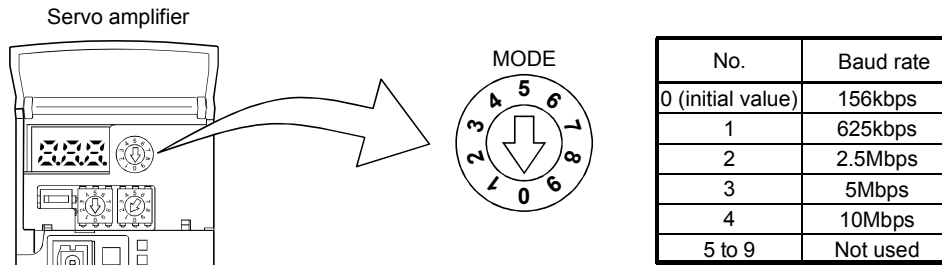
3.2.5 Occupied station count setting

Set the number of occupied stations with the occupied station count switch (SW1) on the servo amplifier front. The usable I/O signals and the number of connectable units change with the set number of occupied stations. Refer to section 3.2.3. In the initial status, the number of stations occupied is set to 1.

Servo amplifier

SW1 setting	Number of occupied stations
Initial value	1 station occupied
	2 station occupied
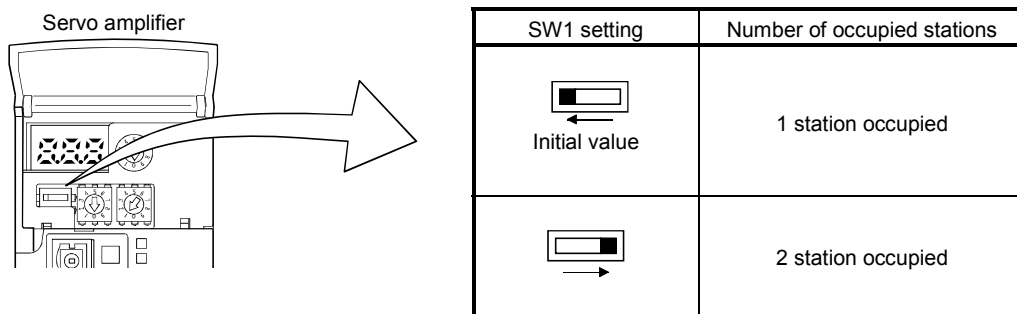
3.3 Functions

3.3.1 Function block diagram

This section explains the transfer of I/O data to/from the servo amplifier in CC-Link, using function blocks.

(1) Between the master station and servo amplifier in the CC-Link system, link refresh is normally performed at intervals of 3.5 to 18ms (512 points). The link scan time of link refresh changes with the communication speed. For details, refer to the CC-Link system master/local unit user's manual.

(2) The I/O refresh and master station sequence program are executed asynchronously. Some PLCs allow link scans to be synchronized with PLC scans.

(3) The FROM instruction from the buffer memory of the CC-Link system master/local unit is used to read data from the servo amplifier, and the TO instruction is used to write data. Some PLCs allow automatic refresh to be set to omit the FROM and TO instructions.
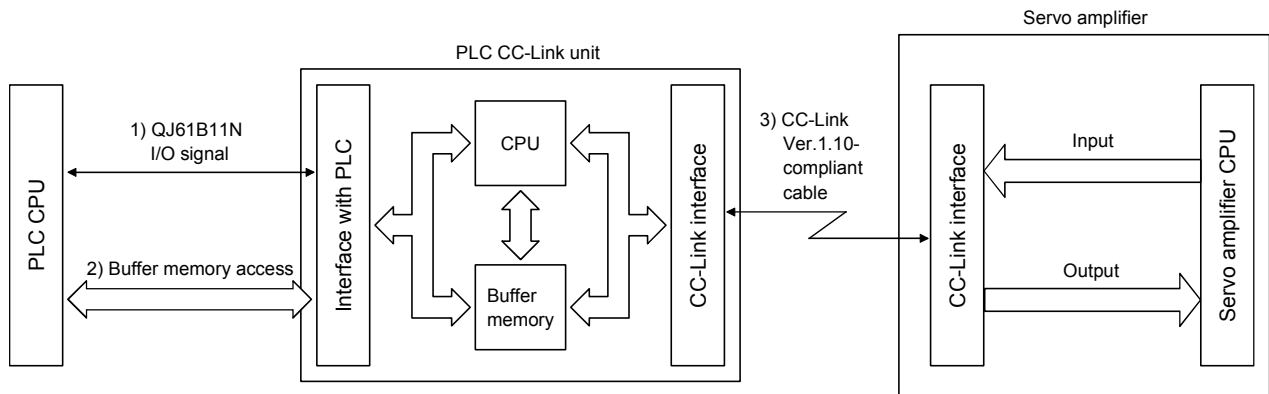
3.3.2 Functions

The following table lists the functions that may be performed from the PLC in the CC-Link system in the CC-Link operation mode or test operation mode.

Item	Operation mode	
	CC-Link operation mode	Test operation mode
Monitor	○	○
Operation	○	
Parameter write	○	○
Parameter read	○	○
Point table data write	○	○
Point table data read	○	○

3.4 Servo amplifier setting

(1) Servo amplifier side operation modes

This servo amplifier has the following operation modes:

Operation mode	Description
Test operation mode	Parameter unit or personal computer in which MR Configurator is installed is used to run the servo motor.
CC-Link operation mode	CC-Link communication functions are used to operate the servo with the PLC programs.

(2) Operation mode changing

(a) Operation mode changing conditions

Change the operation mode after making sure that:

1) The servo motor is at a stop.

2) The forward rotation start (RYn1) or reverse rotation start (RYn2) is OFF.

(b) Operation mode changing method

When changing from test operation to CC-Link operation, deselect test operation by switching power OFF/ON.
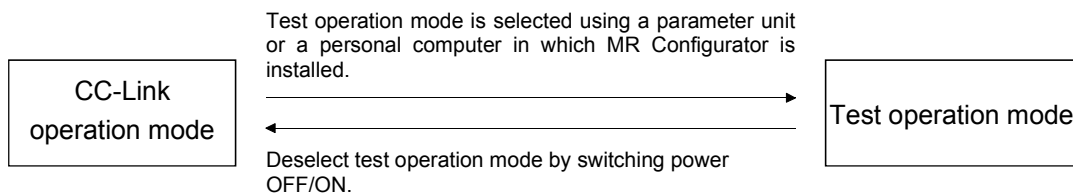
3.5 I/O signals (I/O devices) transferred to/from the PLC CPU

3.5.1 I/O signals (I/O devices)

The input signals (input devices) may be used as either the CC-Link or CN6 external input signals. Make selection in parameter No. PD06 to PD11, PD12 and PD14. The output signals (output devices) can be used as both the CC-Link・CN6 external output signals.

```
POINT
・In the factory-shipped status, the forward rotation stroke end (LSP), reverse
 rotation stroke end (LSN) and proximity dog (DOG) are valid as the CN6
 external input signals.
```

(1) When 1 station is occupied

RYn/RXn: 32 points each, RWrn/RWwn: 4 points each

PLC → Servo amplifier (RYn)				Servo amplifier → PLC (RXn)			
(Note) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.	(Note) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RYn0	Servo-on	SON		RXn0	Ready	RD	14
RYn1	Forward rotation start	ST1		RXn1	In position	INP	
RYn2	Reverse rotation start	ST2		RXn2	Rough match	CPO	
RYn3	Proximity dog	DOG	2	RXn3	Home position return completion	ZP	16
RYn4	Forward rotation stroke end	LSP	3	RXn4	Limiting torque	TLC	
RYn5	Reverse rotation stroke end	LSN	4	RXn5	Reserved		
RYn6	Automatic/manual selection	MDO		RXn6	Electromagnetic brake interlock	MBR	
RYn7	Temporary stop/Restart	TSTP		RXn7	Temporary stop	PUS	
RYn8	Monitor output execution demand	MOR		RXn8	Monitoring	MOF	
RYn9	Instruction code execution demand	COR		RXn9	Instruction code execution completion	COF	
RYnA	Point table No. selection 1	DI0		RXnA	Warning	WNG	
RYnB	Point table No. selection 2	DI1		RXnB	Battery warning	BWNG	
RYnC	Point table No. selection 3	DI2		RXnC	Movement finish	MEND	
RYnD	Point table No. selection 4	DI3		RXnD	Dynamic brake interlock	DB	
RYnE	Point table No. selection 5	DI4		RXnE	Position range output	POT	
RYnF	Clear	CR		RXnF	Reserved		
RY(n+1)0 to RY(n+1)9	Reserved			RX(n+1)1 to RX(n+1)9	Reserved		
RY1A	Reset	RES		RX(n+1)A	Trouble	ALM	15
RY(n+1)B to RY(n+1)F	Reserved			RX(n+1)B	Remote station communication ready	CRD	
				RX(n+1)C to RX(n+1)F	Reserved		

PLC → Servo amplifier (RWwn)		Servo amplifier → PLC (RWrn)	
Address No.	Signal name	Address No.	Signal name
RWwn	Monitor 1	RWrn	Monitor 1 data
RWwn+1	Monitor 2	RWrn+1	Monitor 2 data
RWwn+2	Instruction code	RWrn+2	Answer code
RWwn+3	Writing data	RWrn+3	Reading data

Note. "n" depends on the station number setting.

(2) When 2 stations are occupied

RXn/RYn: 64 points each, RWrn/RWwn: 8 points each

PLC → Servo amplifier (RYn)				Servo amplifier → PLC (RXn)			
(Note 1) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.	(Note 1) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RYn0	Servo-on	SON		RXn0	Ready	RD	14
RYn1	Forward rotation start	ST1		RXn1	In position	INP	
RYn2	Reverse rotation start	ST2		RXn2	Rough match	CPO	
RYn3	Proximity dog	DOG	2	RXn3	Home position return completion	ZP	16
RYn4	Forward rotation stroke end	LSP	3	RXn4	Limiting torque	TLC	
RYn5	Reverse rotation stroke end	LSN	4	RXn5	Reserved		
RYn6	Automatic/manual selection	MD0		RXn6	Electromagnetic brake interlock	MBR	
RYn7	Temporary stop/Restart	TSTP		RXn7	Temporary stop	PUS	
RYn8	Monitor output execution demand	MOR		RXn8	Monitoring	MOF	
RYn9	Instruction code execution demand	COR		RXn9	Instruction code execution completion	COF	
RYnA	Point table No. selection 1	DI0		RXnA	Warning	WNG	
RYnB	Point table No. selection 2	DI1		RXnB	Battery warning	BWNG	
RYnC	Point table No. selection 3	DI2		RXnC	Movement finish	MEND	
RYnD	Point table No. selection 4	DI3		RXnD	Dynamic brake interlock	DB	
RYnE	Point table No. selection 5	DI4		RXnE	Position range output	POT	
RYnF	Clear	CR		RXnF to RX(n+1)9	Reserved		
RY(n+1)0 to RY(n+1)9	Reserved						
RY(n+2)0	Position instruction execution demand (Note)			RX(n+2)0	Position instruction execution completion		
RY(n+2)1	Speed instruction execution demand (Note)			RX(n+2)1	Speed instruction execution completion		
RY(n+2)2	Reserved			RX(n+2)2	Point table No. output 1	PT0	
RY(n+2)3	Point table No. selection 6	DI5		RX(n+2)3	Point table No. output 2	PT1	
RY(n+2)4	Point table No. selection 7	DI6		RX(n+2)4	Point table No. output 3	PT2	
RY(n+2)5	Point table No. selection 8	DI7		RX(n+2)5	Point table No. output 4	PT3	
RY(n+2)6	Internal torque limit selection	TL1		RX(n+2)6	Point table No. output 5	PT4	
RY(n+2)7	Proportion control	PC		RX(n+2)7	Point table No. output 6	PT5	
RY(n+2)8	Gain switch	CDP		RX(n+2)8	Point table No. output 7	PT6	
RY(n+2)9	Reserved			RX(n+2)9	Point table No. output 8	PT7	
RY(n+2)A	Position/speed specifying system selection			RX(n+2)A to RX(n+2)F	Reserved		
RY(n+2)B	Absolute value/incremental value selection			RX(n+3)0 to RX(n+3)9	Reserved		
RY(n+2)C to RY(n+2)F	Reserved			RX(n+3)A	Trouble	ALM	15
RY(n+3)0 to RY(n+3)9	Reserved			RX(n+3)B	Remote station communication ready	CRD	
RY(n+3)A	Reset	RES		RX(n+3)C to RX(n+3)F	Reserved		
RY(n+3)B to RY(n+3)F	Reserved						

Note. "n" depends on the station number setting.

PLC → Servo amplifier (RWwn)		Servo amplifier → PLC (RWrn)	
(Note 1) Address No.	Signal name	(Note 1) Address No.	Signal name
RWwn	(Note 2) Monitor 1	RWrn	Monitor 1 data under 16 bit
RWwn+1	(Note 2) Monitor 2	RWrn+1	Monitor 1 data upper 16 bit
RWwn+2	Instruction code	RWrn+2	Answer code
RWwn+3	Writing data	RWrn+3	Read the data
RWwn+4	(Note 3) Position command data under 16 bit/Point table No.	RWrn+4	
RWwn+5	Position command data upper 16 bit	RWrn+5	Monitor 2 data under 16 bit
RWwn+6	(Note 4) Speed command data/Point table No.	RWrn+6	Monitor 2 data upper 16 bit
RWwn+7	Reserved	RWrn+7	Reserved

Note 1. "n" depends on the station number setting.
  2. Specify the code of the under 16 bit as the monitor code of 32-bit data.
  3. When the parameter No. PC30 setting is "□□0", specify the point table No. in RWwn+4. When the parameter No. PC30 setting is "□□1" or "□□2", specify the position data in RWwn+4/RWwn+5 and turn ON Position instruction execution demand (RY(n+2)0).
  4. When the parameter No. PC30 setting is "□□1", specify the point table No. in RWwn+6. When the parameter No. PC30 setting is "□□2", specify the speed data in RWwn+6, and turn ON Speed instruction execution demand (RY(n+2)1). When the parameter No. PC30 setting is "□□0", the RWwn+6 value is not used.

3.5.2 Detailed explanation of I/O signals

(1) Input signals

The note signs in the remarks column indicates the following descriptions.

＊1: Can be used as external input signals of CN6 connector by setting parameters No. PD06 to PD08 and parameter No. PD12 PD14.

＊2: Can be automatic turned ON internally by setting parameters No. PD01 PD04.

The signal whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name (Device name)	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Servo-on	Turning RYn0 ON powers on the base circuit, making operation ready to start. (Servo on status) Turning it OFF powers off the base circuit, coasting the servo motor. (Servo off status)	RYn0	RYn0	＊1
Forward rotation start	1. In absolute value command system Turning RYn1 ON for automatic operation executes positioning once on the basis of the position data set to the point table. Turning RYn1 ON for a home position return immediately starts a home position return. Keeping RYn1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction. 2. In incremental value command system Turning RYn1 ON for automatic operation executes positioning once in the forward rotation direction on the basis of the position data set to the point table. Turning RYn1 ON for a home position return immediately starts a home position return. Keeping RYn1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction.	RYn1	RYn1	＊1
Reverse rotation start	Use this device in the incremental value command system. Turning RYn2 ON for automatic operation executes positioning once in the reverse rotation direction on the basis of the position data set to the point table. Keeping RYn2 ON for JOG operation performs rotation in the reverse rotation direction. Reverse rotation indicates the address decreasing direction. Reverse rotation start (RYn2) is also used as the start signal of the high-speed automatic positioning function to the home position.	RYn2	RYn2	＊1

Signal name	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Proximity dog	In the shipment status, the proximity dog external input signal (CN6-2) is valid. For use in CC-Link, make it usable in parameter No. PD14. When RYn3 is turned OFF, the proximity dog is detected. The polarity of dog detection can be changed using parameter No. PD16. 	Parameter No. PD16	Proximity dog (RYn3) detection polarity
---	---
□0□□ (initial value)	OFF
□1□□	ON		RYn3	RYn3	*1
Forward rotation stroke end Reverse rotation stroke end	In the factory-shipped status, the forward rotation stroke end is valid as the external input signal (CN6-3) and the reverse rotation stroke end is valid as the external input signal (CN6-4). When starting operation, short CN6-3 - DOCOM and CN6-4 - DOCOM. Opening them causes a sudden stop, resulting in servo lock. For use in CC-Link, make it usable in parameter No. PD12. When starting operation, turn RYn4/RYn5 to ON. Turning it to OFF causes a sudden stop, resulting in servo lock. A stopping method can be changed in parameter No.PD20. When not using the forward/reverse rotation stroke end, set "Automatic ON" in parameter No. PD01. | (Note) Input signal		Operation	
---	---	---	---
RYn4	RYn5	CCW direction	CW direction
1	1	○	○
0	1		○
1	0	○	
0	0		| Note. 0: OFF 1: ON	RYn4 RYn5	RYn4 RYn5	*1 *2
Automatic/manual selection	Turning RYn6 ON selects the automatic operation mode, and turning it OFF selects the manual operation mode.	RYn6	RYn6	*1
Temporary stop/Restart	Turning RYn7 ON during automatic operation makes a temporary stop. Turning RYn7 ON again makes a restart. Forward rotation start (RYn1) or Reverse rotation start (RYn2) is ignored if it is turned ON during a temporary stop. When the automatic operation mode is changed to the manual operation mode during a temporary stop, the movement remaining distance is erased. During a home position return or during JOG operation, Temporary stop/Restart input is ignored.	RYn7	RYn7	

Signal name	Description	Device No. 1 station occupied	Device No. 2 stations occupied	Remarks

Monitor output execution demand	When RYn8 is turned ON, the following data and signals are set. At the same time, RXC turns ON. While RYn8 is ON, the monitor values are kept updated.
	1) When 1 station is occupied
	  Remote register RWrn: Data demanded by Monitor 1 (RWwn)
	  Remote register RWrn+1: Data demanded by Monitor 2 (RWwn+1)
	  Remote register RWrn+2: Answer code indicating normal or error
	2) When 2 stations are occupied
	  Remote register RWrn: Under 16 bits of data demanded by Monitor 1 (RWwn)
	  Remote register RWrn+1: Upper 16 bits of data demanded by Monitor 1 (RWwn)
	  Remote register RWrn+5: Under 16 bits of data demanded by Monitor 2 (RWwn+2)
	  Remote register RWrn+6: Upper 16 bits of data demanded by Monitor 2 (RWwn+2)
	  Remote register RWrn+2: Answer code indicating normal or error
		RYn8	RYn8	

Instruction code execution demand	Turning RYn9 ON executes the processing corresponding to the instruction code stored in remote register RWwn+2. After completion of instruction code execution, the answer code indicating normal or error is set to RWrn+2. At the same time, RXn9 turns ON.	RYn9	RYn9	
Point table No. selection 1	The point table No. and the home position return are selected by RYnA to RY(n+2)5.	RYnA	RYnA	*1 *2
Point table No. selection 2		RYnB	RYnB	
Point table No. selection 3		RYnC	RYnC	
Point table No. selection 4		RYnD	RYnD	
Point table No. selection 5		RYnE	RYnE	
Point table No. selection 6			RY(n+2)3	
Point table No. selection 7			RY(n+2)4	
Point table No. selection 8			RY(n+2)5	
Clear	When the parameter No. PD22 setting is "□□□1", the position control counter droop pulses is cleared at the leading edge of RYnF. The pulse width should be 10ms or more. When the parameter No. PD22 setting is "□□□2", the pulses are always cleared while RYnF is on.	RYnF	RYnF	*1 *2

The following table appears within the "Point table No. selection" rows:

Point table No.	(Note 1) Remote input							
	RY (n+2)5	RY (n+2)4	RY (n+2)3	RYnE	RYnD	RYnC	RYnB	RYnA
(Note 2)	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

Note 1. 0: OFF 1: ON
    2. Home position return is a setting

Signal name	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Position instruction demand	When RY(n+2)0 is turned ON, the point table No. or position command data set to remote register RWwn+4/RWwn+5 is set. When it is set to the servo amplifier, the answer code indicating normal or error is set to RWrn+2. At the same time, RX(n+2)0 turns ON. Refer to section 3.6.3 for details.		RY(n+2)0	
Speed instruction demand	When RY(n+2)1 is turned ON, the point table No. or speed command data set to remote register RWwn+6 is set. When it is set to the servo amplifier, the answer code indicating normal or error is set to RWrn+2. At the same time, RX(n+2)1 turns ON. Refer to section 3.6.3 for details.		RY(n+2)1	
Internal torque limit selection	Turning RY(n+2)6 OFF makes the torque limit value of parameter No. PA11 (forward rotation torque limit) · parameter No. PA12 (reverse rotation torque limit) valid, and turning it ON makes that of parameter No. PC35 (internal torque limit). (Refer to section 4.6.3)		RY(n+2)6	＊1
Proportion control	When RY(n+2)7 is turned ON, the speed amplifier is switched from the proportional integral type to the proportional type. If the servo motor at a stop is rotated even one pulse by an external factor, it develops torque in an attempt to compensate for a position shift. When the shaft is locked mechanically after Movement finish (RXnC) is turned OFF, for example, turning Proportion control (RY(n+2)7) ON as soon as Movement finish (RXnC) turns OFF allows control of unnecessary torque developed in an attempt to compensate for a position shift. When the shaft is to be locked for an extended period of time, turn Internal torque limit selection (RY(n+2)6) ON simultaneously with Proportion control (RY(n+2)7) to make the torque not more than the rated torque using Internal torque limit (parameter No. PC35).		RY(n+2)7	＊1 ＊2
Gain changing	When RY(n+2)8 is turned ON, the load inertia moment ratio and the corresponding gain values change to the values of parameter No. PB29 to PB32. To change the gain using RY(n+2)8, make the auto tuning invalid.		RY(n+2)8	＊1
Position/speed specifying system selection	Select how to give a position command/speed command. (Refer to section 3.6.3.) OFF: Remote input-based position/speed specifying system 　　　Specifying the point table No. with Point table No. selection (RYnA to RYnE) gives a position command/speed command. ON : Remote register-based position/speed specifying system 　　　Setting the instruction code to the remote register (RWwn+4 to RWwn+6) gives a position command/speed command. 　　　Set the parameter No. PC30 (direct specification selection) to "□□□2".		RY(n+2)A	

Signal name	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Absolute value/incremental value selection	RY(n+2)B is made valid when the remote register-based position/speed specifying system is selected with Position/speed specifying system selection (RY(n+2)A) and the absolute value command system is selected in parameter No. PD10. Turn RY(n+2)B OFF or ON to select whether the set position data is in the absolute value command system or incremental value command system. OFF: Position data is handled as an absolute value. ON : Position data is handled as an incremental value.		RY(n+2)B	
Reset	Keeping RY(n+1)A or RY(n+3)A ON for 50ms or longer allows an alarm to be deactivated. Some alarms cannot be deactivated by Reset RY(n+1)A or RY(n+3)A. (Refer to section 11.4.1.) If RY(n+1)A or RY(n+3)A is turned ON with no alarm occurring, the base circuit will not be shut off. When "□□1□" is set in parameter No. PD20 (function selection D-1), the base circuit is shut off. This signal is not designed to make a stop. Do not turn it ON during operation.	RY(n+1)A	RY(n+3)A	＊1
Forced stop	This signal is exclusively used as a CN6 external input signal. It cannot be used for CC-Link. Opening EMG-DOCOM results in a forced stop status, switches the servo off, and operates the dynamic brake to make a sudden stop. Short EMG-DOCOM in the forced stop status to cancel the forced stop status.			

(2) Output signals

```
┌─────────────────────────────────────────────────────────────────────────┐
│  POINT                                                                    │
│  ・The output devices can be used for both the remote output and the external │
│    output signals of CN6 connector.                                       │
└─────────────────────────────────────────────────────────────────────────┘
```

The signal whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name	Description	Device No.	
		1 station occupied	2 stations occupied
Ready	In the factory-shipped status, a proximity dog is assigned to the CN6-14 pin as an external output signal. RXn0 turns ON when the servo amplifier is ready to operate after servo-on.	RXn0	RXn0
In position	RXn1 turns ON when the droop pulse value is within the preset in-position range. The in-position range can be changed using parameter No. PA10. Increasing the in-position range may result in a continuous conduction status during low-speed rotation. RXn1 turns ON at servo-on.	RXn1	RXn1
Rough match	RXn2 turns ON when the command remaining distance becomes less than the rough match output range set in the parameter. RXn2 turns ON at servo-on.	RXn2	RXn2
Home position return completion	In the factory-shipped status, the home position return completion is assigned to the CN6-16 pin as an external output signal. RXn3 turns ON when a home position return is completed. RXn3 turns ON at completion of a home position return. In an absolute position system, RXn3 turns ON when operation is ready to start, but turns OFF in any of the following cases. 1) Servo-on (RYn0) is turned OFF. 2) Forced stop (EMG) is turned OFF. 3) Reset (RY(n+1)A or RY(n+3)A) is turned ON. 4) Alarm occurs. 5) Forward rotation stroke end (RYn4) or Reverse rotation stroke end (RYn5) is turned OFF. 6) Home position return has not been made after product purchase. 7) Home position return has not been made after occurrence of Absolute position erase (A25) or Absolute position counter warning (AE3). 8) Home position return has not been made after electronic gear change. 9) Home position return has not been made after the absolute position system was changed from invalid to valid. 10) Parameter No. PA13 (Rotation direction selection) has been changed. 11) Software limit is valid. 12) While a home position return is being made. When any of 1) to 12) has not occurred and a home position return is already completed at least once, Home position return completion (RXn3) turns to the same output status as Ready (RXn0).	RXn3	RXn3
Limiting torque	RXn4 turns ON when the torque is reached at the time of torque generation.	RXn4	RXn4
Electromagnetic brake interlock	RXn6 turns OFF at servo-off or alarm occurrence. At alarm occurrence, it turns OFF independently of the base circuit status.	RXn6	RXn6
Temporary stop	RXn7 turns ON when deceleration is started to make a stop by Temporary stop/Restart (RYn7). When Temporary stop/Restart (RYn7) is made valid again to resume operation, RXn7 turns OFF.	RXn7	RXn7
Monitoring	Refer to Monitor output execution demand (RYn8).	RXn8	RXn8

Signal name	Description	Device No.	
		1 station occupied	2 stations occupied
Instruction code execution completion	Refer to Instruction code execution demand (RYn9).	RXn9	RXn9
Warning	RXnA turns ON when a warning occurs. When no warning has occurred, RXnA turns OFF within about 1s after power-on.	RXnA	RXnA
Battery warning	RXnB turns ON when Open battery cable warning (A92) or Battery warning (A9F) occurs. When no battery warning has occurred, RXnB turns OFF within about 1s after power-on.	RXnB	RXnB
Movement finish	RXnC turns ON when In position (RXn1) turns ON and the command remaining distance is "0". RXnC turns ON at servo-on.	RXnC	RXnC
Dynamic brake interlock	RXnD turns off simultaneously when the dynamic brake is operated. When using the external dynamic brake on the servo amplifier of 11 kW or more, this device is required. (Refer to section 14.6.) For the servo amplifier of 7kw or less, it is not necessary to use this device.	RXnD	RXnD
Position range	RXnE turns ON when the actual current position falls within the range set in the parameter. It is OFF when a home position return is not yet completed or while the base circuit is off.	RXnE	RXnE
Position instruction execution completion	Refer to Speed instruction execution demand (RY(n+2)0).		RX(n+2)0
Speed instruction execution completion	Refer to Position instruction execution demand (RY(n+2)1). This device is required when using the external dynamic brake with a servo amplifier of 11kW or more. (Refer to section 14.6.) This is not required with servo amplifiers of 7kW or less.		RX(n+2)1
Point table No. output 1	As soon as Movement finish (RXnC) turns ON, the point table No. is output in 8-bit code.		RX(n+2)2
Point table No. output 2			RX(n+2)3
Point table No. output 3			RX(n+2)4
Point table No. output 4			RX(n+2)5
Point table No. output 5			RX(n+2)6
Point table No. output 6			RX(n+2)7
Point table No. output 7			RX(n+2)8
Point table No. output 8			RX(n+2)9

Point table No. output table:

Point table No.	(Note) Remote output							
	RX(n+2)9	RX(n+2)8	RX(n+2)7	RX(n+2)6	RX(n+2)5	RX(n+2)4	RX(n+2)3	RX(n+2)2
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

Note. 0: OFF 1: ON

RX(n+2)2 to RX(n+2)6 turn OFF in any of the following statuses.
・Power on
・Servo off
・During home position return
・Home position return completion
In any of the following statuses, RX(n+2)2 to RX(n+2)6 maintain their pre-change status (ON/OFF).
・When operation mode is changed
・When Automatic/manual selection (RYn6) is turned from OFF to ON or from ON to OFF to change the operation mode.
・During manual operation
・During execution of automatic positioning to home position

Signal name	Description	Device No.	
		1 station occupied	2 stations occupied
Trouble	RX(n+1)A or RX(n+3)A turns ON when the protective circuit is activated to shut off the base circuit. When no alarm has occurred, RX(n+1)A or RX(n+3)A turns OFF within about 1s after power is switched ON.	RX(n+1)A	RX(n+3)A
Remote station communication ready	This signal turns ON at power-on and turns off at a trouble occurrence or in the reset (RX (n+1) B or RX (n+3) B) ON status.	RX(n+1)B	RX(n+3)B

(3) Remote registers

The signal whose Remote Register field has an oblique line cannot be used.

(a) Input (PLC → servo amplifier)

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RWwn	RWwn	Monitor 1	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied 　Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. 2) When 2 stations are occupied 　Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. 　When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn and the upper 16-bit data to RWrn. data is stored in the RXn8. RXn8 turns on at the same time. 　Refer to section 3.5.3 for the item of the monitor code of the status indication.	Refer to section 3.5.3.
RWwn+1	RWwn+1	Monitor 2	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied 　Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+1. RXn8 turns on at the same time. 2) When 2 stations are occupied 　Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+5. RXn8 turns on at the same time. 　When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn+5 and the upper 16-bit data to RWrn+6. data is stored in the RXn8. RXn8 turns on at the same time. 　Refer to section 3.5.3 for the item of the monitor code of the status indication.	Refer to section 3.5.3.

| Remote register | | Signal name | Description | Setting range |
1 station occupied	2 stations occupied			
RWwn+2	RWwn+2	Instruction code	Sets the instruction code used to perform parameter or point table data read and write, alarm reference or the like. Setting the instruction code No. to RWwn+2 and turning RYn9 to ON executes the instruction. RXn9 turns to ON on completion of instruction execution. Refer to section 3.5.4 for instruction code No. definitions.	Refer to section 3.5.4 (1).
RWwn+3	RWwn+3	Writing data	Sets the written data used to perform parameter or point table data write, alarm history clear or the like. Setting the written data to RWwn+3 and turning RYn9 to ON writes the data to the servo amplifier. RXn9 turns to ON on completion of write. Refer to section 3.5.4 (2) for written data definitions.	Refer to section 3.5.4 (2).
	RWwn+4	Point table No./Position command data under 16 bit	Set the point table No. to be executed in the automatic operation mode when 2 stations are occupied. When the point table No. is set to RWwn+4 and RY(n+2)0 is turned ON, the point table No. is set to the servo amplifier. On completion of setting, RX(n+2)0 turns ON. When the point table is not used, set the position command data. When the under 16 bits are set to RWwn+4 and the upper 16 bits to RWwn+5, and RY(n+2)0 is turned ON, the position command data in the upper and under 16 bits are written. On complete of write, RX(n+2)0 turns ON. Use parameter No. PC30 to select whether point table No. setting or position command data setting will be made. Refer to section 3.6.3 for details of Point table No./Position command data.	Point table No.: 0 to 255 Absolute value command: Position command data: −999999 to 999999 Incremental value command: Position command data: 0 to 999999
	RWwn+5	Position command data upper 16 bit		
	RWwn+6	Point table No./Speed command data	When the point table is not used, set the point table No. to be executed or the speed command data (servo motor speed [r/min]). When the point table No. is set to RWwn+6 and RY(n+2)1 is turned ON, the point table No. or speed command data is set to the servo amplifier. On completion of setting, RX(n+2)1 turns ON. Use parameter No. PC30 to select whether point table No. setting or speed command data setting will be made. Refer to section 3.6.3 for details of Point table No./Speed command data.	Point table No.: 0 to 255 Speed command data: 0 to permissible speed

(b) Output (Servo amplifier → PLC)

Note that the data set to RWrn and RWrn+1 depends on whether 1 station or 2 stations are occupied.

If you set inappropriate code No. or data to the remote register input, the error code is set to Answer code (RWrn+2). Refer to section 3.5.5 for the error code.

When 1 station is occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data	The data of the monitor code set to RWwn is set.
RWrn+1	Monitor 2 data	The data of the monitor code set to RWwn+1 is set.
RWrn+2	Answer code	"0000" is set when the codes set to RWwn to RWwn+3 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.

When 2 stations are occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data under 16bit	The lower 16 bits of the data of the monitor code set to RWwn are set.
RWrn+1	Monitor 1 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn are set. A sign is set if there are no data in the upper 16 bits.
RWrn+2	Answer code	"0000" is set when the codes set to RWwn to RWwn+6 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.
RWrn+4		
RWrn+5	Monitor 2 data under 16bit	The lower 16 bits of the data of the monitor code set to RWwn+1 are set.
RWrn+6	Monitor 2 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn+1 are set. A sign is set if there are no data in the upper 16 bits.
RWrn+7		

3.5.3 Monitor codes

To demand 32-bit data when 2 stations are occupied, specify the lower 16-bit code No. Use any of the instruction codes 0101 to 011C to read the decimal point position (multiplying factor) of the status indication.
Setting any code No. that is not given in this section will set the error code (□□1□) to Answer code (RWrn+2).
At this time, "0000" is set to RWrn, RWrn+1, RWrn+5 and RWrn+6.
For monitor data, refer to section 8.5.3 (2).

Code No.		Monitored item	Answer data (Servo amplifier → PLC)	
1 station occupied	2 stations occupied		Data length	Unit
0000h	0000h			
0001h	0001h	Current position under 16bit	16bit	$\times 10^{STM}$[mm] or $\times 10^{STM}$[inch]
0002h		Current position upper 16bit	16bit	
0003h	0003h	Command position under 16bit	16bit	
0004h		Command position upper 16bit	16bit	
0005h	0005h	Command remaining distance under 16bit	16bit	
0006h		Command remaining distance upper 16bit	16bit	
0007h	0007h	Not monitored	16bit	
0008h	0008h	Point table	16bit	[No.]
0009h				
000Ah	000Ah	Feedback pulse value under 16bit	16bit	[pulse]
000Bh		Feedback pulse value upper 16bit	16bit	[pulse]
000Ch				
000Dh				
000Eh	000Eh	Droop pulse value under 16bit	16bit	[pulse]
000Fh		Droop pulse value upper 16bit	16bit	[pulse]
0010h	0010h			
0011h	0011h	Regenerative load factor	16bit	[%]
0012h	0012h	Effective load factor	16bit	[%]
0013h	0013h	Peak load factor	16bit	[%]
0014h		Instantaneusly occurring torque	16bit	[%]
0015h	0015h	ABS counter	16bit	[rev]
0016h	0016h	Motor speed under 16bit	16bit	$\times 0.1$[rev/min]
0017h		Motor speed upper 16bit	16bit	$\times 0.1$[rev/min]
0018h	0018h	Bus voltage	16bit	[V]
0019h	0019h	ABS position under 16bit	16bit	[pulse]
001Ah		ABS position middle 16bit	16bit	[pulse]
001Bh	001Bh	ABS position upper 16bit	16bit	[pulse]
001Ch	001Ch	Within one-revolution position under 16bit	16bit	[pulse]
001Dh		Within one-revolution position upper 16bit	16bit	[pulse]

3.5.4 Instruction codes (RWwn+2 · RWwn+3)
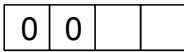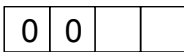
Refer to section 3.6.2 for the instruction code timing charts.

(1) Read instruction codes

The word data requested to be read with the instruction code 0000h to 0AFFh is read by Read code (RWrn+3).

Set the command code No. corresponding to the item to RWrn+2. The codes and answer data are all 4-digit hexadecimal numbers.

Setting any command code No. that is not given in this section will set the error code (□□1□) to Answer code (RWrn+2). At this time, "0000" is set to Reading data (RWrn+3).
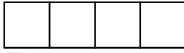
Code No.	Item/Function	Reading data (RWrn+3) contents (Servo amplifier → PLC)
0000h	Operation mode Reads the current operation mode.	0000: CC-Link operation mode 0001: Test operation mode
0002h	Travel multiplying factor Reads the multiplying factor of the position data in the point table set in parameter No. PA05.	Travel multiplying factor 0300: ×1000 0200: ×100 0100: ×10 0000: ×1
0010h	Current alarm (warning) reading Reads the alarm No. or warning No. occurring currently.	0 0 ☐ ☐ — Occurring alarm No./warning No.
0020h	Alarm number in alarm history (most recent alarm)	0 0 ☐ ☐ — Alarm No. that occurred in past
0021h	Alarm number in alarm history (first recent alarm)	
0022h	Alarm number in alarm history (second recent alarm)	
0023h	Alarm number in alarm history (third recent alarm)	
0024h	Alarm number in alarm history (fourth recent alarm)	
0025h	Alarm number in alarm history (fifth recent alarm)	
0030h	Alarm occurrence time in alarm history (most recent alarm)	Occurrence time of alarm that occurred in past
0031h	Alarm occurrence time in alarm history (first recent alarm)	
0032h	Alarm occurrence time in alarm history (second recent alarm)	
0033h	Alarm occurrence time in alarm history (third recent alarm)	
0034h	Alarm occurrence time in alarm history (fourth recent alarm)	
0035h	Alarm occurrence time in alarm history (fifth recent alarm)	
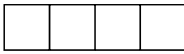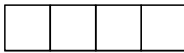
Code No.	Item/Function	Reading data (RWrn+3) contents (Servo amplifier → PLC)
0040h	Input signal status 0 Reads the statuses (OFF/ON) of the input signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF　　　　　　　　　　　　　bit0 When 2 stations are occupied, DI0, DI1 and DI2 do not function and therefore they are always "0". bit0: SON　bit4: LSP　bit8: MOR　bitC: DI2 bit1: ST1　bit5: LSN　bit9: COR　bitD: DI3 bit2: ST2　bit6: MDO　bitA: DI0　bitE: DI4 bit3: DOG　bit7: TSTP　bitB: DI1　bitF: ―――
0041h	Input signal status 1 Reads the statuses (OFF/ON) of the input signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF　　　　　　　　　　　　　bit0 bit0: PSR　bit4: DI6　bit8: CDP　bitC: ――― bit1: SPR　bit5: DI7　bit9: ―――　bitD: ――― bit2: ―――　bit6: TL1　bitA: CSL　bitE: ――― bit3: DI5　bit7: PC　bitB: INC　bitF: ―――
0042h	Input signal status 2 Reads the statuses (OFF/ON) of the input signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF　　　　　　　　　　　　　bit0 bit0: ―――　bit4: ―――　bit8: ―――　bitC: ――― bit1: ―――　bit5: ―――　bit9: ―――　bitD: ――― bit2: ―――　bit6: ―――　bitA: RES　bitE: ――― bit3: ―――　bit7: ―――　bitB: ―――　bitF: ―――
0050h	Output signal status 0 Reads the statuses (OFF/ON) of the Output signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF　　　　　　　　　　　　　bit0 bit0: RD　bit4: TLC　bit8: MOF　bitC: MEND bit1: INP　bit5: ―――　bit9: COF　bitD: ――― bit2: CPO　bit6: MBR　bitA: WNG　bitE: POT bit3: ZP　bit7: PUS　bitB: BWNG　bitF: ―――
0051h	Output signal status 1 Reads the statuses (OFF/ON) of the Output signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF　　　　　　　　　　　　　bit0 When 2 stations are occupied, MC0 and MC1 do not function and therefore they are always "0". bit0: PSF　bit4: PT2　bit8: PT6　bitC: ――― bit1: SPF　bit5: PT3　bit9: PT7　bitD: ――― bit2: PT0　bit6: PT4　bitA: ―――　bitE: ――― bit3: PT1　bit7: PT5　bitB: ―――　bitF: ―――
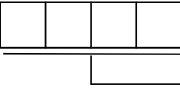
Code No.	Item/Function	Reading data (RWrn+3) contents (Servo amplifier → PLC)
0052h	Output signal status 2 Reads the statuses (OFF/ON) of the Output signals.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output signals. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] When 2 stations are occupied, MC0 and MC1 do not function and therefore they are always "0". bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: ALM bitE: ――― bit3: ――― bit7: ――― bitB: CRD bitF: ―――
0081h	Energization time Reads the energization time from shipment.	Returns the energization time [h]. [ ][ ][ ][ ] Energization time
0082h	Power ON frequency Reads the number of power-on times from shipment.	Returns the number of power-on times. [ ][ ][ ][ ] Power ON frequency
00A0h	Ratio of load inertia moment Reads the estimated ratio of load inertia moment to servo motor shaft inertia moment.	Return unit [times]. [ ][ ][ ][ ] Ratio of load inertia moment
00B0h	Home position within-1-revolution position under 16bit (CYC0) Reads the under 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. [ ][ ][ ][ ] Cycle counter value
00B1h	Home position within-1-revolution position upper 16bit Reads the upper 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. [ ][ ][ ][ ] Cycle counter value
00B2h	Home position Multi-revolution data (ABS0) Multi-revolution counter value of absolute home position reading	Return unit [rev]. [ ][ ][ ][ ] Multi-revolution counter value

00C0h	Error parameter No./Point data No. reading
	Reads the parameter No./point table No. in error.
		[ ][ ][ ][ ]
		Parameter No. or point table No.
		Parameter group
		  0: Basic setting parameters (No.PA□□)
		  1: Gain/filter parameters (No.PB□□)
		  2: Extension setting parameters (No.PC□□)
		  3: I/O setting parameters (No.PD□□)
		Type
		  1: Parameter No.
		  2: Point table No.

Code No.	Item/Function	Reading data (RWrn+3) contents (Servo amplifier → PLC)
0100h to 011Dh	Monitor multiplying factor Reads the multiplying factor of the data to be read with the monitor code. The instruction codes 0100 to 011D correspond to the monitor codes 0000 to 001D. 0000 applies to the instruction code that does not correspond to the monitor code.	Monitor multiplying factor 0003: ×1000 0002: ×100 0001: ×10 0000: ×1
0200h	Parameter group reading Reads the parameter group to be read with code No.8200h to be written.	Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)
0201h to 02FFh	Parameter data reading Reads the set value of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No. PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored.
0301h to 03FFh	Data form of parameter Reads the data format of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No. PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored. Decimal point position 0: Without decimal point 1: First least significant digit (without decimal point) 2: Second least significant digit 3: Third least significant digit 4: Fourth least significant digit Data format 0: Used unchanged as hexadecimal 1: Must be converted into decimal Parameter write type 0: Valid after write 1: Valid when power is switched on again after write
0401h to 04FFh 0501h to 05FFh	Position data of point table No. 1 to 255 Reads the point table data of point table No. 1 to 255. 0400 to 04FF: Position data in under 16 bits of point table No. 1 to 255 0500 to 05FF: Position data in upper 16 bits of point table No. 1 to 255 Example Instruction code 0413: Under 16 bits of point table No. 19 Instruction code 0513: Upper 16 bits of point table No. 19	The position data (upper 16 bits or lower 16 bits) set in the requested point table No. is returned.

Code No.	Item/Function	Reading data (RWrn+3) contents (Servo amplifier → PLC)
0601h to 06FFh	Servo motor speed of point table No. 1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The servo motor speed set to the requested point table No. is returned. Servo motor speed
0701h to 07FFh	Acceleration time constant of point table No. 1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The acceleration time constant set to the requested point table No. is returned.
0801h to 08FFh	Deceleration time constant of point table No. 1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The deceleration time constant set to the requested point table No. is returned.
0901h to 09FFh	Dwell of point table No. 1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The dwell set to the requested point table No. is returned.
0A01h to 0AFFh	Auxiliary function of point table No. 1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The Auxiliary function set to the requested point table No. is returned.

(2) Write instruction codes

Set the data, which was requested to be written with the instruction code 8010h to 91FFh.

Set the instruction code No. corresponding to the item to Instruction code (RWwn+2) and the written data to Writing data (RWwn+3). The codes and answer data are all 4-digit hexadecimal numbers.

When the instruction code which has not been described in this section is set, the error code (□□1□) is stored in answer code (RWrn+2).

Code No.	Item	Writing data (RWwn+3) contents (PLC → Servo amplifier)
8010h	Alarm reset command Deactivates the alarm that occurred.	1EA5
8101h	Feedback pulse value display data is clear Resets the display data of the status indication "feedback pulse value" to 0.	1EA5
8200h	Parameter group write command Writes the group of parameters that are written to with codes No. 8201h to 82FFh and 8301h to 83FFh. Writes the group of parameters that are read with codes No. 0201h to 02FFh and 0301h to 03FFh.	Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)

Code No.	Item	Writing data (RWwn+3) contents (PLC → Servo amplifier)
8201h to 82FFh	Data RAM instruction of parameter Writes the set value of each No. of the parameter group written by code No.8200h to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No. PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before making setting.
8301h to 83FFh	Data EEP-ROM instruction of parameter Writes the set value of each No. of the parameter group written with code No.8200h to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No. PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before making setting.
8401h to 84FFh 8501h to 85FFh	Position data RAM command of point table Writes the position data of point table No. 1 to 255 to RAM. These values are cleared when power is switched off. A set of the upper and under bits makes position data. When changing the data, always set the data of both under and upper bits in order of under 16-bit data and upper 16-bit data. 8400 to 841F: Position data in under 16 bits of point table No. 1 to 255 8500 to 851F: Position data in upper 16 bits of point table No. 1 to 255 Example Instruction code 8413: Under 16 bits of point table No. 19 Instruction code 8513: Upper 16 bits of point table No. 19	Convert the values into hexadecimal before making setting.
8601h to 86FFh	Motor speed of point table Writes the motor speeds of point table No. 1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8701h to 87FFh	Acceleration time constant data RAM command of point table Writes the acceleration time constants of point table No. 1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.

Code No.	Item	Writing data (RWwn+3) contents (PLC → Servo amplifier)
8801h to 88FFh	Deceleration time constant data RAM command of point table Writes the deceleration time constants of point table No. 1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8901h to 89FFh	Dwell data RAM command of point table Writes the dwell data of point table No. 0 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8A01h to 8AFFh	Auxiliary function data RAM command of point table Writes the auxiliary function data of point table No. 0 to 31 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8B01h to 8BFFh 8C01h to 8CFFh	Position data EEP-ROM command of point table Writes the position data of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The lower 16 bits are written in even code and the upper 16 bits in odd code. 8B01h to 8BFF: Position data in under 16 bits of point table No. 1 to 255 8C01h to 8CFF: Position data in upper 16 bits of point table No. 1 to 255 Example Instruction code 8B13: Under 16 bits of point table No. 19 Instruction code 8C13: Upper 16 bits of point table No. 19	Convert the values into hexadecimal before making setting.
8D01h to 8DFFh	Servo motor speed data EEP-ROM command of point table Writes the servo motor speeds of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8E01h to 8EFFh	Acceleration time constant data EEP-ROM command of point table Writes the acceleration time constants of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
8F01h to 8FFFh	Deceleration time constant data EEP-ROM command of point table Writes the deceleration time constants of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.

Code No.	Item	Writing data (RWwn+3) contents (PLC → Servo amplifier)
9001h to 90FFh	Dwell data EEP-ROM command of point table Writes the dwell data of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.
9101h to 91FFh	Auxiliary function data EEP-ROM command of point table Writes the auxiliary function data of point table No. 1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before making setting.

3.5.5 Answer codes (RWrn+2)

If any of the monitor codes, instruction codes, position command data/point table Nos., speed command data/point table Nos. set to the remote register is outside the setting range, the corresponding error code is set to Answer code (RWwn+2). "0000" is set if they are normal.

```
┌─┬─┬─┬─┐
│ │ │ │ │
└─┴─┴─┴─┘
 │ │ │ └────── Error related to Monitor code 1/Monitor code 2
 │ │ └──────── Error related to Instruction code/Writing data
 │ └────────── Error related to Position instruction data/Point table No.
 └──────────── Error related to Speed instruction data/Point table No.
```
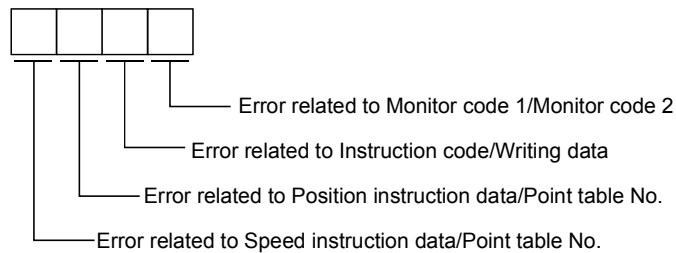
Code No.	Error	Details
0	Normal answer	Instruction was completed normally.
1	Code error	▪ The monitor code not in the specifications was set. ▪ Read/write of the point table of No. 255 or later was set.
2	Parameter ▪ point table selection error	▪ The parameter No. disabled for reference was set.
3	Write range error	▪ An attempt was made to write the parameter or point table data outside the setting range.

3.5.6 Setting the CN6 external input signals

Using parameter No. PD06 to PD08, PD12 and PD14, you can assign the input signals as the CN6 external input signals. The signals assigned as the CN6 external input signals cannot be used in CC-Link. Refer to section 4.5.1 for the pins to which signals can be assigned.

In the initial status, the forward rotation stroke end, reverse rotation stroke end and proximity dog are preset to be usable as the CN6 external input signals.

Parameter No.PD12

Device name	Initial value	
	BIN	HEX
	0	
	0	0
Servo-on (SON)	0	
Reset (RES)	0	

Device name	Initial value	
	BIN	HEX
Proportion control (PC)	0	
	0	0
Clear (CR)	0	
Forward rotation start (ST1)	0	

Device name	Initial value	
	BIN	HEX
Reverse rotation start (ST2)	0	
Internal torque limit selection (TL1)	0	
Forward rotation stroke end (LSP)	1	C
Reverse rotation stroke end (LSN)	1	

Device name	Initial value	
	BIN	HEX
	0	
Gain switch (CDP)	0	0
	0	
	0	

BIN 0: Used in CC-Link
BIN 1: Used as CN6 external input signal

Parameter No.PD14

	Device name	Initial value	
		BIN	HEX
	Automatic/manual selection (MD0)	0	
		0	0
		0	
		0	

	Device name	Initial value	
		BIN	HEX
		0	
		0	0
		0	
	Temporary stop/Restart (TSTP)	0	

	Device name	Initial value	
		BIN	HEX
		0	
		0	8
		0	
	Proximity dog (DOG)	1	

BIN 0: Used in CC-Link
BIN 1: Used as CN6 external input signal

3.6 Data communication timing charts

3.6.1 Monitor codes

(1) When 1 station is occupied
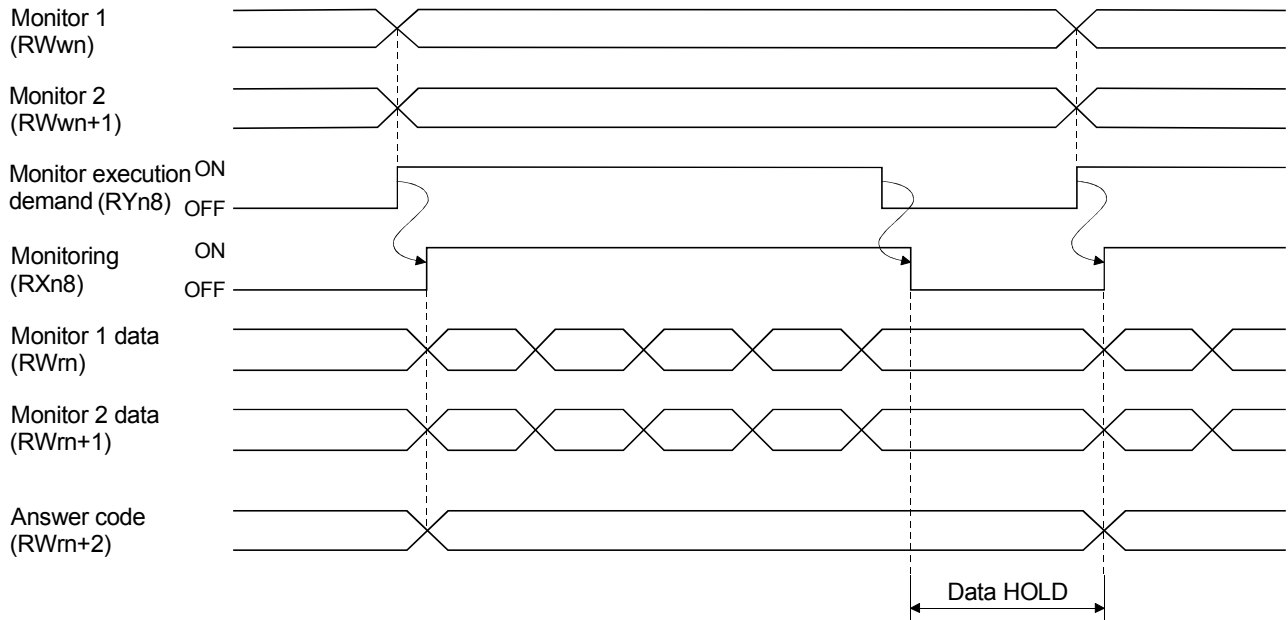
Set the monitor codes (refer to section 3.5.3) to Monitor 1 (RWwn) and Monitor 2 (RWwn+1) and turn Monitor output execution demand (RYn8) to ON. Turning Monitor execution demand (RYn8) to ON sets the next data. Data are all hexadecimal numbers. At this time, Monitoring (RXn8) turns to ON at the same time.

Monitor data 1 (RWrn): Data demanded by Monitor 1 (RWwn)
Monitor data 2 (RWrn+1): Data demanded by Monitor 2 (RWwn+1)

For 32-bit data, set the lower 16 bits of the monitor code to Monitor 1 (RWwn) and the upper 16 bits to Monitor 2 (RWwn+1) and read them simultaneously.
The monitor data set to the remote register are always updated while Monitor execution demand (RYn8) is ON. When Monitoring (RXn8) turns to OFF, the data set to Monitor data RWrn, RWrn+1 are held. If the monitor code not in the specifications is set to either Monitor 1 (RWwn) or Monitor 2 (RWwn+1), the corresponding error code (□□□1) is set to Answer code.

(2) When 2 stations are occupied
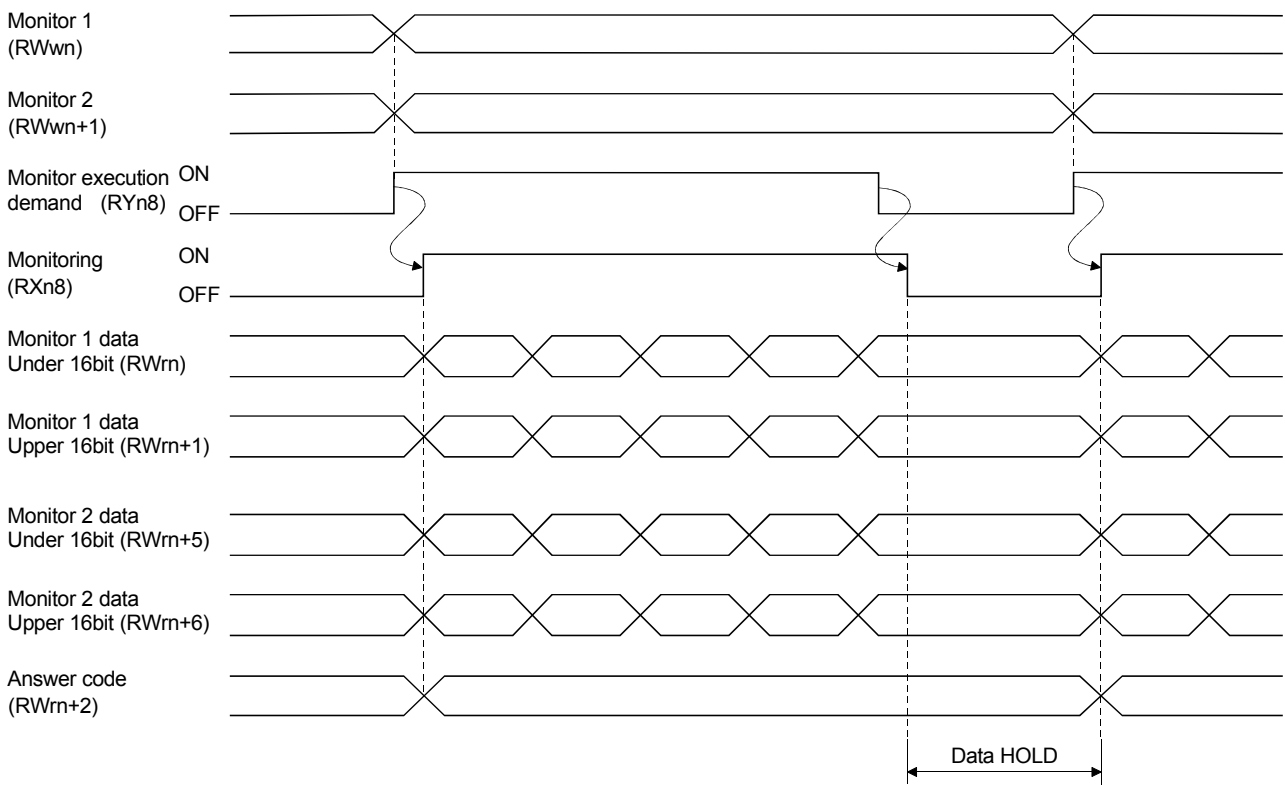
Set the monitor codes (refer to section 3.5.3) to Monitor 1 (RWwn) and Monitor 2 (RWwn+1) and turn Monitor output execution demand (RYn8) to ON. Turning Monitor execution demand (RYn8) to ON sets the next data. 32-bit data are all divided into the upper 16 bits and lower 16 bits, and set to the remote register. Data are all hexadecimal numbers. At this time, Monitoring (RXn8) turns to ON at the same time.

Monitor data 1 under 16 bit (RWrn): Lower 16 bits of data demanded by Monitor 1 (RWwn)
Monitor data 1 upper 16 bit (RWrn+1): Upper 16 bits of data demanded by Monitor 1 (RWwn)
Monitor data 2 under 16 bit (RWrn+5): Lower 16 bits of data demanded by Monitor 2 (RWwn+1)
Monitor data 2 upper 16 bit (RWrn+6): Upper 16 bits of data demanded by Monitor 2 (RWwn+1)

A sign is set if data does not exist in RWrn+1 · RWrn+6. A "+" sign is indicated by "0000", and "−" by "FFFF".
The monitor data set to the remote register are always updated while Monitoring (RXn8) is ON.
When Monitoring (RXn8) turns to OFF, the data set to Monitor data RWrn, RWrn+1, RWrn+5, RWrn+6 are held.
If the monitor code not in the specifications is set to either Monitor 1 (RWwn) or Monitor 2 (RWwn+1), the corresponding error code (□□□1) is set to Answer code.

3.6.2 Instruction codes

(1) Read instruction codes (0000h to 0A1Fh)
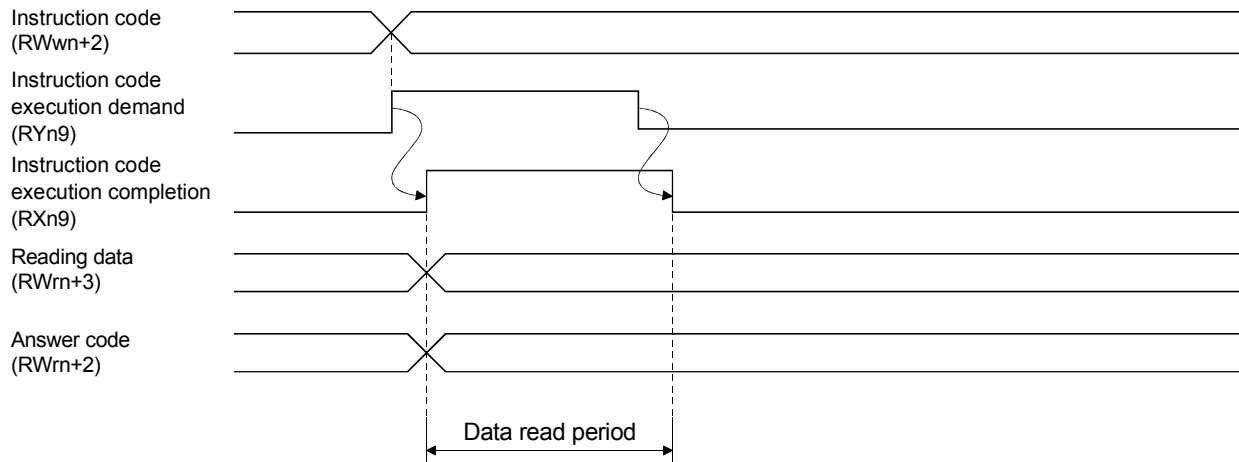
Set the read instruction code (refer to section 3.5.4 (1)) to Instruction code (RWwn+2) and turn Instruction code execution demand (RYn9) to ON. Turning Instruction code execution demand (RYn9) to ON sets the data corresponding to the preset read code to Reading data (RWrn+3). Data are all hexadecimal numbers. At this time, Instruction code execution completion (RXn9) turns to ON at the same time.

Read the read data set to Reading data (RWrn+3) while Instruction code execution completion (RXn9) is ON. The data set to Reading data (RWrn+3) is held until the next read instruction code is set and Instruction code execution demand (RYn9) is turned to ON.

If the instruction code not in the specifications is set to Instruction code (RWwn+2), the corresponding error code (□□1□) is set to Answer code. If any unusable parameter, point table is read, the corresponding error code (□□2□) is set.

Turn Instruction code execution demand (RYn9) to OFF after completion of data read.

(2) Write instruction codes (8000h to 911Fh)
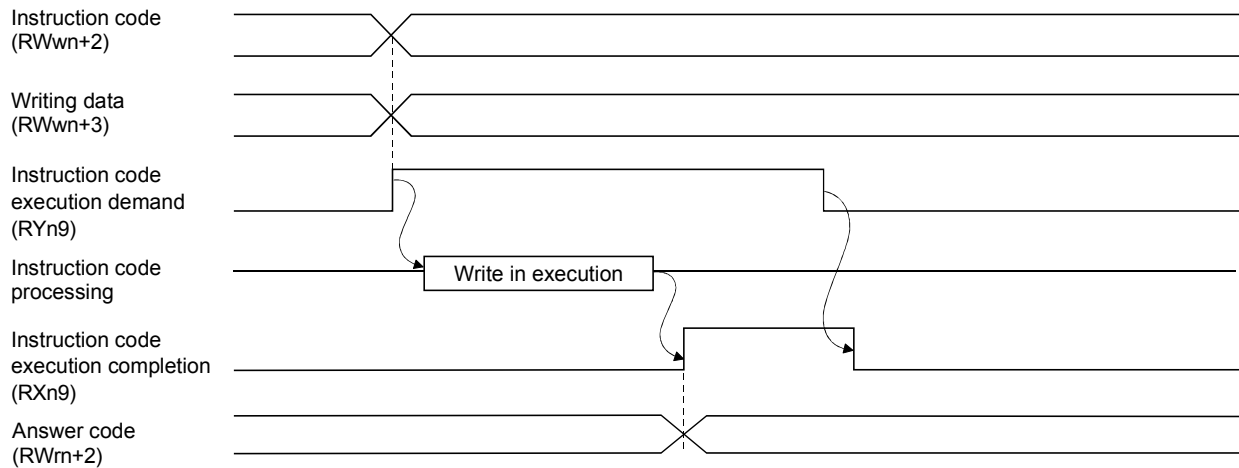
Set the write instruction code (refer to section 3.5.4 (2)) to Instruction code (RWwn+2) and the data to be written (data to be executed) to Writing data (RWwn+3) in hexadecimal, and turn Instruction code execution demand (RYn9) to ON.

Turning instruction code execution completion to ON sets the data set in Wiring data (RWwn+3) to the item corresponding to the write instruction code. When write is executed, Instruction code execution completion (RXn9) turns to ON.

If the instruction code not in the specifications is set to Instruction code (RWwn+2), the corresponding error code (□□1□) is set to Answer code.

Turn Instruction code execution demand (RYn9) to OFF after Instruction code execution completion (RXn9) has turned to ON.

3.6.3 Remote register-based position/speed setting

The functions in this section are usable when Position/speed specifying system selection (RY(n+2)A) is ON (remote register-based position/speed specifying system is selected) with 2 stations occupied.
The position command/speed command necessary for positioning can be selected by parameter No. PC30 setting as indicated below.

Parameter No.PC30

Set value	Position command	Speed command
0	Specify the point table No.	
1	Set the position data.	Specify the point table No.
2		Set the servo motor speed.

(1) When setting the point table No.

Specify the point table No. stored in the servo amplifier and execute positioning.
Preset "□□□0" (initial value) in parameter No. PC30 to enable point table No.-setting operation.
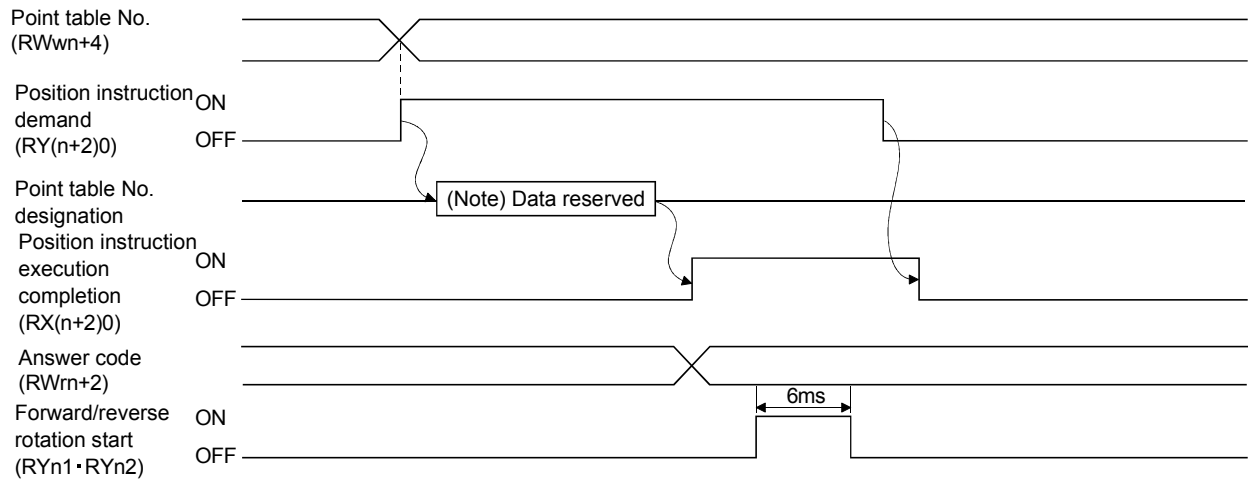
Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the point table No. to point table No. (RWwn+4) and turn Position instruction demand (RY(n+2)0) to ON.
Turning RY(n+2)0 to ON stores the position block No. into RAM of the servo amplifier.
When the data is stored, Position instruction execution completion (RX(n+2)0) turns to ON.
If data outside the setting range is set to Position block No. (RWwn+4), the error code (refer to section 3.5.5) is set to Answer code.
Turn Forward rotation start (RYn1)/Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) has turned to ON.

(2) When setting the position command data/point table No. (speed command)

Specify the position address with the remote register, and specify the speed command data by specifying the point table No. to use the preset servo motor speed, acceleration time constant and deceleration time constant the speed command data, and execute positioning.

Preset "□□□1" in parameter No. PC30 to enable position command data-set and point table No. (speed instruction)-setting operation.
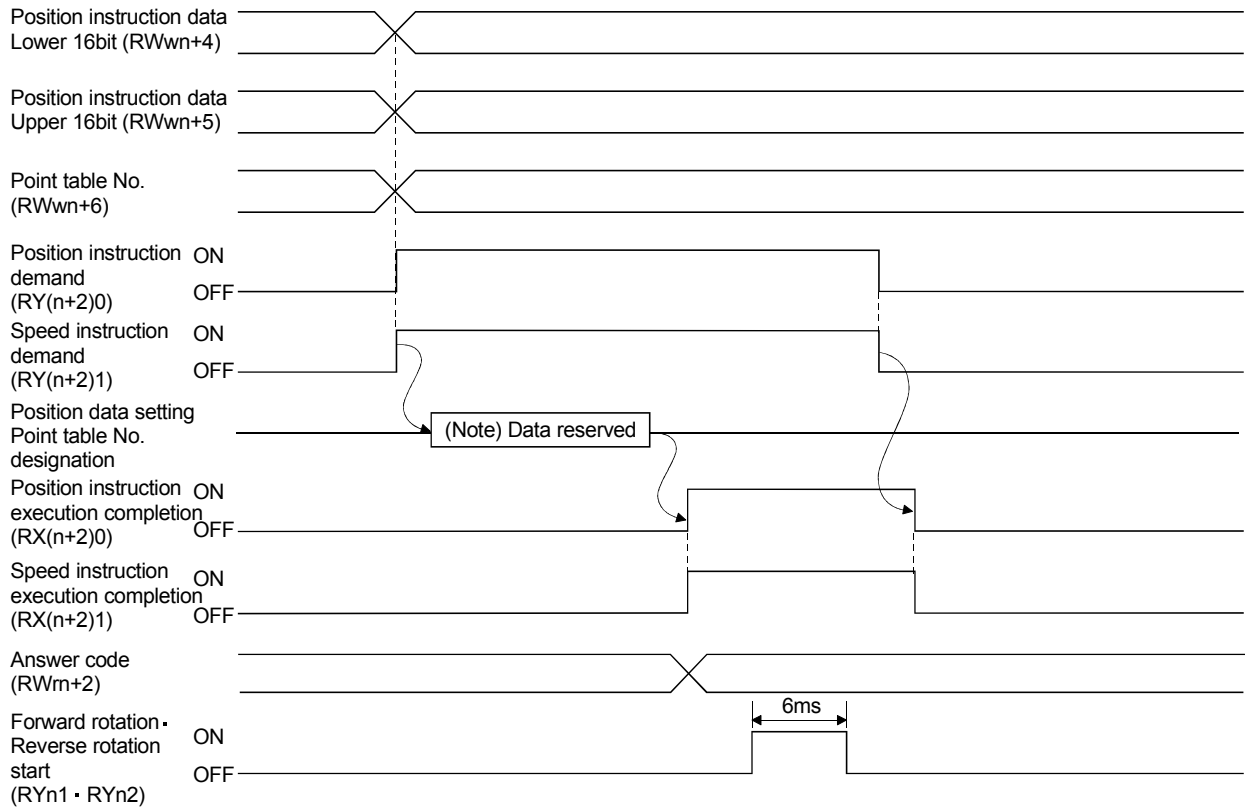
Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data under 16 bit (RWwn+4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWwn+5), and point table for speed command No. to point table No. (RWwn+6), and turn Position instruction demand (RY(n+2)0) and Speed instruction demand (RY(n+2)1) to ON.

Turning RY(n+2)0 and RY(n+2)1 to ON stores the position command data and point table No. into RAM of the servo amplifier.

When the data are stored, Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) turn to ON.

If data outside the setting range is set to any of Position instruction data under 16 bit (RWwn+4), Position instruction data upper 16 bit (RWwn+5) and point table No. (RWwn+6), the error code (refer to section 3.5.5) is set to Answer code.

Turn Forward rotation start (RYn1)・Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) have turned to ON.

(3) When setting the position command data and speed command data

Specify the position address and servo motor speed with the remote register, and execute positioning. At this time, use the acceleration time constant and deceleration time constant set in point table No. 1.

Preset "□□□2" in parameter No. PC30 to enable position command data- and speed command data-set operation.
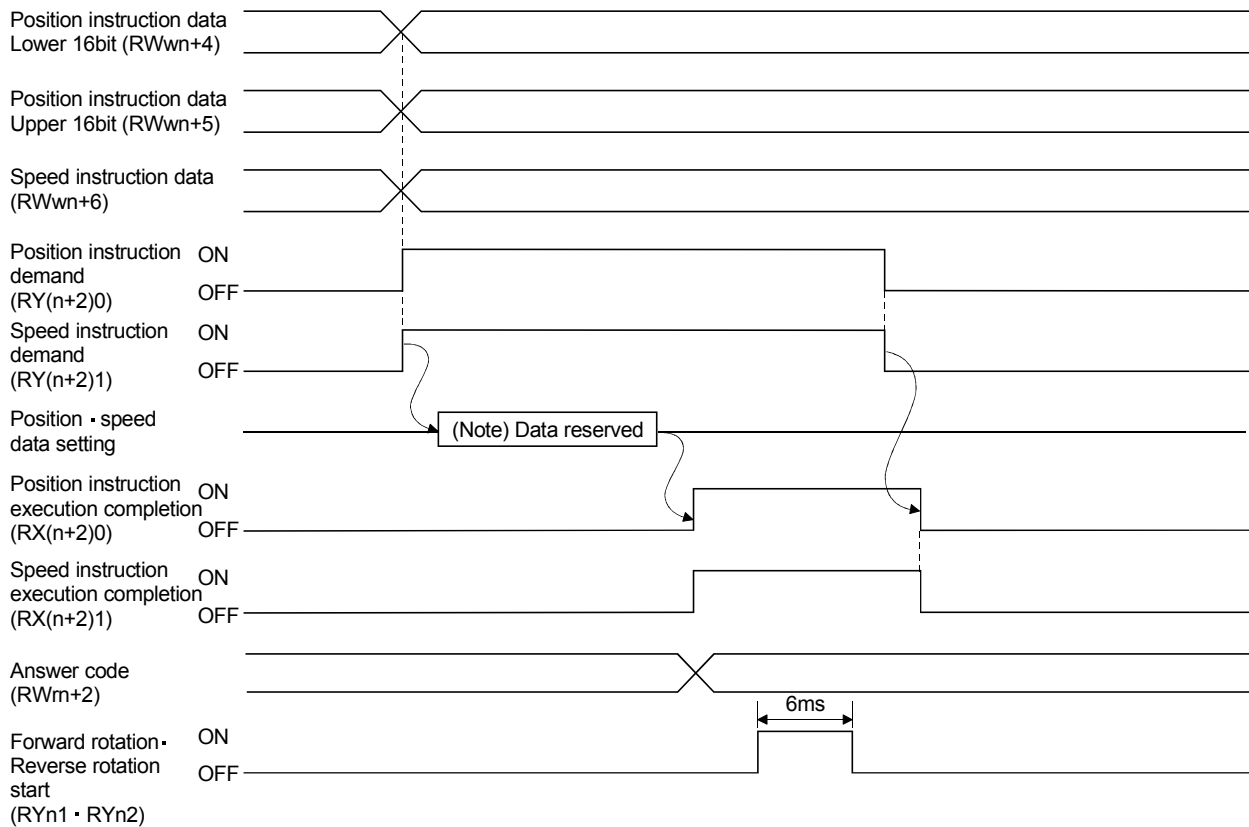
Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data under 16 bit (RWwn+4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWwn+5), and speed instruction data to Speed instruction data (RWwn+6), and turn Position instruction demand (RY(n+2)0) and Speed instruction demand (RY(n+2)1) to ON.

Turning RY(n+2)0 and RY(n+2)1 to ON stores the position command data and speed command data into RAM of the servo amplifier.

When the data are stored, Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) turn to ON.

If data outside the setting range is set to any of Position instruction data under 16 bit (RWwn+4), Position instruction data upper 16 bit (RWwn+5) and Speed command data (RWwn+6), the error code (refer to section 3.5.5) is set to Answer code.

Turn Forward rotation start (RYn1)・Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) have turned to ON.

3.7 Function-by-function programming examples

This section explains specific programming examples for servo operation, monitor, parameter read and write, and others on the basis of the equipment makeup shown in section 3.7.1.

3.7.1 System configuration example

As shown below, the CC-Link system master·local unit is loaded to run two servo amplifiers (1 station occupied / 2 stations occupied).
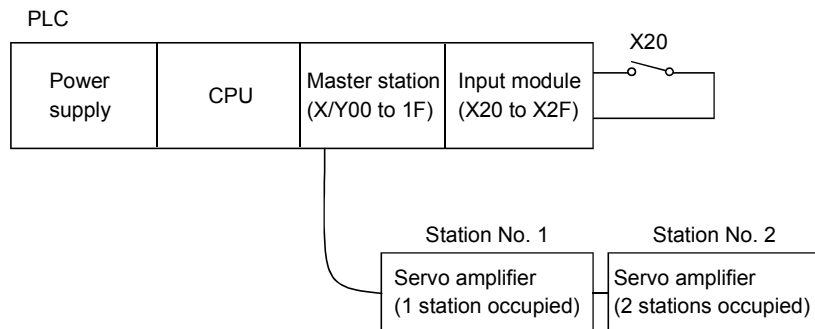
3.7.2 Reading the servo amplifier status

Read the status of the servo amplifier from the master station buffer memory. The servo amplifier status is always stored in the remote input RX (addresses E0H to 15FH). Read the servo amplifier status of station 1 to M0～M31.
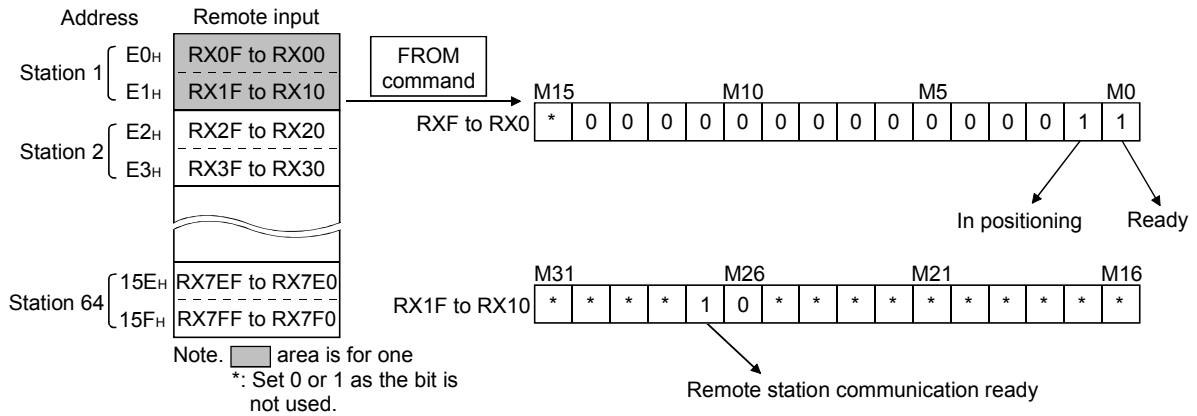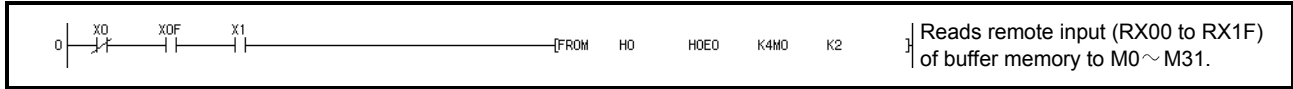
Servo amplifier status (1 station occupied)

M0: Ready (RD)	M8: Monitoring (MOF)	M16: ―――	M24: ―――
M1: In position (INP)	M9: Instruction code execution completion (COF)	M17: ―――	M25: ―――
M2: Rough match (CPO)		M18: ―――	M26: Trouble (ALM)
M3: Home position return completion (ZP)	M10: Warning (WNG)	M19: ―――	M27: Remote station communication ready (CRD)
	M11: Battery warning (BWNG)	M20: ―――	
M4: Limiting torque (TLC)	M12: Movement finish (MEND)	M21: ―――	
M5: ―――	M13: Dynamic brake interlock (DB)	M22: ―――	M28: ―――
M6: Electromagnetic brake interlock (MBR)	M14: Position range (POT)	M23: ―――	M29: ―――
			M30: ―――
M7: Temporary stop (PUS)	M15: ―――		M31: ―――

3.7.3 Writing the operation commands

To operate the servo amplifier, write the operation commands to the remote output RY (addresses 160H to 1DFH). Perform positioning operation of point table No. 2 for the servo amplifier of station 2.

```
    X0    X0F   X1
 0 ─┤/├───┤├────┤├──────────────────────────────[SET    M100 ]   Servo-on command (RY00)

                            ───────────────────[SET    M111 ]   Point table No. selection 2 command (RY0B)

                            ───────────────────[SET    M106 ]   Automatic/manual selection command
                                                                 (RY06)
         X20
         ─┤├───────────────────────────────────[SET    M101 ]   Forward rotation start command (RY01)
    Operation command
         M101                                           K1
         ─┤├──────────────────────────────────────(T200    )   Command demand time 10ms

         T200
         ─┤├───────────────────────────────────[RST    M101 ]   Forward rotation start command reset

                         ──────────[T0   H0    H160  K4M100  K2 ]  Writes M100 to M131 to remote output
                                                                 (RY00 to RY1F) of buffer memory.
```
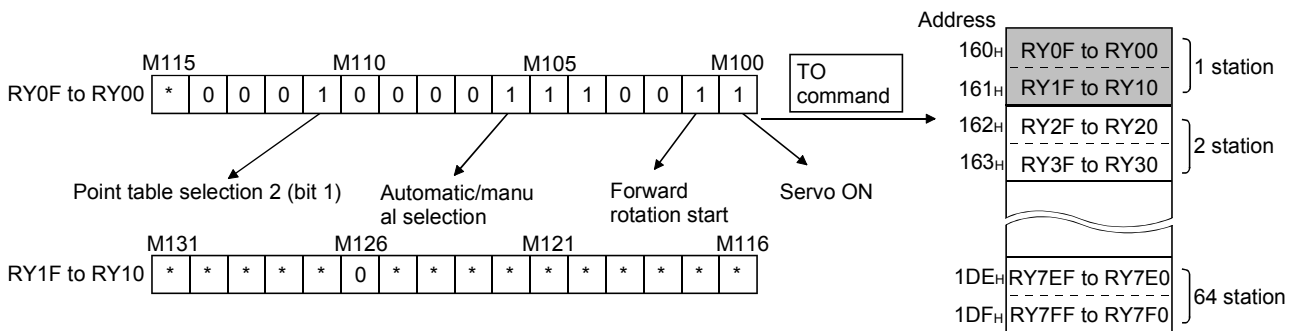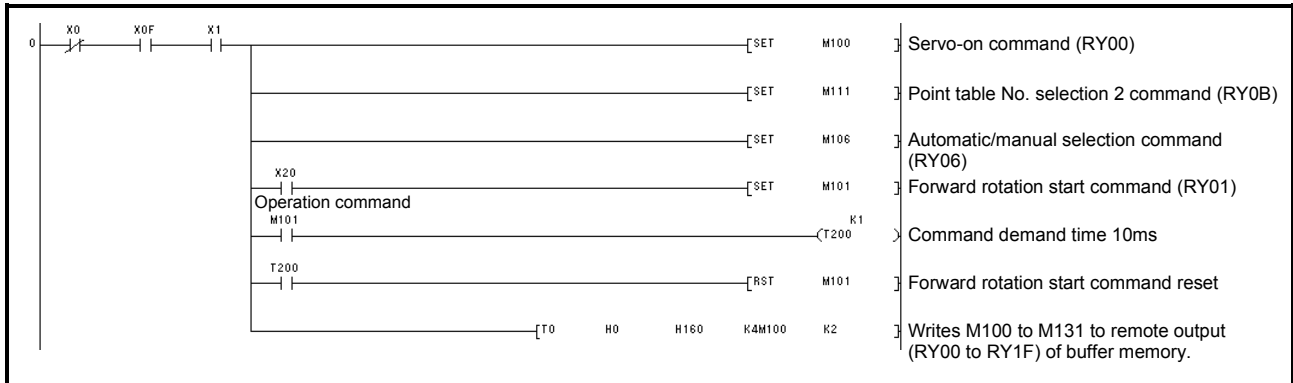

Operation commands (1 station occupied)

M100:	Servo-on (SON)	M108:	Monitor output execution
M101:	Forward rotation start (ST1)		demand (MOR)
M102:	Reverse rotation start (ST2)	M109:	Instruction code execution
M103:	Proximity dog (DOG)		demand (COR)
M104:	Forward rotation stroke end	M110:	Point table No. selection 1 (DI0)
	(LSP)	M111:	Point table No. selection 2 (DI1)
M105:	Reverse rotation stroke end	M112:	Point table No. selection 3 (DI2)
	(LSN)	M113:	Point table No. selection 4 (DI3)
M106:	Automatic/manual selection	M114:	Point table No. selection 5 (DI4)
	(MDO)	M115:	Clear (CR)
M107:	Temporary stop (STP)		

M116:	―――	M124:	―――
M117:	―――	M125:	―――
M118:	―――	M126:	Reset (RES)
M119:	―――	M127:	―――
M120:	―――	M128:	―――
M121:	―――	M129:	―――
M122:	―――	M130:	―――
M123:	―――	M131:	―――

3.7.4 Reading the data

Read various data of the servo amplifier.

(1) Reading the monitor value

Read the (feedback pulse value) of the servo amplifier of station 2 to D1.

Data No.	Description
H000A	Cumulative feedback pulse data (hexadecimal)

The answer code at instruction code execution is set to D9.

`0` `M9036` `[DFRO  H0  H0E2  K8M200  K2 ]`	Reads remote input (RX20 to RX5F) of buffer memory to M200 to M263.
`10` `M208` `[FROM  H0  H2E6  D9  K1 ]`	Stores answer code to D9.
`[= K0 D9 ] (M0)`	Outputs M0 for normal reply.
`26` `X0 X0F X1 X20` Read setting `[MOV  H0A  D110 ]`	Sets monitor code (H000A) of feedback pulse value to RWw4, RWw5.
`[T0  H0  H1E4  D110  K1 ]`	
`[SET  M108 ]`	Turns on Monitor output execution demand (RY28).
`M0 [DFRO  H0  H2E4  D10  K2 ]`	Reads data to RWR4 and RWR5 of buffer memory when answer code is normal reply.
`55` `M9036` `[DT0  H0  H162  K8M100  K2 ]`	Writes M100 to M131 to remote output (RY20 to RY5F) of buffer memory.
`67` `X0 X0F X1 X20` `[RST  M108 ]`	Monitor stop

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(2) Reading the parameter

Read parameter No. PA01 "Control mode" of the servo amplifier of station 2 to D1.

Data No.	Description
H8200	Parameter group selection
H2024	Parameter No. PA04 setting (hexadecimal)

The answer code at instruction code execution is set to D9.

Reads remote input of buffer memory (RX20 to RX5F) to M200 to M263.

Writes parameter group No. write (H8200) to RWw6 and parameter group PA (K0) to RWw7.

Turns on instruction code execution demand (RY29).

Turns off instruction code execution demand (RY29) and proceeds to the next when instruction code execution completion (RX29) turns on.

Writes parameter No.PA04 read (H0204) to RWw6.

Outputs M0 for normal reply.

Reads RWr7 of buffer memory to D1 when answer code is normal reply.

Turn off instruction code execution demand (RY29).

Writes M100 to M163 to remote output (RY20 to RY5F) of buffer memory.

(3) Reading the alarm definition

Read the alarm definition of the servo amplifier of station 2 to D1.

Data No.	Description
H0010	Occurring alarm/warning No. (hexadecimal)

The answer code at instruction code execution is set to D9.
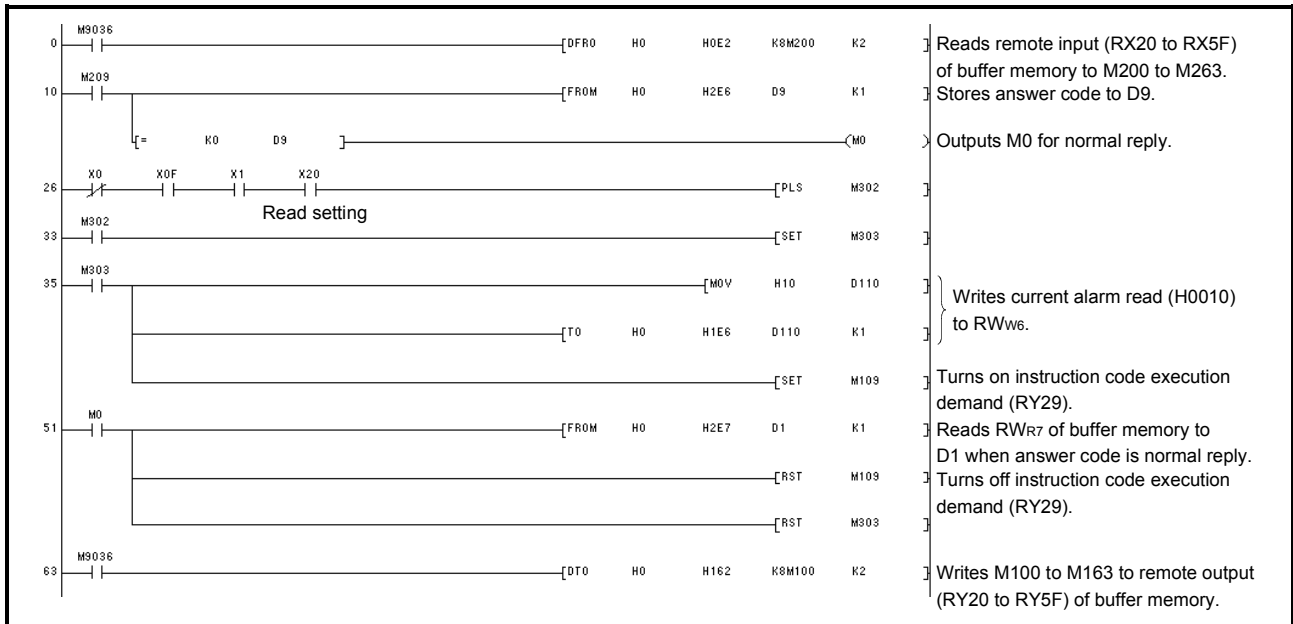
3.7.5 Writing the data

This section explains the programs for writing various data to the servo amplifier.

(1) Writing the servo motor speed data of point table

Change the servo motor speed data in the speed block No. 1 of the servo amplifier of station 2 to "100".

Code No.	Description
H8D01	Write of servo motor speed data of point table No. 1 (hexadecimal)

Set data	Description
K100	Servo motor speed data of point table No. 1 (decimal)

The answer code at instruction code execution is set to D2.

Reads remote input (RX20 to RX5F) of buffer memory to M200 to M263.

Writes speed data (H8D01) of point table No. 1 to RWw6, and speed data (K100) to RWw7.

Turns on instruction code execution demand (RY29).

Reads RWr6 to D2 when instruction code execution completion (RX29) turns on.

Turns off instruction code execution demand (RY29).

Writes M100 to M163 to remote output (RY20 to RY5F) of buffer memory.
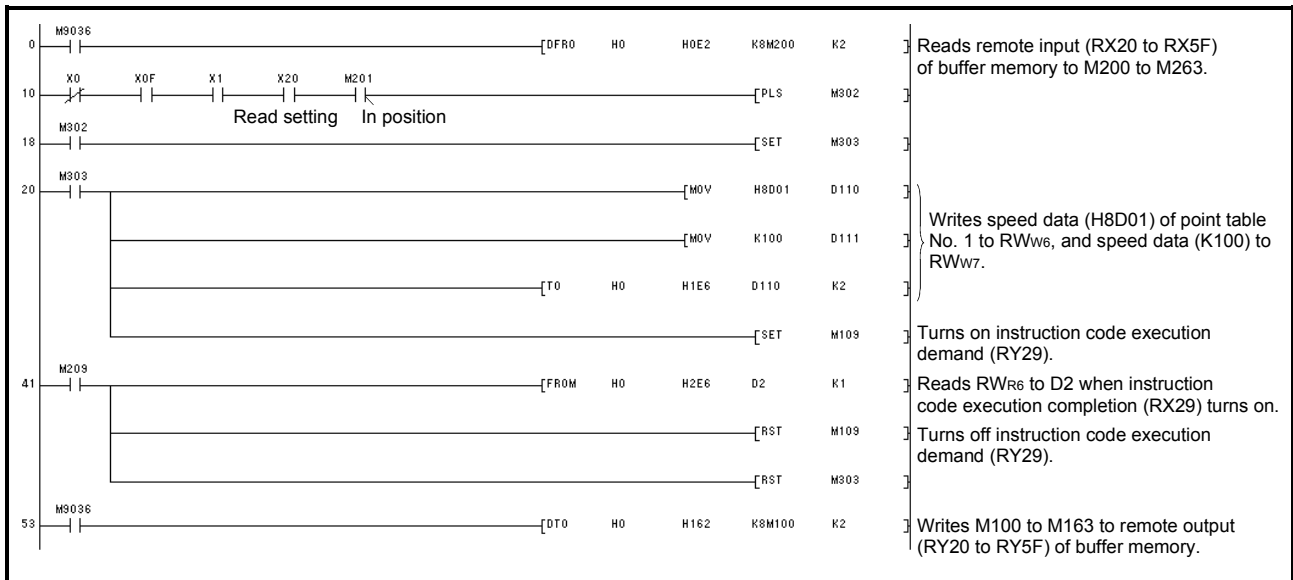
(2) Writing the parameter

Change parameter No. PC12 (JOG speed) of the servo amplifier of station 2 to "100".

The parameter group PC is specified as follows.

Code No.	Description
8200h	Parameter group selection

Set data	Description
K2	Set data (decimal)

The parameter No.12 is changed to "100" as follows.

Code No.	Description
H820C	Parameter No. PC12 write (hexadecimal)

Set data	Description
K100	Set data (decimal)

The answer code at instruction code execution is set to D2.

Ladder	Description
0 ─┤M9036├──────────────────[DFRO H0 H0E2 K8M200 K2]	Reads remote input of buffer memory (RX20 to RX5F) to M200 to M263.
10 ─┤X0├/┤X0F├┤X1├┤X20├────────────────[PLS M302]	
17 ─┤M302├──────────────────────────[SET M303]	
19 ─┤M303├──────────────────────[MOV H8200 D110] ├──────[MOV H2 D111] ├──[TO H0 H1E6 D110 K2] └──────────[SET M109]	Writes parameter group No. write (H8200) to RWw6 and parameter group PC (K2) to RWw7. Turns on instruction code execution demand (RY29).
40 ─┤M303├┤M209├──────────────[RST M109] ├──────[RST M303] └──────[SET M304]	Turns off instruction code execution demand (RY29) and proceeds to the next when instruction code execution completion (RX29) turns on.
45 ─┤M304├──────────────────[MOV H8202 D110] ├──────[MOV K100 D111] ├──[TO H0 H1E6 D110 K1] └──────────[SET M109]	Writes parameter No.PC12 write (H820C) to RWw6 and data (K100) to RWw7. Turns on instruction code execution demand (RY29).
66 ─┤M304├┤M209├──────[FROM H0 H2E6 D2 K1] ├──────[RST M109] └──────[RST M304]	Reads RWw6 to D2 when instruction code execution completion (RX29) turns on. Turn off instruction code execution demand (RY29).
79 ─┤M9036├──────────────────[DTO H0 H1G2 K8M100 K2]	Writes M100 to M163 to remote output (RY20 to RY5F) of buffer memory.

(3) Servo amplifier alarm resetting program examples

  (a) Deactivate the alarm of the servo amplifier of station 2 by issuing a command from the PLC. This method is limited to servo alarm occurrence.

```
     M9036
 0   ─┤├──────────────────────────────────[DFRO   H0    H0E2   K8M200   K2 ]   Reads remote input (RX20 to RX5F) of
                                                                              buffer memory to M200 to M263.
     X0    X0F    X1    M258   X20
10   ─┤/├──┤├────┤├────┤├────┤├───────────────────────────[SET    M158 ]   Turns on reset command (RY5A).
                       Reset
                       command ─────────────────────────[SET    M302 ]

     M302   M258
17   ─┤├───┤/├──────────────────────────────────────────[RST    M158 ]   Turns off reset command (RY5A) if
                                                                          trouble flag (RX5A) is off.
                       ─────────────────────────────────[RST    M302 ]

     M9036
21   ─┤├──────────────────────────────────[DTO    H0    H162   K8M100   K2 ]   Writes M100 to M163 to remote output
                                                                              (RY20 to RY5F) of buffer memory.
```
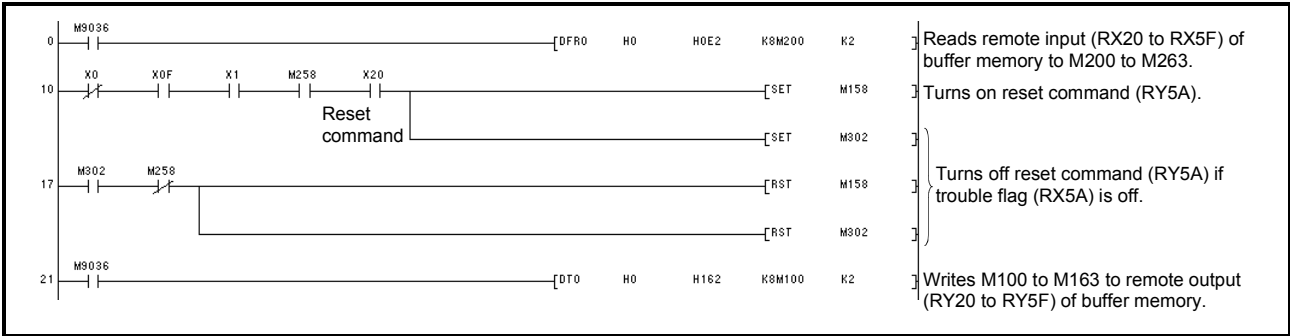
  (b) Deactivate the alarm of the servo amplifier of station 2 using the instruction code.

Code No.	Description
H8010	Alarm reset command (hexadecimal)

Set data	Description
H1EA5	Execution data (hexadecimal)

    The answer code at instruction code execution is set to D2.

```
     M9036
 0   ─┤├──────────────────────────────────[DFRO   H0    H0E2   K8M200   K2 ]   Reads remote input (RX20 to RX5F)
                                                                              of buffer memory to M200 to M263.
     X0    X0F    X1    X20
10   ─┤/├──┤├────┤├────┤├─────────────────────────────────[PLS    M302 ]
                  Reset command

     M302
17   ─┤├──────────────────────────────────────────────────[SET    M303 ]

     M303
19   ─┤├──────────────────────────────────────[MOV    H8010   D110 ]
                                                                          Writes alarm reset command (H8010)
                       ─────────────────────────[MOV    H1EA5   D111 ]   to RWw6 and execution data (H1EA5)
                                                                          to RWw7.
                       ──────────────[TO    H0    H1E6   D110   K2 ]

                       ─────────────────────────────────[SET    M109 ]   Turns on instruction code execution
                                                                          demand (RY29).
     M209
40   ─┤├──────────────────────────[FROM   H0    H2E6   D2    K1 ]   Reads RWr6 to D2 when instruction code
                                                                    execution completion (RX29) turns on.
                       ─────────────────────────────────[RST    M109 ]   Turns off instruction code execution demand
                                                                          (RY29).
                       ─────────────────────────────────[RST    M303 ]

     M9036
52   ─┤├──────────────────────────────────[DTO    H0    H162   K8M100   K2 ]   Writes M100 to M163 to remote output
                                                                              (RY20 to RY5F) of buffer memory.
```

3.7.6 Operation

This section explains the operation programs of the servo amplifier.

(1) JOG operation

Perform JOG operation of the servo amplifier of station 1 and read the "current position" data.

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

(Ladder program with the following annotations:)

- Reads remote input (RX00 to RX1F) of buffer memory to M200 to M231.
- Servo-on command (RY00)
- Forward rotation start (RY01)
- Reverse rotation start (RY02)
- Sets monitor code (H0001) of current position (lower 16 bits) to RW$_{W0}$.
- Sets monitor code (H0002) of current position (upper 16 bits) to RW$_{W1}$.
- Turns on monitor command (RY08).
- Reads RW$_{R0}$ or RW$_{R1}$ to D120, D121 of buffer memory when Monitoring (RX08) turns on.
- Writes M100 to M131 to remote output (RY00 to RY1F) of buffer memory.
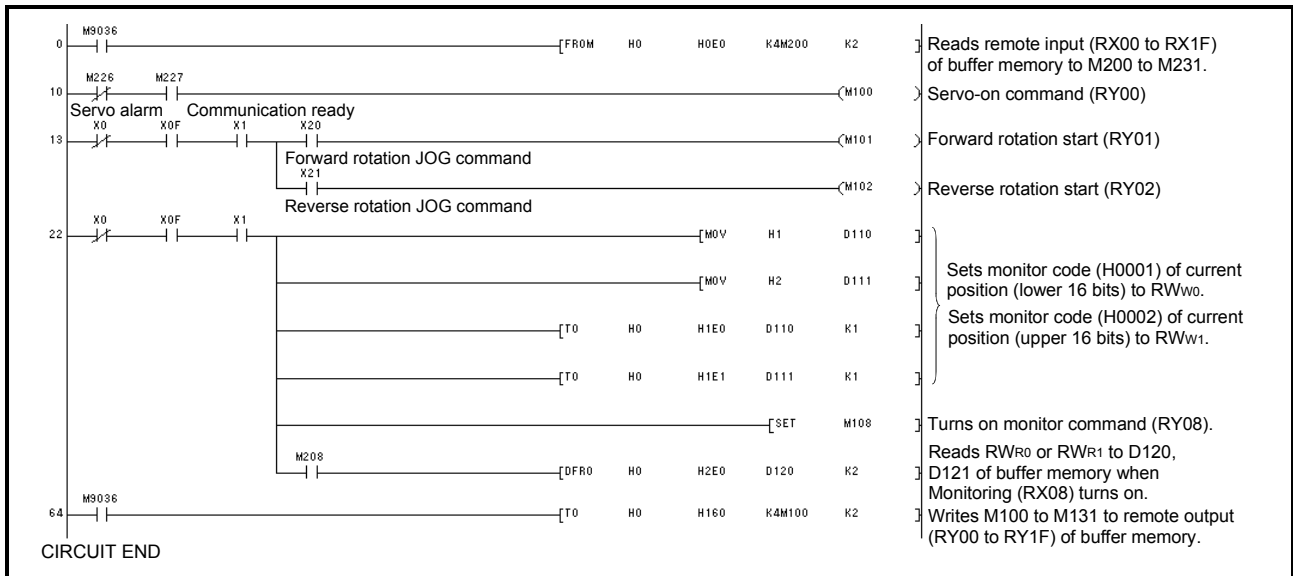
(2) Remote register-based position data/speed data setting

Operate the servo amplifier of station 2 after specifying the position data as "100000" and the speed data as "1000" in the direct specification mode.

Preset "□□□2" in parameter No. PC30.

Set data	Description
K100000	Position command data (decimal)
K1000	Speed command data (decimal)

Ladder	Description
0 M9036 —[DFRO H0 H0E2 K8M200 K2]	Reads remote input (RX20 to RX5F) of buffer memory to M200 to M263.
10 M258 M259 —(M100)	Servo-on command (RY20)
—(M106)	Automatic operation selection (RY26)
—(M142)	Position command selection (RY4A)
15 X0 X0F X1 X20 M201 —[PLS M302] (Operation command In position)	
23 M302 —[SET M303]	
25 M303 —[DMOV K100000 D110]	
—[MOV K1000 D112]	Writes position command data (K100000) to RWW8, RWW9, and speed data (K1000) to RWWA.
—[TO H0 H1E8 D110 K3]	
—[SET M132]	Turns on position instruction demand (RY40).
—[SET M133]	Turns on speed instruction demand (RY41).
49 M232 M233 —[FROM H0 H2E6 D2 K1]	Reads RWR6 to D2 when position instruction execution completion (RX40) and speed instruction execution completion (RX41) turn on.
—[SET M101]	Turns on forward rotation start command (RY21).
—[RST M303]	
62 M101 —(T200 K1)	Command request time 10ms
64 T200 —[RST M101]	Turns off forward rotation start command (RY21).
—[RST M132]	Turns off position instruction demand (RY40).
—[RST M133]	Turns off speed instruction demand (RY41).
68 M9036 —[DTO H0 H162 K8M100 K2]	Writes M100 to M163 to remote output (RY20 to RY5F) of buffer memory.
CIRCUIT END	

(3) Remote register-based point table No. setting (incremental value command system)

Operate the servo amplifier of station 2 with incremental values after specifying the point table No. 5 in the direct specification mode.

Preset "□□□1" in parameter No. PA01 and "□□□2" in parameter No. PA30.

Set data	Description
K5	Point table No. (decimal)

Ladder	Description
`0` M9036 —[DFRO H0 H0E2 K8M200 K2]—	Reads remote input (RX20 to RX5F) of buffer memory to M200 to M263.
`10` M258 M259 —(M100)—	Servo-on command (RY20)
—(M106)—	Automatic operation selection (RY26)
—(M142)—	Position command selection (RY4A)
—(M143)—	Incremental value selection (RY4B)
`16` X0 X0F X1 X20 M201 —[PLS M302]— Operation command In position	
`24` M302 —[SET M303]—	
`26` M303 —[MOV K5 D110]— —[TO H0 H1E8 D110 K1]—	Writes point table No. (K5) to RWw8.
—[SET M132]—	Turns on position instruction demand (RY40).
`42` M232 —[FROM H0 H2E6 D2 K1]—	Reads RWr6 to D2 when position instruction execution completion (RX40) turns on.
—[SET M101]—	Turns on forward rotation start command (RY21).
—[RST M303]—	
`54` M101 —(T200 K1)—	Command request time 10ms
`56` T200 —[RST M101]—	Turns off forward rotation start command (RY21).
—[RST M132]—	Turns off position instruction demand (RY40).
`59` M9036 —[DTO H0 H162 K8M100 K2]—	Writes M100 to M163 to remote output (RY20 to RY5F) of buffer memory.
CIRCUIT END	

3.8 Continuous operation program example   3 - 52

This section shows a program example which includes a series of communication operations from a servo start. The program will be described on the basis of the equipment makeup shown in section 3.8.1, 3.8.3.

3.8.1 System configuration example when 1 station is occupied

As shown below, the CC-Link system master・local unit is loaded to run one servo amplifier (1 station occupied).

PLC

Power supply	CPU	Master station (X/Y00 to 1F)	Input module (X30 to X3F)

Station No. 1

Servo amplifier (1 station occupied)
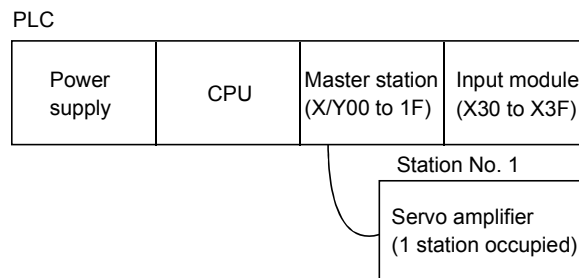
3.8.2 Program example when 1 station is occupied

> **POINT**
> · To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No. PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.

Operate the servo amplifier of station 1 in the positioning mode and read the "current position" data.

Operation: Alarm reset, dog type zeroing, JOG operation, automatic operation under point table command

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

Ladder program with comments:

- Line 0: M9036 —[FROM H0 H0E0 K4M200 K2] — Reads remote input (RX00 to RX1F) of buffer memory to M200 to M231.
- Line 10: M226 —[MOV H10 D10] / [TO H0 H1E2 D10 K1] — Writes current alarm read (H0010) to RWw2 at trouble (RY1A) occurrence.
- [SET M109] — Turns on instruction code execution demand (RY09).
- Line 26: M109 —[FROM H0 H2E3 D11 K1] — Reads RWr3 of buffer memory to D11 when answer code becomes normal reply.
- [RST M109] — Turns off instruction code execution demand (RY09).
- Line 37: X0 X0F X1 M226 X20 (Reset command) —[SET M126] — Alarm reset command (RY1A)
- [SET M302]
- Line 44: M302 M226 —[RST M126] — Alarm reset command (RY1A) reset
- [RST M302]
- Line 48: X21 M227 M226 —(M100) — Servo-on command (RY00) (Servo-on command)
- Line 52: X24 M201 M202 —[SET M106] — Automatic operation selection (RY06) (Automatic/manual operation selection command)
- Line 56: X24 M201 M202 —[RST M106] — Manual operation selection (RY06) (Automatic/manual operation selection command)
- Line 60: X25 M106 M203 —[SET M303] — Home position return request (Home position return command)
- [SET M5] — Forward rotation start request
- Line 65: M5 —(T200 K1) — Command request time 10ms
- Line 67: T200 —[RST M5] — Forward rotation start request reset
- Line 69: X26 —(M103) — Proximity dog command (RY03) (Proximity dog command)
- Line 71: M303 M203 —[RST M303] — Home position return request reset (Home position return completion)
- Line 74: X0 M200 M106 X22 —(M3) — Forward rotation start request (Forward rotation JOG command)
- X23 —(M4) — Reverse rotation start request (Reverse rotation JOG command)
- Line 83: X27 M106 M201 M202 M203 —[SET M6] — Positioning start command (Positioning start command / In position / Rough match / Home position return completion)

```
      M6                                                          K1
89    ├─┤│──────────────────────────────────────────────────────(T201  )─    Command request time 10ms

      T201
91    ├─┤│───────────────────────────────────────────────[RST    M6    ]─    Positioning start command reset

      X28    M303
93    ├─┤│────┤/├────────────────────────────────────────────────(M110  )─    Point table No. selection command (bit0)
      Bit 0 selection
      X29    M303
96    ├─┤│────┤/├────────────────────────────────────────────────(M111  )─    Point table No. selection command (bit1)
      Bit 1 selection
      X2A    M303
99    ├─┤│────┤/├────────────────────────────────────────────────(M112  )─    Point table No. selection command (bit2)
      Bit 2 selection
      X2B    M303
102   ├─┤│────┤/├────────────────────────────────────────────────(M113  )─    Point table No. selection command (bit3)
      Bit 3 selection
      X2C    M303
105   ├─┤│────┤/├────────────────────────────────────────────────(M114  )─    Point table No. selection command (bit4)
      Bit 4 selection
      M3
108   ├─┤│──────────────────────────────────────────────────────(M101  )─    Forward rotation start (RY01)
      M5
      ├─┤│─┤
      M6
      ├─┤│─┘

      M4
112   ├─┤│──────────────────────────────────────────────────────(M102  )─    Reverse rotation start (RY02)

      X0    X0F    X1
114   ├─┤/├──┤│──┤│──┬─────────────────────────────[MOV   H1    D110  ]─
                     │
                     ├─────────────────────────────[MOV   H2    D111  ]─     Sets monitor code (H01) of current
                     │                                                        position (lower 16 bits) to RWW0.
                     ├──────────────────[T0   H0   H1E0  D110  K1   ]─      Sets monitor code (H02) of current
                     │                                                        position (upper 16 bits) to RWW1.
                     ├──────────────────[T0   H0   H1E1  D111  K1   ]─
                     │
                     └──────────────────────────────────[SET    M108 ]─     Turns on monitor output execution demand
                                                                             (RY08).
      M208
      ├─┤│────────────────────────[FROM  H0   H2E0  D120  K2   ]─          Reads RWR0 or RWR1 to D120, D121
                                                                             of buffer memory when Monitoring
                                                                             (RX08) turns on.
      M9036
156   ├─┤│────────────────────────[T0   H0   H160  K4M100  K2   ]─         Writes M100 to M131 to remote output
                                                                             (RY00 to RY2F) of buffer memory.
CIRCUIT END
```

3.8.3 System configuration example when 2 stations are occupied

As shown below, the CC-Link system master・local unit is loaded to run one servo amplifiers (2 station occupied).

PLC

Power supply	CPU	Master station (X/Y00 to 1F)	Input module (X20 to X2F)

Station No.1

Servo amplifier (2 station occupied)

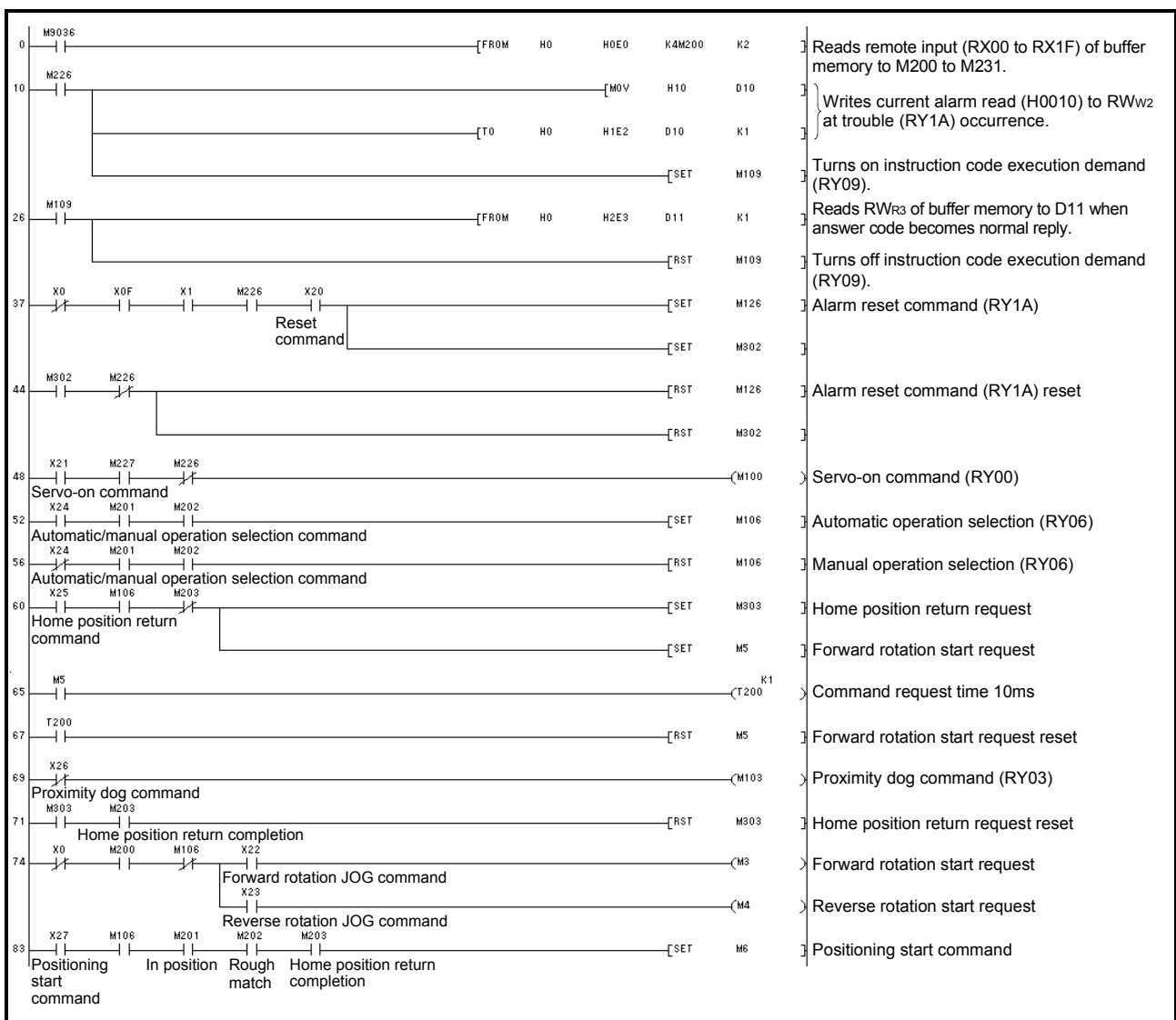## 3.8.4 Program example when 2 stations are occupied

> **POINT**
> · To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No. PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.
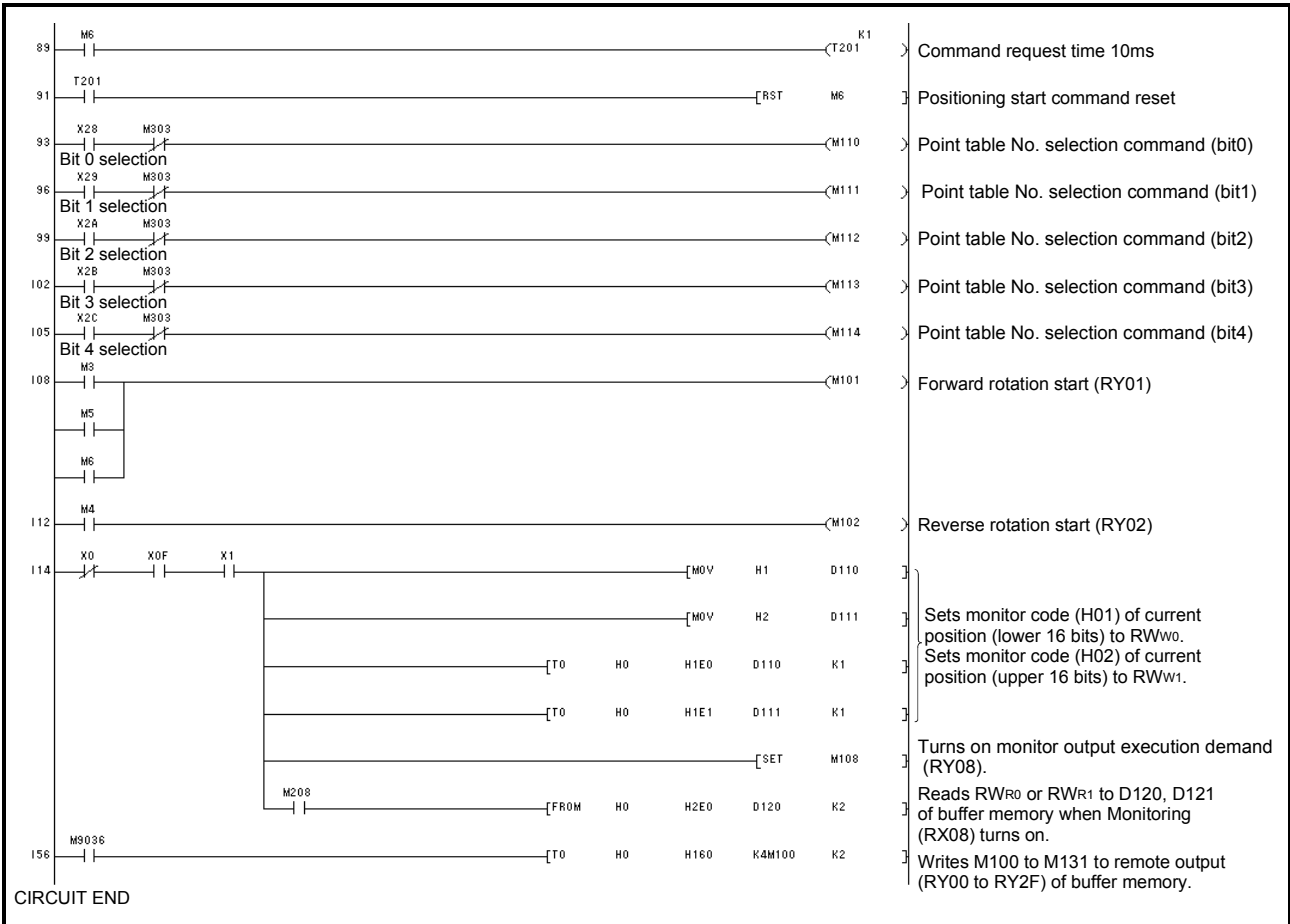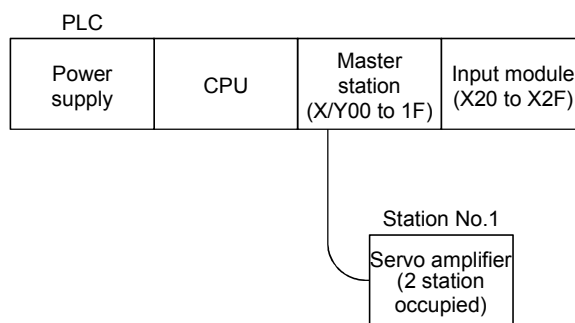
Operate the servo amplifier of station 1 in the positioning mode and read the "motor speed" data.

Operation: Alarm reset, dog type zeroing, JOG operation, automatic operation under point table command

Code No.	Description
H0016	32-bit data of motor speed (hexadecimal)

Code No.	Description
K5000	Position command data (decimal)
K100	Speed command data (decimal)

```
      X27    M106   M201   M202   M203
 85 ─┤├─────┤├─────┤├─────┤├─────┤├──────────────────────[PLS    M304   ]
    Positioning start In position Rough  Home position return
    M304 command              match  completion
 93 ─┤├───────────────────────────────────────────────[SET    M305   ]

      M305
 95 ─┤├──┬──────────────────────────────────[DMOV   K50000   D130   ]─┐
         │                                                            │  Writes position command data (K50000) to
         ├──────────────────────────────────[MOV    K100     D132   ]─┤  RWw4, RWw5, and speed data (K100) to
         │                                                            │  RWw6.
         ├────────────────────────[T0     H0    H1E4    D130   K3   ]─┘
         │
         ├──────────────────────────────────────────────[SET    M132   ]  Turns on position instruction demand (RY20).
         │
         └──────────────────────────────────────────────[SET    M133   ]  Turns on speed instruction demand (RY21).
      M232   M233                                                         Reads RWR2 to D2 when position instruction
119 ─┤├─────┤├────────────────────[FROM   H0    H2E2    D2     K1   ]   execution completion (RX20) and speed
         │                                                            instruction execution completion (RX21) turn on.
         ├──────────────────────────────────────────────[SET    M6    ]  Positioning start command
         │
         └──────────────────────────────────────────────[RST    M305   ]

      M6                                                             K1
132 ─┤├──────────────────────────────────────────────────────(T203   )  Command request time 10ms

      T203
134 ─┤├──┬───────────────────────────────────────────────[RST    M6    ]  Positioning start command reset
         │
         ├───────────────────────────────────────────────[RST    M132   ]  Turns off position instruction demand (RY20).
         │
         └───────────────────────────────────────────────[RST    M133   ]  Turns off speed instruction demand (RY21).
      M3
138 ─┤├──┬───────────────────────────────────────────────────(M101   )  Forward rotation start (RY01)
      M5 │
    ─┤├──┤
      M6 │
    ─┤├──┘
      M4
142 ─┤├───────────────────────────────────────────────────────(M102   )  Reverse rotation start (RY02)
      X0     X0F    X1
144 ─┤╱├────┤├─────┤├──┬───────────────────────[MOV    H16     D110   ]─┐  Sets monitor code (H0016) of motor speed
                       │                                                │  to RWw0.
                       ├────────────────────[T0     H0    H1E0    D110   K1 ]─┘
                       │
                       ├──────────────────────────────────────────[SET    M108   ]  Turns on monitor output execution demand
                       │                                                     (RY08).
                 M208  │
                ─┤├────┴──────────────────[FROM   H0    H2E0    D120   K2   ]  Reads RWR0 or RWR1 of buffer memory to
                                                                              D120, D121 when monitoring (RX08) turns on.
      M9036
172 ─┤├────────────────────────────────[DT0    H0    H160    K8M100   K2   ]  Writes M100 to M163 to remote output
                                                                              (RY00 to RY3F) of buffer memory.
CIRCUIT END
```
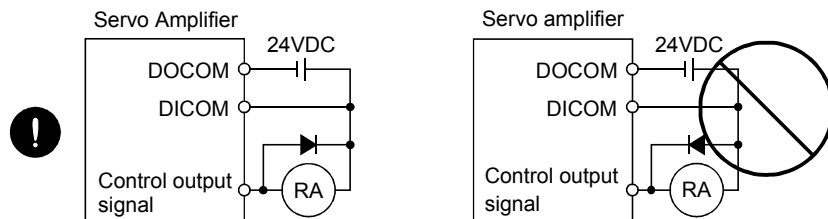
4. SIGNALS AND WIRING

<table>
<tr>
<td>⚠ WARNING</td>
<td>
・Any person who is involved in wiring should be fully competent to do the work.
・Before starting wiring, switch power off, then wait for more than 15 minutes, and after the charge lamp has gone off, make sure that the voltage is safe in the tester or like. Otherwise, you may get an electric shock.
・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.
</td>
</tr>
<tr>
<td>⚠ CAUTION</td>
<td>
・Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
・Connect cables to correct terminals to prevent a burst, fault, etc.
・Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
・The surge absorbing diode installed to the DC relay designed for control output should be fitted in the specified direction. Otherwise, the signal is not output due to a fault, disabling the forced stop (EMG) and other protective circuits.

・Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
・Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo motor.
・When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
・Do not modify the equipment.
・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.
</td>
</tr>
</table>

4.1 Input power supply circuit

⚠ CAUTION	・When the servo amplifier has become faulty, switch power off on the servo amplifier power side. Continuous flow of a large current may cause a fire. ・Use the trouble signal to switch power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire. ・During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

Wire the power supply and main circuit as shown below so that the servo-on (RYn0) turns off as soon as alarm occurrence is detected and power is shut off.

A no-fuse breaker (NFB) must be used with the input cables of the power supply.

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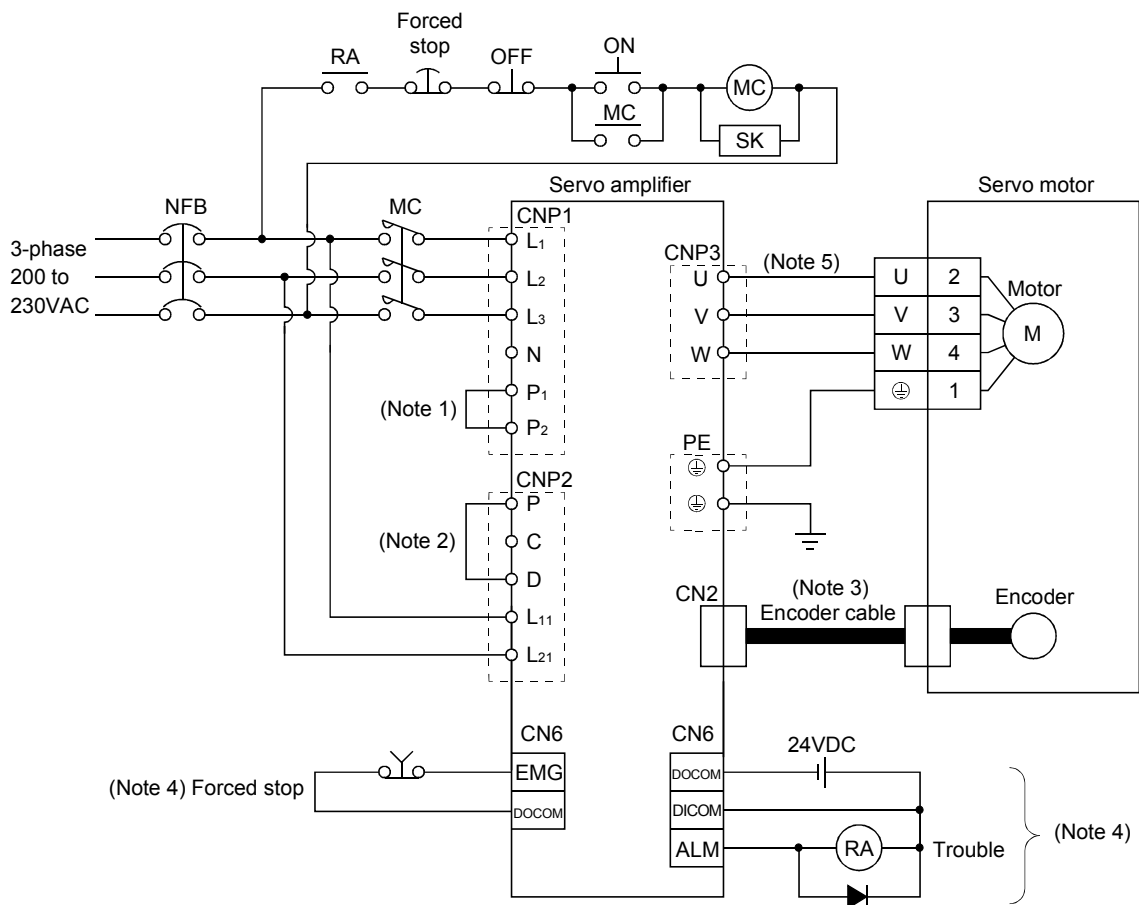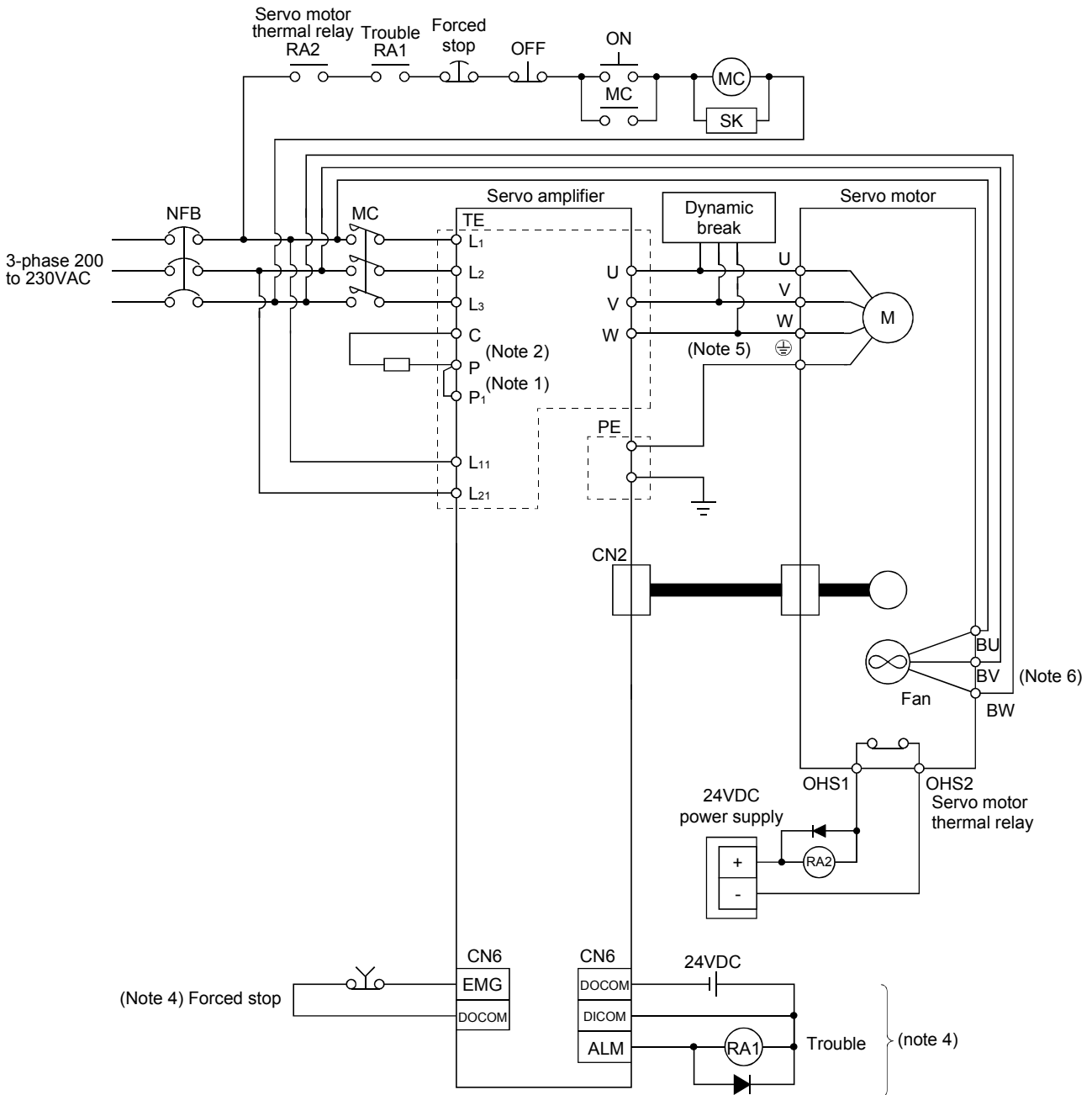

Note 1. Always connect P_1-P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

    2. Always connect P-D. (Factory-wired.) When using the regenerative option, refer to section 14.2.

    3. For encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

    4. For the sink I/O interface.

      For the source I/O interface, refer to section 4.8.3.

   5. Refer to section 4.10.

(2) For 1-phase 200 to 230VAC power supply to MR-J3-10T to MR-J3-70T
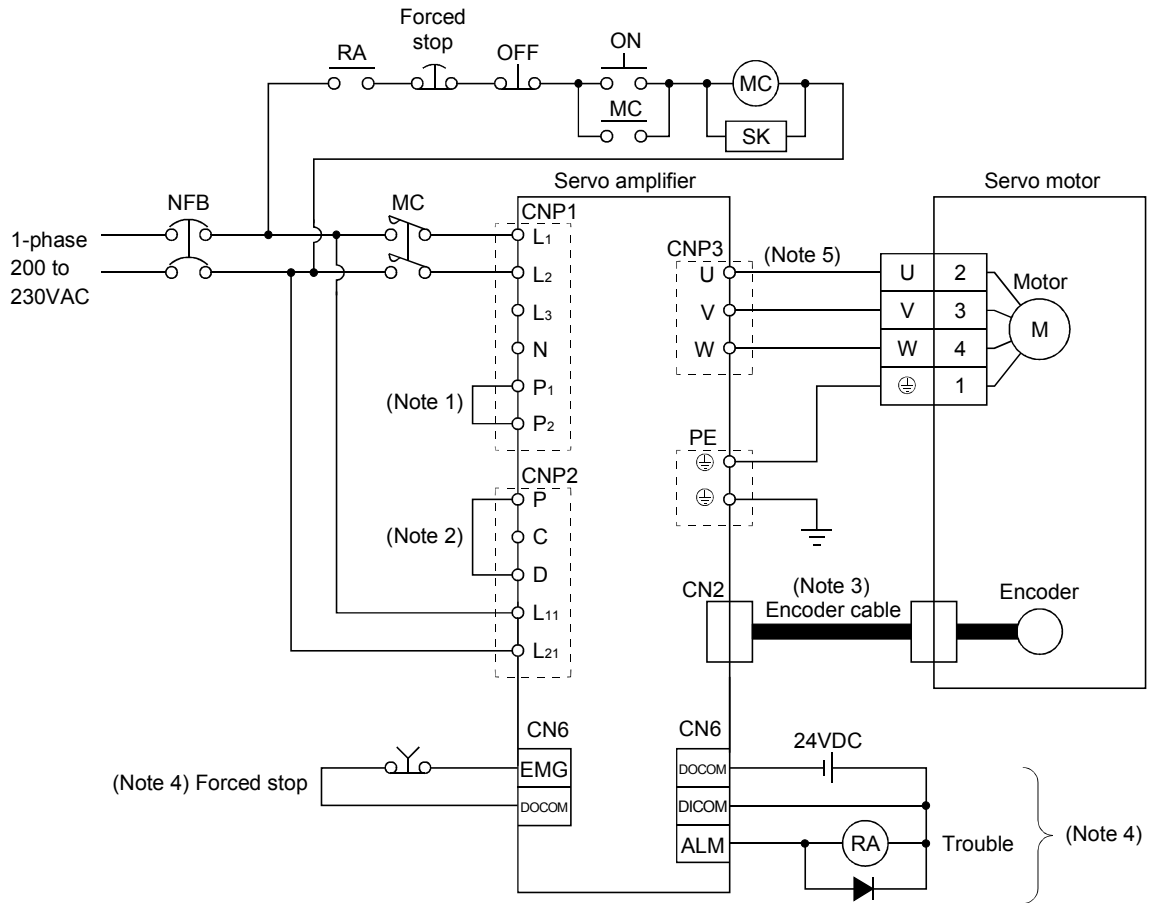
Note 1. Always connect P_1-P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

2. Always connect P-D. (Factory-wired.) When using the regenerative option, refer to section 14.2.

3. For encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

5. Refer to section 4.10.

(3) For 1-phase 100 to 120VAC power supply to MR-J3-10T1 to MR-J3-40T1
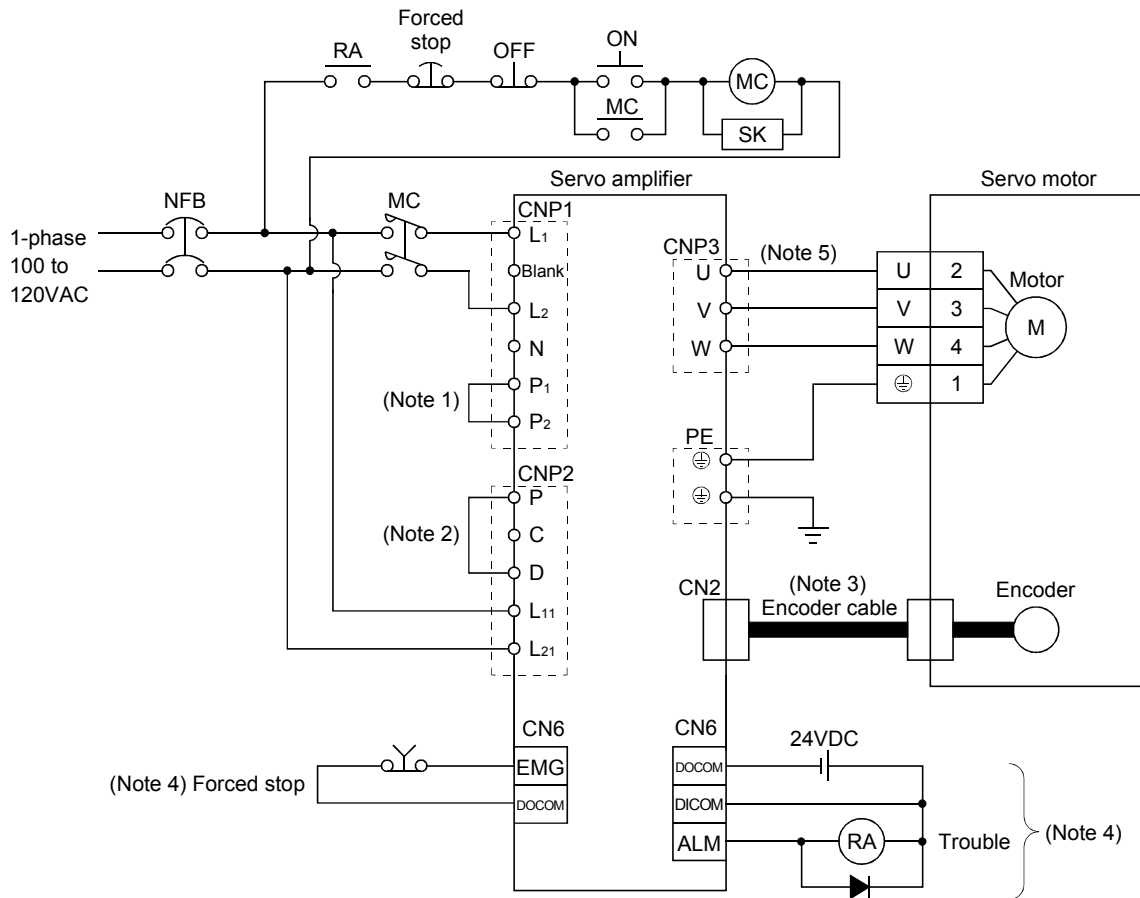
Note 1. Always connect P_1-P_2. (Factory-wired.) The power factor improving DC reactor cannot be used.

    2. Always connect P-D. (Factory-wired.) When using the regenerative option, refer to section 14.2.

    3. For encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

    4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

    5. Refer to section 4.10.

(4) MR-J3-500T・MR-J3-700T
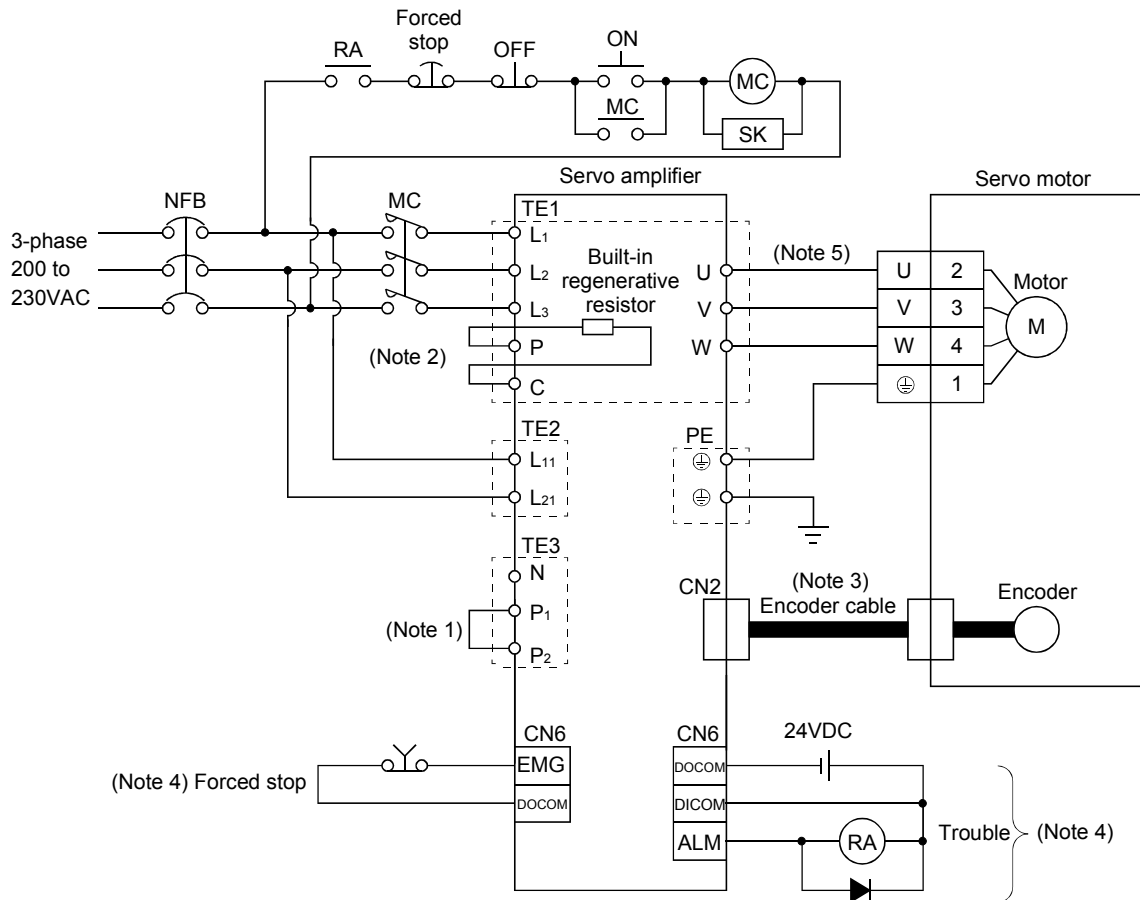
Note 1. Always connect P_1-P_2. (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

2. Always connect P-D. (Factory-wired.) When using the regenerative option, refer to section 14.2.

3. For encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

5. Refer to section 4.10.

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

Note 1. Always connect P-P₁. (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

    2. When using the regenerative option, refer to section 14.2.

    3. For the encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

    4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

    5. Refer to section 4.10.

    6. There is no BW if HA-LP11K2 is used.

4.2 I/O signal connection diagram
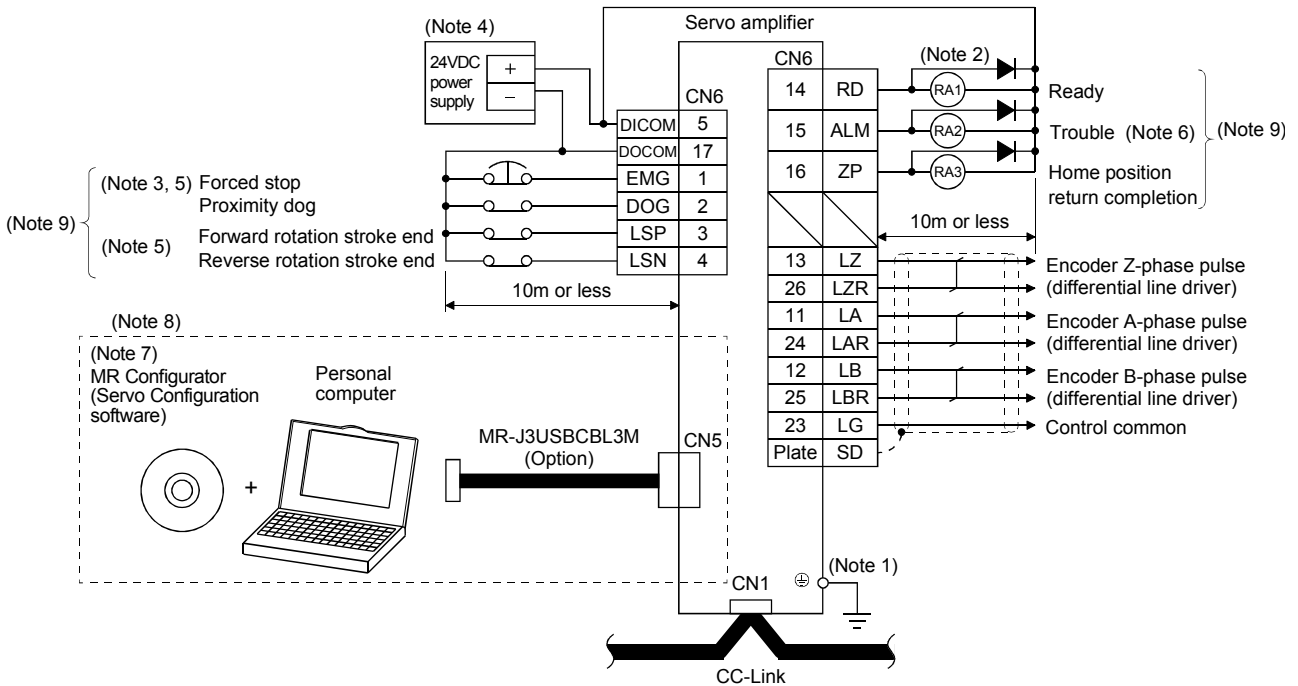
Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

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 (EMG) and other protective circuits.

3. The forced stop switch (normally closed contact) must be installed.

4. Supply 24VDC±10% 150mA current for interfaces from the outside. 150mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 4.8.2 (1) that gives the current value necessary for the interface.

5. When starting operation, always turn on forced stop (EMG) and Forward/Reverse rotation stroke end (LSP/LSN). (Normally closed contacts)

6. Trouble (ALM) turns on in normal alarm-free condition.

7. Use MRZJW3-SETUP 211E.

8. Personal computers or parameter modules can also be connected via the CN3 connector, enabling RS-422 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.
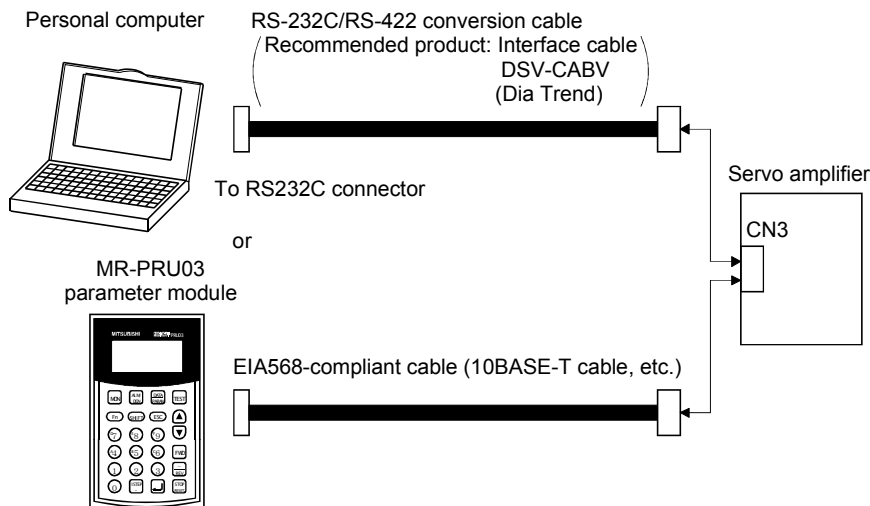
9. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.3 Explanation of power supply system

4.3.1 Signal explanations

> **POINT**
> · For the layout of connector and terminal block, refer to outline drawings in chapter 10.

| Abbreviation	Connection Target (Application)	Description
L_1 L_2 L_3	Main circuit power supply	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. | Power supply \ Servo amplifier	MR-J3-10T to 70T	MR-J3-100T to 22KT	MR-J3-10T1 to 40T1
---	---	---	---
3-phase 200V to 230VAC, 50/60Hz	$L_1 \cdot L_2 \cdot L_3$		
1-phase 200V to 230VAC, 50/60Hz	$L_1 \cdot L_2$		
1-phase 100V to 120VAC, 50/60Hz			$L_1 \cdot L_2$	
P_1 P_2	Power factor improving DC reactor	1) MR-J3-700T or less 　When not using the power factor improving DC reactor, connect P_1-P_2. (Factory-wired.) 　When using the power factor improving DC reactor, disconnect the wiring across P_1-P_2 and connect the power factor improving DC reactor across P_1-P_2. 2) MR-J3-11KT to 22KT 　MR-J3-11KT to 22KT do not have P_2 terminal. 　When not using the power factor improving reactor, connect P_1-P. (Factory-wired) 　When using the power factor improving reactor, connect it across P-P_1. 　Refer to section 14.11.
P C D	Regenerative option	1) MR-J3-350T or less 　When using servo amplifier built-in regenerative resistor, connect between P-D terminals. (Wired by default) 　When using regenerative option, disconnect between P-D terminals and connect regenerative option to P terminal and C terminal. 2) MR-J3-500T · 700T 　MR-J3-500T and 700T do not have D terminal. 　When using servo amplifier built-in regenerative resistor, connect P terminal and C terminal. (Wired by default) 　When using regenerative option, disconnect P terminal and C terminal and connect regenerative option to P terminal and C terminal. 3) MR-J3-11KT to 22KT 　MR-J3-11KT to 22KT do not have D terminal. 　When not using the power supply return converter and the brake unit, make sure to connect the regenerative option to P terminal and C terminal. 　Refer to section 14.2 to 14.5.
L_{11} L_{21}	Control circuit power supply	Supply the following power to $L_{11} \cdot L_{21}$. 	Power supply \ Servo amplifier	MR-J3-10T to 22KT	MR-J3-10T1 to 40T1
1-phase 200V to 230VAC, 50/60Hz	$L_{11} \cdot L_{21}$	
1-phase 100V to 120VAC, 50/60Hz		$L_{11} \cdot L_{21}$	
U V W	Servo motor power	Connect to the servo motor power supply terminals (U, V, W). During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.
N	Return converter Brake unit	When using return converter/brake unit, connect to P terminal and N terminal. Do not connect to servo amplifier MR-J3-350T or less. For details, refer to section 14.3 to 14.5.
⏚	Protective earth (PE)	Connect to the earth terminal of the servo motor and to the protective earth (PE) of the control box to perform grounding.

4.3.2 Power-on sequence

(1) Power-on procedure

1) Always wire the power supply as shown in above section 4.1 using the magnetic contactor with the main circuit power supply (three-phase: L1, L2, L3, single-phase: L1, L2). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply L11, L21 simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the servo amplifier will operate properly.

3) The servo amplifier can accept the servo-on (RYn0) about 1 to 2s after the main circuit power supply is switched on. Therefore, when servo-on (RYn0) is switched on simultaneously with the main circuit power supply, the base circuit will switch on in about 1 to 2s, and the ready (RD) will switch on in further about 5ms, making the servo amplifier ready to operate. (Refer to paragraph (2) of this section.)

4) When the reset (RY(n+1)A or RY(n+3)A) is switched on, the base circuit is shut off and the servo motor shaft coasts.

(2) Timing chart

Power-on timing chart
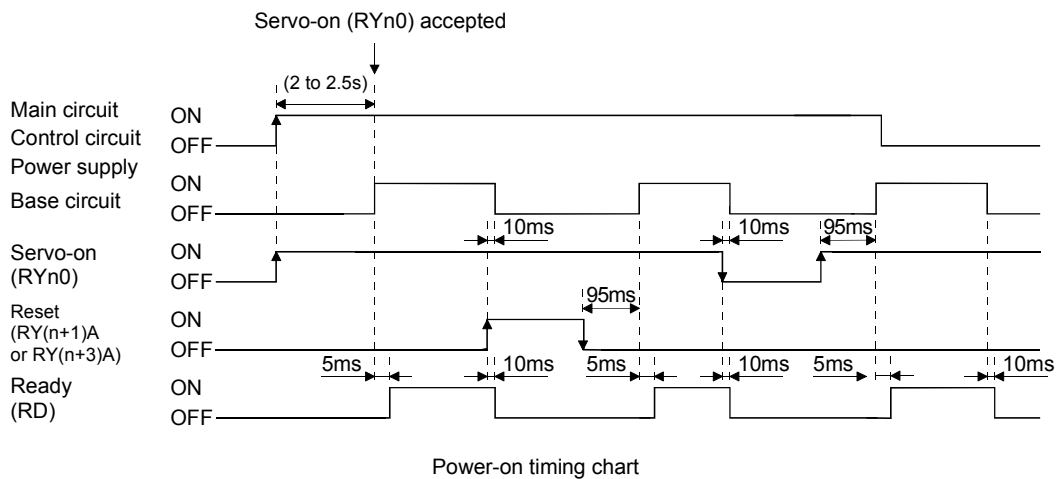
(3) Forced stop

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

Make up a circuit that shuts off main circuit power as soon as EMG is turned off at a forced stop. When EMG is turned off, the dynamic brake is operated to bring the servo motor to a sudden stop. At this time, the display shows the servo forced stop warning (AE6).

During ordinary operation, do not use the external forced stop (EMG) to alternate stop and run.

The servo amplifier life may be shortened.

Also, if the forward rotation start (RYn1) and reverse rotation start (RYn2) are on or a pulse train is input during a forced stop, the servo motor will rotate as soon as the warning is reset. During a forced stop, always shut off the run command. Note also that during a forced stop, RYn1 and RTn2 must be off.
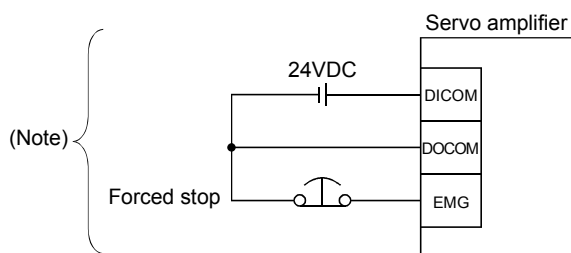
Note. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.3.3 CNP1, CNP2, CNP3 wiring method

> POINT
> ・ Refer to Table 14.1 in section 14.9 for the wire sizes used for wiring.
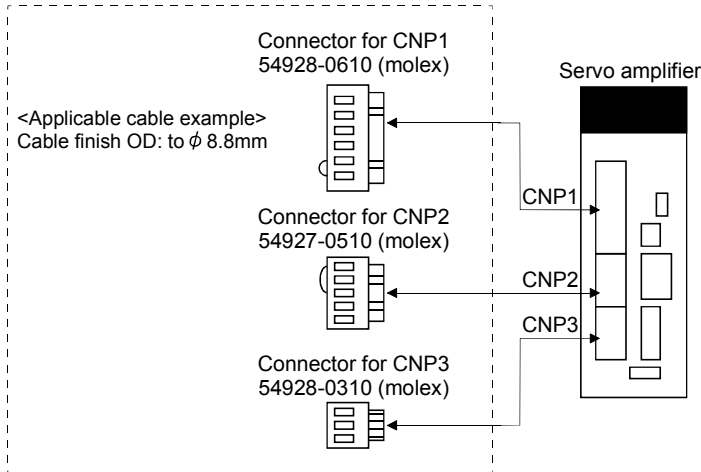> ・ MR-J3-500T or more does not have these connectors.

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

(1) MR-J3-100T or less

    (a) Servo amplifier power supply connectors

(Note)
Servo amplifier power supply connectors

Connector for CNP1
54928-0610 (molex)

Servo amplifier

<Applicable cable example>
Cable finish OD: to φ8.8mm

Connector for CNP2
54927-0510 (molex)

CNP1

CNP2

CNP3

Connector for CNP3
54928-0310 (molex)

Note. These connectors are of insert type. As the crimping type, the following connectors (Molex) are recommended.
    For CNP1: 51241-0600 (connector), 56125-0118 (terminal)
    For CNP2: 51240-0500 (connector), 56125-0118 (terminal)
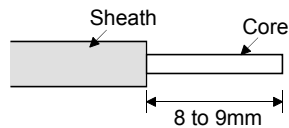   For CNP3: 51241-0300 (connector), 56125-0118 (terminal)
    Crimping tool: CNP57349-5300
    <Connector applicable cable example>
    Cable finish OD: to φ3.8mm

    (b) Termination of the cables

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

Sheath   Core

8 to 9mm

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

Cable size		Bar terminal type		Crimping tool (Note2)
[mm²]	AWG	For 1 cable (Note1)	For 2 cable	
1.25/1.5	16	AI1.5-10BK	AI-TWIN2 × 1.5-10BK	Variocrimp 4 206-204
2/2.5	14	AI2.5-10BU		

Note1. Maker: Phoenix Contact
    2. Maker: WAGO Japan

(c) The twin type connector for CNP2 (L11 · L21): 721-2105/026-000 (WAGO)

Using this connector enables passing a wire of control circuit power supply.

Refer to Appendix 3 for details of connector.
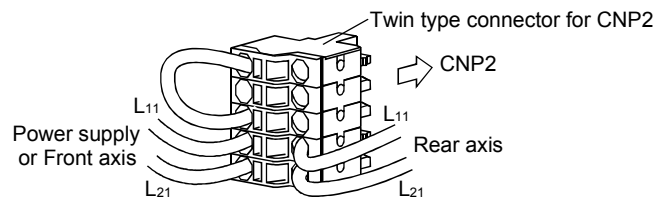
(2) MR-J3-200T · MR-J3-350T

(a) Servo amplifier power supply connectors
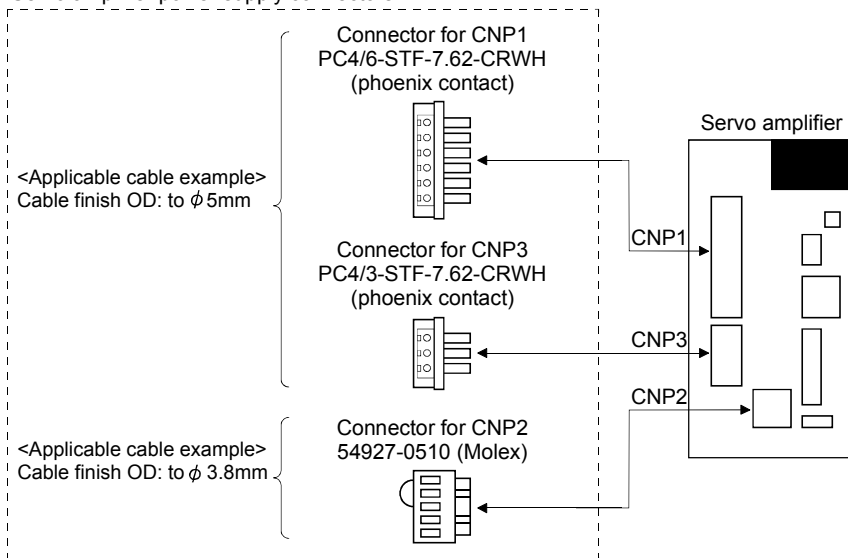
(b) Termination of the cables

1) CNP1・CNP3

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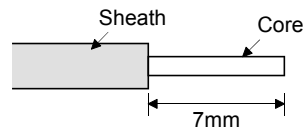
Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

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

2) CNP2

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

(c) As twin type connector for CNP2 (L$_{11}$, L$_{21}$) is the same as MR-J3-100T or smaller.
Refer to (1) (C) of this section.

(3) Insertion of cable into 54928-0610 · 54927-0510 and 54928-0310 (Molex)

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

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

(a) When using the supplied cable connection lever
   1) The servo amplifier is packed with the cable connection lever 54932-0000 (Molex).

[Unit: mm]
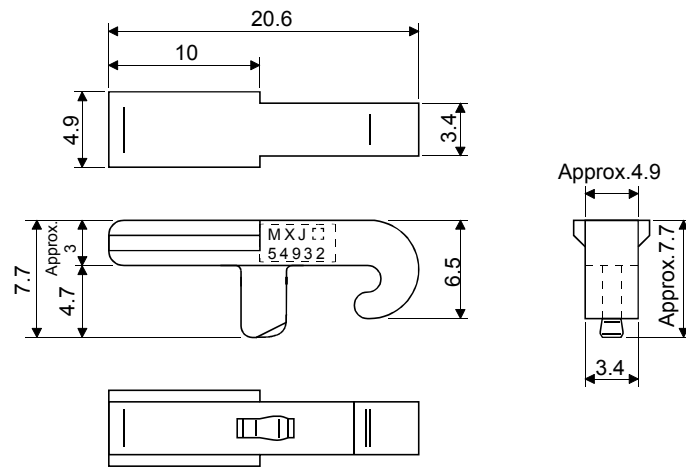
2) Cable connection procedure

Cable connection lever

1) Attach the cable connection lever to the housing. (Detachable)

2) Push the cable connection lever in the direction of arrow.

3) Hold down the cable connection lever and insert the cable in the direction of arrow.

4) Release the cable connection lever.
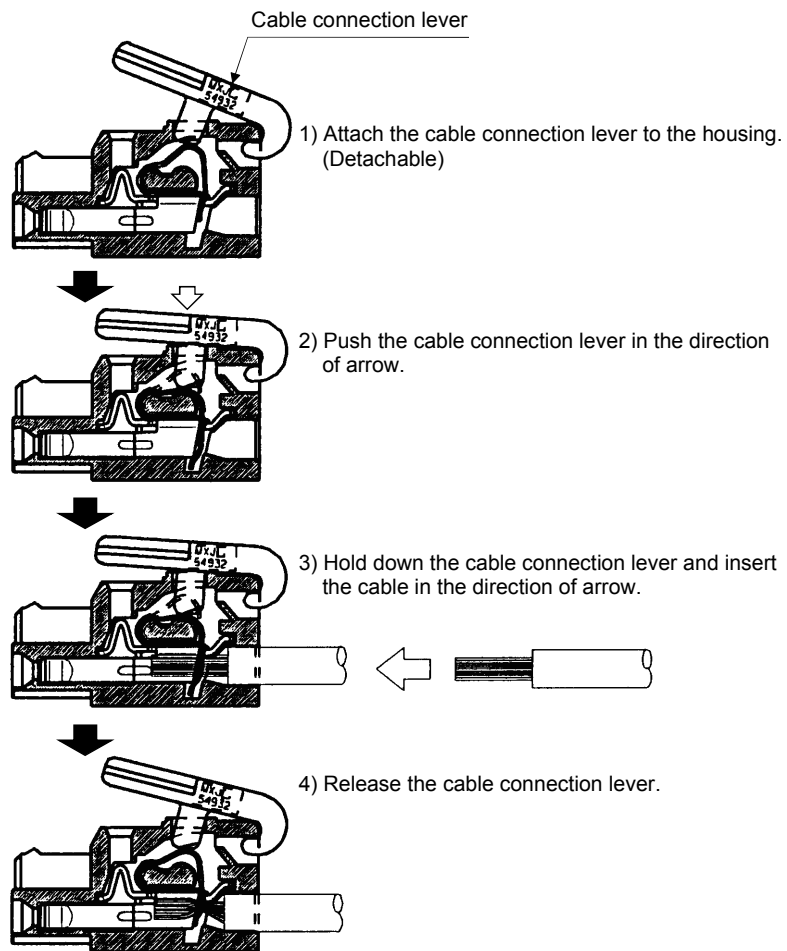
(b) Inserting the cable into the connector
    1) Applicable flat-blade screwdriver dimensions
       Always use the screwdriver shown here to do the work.

[Unit: mm]

Approx.R0.3   Approx.22   3°

0.6

Approx.R0.3

3 to 3.5

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

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

2) If inserted properly, the screwdriver is held.

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

4) Releasing the screwdriver connects the cable.
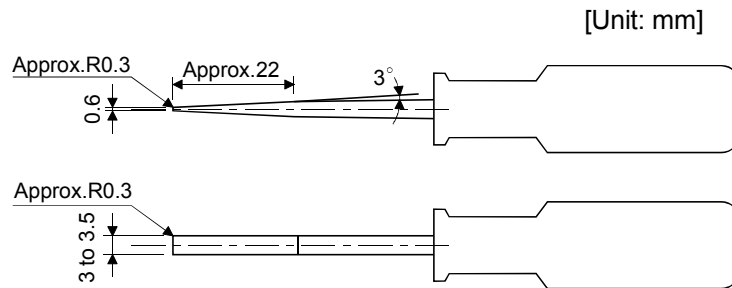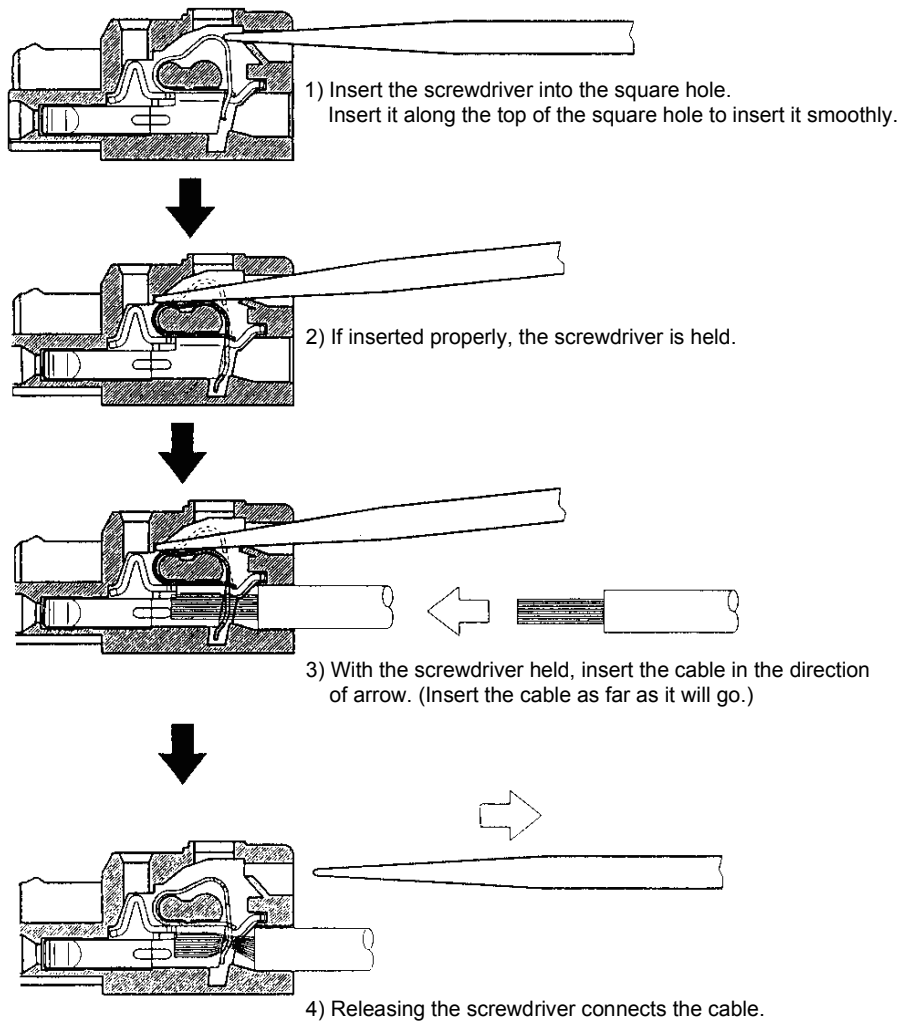
3) When using the flat-blade screwdriver - part 2
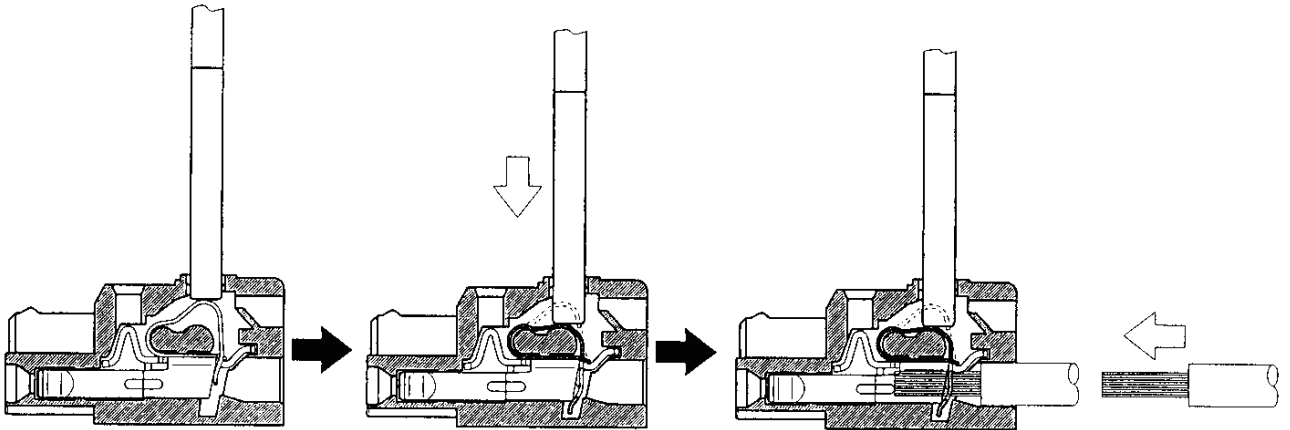
1) Insert the screwdriver into the
   square window at top of the
   connector.

2) Push the screwdriver in the
   direction of arrow.

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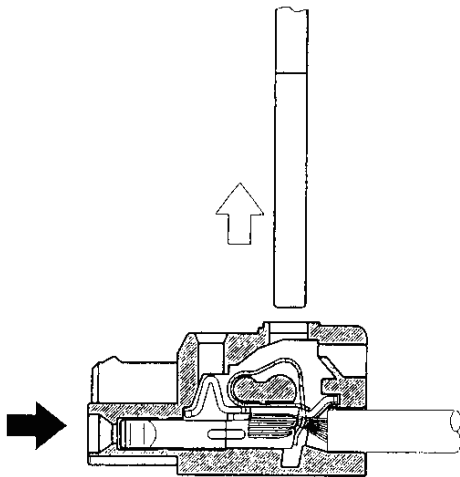
4) Releasing the screwdriver connects the cable.

(4) How to insert the cable into PC4/6-STF-7.62-CRWH or PC4/3-STF-7.62-CRWH connector

Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver so that the cable does not come off. (Tightening torque: 0.5 to 0.6N m(4.425 to 5.31 lb in)) Before inserting the cable into the opening, make sure that the screw of the terminal is fully loose.

When using a cable of 1.5mm^2 or less, two cables may be inserted into one opening.

Cable

Opening

To loosen. To tighten.

Servo amplifier
power supply connector

Flat-blade screwdriver SZS 0.6 ×3.5
(phoenix contact)
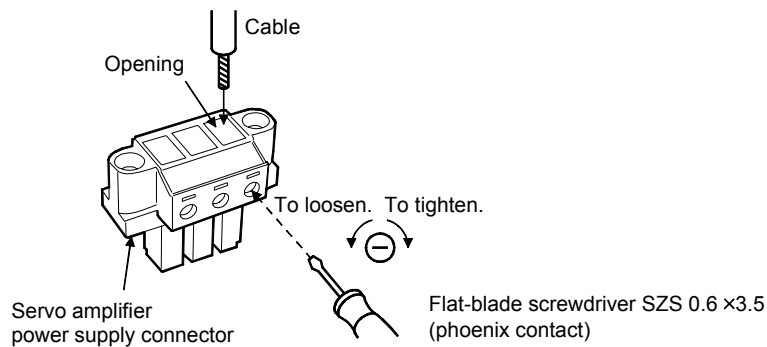
4.4 Connectors and signal arrangements

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

The servo amplifier front view shown is that of the MR-J3-20T or less. Refer to chapter 12 Outline Drawings for the appearances and connector layouts of the other servo amplifiers.

CN5 (USB connector)
Personal computer

CN3
MR-PRU03
parameter module

CN1
CC-Link
communication

CN6

1			14
2	EMG	15	RD
DOG		ALM	16
	3	17	ZP
4	LSP	DOCOM	
LSN	5		18
6	DICOM	19	OPC
PP		NP	20
	7	21	
8			22
	9	23	
10		LG	24
	11	25	LAR
12	LA	LBR	26
LB	13		LZR
	LZ		

CN2

2	4		8	
LG	MRR	6	MDR	10
1		5		9
P5	3		7	BAT
	MR		MD	

The 3M make connector is shown. When using any other connector, refer to section 14.1.2.

The frames of the CN1 and CN6 connectors are connected to the PE (earth) terminal in the amplifier.

4.5 Signal (device) explanation

4.5.1 I/O devices

The CN6 connector provides three pins for inputs and three other pins for outputs. Devices assigned to these pins are changeable. To make this change, configure parameter settings of Nos. PD06 to PD11, PD12, and PD14. Refer to section 4.8.2 for the I/O interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Pin type	CN6 connector pin No.	I/O division	Device in initial status	Parameter of change target device
Input-only pins	1	DI-1	Forced stop (EMG)	
	2		Proximity dog (DOG)	No.PD06
	3		Forward rotation stroke end (LSP)	No.PD07
	4		Reverse rotation stroke end (LSN)	No.PD08
Output-only pins	14	D0-1	Ready (RD)	No.PD09
	15		Trouble (ALM)	No.PD10
	16		Home position return completion (ZP)	No.PD11

(1) Input device

```
┌─────────────────┐
│ POINT           │
└─────────────────┘
```
- Input devices assigned to the CN6 connector pins cannot be used with the remote input of the CC-Link communication function.

Device	Symbol	Connector pin No.	Functions/Applications
Forced stop	EMG	CN6-1	Forced stop (EMG) is fixed at CN6-1. Assigning this device to any other pin is not allowed. For device details, refer to section 3.5.1 (1).
Servo-on	SON		For device details, refer to section 3.5.1 (1).
Forward rotation start	ST1		
Reverse rotation start	ST2		
Proximity dog	DOG	CN6-2 (Note)	
Forward rotation stroke end	LSP	CN6-3 (Note)	
Reverse rotation stroke end	LSN	CN6-4 (Note)	
Automatic/manual selection	MD0		
Temporary stop/Restart	TSTP		
Internal torque limit selection	TL1		
Proportion control	PC		
Gain switch	CDP		
Reset	RES		
Clear	CR		Turn CR on to clear the position control counter droop pulses on its leading edge. The pulse width should be 10ms or more. When the parameter No. PD22 setting is "□ □ □ 1", the pulses are always cleared while CR is on.
Manual pulse generator multiplication 1	TP0		Used to select the multiplication factor of the manual pulse generator. When it is not selected, the parameter No. PA05 setting is made valid.
Manual pulse generator multiplication 2	TP1		

(Note) Input signal		Manual pulse generator multiplication factor
TP1	TP0	
0	0	Parameter No. PA05 setting
0	1	1 time
1	0	10 times
1	1	100 times

Note. 0: OFF
     1: ON

Note. These are pin Nos. assigned at default.

(2) Output device

POINT
· Output devices assigned to the CN6 connector pins can be used with the remote output of the CC-Link communication function.

Device	Symbol	Connector pin No.	Functions/Applications
Ready	RD	CN6-14 (Note)	For device details, refer to section 3.5.1 (2).
Trouble	ALM	CN6-15 (Note)	ALM turns off when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm occurring, ALM turns on within 1.5s after power-on. The significance of this device is opposite of that of remote output (RX (n + 1)A or RX (n +3)A).
Home position return completion	ZP	CN6-16 (Note)	For device details, refer to section 3.5.1 (2).
In position	INP		
Rough match	CPO		
Limiting torque	TLC		
Electromagnetic brake interlock	MBR		
Temporary stop	PUS		
Warning	WNG		
Battery warning	BWNG		
Movement finish	MEND		
dynamic brake interlock	DB		
Position range	POT		
Point table No. output 1	PT0		
Point table No. output 2	PT1		
Point table No. output 3	PT2		
Point table No. output 4	PT3		
Point table No. output 5	PT4		
Point table No. output 6	PT5		
Point table No. output 7	PT6		
Point table No. output 8	PT7		
Speed command reached	SA		SA turns on when servo-on (SON) is on and the commanded speed is at the target speed. SA always turns on when servo-on (SON) is on and the commanded speed is 0r/min. SA turns off when servo-on (SON) is off or the commanded speed is in acceleration/deceleration.

Device	Symbol	Connector pin No.	Functions/Applications
Zero speed	ZSP		ZSP turns on when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed using parameter No. PC17. Example Zero speed is 50r/min ZPS turns on 1) when the servo motor is decelerated to 50r/min, and ZPS turns off 2) when the servo motor is accelerated to 70r/min again. ZPS 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 ZPS turns on, to the point when it is accelerated again and has reached OFF level is called hysteresis width. Hysteresis width is 20r/min for this servo amplifier.
Variable gain selection	CDPS		CDPS is on during gain changing.

Note. These are pin Nos. assigned at default.

4.5.2 Input signals

Device	Symbol	Connector pin No.	Functions/Applications
Manual pulse generator	PP	CN6-6	Used to connect the manual pulse generator (MR-HDP01). (Refer to section 14.18.)
	NP	CN6-19	

4.5.3 Output signals

Refer to section 4.8.2 for the output interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

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

4.5.4 Power supply

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Digital I/F power supply input	DICOM	CN6-5	Used to input 24VDC (24VDC±10% 150mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. Connect the plus of 24VDC terminal external power supply for the sink interface.	
Digital I/F common	DOCOM	CN6-17	Common terminal for input signals such as DOG and EMG. Pins are connected internally. Separated from LG. Connect the plus of 24VDC terminal external power supply for the source interface.	
Open collector power input	OPC	CN6-18	When using the MR-HDP01 manual pulse generator, connect OPC and DICOMD, and supply OPC with the positive (+) voltage of 24VDC.	
Control common	LG	CN6-23	Common terminal for the differential line driver of the encoder pulses (LA・LAR・LB・LBR・LZ・LZR).	
Shield	SD	Plate	Connect the external conductor of the shield cable.	

## 4.6 Detailed description of signals (devices)

4.6.1 Forward rotation start・reverse rotation start・temporary stop/restart

(1) A forward rotation start (RYn1) or a reverse rotation start (RYn2) should make the sequence which can be used after the main circuit has been established. These signals are invalid if it is switched on before the main circuit is established.
    Normally, it is interlocked with the ready signal (RD).

(2) A start in the servo amplifier is made when a forward rotation start (RYn)1 or a reverse rotation start (RYn2) changes from OFF to ON. The delay time of the servo amplifier's internal processing is max. 3ms. The delay time of other signals is max. 10ms.
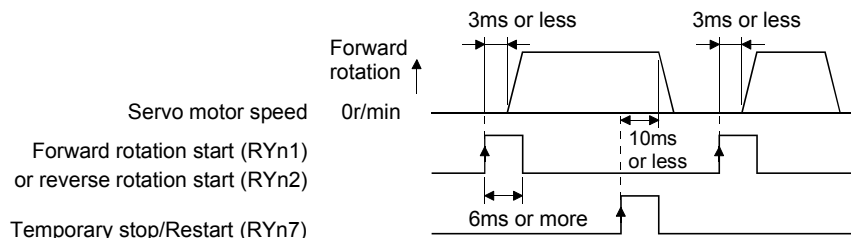
(3) When a programmable controller is used, the ON time of a forward rotation start (RYn1), a reverse rotation start (RYn2) or temporary start/stop (RYn7) signal should be 6ms or longer to prevent a malfunction.

(4) During operation, the forward rotation start (RYn1) or reverse rotation start (RYn2) is not accepted. The next operation should always be started after the rough match (RXn2) is output with the rough match output range set to "0" or after the movement finish (RXnC) is output.

4.6.2 Movement finish・rough match・in position

> POINT
>
> ・If an alarm cause, etc. are removed and servo-on occurs after a stop is made by servo-off, alarm occurrence or Forced stop (EMG) ON during automatic operation, Movement finish (MEND), Rough-match, (CPO) and In position (INP) are turned on. To resume operation, confirm the current position and the selected point table No. for preventing unexpected operation.

(1) Movement finish

The following timing charts show the output timing relationships between the position command generated in the servo amplifier and the movement finished (RYnC). This timing can be changed using parameter No. PA10 (in-position range). RYnC turns ON in the servo-on status.
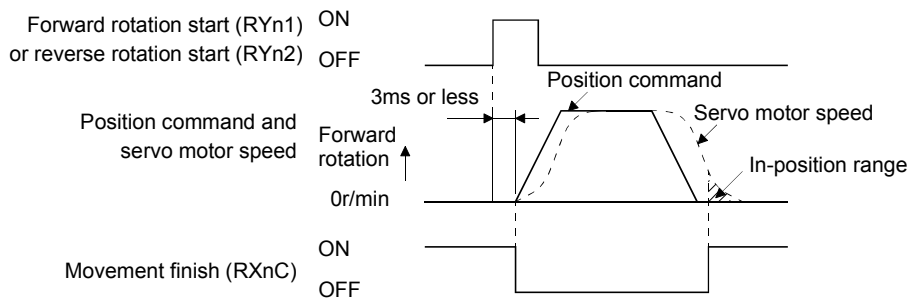
When parameter No. PA10 is small
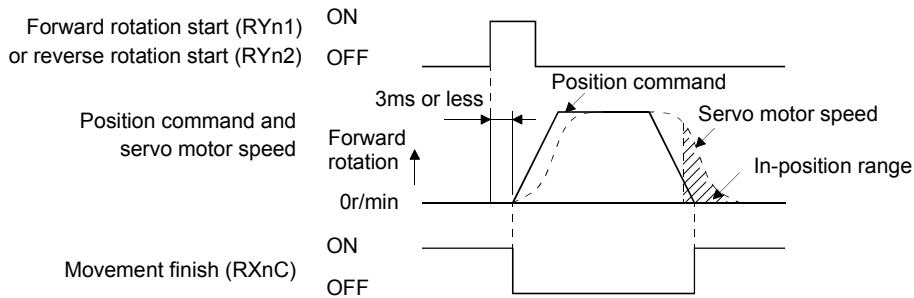
When parameter No. PA10 is large

(2) Rough match

The following timing charts show the relationships between the signal and the position command generated in the servo amplifier. This timing can be changed using parameter No. PC11 (rough match output range). RXn2 turns ON in the servo-on status.

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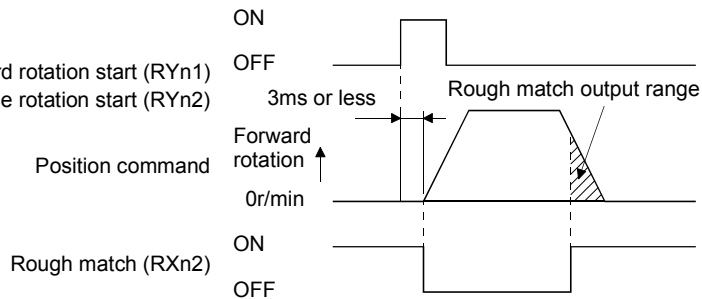
When more than "0" is set in parameter No. PC11

(3) In position

The following timing chart shows the relationship between the signal and the feedback pulse of the servo motor. This timing can be changed using parameter No. PA10 (in-position range). turns on Ryn1 in the servo-on status.
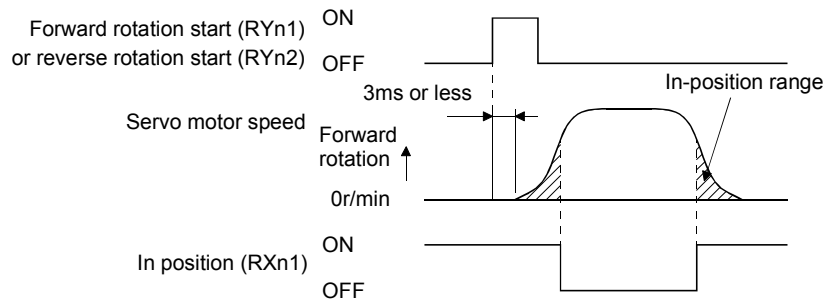
When positioning operation is performed once
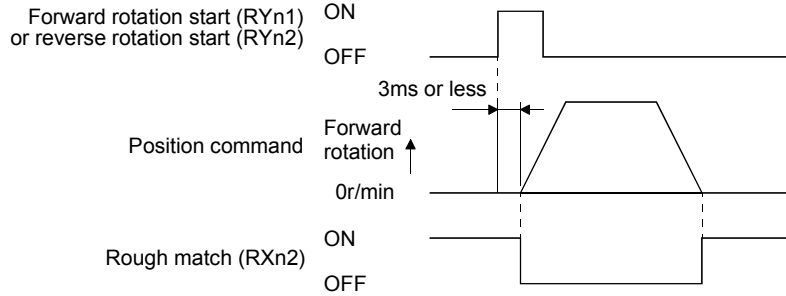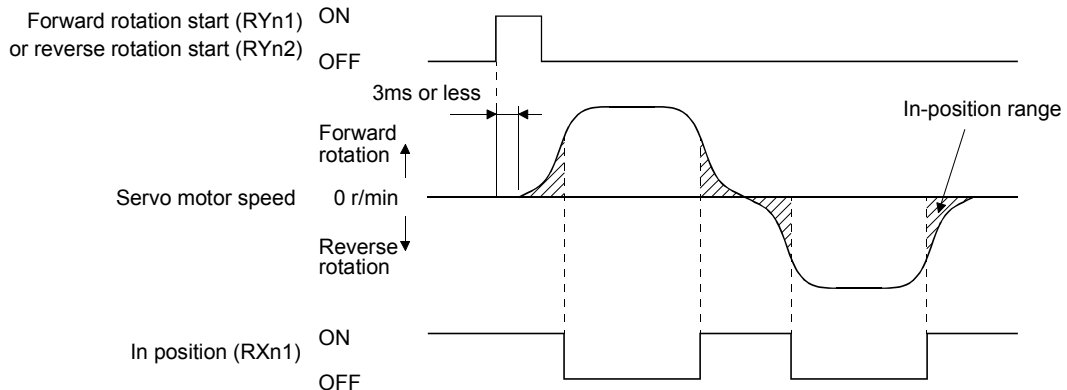

When servo motor reverses rotation direction during automatic continuous operation

4.6.3 Torque limit

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

(1) Torque limit and torque

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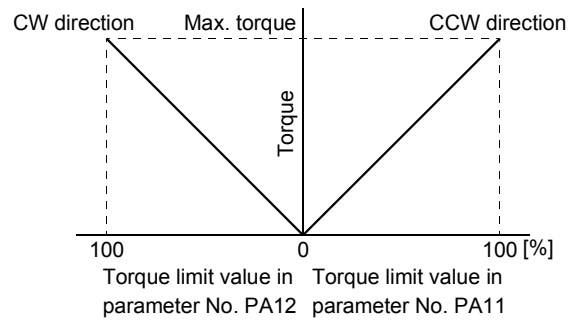
(2) Torque limit value selection

As shown below, the forward torque limit (parameter No. PA11), or reverse torque limit (parameter No. PA12) can be chosen using the external torque limit selection (RY(n+2)6).

(Note) RY(n+2)6	Validated torque limit value	
	CCW driving/CW regeneration	CW driving/CCW regeneration
0	Parameter No. PA11	Parameter No. PA12
1	Parameter No. PC35	

Note. 0: OFF
　　　1: ON

(3) Limiting torque (RXn4)

RXn4 turns on when the servo motor torque reaches the torque limited.

4.7 Alarm occurrence timing chart

⚠ CAUTION	・When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation. ・As soon as an alarm occurs, turn off Servo-on (RYn0) and power off.

When an alarm occurs in the servo amplifier, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To reset the alarm, switch the control circuit power supply from off to on, press the "SET" button on the current alarm screen, or turn the reset (RY(n+1)A or RY(n+3)A) from off to on. However, the alarm cannot be reset unless its cause is removed.
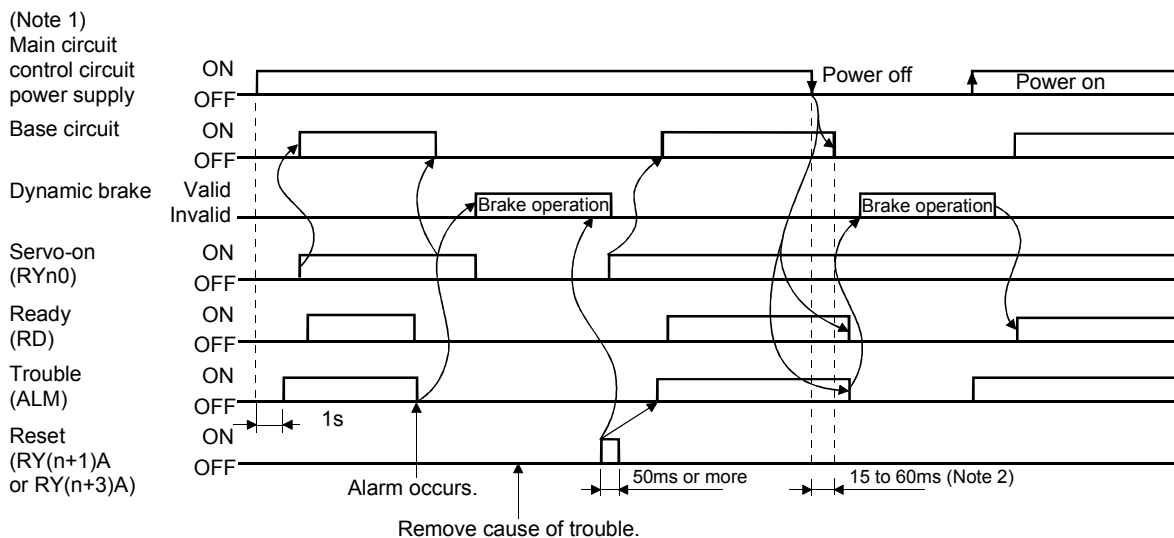
Note 1. Shut off the main circuit power as soon as an alarm occurs.
    2. Changes depending on the operating status.

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

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

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

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

4.8 Interface

4.8.1 Internal connection diagram
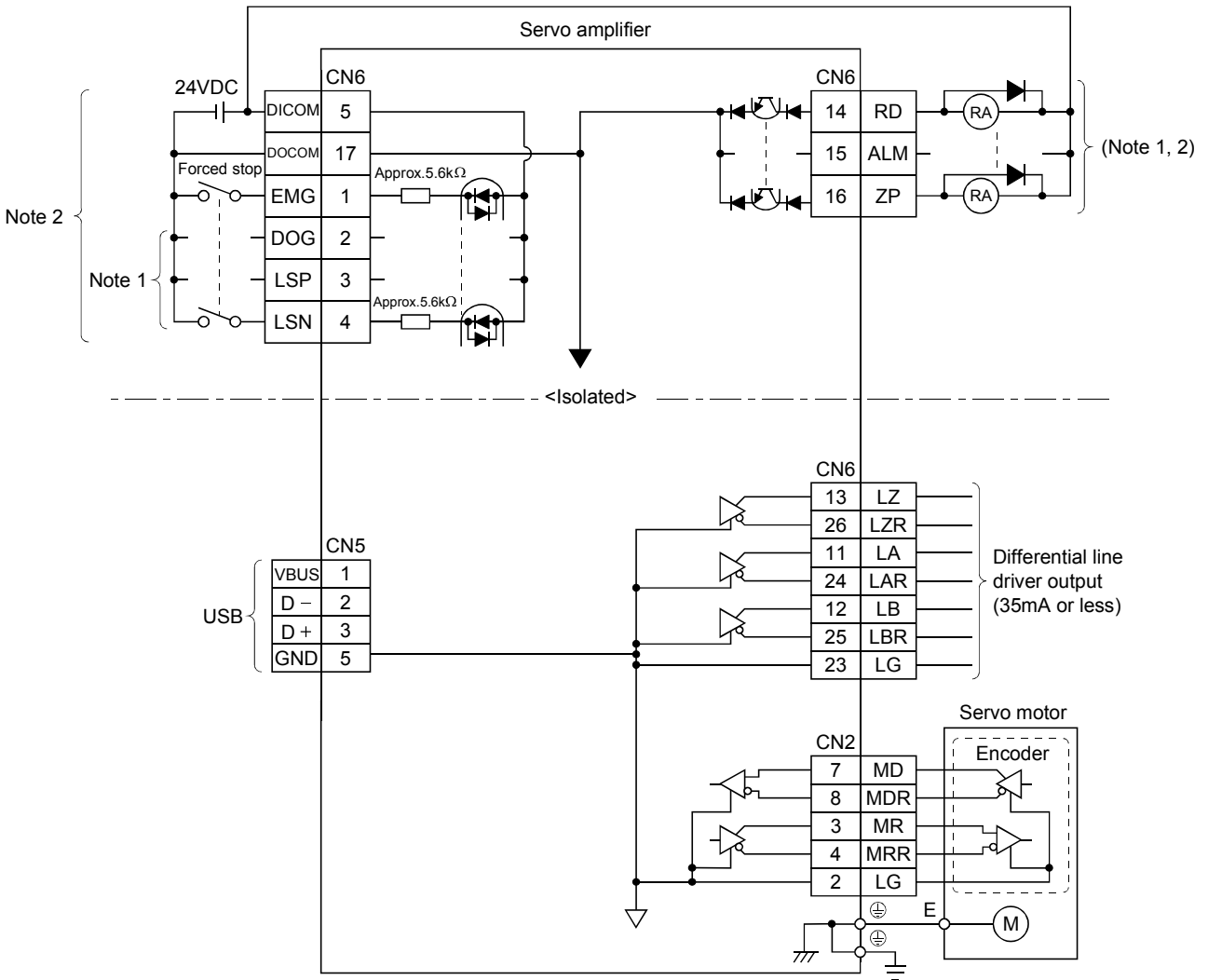
Note 1. Devices assigned to these pins can be changed in the parameter settings.

    2. For this sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.8.2 Detailed description of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 4.5.1 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 4.8.3 for the source input.
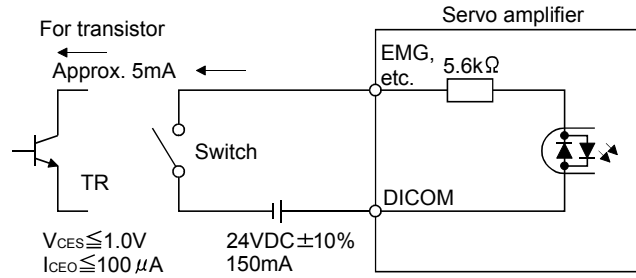
(2) Digital output interface DO-1

A lamp, relay or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less) A maximum of 2.6V voltage drop occurs in the servo amplifier.

Refer to section 4.8.3 for the source output.
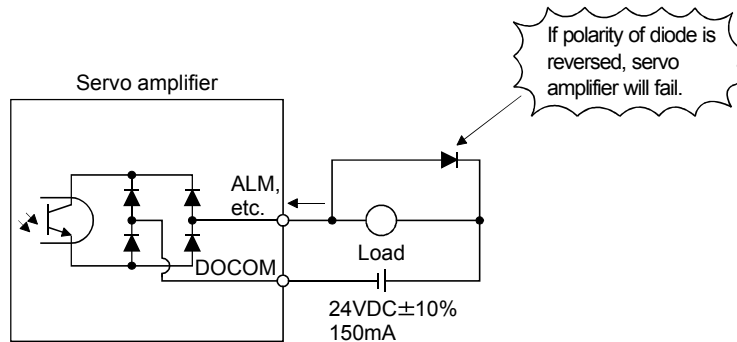
(3) Encoder pulse output DO-2 (Differential line driver system)

(a) Interface

Max. output current: 35mA
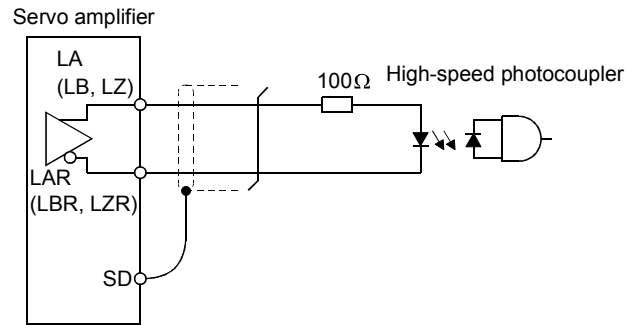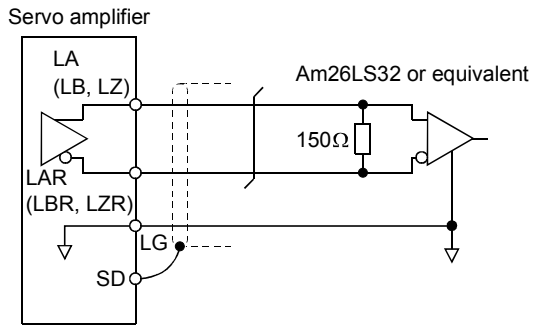
(b) Output pulse
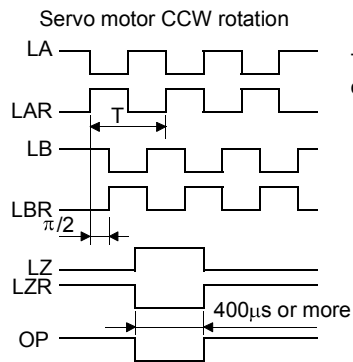
Time cycle (T) is determined by the settings of parameter No.PA15 and PC19.

4.8.3 Source I/O interfaces

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

(1) Digital input interface DI-1
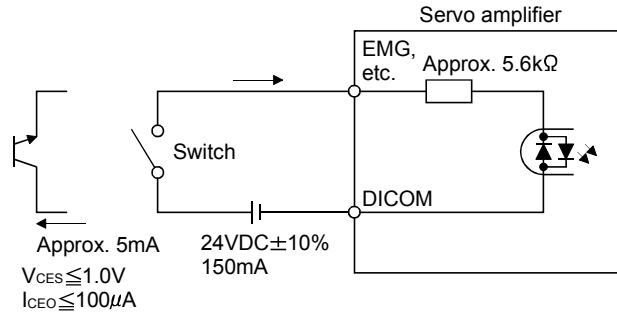
(2) Digital output interface DO-1

A maximum of 2.6V voltage drop occurs in the servo amplifier.
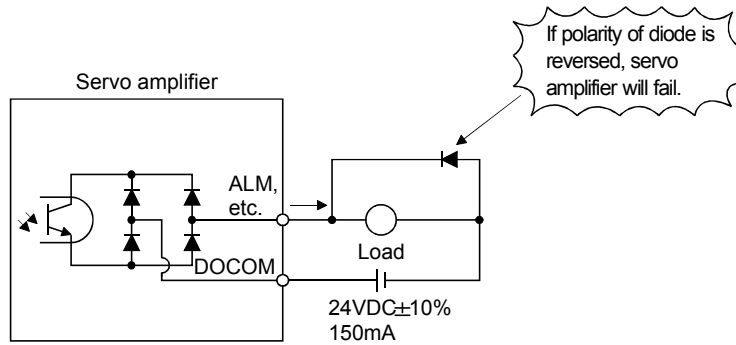
4.9 Treatment of cable shield external conductor

In the case of the CN2 and CN6 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.

External conductor   Sheath

Strip the sheath.

Core   External conductor   Sheath

Pull back the external conductor to cover the sheath
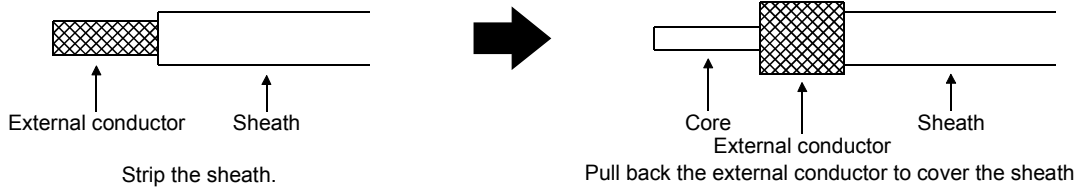
(1) For CN6 connector (3M connector)

Screw

Cable

Screw

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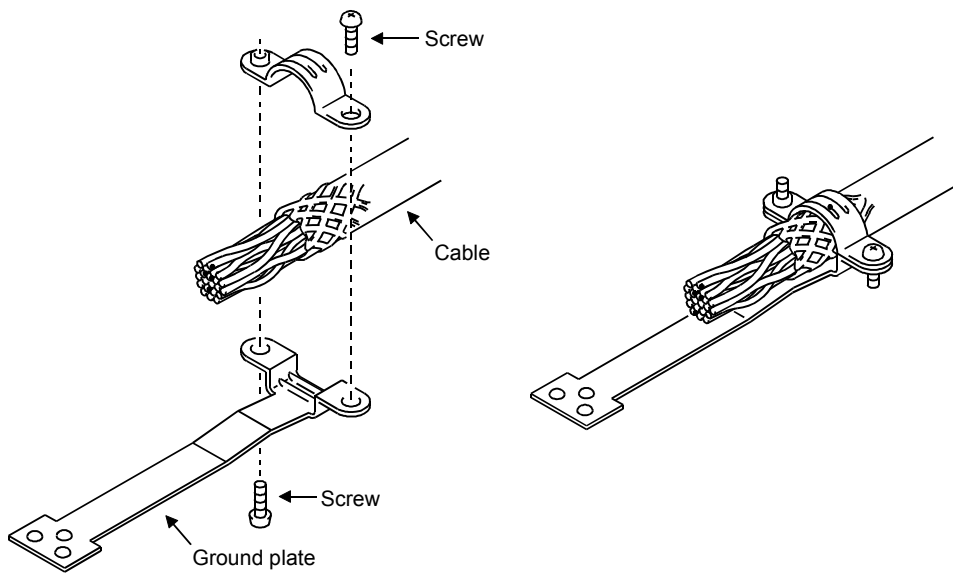
(2) For CN2 connector (3M or Molex connector)

Cable

Ground plate

Screw
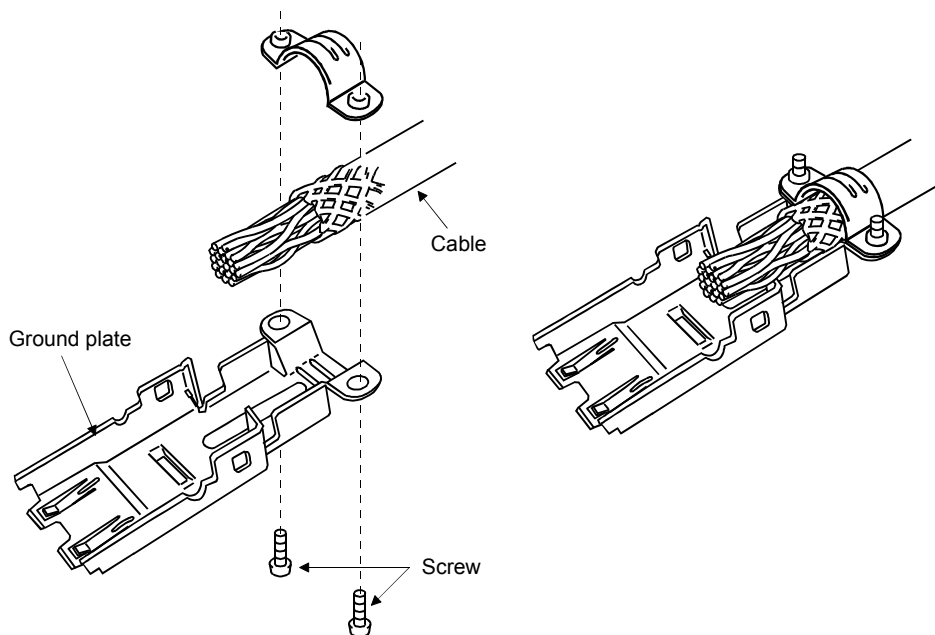
4.10 Connection of servo amplifier and servo motor

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

4.10.1 Connection instructions

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

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

POINT
· Refer to section 14.1 for the selection of the encoder cable.

This section indicates the connection of the motor power supply (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 14.1 for details of the options.

(1) For grounding, connect the earth cable of the servo motor to the protective earth (PE) terminal of the servo amplifier and connect the ground cable of the servo amplifier to the earth via the protective earth of the control box. Do not connect them directly to the protective earth of the control panel.
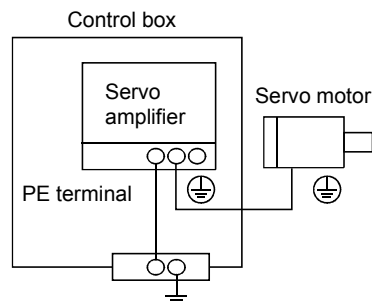
(2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.

4.10.2 Power supply cable wiring diagrams

(1) HF-MP service・HF-KP series servo motor
    (a) When cable length is 10m or less
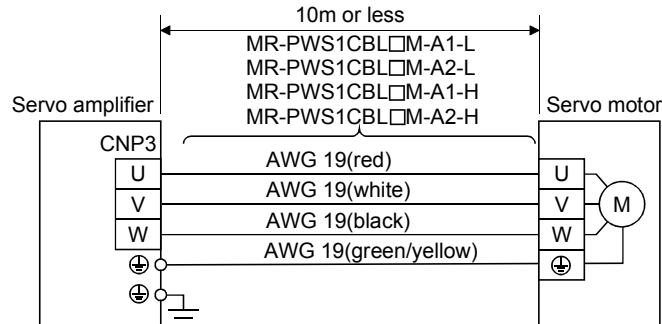
(b) When cable length exceeds 10m
    When the cable length exceeds 10m, fabricate an extension cable as shown below. In this case, the motor power supply cable pulled from the servo motor should be within 2m long.
    Refer to section 14.9 for the wire used for the extension cable.
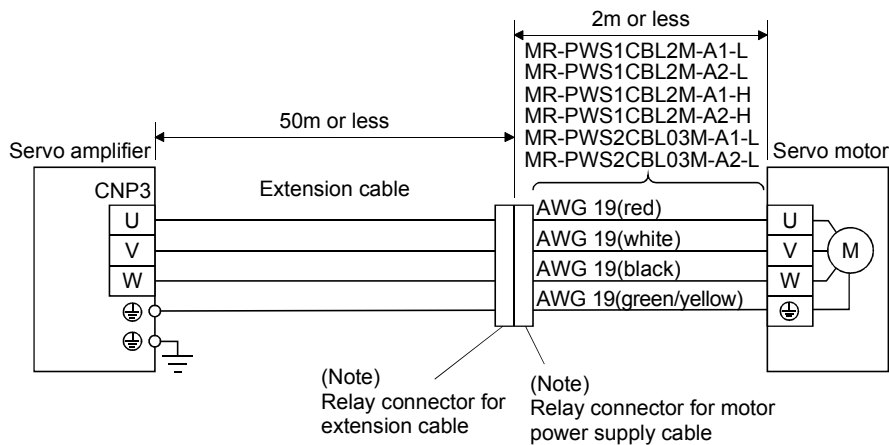
Note. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

Relay Connector	Description	Protective Structure
Relay connector for extension cable	Connector: RM15WTP-4P Cord clamp: RM-15WTP-CP(5) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65
Relay connector for motor power supply cable	Connector: RM15WTJA-4S Cord clamp: RM-15WTP-CP(8) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65

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

POINT

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

Soldered part or crimping part facing up | Pin No.1

For CM10-SP2S-□

Soldered part or crimping part facing down | Pin No.1

For CM10-SP10S-□
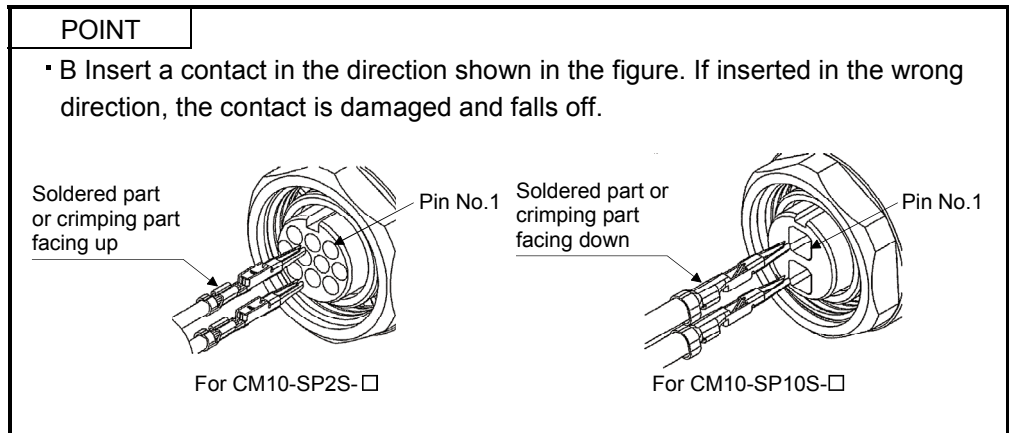
(a) Wiring diagrams

Refer to section 14.9 for the cables used for wiring.
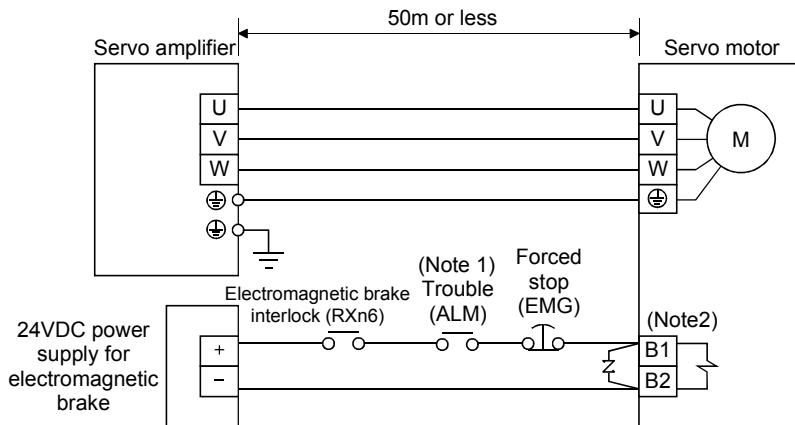
When the power supply connector and the electromagnetic brake connector are separately supplied
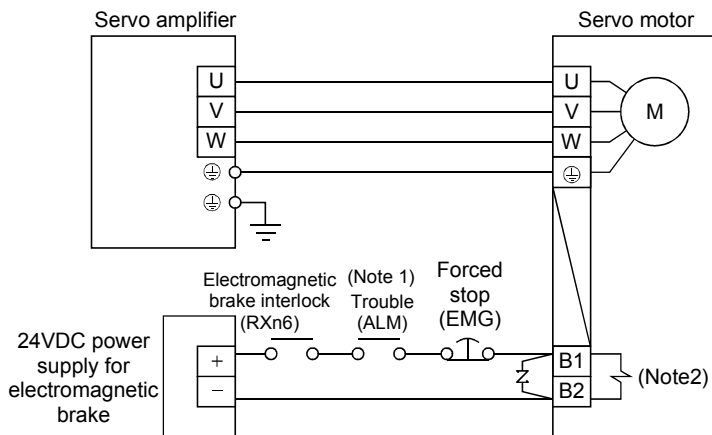
When the power supply connector and the electromagnetic brake connector are shared

Note 1. Shut off the circuit on detection of the servo amplifier alarm.
2. There is no polarity in electromagnetic brake terminals B1 and B2.

(b) Connector and signal allotment
   The connector fitting the servomotor is prepared as optional equipment. Refer to section 14.1. For types other than those prepared as optional equipment, refer to chapter 3 in Servomotor Instruction Manual, Vol. 2 to select.
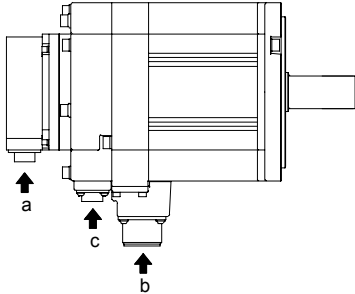
Servo motor	Servo motor side connectors		
	Encoder	Power supply	Electromagnetic brake
HF-SP52 to 152	CM10-R10P (DDK)	MS3102A18-10P	CM10-R2P (DDK)
HF-SP51 · 81			
HF-SP202 to 502		MS3102A22-22P	
HF-SP121 to 301			
HF-SP421 · 702		CE05-2A32-17RD-B	
HC-RP103 to 203		CE05-2A22-23PD-B	The connector for power is shared
HC-RP353 · 503		CE05-2A24-10PD-B	
HC-UP72 · 152		CE05-2A22-23PD-B	
HC-UP202 to 502		CE05-2A24-10PD-B	MS3102A10SL-4P
HC-LP52 to 152		CE05-2A22-23PD-B	The connector for power is shared
HC-LP202 · 302		CE05-2A24-10PD-B	MS3102A10SL-4P

Encoder connector signal allotment
CM10-R10P

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

View a

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

Terminal No.	Signal
A	U
B	V
C	W
D	$\bigoplus$ (earth)

View b

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

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

View b

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

Power supply connector signal allotment
CE05-2A24-10PD-B
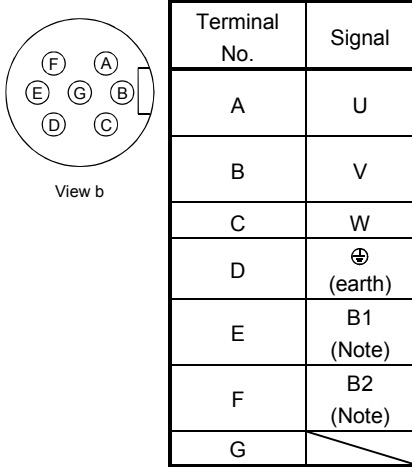
Terminal No.	Signal
A	U
B	V
C	W
D	⏚ (earth)
E	B1 (Note)
F	B2 (Note)
G	

View b

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

Brake connector signal allotment
CM10-R2P

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

View c

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

Brake connector signal allotment
MS3102A10SL-4P

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

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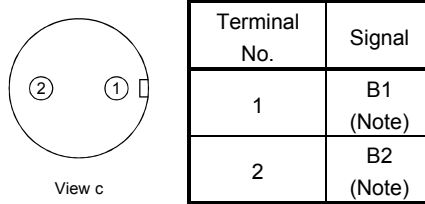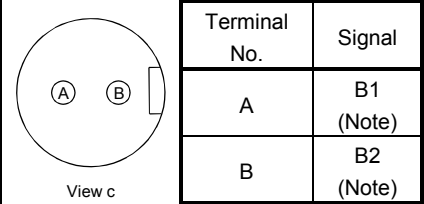
Note. For the motor with electromagnetic brake, supply electromagnetic brake power (24VDC). There is no polarity.

(3) HA-LP series servo motor

  (a) Wiring diagrams

    Refer to section 14.9 for the cables used for wiring.
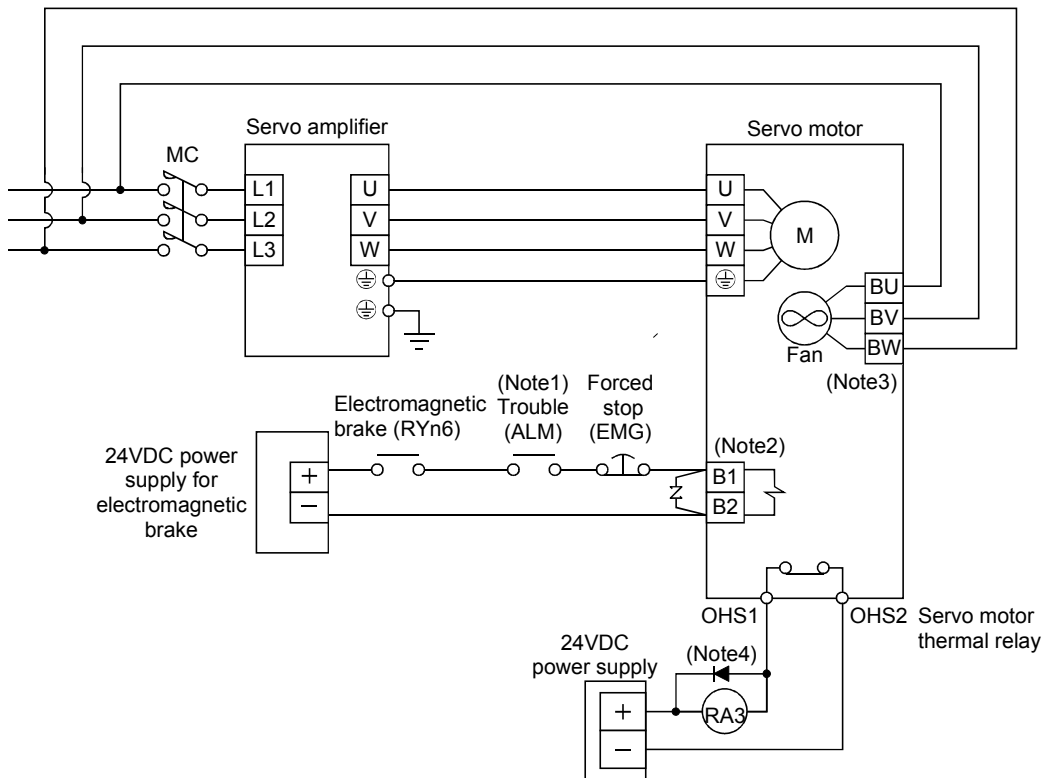
Note 1. Shut off the circuit on detection of the servo amplifier alarm.

    2. When using the external dynamic brake, refer to section 14.6.

    3. There is no BW for HA-LP801, HA-LP12K1, HA-LP11K1M or HA-LP11K2.

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

(b) Servo motor terminals
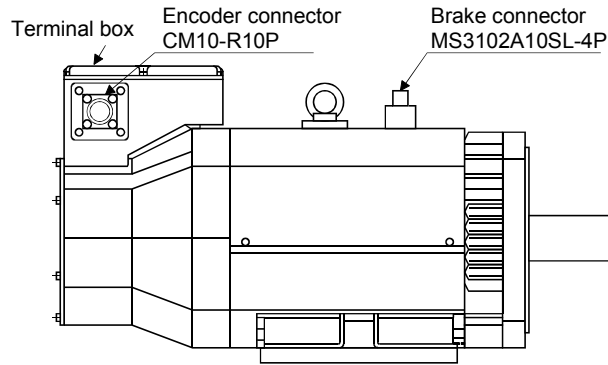
Encoder connector signal allotment CM10-R10P
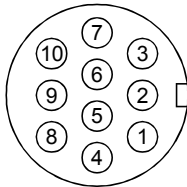
Terminal No.	Signal
1	MR
2	MRR
3	
4	BAT
5	LG
6	
7	
8	P5
9	
10	SHD

Brake connector signal allotment MS3102A10SL-4P
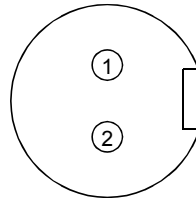
Terminal No.	Signal
1	B1 (Note)
2	B2 (Note)

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

Terminal box inside (HA-LP601, 701M, 11K2)
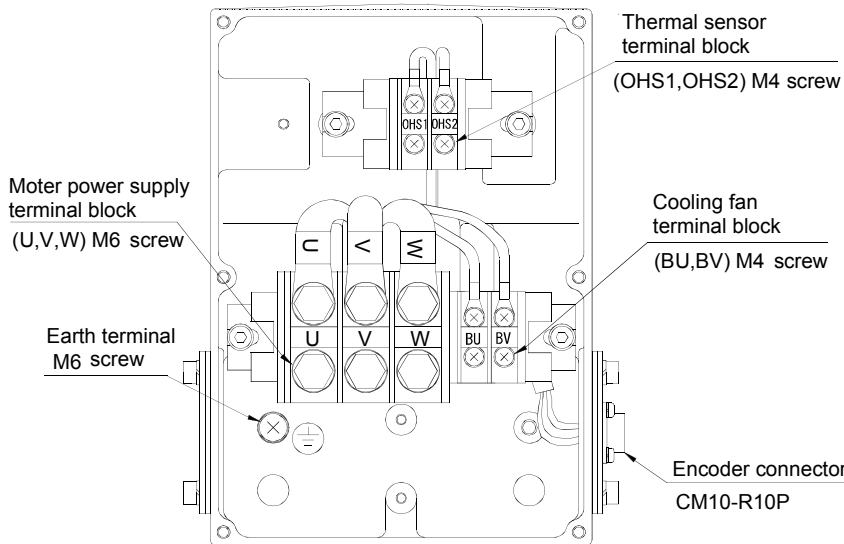
Terminal block signal arrangement
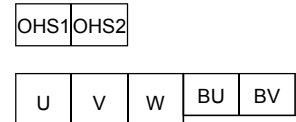
Terminal box inside (HA-LP801, 12K1, 11K1M, 15K1M, 15K2, 22K2)

Cooling fan terminal block
(BU,BV,BW) M4 screw

Thermal sensor terminal block
(OHS1,OHS2) M4 screw

Encoder connector
CM10-R10P

Motor power supply terminal block
(U,V,W) M8 screw

Earth terminal M6 screw

Terminal block
signal arrangement

BU	BV	BW	OHS1	OHS2

U	V	W
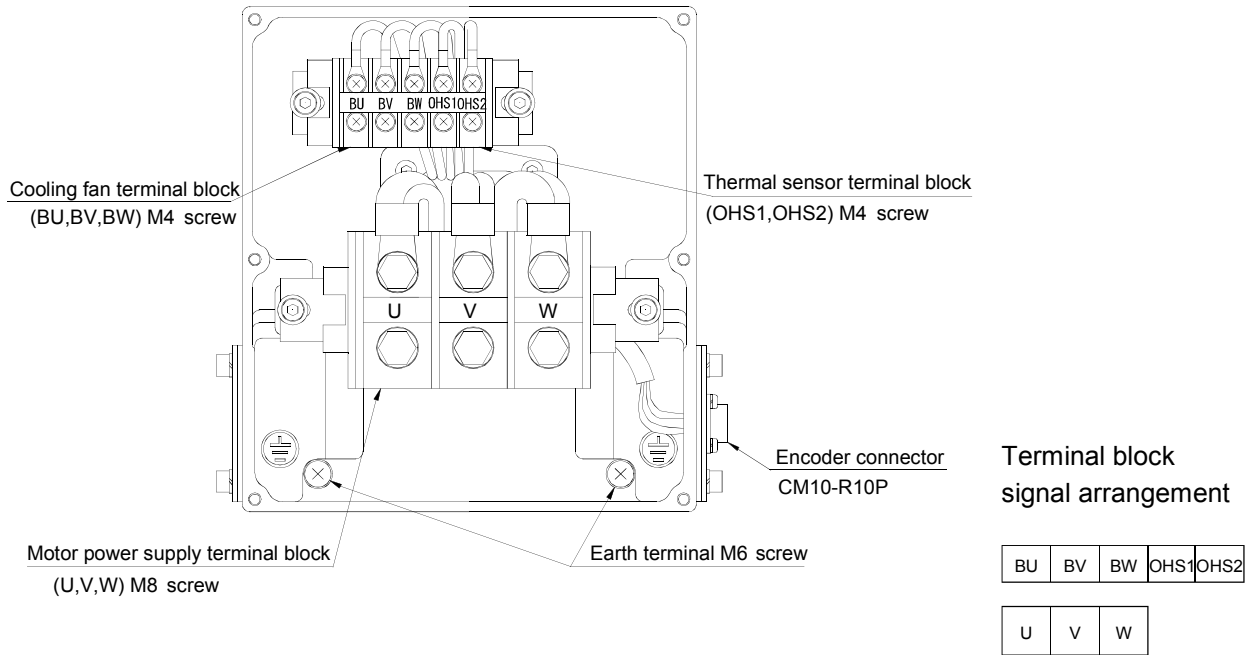
Terminal box inside (HA-LP15K1, 20K1, 22K1M)

Encoder connector
CM10-R10P

Earth terminal
M6 screw

Thermal sensor terminal block
(OHS1,OHS2) M4 screw

Moter power supply
terminal block
(U,V,W) M8 screw

Cooling fan
terminal block
(BU,BV,BW) M4 screw

Terminal block signal arrangement

U	V	W	BU	BV	BW	OHS1	OHS2

4 - 39
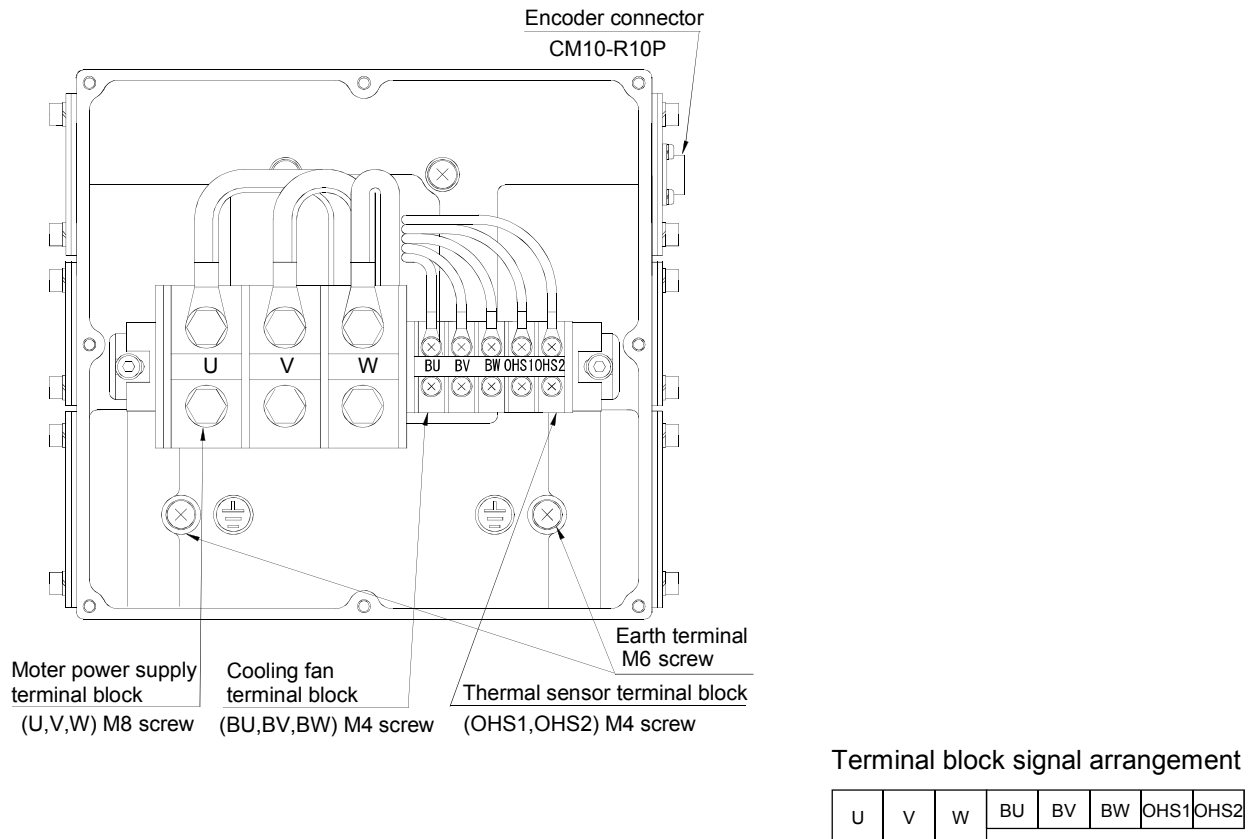
Signal Name	Abbreviation	Description
Power supply	U・V・W	Connect to the motor output terminals (U, V, W) of the servo amplifier. During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.
Cooling fan	(Note) BU・BV・BW	Supply power which satisfies the following specifications. HA-LP801・HA-LP12K1・HA-LP11K1M・HA-LP11K2 表1 HA-LP15K1・HA-LP15K1M・HA-LP15K2・HA-LP20K1・HA-LP25K1・ HA-LP22K1M・HA-LP22K2 表2
Motor thermal relay	OHS1・OHS2	OHS1－OHS2 are opened when heat is generated to an abnormal temperature. Maximum rating: AC/DC 125V, or 250V, 2A Minimum rating: AC/DC 6V, 0.15A
Earth terminal	⏚	For grounding, connect to the earth of the control box via the earth terminal of the servo amplifier.

Cooling fan (表1) for HA-LP801・HA-LP12K1・HA-LP11K1M・HA-LP11K2:

Item	Description
Voltage/frequency	Single-phase 200 to 220VAC, 50Hz Single-phase 200 to 230VAC, 60Hz
Power consumption [W]	42(50Hz)/54(60Hz)
Rated voltage [V]	0.12(50Hz)/0.25(60Hz)

Cooling fan (表2) for HA-LP15K1・HA-LP15K1M・HA-LP15K2・HA-LP20K1・HA-LP25K1・HA-LP22K1M・HA-LP22K2:

Item	Description
Voltage/frequency	Single-phase 200 to 220VAC, 50Hz Single-phase 200 to 230VAC, 60Hz
Power consumption [W]	42(50Hz)/54(60Hz)
Rated voltage [V]	0.30(50Hz)/0.25(60Hz)

Note. There is no BW if HA-LP801,HA-LP12K1, HA-LP11K1M or HA-LP11K2 is used.

4.11 Servo motor with electromagnetic brake

4.11.1 Safety precautions

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

Contacts must be open when servo-off, when an trouble (ALM) and when an electromagnetic brake interlock (RXn6).

Circuit must be opened during forced stop (EMG).

Servo motor

RA   EMG

24VDC

Electromagnetic brake

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

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

Note the following when the servo motor equipped with electromagnetic brake is used:
1) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.
2) The brake will operate when the power (24VDC) switches off.
3) Switch off the servo-on (RYn0) after the servo motor has stopped.

Using parameter No. PC16 (electromagnetic brake sequence output), set a time delay (Tb) at servo-off from electromagnetic brake operation to base circuit shut-off as in the timing chart shown in section 4.11.2 in this section.

4.11.2 Timing charts

(1) Servo-on (RYn0) command (from controller) ON/OFF

Tb [ms] after the servo-on (RYn0) signal is switched off, the servo lock is released and the servo motor coasts. If the electromagnetic brake is made valid in the servo lock status, the brake life may be shorter. Therefore, when using the electromagnetic brake in a vertical lift application or the like, set Tb to about the same as the electromagnetic brake operation delay time to prevent a drop.
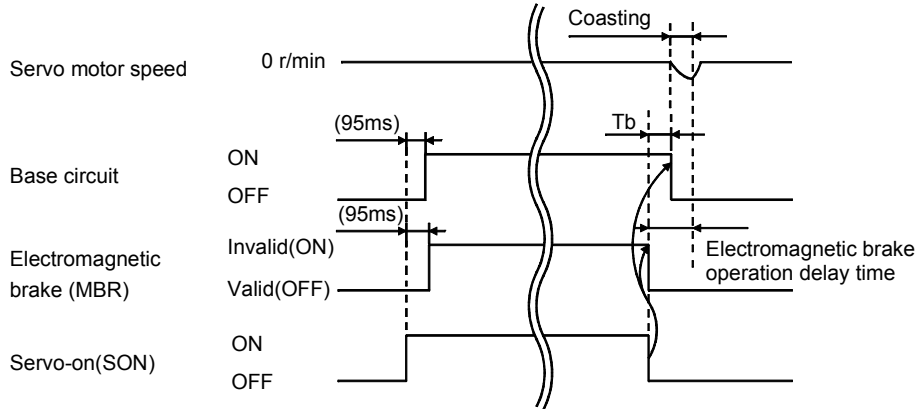
(2) Forced stop (EMG) ON/OFF
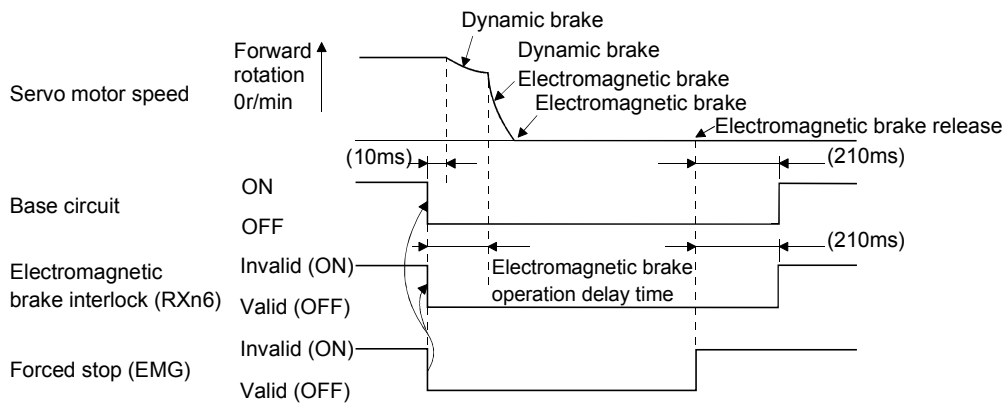
(3) Alarm occurrence
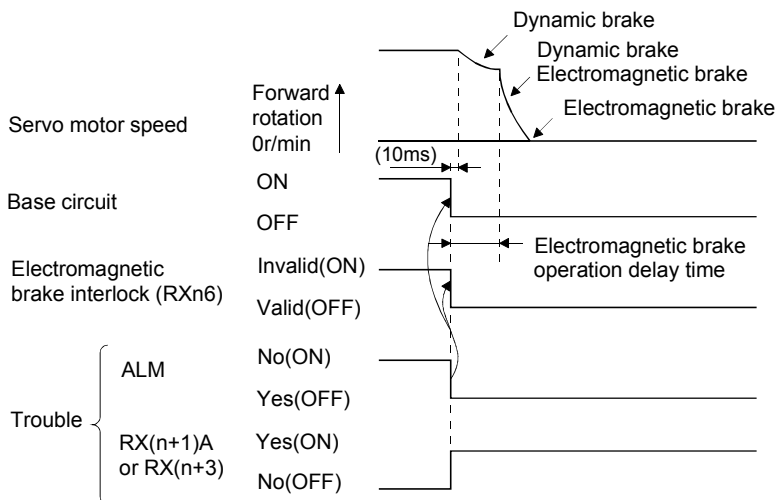
(4) Both main and control circuit power supplies off
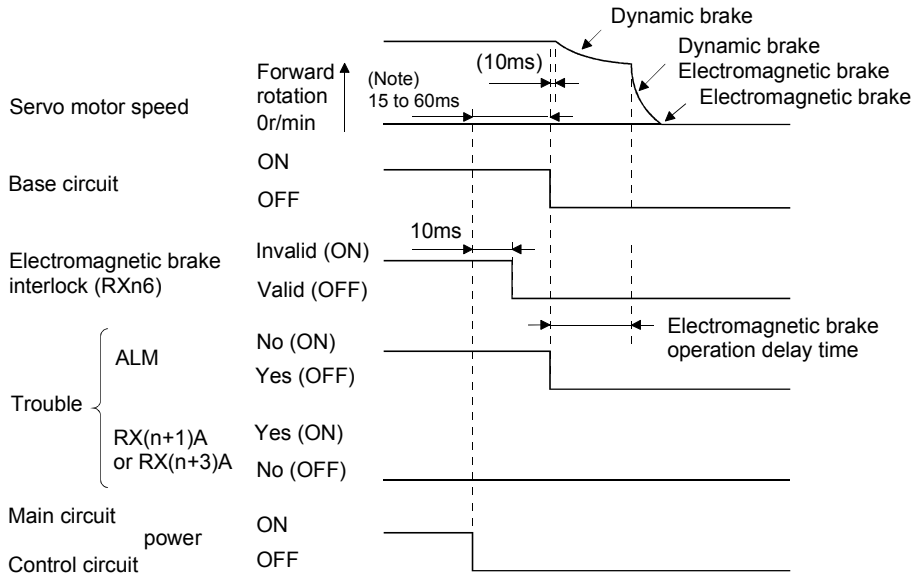
Note. Changes with the operating status.

(5) Only main circuit power supply off (control circuit power supply remains on)
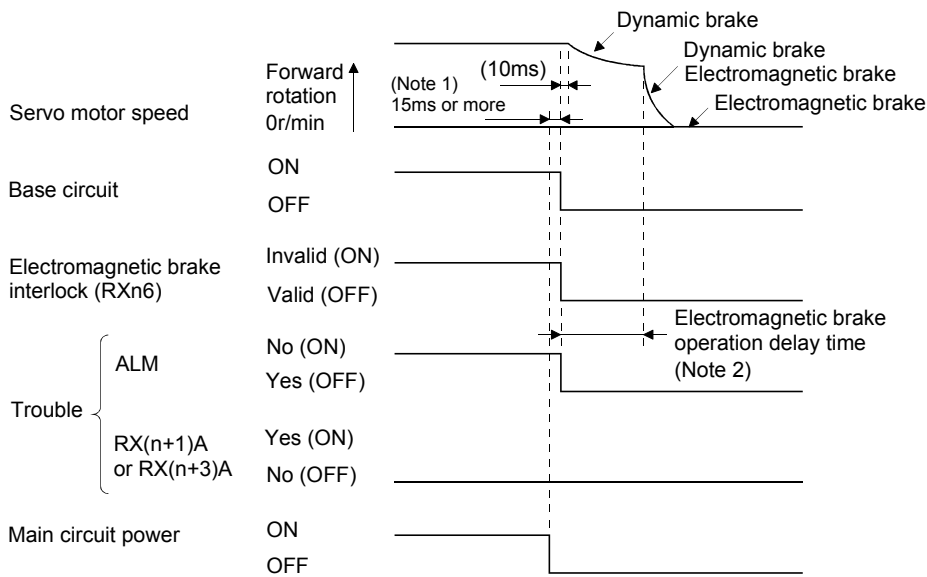
Note 1. Changes with the operating status.
     2. When the main circuit power supply is off in a motor stop status,
       the main circuit off warning (A.E9) occurs and the trouble (ALM) does not turn off.

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

> POINT
> ・For HF-SP series・HC-RP series・HC-UP series・HC-LP series servo
> motors, refer to section 4.10.2 (2).

(1) When cable length is 10m or less
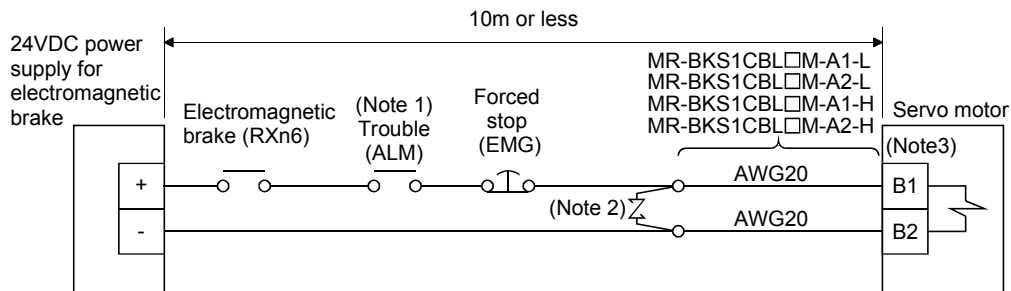
Note 1. Shut off the circuit on detection of the servo amplifier alarm.
   2. Connect a surge absorber as close to the servo motor as possible.
   3. There is no polarity in electromagnetic brake terminals (B1 and B2).

When fabricating the motor brake cable MR-BKS1CBL-□M-H, refer to section 14.1.4.

(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 power supply cable pulled from the servo motor should be within 2m long.
Refer to section 14.9 for the wire used for the extension cable.
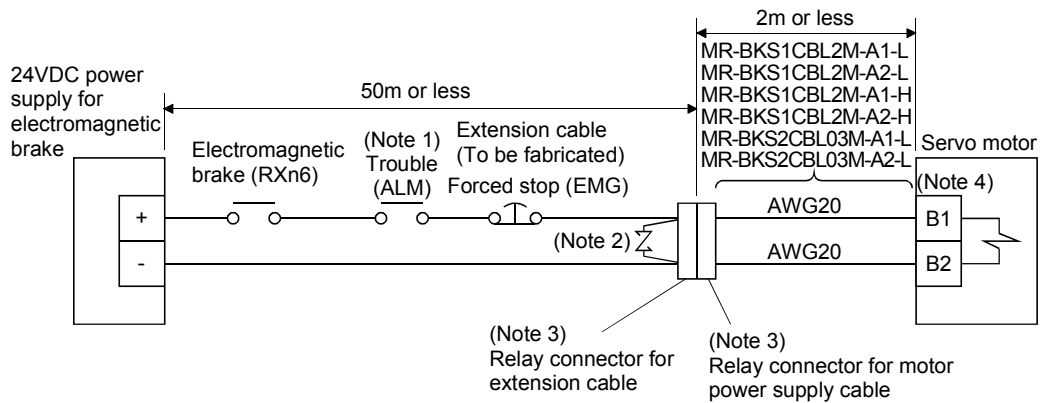
Note 1. Shut off the circuit on detection of the servo amplifier alarm.
   2. Connect a surge absorber as close to the servo motor as possible.
   3. Use of the following connectors is recommended when ingress protection (IP65) is necessary.
   4. There is no polarity in electromagnetic brake terminals (B1 and B2).

Relay Connector	Description	Protective Structure
Relay connector for extension cable	CM10-CR2P-＊ (DDK) └ Wire size: S, M, L	IP65
Relay connector for motor power supply cable	CM10-SP2S-＊ (DDK) └ Wire size: S, M, L	IP65

4.12 Grounding

<table>
<tr>
<td>⚠ WARNING</td>
<td>・Ground the servo amplifier and servo motor securely.
・To prevent an electric shock, always connect the protective earth (PE) terminal of the servo amplifier with the protective earth (PE) of the control box.</td>
</tr>
</table>

The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).
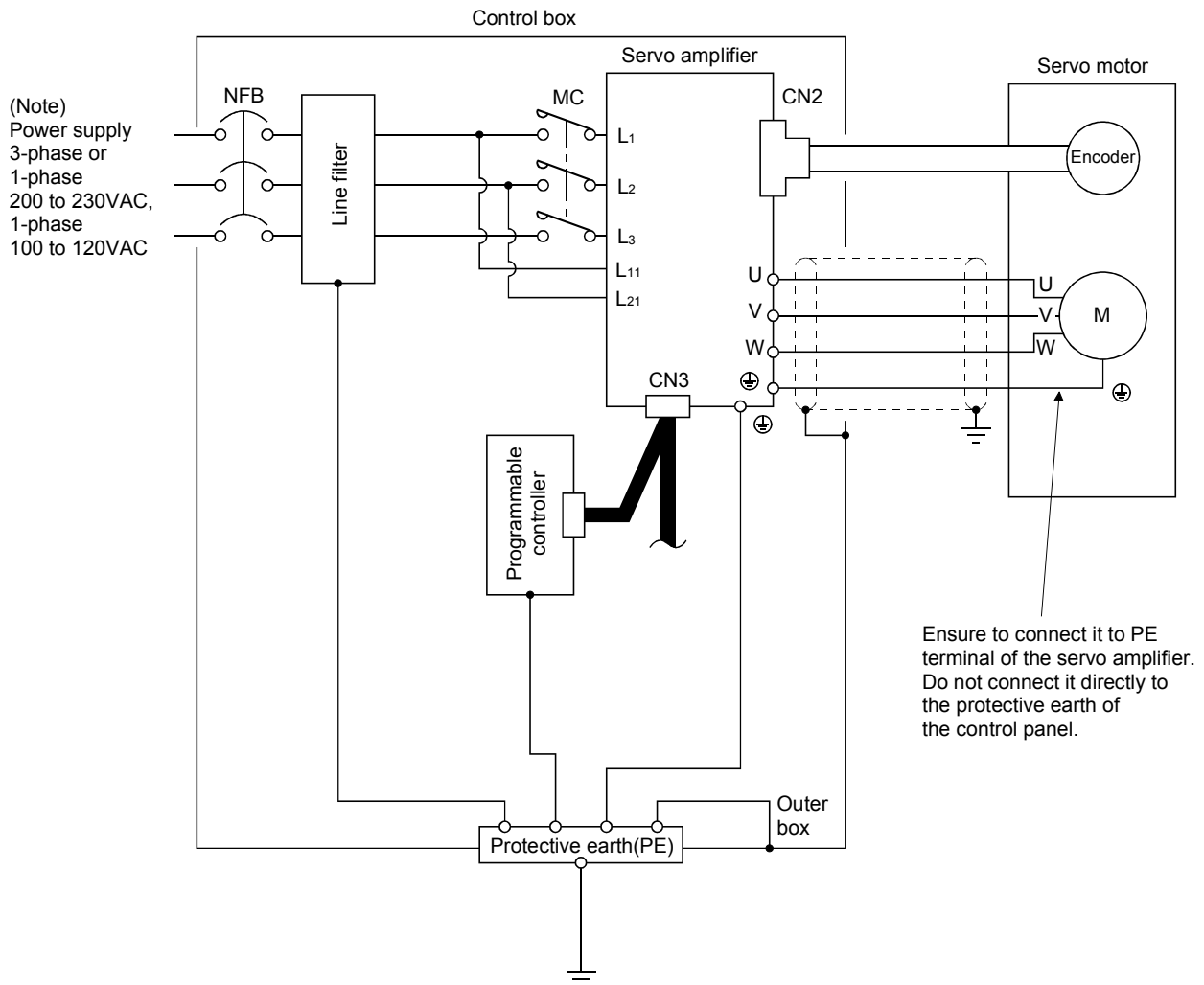
Note. For 1-phase 200 to 230VAC or 1-phase 100 to 120VAC, connect the power supply to $L_1 \cdot L_2$ and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply.

MEMO

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5. 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.

5.1 Switching power on for the first time

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

5.1.1 Startup procedure
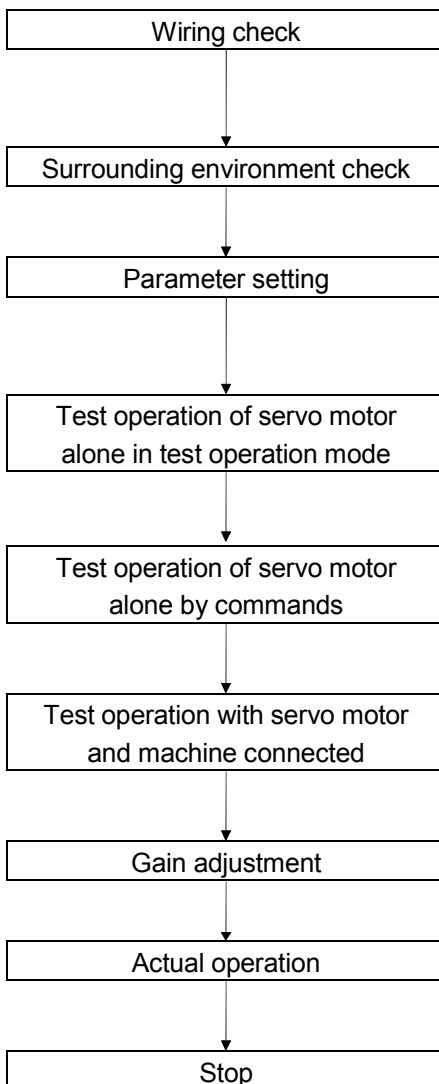
| Wiring check | Check whether the servo amplifier and servo motor are wired correctly using visual inspection, DO forced output function (Section 7.7.4, 8.5.7 (4)), etc. (Refer to section 5.1.2.) |

| Surrounding environment check | Check the surrounding environment of the servo amplifier and servo motor. (Refer to section 5.1.3.) |

| Parameter setting | Set the parameters as necessary, such as the used control mode and regenerative option selection with the parameter unit or MR Configurator. (Refer to chapter 6.) |

| Test operation of servo motor alone in test operation mode | For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly. (Refer to sections 7.7 and 8.5.7.) |

| Test operation of servo motor alone by commands | For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly. |

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

| Gain adjustment | Make gain adjustment to optimize the machine motions. (Refer to chapter 9.) |

| Actual operation |

| Stop | Stop giving commands and stop operation. |

5.1.2 Wiring check

(1) Power supply system wiring

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

(a) Power supply system wiring

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

(b) Connection of servo amplifier and servo motor

1) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.
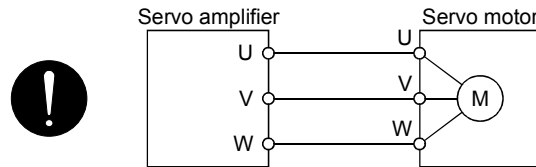
2) The power supplied to the servo amplifier should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected servo amplifier and servo motor.
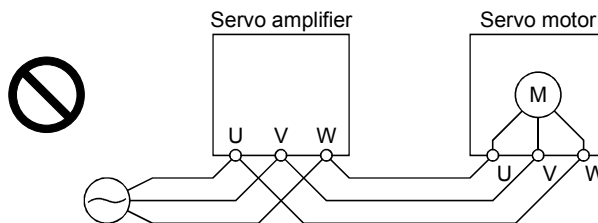
3) The earth terminal of the servo motor is connected to the PE terminal of the servo amplifier.
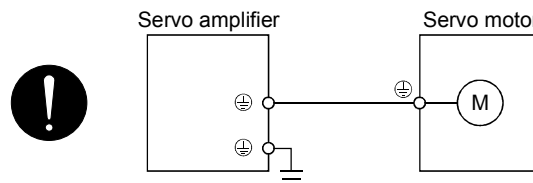
4) P_1-P_2 (For 11kW or more, P-P_1) should be connected.
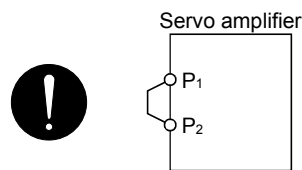
(c) When option and auxiliary equipment are used

1) When regenerative option is used under 3.5kW

・ The lead between P terminal and D terminal of CNP2 connector should not be connected.

・ The generative brake option should be connected to P terminal and C terminal.

・ A twisted cable should be used. (Refer to section 14.2)

2) When regenerative option is used over 5kW
・ The lead of built-in regenerative resistor connected to P terminal and D terminal of TE1 terminal block should not be connected.
・ The generative brake option should be connected to P terminal and C terminal.
・ A twisted cable should be used when wiring is over 5m and under 10m. (Refer to section 14.2)

3) When brake unit and power supply return converter are used over 5kW
・ The lead of built-in regenerative resistor connected to P terminal and D terminal of TE1 terminal block should not be connected.
・ Brake unit, power supply return converter or power regeneration common converter should be connected to P terminal and N terminal. (Refer to section 14.3 to 14.5)
4) The power factor improving DC reactor should be connected across P_1-P_2 (For 11kW or more, P-P_1). (Refer to section 14.11.)
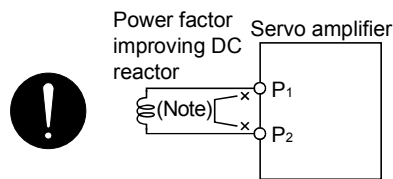
Note. Always disconnect the wiring across P_1-P_2 (For 11kW or more, P-P1).

(2) I/O signal wiring
(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN6 connector. This function can be used to perform a wiring check. (Refer to section 7.7.4.) In this case, switch on the control circuit power supply only.
(b) 24VDC or higher voltage is not applied to the pins of connectors CN6.
(c) SD and DOCOM of connector CN6 is not shorted.
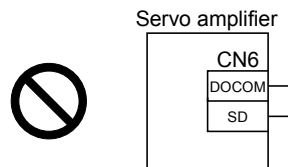
5.1.3 Surrounding environment

(1) Cable routing
(a) The wiring cables are free from excessive force.
(b) The encoder cable should not be used in excess of its flex life. (Refer to section 13.4.)
(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.

5.2 Startup

5.2.1 Power on and off procedures

(1) Power-on
Switch power on in the following procedure. Always follow this procedure at power-on.
1) Switch off the servo-on (RYn0).
2) Make sure that the Forward rotation start (RYn1) and Reverse rotation start (RYn2) are off.
3) Switch on the main circuit power supply and control circuit power supply.
When main circuit power/control circuit power is switched on, the servo amplifier display shows "b01" (if the servo amplifier has the station number of 1).

```
b01
```

In the absolute position detection system, first power-on results in the absolute position lost (A25) alarm and the servo system cannot be switched on.
The alarm can be deactivated then switching power off once and on again.
Also in the absolute position detection system, if power is switched on at the servo motor speed of 3000r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Power-off
1) Make sure that the Forward rotation start (RYn1) and Reverse rotation start (RYn2) are off.
2) Switch off the Servo-on (RYn0).
3) Switch off the main circuit power supply and control circuit power supply.

5.2.2 Stop

In any of the following statuses, the servo amplifier interrupts and stops the operation of the servo motor:
Refer to section 4.11.2 for the servo motor equipped with electromagnetic brake.
(a) Servo-on (RYn0) OFF
The base circuit is shut off and the servo motor coasts.
(b) Alarm occurrence
When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.
(c) Forced stop (EMG) OFF
The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.
The servo forced stop warning (AE6) occurs.
(d) Forward rotation stroke end (LSP), reverse rotation stroke end (LSN) OFF
The droop pulse value is erased and the servo motor is stopped and servo-locked. It can be run in the opposite direction.

5.2.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.
Refer to section 5.2.1 for the power on and off methods of the servo amplifier.

Test operation of servo motor alone in JOG operation of test operation mode
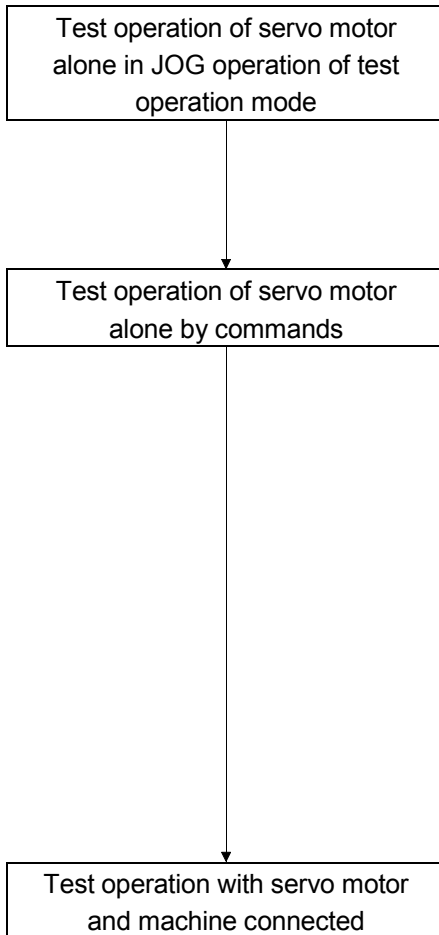
In this step, confirm that the servo amplifier and servo motor operate normally.
With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 7.7 and 8.5.7 for the test operation mode.

Test operation of servo motor alone by commands

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

1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the servo amplifier is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is designated to switch on the forward rotation (RYn1) or reverse rotation (RYn2), the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the servo motor does not operate in the intended direction, check the input signal.

Test operation with servo motor and machine connected

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

1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the servo amplifier is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is specified from the command device and the forward rotation start (ST1) or reverse rotation start (ST2) is turned ON, the servo motor starts rotating. Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, command pulse frequency, load ratio, etc.
4) Then, check automatic operation with the program of the command device.

5.2.4 Parameter setting

POINT

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

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

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

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

5.2.5 Point table setting

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

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

Refer to section 5.4.2. for details of the point table.

5.2.6 Actual operation

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

5.3 Servo amplifier display

On the servo amplifier display (three-digit, seven-segment display), check the status of communication with the CC-Link controller at power-on, check the station number, and diagnose a fault at occurrence of an alarm.

(1) Display sequence
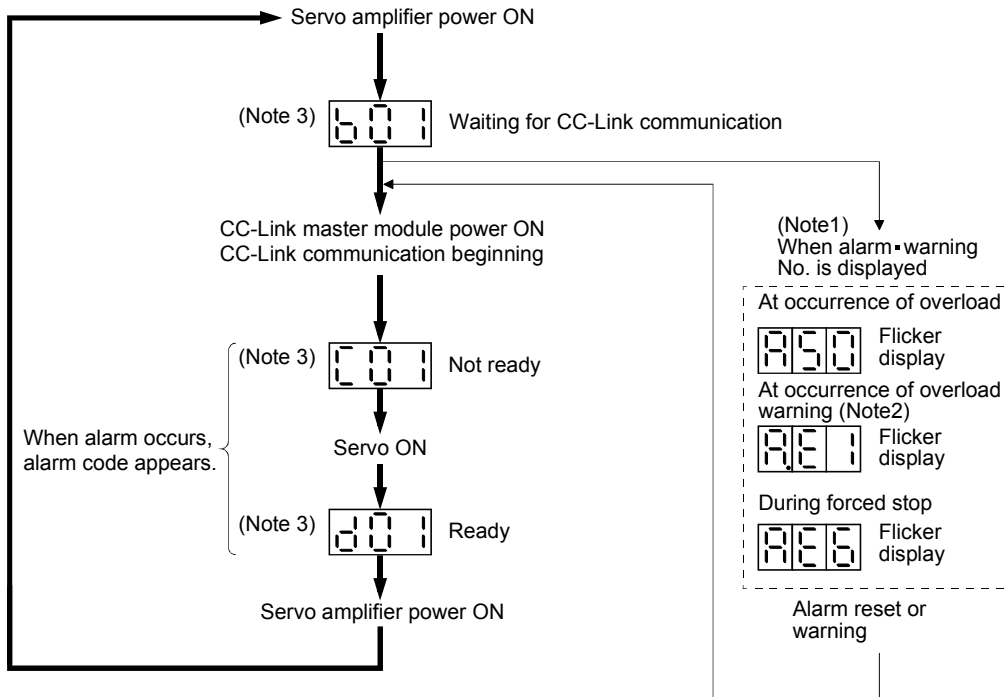
Note 1. Only alarm and warning No. are displayed, but no station No. is displayed
2. If warning other than AE6 occurs during the servo on, flickering the second place of decimal point indicates that it is during the servo on.
3. The right-hand segments of b01, c02 and d16 indicate the axis number. (Below example indicates Station No.1)

Station No.1   Station No.2   Station No.64

(2) Indication list

Indication	Status	Description
b # #	Waiting for CC-Link communication	・Power of the CC-Link master module was switched on at the condition that the power of CC-Link master module is OFF. ・The CC-Link master module is faulty.
(Note 1) d # #	Ready	The servo was switched on after completion of initialization and the servo amplifier is ready to operate. (This is indicated for 2 seconds.)
(Note 1) C # #	Not ready	The servo amplifier is being initialized or an alarm has occurred.
(Note 2) A * *	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 11.4.)
8 8 8	CPU error	CPU watchdog error has occurred.
(Note 3) b 0 0.	(Note 4) Test operation mode	JOG operation・positioning operation・programmed operation・DO forced output・single-step feed
(Note 1) d # #. C # #.		Motor-less operation

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

##	Description
00	Set to the test operation mode.
01	Station number 1
02	Station number 2
03	Station number 3
:	:
:	:
62	Station number 62
63	Station number 63
64	Station number 64

Note 2. ＊＊ indicates the warning/alarm No.
Note 3. Requires MR Configurator or MR-PRU03 parameter module.

5.4 Automatic operation mode

5.4.1 What is automatic operation mode?

(1) Command system
 After selection of preset point tables using the input signals or communication, operation is started by the forward rotation start (RYn1) or reverse rotation start (RYn2). Automatic operation has the absolute value command system, incremental value command system.
 (a) Absolute value command system
  As position data, set the target address to be reached.
  Setting range: -999999 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)
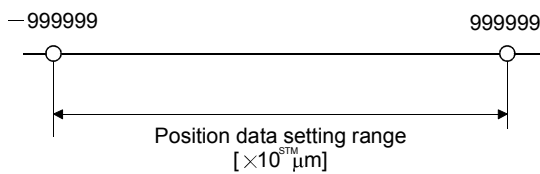
 (b) Incremental value command system
  As position data, set the moving distance from the current address to the target address.
  Setting range: 0 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)
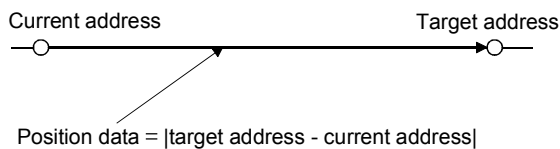
(2) Point table
 (a) Point table setting
  Up to 255 point tables may be set.
  Set the point tables using the MR Configurator Software, the MR-PRU03 parameter unit or CC-Link write instruction code.
  The following table lists what to set: Refer to section 5.4.2 for details of the settings.

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

(b) Selection of point table

Using the input signal or CC-Link, select the point table No. with the remote input and remote register from the command device (controller) such as a personal computer.

The following table lists the point table No. selected in response to the remote input. When 2 stations are occupied, the point table No. can be selected by remote register setting. (Refer to section 3.6.3.)

Remote input (0: OFF 1: ON)								Selected point table No.
2 stations occupied			1 station occupied					
RY(n+2)5	RY(n+2)4	RY(n+2)3	RYnE	RYnD	RYnC	RYnB	RYnA	
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

5.4.2 Automatic operation using point table

(1) Absolute value command system
   (a) Point table
      Set the point table values using the MR Configurator, the MR-PRU03 parameter unit or the remote register of CC-Link.
      Set the position data, motor speed, acceleration time constant, deceleration time constant, dwell and auxiliary function to the point table. The following table gives a setting example. However, this function cannot be used when the point table No. is selected using the remote register of CC-Link:

Name	Setting range	Unit	Description

Position data	$-$999999 to 999999	$\times 10^{STM}\mu m$	(1) When using this point table as absolute value command system
			   Set the target address (absolute value).
			(2) When using this point table as incremental value command system
			     Set the moving distance. A "-" sign indicates a reverse rotation command.

Motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform continuous operation. When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started.

Auxiliary function	0 to 3		This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link.
			(1) When using this point table in the absolute value command system
			0: Automatic operation is performed in accordance with a single point table chosen.
			1: Operation is performed in accordance with consecutive point tables without a stop.
			(2) When using this point table in the incremental value command system
			2: Automatic operation is performed in accordance with a single point table chosen.
			3: Operation is performed in accordance with consecutive point tables without a stop.
			   When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed.
			   Setting "1" in point table No.255 results in an error.
			For full information, refer to this section (4).

   (b) Parameter setting
      Set the following parameters to perform automatic operation:
        1) Command mode selection (parameter No.PA01)
          Select the absolute value command system.

              Parameter No. PA01

                       | 0 |

                           └─Absolute value command system

2) Rotation direction selection (parameter No.PA14)

Choose the servo motor rotation direction at the time when the forward rotation start (RYn1) is switched on.

Parameter No. PA14 setting	Servo motor rotation direction when forward rotation start (RYn1) is switched on
0	CCW rotation with + position data CW rotation with − position data
1	CW rotation with + position data CCW rotation with − position data
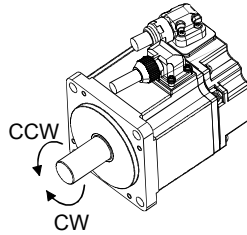
CCW
CW

3) Feed length multiplication selection (parameter No.PA05)

Set the unit multiplication factor (STM) of position data.

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

(c) Operation

Choosing the point table using RYnA to RynE, RY(n+2)3 to RY(n+2)5 and turning RYn1 ON starts positioning to the position data at the preset speed, acceleration time constant and deceleration time constant. At this time, reverse rotation start (RYn2) is invalid.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Point table selection	Point table No. selection 1 (RYnA) Point table No. selection 2 (RYnB) Point table No. selection 3 (RYnC) Point table No. selection 4 (RYnD) Point table No. selection 5 (RYnE) Point table No. selection 6 (RY(n+2)3) Point table No. selection 7 (RY(n+2)4) Point table No. selection 8 (RY(n+2)5)	Refer to section 5.4.1, (2).
Start	Forward rotation start (RYn1)	Turn RYn1 ON to start.

(2) Incremental value command system

    (a) Point table

        Set the point table values using the MR Configurator, the MR-PRU03 parameter unit or the remote register of CC-Link.

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

Name	Setting range	Unit	Description
Position data	0 to 999999	$\times 10^{STM} \mu m$	Set the moving distance. The unit can be changed using feed length multiplication factor selection of parameter No. PA05.
Servo motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform continuous operation. When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started.

Auxiliary function	0 · 1		This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link.
			0: Automatic operation is performed in accordance with a single point table chosen.
			1: Operation is performed in accordance with consecutive point tables without a stop.
			   When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed.
			   Setting "1" in point table No.255 results in an error.
			For full information, refer to (4) of this section.

    (b) Parameter setting

        Set the following parameters to perform automatic operation:

      1) Command mode selection (parameter No.PA01)

        Select the incremental value command system.

Parameter No. PA01

			1

           └ Incremental value command system

2) Forward rotation direction selection (parameter No.PA14)

Choose the servo motor rotation direction at the time when the forward rotation start (RYn1) signal or reverse rotation start (RYn2) signal is switched on.

Parameter No.PA14 setting	Servo motor rotation direction	
	Forward rotation start (RYn1) ON	Reverse rotation start (RYn2) ON
0	CCW rotation (address incremented)	CW rotation (address decremented)
1	CW rotation (address incremented)	CCW rotation (address decremented)

RYn1: ON
CCW

CW
RYn2: ON

Parameter No.PA14: 0

RYn2: ON
CCW

CW
RYn1: ON
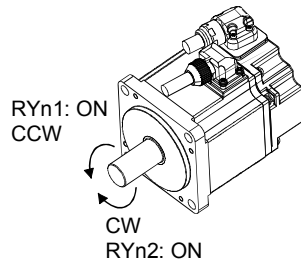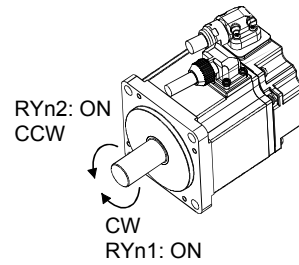
Parameter No.PA14: 1

3) Feed length multiplication selection (parameter No.PA05)

Set the unit multiplication factor (STM) of position data.

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

(c) Operation

Choosing the point table using RYnA to RynE, RY(n+2)3 to RY(n+2)5 and turning RYn1 ON starts a motion in the forward rotation direction over the moving distance of the position data at the preset speed and acceleration time constant.

Turning RYn2 ON starts a motion in the reverse rotation direction according to the values set to the selected point table.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Point table selection	Point table No. selection 1 (RYnA) Point table No. selection 2 (RYnB) Point table No. selection 3 (RYnC) Point table No. selection 4 (RYnD) Point table No. selection 5 (RYnE) Point table No. selection 6 (RY(n+2)3) Point table No. selection 7 (RY(n+2)4) Point table No. selection 8 (RY(n+2)5)	Refer to section 5.4.1, (2).
Start	Forward rotation start (RYn1)	Turn RYn1 ON to start motion in forward rotation direction.
	Reverse rotation start (RYn2)	Turn RYn2 ON to start motion in reverse rotation direction.

(3) Automatic operation timing chart

The timing chart is shown below.
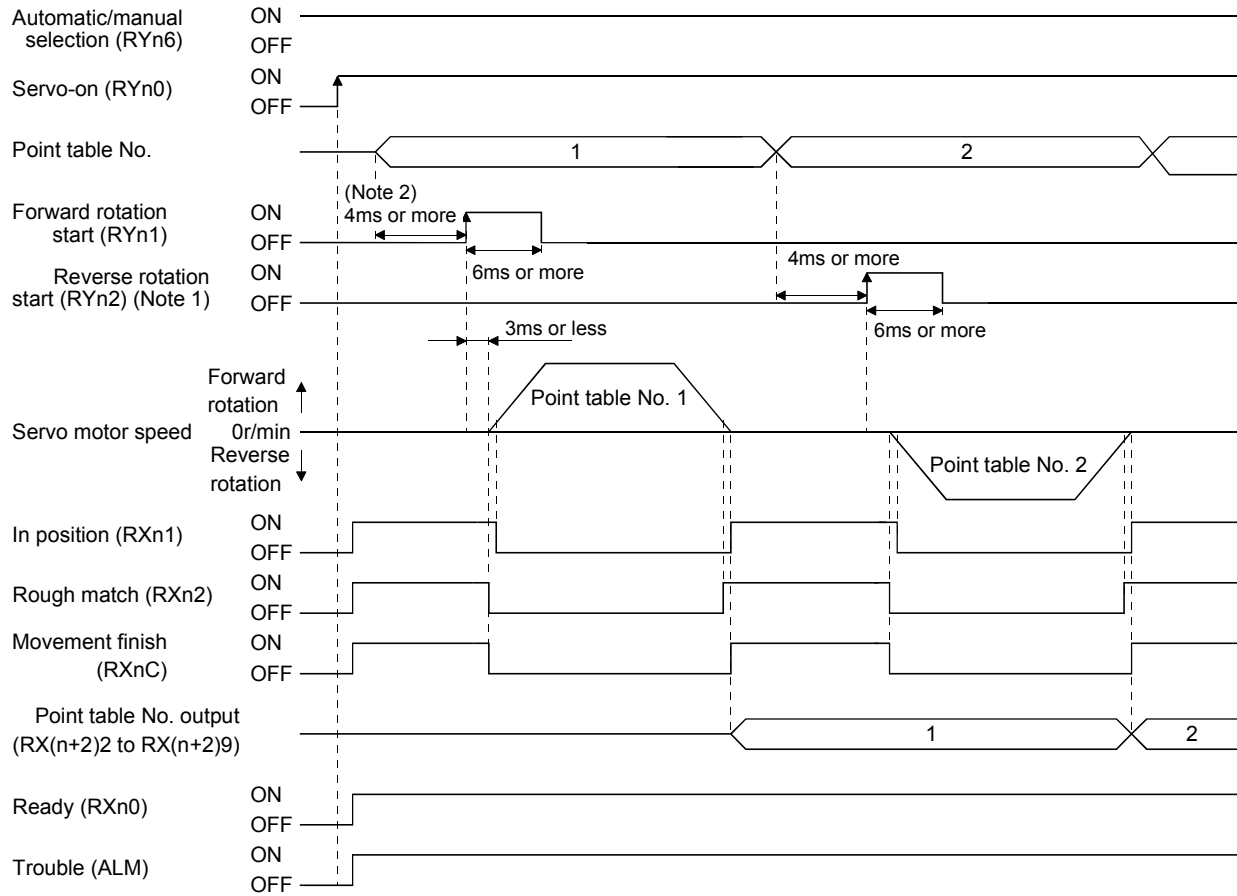
Note 1. Reverse rotation start (RYn2) is invalid in the absolute value command system.
2. External input signal detection delays by the input filter setting time of parameter No. PD19. Also, make up a sequence that will change the point table selection earlier by the time that takes into account the output signal sequence from the controller and the variation of a signal change due to the hardware.

(4) Automatic continuous operation

> POINT
> · This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link.

(a) What is automatic continuous operation?

By merely choosing one point table and making a start (RYn1 or RYn2), operation can be performed in accordance with the point tables having consecutive numbers.

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

Either type may be selected as follows:

1) In absolute value command specifying system

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

Automatic continuous operation ⎡ Speed changing operation ⎣ Automatic continuous positioning operation

2) In incremental value command system

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

Automatic continuous operation ⎡ Speed changing operation ⎣ Automatic continuous positioning operation

(b) Varied speed operation

Speed during positioning operation can be changed by setting the auxiliary function of the point table. Use the number of point tables equal to the number of speeds to be set.

By setting "1" to the auxiliary function, operation is performed at the speed set in the next point table during positioning. The position data valid at this time is the data selected at start and the acceleration and deceleration time constants of the subsequent point tables are made invalid.

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

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

The following table gives a setting example:

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

Note 1. Always set "0".

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

1) Absolute value command specifying system

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

・Positioning in single direction

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

Point table No.	Position data [×10^{STM}μm]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	3.00	2000	Invalid	Invalid	0	3
3	10.00	1000	Invalid	Invalid	0	1
4	6.00	500	Invalid	Invalid	0	0 (Note 2)

Note 1. Always set "0".

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

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

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

5 - 18
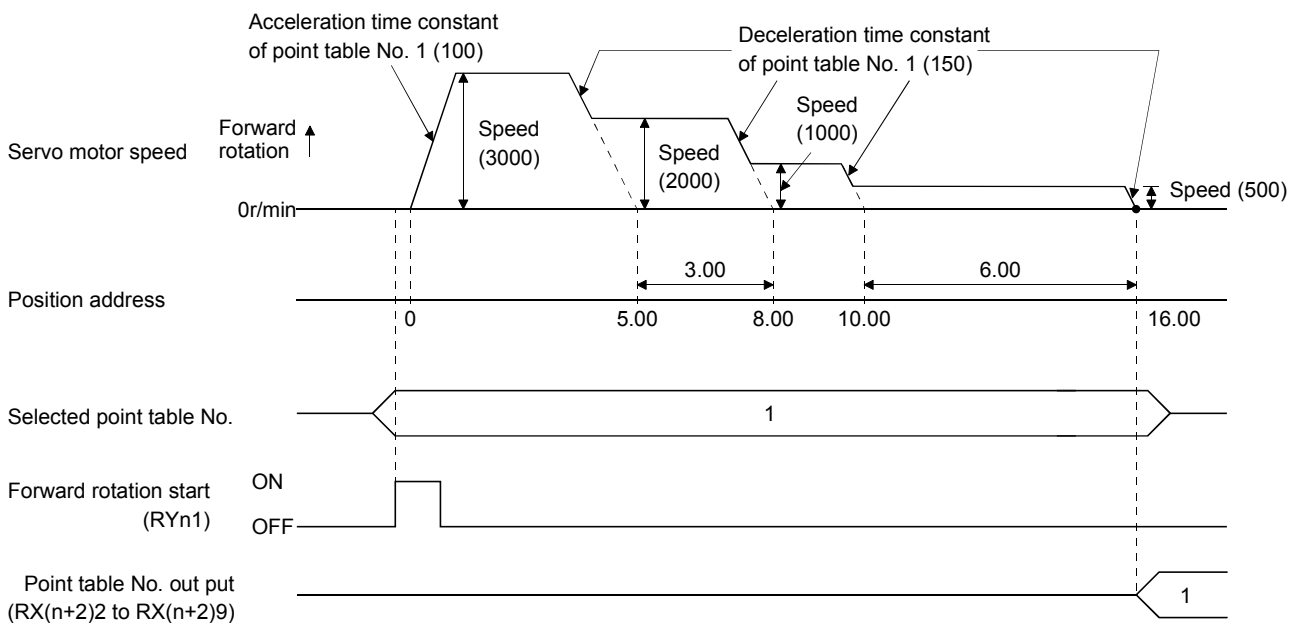
・Positioning that reverses the direction midway

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

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

Note 1. Always set "0".

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

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

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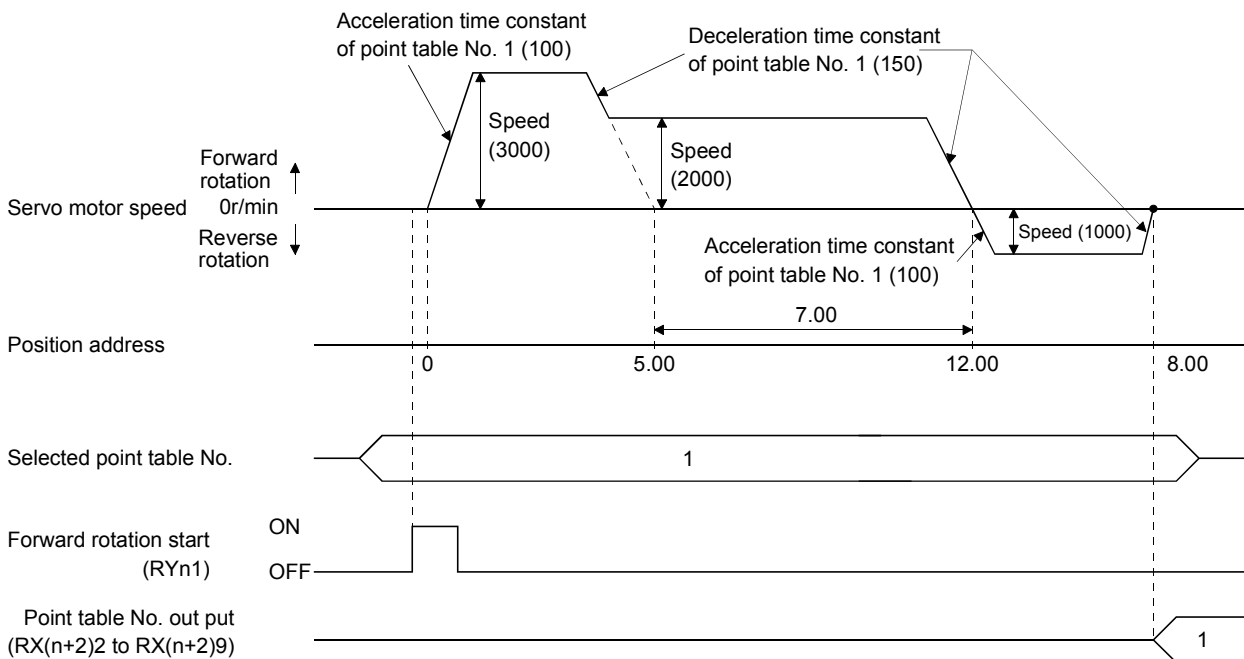
2) Incremental value command system

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

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

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

Note 1. Always set "0".

2. Always set "0" to the auxiliary function of the last point table among the consecutive point tables.
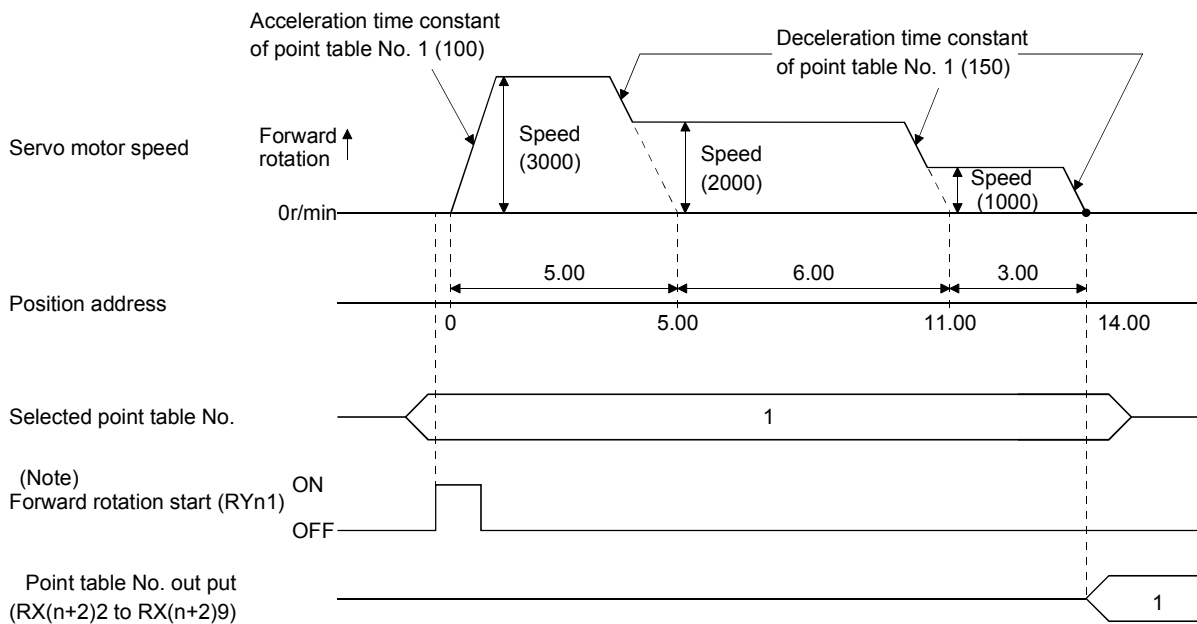
Note. Turning on Reverse rotation start (RYn2) starts positioning in the reverse rotation direction.

(c) Temporary stop/restart

When RYn7 is turned ON during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When RYn7 is turned ON again, the remaining distance is executed.

If the forward/reverse rotation start signal (RYn1 or RYn2) is ignored if it is switched on during a temporary stop.

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

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

1) When the servo motor is rotating
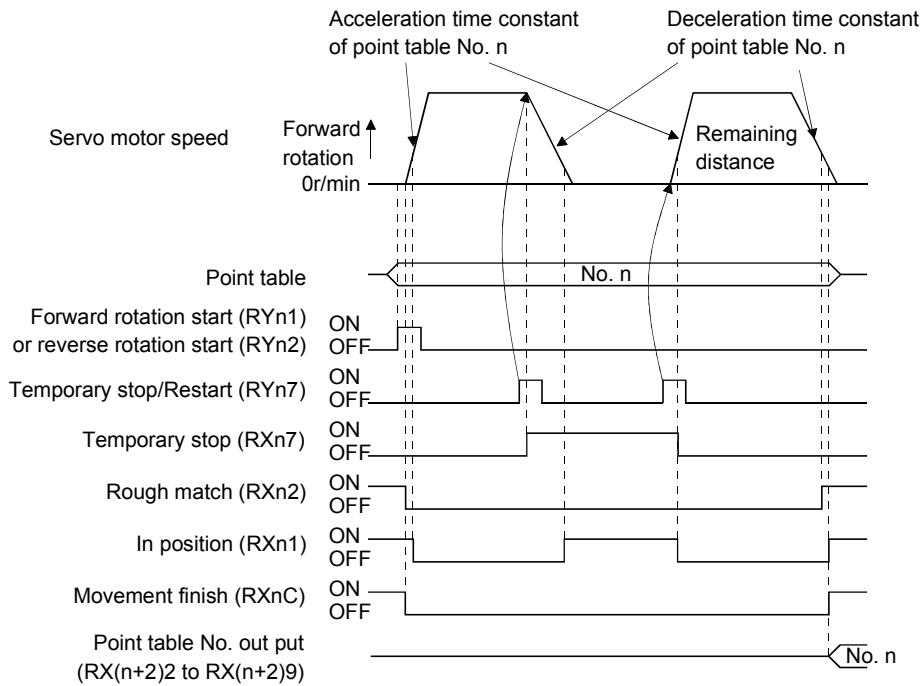
2) During dwell
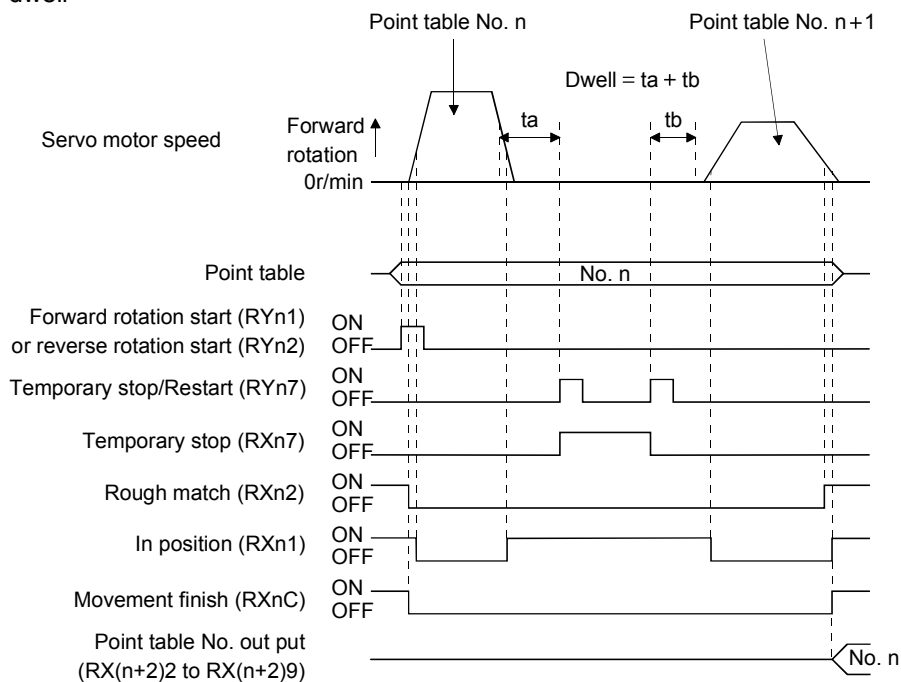
5.4.3 Remote register-based position/speed setting

This operation can be used when 2 stations are occupied. This section explains operation to be performed when the remote register is used to specify the position command data/speed command data.

(1) Absolute value command positioning in absolute value command system
    The position data set in the absolute value command system are used as absolute values in positioning. Set the input signals and parameters as indicated below.

Item	Used device/parameter	Description
Automatic operation mode	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Remote register-based position/speed setting	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Command system	Parameter No.PA03	□□□0 : Absolute value command system is selected.
Remote register-based position/speed specifying system selection	Parameter No.PC30	□□□2 : Remote register-based position/speed specifying system is selected.
Position data	Position command data under 16 bit (RWwn+4)	Set the under 16 bits of position data to RWwn+4, and the upper 16 bits to RWwn+5. Setting range: −999999 to 999999
	Position command data upper 16 bit (RWwn+5)	
Servo motor speed	Speed command data (RWwn+6)	Set the servo motor speed.

Set the position data to RWwn+4/RWwn+5, and the speed command data to RWwn+6, and store them into the servo amplifier.
In the absolute value command system, Absolute value/incremental value selection (RY(n+2)B) can be used to select whether the values set to the position data are absolute values or incremental values. The position data set to RWwn+4/RWwn+5 are handled as absolute values when RY(n+2)B is turned OFF or as incremental values when it is turned ON. During operation, how the position data will be handled (absolute values or incremental values) depends on the status of RY(n+2)B when Forward rotation start (RYn1) is turned ON.
Here, RY(n+2)B is turned OFF since the position data are handled as absolute values.
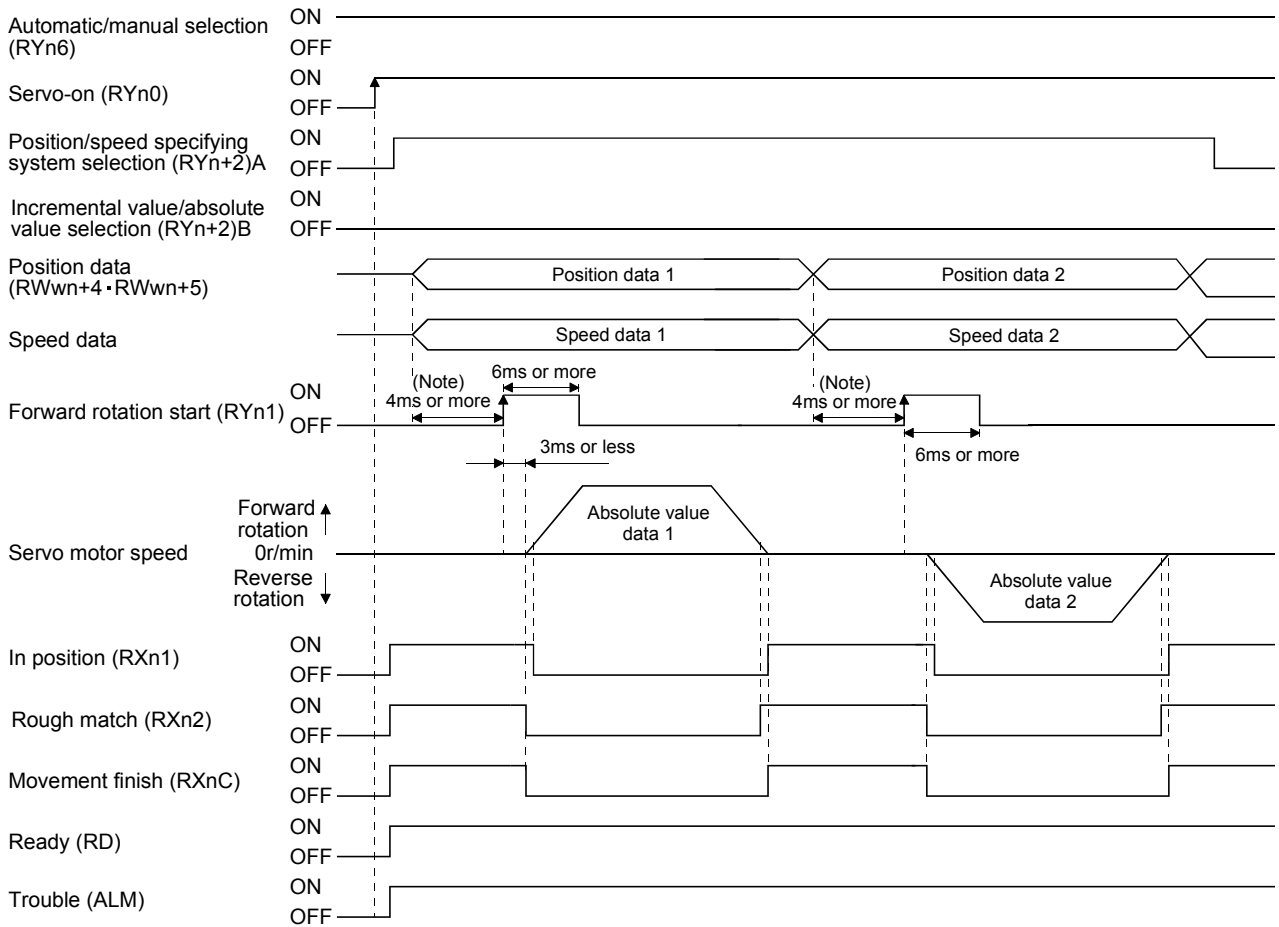
Note. An external input signal is detected after a delay of the input filter setting time in parameter No. PD19. Also, configure a sequence that will change Point table selection earlier with consideration given to the output signal sequence from the controller and the variations of signal changes due to the hardware.

(2) Incremental value command positioning in absolute value command system

The position data set in the absolute value command system are used as incremental values in positioning. Set the input signals and parameters as indicated below.

Item	Used device/parameter	Description
Automatic operation mode	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Remote register-based position/speed setting	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Command system	Parameter No.PA03	□□□0 : Absolute value command system is selected.
Remote register-based position/speed specifying system selection	Parameter No.PC30	□□□2 : Remote register-based position/speed specifying system is selected.
Position data	Position command data under 16 bit (RWwn+4)	Set the under 16 bits of position data to RWwn+4, and the upper 16 bits to RWwn+5.
	Position command data upper 16 bit (RWwn+5)	Setting range: −999999 to 999999
Servo motor speed	Speed command data (RWwn+6)	Set the servo motor speed.

Here, Absolute value/incremental value selection RY(n+2)B is turned ON since the position data are handled as incremental values.
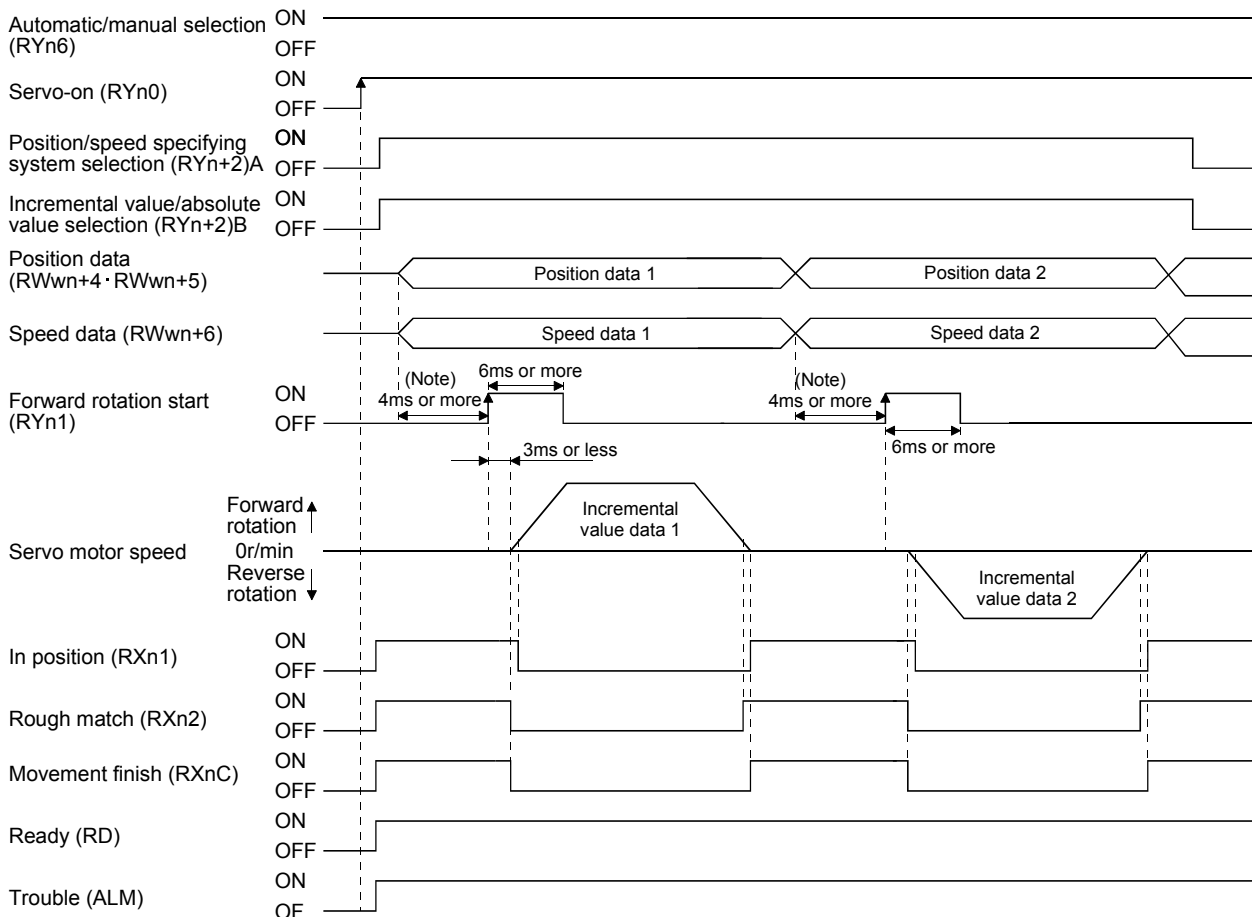
Note. An external input signal is detected after a delay of the input filter setting time in parameter No. PD19. Also, configure a sequence that will change Point table selection earlier with consideration given to the output signal sequence from the controller and the variations of signal changes due to the hardware.

(3) Positioning in incremental value command system

Execute positioning in the incremental value command system. Set the input signals and parameters as indicated below.

Item	Used device/parameter	Description
Automatic operation mode	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Remote register-based position/speed setting	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Command system	Parameter No.PA30	□□□1 : Incremental value command system is selected.
Remote register-based position/speed specifying system selection	Parameter No.PC30	□□□2 : Remote register-based position/speed specifying system is selected.
Position data	Position command data under 16 bit (RWwn+4)	Set the under 16 bits of position data to RWwn+4, and the upper 16 bits to RWwn+5.
	Position command data upper 16 bit (RWwn+5)	Setting range: 0 to 999999
Servo motor speed	Speed command data (RWwn+6)	Set the servo motor speed.

Set "□□□1" in parameter No. PA03 to select the incremental value command system. In the incremental value command system, the position data are handled as incremental values. Hence, Absolute value/incremental value selection (RY(n+2)B) is invalid.
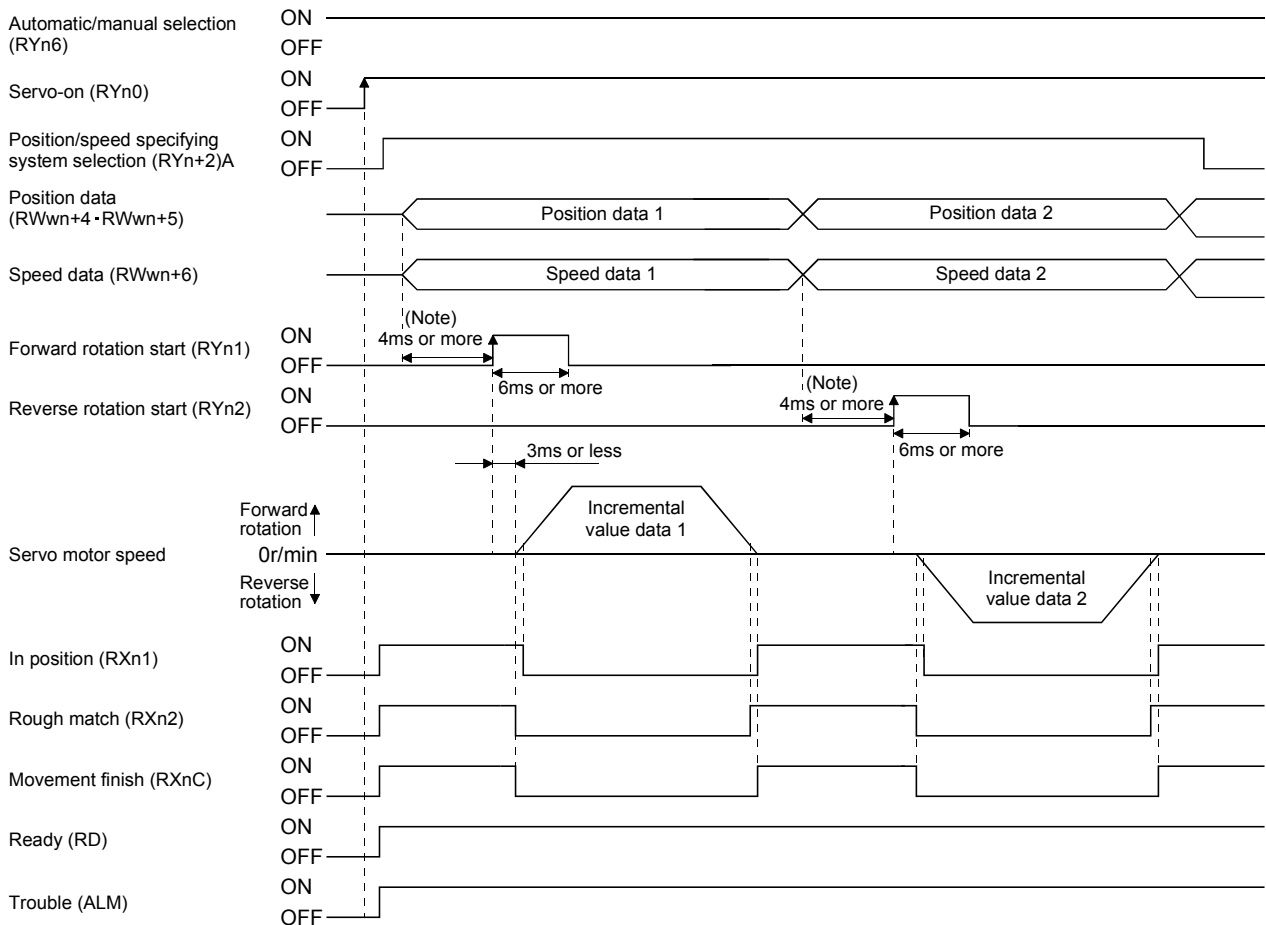
Note. An external input signal is detected after a delay of the input filter setting time in parameter No. PD19. Also, configure a sequence that will change Point table selection earlier with consideration given to the output signal sequence from the controller and the variations of signal changes due to the hardware.

5.5 Manual operation mode

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

5.5.1 JOG operation

(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5) are invalid:

Item	Setting method	Description
Manual operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 OFF.
Servo motor rotation direction	Parameter No.PA14	Refer to (2) of this section.
Jog speed	Parameter No.PC12	Set the speed of the servo motor.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constants in point table No.1.

(2) Servo motor rotation direction

Parameter No. PA14 setting	Servo motor rotation direction	
	Forward rotation start (RYn1) ON	Reverse rotation start (RYn2) ON
0	CCW rotation	CW rotation
1	CW rotation	CCW rotation

RYn1: ON
CCW

CW
RYn2: ON

Parameter No.PA14: 0

RYn2: ON
CCW

CW
RYn1: ON
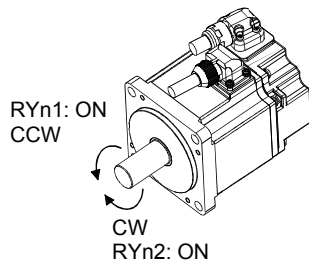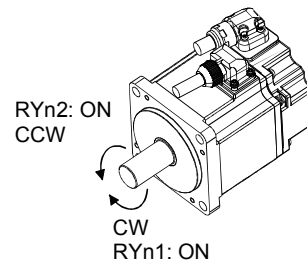
Parameter No.PA14: 1

(3) Operation

By turning RYn1 ON, operation is performed under the conditions of the jog speed set in the parameter and the acceleration and deceleration time constants in set point table No.1. For the rotation direction, refer to (2) of this section. By turning RYn2 ON, the servo motor rotates in the reverse direction to forward rotation start (RYn1).

(4) Timing chart

| Automatic/manual selection (RYn6) | ON / OFF |
| Servo-on (RYn0) | ON / OFF |

100m

| Forward rotation start (RYn1) | ON / OFF |

Forward rotation jog

| Reverse rotation start (RYn2) | ON / OFF |

Reverse rotation jog

Servo motor speed
Forward rotation ↑
0r/min
Reverse rotation ↓

Rough match (RXn2)	ON / OFF
Movement finish (RXnC)	ON / OFF
Ready (RD)	ON / OFF
Trouble (ALM)	ON / OFF
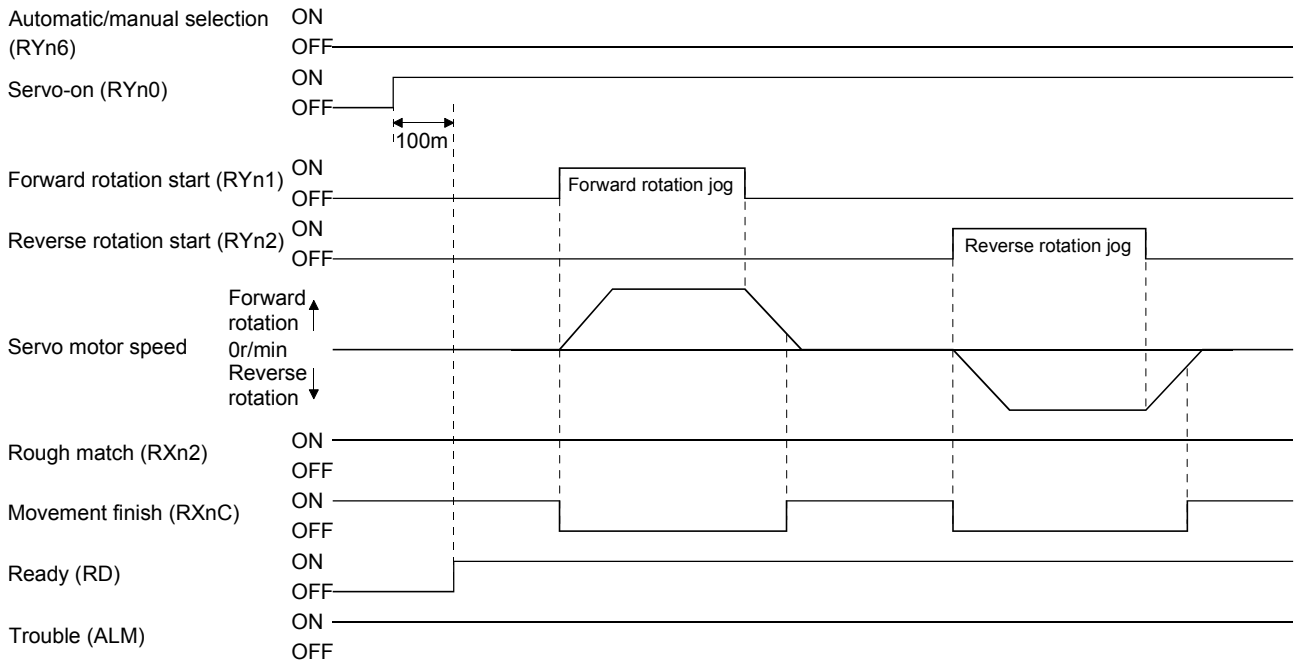
5.5.2 Manual pulse generator

(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5) are invalid:

Item	Setting method	Description
Manual operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 OFF.
Manual pulse generator multiplication	Parameter No.PA05	For more information, refer to (3) of this section.
Servo motor rotation direction	Parameter No.PA14	Refer to (2) of this section.

(2) Servo motor rotation direction

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

CCW
CW

Foward rotation
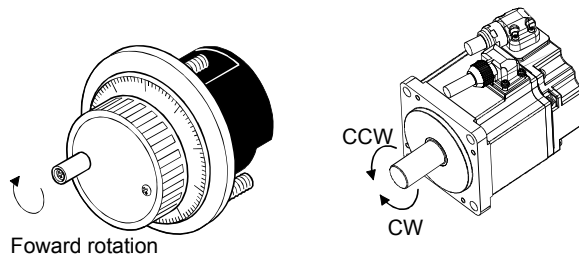
(3) Manual pulse generator multiplication

(a) Using the parameter for setting

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

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

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

Set the pulse generator multiplication 1 (TP0) and the pulse generator multiplication 2 (TP1) to the CN6 connector pins in the parameters of Nos. PD06 to PD08.

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

Note. 0: OFF
      1: ON

(4) Operation

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

5.6 Manual home position return mode

5.6.1 Outline of home position return

Home position return is performed to match the command coordinates with the machine coordinates. In the incremental system, home position return is required every time input power is switched on. In the absolute position detection system, once home position return is done at the time of installation, the current position is retained if power is switched off. Hence, home position return is not required when power is switched on again. This servo amplifier has the home position return methods given in this section. Choose the most appropriate method for your machine structure and application.

This servo amplifier has the home position return automatic return function which executes home position return by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by jog operation or the like is not required.

(1) Home position return types

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

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

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

(2) Home position return parameter

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

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

Parameter No.PC02

0	0	0	

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

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

Parameter No.PC03

0	0	0	

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

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

Parameter No.PD16

0	0	0	

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

(3) Instructions

1) Before starting home position return, always make sure that the limit switch operates.
2) Confirm the home position return direction. Incorrect setting will cause the machine to run reversely.
3) Confirm the proximity dog input polarity. Otherwise, misoperation can occur.

5.6.2 Dog type home position return

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

(1) Signals, parameters

Set the input devices and parameters as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog type home position return	Parameter No.PC02	□□□0 :Dog type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position starting at the first Z-phase signal after passage of proximity dog rear end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Length of proximity dog

To ensure that the Z-phase signal of the servo motor is generated during detection of the proximity dog (DOG), the proximity dog should have the length which satisfies formulas (5.1) and (5.2):

$$L_1 \geq \frac{V}{60} \cdot \frac{td}{2} \quad\text{... (5.1)}$$

L_1 : Proximity dog length [mm]
V : Home position return speed [mm/min]
td : Deceleration time [s]

$$L_2 \geq 2 \cdot \triangle S \quad\text{... (5.2)}$$

L_2 : Proximity dog length [mm]
$\triangle S$: Moving distance per servo motor revolution [mm]
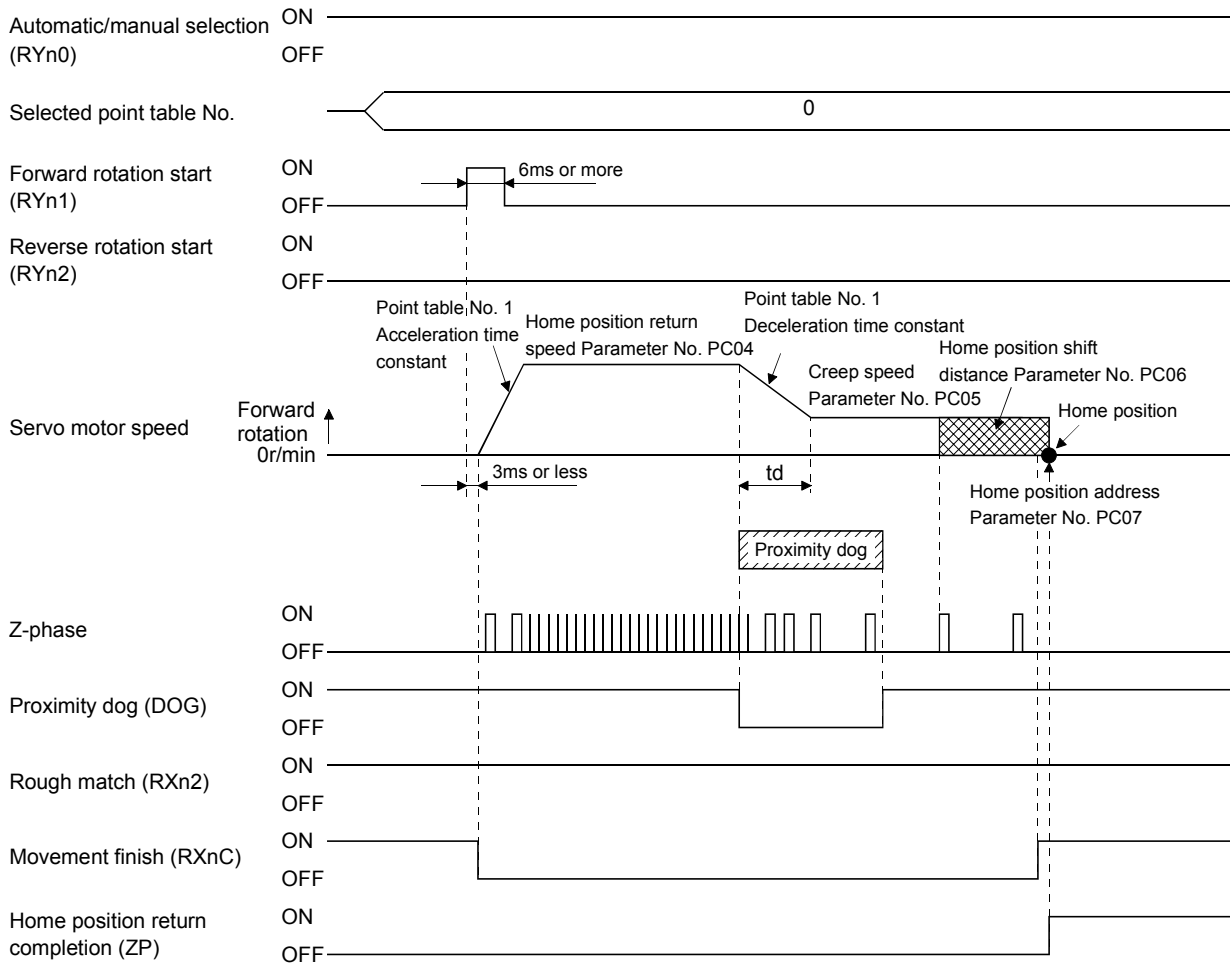
(3) Timing chart

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

(4) Adjustment

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

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

5.6.3 Count type home position return

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

(1) Signals, parameters

Set the input devices and parameters as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Count type home position return	Parameter No.PC02	□□□1: Count type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position, starting at the first Z-phase signal given after passage of the proximity dog front end and movement over the moving distance.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after passage of proximity dog front end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn0)	ON	
	OFF	
Selected point table No.		0
Forward rotation start (RYn1)	ON	6ms or more
	OFF	
Reverse rotation start (RYn2)	ON	
	OFF	

Point table No. 1 Acceleration time constant — Home position return speed Parameter No. PC04 — Point table No. 1 Deceleration time constant — Creep speed Parameter No. PC05 — Home position shift distance Parameter No. PC06 — Home position

Servo motor speed — Forward rotation 0r/min

3ms or less

Moving distance after proximity dog Parameter No. PC08 — Proximity dog

Home position address Parameter No. PC07

Z-phase	ON	
	OFF	
Proximity dog (DOG)	ON	
	OFF	
Rough match (RXn2)	ON	
	OFF	
Movement finish (RXnC)	ON	
	OFF	
Home position return completion (ZP)	ON	
	OFF	

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

5.6.4 Data setting type home position return

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

(1) Signals, parameters

Set the input devices and parameters as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Data setting type home position return	Parameter No.PC02	□□□2: Data setting type home position return is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

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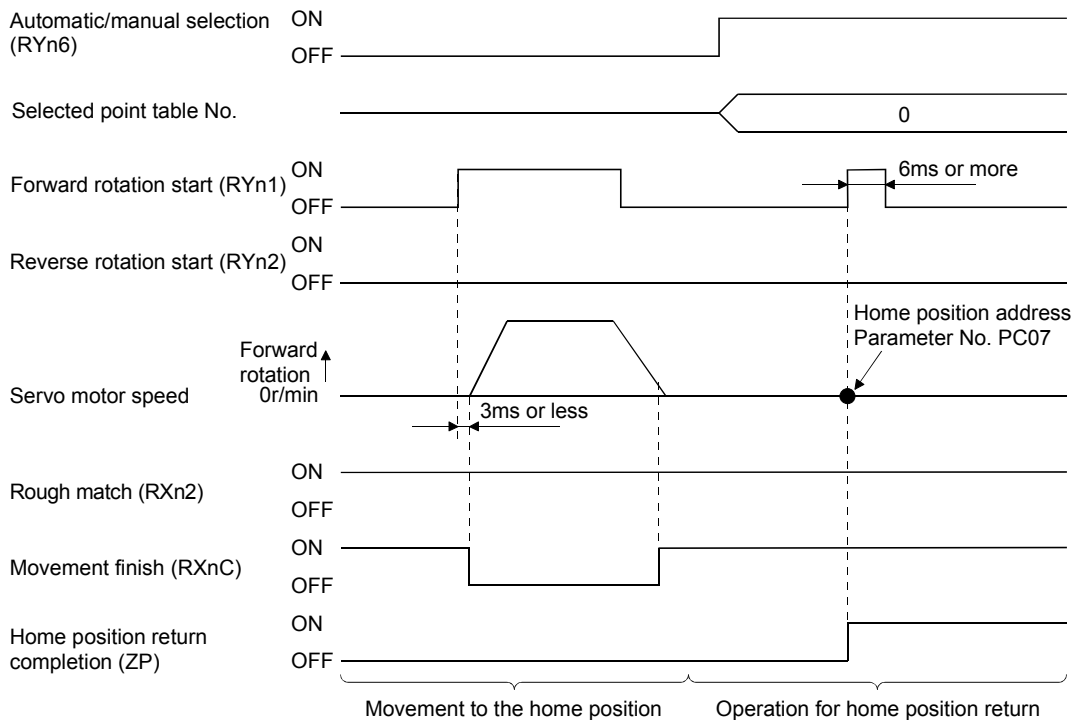
The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.5 Stopper type home position return

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

(1) Signals, parameters
Set the input devices and parameters as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Stopper type home position return	Parameter No.PC02	□□□3:Stopper type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till contact with the stopper.
Stopper time	Parameter No.PC09	Time from when the part makes contact with the stopper to when home position return data is obtained to output home position return completion (ZP).
Stopper type home position return torque limit	Parameter No.PC10	Set the servo motor torque limit value for execution of stopper type home position return.
Home position return acceleration time constant	Point table No.1	Use the acceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart
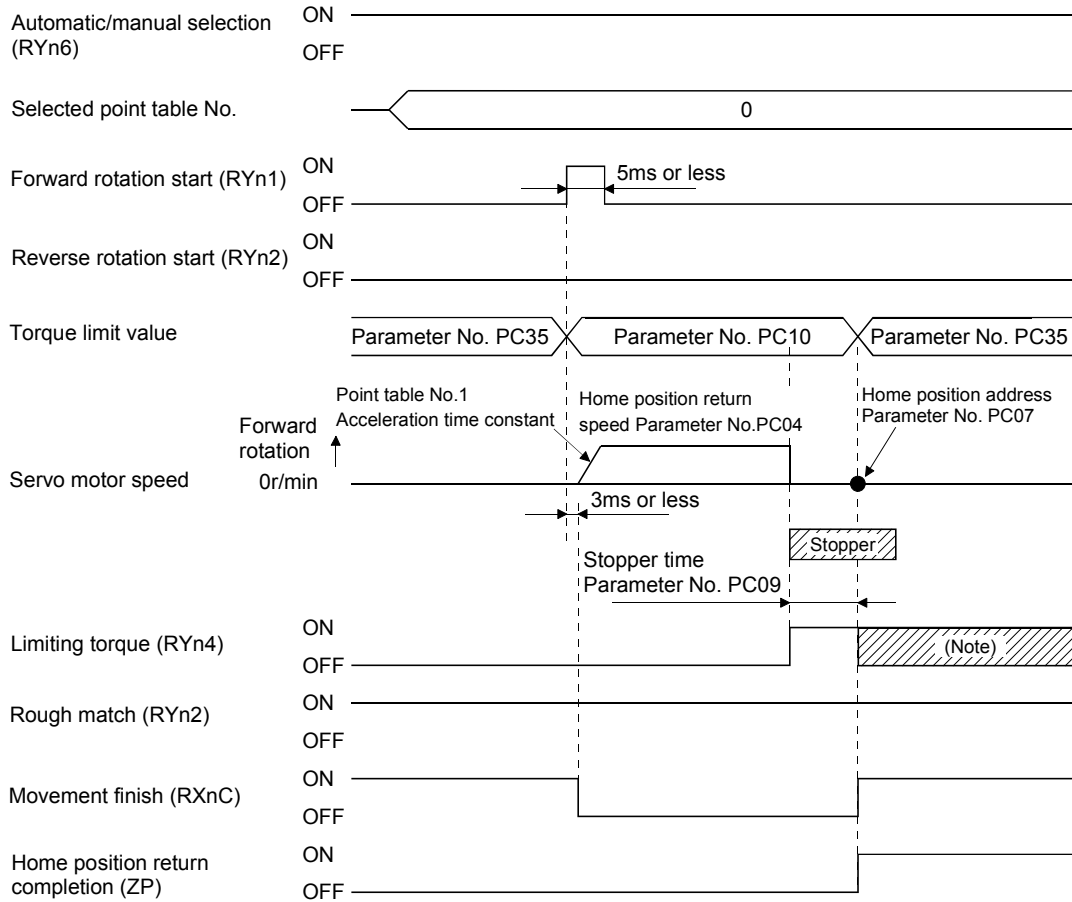
Note. Turns ON when the torque reaches the value set to Forward torque limit (parameter No. PA11), Reverse torque limit (parameter No. PA12), Internal torque limit (parameter No. PC35) or Analog torque limit (TLA).
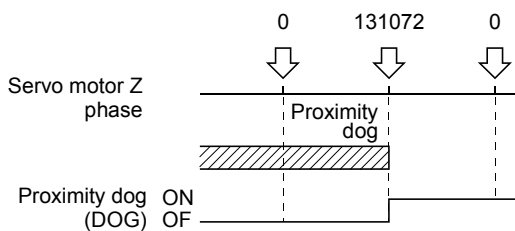
The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

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

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

(1) Signals, parameter

Set the input devices and parameter as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Home position ignorance	Parameter No.PC02	□□□4: Home position ignorance is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

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

5.6.7 Dog type rear end reference home position return

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

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

(1) Signals, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog type rear end reference home position return	Parameter No.PC02	□□□5: Select the dog type rear end reference.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn6)
ON
OFF

Selected point table No.
0

Forward rotation start (RYn1)
ON
OFF

6ms or more

Reverse rotation start (RYn2)
ON
OFF

Moving distance after proximity dog
+
Home position shift distance

Home position return speed

Servo motor speed
Forward rotation
0r/min

Creep speed

3ms or less

Home position address
Parameter No. PC07

Proximity dog

Proximity dog (DOG)
ON
OFF

Rough match (RXn2)
ON
OFF

Movement finish (RXnC)
ON
OFF

Home position return completion (ZP)
ON
OFF

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

5.6.8 Count type front end reference home position return

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

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

(1) Signals, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Count type dog front end reference home position return	Parameter No.PC02	□□□6: Select the count type dog front end reference.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn6)	ON / OFF
Selected point table No.	0
Forward rotation start (RYn1)	ON / OFF
	6ms or more
Reverse rotation start (RYn2)	ON / OFF
Servo motor speed	Forward rotation / 0r/min — Home position return speed, Creep speed, Moving distance after proximity dog + Home position shift distance, 3ms or less, Home position address Parameter No. PC07, Proximity dog (DOG)
Proximity dog (DOG)	ON / OFF
Rough match (RXn2)	ON / OFF
Movement finish (RXnC)	ON / OFF
Home position return completion (ZP)	ON / OFF

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

5.6.9 Dog cradle type home position return

The position where the first Z-phase signal is issued after detection of the proximity dog front end can be defined as a home position.
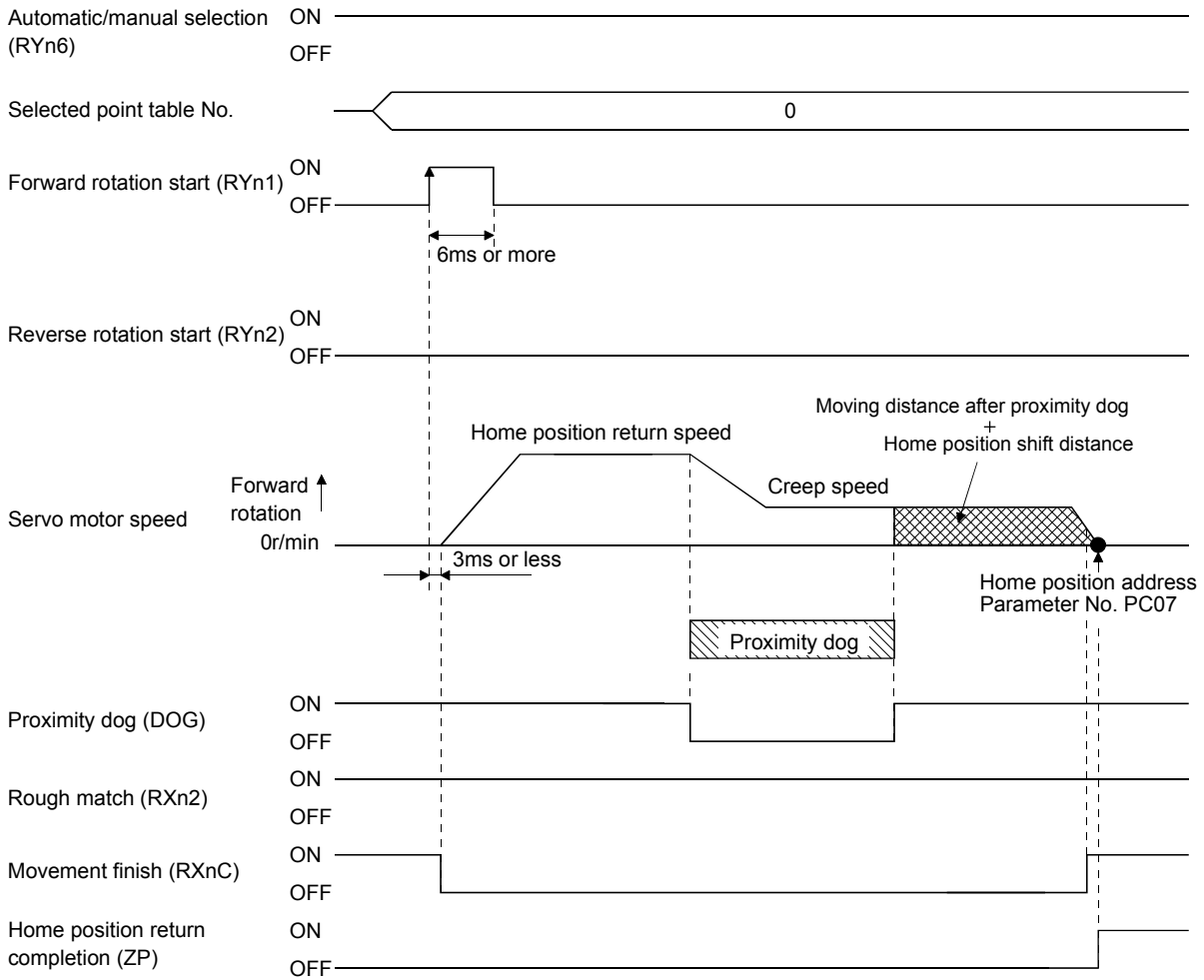
(1) Signals, parameters
Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□7: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn6)	ON / OFF	
Selected point table No.	0	
Forward rotation start (RYn1)	ON / OFF	6ms or more
Reverse rotation start (RYn2)	ON / OFF	

Servo motor speed — Forward rotation / 0r/min / Reverse rotation

Home position return speed
Creep speed
Home position shift distance
3ms or less
Home position address Parameter No. PC07
Proximity dog

Z-phase	ON / OFF	
Proximity dog (DOG)	ON / OFF	
Rough match (RXn2)	ON / OFF	
Movement finish (RXnC)	ON / OFF	
Home position return completion (ZP)	ON / OFF	

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

5.6.10 Dog type first Z-phase reference home position return

After the proximity dog front end is detected, the current position moves in the reverse direction at creep speed. After this moving away from the proximity dog, the home position is determined to be where the first Z-phase pulse is issued.
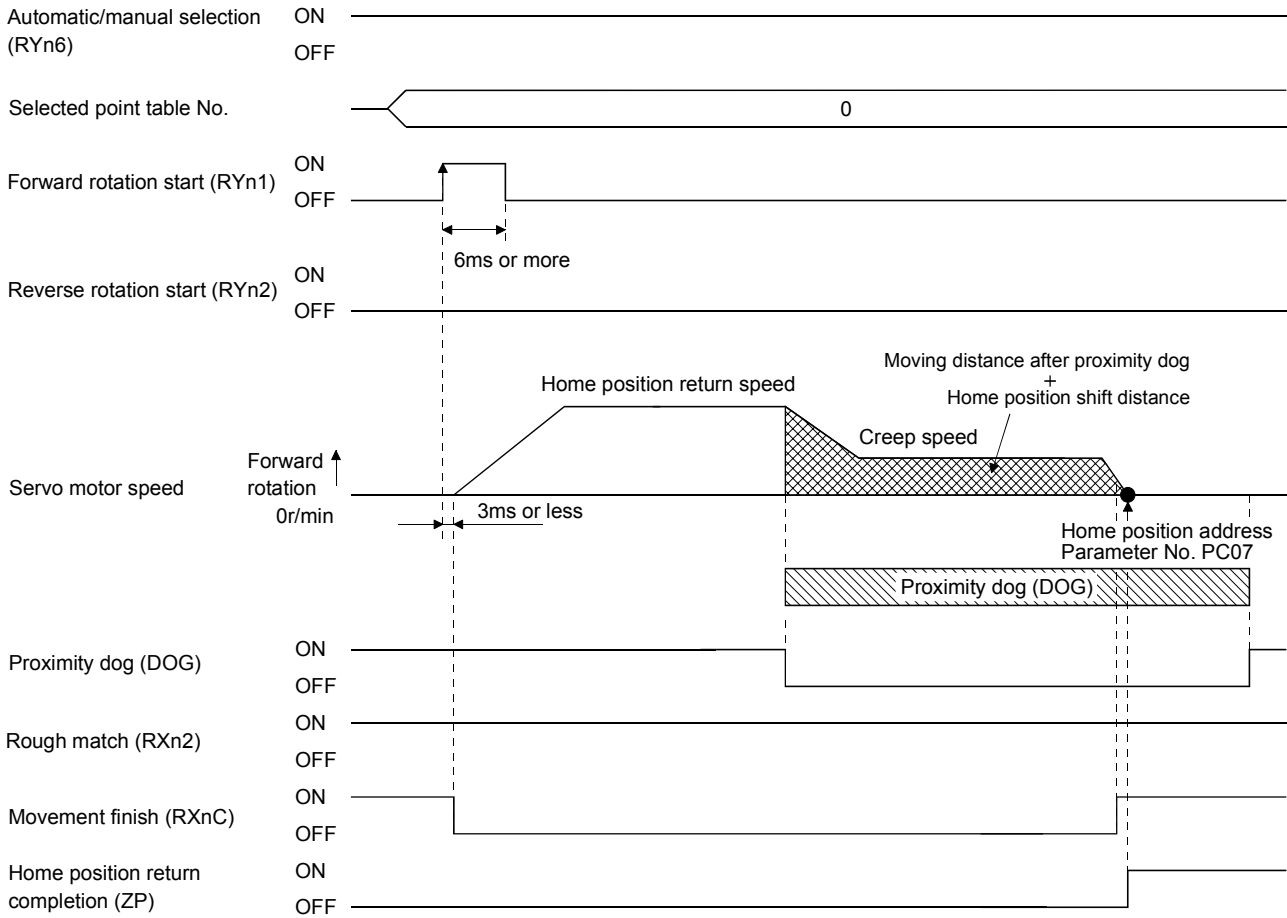
(1) Signals, parameters
    Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□ 8: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn6)

ON / OFF

Selected point table No.

0

Forward rotation start (RYn1)

ON / OFF

6ms or more

Reverse rotation start (RYn2)

ON / OFF

Home position return speed
Home position shift distance
Home position address
Parameter No. PC07

Servo motor speed

Forward rotation
0r/min
Reverse rotation

3ms or less

Creep speed

Proximity dog

Z-phase

ON / OFF

Proximity dog (DOG)

ON / OFF

Rough match (RXn2)

ON / OFF

Movement finish (RXnC)

ON / OFF

Home position return completion (ZP)

ON / OFF

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

5.6.11 Dog type front end reference home position return method

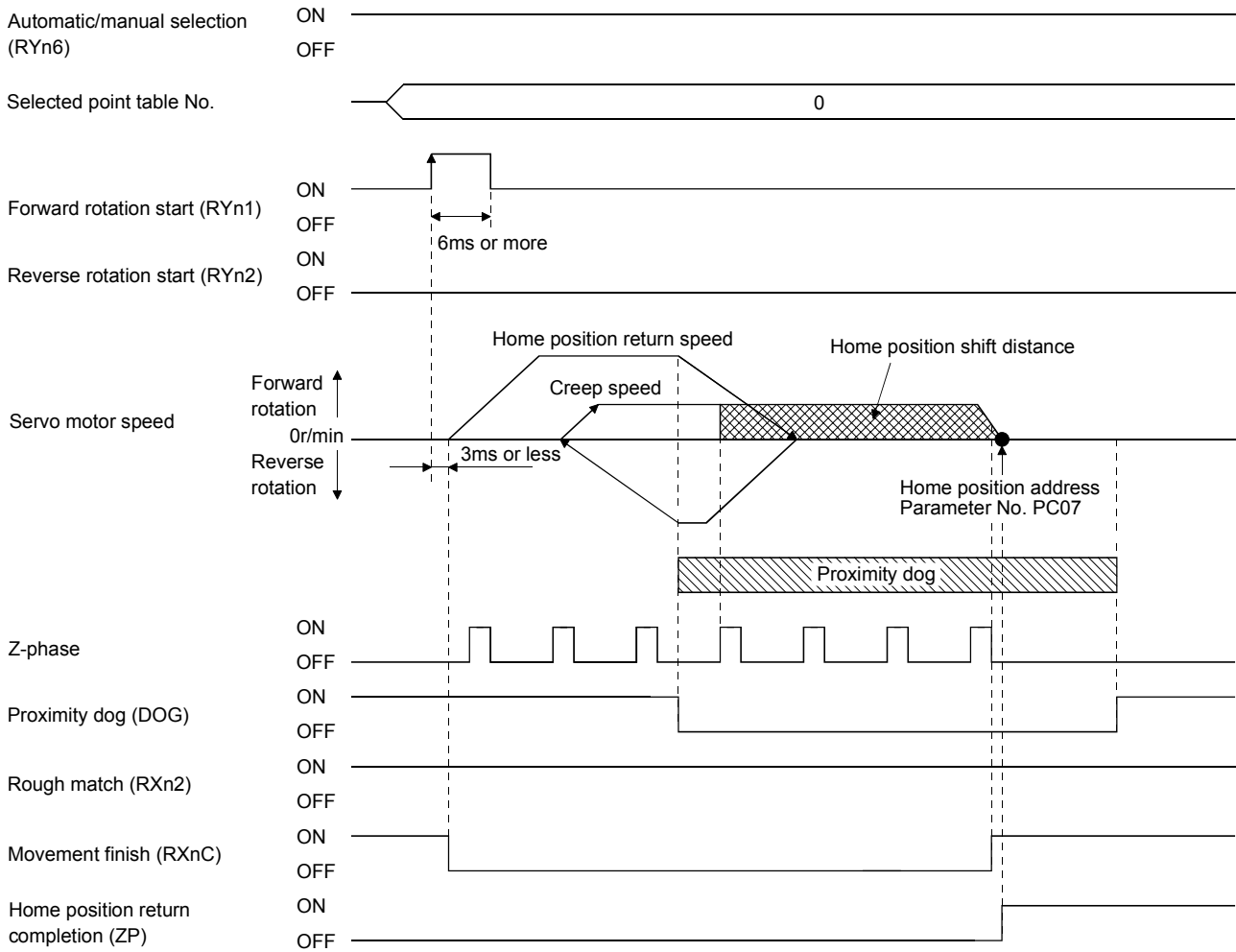The home position is determined to be the position of the front end of the proximity dog.

(1) Signals, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□9: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

Automatic/manual selection (RYn6)	ON	
	OFF	
Selected point table No.		0
Forward rotation start (RYn1)	ON	
	OFF	
		6ms or more
Reverse rotation start (RYn2)	ON	
	OFF	

Home position return speed

Forward rotation

0r/min

Reverse rotation

Servo motor speed

3ms or less

Moving distance after proximity dog + Home position shift distance

Proximity dog

Proximity dog (DOG)	ON	
	OFF	
Rough match (RXn2)	ON	
	OFF	
Movement finish (RXnC)	ON	
	OFF	
Home position return completion (ZP)	ON	
	OFF	

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

5.6.12 Dogless Z-phase reference home position return method

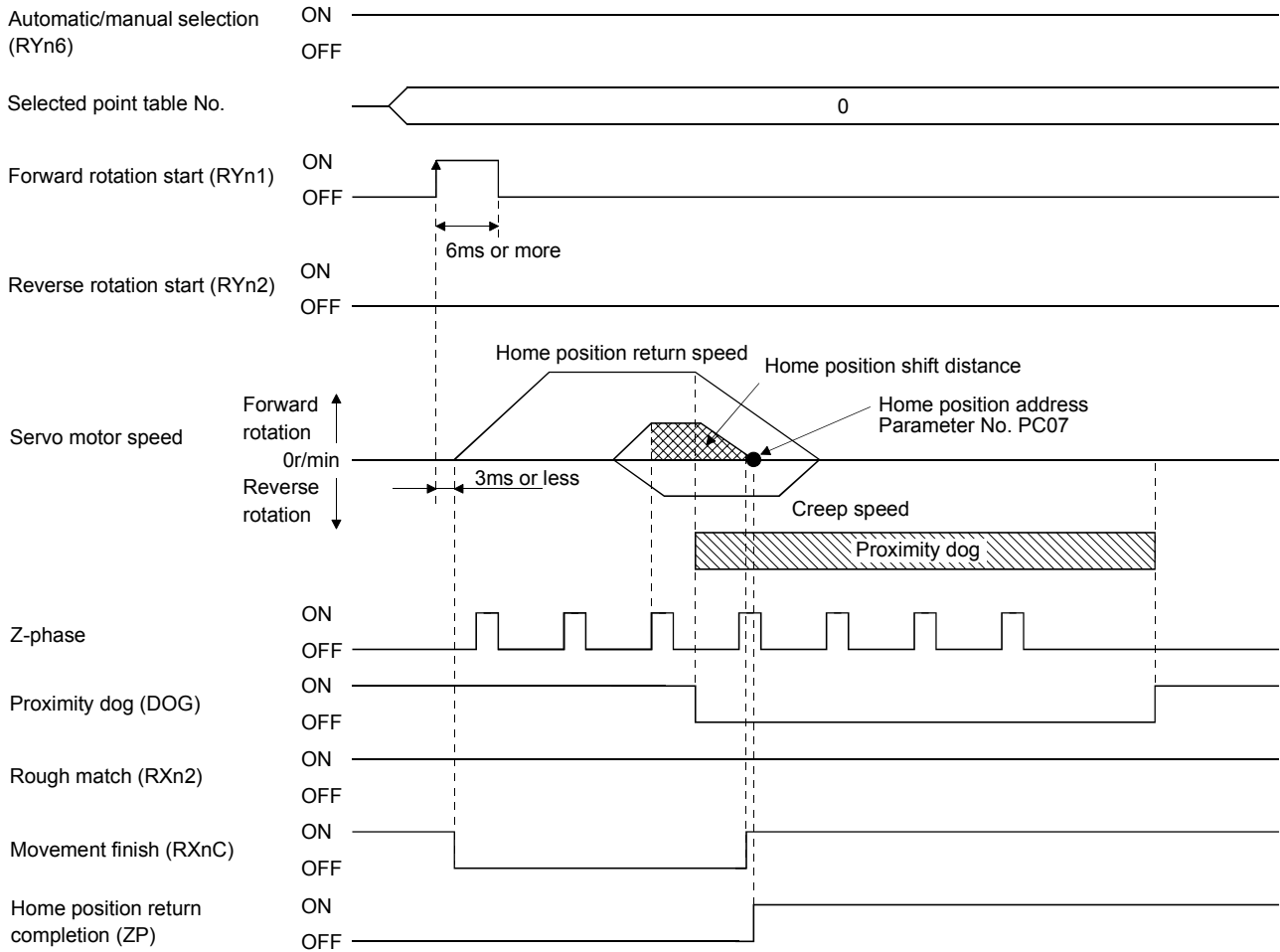The home position is determined to be where the first Z-phase pulse is issued after the home position return is started.

(1) Signals, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Dog cradle type home position return	Parameter No.PC02	□□□ A: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart

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

5.6.13 Home position return automatic return function

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

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

Home position return direction

Proximity dog

Home position return start position

Makes an automatic return to a position before the proximity dog, then executes home position return at this position.
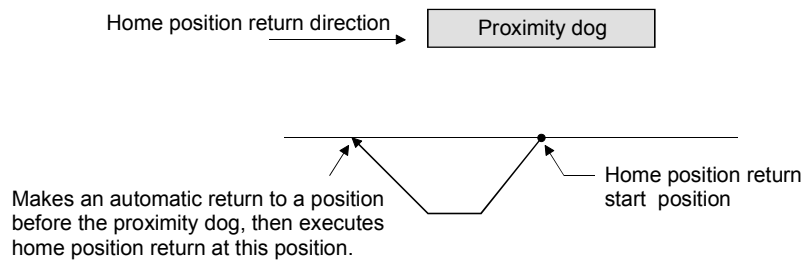
(2) When the current position is beyond the proximity dog
    At a start, a motion is made in the home position return direction and an automatic return is made on detection of the strok end (LSP or LSN). The motion stops past the front end of the proximity dog, and home position return is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the LSP or LSN switch and A90 occurs.

Strok end (LSP or LSN)

Home position return direction

Proximity dog

Home position return start position

Makes an automatic return to a position before the proximity dog, then executes home position return at this position.
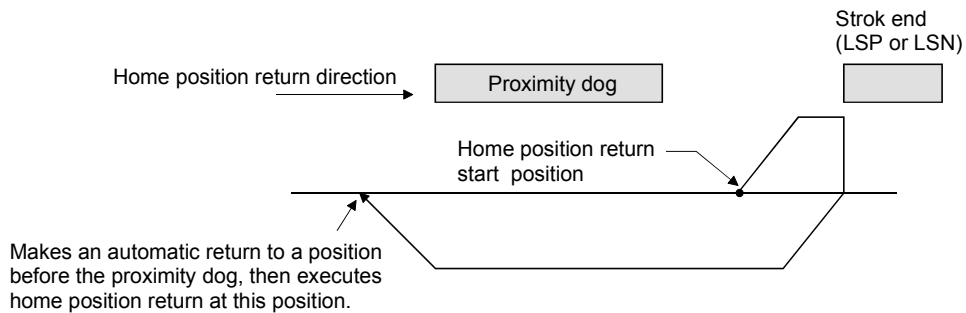
Software limit cannot be used with these functions.

5.6.14 Automatic positioning function to the home position

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

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

Please perform a manual home position return beforehand after a power-on.

Set the input signals and parameter as follows:

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No. 1.

Set up the home position return speed of the automatic positioning function to the home position by parameter No.PC04. Use the data of point table No.1 to set the acceleration time constant and deceleration time constant. When reverse rotation start (RYn2) is ON, it will position automatically at the home position.
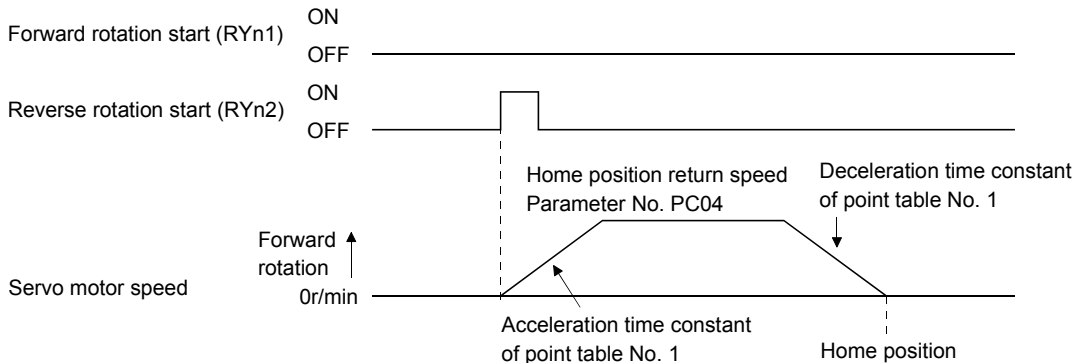
5.7 Roll feed display function in roll feed mode

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

(1) Parameter settings

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

(2) Roll feed display function

At start up, the roll feed display function clears the status display of the current position and command position to zero.
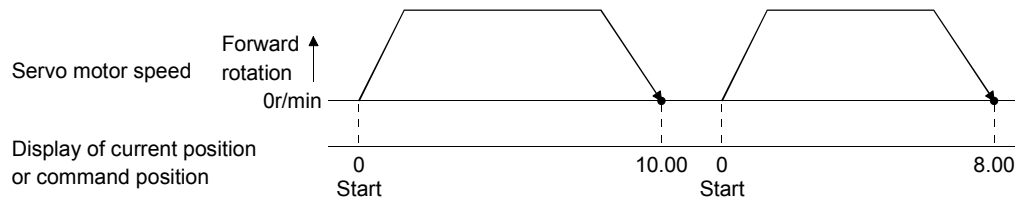
(3) Operation procedure

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

Operation procedure		Details
Automatic operation	Automatic operation according to the point table	Section 5.4.2
Manual operation	JOG operation	Section 5.5.1
	Manual pulse generator operation	Section 5.5.2
Home position return mode		Section 5.6

5.8 Absolute position detection system

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

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

(1) Restrictions

An absolute position detection system cannot be built under the following conditions:
1) Stroke-less coordinate system, e.g. rotary shaft, infinite positioning.
2) Operation performed in incremental value command type positioning system.

(2) Specifications

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

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.
   2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.

(3) Structure

Component	Description
Servo amplifier	Use standard models.
Servo motor	
Battery	MR-J3BAT
Encoder cable	Use a standard model. (Refer to section 14.1)

(4) Outline of absolute position detection data communication

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose programming controller power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.
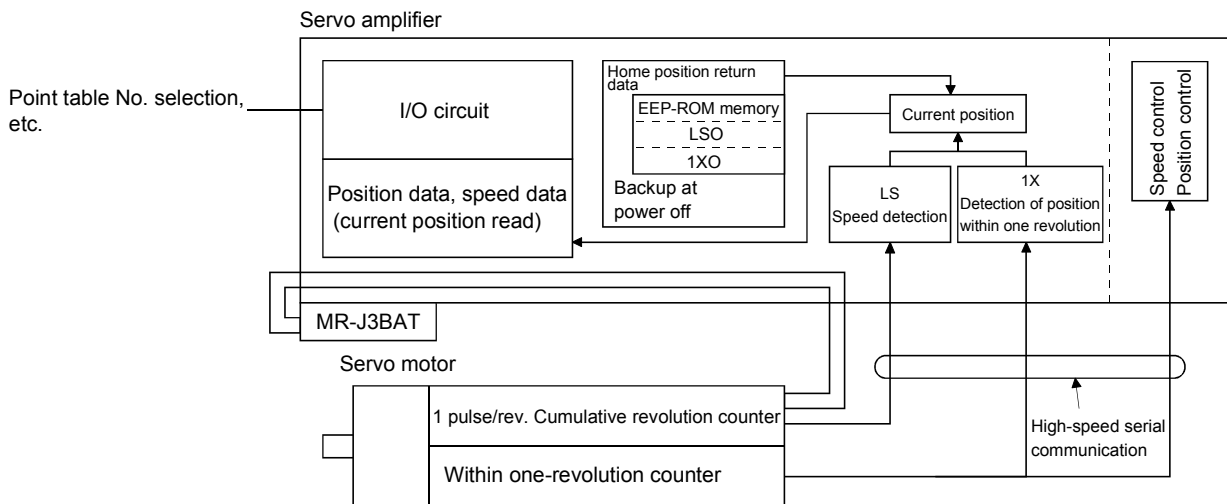
(5) Battery installation procedure

⚠ WARNING
· Before starting battery installation procedure, make sure that the charge lamp is off more than 15 minutes after power is switched OFF. Then, confirm that the voltage between P-N terminals is safe in the tester or the like with control circuit power ON. Otherwise, you may get an electric shock.

POINT
· The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions:
  · Ground human body and work bench.
  · Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.
· Before starting battery changing procedure, make sure that the main circuit power is switched OFF with the control circuit power ON. When battery is changed with the control power OFF, the absolute position data is lost.

(a) For MR-J3-350T or less

POINT

・For the servo amplifier of 3.5kW or less, in the state to insert the battery, it is not possible to wire for the earth. Insert the battery after executing the earth wiring of the servo amplifier.

Insert connector into CN4.
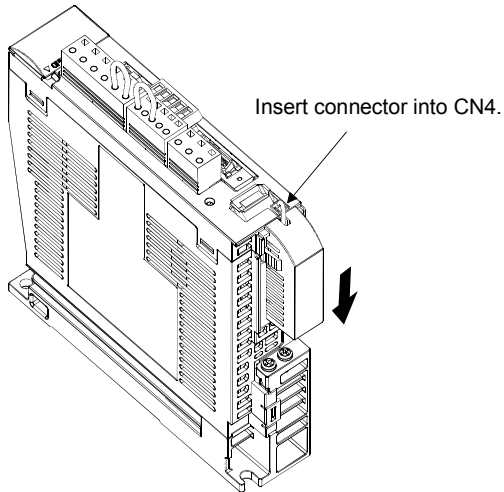
(b) For MR-J3 500T or more

Insert connector into CN4.
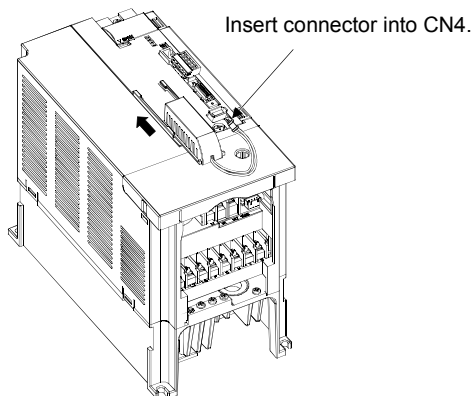
(c) Parameter setting

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

Parameter No.PA03

```
┌──┬──┬──┬──┐
│  │  │  │ 1│
└──┴──┴──┴──┘
           └──────── Selection of absolute position detection system
                     0: Incremental system
                     1: Absolute position detection system
```

6. PARAMETERS

⚠ CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable.

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

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

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

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

6.1 Basic setting parameters (No.PA □ □)

6.1.1 Parameter list

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

6.1.2 Parameter write inhibit

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

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

In the factory setting, this servo amplifier allows changes to the basic setting parameter, gain/filter parameter and extension setting parameter settings. With the setting of parameter No. PA19, write can be disabled to prevent accidental changes.

The following table indicates the parameters which are enabled for reference and write by the setting of parameter No. PA19. Operation can be performed for the parameters marked ○ .

Parameter No. PA19 Setting	Setting Operation	Basic Setting Parameters No. PA□□	Gain/Filter Parameters No. PB□□	Extension Setting Parameters No. PC□□	I/O Setting Parameters No. PD□□
0000h	Reference	○			
	Write	○			
000Bh	Reference	○	○	○	
	Write	○	○	○	
000Ch (initial value)	Reference	○	○	○	○
	Write	○	○	○	○
100Bh	Reference	○			
	Write	Parameter No. PA19 only			
100Ch	Reference	○	○	○	○
	Write	Parameter No. PA19 only			

6.1.3 Selection of command system

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

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

Select the command system.

Parameter No. PA01

```
0 | 0 | 0 |
```

└ Selection of command system
(Refer to section 5.4)
0: Absolute value command system
1: Incremental value command system

6.1.4 Selection of regenerative option

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

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

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

Parameter No. PA02

```
0 | 0 |   |
```

└ Selection of regenerative option
00: Regenerative option is not used
　　・For MR-J3-10T, regenerative resistor is not used.
　　・For MR-J3-20T or more and -700T or less, built-in regenerative resistor is used.
　　・Supplied regenerative resistors or regenerative option is used with the MR-J3-11KT or more servo amplifier.
01: FR-BU・FR-RC・FR-CV
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50
08: MR-RB31
09: MR-RB51
FA: When regenerative resistors or regenerative option supplied to MR-J3-11KT or more are cooled by fans to increase

6.1.5 Using absolute position detection system

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

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

Set this parameter when using the absolute position detection system.

Parameter No. PA03

0	0	0	

└ Selection of absolute position detection system (refer to section 5.7)
   0: Used in incremental system
   1: Used in absolute position detection system

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

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

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

If this parameter is made valid, the home position is not lost in the servo-off or forced stop state, and the operation can be resumed when the servo-on (RYn0) or forced stop (EMG) is deactivated.

Parameter No. PA04

0	0	0	

└ Servo-on (RYn0) -off, forced stop (EMG) -off
follow-up for absolute value command
in incremental system
0: Invalid
1: Valid
Normally, when this servo amplifier is used
in the absolute value command method of the
incremental system, placing it in a servo off or
forced stop status will erase the home position.
When "1" is set in this parameter, the home
position will not be erased if the servo amplifier is
placed in a servo-off or forced stop status or if the
alarm that can be deactivated by resetting occurs.
The operation can be resumed when the servo-on
(RYn0) or forced stop (EMG) is deactivated or an
alarm is deactivated by resetting (RES).

6. PARAMETERS

6.1.7 Feeding function selection

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

POINT

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

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

Parameter No.PA05

0 0 ☐ ☐

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

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

6.1.8 Electronic gear

⚠ CAUTION　　·False setting will result in unexpected fast rotation, causing injury.

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

(1) Concept of electronic gear

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

$$\frac{CMX}{CDV} = \frac{\text{Parameters No. PA06}}{\text{Parameters No. PA07}}$$
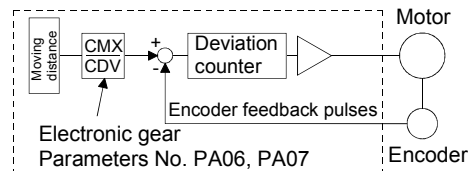
The following examples are used to explain how to calculate the electronic gear value:

> **POINT**
> · The following specification symbols are needed for electronic gear calculation:
> Pb ： Ballscrew lead [mm]
> n ： Reduction ratio
> Pt ： Servo motor resolution [pulse/rev]
> ∆S ： Travel per servo motor revolution [mm/rev]

(a) Ballscrew setting example

Machine specifications

Ballscrew lead: Pb = 10 [mm]
Reduction ratio: n = 1/2
Servo motor resolution: Pt = 262144 [pulse/rev]

Servo motor 262144[pulse/rev]
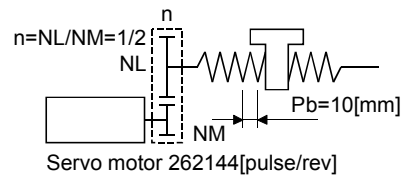
$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot p_b \cdot 1000} = \frac{262144}{1/2 \cdot 10 \cdot 1000} = \frac{262144}{5000} = \frac{32768}{625}$$

Hence, set 32768 to CMX and 625 to CDV.

(b) Conveyor setting example

Machine specifications

Pulley diameter: r = 160 [mm]
Reduction ratio: n = 1/3
Servo motor resolution: Pt = 262144 [pulse/rev]

r=160[mm]
Servo motor 262144[pulse/rev]
n=NL/NM=1/3
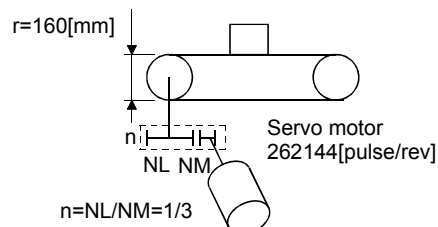
$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{262144}{1/3 \cdot 160 \cdot \pi \cdot 1000} = \frac{262144}{167551.61} \doteqdot \frac{32768}{20944}$$

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

Hence, set 32768 to CMX and 20944 to CDV.

6.1.9 Auto tuning

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

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

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

Select the gain adjustment mode.

Parameter No. PA08

0	0	0	

Gain adjustment mode setting

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

Note. The parameters have the following names.

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

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

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

Setting	Response	Guideline for Machine Resonance Frequency [Hz]	Setting	Response	Guideline for Machine Resonance Frequency [Hz]
1	Low response	10.0	17	Low response	67.1
2		11.3	18		75.6
3		12.7	19		85.2
4		14.3	20		95.9
5		16.1	21		108.0
6		18.1	22		121.7
7		20.4	23		137.1
8		23.0	24		154.4
9		25.9	25		173.9
10		29.2	26		195.9
11		32.9	27		220.6
12		37.0	28		248.5
13		41.7	29		279.9
14		47.0	30		315.3
15		52.9	31		355.1
16	Middle response	59.6	32	Middle response	400.0

6.1.10 In-position range

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

Set the range, where In position (RXn1) and Movement finish (RXnC) are output, in the command pulse unit before calculation of the electronic gear. With the setting of parameter No. PC24, the range can be changed to the encoder output pulse unit.
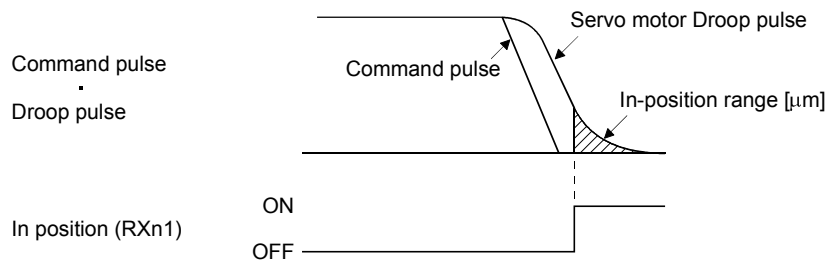
6.1.11 Torque limit

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

The torque generated by the servo motor can be limited.

(1) Forward rotation torque limit (parameter No. PA11)

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

When torque is output with the analog monitor output, the smaller torque of the values in this parameter and parameter No. PA12 (reverse rotation torque limit) is the maximum output voltage (+8V).

(2) Reverse rotation torque limit (parameter No. PA12)

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

6.1.12 Selection of servo motor rotation direction

Parameter			Initial Value	Unit	Setting Range
No.	Symbol	Name			
PA14	*POL	Rotation direction selection	0		0 · 1

POINT

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

Select servo motor rotation direction relative to the input pulse train.

Parameter No. PA14 Setting	Servo Motor Rotation Direction	
	Forward rotation start (Ryn1) ON	Reverse rotation start (Ryn2) ON
0	CCW	CW
1	CW	CCW

Forward rotation (CCW)

Reverse rotation (CW)
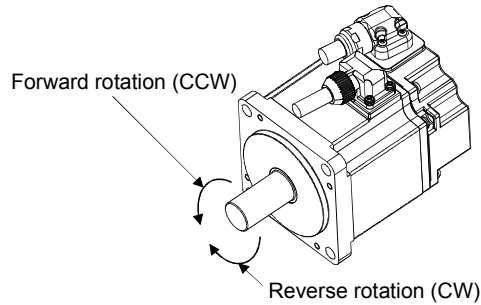
6.1.13 Encoder output pulse

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

POINT

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

Used to set the encoder pulses (A-phase, B-phase) output by the servo amplifier.

Set the value 4 times greater than the A-phase or B-phase pulses.

You can use parameter No. PC19 to choose the output pulse setting or output division ratio setting.

The number of A/B-phase pulses actually output is 1/4 times greater than the preset number of pulses.

The maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within this range.

(1) For output pulse designation

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

Set the number of pulses per servo motor revolution.

Output pulse = set value [pulses/rev]

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

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

(2) For output division ratio setting

Set " □□ 1 □ " in parameter No. PC19.

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

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

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

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

(3) When outputting pulse train similar to command pulses

Set parameter No. PC19 to " □□ 2 □ ". The feedback pulses from the servo motor encoder are processed and output as shown below. The feedback pulses can be output in the same pulse unit as the command pulses.
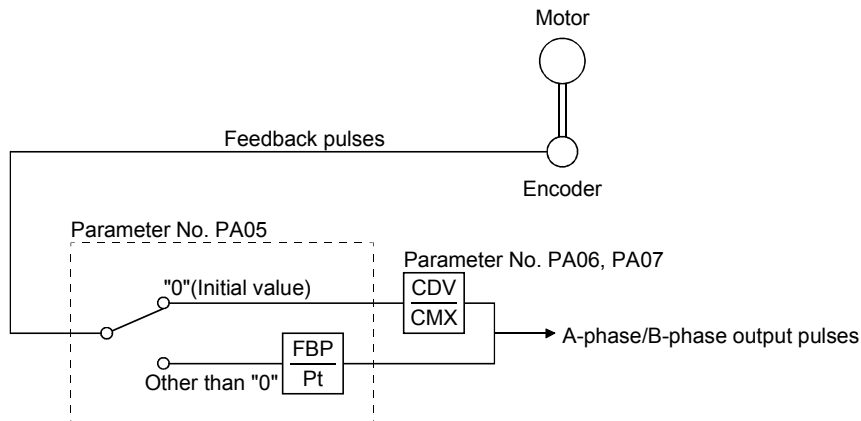
6.2 Gain/Filter parameters (No. PB □□)

6.2.1 Parameter list

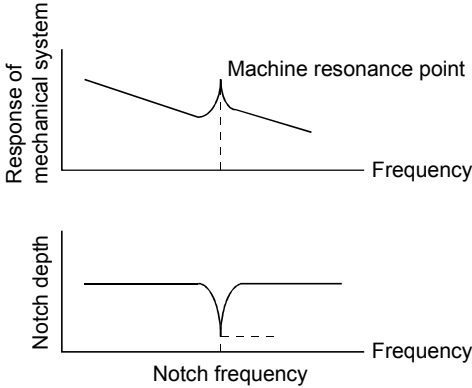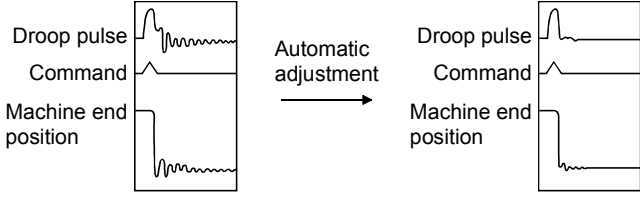| No.	Symbol	Name	Initial Value	Unit
PB01	FILT	Adaptive tuning mode (Adaptive filter II)	0000h	
PB02	VRFT	Vibration suppression control filter tuning mode (Advanced vibration suppression control)	0000h	
PB03		For manufacturer setting	0000h	
PB04	FFC	Feed forward gain	0	%
PB05		For manufacturer setting	500	
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	7.0	times
PB07	PG1	Model loop gain	24	rad/s
PB08	PG2	Position loop gain	37	rad/s
PB09	VG2	Speed loop gain	823	rad/s
PB10	VIC	Speed integral compensation	33.7	ms
PB11	VDC	Speed differential compensation	980	
PB12		For manufacturer setting	0	
PB13	NH1	Machine resonance suppression filter 1	4500	Hz
PB14	NHQ1	Notch form selection 1	0000h	
PB15	NH2	Machine resonance suppression filter 2	4500	Hz
PB16	NHQ2	Notch form selection 2	0000h	
PB17		Automatic setting parameter		
PB18	LPF	Low-pass filter	3141	rad/s
PB19	VRF1	Vibration suppression control vibration frequency setting	100.0	Hz
PB20	VRF2	Vibration suppression control resonance frequency setting	100.0	Hz
PB21		For manufacturer setting	0.00	
PB22			0.00	
PB23	VFBF	Low-pass filter selection	0000h	
PB24	*MVS	Slight vibration suppression control selection	0000h	
PB25		For manufacturer setting	0000h	
PB26	*CDP	Gain changing selection	0000h	
PB27	CDL	Gain changing condition	10	
PB28	CDT	Gain changing time constant	1	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	7.0	times
PB30	PG2B	Gain changing position loop gain	37	rad/s
PB31	VG2B	Gain changing speed loop gain	823	rad/s
PB32	VICB	Gain changing speed integral compensation	33.7	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	100.0	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	100.0	Hz
PB35		For manufacturer setting	0.00	
PB36			0.00	
PB37			100	
PB38			0	
PB39			0	
PB40			0	
PB41			1125	
PB42			1125	
PB43			0004h	
PB44			0.0	
PB45			0000h	

6.2.2 Detail list

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB01	FILT	Adaptive tuning mode (adaptive filter II) Select the setting method for filter tuning. Setting this parameter to "□□□1" (filter tuning mode 1) automatically changes the machine resonance suppression filter 1 (parameter No. PB13) and notch shape selection (parameter No. PB14).	0000h		

Filter tuning mode selection

Setting	Filter adjustment mode	Automatically set parameter
0	Filter OFF	(Note)
1	Filter tuning mode	Parameter No. PB13 Parameter No. PB14
2	Manual mode	

Note. Parameter No. PB13 and PB14 are fixed to the initial values.

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

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB02	VRFT	Vibration suppression control tuning mode (advanced vibration suppression control) The vibration suppression is valid when the parameter No. PA08 (auto tuning) setting is " □□□ 2" or " □□□ 3". When PA08 is " □□□ 1", vibration suppression is always invalid. Select the setting method for vibration suppression control tuning. Setting this parameter to " □□□ 1" (vibration suppression control tuning mode) automatically changes the vibration suppression control - vibration frequency (parameter No. PB19) and vibration suppression control - resonance frequency (parameter No. PB20) after positioning is done the predetermined number of times. Vibration suppression control tuning mode (table below) Note. Parameter No. PB19 and PB20 are fixed to the initial values. When this parameter is set to " □□□ 1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to " □□□ 2". When the vibration suppression control tuning is not necessary, the setting changes to " □□□ 0". When this parameter is set to " □□□ 0", the initial values are set to the vibration suppression control - vibration frequency and vibration suppression control - resonance frequency. However, this does not occur when the servo off.	0000h		
PB03		For manufacturer setting Do not change this value by any means.	0000h		
PB04	FFC	Feed forward gain Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1s or more as the acceleration/deceleration time constant up to the rated speed.	0	%	0 to 100

Setting	Vibration suppression control tuning mode	Automatically set parameter
0	Vibration suppression control OFF	(Note)
1	Vibration suppression control tuning mode (Advanced vibration suppression control)	Parameter No. PB19 Parameter No. PB20
2	Manual mode	

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB05		For manufacturer setting Do not change this value by any means.	500		
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 9.1.1) In this case, it varies between 0 and 100.0.	7.0	times	0 to 300.0
PB07	PG1	Model loop gain Set the response gain up to the target position. Increase the gain to improve track ability in response to the command. When auto turning mode 1,2 is selected, the result of auto turning is automatically used.	24	rad/s	1 to 2000
PB08	PG2	Position loop gain Used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	37	rad/s	1 to 1000
PB09	VG2	Speed loop gain Set this parameter when vibration occurs on machines of low rigidity or large backlash. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2, manual mode and interpolation mode is selected, the result of auto tuning is automatically used.	823	rad/s	20 to 50000
PB10	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. Lower setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.	33.7	ms	0.1 to 1000.0
PB11	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control (RY(n+2)7) is switched on.	980		0 to 1000
PB12		For manufacturer setting Do not change this value by any means.	0		
PB13	NH1	Machine resonance suppression filter 1 Set the notch frequency of the machine resonance suppression filter 1. Setting parameter No. PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter. When the parameter No. PB01 setting is "□□□0", the setting of this parameter is ignored.	4500	Hz	100 to 4500

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB14	NHQ1	Notch shape selection 1 Used to selection the machine resonance suppression filter 1. 0 □ □ 0 Notch depth selection <table><tr><td>Setting value</td><td>Depth</td><td>Gain</td></tr><tr><td>0</td><td>Deep</td><td>-40dB</td></tr><tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr><tr><td>2</td><td>-8dB</td></tr><tr><td>3</td><td>Shallow</td><td>-4dB</td></tr></table> Notch width <table><tr><td>Setting value</td><td>Width</td><td>α</td></tr><tr><td>0</td><td>Standard</td><td>2</td></tr><tr><td>1</td><td rowspan="2">to</td><td>3</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</td><td>Wide</td><td>5</td></tr></table> Setting parameter No. PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter. When the parameter No. PB01 setting is "□□□0", the setting of this parameter is ignored.	0000h		Refer to Name and function column.
PB15	NH2	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.	4500	Hz	100 to 4500
PB16	NHQ2	Notch shape selection 2 Select the shape of the machine resonance suppression filter 2. 0 □ □ □ Machine resonance suppression filter 2 selection 0: Invalid 1: Valid Notch depth selection <table><tr><td>Setting value</td><td>Depth</td><td>Gain</td></tr><tr><td>0</td><td>Deep</td><td>-40dB</td></tr><tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr><tr><td>2</td><td>-8dB</td></tr><tr><td>3</td><td>Shallow</td><td>-4dB</td></tr></table> Notch width <table><tr><td>Setting value</td><td>Width</td><td>α</td></tr><tr><td>0</td><td>Standard</td><td>2</td></tr><tr><td>1</td><td rowspan="2">to</td><td>3</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</td><td>Wide</td><td>5</td></tr></table>	0000h		Refer to Name and function column.
PB17		Automatic setting parameter The value of this parameter is set according to a set value of parameter No.PB06 (Ratio of load inertia moment to servo motor inertia moment).			

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

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB25		For manufacturer setting Do not change this value by any means.	0000h		
PB26	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 10.6.) `0 0 □ □` Gain changing selection Under any of the following conditions, the gains change on the basis of the parameter No. PB29 to PB32 settings. 0: Invalid 1: Gain changing (RX(n+2)8) is ON 2: Command frequency (Parameter No.PB27 setting) 3: Droop pulse value (Parameter No.PB27 setting) 4: Servo motor speed (Parameter No.PB27 setting) Gain changing condition 0: Valid at more than condition (Valid when gain changing (RX(n+2)8) is ON) 1: Valid at less than condition (Valid when gain changing (RX(n+2)8) is OFF)	0000h		Refer to Name and function column.
PB27	CDL	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No. PB26. The set value unit changes with the changing condition item. (Refer to section 10.6.)	10	kpps pulse r/min	0 to 9999
PB28	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No. PB26 and PB27. (Refer to section 10.6.)	1	ms	0 to 100
PB29	GD2B	Gain changing - ratio of load inertia moment to servo motor inertia moment Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□ 3).	7.0	times	0 to 300.0
PB30	PG2B	Gain changing - position loop gain Set the position loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□ 3).	37	rad/s	1 to 2000
PB31	VG2B	Gain changing - speed loop gain Set the speed loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□ 3). Note. The setting range of 50000 applies to the servo amplifier whose software version is A3 or later. The setting range of the servo amplifier whose software version is older than A3 is 20 to 20000. When the software version of MR Configurator is A3 or earlier, 20001 or more cannot be set. Use the display/operation section of the servo amplifier to set 20001 or more.	823	rad/s	20 to 20000
PB32	VICB	Gain changing - speed integral compensation Set the speed integral compensation when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□ 3).	33.7	ms	0.1 to 5000.0

No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
PB33	VRF1B	Gain changing - vibration suppression control - vibration frequency setting Set the vibration frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No. PB02 setting is "□□□2" and the parameter No. PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB34	VRF2B	Gain changing - vibration suppression control - resonance frequency setting Set the resonance frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No. PB02 setting is "□□□2" and the parameter No. PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB35		For manufacturer setting Do not change this value by any means.	0.00		
PB36			0.00		
PB37			100		
PB38			0		
PB39			0		
PB40			0		
PB41			1125		
PB42			1125		
PB43			0004h		
PB44			0.0		
PB45			0000h		

6.3 Extension setting parameters (No. PC □□)

6.3.1 Parameter list

No.	Symbol	Name	Initial Value	Unit
PC01		For manufacturer setting	0000h	
PC02	*ZTY	Home position return type	0000h	
PC03	*ZDIR	Home position return direction	0001h	
PC04	ZRF	Home position return speed	500	r/min
PC05	CRF	Creep speed	10	r/min
PC06	ZST	Home position shift distance	0	μm
PC07	*ZPS	Home position return position data	0	$\times 10^{STM}$μm
PC08	DCT	Moving distance after proximity dog	1000	$\times 10^{STM}$μm
PC09	ZTM	Stopper type home position return stopper time	100	ms
PC10	ZTT	Stopper type home position return torque limit value	15	%
PC11	CRP	Rough match output range	0	$\times 10^{STM}$μm
PC12	JOG	Jog speed	100	r/min
PC13	*STC	S-pattern acceleration/deceleration time constant	0	ms
PC14	*BKC	Backlash compensation	0	pulse
PC15		For manufacturer setting	0000h	
PC16	MBR	Electromagnetic brake sequence output	100	ms
PC17	ZSP	Zero speed	50	r/min
PC18	*BPS	Alarm history clear	0000h	
PC19	*ENRS	Encoder output pulse selection	0000h	
PC20	*SNO	Station number setting	0	station
PC21	*SOP	RS-422 communication function selection	0000h	
PC22	*COP1	Function selection C-1	0000h	
PC23		For manufacturer setting	0000h	
PC24	*COP3	Function selection C-3	0000h	
PC25		For manufacturer setting	0000h	
PC26	*COP5	Function selection C-5	0000h	
PC27		For manufacturer setting	0000h	
PC28			0000h	
PC29			0000h	
PC30	*DSS	Remote register-based position/speed specifying system selection	0000h	
PC31	LMPL	Software limit +	0	$\times 10^{STM}$μm
PC32	LMPH			
PC33	LMNL	Software limit −	0	$\times 10^{STM}$μm
PC34	LMNH			
PC35	TL2	Internal torque limit 2	100.0	%
PC36		For manufacturer setting	0000h	
PC37	*LPPL	Position range output address +	0	$\times 10^{STM}$μm
PC38	*LPPH			
PC39	*LNPL	Position range output address −	0	$\times 10^{STM}$μm
PC40	*LNPH			
PC41		For manufacturer setting	8192	
PC42			1024	
PC43			500	
PC44			0	
PC45			10	
PC46			100	
PC47			0000h	
PC48			0000h	

No.	Symbol	Name and Function	Initial Value	Unit
PC49		For manufacturer setting	0000h	
PC50			0000h	
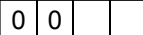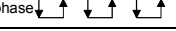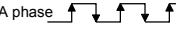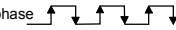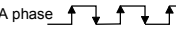
6.3.2 Detail list

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PC01		For manufacturer setting Do not change this value by any means.	0000h		
PC02	*ZTY	Home position return type Used to set the home position return system. (Refer to section 5.6) 0 0 0 ☐ Home position return system 0: Dog type 1: Count type 2: Data setting type 3: Stopper type 4: Home position ignorance (Servo-on position as home position) 5: Dog type rear end reference 6: Count type front end reference 7: Dog cradle type 8: Dog type right-before Z-phase reference 9: Dog type front end reference A: Dogless Z-phase reference	0000h		Refer to Name and function column.
PC03	*ZDIR	Home position return direction Used to set the home position return direction. 0 0 0 ☐ Home position return direction 0: Address increment direction 1: Address decrement direction	0001h		Refer to Name and function column.
PC04	ZRF	Home position return speed Used to set the servo motor speed for home position return. (Refer to section 5.6)	500	r/min	0 to permissible speed
PC05	CRF	Creep speed Used to set the creep speed after proximity dog detection. (Refer to section 5.6)	10	r/min	0 to permissible speed
PC06	ZST	Home position shift distance Used to set the shift distance starting at the Z-phase pulse detection position inside the encoder. (Refer to section 5.6)	0	μm	0 to 65535
PC07	*ZPS	Home position return position data Used to set the current position on completion of home position return. (Refer to section 5.6)	0	$\times 10^{STM}\mu$m	-32768 to 32767
PC08	DCT	Moving distance after proximity dog Used to set the moving distance after proximity dog in count type home position return. (Refer to section 5.6)	1000	$\times 10^{STM}\mu$m	0 to 65535
PC09	ZTM	Stopper type home position return stopper time In stopper type home position return, used to set the time from when the machine part is pressed against the stopper and the torque limit set in parameter No.PC10 is reached to when the home position is set. (Refer to section 5.6.5)	100	ms	5 to 1000

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PC10	ZTT	Stopper type home position return torque limit Used to set the torque limit value relative to the max. torque in [%] in stopper type home position return. (Refer to section 5.6.5)	15.0	%	1 to 100.0
PC11	CRP	Rough match output range Used to set the command remaining distance range where the rough match (RXn2) is output.	0	$\times 10^{STM}\mu$m	0 to 65535
PC12	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to permissible speed
PC13	*STC	S-pattern acceleration/deceleration time constant Set when inserting S-pattern time constant into the acceleration/deceleration time constant of the point table. (Refer to section 6.3.3) This time constant is invalid for home position return.	0	ms	0 to 1000
PC14	*BKC	Backlash compensation Used to set the backlash compensation made when the command direction is reversed. This function compensates for the number of backlash pulses in the opposite direction to the home position return direction. For the home position ignorance (servo-on position as home position), this function compensates for the number of backlash pulses in the opposite direction to the first rotating direction after establishing the home position by switching ON the servo-on (RYn0). In the absolute position detection system, this function compensates for the backlash pulse count in the direction opposite to the operating direction at power-on.	0	pulse	0 to 32000
PC15		For manufacturer setting Do not change this value by any means.	0000h		
PC16	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake interlock (RXn6) switches off and when the base circuit is shut off.	100	ms	0 to 1000
PC17	ZSP	Zero speed Used to set the output range of the zero speed (ZSP). Zero speed signal detection has hysteresis width of 20r/min.	50	r/min	0 to 10000
PC18	*BPS	Alarm history clear Used to clear the alarm history. 0 0 0 ☐ Alarm history clear 0: Invalid 1: Valid When alarm history clear is made valid, the alarm history is cleared at next power-on. After the alarm history is cleared, the setting is automatically made invalid (reset to 0).	0000h		Refer to Name and function column.

6. PARAMETERS

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

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PC24	*COP3	Function selection C-3 Select the unit of the in-position range. □ 0 0 0 In-position range unit selection 0: Command input unit 1: Servo motor encoder unit	0000h		Refer to Name and function column
PC25		For manufacturer setting Do not change this value by any means.	0000h		
PC26	*COP5	Function selection C-5 Select the stroke limit warning (A99). □ 0 0 0 Stroke limit warning (A99) selection 0: Valid 1: Invalid When this parameter is set to "1", A99 will not occur if the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns OFF.	0000h		Refer to Name and function column
PC27		For manufacturer setting Do not change this value by any means.	0000h		
PC28			0000h		
PC29			0000h		
PC30	*DSS	Remote register-based position/speed specifying system This parameter is made valid when Position/speed specification selection (RY(n+2)A) is turned ON with 2 stations occupied. Select how to receive the position command and speed command. When 1 station is occupied, selection of "0100" or "0002" will result in a parameter error. □ 0 0 0 | Set value	Position command	Speed command | | 0 | Specify the point table No. | | 1 | Set the position data. | Specify the point table No. | | 2 | | Set the servo motor speed. |	0000		Refer to Name and function column.
PC31	LMPL	Software limit + Used to set the address increment side software stroke limit. The software limit is made invalid if this value is the same as in "software limit −". (Refer to section 6.3.6) Set the same sign to parameters No. PC31 and No. PC32. Setting of different signs will result in a parameter error. Set address: □□□□□□ Upper 3 digits Lower 3 digits Parameter No. PC31 Parameter No. PC32 The software limit+ is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM} \mu m$	−999999 to 999999
PC32	LMPH				

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PC33	LMNL	Software limit −	0	$\times 10^{STM}\mu m$	−999999
PC34	LMNH	Used to set the address decrement side software stroke limit. The software limit is made invalid if this value is the same as in "software limit +". (Refer to section 6.3.6) Set the same sign to parameters No. PC33 and PC34. Setting of different signs will result in a parameter error. Set address: □□□□□ Upper 3 digits / Lower 3 digits └── Parameter No. PC33 └── Parameter No. PC34 The software limit− is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.			to 999999
PC35	TL2	Internal torque limit 2 Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%]. When 0 is set, torque is not produced.	100.0	%	0 to 100.0
PC36		For manufacturer setting Do not change this value by any means.	0000h		
PC37	*LPPL	Position range output address + Used to set the address increment side position range output address. Set the same sign to parameters No. PC37 and PC38. Setting of different signs will result in a parameter error. In parameters No. PC37 to PC40, set the range where position range (RXnE) turns on. Set address:□□□□□ Upper 3 digits / Lower 3 digits └── Parameter No. PC37 └── Parameter No. PC38 Position range output address + is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}\mu m$	−999999 to 999999
PC38	*LPPH				
PC39	*LNPL	Position range output address − Used to set the address decrement side position range output address. Set the same sign to parameters No. PC39 and PC40. Setting of different signs will result in a parameter error. Set address:□□□□□ Upper 3 digits / Lower 3 digits └── Parameter No. PC39 └── Parameter No. PC40 Position range output address − is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}\mu m$	−999999 to 999999
PC40	*LNPH				

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PC41		For manufacturer setting	8192		
PC42		Do not change this value by any means.	1024		
PC43			500		
PC44			0		
PC45			10		
PC46			100		
PC47			0000h		
PC48			0000h		
PC49			0000h		
PC50			0000h		

6.3.3 S-pattern acceleration/deceleration

In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern acceleration/deceleration time constant (parameter No. PC13), a smooth start/stop can be made. When the S-pattern time constant is set, smooth positioning is executed as shown below. Note that the time equivalent to the S-pattern time constant setting increases until positioning (RXnC) is complete.
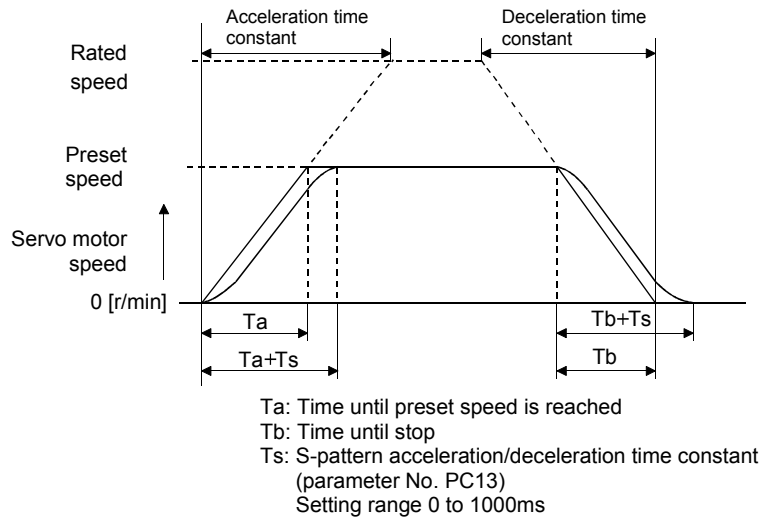
Ta: Time until preset speed is reached
Tb: Time until stop
Ts: S-pattern acceleration/deceleration time constant
(parameter No. PC13)
Setting range 0 to 1000ms

6.3.4 Alarm history clear

The alarm history can be confirmed by using the MR Configurator. The servo amplifier stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using parameter No. PC18 (alarm history clear) before starting operation. Clearing the alarm history automatically returns to "□□□0".
This parameter is made valid by switching power off, then on after setting.

```
Parameter No. 16
┌───┬───┬───┬───┐
│ 0 │ 0 │ 0 │   │
└───┴───┴───┴───┘
                └─── Alarm history clear
                     0: Invalid (not cleared)
                     1: Valid (cleared)
```
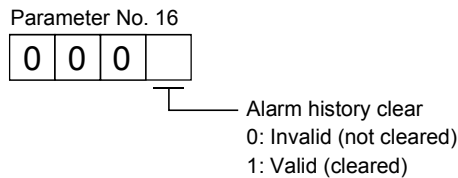
6.3.5 Rough match output

Rough match (RXn2) is output when the command remaining distance reaches the value set in parameter No. PC11 (rough match output range). The set remaining distance is 0 to 65535 [$\times 10^{STM}\mu$m].
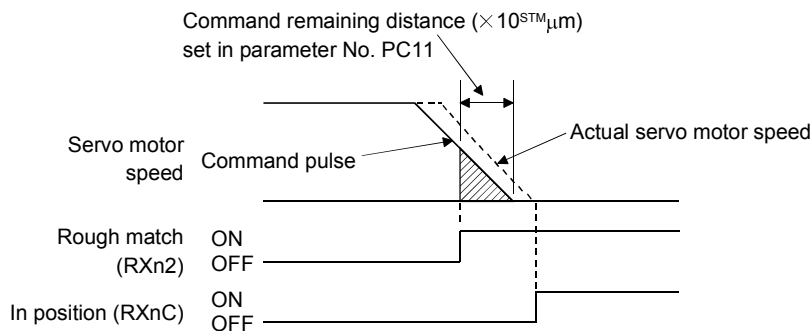
6.3.6 Software limit

A limit stop using a software limit (parameter No. PC31 to PC34) is made as in stroke end operation. When a motion goes beyond the setting range, the motor is stopped and servo-locked. This function is made valid at power-on but made invalid during home position return. This function is made invalid when the software limit $+$ setting is the same as the software limit $-$ setting. A parameter error (A37) will occur if the software limit $+$ setting is less than the software limit $-$ setting.
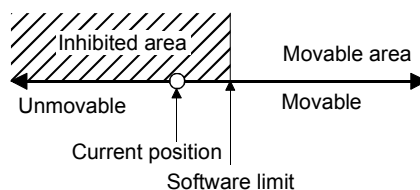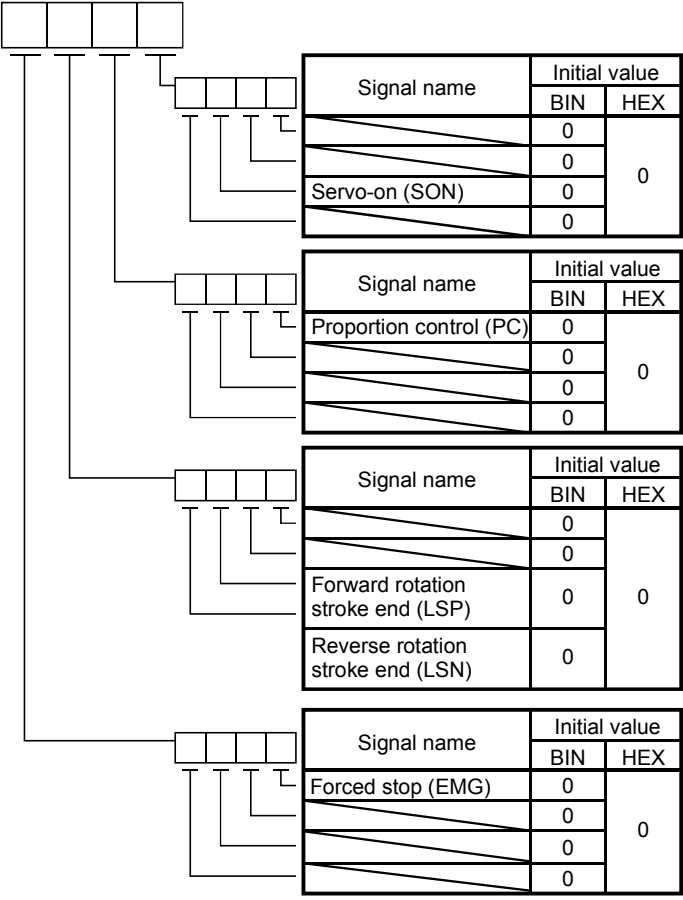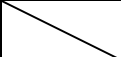
6.4 I/O setting parameters (No. PD □□)

6.4.1 Parameter list
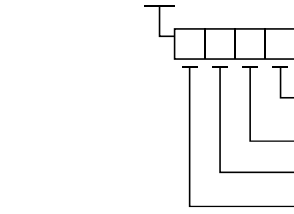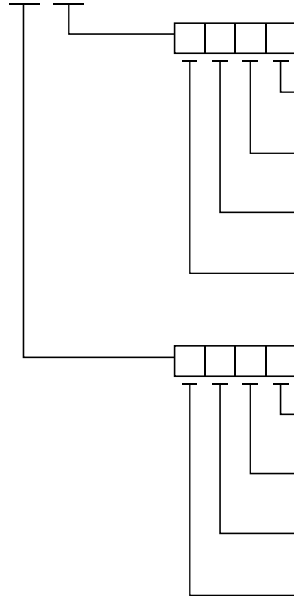
No.	Symbol	Name	Initial Value	Unit
PD01	*DIA1	Input signal automatic ON selection 1	0000h	
PD02		For manufacturer setting	0000h	
PD03	*DIA3	Input signal automatic ON selection 3	0000h	
PD04	*DIA4	Input signal automatic ON selection 4	0000h	
PD05		For manufacturer setting	0000h	
PD06	*DI2	Input signal device selection 2 (CN6-2)	002Bh	
PD07	*DI3	Input signal device selection 3 (CN6-3)	000Ah	
PD08	*DI4	Input signal device selection 4 (CN6-4)	000Bh	
PD09	*DO1	Input signal device selection 1 (CN6-pin 14)	0002h	
PD10	*DO2	Input signal device selection 2 (CN6-pin 15)	0003h	
PD11	*DO3	Input signal device selection 3 (CN6-pin 16)	0024h	
PD12	DIN1	External DI function selection 1	0C00h	
PD13		For manufacturer setting	0000h	
PD14	DIN3	External DI function selection 3	0800h	
PD15		For manufacturer setting	0000h	
PD16	*DIAB	Input polarity selection	0000h	
PD17		For manufacturer setting	0000h	
PD18			0000h	
PD19	*DIF	Response level setting	0002h	
PD20	*DOP1	Function selection D-1	0010h	
PD21		For manufacturer setting	0000h	
PD22	*DOP3	Function selection D-2	0000h	
PD23		For manufacturer setting	0000h	
PD24	*DOP5	Function selection D-5	0000h	
PD25		For manufacturer setting	0000h	
PD26			0000h	
PD27			0000h	
PD28			0000h	
PD29			0000h	
PD30			0000h	

6.4.2 Detail list

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD01	*DIA1	Input signal automatic ON selection 1 Select the input devices to be automatically turned ON. [diagonal] part is for manufacturer setting. Do not set the value by any means. BIN 0: Used in CC-Link or as external input signal. BIN 1: Automatic ON For example, to turn ON SON, the setting is "□□□4".	0000h		Refer to Name and function column.
PD02		For manufacturer setting Do not change this value by any means.	0000h		

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD03	*DIA3	**Input signal automatic ON selection 3** Select the input devices to be automatically turned ON. ⬚ part is for manufacturer setting. Do not set the value by any means. `0 0 0 ☐` Signal name / Initial value (BIN / HEX): Automatic/manual selection (MD0): BIN 0 ———— : BIN 0, HEX 0 ———— : BIN 0 ———— : BIN 0 BIN 0: Used in CC-Link or as external input signal. BIN 1: Automatic ON	0000h		Refer to Name and function column.
PD04	*DIA4	**Input signal automatic ON selection 4** Select the input devices to be automatically turned ON. ⬚ part is for manufacturer setting. Do not set the value by any means. `☐ ☐ 0 0` Signal name / Initial value (BIN / HEX): Point table No. selection 1 (DI0): BIN 0 Point table No. selection 2 (DI1): BIN 0 Point table No. selection 3 (DI2): BIN 0, HEX 0 Point table No. selection 4 (DI3): BIN 0 Signal name / Initial value (BIN / HEX): Point table No. selection 5 (DI4): BIN 0 Point table No. selection 6 (DI5): BIN 0 Point table No. selection 7 (DI6): BIN 0, HEX 0 Point table No. selection 8 (DI7): BIN 0 BIN 0: Used in CC-Link or as external input signal. BIN 1: Automatic ON	0000h		Refer to Name and function column.
PD05		For manufacturer setting Do not change this value by any means.	0000h		

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD06	*DI2	Input signal device selection 2 (CN6-2) Any input device can be assigned to the CN6-2 pin. `0` `0` `☐` `☐` └── Select the input device of the CN6-2 pin The devices that can be assigned are indicated in the following table. Note. The other setting values than shown in this table are for manufacturer setting.	002Bh		Refer to Name and function column.
PD07	*DI3	Input signal device selection 3 (CN6-3) Any input device can be assigned to the CN6-3 pin. The devices that can be assigned and the setting method are the same as in parameter No. PD06. `0` `0` `☐` `☐` └── Select the input device of the CN6-3 pin	000Ah		Refer to Name and function column.
PD08	*DI4	Input signal device selection 4 (CN6-4) Any input device can be assigned to the CN6-4 pin. The devices that can be assigned and the setting method are the same as in parameter No. PD06. `0` `0` `☐` `☐` └── Select the input device of the CN6-4 pin	000Bh		Refer to Name and function column.

Table for PD06:

Setting (Note)	Input device Name	Abbreviation
00	No assignment function	
02	Servo-on	SON
03	Reset	RES
04	Proportion control	PC
06	Clear	CR
07	Forward rotation start	ST1
08	Reverse rotation start	ST2
09	Internal torque limit selection	TL2
0A	Forward rotation stroke end	LSP
0B	Reverse rotation stroke end	LSN
0D	Gain switch	CDP
20	Automatic/manual selection	MD0
24	Manual pulse generator multiplication 1	TP0
25	Manual pulse generator multiplication 2	TP1
27	Temporary stop/restart	TSTP
2B	Proximity dog	DOG

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD09	*DO1	Output signal device selection 1 (CN6-14) Any output signal can be assigned to the CN6-14 pin. 0 0 ☐ ☐ └── Select the output device of the CN6-14 pin The devices that can be assigned are indicated in the following table.	0002h		Refer to Name and function column.

Setting (Note)	Output device	
	Name	Symbol
00	Always OFF	
02	Ready	RD
03	Trouble	ALM
04	In position	INP
05	Electromagnetic brake interlock	MBR
06	Dynamic brake interlock	DB
07	Limiting torque	TLC
08	Warning	WNG
09	Battery warning	BWNG
0A	Speed command reached	SA
0C	Zero speed	ZSP
0F	Variable gain selection	CDPS
23	Rough match	CPO
24	Home position return completion	ZP
25	Position range	POT
26	Temporary stop	PUS
27	Movement finish	MEND
38	Point table No. output 1	PT0
39	Point table No. output 2	PT1
3A	Point table No. output 3	PT2
3B	Point table No. output 4	PT3
3C	Point table No. output 5	PT4
3D	Point table No. output 6	PT5
3E	Point table No. output 7	PT6
3F	Point table No. output 8	PT7

Note. The other setting values than shown in this table are for manufacturer setting.

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD10	*DO2	Output signal device selection 2 (CN6-15) Any output signal can be assigned to the CN6-15 pin. The devices that can be assigned and the setting method are the same as in parameter No. PD09. 0 0 ☐ ☐ └── Select the output device of the CN6-15 pin	0003h		Refer to Name and function column.
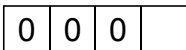
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No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD11	*DO3	Output signal device selection 3 (CN6-16) Any output signal can be assigned to the CN6-16 pin. The devices that can be assigned and the setting method are the same as in parameter No. PD09. [0 | 0 | |] └── Select the output device of the CN6-16 pin	0024h		Refer to Name and function column.
PD12	DIN1	External DI function selection 1 This function sets any signal imported from the CN6 connector. ▧ part is for manufacturer setting. Do not set the value by any means. _(diagram of bit assignments)_ 	Signal name	Initial value	
	BIN	HEX
▧	0	
▧	0	0
Servo-on (SON)	0	
Reset (RES)	0	| | Signal name	Initial value	
	BIN	HEX
Proportion control (PC)	0	
▧	0	0
Clear (CR)	0	
Forward rotation start (ST1)	0	| | Signal name	Initial value	
	BIN	HEX
Reverse rotation start (ST2)	0	
Internal torque limit (TL1)	0	C
Forward rotation stroke end (LSP)	1	
Reverse rotation stroke end (LSN)	1	| | Signal name	Initial value	
	BIN	HEX
▧	0	
Gain switch (CDP)	0	0
▧	0	
▧	0	| BIN 0: Used in CC-Link BIN 1: Used in CN6 external input signal	0C00h		Refer to Name and function column.
PD13		For manufacturer setting Do not change this value by any means.	0000h		

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No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD14	DIN3	External DI function selection 3 This function sets any signal imported from the CN6 connector. ▨ part is for manufacturer setting. Do not set the value by any means. BIN 0: Used in CC-Link BIN 1: Used in CN6 external input signal	0800h		Refer to Name and function column.
PD15		For manufacturer setting Do not change this value by any means.	0000h		
PD16	*DIAB	Input polarity selection Used to set the proximity dog input polarity. (Refer to section 5.6) Proximity dog input polarity 0: OFF indicates detection of the dog. 1: ON indicates detection of the dog.	0000h		Refer to Name and function column.
PD17		For manufacturer setting	0000h		
PD18		Do not change this value by any means.	0000h		
PD19	*DIF	Response level setting Used to select the input. Input filter If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 0.88[ms] 2: 1.77[ms] 3: 2.66[ms] 4: 3.55[ms] 5: 4.44[ms]	0002h		Refer to Name and function column.

PD14 diagram detail:

Signal name / Initial value (BIN / HEX):
- Automatic/manual selection (MD0) — BIN 0
- (manufacturer) — BIN 0 — HEX 0
- (manufacturer) — BIN 0
- (manufacturer) — BIN 0

Signal name / Initial value (BIN / HEX):
- (manufacturer) — BIN 0
- (manufacturer) — BIN 0
- (manufacturer) — BIN 0 — HEX 0
- Temporary stop/Restart (TSTP) — BIN 0

Signal name / Initial value (BIN / HEX):
- (manufacturer) — BIN 0
- (manufacturer) — BIN 0 — HEX 8
- (manufacturer) — BIN 0
- Proximity dog (DOG) — BIN 1

PD16 diagram: 0 0 0 ☐

PD19 diagram: 0 0 0 ☐

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No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD20	*DOP1	Function selection D-1 Select the stop processing at forward rotation stroke end (LSN)/reverse rotation stroke end (LSN) OFF and the base circuit status at reset (RY(N+1)A or RY(n+3)A) ON. `0 □ □ □` Stopping method used when forward rotation stroke end (LSP), reverse rotation stroke end (LSN) device or software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constant) 3: Sudden stop (Stop by remaining move distance clear) Selection of base circuit status at reset (RY(n+1)A or RY(n+3)A)ON 0: Base circuit not switched off 1: Base circuit switched off Stopping method used when software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constant) 3: Sudden stop (Stop by remaining move distance clear) As in the following parameter settings, when the home position is lost by the forward rotation stroke end, reverse rotation stroke end, or the software limit detection, the home position return completion (ZP) turns on by turning OFF/ON the servo-on (RYn0). In this case, there is no need to perform the home position return again. 1. In absolute position detection system Parameter No. PA03: □□□ 1 (Select the absolute position detection system) Parameter No. PA01: □□□ 0 (Select the absolute value command system) 2. In incremental system Parameter No. PA03: □□□ 0 (Select the incremental system) Parameter No. PA01: □□□ 0 (Select the absolute value command system) Parameter No. PA04: □□□ 1 (Follow-up valid)	0010h		Refer to Name and function column.
PD21		For manufacturer setting Do not change this value by any means.	0000h		
PD22	*DOP3	Function selection D-3 Set the clear (RYnF). `0 0 0 □` Clear (RYnF) selection 0: Droop pulses are cleared on the leading edge. 1: While on, droop pulses are always cleared.	0000h		Refer to Name and function column.
PD23		For manufacturer setting Do not change this value by any means.	0000h		

No.	Symbol	Name and Function	Initial value	Unit	Setting range
PD24	*DOP5	Function selection D-5 Select the output status of the warning (WNG). `0` `0` ` ` `0` Selection of output device at warning occurrence Select the warning (RXnA) and trouble (RX(n+1)A or RX(n+3)A) output status at warning occurrence. 	Setting	(Note) Device status
---	---
0	Remote output: RXnA 1/0, RX(n+1)A or RX(n+3)A 1/0; Output signal: WNG ON/OFF, ALM ON/OFF — Warning occurred.
1	Remote output: RXnA 1/0, RX(n+1)A or RX(n+3)A 1/0; Output signal: WNG ON/OFF, ALM ON/OFF — Warning occurred.	 Note. 0: OFF 1: ON	0000h		
PD25		For manufacturer setting Do not change this value by any means.	0000h		
PD26			0000h		
PD27			0000h		
PD28			0000h		
PD29			0000h		
PD30			0000h		

7. MR Configurator

The MR Configurator (MRZJW3-SETUP221 version B4 or later) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

7.1 Specifications

Item	Description
Baud rate [bps]	115200, 57600, 38400, 19200, 9600
Monitor	Display, I/O interface display, high speed monitor, trend graph
Alarm	Display, history, amplifier data
Diagnostic	No motor rotation, system information, tuning data, absolute encoder data, Axis name setting.
Parameters	Parameter list, device setting, turning, change list, detailed information
Test operation	Jog operation, positioning operation, motor-less operation, Do forced output, program operation, single-step feed, parameter copy.
Advanced function	Machine analyzer, gain search, machine simulation, Robust disturbance compensation.
Point data	Point table
File operation	Data read, save, delete, print
Others	Automatic demo, help display

7.2 System configuration

(a) Components

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

Model	Description

(Note 2) Personal computer	IBM PC-AT compatible where the English version of Windows® 98, Windows® Me, Windows® 2000 Professional, Windows® XP Professional and Windows® XP Home Edition operates
	Processor: Pentium® 133MHz or more (Windows® 98, Windows® 2000 Professional)
	        Pentium® 150MHz or more (Windows® Me)
	        Pentium® 300MHz or more (Windows® XP Professional, Windows® XP Home Edition)
	Memory: 24MB or more (Windows® 98)
	      32MB or more (Windows® Me, Windows® 2000 Professional)
	      128MB or more (Windows® XP Professional, Windows® XP Home Edition)
	Free hard disk space: 130MB or more

OS	Windows® 98, Windows® Me, Windows® 2000 Professional, Windows® XP Professional, Windows® XP Home Edition (English version)
Display	One whose resolution is 800×600 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.
Keyboard	Connectable with the above personal computer.
Mouse	Connectable with the above personal computer.
Printer	Connectable with the above personal computer.
USB cable	MR-J3USBCBL3M
RS-422/232C conversion cable	DSV-CABV (Diatrend) is recommended.
RS-422/232C converter	FA-T-RS40VS (Mitsubishi Electric Engineering) is recommended. Required for use of the multidrop communication function.

Note 1. Windows is the registered trademarks of Microsoft Corporation in the United State and other countries.

      Pentium is the registered trademarks of Intel Corporation.

   2. On some personal computers, this software may not run properly.

(b) Connection with servo amplifier

1) For use of USB

Personal computer

Servo amplifier   USB cable
MR-J3USBCBL3M   To USB
(Option)   connector

CN5

2) For use of RS-422

Personal computer

Servo amplifier   RS-422/232C conversion cable
                   DSV-CABV   To RS-232C
                   (Diatrend)   connector

CN3
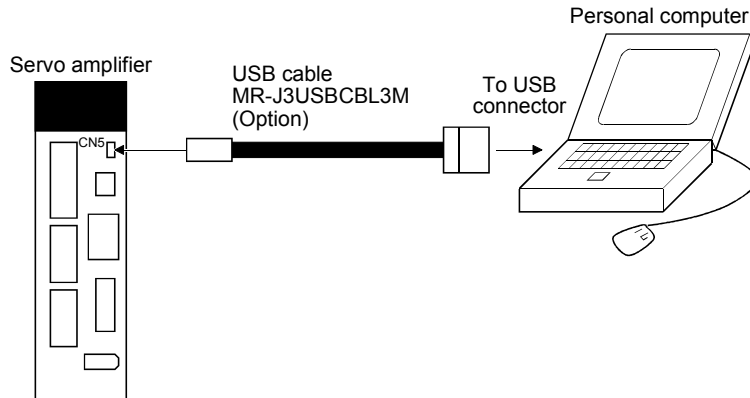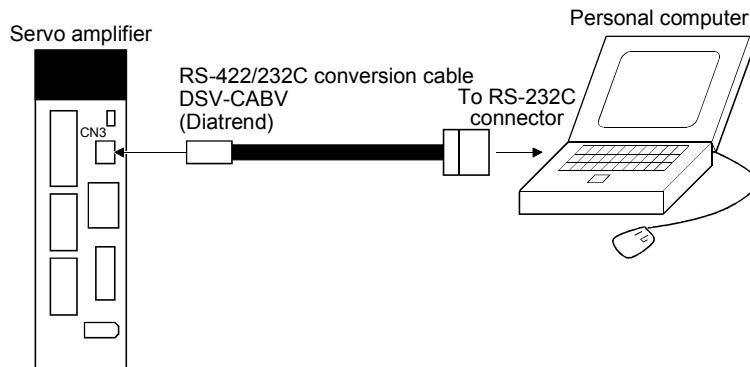
3) For use of RS-422 to make multidrop connection

Servo amplifier   Servo amplifier   Servo amplifier

CN3   CN3   CN3

(Note 2)   (Note 2)   (Note 2)

Personal computer

(Note 1)

To RS-232C
connector

RS-422/232C converter
FA-T-RS40VS
(Mitsubishi Electric Engineering)

(Note 3)
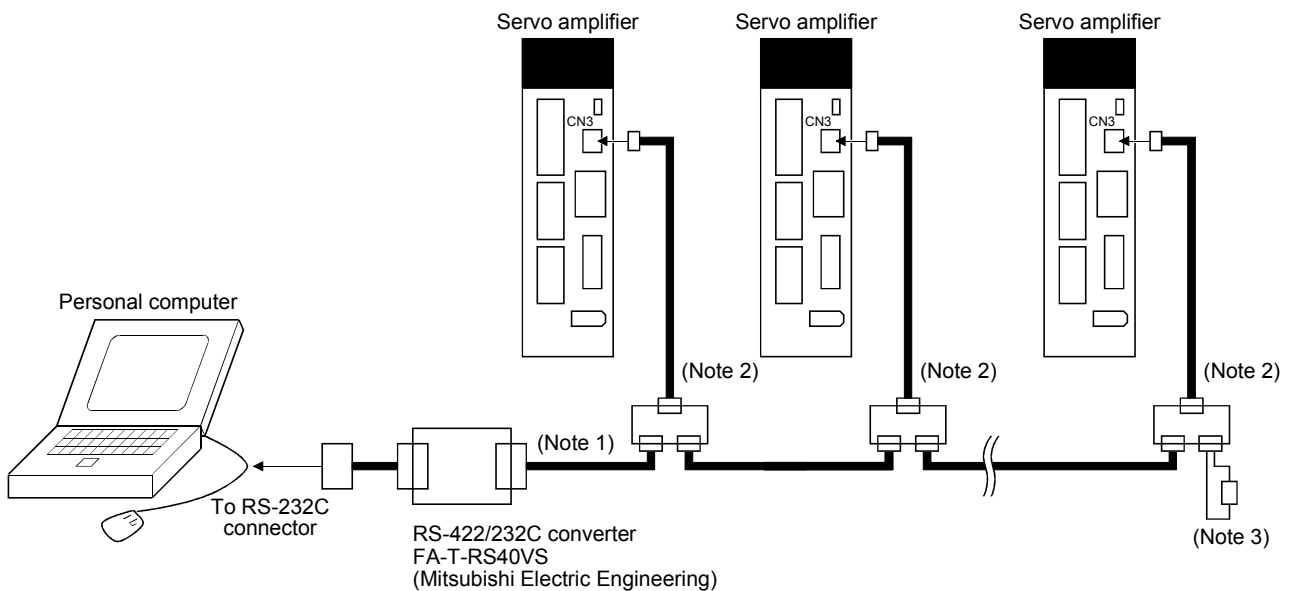
Note 1. Refer to section 15.1 for cable wiring.

2. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

3. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

7.3 Station selection

Click "Setup" on the menu bar and click "System settings" on the menu.
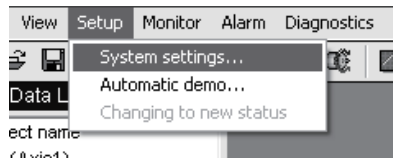
When the above choices are made, the following window appears:
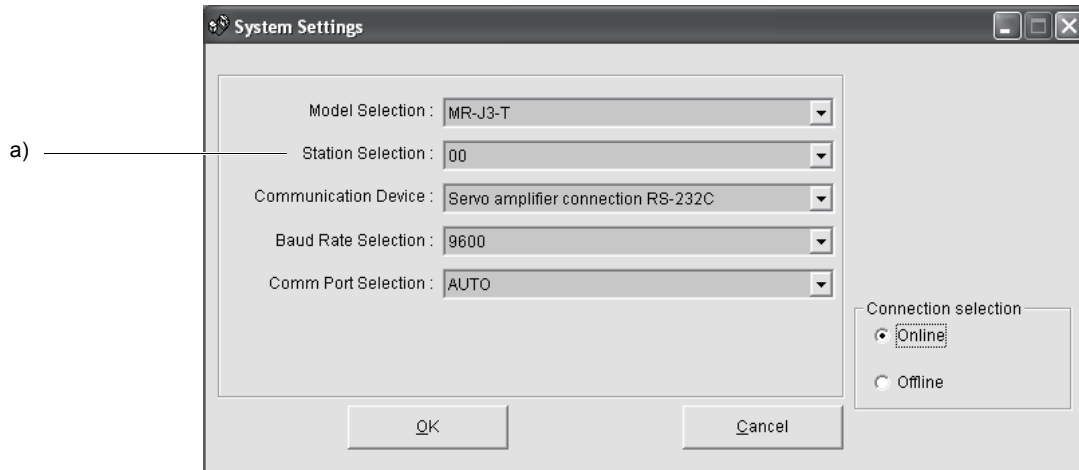
(1) Station number selection
   Choose the station number in the combo box (a)).

> POINT
>
> ・This setting should be the same as the station number which has been set in
>   the parameter in the servo amplifier used for communication.

(2) Closing of the station selection window
   Click the "OK" button to close the window.

7.4 Parameters

Click "Parameters" on the menu bar and click "Parameter list" on the menu.
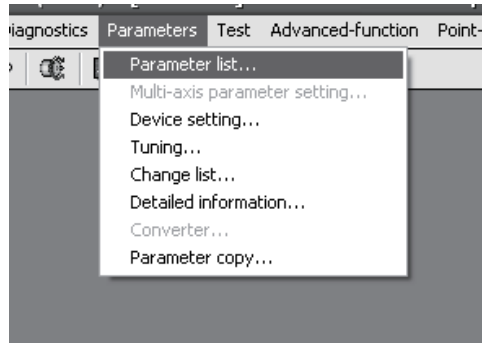
When the above choices are made, the following window appears:
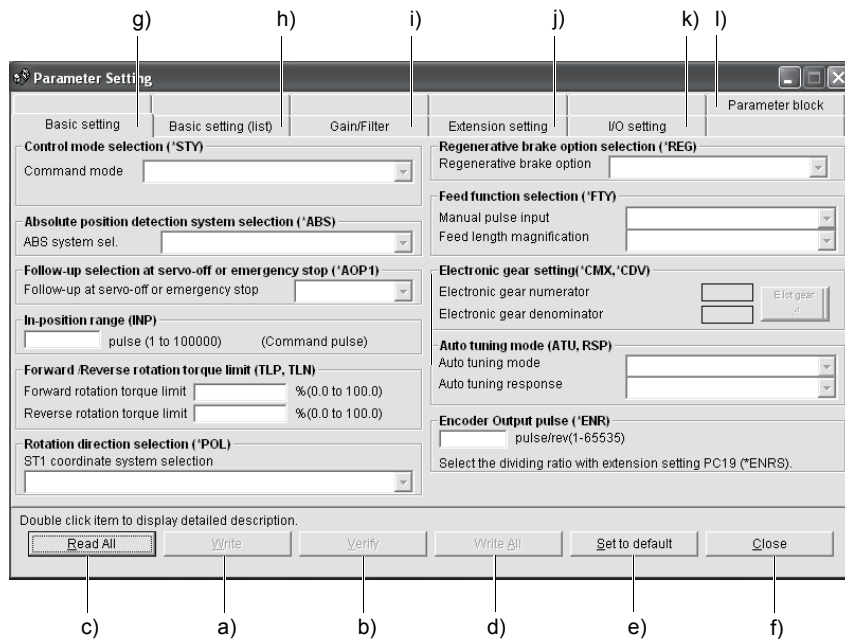
(1) Parameter value write (a))

Click the parameter whose setting was changed and press the "Write" button to write the new parameter setting to the servo amplifier.

(2) Parameter value verify (b))

Click the "Verify" button to verify all parameter values being displayed and the parameter values of the servo amplifier.

(3) Parameter value batch-read (c))

Click the "Read All" button to read and display all parameter values from the servo amplifier.

(4) Parameter value batch-write (d))
   Click the "Write All" button to write all parameter values to the servo amplifier.

(5) Parameter default value indication (e))
   Click the "Set to default" button to show the initial value of each parameter.

(6) Basic settings for parameters (g))
   Used to make the basic settings such as control mode selection and absolute position system selection.

(7) Basic setting parameters (h))
   Used to make the basic settings for the servo amplifier. Select a parameter to be changed the setting, enter a new value to "Set value" and click "Enter".

(8) Gain/Filter parameters (i))
   Used to adjust the gain manually. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(9) Extension setting parameters (j))
   Used to make the setting unique to MR-J3-□T servo amplifier. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(10) I/O setting parameters (k))
   Used to change the I/O device of the servo amplifier. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(11) Parameter block (l))
   Used to set the availability of parameter write.

(12) Parameter data file read
   Used to read and display the parameter values stored in the file. Use the "Project" menu on the menu bar to read.

(13) Parameter value storage
   Used to store all parameter values being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(14) Parameter data list print
   Used to print all parameter values being displayed on the window. Use the "Project" menu on the menu bar to print.

(15) Parameter list window closing (f))
   Click the "Close" button to close the window. If the "Close" button is clicked without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

7.5 Point table

```
┌─────────────┐
│ POINT       │
└─────────────┘
 ・The value of the parameter No. PA05 set on the parameter setting screen is
   not engaged with the STM (feed length multiplication) value on the point table
   list screen. Set the STM (feed length multiplication) value to the same as set
   in the parameter No. PA05 on the point table list screen.
```

Click "Point-data" on the menu bar and click "Point table" on the menu.

When the above choices are made, the following window appears:

(1) Point table data write (a))
    Click the point table data changed and press the "Write" button to write the new point table data to the
    servo amplifier.

(2) Point table data verify (b))
    Click the "Verify" button to verify all data being displayed and the data of the servo amplifier.

(3) Point table data batch-read (c))
    Click the "Read All" button to read and display all point table data from the servo amplifier.

(4) Point table data batch-write (d))
    Click the "Write All" button to write all point table data to the servo amplifier.

(5) Point table data insertion (e))

Click the "Insert" button to insert one block of data into the position before the point table No. chosen. The blocks after the chosen point table No. are shifted down one by one.

(6) Point table data deletion (f))

Click the "Delete" button to delete all data in the point table No. chosen. The blocks after the chosen point table No. are shifted up one by one.

(7) Point table data change (g))

Click the data to be changed, enter a new value into the "Enter" input field, and press the enter key or Enter Data button.

(8) Point table data file read

Used to read and display the point table data stored in the file. Use the "Project" menu on the menu bar to read.

(9) Point table data storage

Used to store all point table data being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(10) Point table data list print

Used to print all point table data being displayed on the window. Use the "Project" menu on the menu bar to print.

(11) Point table data list window closing (h))

Click the "Close" button to close the window.

7.6 Device assignment method

> POINT
>
> ・To use a device as an external I/O signal, the settings for the parameter No.
> PD12 and PD14 are required after the device is assigned according to the
> device setting described below.

(1) How to open the setting screen

Click "Parameters" on the menu bar and click "Device setting" in the menu.
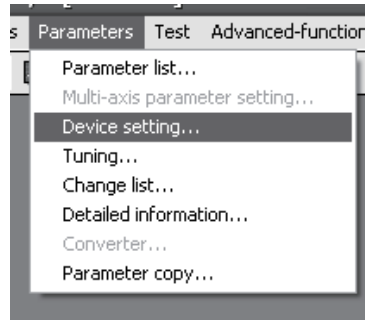
Making selection displays the following window.
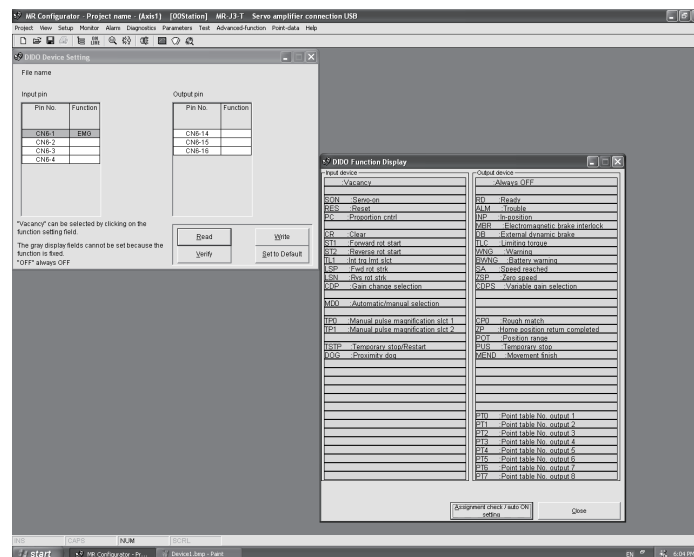
(2) Screen explanation

(a) DIDO device setting window screen

This is the device assignment screen of the servo amplifier displays the pin assignment status of the servo amplifier.
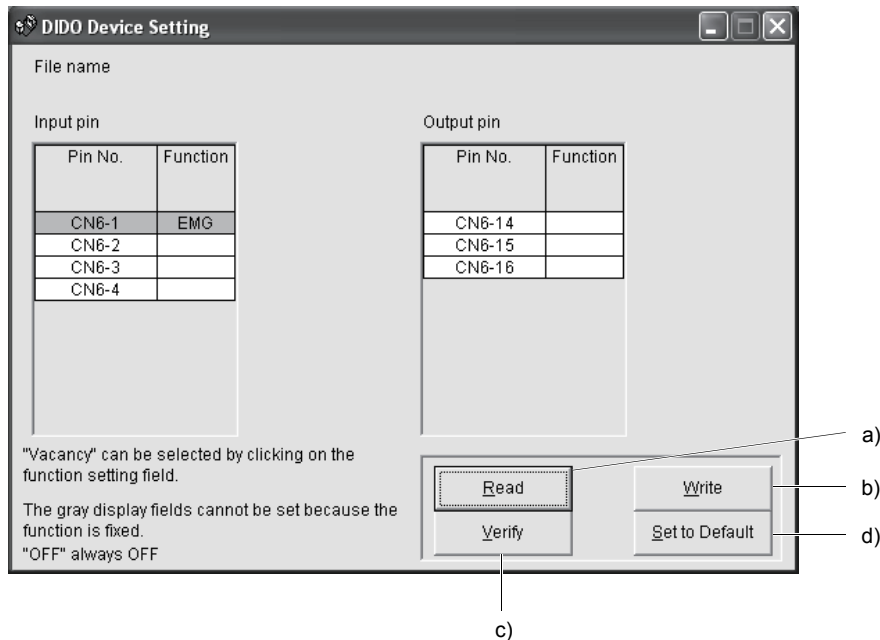
1) Read of function assignment (a))

Click the "Read" button reads and displays all functions assigned to the pins from the servo amplifier.

2) Write of function assignment (b))

Click the "Write" button writes all pins that are assigned the functions to the servo amplifier.

3) Verify of function assignment (c))

Click the "Verify" button verifies the function assignment in the servo amplifier with the device information on the screen.

4) Initial setting of function assignment (d))

Click the "Set to Default" button initializes the function assignment.

(b) DIDO function display window screen

This screen is used to select the device assigned to the pins.

The functions displayed below * and * are assignable.
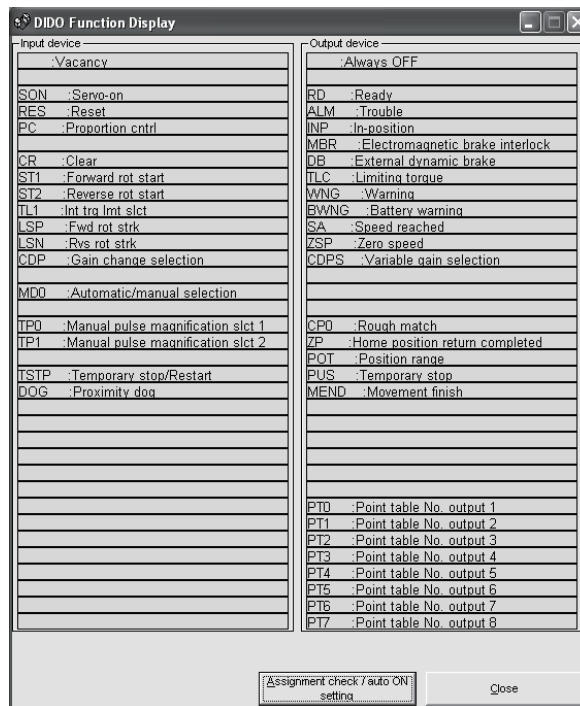
a)   b)

Move the pointer to the place of the function to be assigned. Drag and drop it as-is to the pin you want to assign in the DIDO device setting window.

1) Assignment checking, automatic ON setting (a))

Press this button to display the screen that shows the assignment list and enables auto ON setting.

Refer to (2)(c) of this section for more information.

2) Quitting

Click "Close" button to exit from the window. (b))

(c) Function device assignment checking auto ON setting display

Click the "Assignment check / auto ON setting" button in the DIDO function display window displays the following window.
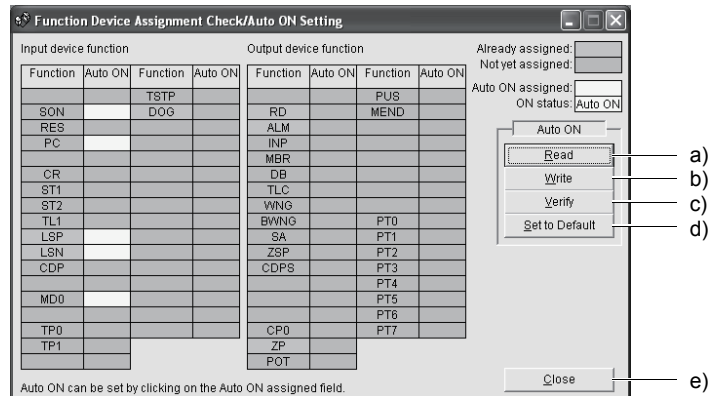
The assigned functions are indicated by .

The functions assigned by auto ON are grayed. When you want to set auto ON to the function that is enabled for auto ON, click the corresponding cell. Clicking it again disables auto ON.

1) Auto ON read of function assignment (a))

Click "Read" button reads the functions set for auto ON from the interface unit and extension IO unit.

2) Auto ON write of function assignment (b))

Click "Write" button writes the functions currently set for auto ON to the interface unit and extension IO unit.

3) Auto ON verify of function assignment (c))

Click "Verify" button verifies the current auto ON setting in the interface unit and extension IO unit with the auto ON setting on the screen.

4) Auto ON initial setting of function assignment (d))

Click "Set to Default" button initializes the auto ON setting.

5) Quitting the function device assignment checking/auto ON setting window (e))

Click "Close" button exits from the window.

7.7 Test operation

| ⚠ CAUTION | ・When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates. |
| | ・If any operational fault has occurred, stop operation using the forced stop (EMG). |

7.7.1 Jog operation

POINT
・For the program operation, refer to the manual of MR Configurator.
・The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and SG. (Refer to section 7.6.)
・When an alarm occurs, the JOG operation is automatically canceled.

Click "Test" on the menu bar and choose "Jog" on the menu.
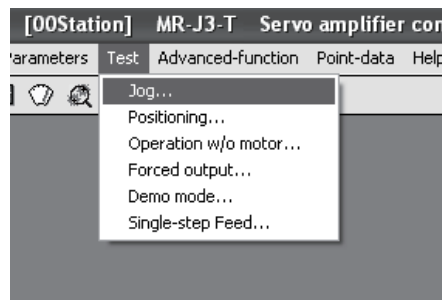
Clicking displays the confirmation window for switching to the test operation mode.
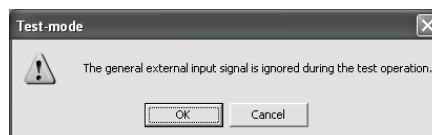
Click the "OK" button to display the setting screen of the Jog operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.
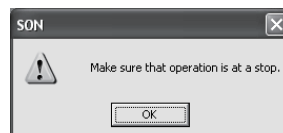
Turn the servo off, confirm that the operation is in the stop status, and click the "OK" button to display the setting screen for the Jog operation.
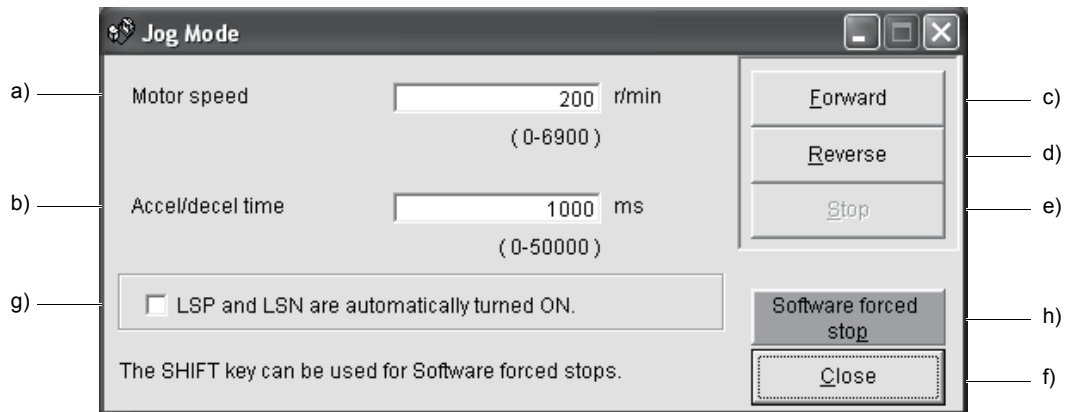
(1) Servo motor speed setting (a))

Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))

Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Servo motor start (c), d))

Hold down the "Forward" button to rotate the servo motor in the CCW rotation direction.

Hold down the "Reverse" button to rotate the servo motor in the CW rotation direction.

(4) Servo motor stop (e))

Click the "Stop" button to stop the rotation of the servo motor.

(5) LSP/LSN (stroke end) automatic ON setting (g))

Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the external signal LSP and the LSN signal are ignored.

(6) Servo motor software forced stop (h))

Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

(7) Jog operation window closing (f))

Click the "Close" button to cancel the jog operation mode and close the window.

(8) Switching to CC-Link operation mode

To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the servo amplifier.

7.7.2 Positioning operation

```
┌─────────────────────────────────────────────────────────────────┐
│  ┌─────────────┐                                                  │
│  │   POINT     │                                                  │
│  └─────────────┘                                                  │
│  ・The servo motor will not operate if the forced stop (EMG), forward rotation │
│    stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make        │
│    automatic ON setting to turn on these devices or make device setting to     │
│    assign them as external input signals and turn on across these signals and  │
│    DOCOM. (Refer to section 7.6.)                                              │
│  ・When an alarm occurs, the positioning operation is automatically canceled.  │
└─────────────────────────────────────────────────────────────────┘
```

Click "Test" on the menu bar and click "Positioning" on the menu.
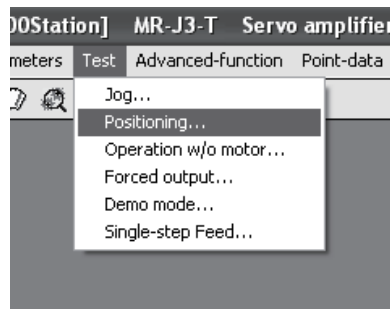
Clicking displays the confirmation window for switching to the test operation mode.
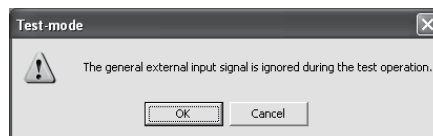
Click the "OK" button to display the setting screen of the Positioning operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.
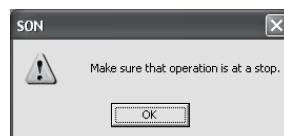
After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the positioning operation.
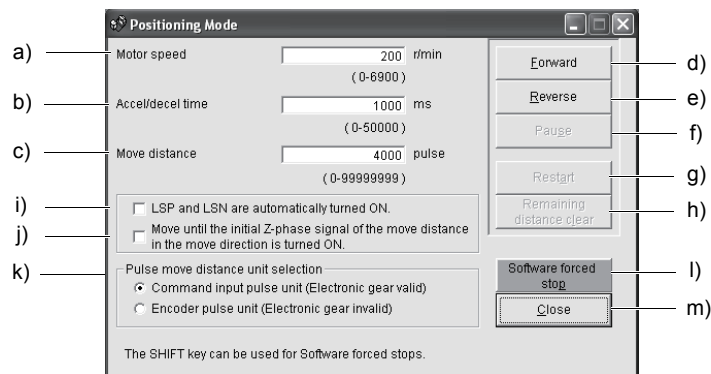
(1) Servo motor speed setting (a))

Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))

Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Moving distance setting (c))

Enter a new value into the "Move distance" input field and press the enter key.

(4) Servo motor start (d), e))

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

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

(5) Temporary stop of servo motor (f))

Click the "Pause" button to stop the servo motor temporarily.

(6) Servo motor restart (g))

Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.

Enter a new value into the "Motor speed" input field and press the enter key.

(7) Move distance clear (h))

Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(8) LSP/LSN (stroke end) automatic ON setting (i))

Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the external signal LSP and the LSN signal are ignored.

(9) Automatic ON setting for the movement to the Z-phase signal (j))

To move to the first Z-phase signal of the move distance + move direction, put a check mark in the check box.

(10) Pulse move distance unit selection (k)
    Select with the option buttons whether the moving distance set is in the command input pulse unit or in the encoder pulse unit.

(11) Servo motor software forced stop (1))
    Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

(12) Positioning operation window closing (m))
    Click the "Close" button to cancel the positioning operation mode and close the window.

(13) Switching to CC-Link operation mode
    To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the servo amplifier.

7.7.3 Motor-less operation

> POINT
> ・When this operation is used in an absolute position detection system, the
> home position cannot be restored properly.

Without a servo motor being connected, the output signals are provided and the servo amplifier display shows
the status as if a servo motor is actually running in response to the external I/O signals.
The sequence of the host programmable controller (PC) can be checked without connection of a servo motor.

Click "Test" on the menu bar and click "Operation w/o Motor" on the menu.
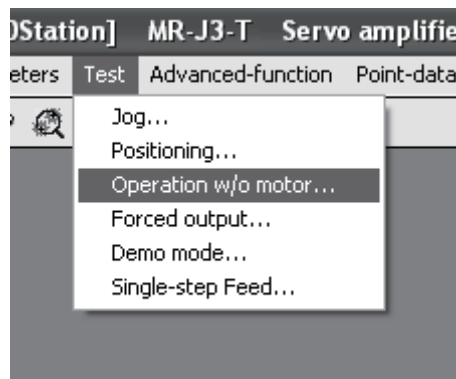
When the above choices are made, the following window appears:
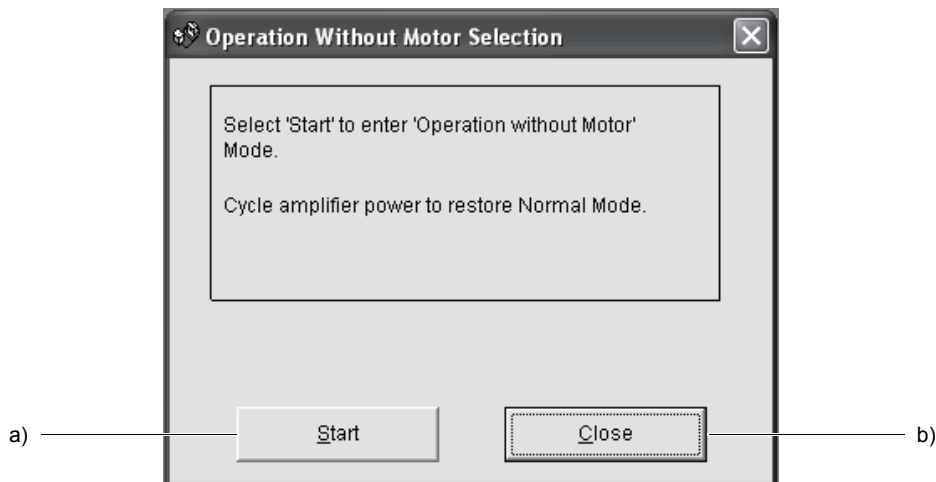
(1) Execution of motor-less operation (a))
   Click "Start" to perform motor-less operation.

(2) Termination of motor-less operation (b))
   Click "Close" to close the window.
   Note that just clicking the "Close" button does not cancel motor-less operation. To cancel motor-less
   operation, turn ON the power of the servo amplifier and switch to the CC-Link operation mode once.

7.7.4 Output signal (DO) forced output

```
POINT
・When an alarm occurs, the DO forced output is automatically canceled.
```

Each servo amplifier output signal is forcibly switched on/off independently of the output condition of the output signal.
Click "Test" on the menu bar and click "Forced output" on the menu.
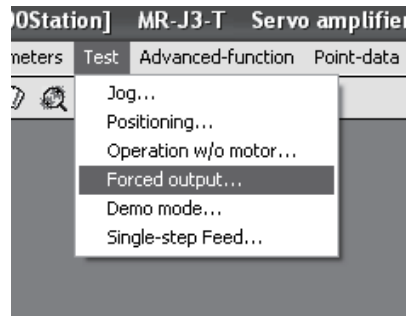
Clicking displays the confirmation window for switching to the test operation mode.
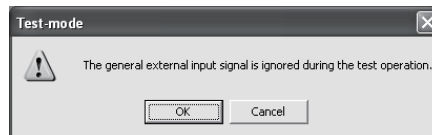
Click the "OK" button to display the setting screen of the DO forced output.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.
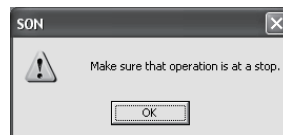
After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the DO forced output.

When the above choices are made, the following window appears:
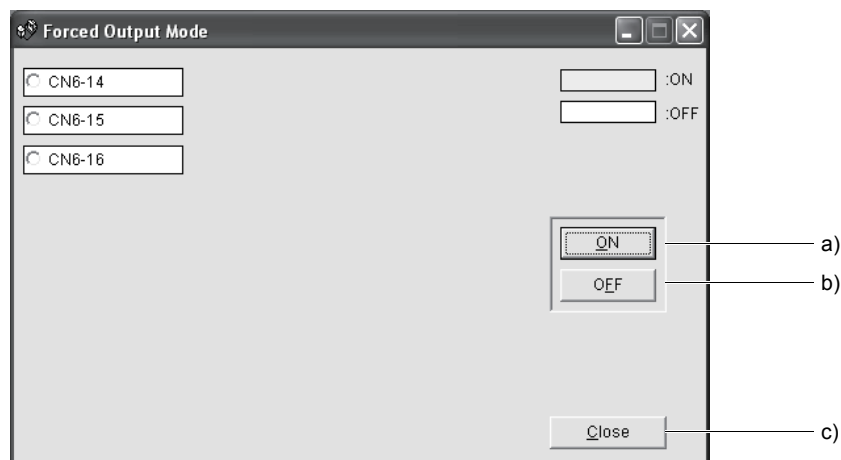
(1) Signal ON/OFF setting (a), b))

Choose the signal name or pin number and click the "ON" or "OFF" button to write the corresponding signal status to the servo amplifier.

(2) DO forced output window closing (c))

Click the "Close" button to cancel the DO forced output mode and close the window.

(3) Switching to CC-Link operation mode

To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the servo amplifier.

7.7.5 Single-step feed

> POINT
> ・The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and SG. (Refer to section 7.6.)
> ・When an alarm occurs, the 1-step feed is automatically canceled.

Operation is performed in accordance with the preset point table No.

Click "Test" on the menu bar and click "Single-step Feed" on the menu.
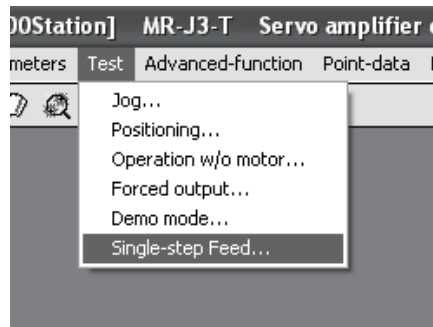
Clicking displays the confirmation window for switching to the test operation mode.
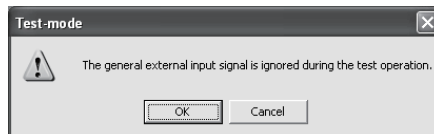
Click the "OK" button to display the setting screen of the Single-step feed.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.
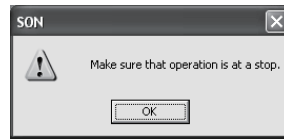
After confirming that the operation is in the stop status, click the "OK" button.
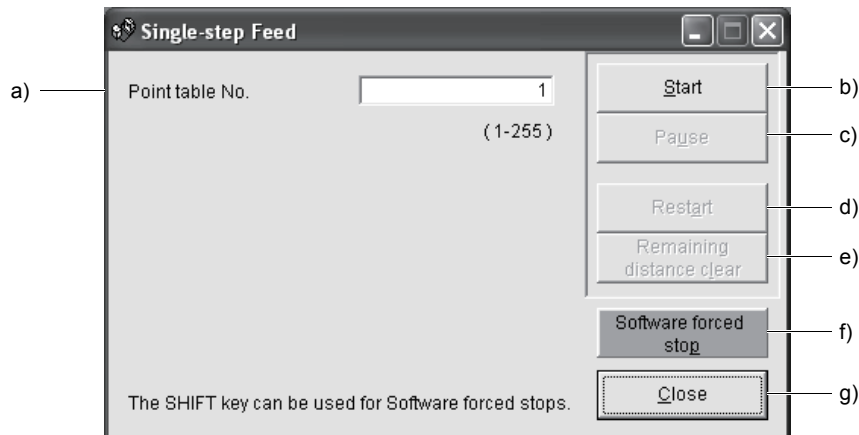
(1) Point table No. setting (a))
    Enter the point table No. into the "Point table No." input field and press the enter key.

(2) Servo motor start (b))
    Click the "Start" button to rotate the servo motor.

(3) Temporary stop of servo motor (c))
    Press the "Pause" button to stop the servo motor temporarily.

(4) Servo motor stop (c))
    Click the "Pause" button again during a temporary stop of the servo motor to clear the remaining moving distance.

(5) Servo motor restart (d))
    Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.

(6) Move distance clear (e))
    Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(7) Servo motor software forced stop (f))
Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Start" button cannot be used. Click the "Software forced stop" button again to make the "Start" button enabled.

(8) Single-step feed window closing (g))
Click the "Close" button to cancel the single-step feed mode and close the window.
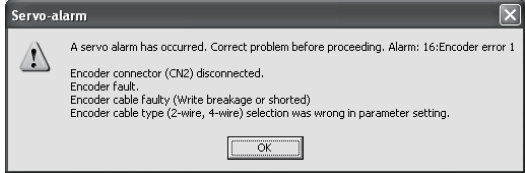
(9) Switching to CC-Link operation mode
To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the servo amplifier.

7.8 Alarm

7.8.1 Alarm display

```
┌─────────────────────────────────────────────────────────────────┐
│ ┌──────────┐                                                      │
│ │  POINT   │                                                      │
│ └──────────┘                                                      │
│ ･If a menu is clicked or any other operation is performed during  │
│  alarm occurrence, the following message window appears. The      │
│  example given here is the window that indicates an occurrence of │
│  Encoder error 1 (16).                                            │
│                                                                   │
│         ┌───────────────────────────────────────────────────┐    │
│         │ Servo-alarm                                   [X]  │    │
│         │ ┌───────────────────────────────────────────────┐ │    │
│         │ │ ⚠  A servo alarm has occurred. Correct problem│ │    │
│         │ │    before proceeding. Alarm: 16:Encoder error1│ │    │
│         │ │                                               │ │    │
│         │ │    Encoder connector (CN2) disconnected.      │ │    │
│         │ │    Encoder fault.                             │ │    │
│         │ │    Encoder cable faulty (Write breakage or    │ │    │
│         │ │    shorted)                                   │ │    │
│         │ │    Encoder cable type (2-wire, 4-wire)        │ │    │
│         │ │    selection was wrong in parameter setting.  │ │    │
│         │ │              ┌────────┐                       │ │    │
│         │ │              │   OK   │                       │ │    │
│         │ │              └────────┘                       │ │    │
│         │ └───────────────────────────────────────────────┘ │    │
│         └───────────────────────────────────────────────────┘    │
└─────────────────────────────────────────────────────────────────┘
```

The current alarm can be displayed.
To display the current alarm, click "Alarm" on the menu bar and click "Display" on the menu.
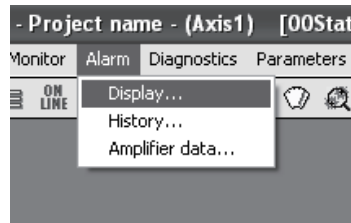
```
┌───────────────────────────────────────────┐
│ - Project name - (Axis1)   [00Stati        │
│ Monitor  Alarm  Diagnostics  Parameters    │
│        ┌──────────────────────┐            │
│  ▤  ON │  Display...          │  🕮  🔍    │
│     LINE│  History...          │            │
│        │  Amplifier data...   │            │
│        └──────────────────────┘            │
└───────────────────────────────────────────┘
```

When the above choices are made, the following window appears:

```
┌──────────────────────────────────────────┐
│ ✦ Alarm Display            [_][□][X]      │
│ ┌─ Current Alarm ───────────────────────┐ │
│ │                                       │ │
│ │  Alarm Number      AL16               │ │
│ │                                       │ │
│ │  Alarm Name        Encoder error 1    │ │
│ │                                       │ │
│ │  Cause of Alarm                       │ │
│ │  ┌─────────────────────────────────┐  │ │
│ │  │Encoder connector (CN2) disconnec│▲ │ │
│ │  │Encoder fault.                   │  │ │
│ │  │Encoder cable faulty (Write break│  │ │
│ │  │Encoder cable type (2-wire, 4-wir│▼ │ │
│ │  │ ◄        ▓▓▓▓              ►    │  │ │
│ │  └─────────────────────────────────┘  │ │
│ │                                       │ │
│ │    Time of Alarm (hour:min:sec)       │ │
│ │                                       │ │
│ │           10:39:56                    │ │
│ │                                       │ │
│ │  ┌─────────┐      ┌─────────┐         │ │
│ │  │  Reset  │      │  Close  │         │ │
│ │  └─────────┘      └─────────┘         │ │
│ └──────────────────────────────────────┘ │
└──────────────────────────────────────────┘
              │              │
             a)             b)
```
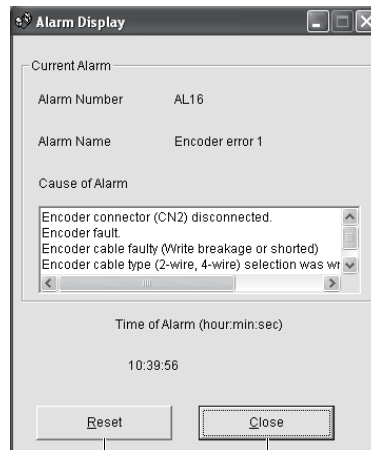
(1) Current alarm display

The window shows the alarm number, name, cause and occurrence time.

The following example is the window that indicates an occurrence of Encoder error 1 (16).

(2) Alarm reset (a))

Click the "Reset alarm" button to reset the current alarm and clear alarms on the window. The alarm at this time is stored as the latest alarm.

(3) Closing the current alarm window (b))

Click the "Close" button to close the window.

7.8.2 Batch display of data at alarm occurrence

Monitor data during alarm occurrence is displayed.
To display monitor data, click "Alarm" on the menu bar and click "Amplifier data" on the menu.
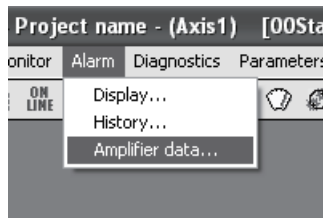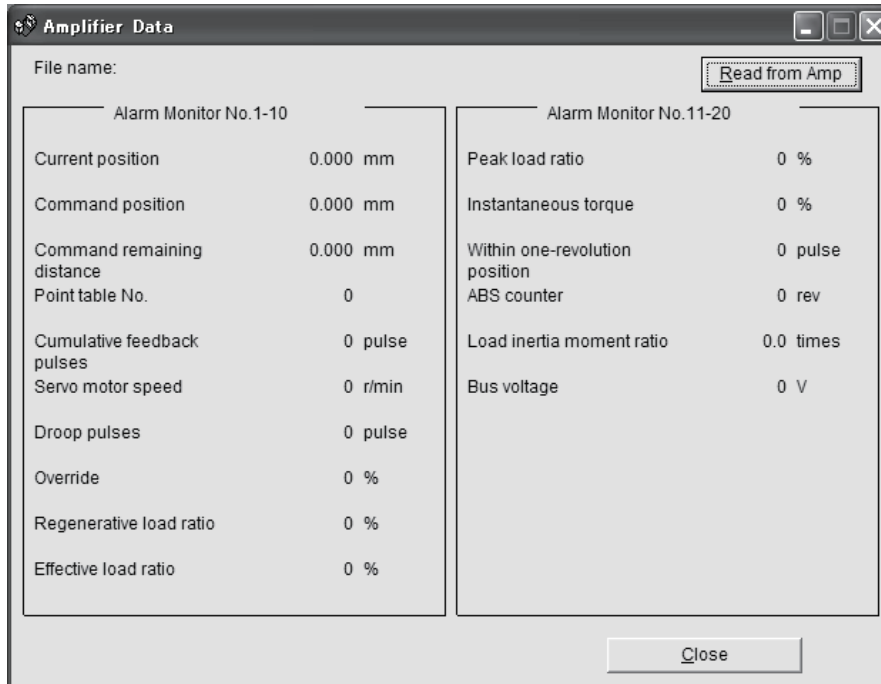
When the above choices are made, the following window appears:
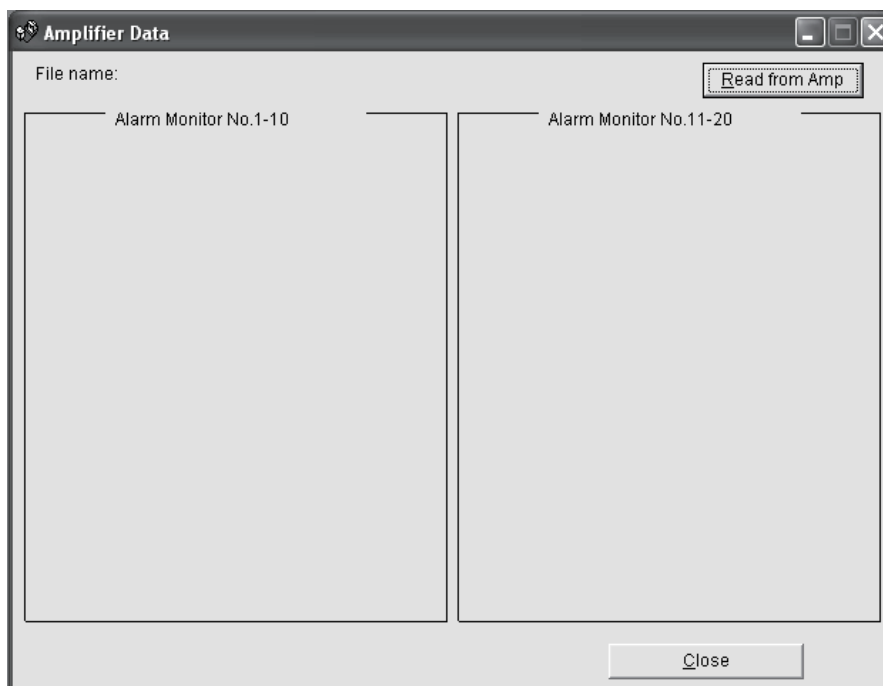
Click the "Read" button to read the monitor data at error occurrence from the servo amplifier. Read results are displayed as follows.

7.8.3 Alarm history

Click "Alarm" on the menu bar and click "History" on the menu.

When the above choices are made, the following window appears:

a)   b)
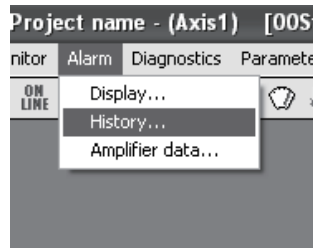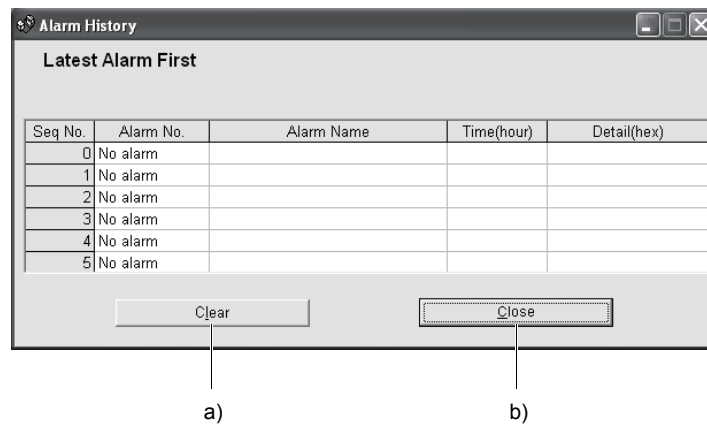
(1) Alarm history display
    The most recent six alarms are displayed. The smaller numbers indicate newer alarms.

(2) Alarm history clear (a))
    Click the "Clear" button to clear the alarm history stored in the servo amplifier.

(3) Closing of alarm history window (b))
    Click the "Close" button to close the window.

MEMO

8. PARAMETER UNIT (MR-PRU03)   8 - 1

POINT
・Do not use MR-PRU03 parameter unit and MR Configurator together.

Perform simple data setting, test operation, parameter setting, etc. without MR Configurator by connecting the MR-PRU03 parameter unit to the servo amplifier.

8.1 External appearance and key explanations

This section gives the external appearance and explanations of the keys.

Display
LCD (16 characters x 4 lines)
Used to display the following or others:
・Parameter setting
・Monitor

	Key	Key explanations
Mode key	MON	**Monitor mode key** ・Used to display the monitor screen.
	ALM/DGN	**Alarm/diagnosis mode** ・Used to display the alarm/DO forced output/diagnosis selection screen.
	DATA PARAM	**Parameter mode key** ・Used to display parameter selection screen. ・Press this key while holding down the "SHIFT" key to display the point table setting screen.
	TEST	**Test operation mode key** ・Used to display the exit/JOG operation/positioning operation/motor-less operation/DO forced output/single-step feed selection screen.
Operation key	Fn	**Function key** ・Used to perform various operations in the test operation mode. ・Used to display the parameter range and point table setting range.
	SHIFT	**SHIFT key** ・Used to enter hexadecimal values. Press the "4" to "9" keys while holding down the "SHIFT" key to enter A to F. ・Press the "▲▼" keys while holding down the "SHIFT" key to move to the previous or next screen.
	ESC	**ESC key** ・Used to display the screen at one step upper hierarchical level. (not the pervious screen) Used to display the setting selection screen (the initial screen) of the monitor mode.
	▲ ▼	**Scroll key** ・Used to move the cursor across the screen or scroll the screen. Press this key while holding down the "SHIFT" key to move to the previous or next screen. ・Used to change parameter No. or point table No.
Test Operation key	FWD	**Forward rotation key** ・Used to start the forward rotation in the tes operation mode (JOG operation/positioning operation).
	– REV	**Symbol key/reverse rotation key** ・Used to start the reverse rotation in the test operation mode (JOG operation/positioning operation). ・Used together with the "SHIFT" key to enter negative values. To exit the negative value entry mode, press the "SHIFT" key again and press the "-" key. ("-" disappears.)
	STOP RESET	**Stop/reset key** ・Used to stop temporarily in the JOG operation/positioning operation/single-step feed. ・The "RESET" key is valid when the "Fn" key is not pressed (i.e. at a stop). ・Used to reset alarms or alarm history, or clear cumulated monitor data or inputs. ・Normal operation cannot be stopped with this key.
Enter key	↵	**Enter key** ・Used to determine the selection, numerical values, etc. ・Used to determine to exit the test operation mode, or enter the motor-less operation. ・Used to switch ON/OFF in the DO output screen.
Numerical key	0 to F9	**Numerical keys** ・Used to enter parameter No., setting values, etc. ・Press the "4" to "9" keys while holding down the "SHIFT" key to enter A to F.
	1STEP .	**Decimal point key** ・Used to enter a decimal point. ・Used to start the single-step feed.

8.2 Specifications

Item		Description
Model		MR-PRU03
Power supply		Supplied from the servo amplifier
Functions	Parameter mode	Basic setting parameters, Gain/filter parameters, Extension setting parameters, I/O setting parameters
	Monitor mode (Status display)	Current position, Command position, Command remaining distance, Point table No., Feedback pulse value, Servo motor speed, Droop pulse value, Regenerative load factor, Effective load factor, Peak load factor, Instantaneous torque, Within one-revolution position, ABS counter, Load inertia moment ratio, Bus voltage
	Diagnosis mode	External I/O display, motor information
	Alarm mode	Current alarm, Alarm history
	Test operation mode	Jog operation, Positioning operation, DO forced output, Motor-less operation, Single-step feed
	Point table mode	Point data, Servo motor speed, Acceleration/deceleration time constant, Dwell, Auxiliary function
Display section		LCD system (16 characters × 4 lines)
Environment	Ambient temperature	−10 to +55℃ (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature range	−20 to +65℃ (non-freezing)
	Storage humidity range	90%RH or less (non-condensing)
	Ambience	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
Mass [g]		130

8.3 Outline dimension drawings

[Unit: mm]

Front face   Side face   Back face   Mounting hole dimension
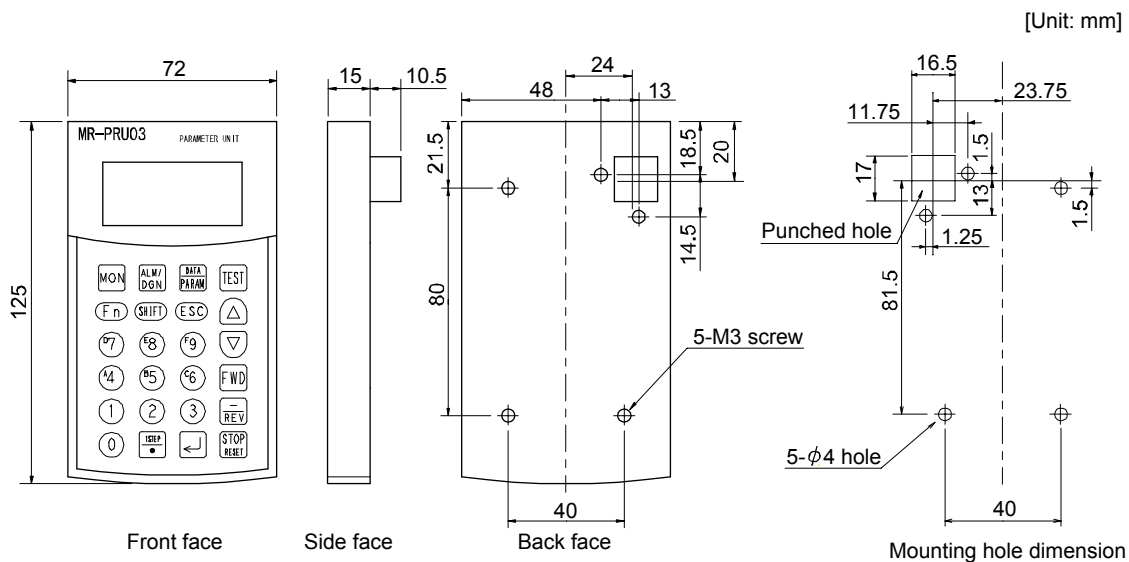
8.4 Connection with servo amplifier

8.4.1 Single axis

(1) Configuration diagram
    Operate the single-axis servo amplifier. It is recommended to use the following cable.

(2) Cable internal wiring diagram

Parameter unit (MR-PRU03) connector side			Servo amplifier CN3 connector (RJ45 connector)
GND	1	1	LG
+5V	2	2	P5
TXD+	3	3	RDP
RXD−	4	4	SDN
RXD+	5	5	SDP
TXD−	6	6	RDN
GND	7	7	LG
NC		8	NC

10m or less
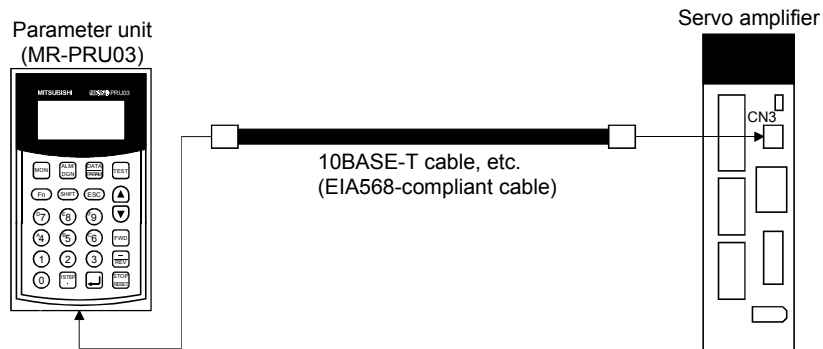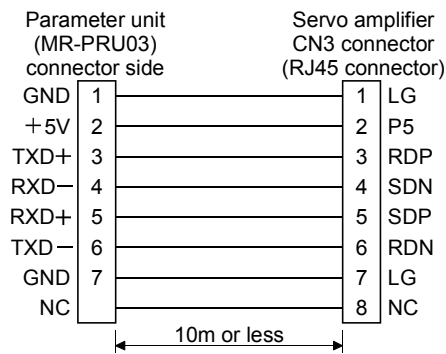
8.4.2 Multidrop connection

(1) Configuration diagram

Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.
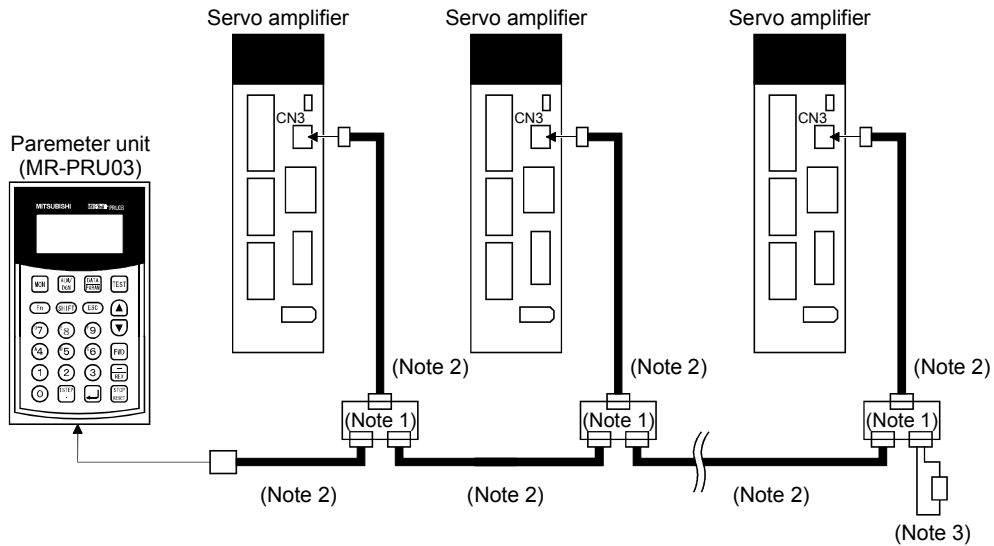
Note 1. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.
   2. Use the 10BASE-T cable (EIA568-compliant), etc.
   3. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

(2) Cable internal wiring diagram

Wire the cables as shown below.
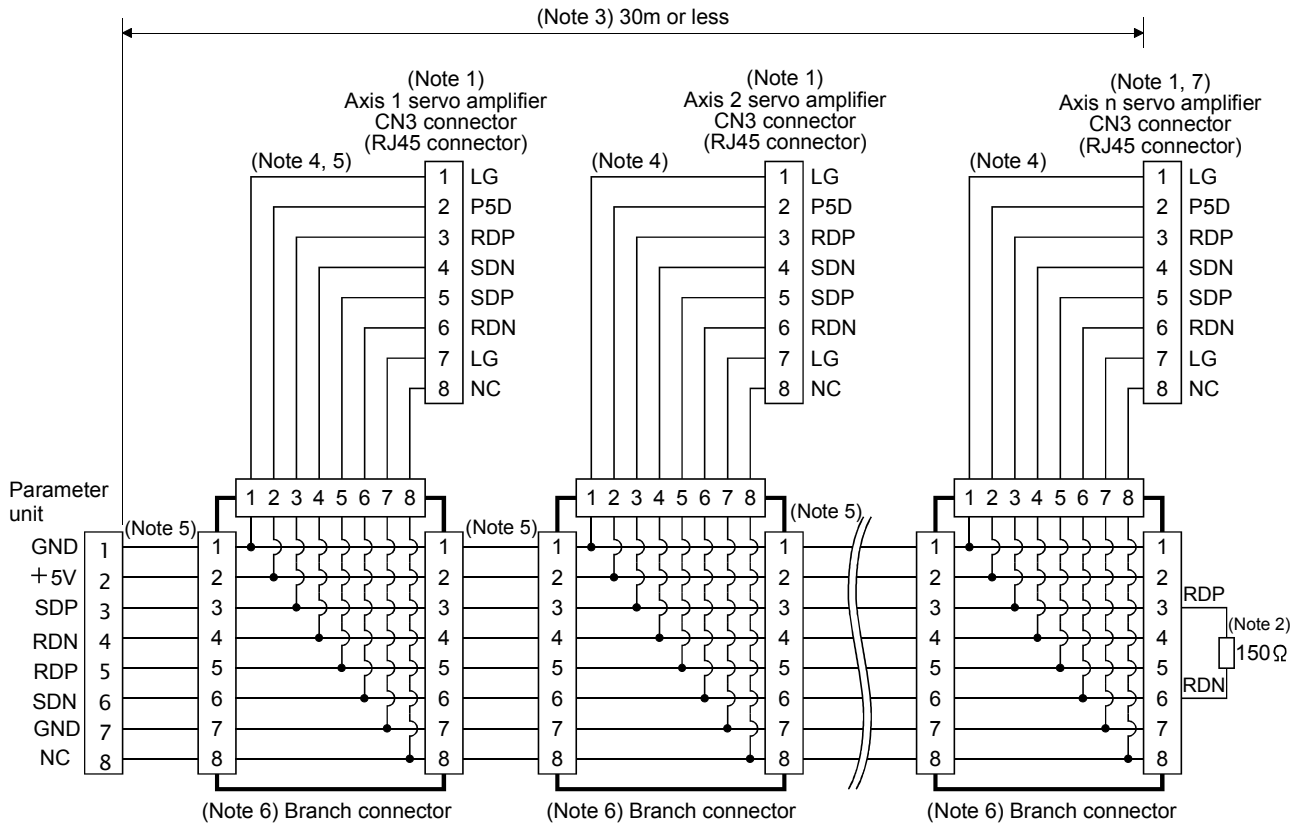
Note 1. Recommended connector (Hirose Electric)

      Plug: TM10P-88P

      Connection tool: CL250-0228-1

  2. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

  3. The overall length is 30m or less in low-noise environment.

  4. The wiring between the branch connector and servo amplifier should be as short as possible.

  5. Use the EIA568-compliant cable (10BASE-T cable, etc.).

  6. Recommended branch connector: BMJ-8 (Hakko Electric Machine Works)

  7. $n \leq 32$ (Up to 32 axes can be connected.)

8.5 Display

Connect the MR-PRU03 parameter unit to the servo amplifier, and turn ON the power of the servo amplifier. In this section, the screen transition of the MR-PRU03 parameter unit is explained, together with the operation procedure in each mode.

8.5.1 Outline of screen transition
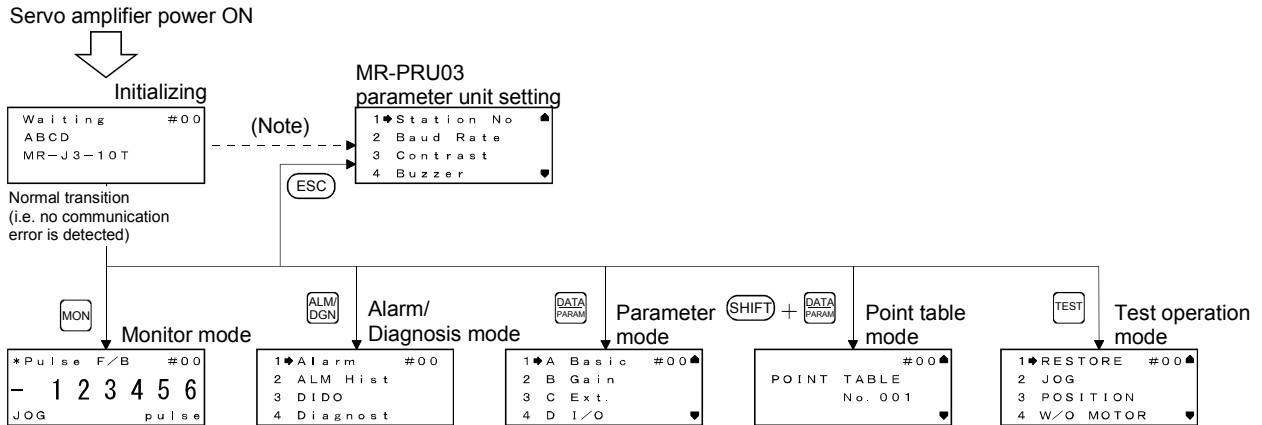
Note. If initialization communication fails, a communication error is displayed. Press the "ESC" key to return to the PRU setting screen.

8.5.2 MR-PRU03 parameter unit setting

MR-PRU03
parameter unit setting

```
1→Station No    ▲
2  Baud Rate
3  Contrast
4  Buzzer       ▼
```

Station number

```
Station No.
            00

0－31
```

Set and enter the station number.
(e.g. To enter 31st axis)

③①

```
Station No.
            00
            31
0－31
```

```
Station No.
            31
```

```
1  Station No    ▲
2→Baud Rate
3  Contrast
4  Buzzer        ▼
```

Baud rate selection

```
→■9600bps       ▲
  □19200bps
  □38400bps
  □57600bps     ▼
```

· Press the " ▲ ▼ " keys to select,
  and press the " ↵ " key to set.

```
1  Station No    ▲
2  Baud Rate
3→Contrast
4  Buzzer        ▼
```

Contrast adjustment

```
Contrast
            58
            58
0－63
```

· Press the " ▲ ▼ " keys to select
  from 0 to 63, and press the " ↵ " key

```
1  Station No    ▲
2  Baud Rate
3  Contrast
4→Buzzer         ▼
```

Buzzer

```
Buzzer
            0

0:OFF 1:ON
```

· Press the " ① " key to select ON or
  the " ⓪ " key to select OFF, and press
  the " ↵ " key to set.

```
5→Version        ▲
6  Close
```

Version info

```
Version

BCD－B41W000
            A1
```

· PRU03 software number is displayed.

```
5  Version       ▲
6→Close
```

```
Waiting      #00
ABCD
MR－J3－10T
```

Note. Press the "SHIFT" key and "ESC" key together on any screen to return to the station number setting screen.

8.5.3 Monitor mode (status display)

(1) Monitor display

The servo status during operation is shown on the display. Refer to (2) of this section for details.

	MON	
1. Current position	Cur posit #00 0.004 mm	11. Regenerative load ratio Regn Load #00 0 %
2. Command position	Cmd posit #00 0.000 mm	12. Effective load ratio Effc Load #00 0 %
3. Command remaining distance	Cmd remin #00 0.000 mm	13. Peak load ratio Peak Load #00 0 %
4. Point table No.	Pnttbl No #00 0	14. Instantaneous torque Instn Trq #00 0 %
5. Cumulative feedback pulses	Pulse F/B #00 3 pulse	15. Within one-revolution position Cyc posit #00 109549 pulse
6. Servo motor speed	Speed F/B #00 0 r/min	16. ABS counter Abs count #00 1 rev
7. Droop pulses	Droop Pls #00 0 pulse	17. Load inertia moment ratio Moment Rt #00 0.8
8. For manufacturer setting	Override #00 10.66 volt	18. Bus voltage P-N Volt #00 296 volt
9. For manufacturer setting	Override #00 100 %	19. For manufacturer setting Moni Out1 #00 0.00 volt
10. For manufacturer setting	Trq Limit #00 1.26 volt	20. For manufacturer setting Moni Out2 #00 0.00 volt
		21. For manufacturer setting ABpls F/B #00 0 pulse

(2) Monitor display list

The following table lists the items and descriptions of monitor display.

Status display	Display on parameter unit	Unit	Description	Display range
Current position	Cur posit	$\times 10^{STM}$ mm	The current position from the machine home position of 0 is displayed.	-9999999 to 9999999
Command position	Cmd Posit	$\times 10^{STM}$ mm	The command position is displayed.	-9999999 to 9999999
Command remaining distance	Cmd remin	$\times 10^{STM}$ mm	The command remaining distance of the currently selected point table is displayed.	-999999999 to 999999999
Point table No.	Pnttbl No		The point table No. being executed is displayed.	0 to 255
Cumulative feedback pulses	Pulse F/B	pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the value exceeds ±999999, characters are displayed smaller. Press the "RESET" key of the parameter unit to reset the display value to zero.	-999999999 to 999999999
Servo motor speed	Speed F/B	r/min	The servo motor speed is displayed. "-" is added to the speed of the servo motor rotating in the reverse rotation. The value rounded off is displayed in $\times 0.1$r/min.	-7200 to 7200
Droop pulse	Droop Pls	pulse	The number of droop pulses in the deviation counter is displayed. "- " is added to the reverse pulses. When the value exceeds ±999999, characters are displayed smaller. The number of pulses displayed is in the encoder pulse unit.	-999999999 to 999999999
Regenerative load ratio	Regn Load	%	The ratio of regenerative power to permissible regenerative power is displayed in %. When regenerative option is used, the ratio to the permissible regenerative power is displayed.	0 to 100
Effective load ratio	Effc Load	%	The continuous effective load current is displayed The effective value is displayed relative to the rated current of 100%.	0 to 300
Peak load ratio	Peak Load	%	The maximum torque is displayed. The highest value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 400
Instantaneous torque	Instn Trq	%	Torque that occurred instantaneously is displayed. The value of the torque that occurred is displayed in real time relative to the rate torque of 100%.	0 to 400
Within one-revolution position	Cyc posit	pulse	Position within one revolution is displayed in encoder pulses. The value returns to 0 when it exceeds the maximum number of pulses. The value is incremented in the CCW direction of rotation.	0 to 262143
ABS counter	Abs count	rev	Travel value from the home position in the absolute position detection systems is displayed in terms of the absolute position detectors counter value.	-32768 to 32767
Load inertia moment ratio	Moment Rt	times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0.0 to 300.0
Bus voltage	P-N Volt	V	The voltage (across P-N) of the main circuit converter is displayed.	0 to 450

8.5.4 Alarm/diagnostic mode

(1) Alarm display

　　The flowchart below shows the procedure of settings involving alarms, alarm history, external I/O signal (DIDO) display, device and diagnosis.

ALM/
DGN

Alarm

```
1 Alarm    #00
2 ALM Hist
3 DIDO
4 Diagnost
```

Current alarm
(When undervoltage (AL.10) occurred.)

```
AL10       #00
```

・The alarm number of the current alarm is displayed.
・This screen is displayed once an alarm occurred regardless of the display mode selected.

When parameter error (A37) occurred.

```
AL37       #00
PB10    PB11
PB12    PB16
Pos001 Spd255
```

・The parameter No. of the erroneous parameter is displayed when parameter error (A37) occurred.
・Parameter error (37) also occurs in response to a point table error. (Refer to Section 11.5.)

STOP
RESET

```
ALARM RESET #00

1:EXECUTION
0:CANCEL
```

・Alarms are reset by the error reset command. Press the "1" key to execute, or the "0" key to cancel.

Alarm history

```
1 Alarm    #00
2 ALM Hist
3 DIDO
4 Diagnost
```

```
0 AL10   20#00
  999999999h
1 AL32   20
       87600h
```

・For six alarms including the latest alarm and five other alarms in alarm history (0 to 5), their alarm numbers and energization time elapsed before the alarm occurrence are displayed.
・The alarm history can be cleared. (Refer to (2) in this section.)

I/O display

```
1 Alarm    #00
2 ALM Hist
3 DIDO
4 Diagnost
```

```
I □CN6-1   #00
I □CN6-2
I ■CN6-3
I □CN6-4
```

・ON/OFF status of DIDO is displayed.
　　■ : ON
　　□ : OFF

Diagnosis

```
1 Alarm
2 ALM Hist
3 DIDO
4 Diagnost
```

Software number

```
1 S/W No.   #00
2 MOTOR INF
3 P-ON TIME
```

```
S/W No.    #00

BCD-B35W400
        A0
```

・The software number is displayed.

Motor information

```
1 S/W No.   #00
2 MOTOR INF
3 P-ON TIME
```

```
MOTOR INF  #00
Serice      16
Type      F053
Encoder   0044
```

・The motor information is displayed.

Total power-on time

```
1 S/W No.   #00
2 MOTOR INF
3 P-ON TIME
```

```
P-ON TIME  #00
P-on time999999h
SW. times999999
```

・The total power-on time (P-on) and the number of power-on times (SW.) since shipped are displayed.

(2) Alarm history clear

The servo amplifier stores one current alarm and five past alarms from when its power is switched on first.
To control alarms which will occur during operation, clear the alarm history before starting operation.

ALM/
DGN

```
1➡A l a r m      # 0 0
2  A L M  H i s t
3  D I D O
4  D i a g n o s t
```

▼

↑▲

```
1  A l a r m      # 0 0
2➡A L M  H i s t
3  D I D O
4  D i a g n o s t
```
· Select "ALM Hist".

↵

```
0  A L 1 0    2 0 # 0 0▲
        9 9 9 9 9 9 9 9 9 h
1  A L 3 2    2 0
              8 7 6 0 0 h▼
```
· For six alarms including the latest
  alarm and five other alarms in
  alarm history (0 to 5), their alarm
  numbers and energization time
  elapsed before the alarm
  occurrence are displayed.

STOP
RESET

```
A L R A M  R E S E T

1 : E X E C U T E
0 : C A N C E L
```
· The alarm history clear menu is
  displayed.
· Select "1" to clear the alarm
  history.

1)

```
0  A L ― ―      # 0 0▲

1  A L ― ―
                      ▼
```

8.5.5 Parameter mode

The flowchart below shows the procedure for setting parameters.

Select a parameter group.

e.g. To select the gain/filter parameter, press:

e.g. To select parameter No. PB10, press:

e.g. To set setting value "1234", press:

- First parameter number is displayed.

- The parameter number, abbreviation and setting value are displayed.
- Press the "Fn" key to display the range.

Write

- Write is completed.
- The following message appears if switching power off or on is needed to enable the setting.

8.5.6 Point table mode

The flowchart below shows the procedure for setting point table data.

Note. This applies to all types of data.

8.5.7 Test operation mode

⚠ CAUTION	・When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates. ・If any operational fault has occurred, stop operation using the forced stop (EMG).

POINT
・The test operation mode cannot be used in the absolute position detection system. Use it after choosing "□□□0" in parameter No. PA03. ・Test operation cannot be performed if the servo-on signal is not turned OFF.

Exiting test/JOG operation/positioning operation/motor-less operation/DO forced stop/single-step feed can be performed in this mode. The following shows how to set each operation.
When the servo motor equipped with electromagnetic brake is used, make sure to program a sequence circuit which will operate the electromagnetic brake by the servo amplifier electromagnetic brake interlock (MBR).
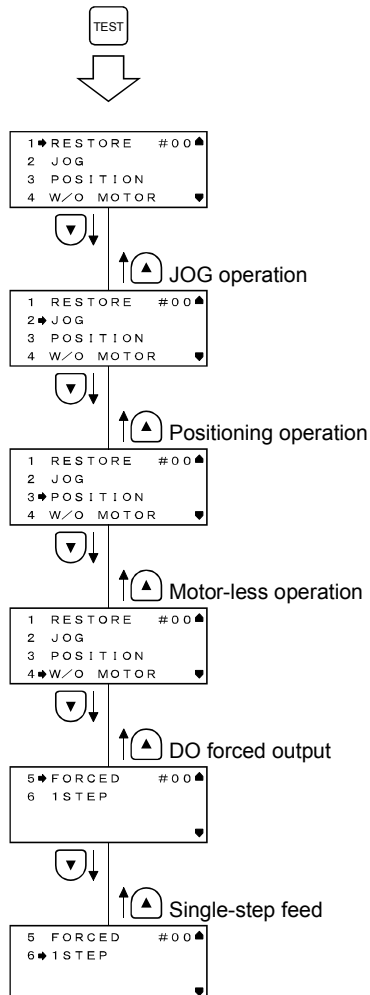
(1) Jog operation

Jog operation can be performed when there is no command from the external command device.

Connect EMG-DOCOM to start jog operation.

(a) Operation/cancel

You can change the operation conditions with the parameter unit. The initial conditions and setting ranges for operation are listed below:

Item	Initial setting	Setting range
Speed [r/min]	200	0 to instantaneous permissible speed
(Note) Acceleration/deceleration time constant [ms]	1000	0 to 20000

Note. Acceleration time constant refers to time required to reach the rated speed from stop status (0r/min), and deceleration time constant refers to time required to reach 0r/min from the rated speed.

The following shows the operation condition settings and the operation procedures.
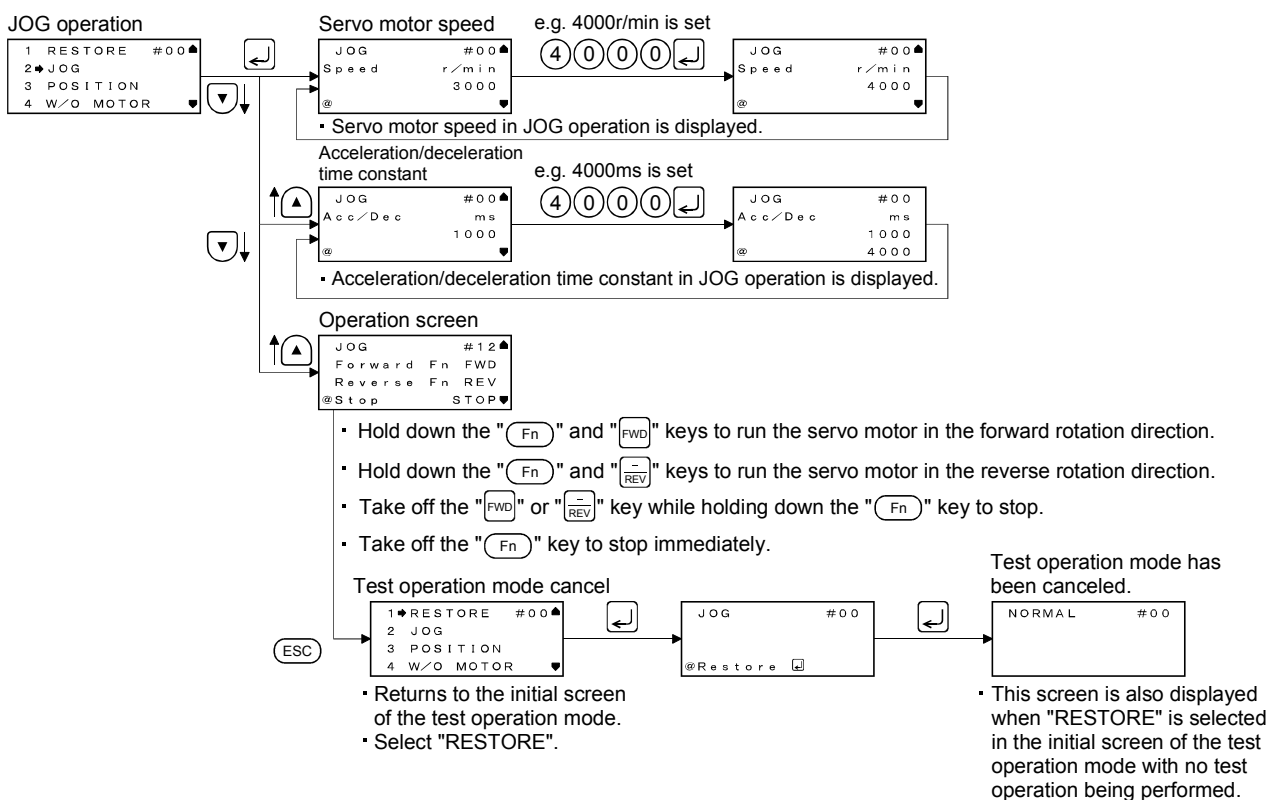
If the parameter unit cable is disconnected during jog operation, the servo motor will be decelerated to a stop.

(b) Status display

You can monitor the status display even during JOG operation. At this time, the "FWD", "REV" and "STOP" keys can be used.

(2) Positioning operation

Positioning operation can be performed once when there is no command from the external command device.

Connect EMG-DOCOM to start positioning operation.

(a) Operation/cancel

You can change the operation conditions with the parameter unit. The initial conditions and setting ranges for operation are listed below:

Item	Initial setting	Setting range
Speed [r/min]	200	0 to instantaneous permissible speed
(Note 2) Acceleration/deceleration time constant [ms]	1000	0 to 20000
(Note 1) Travel distance [pulse]	4000	0 to 99999999

Note 1. The unit of move distance can be changed using feed length multiplication factor selection of parameter No. PA05.

2. Acceleration time constant refers to time required to reach the rated speed from stop status (0r/min), and deceleration time constant refers to time required to reach 0r/min from the rated speed.

The following shows the operation condition settings and the operation procedures.

· Press the "Fn" and "FWD" keys to start rotating the servo motor in the forward direction. When the preset move distance is reached, the servo motor stops.

· Press the "Fn" and "REV" keys to start rotating the servo motor in the reverse direction. When the preset move distance is reached, the servo motor stops.

· Press the "STOP/RESET" key to stop the motor temporarily, and press the "Fn" or "REV" key to restart.

· Take off the "Fn" key to stop the motor immediately and clear the remaining distance.

8 - 17
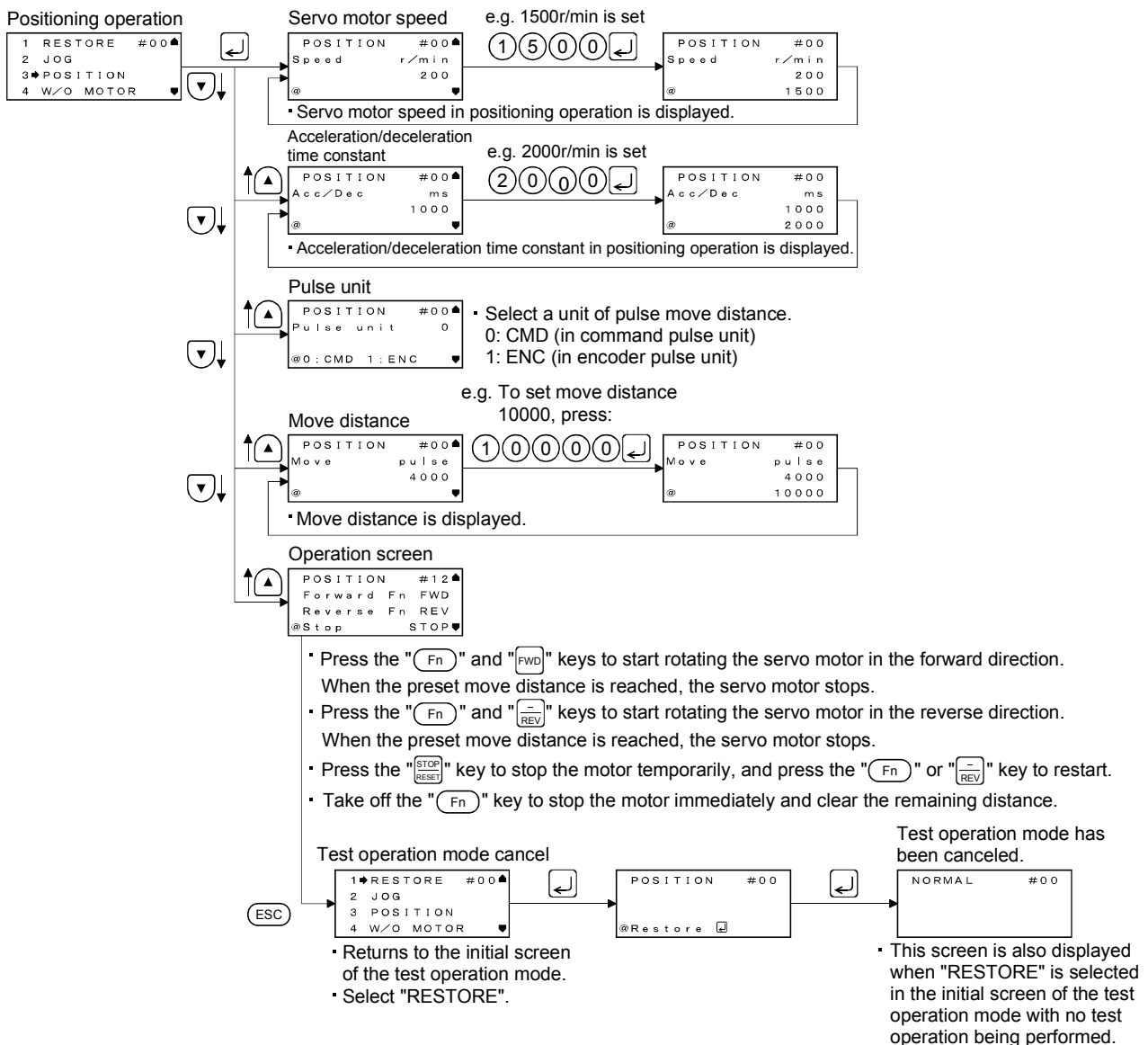
If the communication cable is disconnected during positioning operation, the servo motor will come to a sudden stop.

(b) Status display

You can monitor the status display even during positioning operation. At this time, the "FWD", "REV" and "STOP" keys can be used.

(3) Motor-less operation

Without connecting the servo motor, you can provide output signals or monitor the status display as if the servo motor is running in response to external input signals. This operation can be used to check the sequence of a servo system controller or the like.

(a) Operation/cancel

After turning off the SON signal, choose motor-less operation. After that, perform external operation as in ordinary operation.

The following shows the operation procedures.
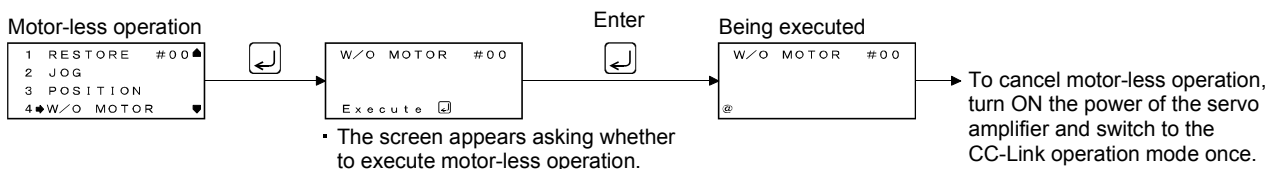
(b) Status display

You can monitor the status display even during motor-less operation.

(4) DO forced output

Each output signal can be forced on/off independently of the servo status. This function is used for the servo wiring check, etc.

Connect EMG-DOCOM to start DO forced output.

The following shows the operation procedures.
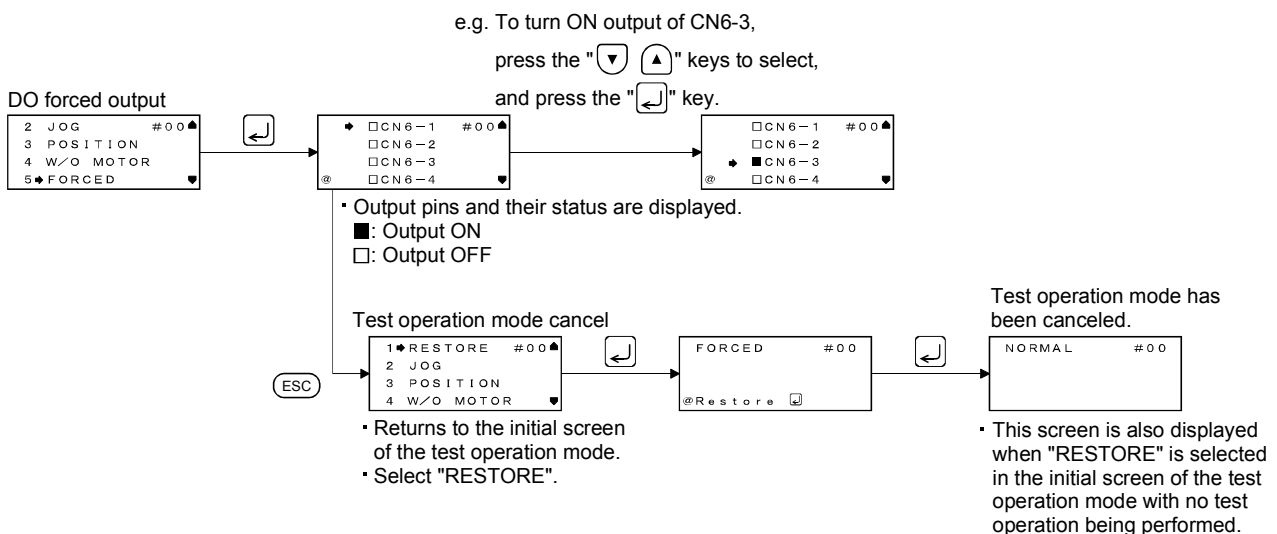
(5) Single-step feed

Operation is performed in accordance with the preset point table No.

Connect EMG-DOCOM to start single-step feed.

The following shows the operation condition settings and the operation procedures.
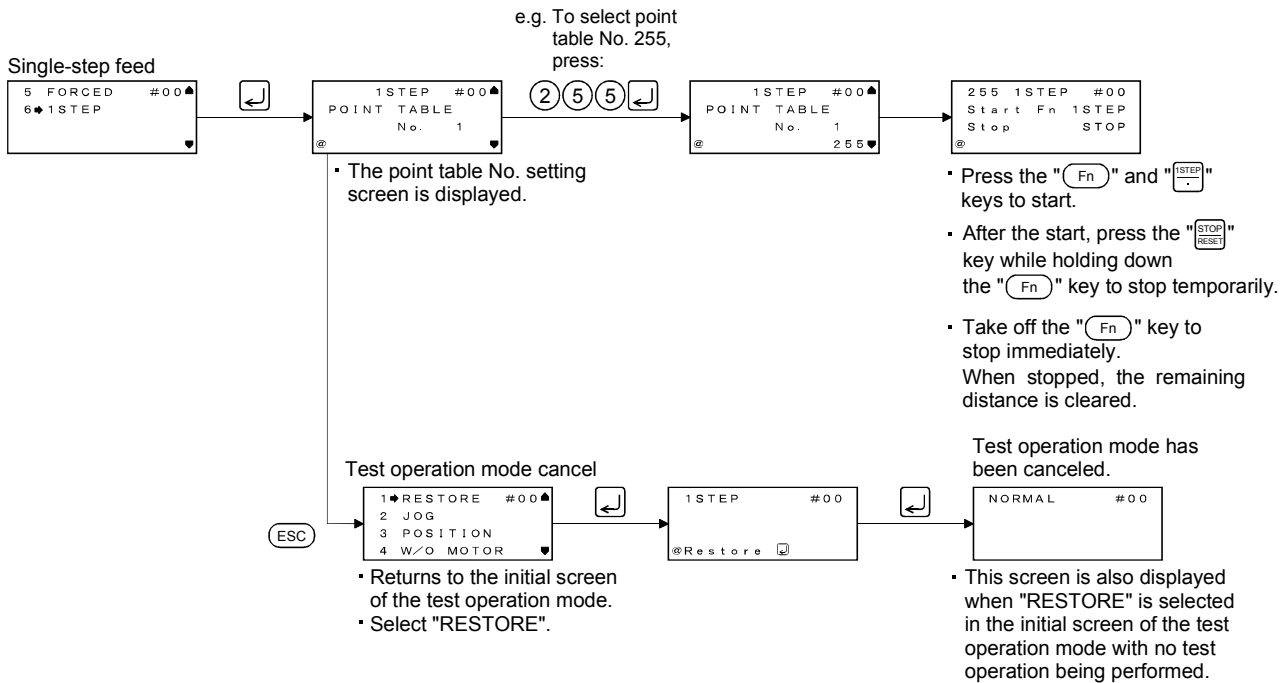
8.6 Error Message List

When using the MR-PRU03 parameter unit, the following error messages may be displayed. When displayed, refer to this section to remove cause.

(1) Error messages

Operation	Message	Cause
Communication error	```COMMUNICATION #00 ERROR PUSH ESC```	1. Hardware reason 2. Mismatch in station number 3. Mismatch in baud rate
Setting error	```PB10 #00 VIC 1234 INPUT ERR.```	Incorrect input, etc.
Write error	```PB10 #00 VIC 1234 WRITE ERR.```	Value is written while write is disabled.
EEP-ROM write error	```EEPROM ERR. #00 PUSH ESC```	1. Parts in the MR-PRU03 parameter unit are faulty. 2. EEP-ROM built in the MR-PRU03 parameter unit has been overwritten more than 100000 times.

(2) Messages

Message	Description
#00 Power off PUSH ESC	Valid parameters were written when power is off.
#00 DO NOT CHANGE STATION NO PUSH ESC	The MR-PRU03 parameter unit was used to set a station number and perform transition during the test operation mode.
#00 SET TEST DRIVE DIFFER PUSH ESC	Operation mode is the test operation mode.
#00 TEST MODE CHANGED PUSH ESC	The test mode was changed due to external factor.
#00 DO NOT READ PARAMETER PUSH ESC	Reading settings specified for the parameter write disable (parameter No. PA19) was attempted.
TEST DRIVE ON PUSH ESC	In the test operation, the "ESC" key was pressed while the "Fn" key was held down to switch the screen to the MR-PRU03 parameter unit setting screen.
SERVO NOT READY PUSH ESC	The ready cannot be turned ON due to alarm, etc.
#12 SON ON PUSH ESC	Operation mode can be switched to the test operation mode at servo-on.
#12 DO NOT CHANGE STATION NO PUSH ESC	Station number change was attempted in the test operation mode.
#12 DO NOT WRITE BLOCK NUMBER PUSH ESC	Point table No. change was attempted in the single-step feed operation.

9. GENERAL GAIN ADJUSTMENT

9.1 Different adjustment methods

9.1.1 Adjustment on a single servo amplifier

The gain adjustment in this section can be made on a single servo amplifier. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2 and manual mode in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	Parameter No. PA08 setting	Estimation of load inertia moment ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	0001	Always estimated	GD2 (parameter No. PB06) PG2 (parameter No. PB08) PG1 (parameter No. PB07) VG2 (parameter No. PB09) VIC (parameter No. PB10)	Response level setting of parameter No. 2
Auto tuning mode 2	0002	Fixed to parameter No. PB06 value	PG2 (parameter No. PB08) PG1 (parameter No. PB07) VG2 (parameter No. PB09) VIC (parameter No. PB10)	GD2 (parameter No. PB06) Response level setting of parameter No. PA09
Manual mode	0003			PG1 (parameter No. PB07) GD2 (parameter No. PB06) VG2 (parameter No. PB09) VIC (parameter No. PB10)
Interpolation mode	0000	Always estimated	GD2 (parameter No. PB06) PG2 (parameter No. PB08) VG2 (parameter No. PB09) VIC (parameter No. PB10)	PG1 (parameter No. PB07)

(2) Adjustment sequence and mode usage

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

9.1.2 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.

9.2 Auto tuning

9.2.1 Auto tuning mode

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

(1) Auto tuning mode 1
    The servo amplifier is factory-set to the auto tuning mode 1.
    In this mode, the load inertia moment ratio of a machine is always estimated to set the optimum gains automatically.
    The following parameters are automatically adjusted in the auto tuning mode 1.

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

POINT
・The auto tuning mode 1 may not be performed properly if the following conditions are not satisfied.
・Time to reach 2000r/min is the acceleration/deceleration time constant of 5s or less.
・Speed is 150r/min or higher.
・The ratio of load inertia moment to servo motor inertia moment is 100 times or less.
・The acceleration/deceleration torque is 10% or more of the rated torque.
・Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode to make gain adjustment.

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

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

9.2.2 Auto tuning mode operation

The block diagram of real-time auto tuning is shown below.
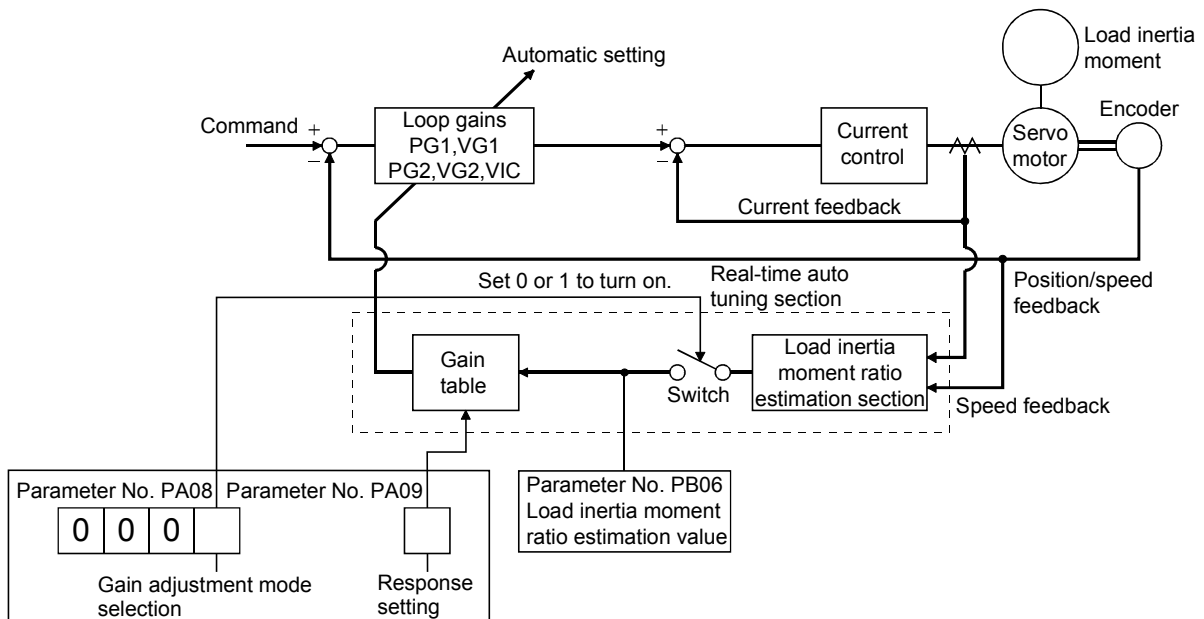
When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No. PB06 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the servo configuration software section.

If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, chose the "auto tuning mode 2" (parameter No. PA08: 0002) to stop the estimation of the load inertia moment ratio (Switch in above diagram turned off), and set the load inertia moment ratio (parameter No. 34) manually.

From the preset load inertia moment ratio (parameter No. PB06) value and response level (parameter No. PA09), the optimum loop gains are automatically set on the basis of the internal gain tale.

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

POINT

- If sudden disturbance torque is imposed during operation, the estimation of the inertia moment ratio may malfunction temporarily. In such a case, choose the "auto tuning mode 2" (parameter No. PA08: 0002) and set the correct load inertia moment ratio in parameter No. PB06.

- When any of the auto tuning mode 1 and auto tuning mode settings is changed to the manual mode 2 setting, the current loop gains and load inertia moment ratio estimation value are saved in the EEP-ROM.

9.2.3 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.

```
              ┌──────────────────────────────┐
              │   Auto tuning adjustment      │
              └──────────────────────────────┘
                            │
              ┌──────────────────────────────┐
              │ Acceleration/deceleration     │
              │ repeated                      │
              └──────────────────────────────┘
                            │
  Yes                 ◇ Load inertia moment ratio
  ┌─────────────────── estimation value stable? ◇
  │                           │ No
  │                 ◇ Auto tuning
  │                   conditions not satisfied.    No
  │                   (Estimation of load inertia ──────┐
  │                   moment ratio is difficult) ◇      │
  │                           │ Yes                     │
  │          ┌──────────────────────────────┐          │
  │          │ Choose the auto tuning mode 2 │          │
  │          │ (parameter No. PA08 : 0002) and│         │
  │          │ set the load inertia moment ratio│       │
  │          │ (parameter No. PB06) manually. │         │
  │          └──────────────────────────────┘          │
  │                           │                         │
  └──────────┐                │                         │
             ┌──────────────────────────────┐          │
             │ Adjust response level setting  │         │
             │ so that desired response is    │         │
             │ achieved on vibration-free level.│       │
             └──────────────────────────────┘          │
                            │◄───────────────────────────┘
             ┌──────────────────────────────┐
             │ Acceleration/deceleration     │
             │ repeated                      │
             └──────────────────────────────┘
                            │
                 ◇ Requested            No
                   performance satisfied? ◇ ──────┐
                            │ Yes                   │
              ┌──────────────┐          ┌──────────────────┐
              │    END        │          │  To manual mode   │
              └──────────────┘          └──────────────────┘
```

9.2.4 Response level setting in auto tuning mode

Set the response (The first digit of parameter No. PA09) of the whole servo system. As the response level setting is increased, the track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range.

If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100Hz, filter tuning mode (parameter No. PB01) or machine resonance suppression filter (parameter No. PB13 to PB16) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 10.3 for filter tuning mode and machine resonance suppression filter.

Setting of parameter No. PA09

Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	10.0	
2		11.3	
3		12.7	
4		14.3	
5		16.1	
6		18.1	
7		20.4	
8		23.0	
9		25.9	
10		29.2	
11		32.9	
12		37.0	
13		41.7	
14		47.0	
15		52.9	
16	Middle	59.6	
17		67.1	
18		75.6	
19		85.2	
20		95.9	
21		108.0	
22		121.7	
23		137.1	
24		154.4	
25		173.9	
26		195.9	
27		220.6	
28		248.5	
29		279.9	
30		315.3	
31		355.1	
32	High	400.0	

Large conveyor

Arm robot

General machine tool conveyor

Precision working machine

Inserter Mounter Bonder

9.3 Manual mode 1 (simple manual adjustment)

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

```
┌─────────────────────────────────────────────────────────────────────┐
│  POINT                                                                │
│  ・If machine resonance occurs, filter tuning mode (parameter         │
│    No. PB01) or machine resonance suppression filter (parameter       │
│    No. PB13 to PB16) may be used to suppress machine resonance.       │
│    (Refer to section 10.1.)                                           │
└─────────────────────────────────────────────────────────────────────┘
```

(1) For speed control

    (a) Parameters

        The following parameters are used for gain adjustment:

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

    (b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 9.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the model loop gain, and return slightly if overshooting takes place.	Increase the model loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with filter tuning mode or machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance. Refer to section 10.2, 10.3.
9	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed loop gain (parameter No. PB09)

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

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

2) Speed integral compensation (VIC: parameter No. PB10)

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

$$\text{Speed integral compensation setting(ms)} \geq \frac{2000 \text{ to } 3000}{\text{Speed loop gain setting/ (1+ratio of load inertia moment to servo motor inertia moment setting}\times 0.1)}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

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

9. GENERAL GAIN ADJUSTMENT

(2) For position control

  (a) Parameters

    The following parameters are used for gain adjustment:

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

  (b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 9.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain and the position loop gain. Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the position loop gain, and return slightly if vibration takes place.	Increase the position loop gain.
8	Increase the model loop gain, and return slightly if overshooting takes place.	Increase the position loop gain.
9	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with filter tuning mode or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to section 10.2・10.3.
10	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment.

(c) Adjustment description

1) Speed loop gain (VG2: parameter No. PB09)

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

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

2) Speed integral compensation (VIC: parameter No. PB10)

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

$$\text{Speed integral compensation setting(ms)} \geq \frac{2000 \text{ to } 3000}{\text{Speed loop gain 2 setting}/(1 + \text{ratio of load inertia moment to servo motor inertia moment 2 setting})}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

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

4) Model loop gain (PG1: parameter No. PB07)

This parameter determines the response level to a position command. Increasing position loop gain 1 improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain 2 setting}}{(1 + \text{ratio of load inertia moment to servo motor inertia moment})} \times \left(\frac{1}{4} \text{ to } \frac{1}{8}\right)$$

9.4 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, the model loop gain and speed loop gain which determine command track ability are set manually and the other parameter for gain adjustment are set automatically.

(1) Parameter

    (a) Automatically adjusted parameters

        The following parameters are automatically adjusted by auto tuning.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

    (b) Manually adjusted parameters

        The following parameters are adjustable manually.

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain

(2) Adjustment procedure

Step	Operation	Description
1	Set to the auto tuning mode.	Select the auto tuning mode 1.
2	During operation, increase the response level setting (parameter No. PA09), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of model loop gain.	Check the upper setting limits.
4	Set the interpolation mode (parameter No. PA08: 0000).	Select the interpolation mode.
5	Set the model loop gain of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest model loop gain.	Set position loop gain.
6	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

    (a) Model loop gain (parameter No. PB07)

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

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

9.5 Differences between MELSERVO-J2-Super and MELSERVO-J3 in auto tuning

To meet higher response demands, the MELSERVO-J3 series has been changed in response level setting range from the MR-J2-Super. The following table lists comparison of the response level setting.

MELSERVO-J2-Super		MELSERVO-J3	
Parameter No. 3 Setting	Guideline for Machine Resonance Frequency [Hz]	Parameter No. PA09 Setting	Guideline for Machine Resonance Frequency [Hz]
		1	10.0
		2	11.3
		3	12.7
□□□1	15	4	14.3
		5	16.1
		6	18.1
□□□2	20	7	20.4
		8	23.0
□□□3	25	9	25.9
□□□4	30	10	29.2
		11	32.9
□□□5	35	12	37.0
		13	41.7
□□□6	45	14	47.0
□□□7	55	15	52.9
		16	59.6
□□□8	70	17	67.1
		18	75.6
□□□9	85	19	85.2
		20	95.9
□□□A	105	21	108.0
		22	121.7
□□□B	130	23	137.1
□□□C	160	24	154.4
		25	173.9
□□□D	200	26	195.9
		27	220.6
□□□E	240	28	248.5
		29	279.9
□□□F	300	30	315.3
		31	355.1
		32	400.0

Note that because of a slight difference in gain adjustment pattern, response may not be the same if the resonance frequency is set to the same value.

10. SPECIAL ADJUSTMENT FUNCTIONS

> POINT
> ・The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 9.

If a mechanical system has a natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency.
Using the machine resonance suppression filter and adaptive tuning can suppress the resonance of the mechanical system.

10.1 Function block diagram
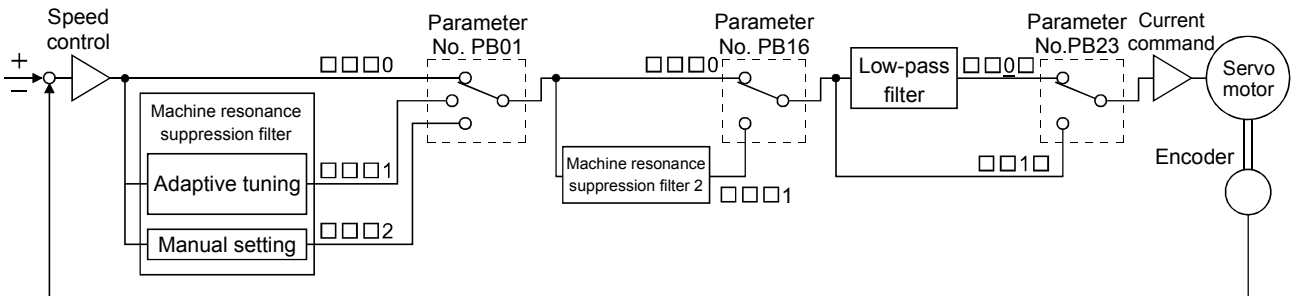
10.2 Adaptive filter Ⅱ

(1) Function

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

When machine resonance is large and frequency is low   When machine resonance is small and frequency is high
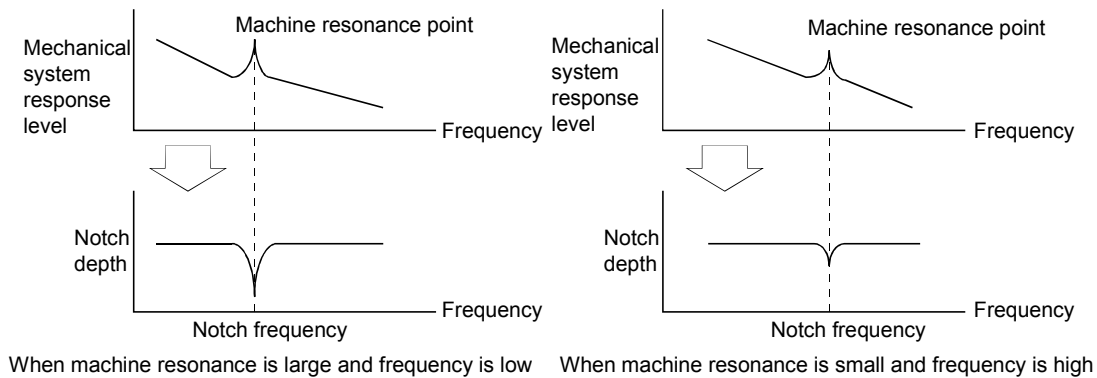
> POINT
> ・The machine resonance frequency which adaptive tuning mode can respond to is about 100 to 2.25kHz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range.
>
> ・Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics.

(2) Parameters

The operation of adaptive tuning mode (parameter No. PB01).

Parameter No.60

| 0 | 0 | 0 | |

└ Filter tuning mode selection

Setting	Filter adjustment mode	Automatically set parameter
0	Filter OFF	(Note)
1	Filter tuning mode	Parameter No. PB13 Parameter No. PB14
2	Manual mode	

Note. Parameter No. PB19 and PB20 are fixed to the initial values.

(3) Adaptive tuning mode procedure

```
           ┌─────────────────────────────────┐
           │   Adaptive tuning adjustment    │
           └─────────────────────────────────┘
                          │
                          ▼
           ┌─────────────────────────────────┐
           │           Operation             │◀────────────┐
           └─────────────────────────────────┘             │
                          │                                 │
      Yes                 ▼                                 │
  ┌─────────────< Is the target response >                 │
  │                     reached?                            │
  │                       │ No                              │
  │                       ▼                                 │
  │         ┌─────────────────────────────────┐            │
  │         │   Increase the response setting. │           │
  │         └─────────────────────────────────┘            │
  │                       │                                 │
  │                       ▼                      No         │
  │           < Has vibration or unusual noise >───────────┤
  │                     occurred?                           │
  │                       │ Yes                             │
  │                       ▼                                 │
  │         ┌─────────────────────────────────┐            │
  │         │ Execute or re-execute adaptive  │            │
  │         │ tuning. (Set parameter No. PB01 │            │
  │         │ to "0001".)                     │            │
  │         └─────────────────────────────────┘            │
  │                       │                                 │
  │                       ▼                                 │
  │         ┌─────────────────────────────────┐            │
  │         │ Tuning ends automatically after │            │
  │         │ the predetermined period of     │            │
  │         │ time. (Parameter No. PB01 turns │            │
  │         │ to "0002" or "0000".)           │            │
  │         └─────────────────────────────────┘            │
  │                       │                    Yes          │
  │           < Has vibration or unusual noise >───────────┘
  │                 been resolved?
  │                       │ No
  │          ┌────────────┴────────────┐
  │          ▼                         ▼
  │  ┌──────────────────┐   ┌──────────────────────┐
  │  │ Decrease the     │   │ Using the machine    │
  │  │ response until   │   │ analyzer, set the    │
  │  │ vibration or     │   │ filter manually.     │
  │  │ unusual noise is │   └──────────────────────┘
  │  │ resolved.        │              │
  │  └──────────────────┘              │
  │          │                         │
  └──────────┴─────────────────────────┤
                                        ▼
                          ┌─────────────────────────┐
                          │           End           │
                          └─────────────────────────┘
```

If assumption fails after tuning is executed at a large vibration or oscillation, decrease the response setting temporarily down to the vibration level and execute again.

Factor
・ The response has increased to the machine limit.
・ The machine is too complicated to provide the optimum filter.

POINT
· "Filter OFF" enables a return to the factory-set initial value.
· When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds.
· When adaptive tuning is executed, machine resonance is detected for a maximum of 10 seconds and a filter is generated. After filter generation, the adaptive tuning mode automatically shifts to the manual mode.
· Adaptive tuning generates the optimum filter with the currently set control gains. If vibration occurs when the response setting is increased, execute adaptive tuning again.
· During adaptive tuning, a filter having the best notch depth at the set control gain is generated. To allow a filter margin against machine resonance, increase the notch depth in the manual mode.

10.3 Machine resonance suppression filter

(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency), gain decreasing depth and width.
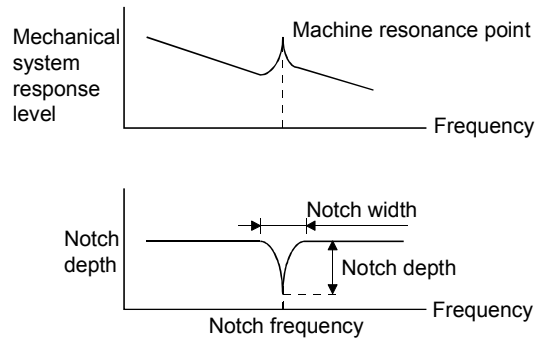
You can use the machine resonance suppression filter 1 (parameter No. PB13, PB14) and machine resonance suppression filter 2 (parameter No. PB15, PB16) to suppress the vibration of two resonance frequencies. Execution of adaptive tuning in the filter tuning mode automatically adjusts the machine resonance suppression filter. When adaptive tuning is ON, the adaptive tuning mode shifts to the manual mode after the predetermined period of time. The manual mode enables manual setting using the machine resonance suppression filter 1.
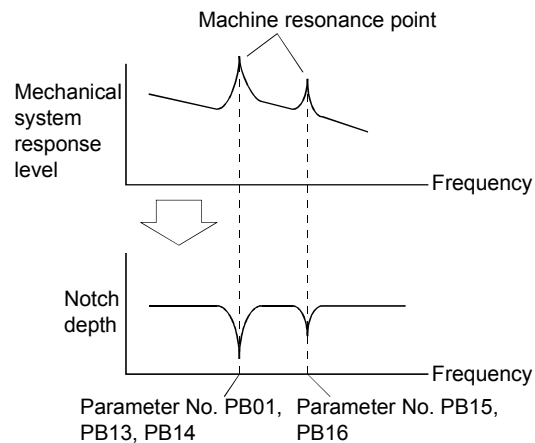
(2) Parameters

(a) Machine resonance suppression filter 1 (parameter No. PB13, PB14)

Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 (parameter No. PB13, PB14)

When you have made adaptive filter tuning mode (parameter No. PB01) "manual mode", set up the machine resonance suppression filter 1 becomes effective.

POINT
・ The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.
・ If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal.
・ A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
・ A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
・ The machine characteristic can be grasped beforehand by the machine analyzer on the MR Configurator (Servo configuration software). This allows the required notch frequency and depth to be determined.

10.4 Advanced vibration suppression control

(1) Operation

Vibration suppression control is used to further suppress machine end vibration, such as workpiece end vibration and base shake. The motor side operation is adjusted for positioning so that the machine does not shake.

Vibration suppression control OFF   Vibration suppression control ON
(Normal control)
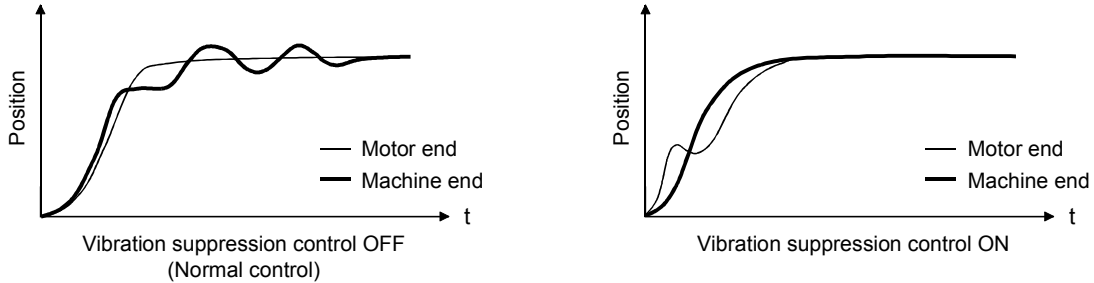
When the advanced vibration suppression control (vibration suppression control tuning mode parameter No. PB02) is executed, the vibration frequency at machine end can automatically be estimated to suppress machine end vibration.

In the vibration suppression control tuning mode, this mode shifts to the manual mode after operation is performed the predetermined number of times. The manual mode enables manual setting using the vibration suppression control vibration frequency setting (parameter No. PB19) and vibration suppression control resonance frequency setting (parameter No. PB20).

(2) Parameter

Select the operation of the vibration suppression control tuning mode (parameter No. PB02).

Parameter No. PB02

```
0 | 0 | 0 |   |
```

Vibration suppression control
tuning mode

Setting	Vibration Suppression Control Tuning Mode	Automatically Set Parameter
0	Vibration suppression control OFF	(Note)
1	Vibration suppression control tuning mode (Advanced vibration suppression control)	Parameter No. PB19 Parameter No. PB20
2	Manual mode	

Note. Parameter No. PB19 and PB20 are fixed to the initial values.

> **POINT**
> - The function is made valid when the auto tuning mode (parameter No. PA08) is the auto tuning mode 2 ("0002") or manual mode ("0003").
> - The machine resonance frequency supported in the vibration suppression control tuning mode is 1.0Hz to 100.0Hz. The function is not effective for vibration outside this range.
> - Stop the motor before changing the vibration suppression control-related parameters (parameter No. PB02, PB19, PB20, PB33, PB34). A failure to do so will cause a shock.
> - For positioning operation during execution of vibration suppression control tuning, provide a stop time to ensure a stop after full vibration damping.
> - Vibration suppression control tuning may not make normal estimation if the residual vibration at the motor end is small.
> - Vibration suppression control tuning sets the optimum parameter with the currently set control gains. When the response setting is increased, set vibration suppression control tuning again.

(3) Vibration suppression control tuning mode procedure

```
         ┌─────────────────────────┐
         │ Vibration suppression control │
         │   tuning adjustment      │
         └─────────────────────────┘
                    │
                    ▼
         ┌─────────────────────────┐
         │        Operation         │◄──────────┐
         └─────────────────────────┘           │
                    │                            │
                    ▼                            │
  Yes      ╱────────────────╲                    │
  ◄────────   Is the target response             │
            ╲    reached?    ╱                    │
             ╲──────────────╱                     │
                    │ No                          │
                    ▼                             │
         ┌─────────────────────────┐             │
         │ Increase the response setting. │       │
         └─────────────────────────┘             │
                    │                             │
                    ▼                             │
         ╱────────────────╲         No            │
        ╱ Has vibration of workpiece ╲────────────┤
        ╲  end/device increased?     ╱            │
         ╲──────────────────────────╱             │
                    │ Yes                          │
                    ▼                              │
         ┌─────────────────────────┐              │
         │      Stop operation.     │              │
         └─────────────────────────┘              │
                    │                              │
                    ▼                              │
         ┌─────────────────────────┐              │
         │ Execute or re-execute vibration │       │
         │ suppression control tuning. (Set │      │
         │ parameter No. PB02 to "0001".)  │       │
         └─────────────────────────┘              │
                    │                              │
                    ▼                              │
         ┌─────────────────────────┐              │
         │     Resume operation.    │              │
         └─────────────────────────┘              │
                    │                              │
                    ▼                              │
         ┌─────────────────────────┐              │
         │ Tuning ends automatically after │       │
         │ operation is performed the │            │
         │ predetermined number of times. │        │
         │ (Parameter No. PB02 turns to "0002" │   │
         │ or "0000".)             │              │
         └─────────────────────────┘              │
                    │                              │
                    ▼                              │
         ╱────────────────────────╲    Yes         │
        ╱ Has vibration of workpiece ╲─────────────┘
        ╲ end/device been resolved?  ╱
         ╲──────────────────────────╱
                    │ No
          ┌─────────┴─────────┐
          ▼                   ▼
```

Decrease the response until vibration of workpiece end/device is resolved.	Using the machine analyzer or from machine end vibration waveform, set the vibration suppression control manually.

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

```
                    │
                    ▼
             ┌────────────┐
             │    End     │
             └────────────┘
```

(4) Vibration suppression control manual mode

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

(a) When a vibration peak can be confirmed using MR Configurator, machine analyzer or external FFT equipment
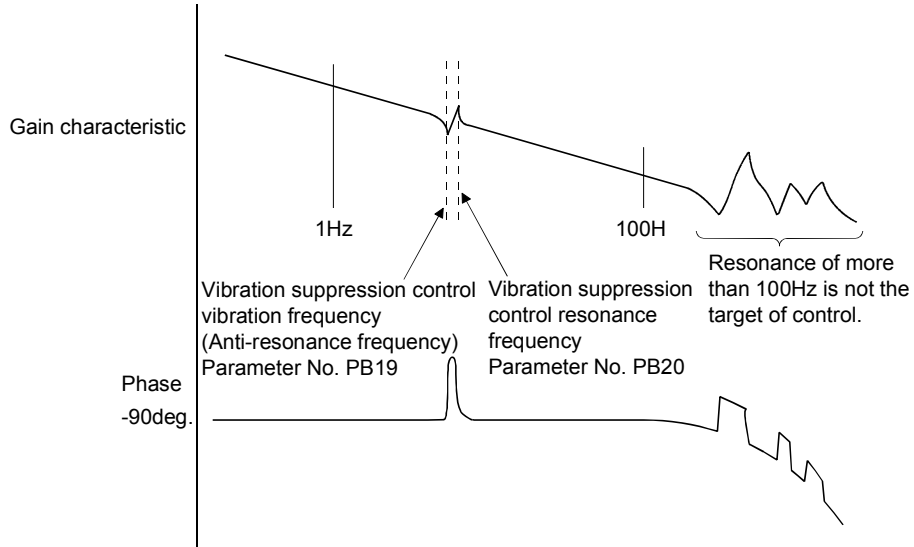
(b) When vibration can be confirmed using monitor signal or external sensor

POINT

・When machine end vibration does not show up in motor end vibration, the setting of the motor end vibration frequency does not produce an effect.

・When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external FFT device, do not set the same value but set different values to improve the vibration suppression performance.

・A vibration suppression control effect is not produced if the relationship between the model loop gain (parameter No. PB07) value and vibration frequency is as indicated below. Make setting after decreasing PG1, e.g. reduce the response setting.

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

10.5 Low-pass filter

(1) Function

When a ballscrew 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:

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

When parameter No. PB23 is set to " □ □ 1 □ ", manual setting can be made with parameter No. PB18.

(2) Parameter

Set the operation of the low-pass filter selection (parameter No. PB23.)

Parameter No. PB23

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

10.6 Gain changing function

This function can change the gains. You can change between gains during rotation and gains during stop or can use an external signal to change gains during operation.

10.6.1 Applications

This function is used when:
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.
(2) You want to increase the gains during settling to shorten the stop settling time.
(3) You want to change the gains using an external signal 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).

10.6.2 Function block diagram

The valid loop gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection CDP (parameter No. PB26) and gain changing condition CDS (parameter No. PB27).
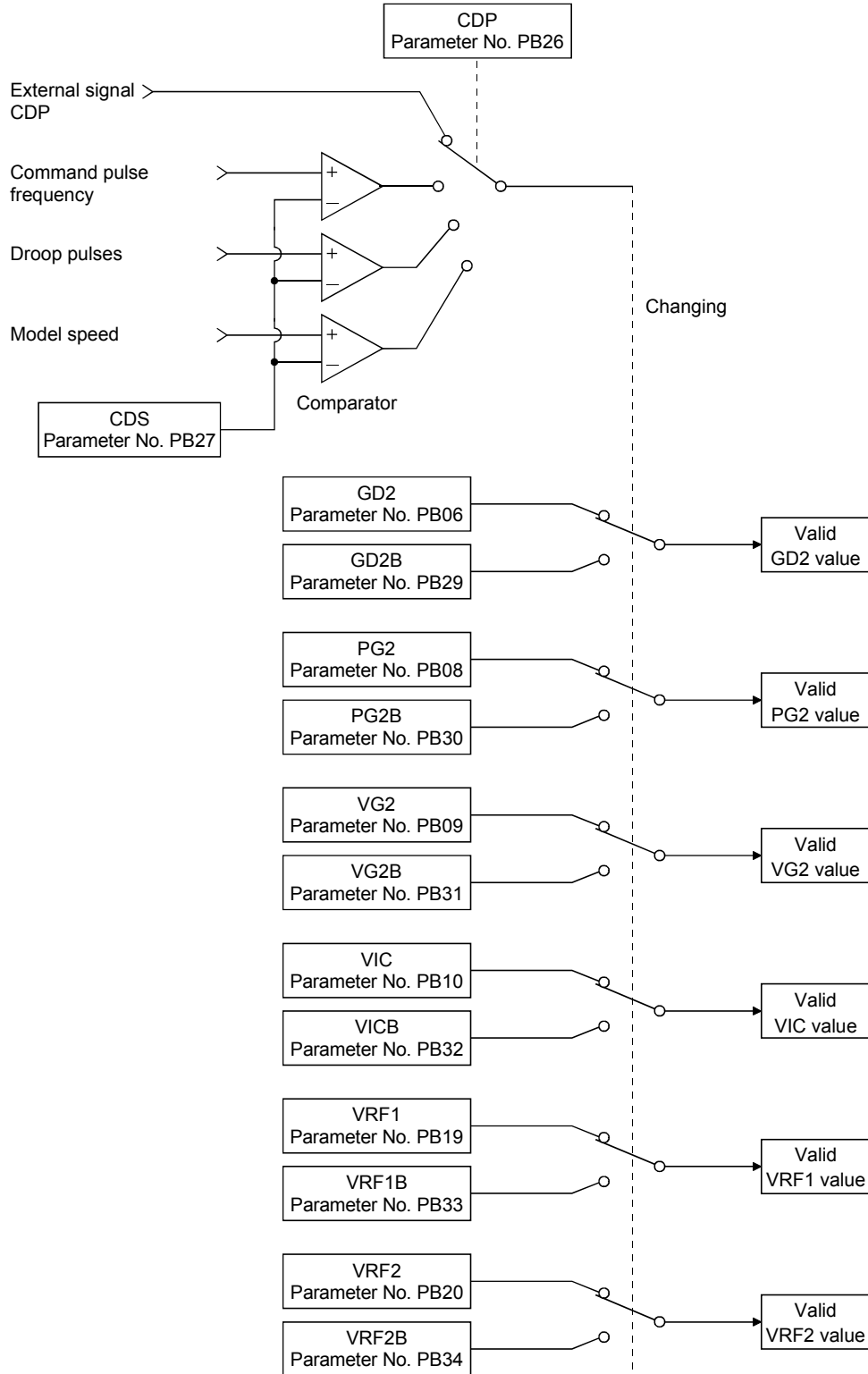
10.6.3 Parameters

When using the gain changing function, always set "□□□3" in parameter No. PA08 (auto tuning) to choose the manual mode of the gain adjustment modes. The gain changing function cannot be used in the auto tuning mode.

Parameter No.	Abbreviation	Name	Unit	Description
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	times	Control parameters before changing
PB07	PG1	Model loop gain	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
PB08	PG2	Position loop gain	rad/s	
PB09	VG2	Speed loop gain	rad/s	
PB10	VIC	Speed integral compensation	ms	
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	times	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
PB30	PG2B	Gain changing position loop gain 2	rad/s	Used to set the value of the after-changing position loop gain 2.
PB31	VG2B	Gain changing speed loop gain 2	rad/s	Used to set the value of the after-changing speed loop gain.
PB32	VICB	Gain changing speed integral compensation	ms	Used to set the value of the after-changing speed integral compensation.
PB26	CDP	Gain changing selection		Used to select the changing condition.
PB27	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
PB28	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Hz	Used to set the value of the after-changing vibration suppression control vibration frequency setting.
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Hz	Used to set the value of the after-changing vibration suppression control resonance frequency setting.

(1) Parameters No. PB06 to PB10

These parameters are the same as in ordinary manual adjustment. Gain changing allows the values of ratio of load inertia moment to servo motor inertia moment, position loop gain, speed loop gain and speed integral compensation to be changed.

(2) Gain changing ratio of load inertia moment to servo motor inertia moment (GD2B: parameter No. PB29)

Set the ratio of load inertia moment to servo motor inertia moment after changing. If the load inertia moment ratio does not change, set it to the same value as ratio of load inertia moment to servo motor inertia moment (parameter No. PB06).

(3) Gain changing position loop gain (parameter No. PB30), Gain changing speed loop gain (parameter No. PB31), Gain changing speed integral compensation (parameter No. PB32)

Set the values of after-changing position loop gain, speed loop gain and speed integral compensation.

(4) Gain changing selection (parameter No. PB26)

Used to set the gain changing condition. Choose the changing condition in the first digit and second digit. If you set "1" in the first digit here, you can use the gain changing (RY(n+2)) external input signal for gain changing.
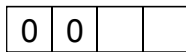
Gain changing selection
Under any of the following conditions, the gains change on the basis of the parameter No. PB29 to PB32 settings.
0: Invalid
1: Gain changing (RY(n+2)) is ON
2: Command frequency (Parameter No.PB27 setting)
3: Droop pulse value (Parameter No.PB27 setting)
4: Servo motor speed (Parameter No.PB27 setting)

Gain changing condition
0: Valid at more than condition (Valid when gain changing (RY(n+2) is ON)
1: Valid at less than condition (Valid when gain changing (RY(n+2) is OFF)

(5) Gain changing condition (parameter No. PB27)

When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (parameter No. PB26), set the gain changing level.

The setting unit is as follows:

Gain changing condition	Unit
Command frequency	kpps
Droop pulses	pulse
Servo motor speed	r/min

(6) Gain changing time constant (parameter No. PB28)

You can set the primary delay filter to each gain at gain changing. This parameter is used to suppress shock given to the machine if the gain difference is large at gain changing, for example.

10.6.4 Gain changing operation

This operation will be described by way of setting examples.

(1) When you choose changing by external input

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	times
PB08	PG2	Position loop gain	120	rad/s
PB09	VG2	Speed loop gain	3000	rad/s
PB10	VIC	Speed integral compensation	20	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	times
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0001 (Changed by ON/OFF of Input signal)	
PB28	CDT	Gain changing time constant	100	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Used to set the value of the after-changing vibration suppression control vibration frequency setting.	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Used to set the value of the after-changing vibration suppression control resonance frequency setting.	Hz

(b) Changing operation
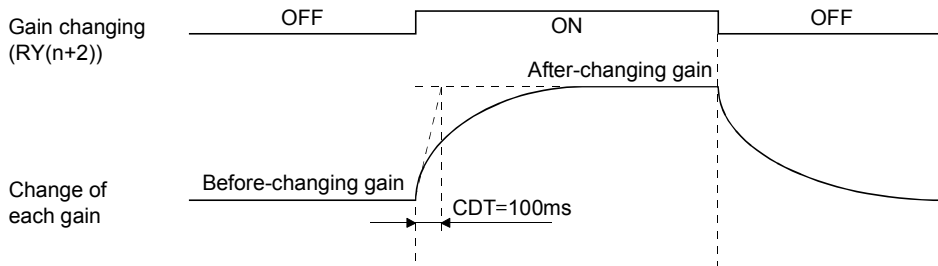
Model loop gain 1	100				
Ratio of load inertia moment to servo motor inertia moment	4.0	$\rightarrow$	10.0	$\rightarrow$	4.0
Position loop gain	120	$\rightarrow$	84	$\rightarrow$	120
Speed loop gain	3000	$\rightarrow$	4000	$\rightarrow$	3000
Speed integral compensation	20	$\rightarrow$	50	$\rightarrow$	20

(2) When you choose changing by droop pulses

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	times
PB08	PG2	Position loop gain	120	rad/s
PB09	VG2	Speed loop gain 2	3000	rad/s
PB10	VIC	Speed integral compensation	20	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	times
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0003 (Changed by droop pulses)	
PB27	CDS	Gain changing condition	50	pulse
PB28	CDT	Gain changing time constant	100	ms

(b) Changing operation
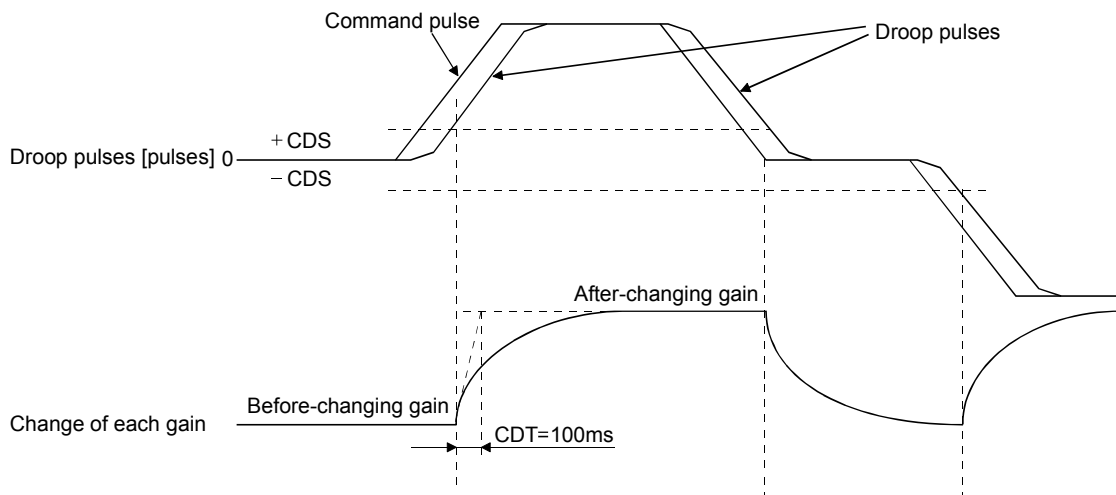
Model loop gain	100						
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0	→	10.0
Position loop gain	120	→	84	→	120	→	84
Speed loop gain	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

MEMO

11. TROUBLESHOOTING

11.1 Trouble at start-up

⚠ CAUTION	・Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

> **POINT**
> ・Using the MR Configurator, you can refer to unrotated servo motor reasons, etc.

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

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・LED is not lit. ・LED flickers.	Not improved if connectors CN2, CN3 and CN6 are disconnected.	1. Power supply voltage fault 2. Servo amplifier is faulty.	
			Improved when connectors CN6 is disconnected.	Power supply of CN6 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to section 14.4 and remove cause.		Section 14.4
2	Switch on servo-on (RYn0) signal.	Alarm occurs.	Refer to section 14.4 and remove cause.		Section 14.4
		Servo motor shaft is not servo-locked (is free).	1. Check the display to see if the servo amplifier is ready to operate. 2. Check the external I/O signal indication to see if the servo-on (RYn0) signal is ON.	1. Servo-on (RYn0) is not input. (Wiring mistake) 2. 24VDC power is not supplied to DICOM.	Section 8.5.4
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure: 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	

11.2 Operation at error occurrence

An error occurring during operation will result in any of the statuses indicated in the following table.

Error location	Description	Operation mode	
		Test operation	CC-Link operation
Servo side alarm occurrence	Servo operation	Stop	Stop
	CC-Link data communication	Continued	Continued
Option unit communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
CC-Link communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
PLC error/STOP	Servo operation	Continued	Stop
	CC-Link data communication	Stop	Stop
Servo side warning occurrence	Servo operation	Stop	Continued
	CC-Link data communication	Continued	Continued

11.3 CC-Link communication error

This section gives the definitions of the indications given in the communication alarm display section.
The servo amplifier has four LED indications.

L.RUN : Lit at normal receive of refresh data. Extinguished when data is not received for a given period of time.
SD : Lit when send data is "0".
RD : Lit when the carrier of receive data is detected.
L.ERR : Lit when the data addressed to the host is in CRC or abort error.

(Note) Communication alarm display LED				Operation
L.RUN	SD	RD	L.ERR	
○	◎	◎	◎	Normal communication is made, but a CRC error sometimes occurs due to noise.
○	◎	◎	●	Normal communication
○	◎	●	◎	Hardware fault
○	◎	●	●	Hardware fault
○	●	◎	◎	Receive data results in CRC error, disabling a response.
○	●	◎	●	Data does not reach the host.
○	●	●	◎	Hardware fault
○	●	●	●	Hardware fault
●	◎	◎	◎	Polling response is made, but refresh receive is in CRC error.
●	◎	◎	●	Hardware fault
●	◎	●	◎	Hardware fault
●	◎	●	●	Hardware fault
●	●	◎	◎	Data addressed to the host resulted in CRC error.
●	●	◎	●	Data does not reach the host, or the data addressed to the host cannot be received due to noise.
●	●	●	◎	Hardware fault
●	●	●	○	Baud rate setting illegal
●	●	○	○	Station number setting illegal
●	○	○	◎	Baud rate or station number setting changed midway (ERROR flickers for about 4s)
●	●	●	●	Data cannot be received due to power-off, power supply failure, open cable, etc. WDT error occurrence (hardware fault)

Note. ○ : Lit   ● : Extinguished   ◎ : Flicker

11.4 When alarm or warning has occurred

POINT
・Configure up a circuit which will detect the trouble (ALM) signal and turn off the servo-on (RYn0) at occurrence of an alarm.

11.4.1 Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 11.4.2 or 11.4.3 and take the appropriate action. When an alarm occurs, ALM turns off.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	Name	Alarm deactivation		
			Power OFF→ON	(Note3) MR Configurator parameter unit	(Note2) Alarm reset (RES)
Alarms	A10	Undervoltage	○	○	○
	A12	Memory error 1 (RAM)	○		
	A13	Clock error	○		
	A15	Memory error 2 (EEP-ROM)	○		
	A16	Encoder error 1 (At power on)	○		
	A17	Board error	○		
	A19	Memory error 3 (Flash-ROM)	○		
	A1A	Motor combination error	○		
	A20	Encoder error 2	○		
	A24	Main circuit error	○	○	○
	A25	Absolute position erase	○		
	A30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A31	Overspeed	○	○	○
	A32	Overcurrent	○		
	A33	Overvoltage	○	○	○
	A35	Command pulse frequency alarm	○	○	○
	A37	Parameter error	○		
	A45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A46	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A47	Cooling fan alarm	○		
	A50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A52	Error excessive	○	○	○
	A61	Operation alarm	○	○	○
	A8A	Serial communication time-out	○	○	○
	A8D	CC-Link alarm	○	○	○
	A8E	Serial communication error	○	○	○
	888	Watchdog	○		

	Display	Name
Warnings	A90	Home positoning incomplete warning
	A92	Open battery cable warning
	A96	Home position setting error
	A98	Software limit warning
	A99	Stoke limit warning
	A9D	CC-Link warning 1
	A9E	CC-Link warning 2
	A9F	Battery warning
	AE0	Excessive regeneration warning
	AE1	Overload warning 1
	AE3	Absolute position counter warning
	AE6	Servo emergency stop warning
	AE8	Cooling fan speed reduction warning
	AE9	Main circuit off warning
	AEC	Overload warning 2
	AED	Output watt excess warning

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. Turns on RY(n+1)A or RY(n+3)A.
3. Clicking the "Alarm reset" button on the "Alarm display" screen of MR Configurator allows an alarm to be deactivated.
Pressing the "STOP RESET" key of the parameter unit allows an alarm to be deactivated.

11.4.2 Remedies for alarms

⚠ CAUTION	・When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur. ・If an absolute position erase (A25) occurred, always make home position setting again. Otherwise, misoperation may occur. ・As soon as an alarm occurs, turn off Servo-on (Ryn0) and power off.

POINT
・When any of the following alarms has occurred, do not deactivate the alarm and resume operation repeatedly. To do so will cause the servo amplifier/servo motor to fail. Remove the cause of occurrence, and leave a cooling time of more than 30 minutes before resuming operation.
　・Regenerative error (A30)
　・Overload 1 (A50)
　・Overload 2 (A51)
・For the alarm deactivation method, refer to section 11.4.1.

When an alarm occurs, the trouble (ALM) switches off and the dynamic brake is operated to stop the servomotor. 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. The optional MR Configuration may be used to refer to the cause.

Display	Name	Definition	Cause	Action
A10	Undervoltage	Power supply voltage dropped. MR-J3-□T: 160VAC or less MR-J3-□T1: 83VAC or less	1. Power supply voltage is low.	Review the power supply.
			2. There was an instantaneous control power failure of 60ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. The bus voltage dropped to the following value or less. MR-J3-□T: 200VDC MR-J3-□T1: 158VDC	
			5. Faulty parts in the servo amplifier. ┌─ Checking method ─┐ Alarm (A10) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
A12	Memory error 1 (RAM)	RAM, memory fault	Faulty parts in the servo amplifier. ┌─ Checking method ─┐ Alarm (any of A11 and A13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
A13	Clock error	Printed board fault		

Display	Name	Definition	Cause	Action
A15	Memory error 2 (EEP-ROM)	EEP-ROM fault	1. Faulty parts in the servo amplifier Checking method Alarm (A15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
			2. The number of write times to EEP-ROM exceeded 100,000.	
A16	Encoder error 1 (At power on)	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change cable.
			4. Encoder cable type (2-wire, 4-wire) selection was wrong in parameter setting.	Correct the setting in the fourth digit of parameter No. PC22.
A17	Board error	CPU/parts fault	Faulty parts in the servo amplifier Checking method Alarm (A17 or A19) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the servo amplifier.
A19	Memory error 3 (Flash ROM)	ROM memory fault		
A1A	Motor combination error	Wrong combination of servo anplifier and servo motor.	Wrong combination of servo amplifier and servo motor connected.	Use correct combination.
A20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			3. Encoder fault	Change the servo motor.
A24	Main circuit error	Ground fault occurred at the servo motor power (U,V and W phases) of the servo amplififer.	1. Power input wires and servo motor power wires are in contact.	Connect correctly.
			2. Sheaths of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of servo amplifier failed. Checking method A24 occurs if the servo is switched on after disconnecting the U, V, W power cables from the servo amplifier.	Change the servo amplifier.
A25	Absolute position erase	Absolute position data in error	1. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
			2. Battery voltage low	Change battery. Always make home position setting again.
			3. Battery cable or battery is faulty.	
		Power was switched on for the first time in the absolute position detection system.	4. Home position not set.	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.

Display	Name	Definition	Cause	Action
A30	Regenerative alarm	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Wrong setting of parameter No. PA02	Set correctly.
			2. Built-in regenerative resistor or regenerative option is not connected.	Connect correctly
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. ┌─ Checking method ─┐ Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. MR-J3-□T:260VAC or more MR-J3-□1:More than 135VAC	Review power supply
			5. Built-in regenerative resistor or regenerative option faulty.	Change servo amplifier or regenerative option.
		Regenerative transistor fault	6. Regenerative transistor faulty. ┌─ Checking method ─┐ 1) The regenerative option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Change the servo amplifier.
A31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency exceeded the permissible instantaneous speed frequency.	Set command pulses correctly.
			2. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.

			3. Servo system is instable to cause overshoot.	1. Re-set servo gain to proper value.
				2. If servo gain cannot be set to proper value:
				  1) Reduce load inertia moment ratio; or
				  2) Reexamine acceleration/deceleration time constant.

			4. Electronic gear ratio is large (parameters No. PA06, PA07)	Set correctly.
			5. Encoder faulty.	Change the servo motor.
A32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier.	1. Short occurred in servo motor power (U, V, W).	Correct the wiring.
			2. Transistor (IPM) of the servo amplifier faulty. ┌─ Checking method ─┐ Alarm (A32) occurs if power is switched on after U,V and W are disconnected.	Change the servo amplifier.
			3. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.

Display	Name	Definition	Cause	Action
A33	Overvoltage	The following shows the input value of converter bus voltage. MR-J3-□T(1)	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No.PA02 setting is "□□ 00 (not used)".	Set correctly.
			3. Lead of built-in regenerative resistor or regenerative option is open or disconnected.	1. Change lead. 2. Connect correctly.
			4. Regenerative transistor faulty.	Change servo amplifier
			5. Wire breakage of built-in regenerative resistor or regenerative option.	1. For wire breakage of built-in regenerative resistor, change servo amplifier. 2. For wire breakage of regenerative option, change regenerative option.
			6. Capacity of built-in regenerative resistor or regenerative option is insufficient.	Add regenerative option or increase capacity.
			7. Power supply voltage high.	Review the power supply.
			8. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
A35	Command pulse frequency error	Input pulse frequency of the command pulse is too high.	1. Pulse frequency of the manual pulse generator is too high.	Change the pulse frequency to a proper value.
			2. Noise entered the pulses of the manual pulse generator.	Take action against noise.
			3. Manual pulse generator failure.	Change the manual pulse generator.
A37	Parameter error	Parameter setting is wrong.	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
			2. Regenerative option not used with servo amplifier was selected in parameter No.PA02.	Set parameter No.PA02 correctly.
			3. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Change the servo amplifier.
A45	Main circuit device overheat	Main circuit device overheat.	1. Servo amplifier faulty.	Change the servo amplifier.
			2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
			3. Ambient temperature of servo motor is over 55℃.	Review environment so that ambient temperature is 0 to 55℃.
			4. Used beyond the specifications of close mounting.	Use within the range of specifications.
A46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃.	Review environment so that ambient temperature is 0 to 40℃.
			2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal sensor in encoder is faulty.	Change servo motor.
A47	Cooling fan alarm	The cooling fan of the servo amplifier stopped, or its speed decreased to or below the alarm level.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the servo amplifier.
			Foreign matter caught in the fan stopped rotation.	Remove the foreign matter.
			The power supply of the cooling fan failed.	Change servo amplifier.

Display	Name	Definition	Cause	Action
A50	Overload 1	Load exceeded overload protection characteristic of servo amplifier.	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
A51	Overload 2	Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked: 1s or more During rotation: 2.5s or more	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.

Display	Name	Definition	Cause	Action
A52	Error excessive	The difference between the model position and the actual servomotor position exceeds three rotations. (Refer to the function block diagram in section 1.1.2.)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Foward torque limit (parameter No.PA11) or reverse torque limit (parameter No.PA12) are too small.	Increase the torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply voltage drop.	1. Review the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position loop gain (parameter No.PB08) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			7. Encoder faulty.	Change the servo motor.
			8. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
A61	Operation alarm	Setting mistake of auxiliary function.	"1" or "3" is set for the auxiliary function of point table No.255.	Set "0" or "2" for the value of auxiliary function.
A8A	Serial communication time-out error	Communication stopped for longer than the specified time.	1. Communication cable breakage.	Repair or change communication cable
			2. Communication cycle longer than regulated time.	Shorten the communication cycle.
			3. Wrong protocol.	Correct protocol.
A8D	CC-Link alarm	Normal communication with the master station cannot be made.	1. The station number switch (STATION NO.) setting is 0 or not less than 65.	Set the station number to within the range 1 to 64, and switch power on.
			2. The baud rate switch (MODE) setting is outside the range 0 to 4.	Set the baud rate switch (MODE) to within the range 0 to 4.
			3. The transmission status is abnormal.	Reexamine the wiring.
			4. CC-Link twisted cable wiring incorrect.	1. Repair or change the CC-Link twisted cable.
			5. CC-Link twisted cable faulty.	2. Connect the cable or connector correctly.
			6. The CC-Link connector has come off.	
			7. The terminating resistor is not connected.	Connect the terminating resistor correctly
			8. Noise entered the CC-Link twisted cable.	
A8E	Serial communication error	Serial communication error occurred between servo amplifier and communication device (e.g. personal computer).	1. Communication cable fault (Open cable or short circuit).	Repair or change the cable.
			2. Communication device (e.g. personal computer) faulty.	Change the communication device (e.g. personal computer).
(Note) 888	Watchdog	CPU, parts faulty.	Fault of parts in servo amplifier. ┌─ Checking method ─┐ Alarm (888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change servo amplifier.

Note. At power-on, "888" appears instantaneously, but it is not an error.

11.4.3 Remedies for warnings

⚠ CAUTION	・If an absolute position counter warning (AE3) occurred, always make home position setting again. Otherwise, misoperation may occur.

> POINT
> ・When any of the following alarms has occurred, do not resume operation by switching power of the servo amplifier OFF/ON repeatedly. The servo amplifier and servo motor may become faulty. If the power of the servo amplifier is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
> 　・Excessive regenerative warning (AE0)
> 　・Overload warning 1 (AE1)

If AL.E6 or AL.EA occurs, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed. Use the optional servo configuration software to refer to the cause of warning.

Remove the cause of warning according to this section. Use the optional MR Configurator to refer to a factor of warning occurrence.

Display	Name	Definition		Cause	Action
A90	Home position return incomplete	In incremental system	Positioning operation was performed without home position return.	1. Positioning operation was performed without home position return.	Perform home position return.
			Home position return ended abnormally.	2. Home position return speed could not be decreased to creep speed. 3. Limit switch was actuated during home position return starting at other than position beyond dog.	Review home position return speed/creep speed/moving distance after proximity dog.
		In absolute position detection system	Positioning operation was performed without home position setting.	1. Positioning operation was performed without home position setting.	Perform home position setting.
			Home position setting ended abnormally.	2. Home position setting speed could not be decreased to creep speed. 3. Limit switch was actuated during home position setting starting at other than position beyond dog.	Review home position setting speed/creep speed/moving distance after proximity dog.
			Operation was performed without making home position setting while an absolute position erase (A25) is being occurred.	4. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
				5. Battery voltage low	Change battery.
				6. Battery cable or battery is faulty.	Always make home position setting again.
A92	Open battery cable warning	Absolute position detection system battery voltage is low.		1. Battery cable is open.	Repair cable or changed.
				2. Battery voltage supplied from the servo amplifier to the encoder fell to about 3V or less. (Detected with the encoder)	Change battery.
A96	Home position setting warning	Home position setting could not be made.		1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence
				2. Command pulse entered after clearing of droop pulses.	Do not enter command pulse after clearing of droop pulses.
				3. Creep speed high.	Reduce creep speed.

Display	Name	Definition	Cause	Action
A98	Software limit warning	Software limit set in parameter is reached.	1. Software limit was set within actual operation range.	Set parameter No. PC31 to PC34 correctly.
			2. Point table of position data in excess of software limit was executed.	Set point table correctly.
			3. Software limit was reached during JOG operation or manual pulse generator operation.	Perform operation within software limit range.
A99	Stroke limit warning	The stroke end (LSP or LSN) of the direction which gave instructions was turned off.	The limit switch became valid.	Reexamine the operation pattern to turn LSP/LSN ON.
A9D	CC-Link warning 1	The station number switch or baud rate switch position was changed from the setting at power-on.	1. The station number switch position was changed from the setting at power-on.	Return to the setting at power-on.
			2. The baud rate switch position was changed from the setting at power-on.	
			3. The occupied station count switch position was changed from the setting at power-on.	
A9E	CC-Link warning 2	Communication error of cable.	1. The transmission status is abnormal.	Take measures against noise.
			2. CC-Link twisted cable wiring incorrect.	1. Change the CC-Link twisted cable.
			3. CC-Link twisted cable faulty.	
			4. The CC-Link connector has come off.	2. Connect the cable or connector correctly.
			5. The terminating resistor is not connected.	Connect the terminating resistor correctly.
			6. Noise entered the CC-Link twisted cable.	
A9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the servo amplifier)	Change the battery.
AE0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative resistor or regenerative option. ┌─ Checking method ─┐ Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenerative option for the one with larger capacity. 3. Reduce load.
AE1	Overload warning 1	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. ┌─ Cause, checking method ─┐ Refer to A50, A51.	Refer to AL.50, AL.51.
AE3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change servo motor.
		The multi-revolution counter value of the absolute position encoder exceeded the maximum revolution range.	3. The movement amount from the home position exceeded a 32767 rotation or 37268 rotation in succession.	Make home position setting again.
AE6	Servo forced stop warning	EMG is off.	External forced stop was made valid. (EMG was turned off.)	Ensure safety and deactivate forced stop.
AE8	Cooling fan speed reduction warning	The speed of the servo amplifier decreased to or below the warning level. This warning is not displayed with MR-J3-70T/100T among servo amplifiers equipped with a cooling fan.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the servo amplifier.
			The power supply of the cooling fan is broken.	Change servo amplifier.
AE9	Main circuit off warning	Servo-on (SON) was switched on with main circuit power off.		Switch on main circuit power.

Display	Name	Definition	Cause	Action
AEC	Overload warning 2	Operation, in which a current exceeding the rating flew intensively in any of the U, V and W phases of the servo motor, was repeated.	During a stop, the status in which a current flew intensively in any of the U, V and W phases of the servo motor occurred repeatedly, exceeding the warning level.	1. Reduce the positioning frequency at the specific positioning address. 2. Reduce the load. 3. Replace the servo amplifier/ servo motor with the one of larger capacity.
AED	Output watt excess warning	The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	Continuous operation was performed with the output wattage (speed × torque) of the servo motor exceeding 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.

11.5 Point table error

When a point table error occurs, the parameter error (A37) occurs. After the parameter No. of parameter error (37), the point table error details are displayed.

```
AL37          #00
PB10    PB11
PB12    PB16
Pos001              ▾
```
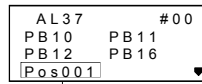
— Point table error details
For the point table No.1 position data error

```
Pos001
```

— Point table No. with error

— Error item
・Pos: position data
・Spd: speed
・Acc: acceleration time constant
・Dec: deceleration time constant
・Dwl: dwell
・Aux: auxiliary function

12. OUTLINE DRAWINGS

12.1 Servo amplifier

(1) MR-J3-10T · MR-J3-20T
    MR-J3-10T1 · MR-J3-20T1
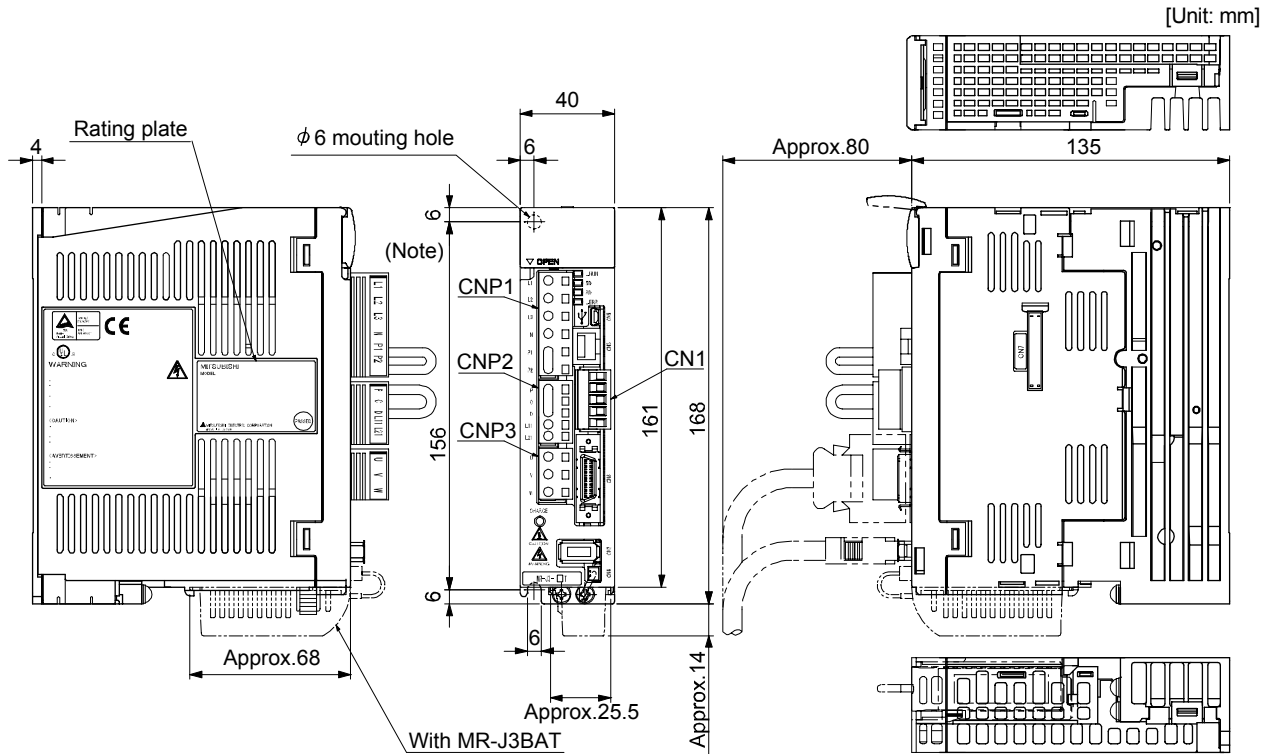
[Unit: mm]

Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase, 100 to 120VAC power supply, refer to the terminal signal layout.

Mass: 0.8 [kg] (1.76 [lb])
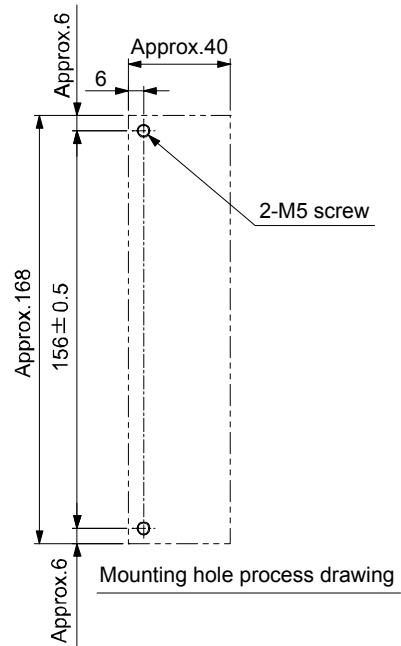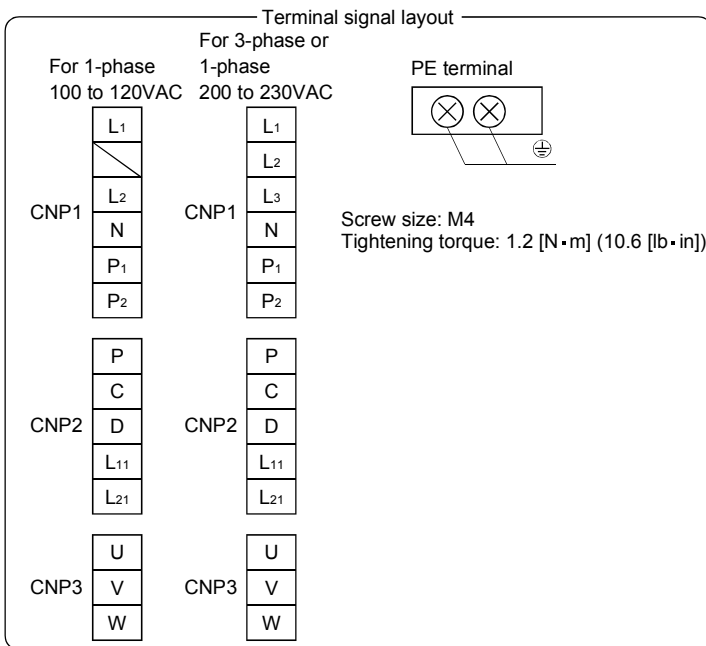
Terminal signal layout

For 1-phase 100 to 120VAC		For 3-phase or 1-phase 200 to 230VAC	
CNP1	L₁	CNP1	L₁
			L₂
	L₂		L₃
	N		N
	P₁		P₁
	P₂		P₂
CNP2	P	CNP2	P
	C		C
	D		D
	L₁₁		L₁₁
	L₂₁		L₂₁
CNP3	U	CNP3	U
	V		V
	W		W

PE terminal

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

Mounting hole process drawing

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

12 - 1

(2) MR-J3-40T・MR-J3-60T

MR-J3-40T1
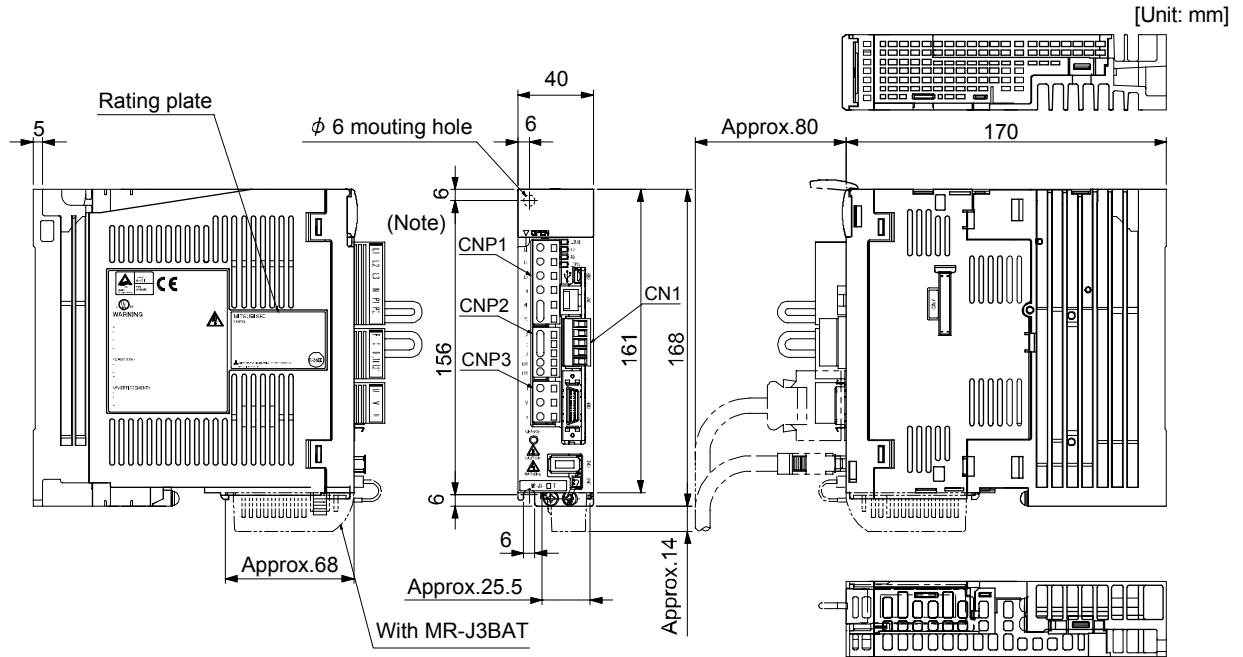
[Unit: mm]

Rating plate

φ 6 mouting hole

(Note)

CNP1
CNP2
CNP3

CN1

With MR-J3BAT

Approx.68
Approx.25.5
5
40
6
156
161
168
6
6
6
Approx.14
Approx.80
170

Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase, 100 to 120VAC power supply, refer to the terminal signal layout.

Mass: 1.0 [kg] (2.21 [lb])
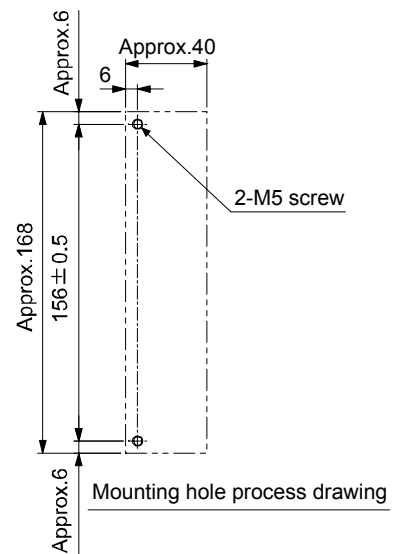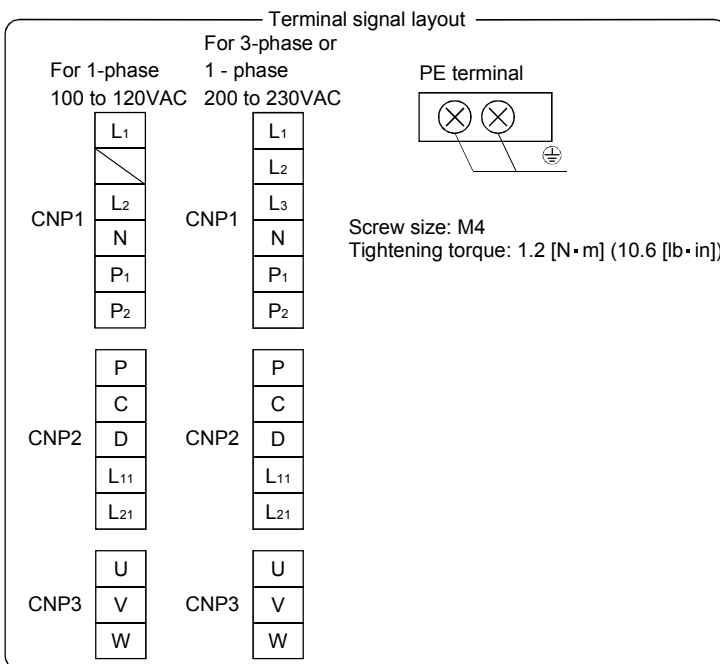
Terminal signal layout

For 1-phase 100 to 120VAC		For 3-phase or 1-phase 200 to 230VAC	
CNP1	L_1	CNP1	L_1
			L_2
	L_2		L_3
	N		N
	P_1		P_1
	P_2		P_2
CNP2	P	CNP2	P
	C		C
	D		D
	L_{11}		L_{11}
	L_{21}		L_{21}
CNP3	U	CNP3	U
	V		V
	W		W

PE terminal

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

Mounting hole process drawing

Approx.6
Approx.40
6
Approx.168
156 ± 0.5
Approx.6
2-M5 screw

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

(3) MR-J3-70T・MR-J3-100T

[Unit: mm]
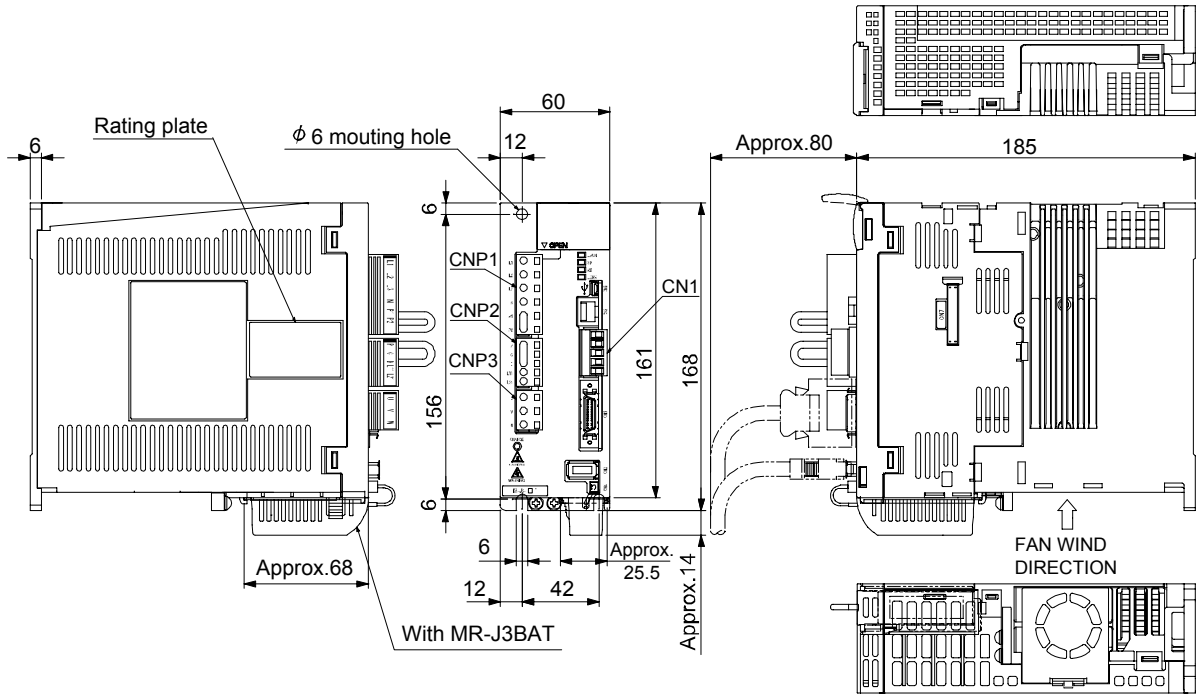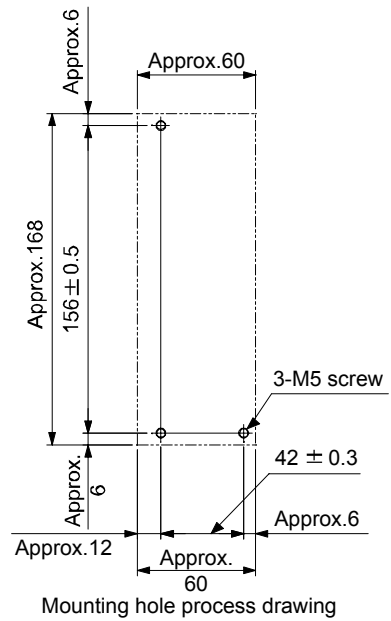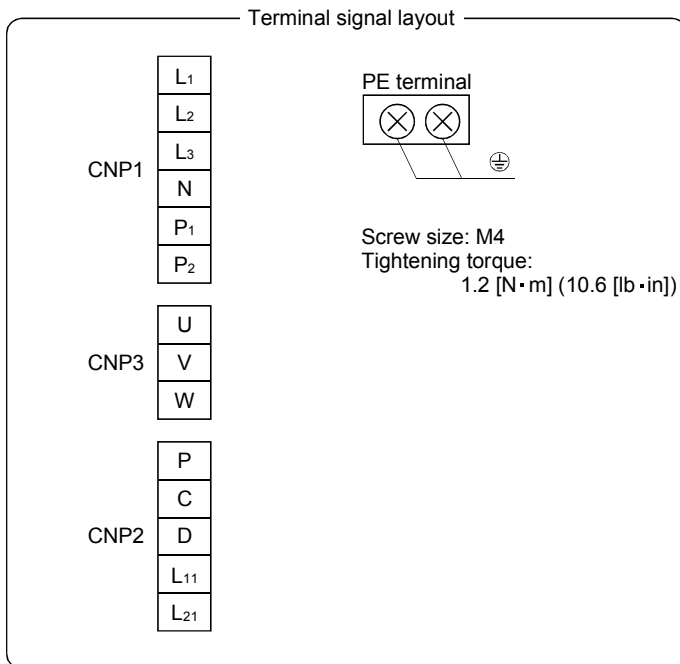
Rating plate

φ 6 mouting hole

6

60

12

CNP1

CNP2

CNP3

156

161

168

6

6

CN1

6

12

42

Approx.
25.5

Approx.14

Approx.68

With MR-J3BAT

Approx.80

185

FAN WIND
DIRECTION

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

─── Terminal signal layout ───

CNP1
| L₁ |
| L₂ |
| L₃ |
| N |
| P₁ |
| P₂ |

CNP3
| U |
| V |
| W |

CNP2
| P |
| C |
| D |
| L₁₁ |
| L₂₁ |

PE terminal

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

Approx.6

Approx.60

Approx.168

156 ± 0.5

Approx.
6

3-M5 screw

42 ± 0.3

Approx.6

Approx.12

Approx.
60

Mounting hole process drawing

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

12 - 3

(4) MR-J3-200T・MR-J3-350T

[Unit: mm]

Rating plate

90
85
45

φ 6 mouting hole

CNP1
CNP3
CNP2

CN1

156
168

6

6
6

Approx.
25.5

6

78

6

Approx.68

Approx.14

With MR-J3BAT

Approx.80   195

6

21.4

FAN WIND DIRECTION

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

— Terminal signal layout —

CNP1	L₁
	L₂
	L₃
	N
	P₁
	P₂

CNP3	U
	V
	W

CNP2	P
	C
	D
	L₁₁
	L₂₁

PE terminal

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

Approx.6

Approx.90

Approx.168
156±0.5

3-M5 screw

Approx.6

78±0.3   Approx.6

Approx.6

Mounting hole process drawing

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

(5) MR-J3-500T

[Unit: mm]

2-ϕ6 mounting hole

Approx.7.5
130
6
118
250
235
Approx.7.5
6

Approx.80
131.5
200
68.5
Fan air orientation
FAN
6

With MR-J3BAT

20.5

Terminal layout
(Terminal cover open)

TE2
TE3
TE1

3 places for ground⏚(M4)

Built-in regenerative resistor lead terminal fixing screw

Mass: 4.6 [kg] (10.1 [lb])

── Terminal signal layout ──

TE1

L₁	L₂	L₃	P	C	U	V	W

Terminal screw: M4
Tightening torque: 1.2[N·m]

TE2

L₁₁	L₂₁

Terminal screw: M3.5
Tightening torque: 0.8[N·m]

TE3

N	P₁	P₂

Terminal screw: M4
Tightening torque: 1.2[N·m]

PE terminal

⊕ ⊕ ⊕   ⊕

⏚

Terminal screw: M4
Tightening torque: 1.2[N·m]

Built-in regenerative resistor lead terminal fixing screw

Approx.130
Approx.6
118±0.5
Approx.6
Approx.7.5
4-M5 screw
Approx.250
235±0.5
Approx.7.5

Mounting hole process drawing

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

(6) MR-J3-700T

[Unit: mm]

172
6 160 6
7.5
2-φ6 mouting hole
300 285
CN1
With MR-J3BAT
7.5 6

Approx.80 200
Fan air orientation ⇧
75
99.8
102.6
149.2

Rating plate
TE3 34 13 13
57 23.5
21.4
TE1 31 13
13
24.5 7×13=91 14.5 10
Built-in regenerative resistor lead terminal fixing screw

Mass: 6.2 [kg] (13.7[lb])

Terminal signal layout

TE1

L₁	L₂	L₃	P	C	U	V	W

Terminal screw: M4
Tightening torque: 1.2[N·m]

TE2

L₁₁	L₂₁

Terminal screw: M3.5
Tightening torque: 0.8[N·m]

TE3

N	P₁	P₂

Terminal screw: M4
Tightening torque: 1.2[N·m]

PE terminal

Terminal screw: M4
Tightening torque: 1.2[N·m]

Built-in regenerative resistor lead terminal fixing screw

Approx.172
Approx.6 160±0.5 Approx.6
Approx.7
4-M5 screw
Approx.300 285±0.5
Approx.7.5
Mounting hole process drawing

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

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

[Unit: mm]
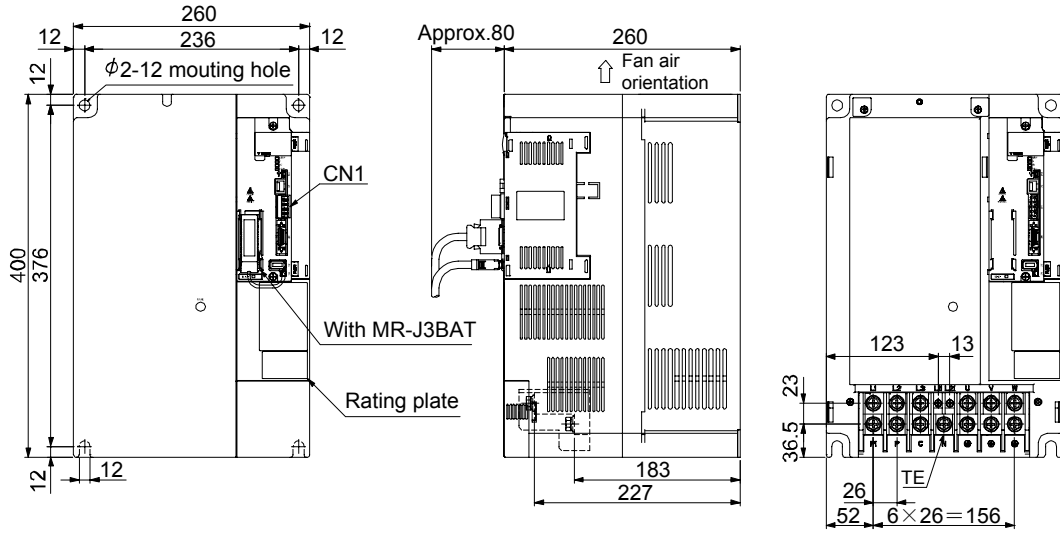
Servo amplifier	Mass[kg]([lb])
MR-J3-11KT	18.0(40)
MR-J3-15KT	18.0(40)
MR-J3-22KT	19.0(42)

Mounting hole process drawing
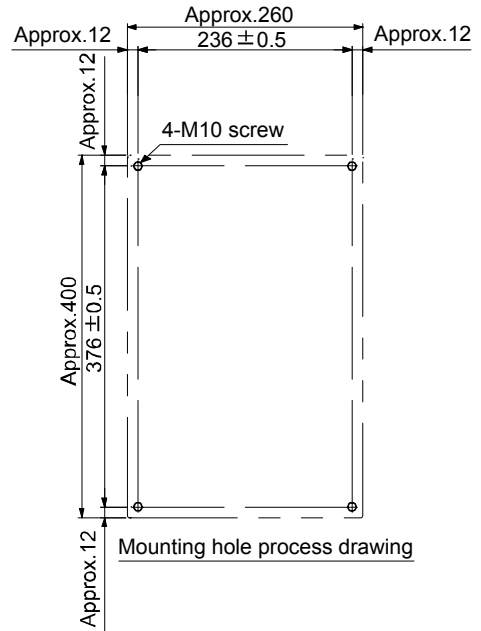
Terminal signal layout

TE

L_1	L_2	L_3	L_{11} L_{21}	U	V	W
P_1	P	C	N	⊕	⊕	⊕

Mounting screw

Servo amplifier	Screw size	Tightening torque [N · m]([lb · in])
MR-J3-11KT MR-J3-15KT MR-J3-22KT	M10	26.5 (234.5)

		$L_1 \cdot L_2 \cdot L_3 \cdot U \cdot V \cdot W \cdot P1 \cdot P \cdot C \cdot N$	$L_{11} \cdot L_{21}$	⊕
MR-J3-11KT MR-J3-15KT	Screw size	M6	M4	M6
	Tightening torque [(lb:in)][N · m]	3.0	1.2	6.0
MR-J3-22KT	Screw size	M8	M4	M8
	Tightening torque [(lb:in)][N · m]	6.0	1.2	6.0

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12.2 Connector for CN3

(1) One-touch lock type

[Unit: mm]

Logo etc, are indicated here.
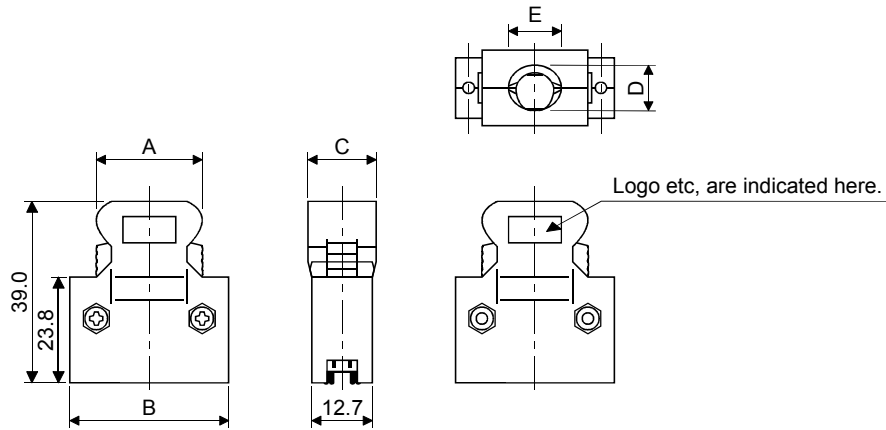
Connector	Shell kit	Each type of dimension				
		A	B	C	D	E
10120-3000VE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0

(2) Jack screw M2.6 type

This is not available as option.

[Unit: mm]

Logo etc, are indicated here.
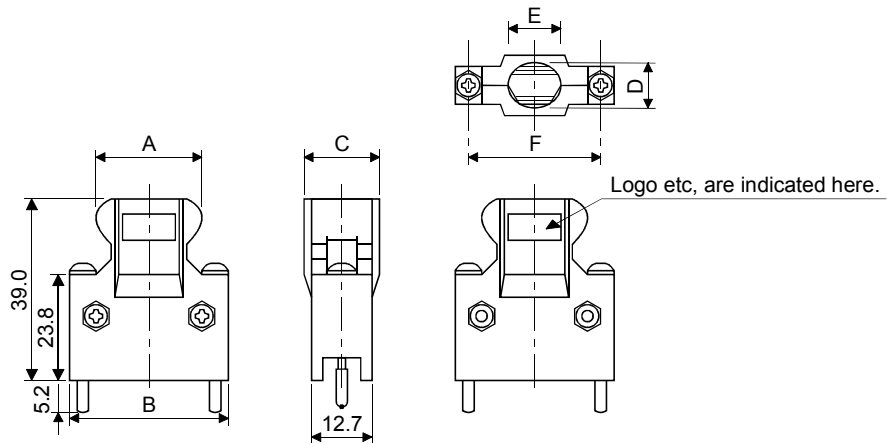
Connector	Shell kit	Each type of dimension					
		A	B	C	D	E	F
10120-3000VE	10320-52F0-008	22.0	33.3	14.0	10.0	12.0	27.4

13. CHARACTERISTICS

13.1 Overload protection characteristics

An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. Overload 1 alarm (A50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 13.1. Overload 2 alarm (A51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.

When you carry out adhesion mounting of the servo amplifier, make circumference temperature into 0 to 45℃, or use it at 75% or a smaller effective load ratio.

Servo amplifier	Graph
MR-J3-10T (1)	Fig 12. 1 a
MR-J3-20T (1)・MR-J3-40T (1)	Fig 12. 1 b
MR-J3-60T to MR-J3-100T	
MR-J3-200T・Mr-J3-350T	Fig 12. 1 c
MR-J3-500T・MR-J3-700T	Fig 12. 1 d
MR-J3-11KT to MR-J3-22KT	Fig 12. 1 e
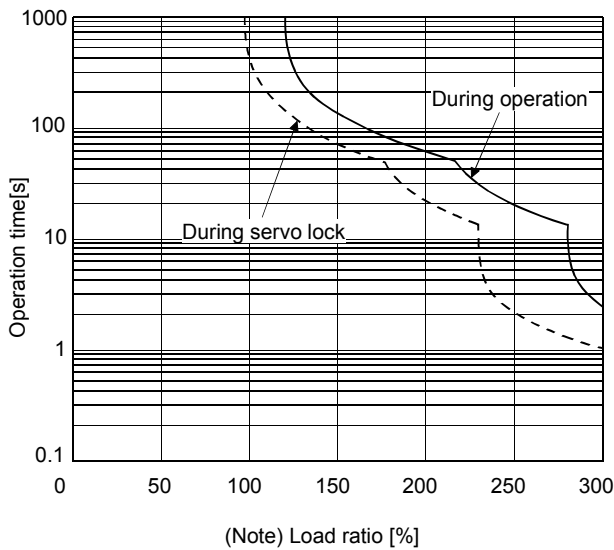
a. Electronic thermal relay
   protection characteristics1
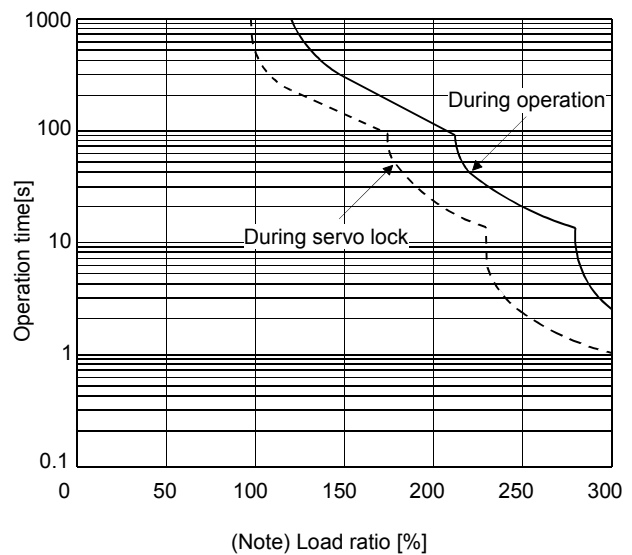
b. Electronic thermal relay
   protection characteristics2

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may fail even when the electronic thermal relay protection is not activated.

Fig 13.1 Electronic thermal relay protection characteristics (1/2)
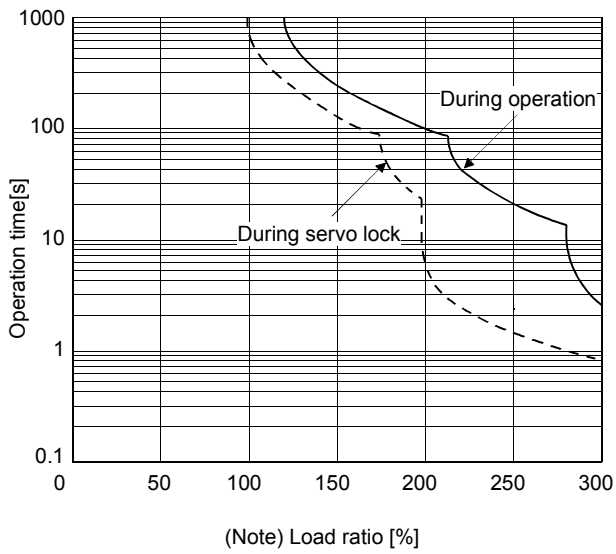
c. Electronic thermal relay
protection characteristics3
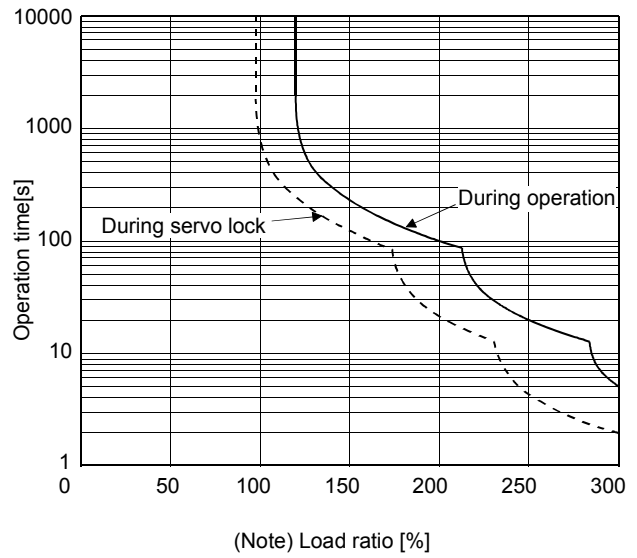
d. Electronic thermal relay
protection characteristics4
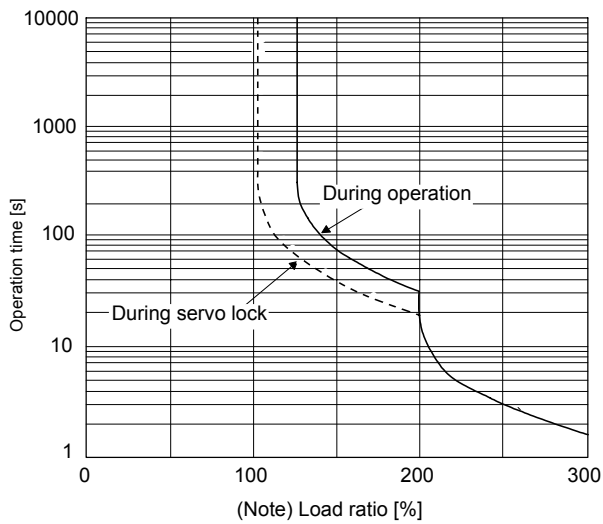
e. Electronic thermal relay
protection characteristics5

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor
stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may fail even when the
electronic thermal relay protection is not activated.

Fig 13.1 Electronic thermal relay protection characteristics (2/2)

13.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 13.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 13.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo off according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 13.1 Power supply capacity and generated heat per servo amplifier at rated output

Servo amplifier	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Servo amplifier-generated heat[W]		Area required for heat dissipation [m²]
			At rated torque	With servo off	
MR-J3-10T (1)	HF-MP053	0.3	25	15	0.5
	HF-MP13	0.3	25	15	0.5
	HF-KP053・13	0.3	25	15	0.5
MR-J3-20T (1)	HF-MP23	0.5	25	15	0.5
	HF-KP23	0.5	25	15	0.5
MR-J3-40T (1)	HF-MP43	0.9	35	15	0.7
	HF-KP43	0.9	35	15	0.7
MR-J3-60T	HF-SP52	1.0	40	15	0.8
	HF-SP51	1.0	40	15	0.8
	HC-LP52	1.0	40	15	0.8
MR-J3-70T	HF-MP73	1.3	50	15	1.0
	HF-KP73	1.3	50	15	1.0
	HC-UP72	1.3	50	15	1.0
MR-J3-100T	HF-SP102	1.7	50	15	1.0
	HF-SP81	1.5	50	15	1.0
	HC-LP102	1.7	50	15	1.0
MR-J3-200T	HF-SP152	2.5	90	20	1.8
	HF-SP202	3.5	90	20	1.8
	HF-SP121	2.1	90	20	1.8
	HF-SP201	3.5	90	20	1.8
	HC-RP103	1.8	50	15	1.0
	HC-RP153	2.5	90	20	1.8
	HC-UP152	2.5	90	20	1.8
	HC-LP152	2.5	90	20	1.8
MR-J3-350T	HF-SP352	5.5	130	20	2.7
	HC-RP203	3.5	90	20	1.8
	HC-UP202	3.5	90	20	1.8
	HC-LP202	3.5	90	20	1.8
	HF-SP301	4.8	120	20	2.4
MR-J3-500T	HF-SP502	7.5	195	25	3.9
	HC-RP353	5.5	135	25	2.7
	HC-RP503	7.5	195	25	3.9
	HC-UP352	5.5	195	25	3.9
	HC-UP502	7.5	195	25	3.9
	HC-LP302	4.5	120	25	2.4
	HA-LP502	7.5	195	25	3.9
	HF-SP421	6.7	160	25	3.2

Servo amplifier	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Servo amplifier-generated heat[W]		Area required for heat dissipation [m²]
			At rated torque	With servo off	
MR-J3-700T	HF-SP702	10.0	300	25	6.0
	HA-LP702	10.6	300	25	6.0
	HA-LP601	10.0	260	25	5.2
	HA-LP701M	11.0	300	25	6.0
MR-J3-11KT	HA-LP11K2	16.0	530	45	11.0
	HA-LP801	12.0	390	45	7.8
	HA-LP12K1	18.0	580	45	11.6
	HA-LP11K1M	16.0	530	45	11.0
MR-J3-15KT	HA-LP15K2	22.0	640	45	13.0
	HA-LP15K1	22.0	640	45	13.0
	HA-LP15K1M	22.0	640	45	13.0
MR-J3-22KT	HA-LP22K2	33.0	850	55	17.0
	HA-LP20K1	30.1	775	55	15.5
	HA-LP25K1	37.6	970	55	19.4
	HA-LP22K1M	33.0	850	55	17.0

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value assumes that the power factor improving reactor is not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, in section 14.2.

(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℃ (+50°F) at the ambient temperature of 40℃ (104°F). (With a 5℃ (41°F) safety margin, the system should operate within a maximum 55℃ (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 13.1:

$$A = \frac{P}{K \cdot \Delta T} \quad\text{.. (13.1)}$$

where, A : Heat dissipation area [m^2]

P : Loss generated in the control box [W]

ΔT : Difference between internal and ambient temperatures [℃]

K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 13.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 13.1 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 fan should be considered.

Table 13.1 lists the enclosure dissipation area for each servo amplifier when the servo amplifier is operated at the ambient temperature of 40℃ (104°F) under rated load.

(Outside)　　　(Inside)
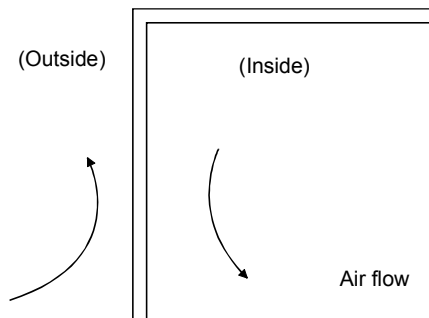
Air flow

Fig. 13.2 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.

13.3 Dynamic brake characteristics

Fig. 13.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 13.2 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 Fig. 13.4, 13.5)
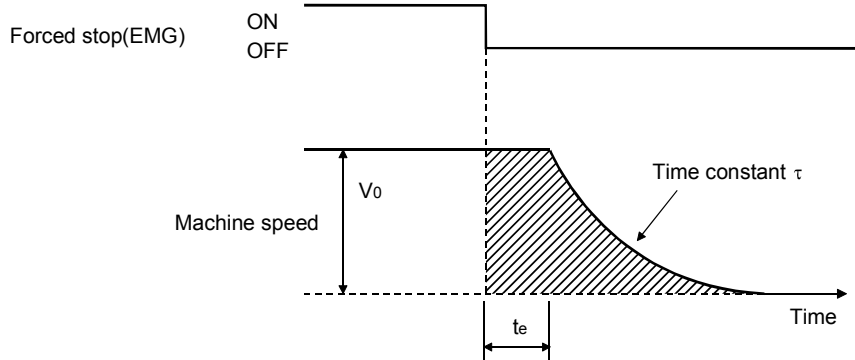
Fig. 13.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ te + \tau \left[1 + \frac{J_L}{J_M} \right] \right\} \quad \text{.. (13.2)}$$

L_{max} : Maximum coasting distance .... [mm][in]
V_0 : Machine rapid feedrate ....[mm/min][in/min]
J_M : Servo motor inertial moment.. [kg・cm^2][oz・in^2]
J_L : Load inertia moment converted into equivalent value on servo motor shaft .... [kg・cm^2][oz・in^2]
τ : Brake time constant .... [s]
te : Delay time of control section.. [s]

　　For 7kW or less servo, there is internal relay delay time of about 30ms. For 11kW to 22kW servo, there is delay time of about 100ms caused by a delay of the external relay and a delay of the magnetic contactor built in the external dynamic brake.

HF-MP series

HF-KP series

HF-SP1000r/min series

HF-SP2000r/min series
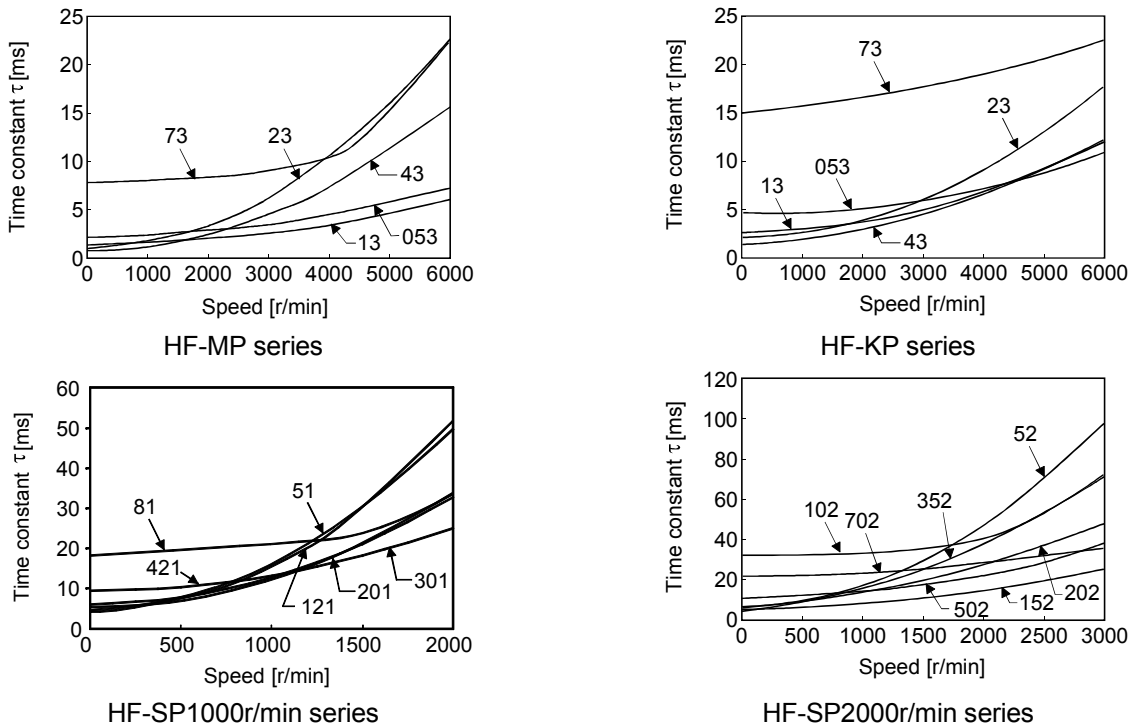
Fig. 13.4 Dynamic brake time constant

HA-LP1000r/min series

HA-LP1500r/min series

HA-LP2000r/min series

HC-LP series
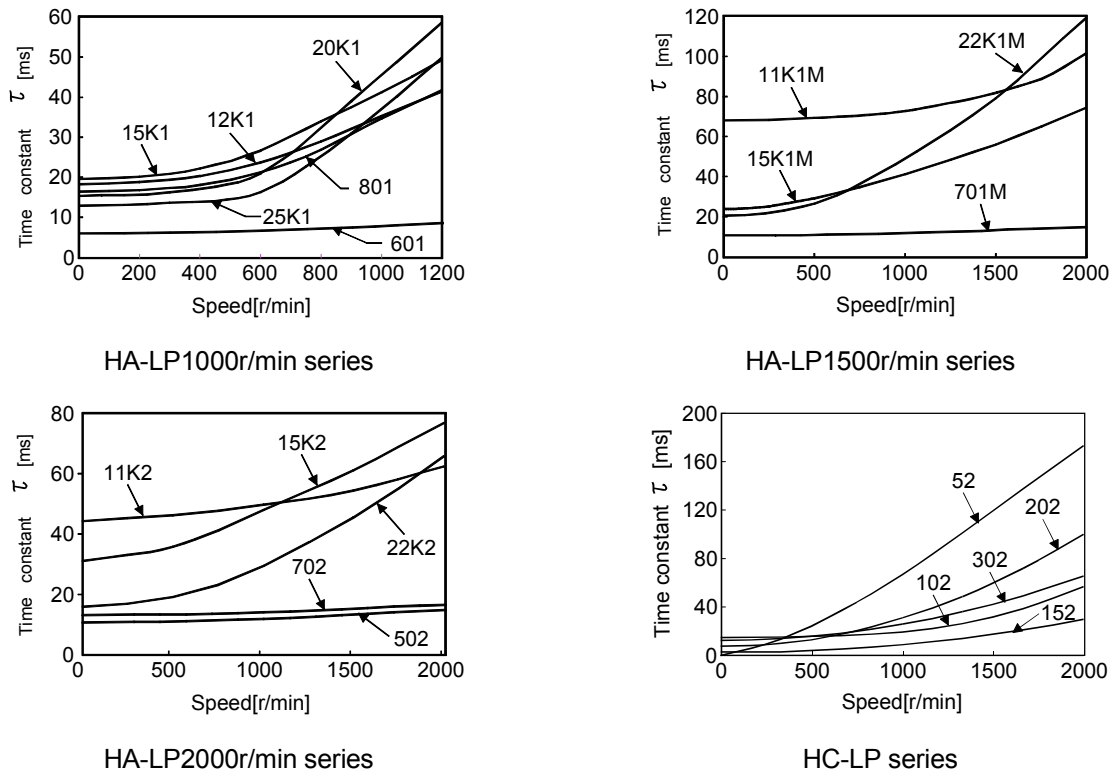
Fig. 13.5 Dynamic brake time constant2

Use the dynamic brake at the load inertia moment indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact Mitsubishi.

Servo amplifier	Load inertia moment ratio [times]
MR-J3-10T (1)	30
MR-J3-20T (1)	
MR-J3-40T (1)	
MR-J3-60T	
MR-J3-70T	
MR-J3-100T	
MR-J3-200T	
MR-J3-350T	16
MR-J3-500T	15
MR-J3-700T	(Note 1) 15
(Note 2) MR-J3-11KT	30
(Note 2) MR-J3-15KT	
(Note 2) MR-J3-22KT	

Note 1. The value is 5 when used at motor speed over 2000r/min.
2. When the external dynamic brake is used.

13.4 Cable flexing life

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

a : Long flexing life encoder cable
    Long flexing life motor power cable
    Long flexing life motor brake cable

b : Standard encoder cable
    Standard motor power cable
    Standard motor brake cable
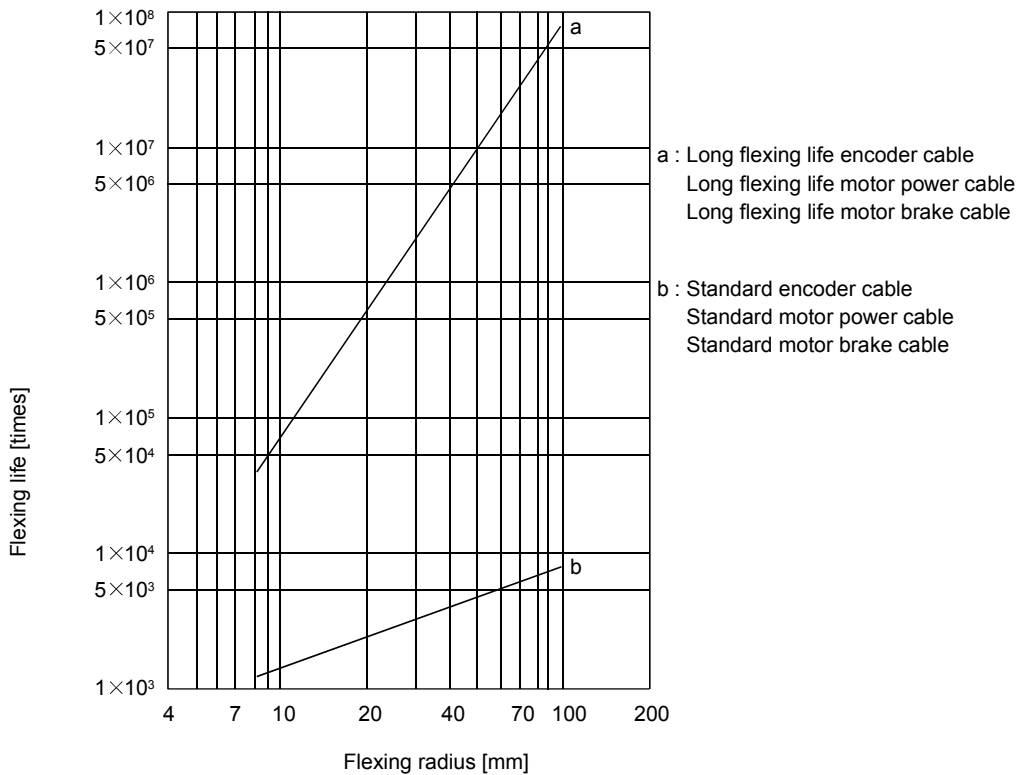
13.5 Inrush currents at power-on of main circuit and control circuit

The following table indicates the inrush currents (reference data) that will flow when the maximum permissible voltage (200VAC class: 253VAC) is applied at the power supply capacity of 2500kVA and the wiring length of 1m.

Servo Amplifier	Inrush Currents (A_0-p)	
	Main circuit power supply (L_1, L_2, L_3)	Control circuit power supply (L_{11}, L_{21})
MR-J3-10T to 60T	30A (Attenuated to approx. 5A in 10ms)	20 to 30A (Attenuated to approx. 0A in 1 to 2ms)
MR-J3-70T・100T	54A (Attenuated to approx. 12A in 10ms)	
MR-J3-200T・350T	120A (Attenuated to approx. 12A in 20ms)	
MR-J3-10T1 to 40T1	38A (Attenuated to approx. 14A in 10ms)	
MR-J3-500T	44A (Attenuated to approx. 20A in 20ms)	30A (Attenuated to approx. 0A in 3ms)
MR-J3-700T	88A (Attenuated to approx. 20A in 20ms)	
MR-J3-11KT	235A (Attenuated to approx. 20A in 20ms)	
MR-J3-15KT		
MR-J3-22KT		

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 14.10.)
When circuit protectors are used, it is recommended to use the inertia delay type that will not be tripped by an inrush current.

14. OPTIONS AND AUXILIARY EQUIPMENT

⚠ WARNING	· Before connecting any option or auxiliary equipment, make sure that the charge lamp is off more than 15 minutes after power-off, then confirm the voltage with a tester or the like. Otherwise, you may get an electric shock.

⚠ CAUTION	· Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

14.1 Cable/connector sets

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

14.1.1 Combinations of cable/connector sets
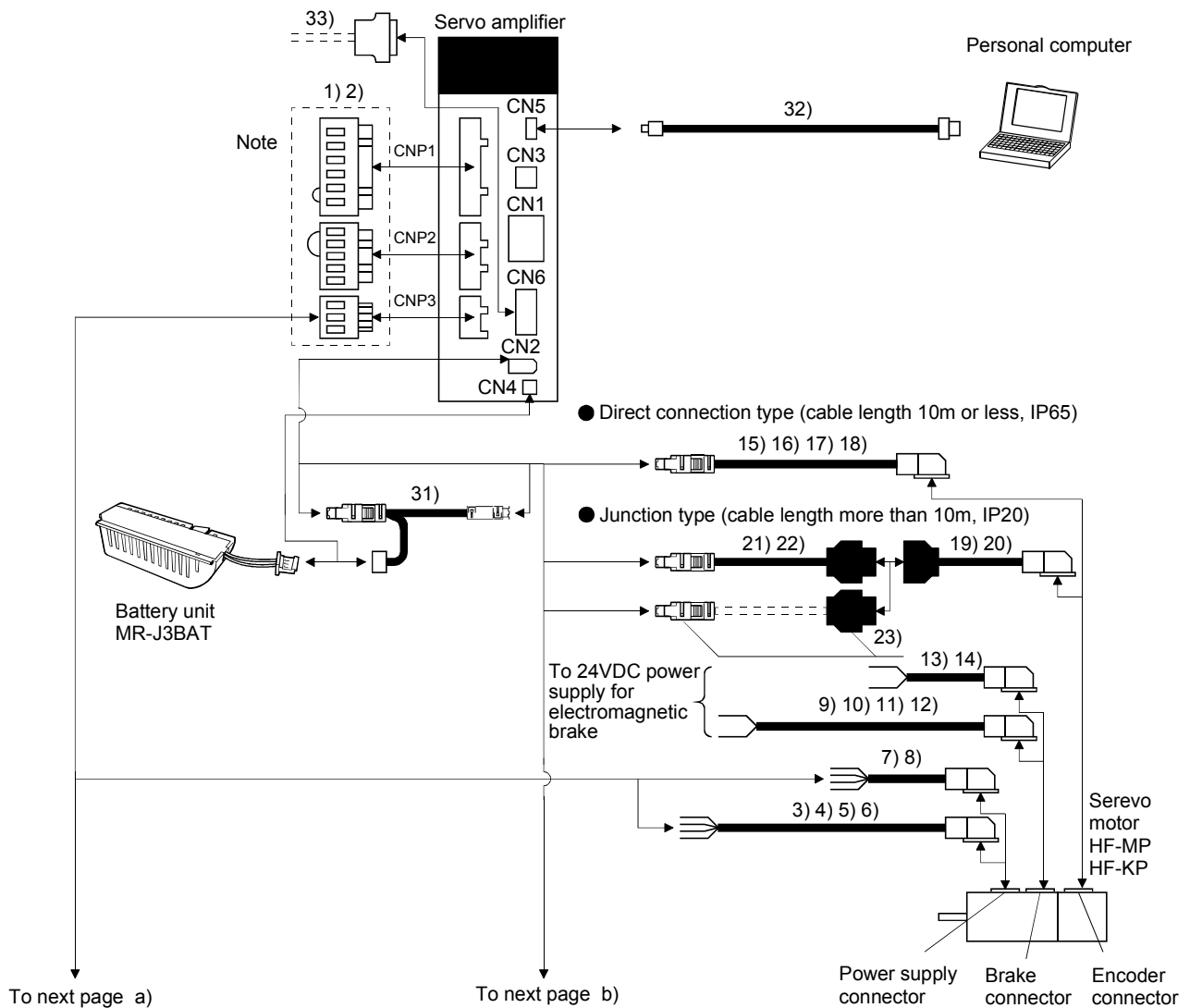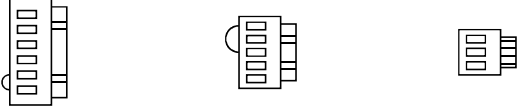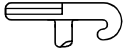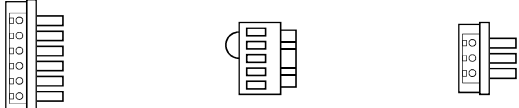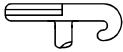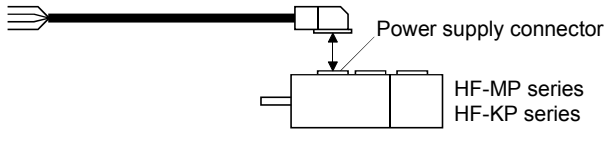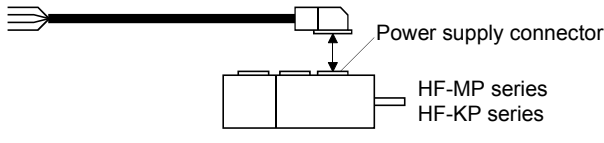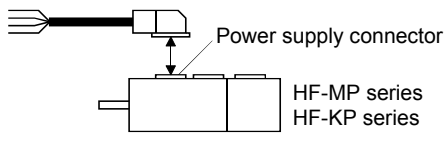
Note. Connectors for 3.5kw or less. For 5kw or more, terminal blocks.
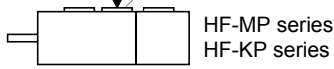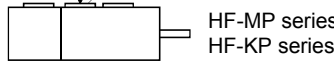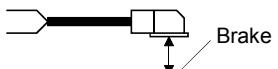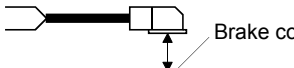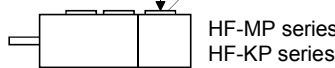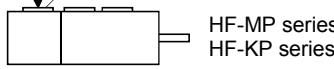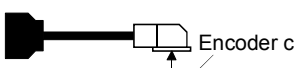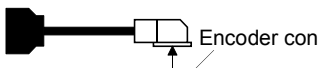
a)

b)

26)

24) 25)

27)

28) 29)

30)

Servo motor
HF-SP

Power supply
connector

Brake
connector

Encoder
connector

26)

24) 25)

34)

30) 35) 36)

Servo motor
HC-RP
HC-UP
HC-LP

Power supply
connector

Brake
connector

Encoder
connector

26)

24) 25)

Servo motor
HA-LP

Terminal box
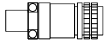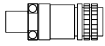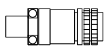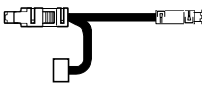
No.	Product	Model	Description	Application
1)	Servo amplifier power supply connector		CNP1 connector: 54928-0610 (Molex) CNP2 connector: 54927-0510 (Molex) CNP3 connector: 54928-0310 (Molex) <Applicable cable example> Wire size: 0.14mm^2(AWG26) to 2.5mm^2 (AWG14) Cable finish OD: to ϕ3.8mm REC. Lever: 54932-0000 (Molex)	Supplied with servo amplifiers of 1kW or less
2)	Servo amplifier power supply connector		CNP1 connector: PC4/6-STF-7.62-CRWH (Phoenix Contact) CNP2 connector: 54927-0510 (Molex) CNP3 connector: PC4/3-STF-7.62-CRWH (Phoenix Contact) <Applicable cable example> Wire size: 0.2mm^2 (AWG24) to 5.5mm^2 (AWG10) Cable finish OD: to ϕ5mm REC. Lever: 54932-0000 (Molex)	Supplied with servo amplifiers of 2kW and 3.5kW
3)	Motor power supply cable	MR-PWS1CBL□M-A1-L Cable length: 2・5・10m	Power supply connector HF-MP series HF-KP series Refer to section 14.1.3 for details.	IP65 Load side lead
4)	Motor power supply cable	MR-PWS1CBL□M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long flex life
5)	Motor power supply cable	MR-PWS1CBL□M-A2-L Cable length: 2・5・10m	Power supply connector HF-MP series HF-KP series Refer to section 14.1.3 for details.	IP65 Opposite-to-load side lead
6)	Motor power supply cable	MR-PWS1CBL□M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
7)	Motor power supply cable	MR-PWS2CBL03M-A1-L Cable length: 0.3m	Power supply connector HF-MP series HF-KP series Refer to section 14.1.3 for details.	IP55 Load side lead
8)	Motor power supply cable	MR-PWS2CBL03M-A2-L Cable length: 0.3m	Power supply connector HF-MP series HF-KP series Refer to section 14.1.3 for details.	IP55 Opposite-to-load side lead
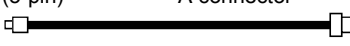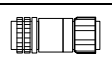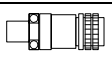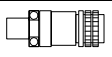
No.	Product	Model	Description	Application
9)	Motor brake cable	MR-BKS1CBL□M-A1-L Cable length: 2・5・10m	Brake connector / HF-MP series HF-KP series / Refer to section 14.1.4 for details.	IP65 Load side lead
10)	Motor brake cable	MR-BKS1CBL□M-A1-H Cable length: 2・5・10m		IP65 Load side lead Long flex life
11)	Motor brake cable	MR-BKS1CBL□M-A2-L Cable length: 2・5・10m	Brake connector / HF-MP series HF-KP series / Refer to section 14.1.4 for details.	IP65 Opposite-to-load side lead
12)	Motor brake cable	MR-BKS1CBL□M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
13)	Motor brake cable	MR-BKS2CBL03M-A1-L Cable length: 0.3m	Brake connector / HF-MP series HF-KP series / Refer to section 14.1.4 for details.	IP55 Load side lead
14)	Motor brake cable	MR-BKS2CBL03M-A2-L Cable length: 0.3m	Brake connector / HF-MP series HF-KP series / Refer to section 14.1.4 for details.	IP55 Opposite-to-load side lead
15)	Encoder cable	MR-J3ENCBL□M-A1-L Cable length: 2・5・10m	Encoder connector / HF-MP series HF-KP series / Refer to section 14.1.2 (1) for details.	IP65 Load side lead
16)	Encoder cable	MR-J3ENCBL□M-A1-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
17)	Encoder cable	MR-J3ENCBL□M-A2-L Cable length: 2・5・10m	Encoder connector / HF-MP series HF-KP series / Refer to section 14.1.2 (1) for details.	IP65 Opposite-to-load side lead
18)	Encoder cable	MR-J3ENCBL□M-A2-H Cable length: 2・5・10m		IP65 Opposite-to-load side lead Long flex life
19)	Encoder cable	MR-J3JCBL03M-A1-L Cable length: 0.3m	Encoder connector / HF-MP series HF-KP series / Refer to section 14.1.2 (3) for details.	IP20 Load side lead
20)	Encoder cable	MR-J3JCBL03M-A2-L Cable length: 0.3m	Encoder connector / HF-MP series HF-KP series / Refer to section 14.1.2 (3) for details.	IP20 Opposite-to-load side lead

No.	Product	Model	Description	Application
21)	Encoder cable	MR-EKCBL □ M-L Cable length: 20・30m		IP20
22)	Encoder cable	MR-EKCBL □ M-H Cable length: 20・30・40・50m	For HF-MP・HF-KP series Refer to section 14.1.2 (2) for details.	IP20 Long flex life
23)	Encoder connector set	MR-ECNM	For HF-MP・HF-KP series Refer to section 14.1.2 (2) for details.	IP20
24)	Encoder cable	MR-J3ENSCBL □ M-L Cable length: 2・5・10・20・30m		IP67 Standard flex life
25)	Encoder cable	MR-J3ENSCBL □ M-H Cable length: 2・5・10・20・30・40・50m	For HF-SP・HA-LP・HC-UP・HC-LP・HC-RP series Refer to section 14.1.2 (4) for details.	IP67 Long flex life
26)	Encoder connector set	MR-J3SCNS	For HF-SP・HA-LP・HC-UP・HC-LP・HC-RP series Refer to section 14.1.2 (4) for details.	IP67
27)	Brake connector set	MR-BKCNS1	Straight plug: CM10-SP2S-L Socket contact: CM10-#22SC(S2)-100 (DDK) For HF-SP series	IP67
28)	Power supply connector set	MR-PWCNS4	Plug: CE05-6A18-10SD-B-BSS Cable clamp: CE3057-10A-1 (D265) (DDK) Example of applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Cable finish ϕD: ϕ 10.5 to 14.1mm For HF-SP51・81 For HF-SP52・152	IP67
29)	Power supply connector set	MR-PWCNS5	Plug: CE05-6A22-22D-B-BSS Cable clamp: CE3057-12A-1 (D265) (DDK) Example of applicable cable Applicable wire size: 5.5mm^2 (AWG10) to 8mm^2 (AWG8) Cable finish ϕD: ϕ 12.5 to 16mm For HF-SP121・201 For HF-SP202 to 502	IP67
30)	Power supply connector set	MR-PWCNS3	Plug: CE05-6A32-17SD-B-BSS Cable clamp: CE3057-20A-1(D265) (DDK) Example of applicable cable Applicable wire size: 14mm^2 (AWG6) to 22mm^2 (AWG4) Cable finish ϕ D: ϕ 22 to 23.8mm For HF-SP702 For HC-UP For HC-LP For HC-RP	IP65 IP67 Be sure to use this when corresponding to EN Standard.
31)	Cable for connecting battery	MR-J3BTCBL03M	Refer to section 14.1.2 (5) for details.	For connection of battery

No.	Product	Model	Description		Application
32)	USB cable	MR-J3USBCBL3M Cable length: 3m	For CN5 connector minB connector (5-pin)	For personal computer connector A connector	For connection with PC-AT compatible personal computer
33)	Connector set	MR-J2CMP2	Connector: 10126-3000VE Shell kit: 10326-52F0-008(3M or equivalent)		
34)	Break connector set	MR-BKCN	Plug: MS3106A10SL-4S(D190) (DDK) For cable connector : YS010-5-8(Daiwa Dengyo) Example of applicable cable Applicable wire size: 0.3mm^2 (AWG22) to 1.25mm^2 (AWG16) Cable finish: ϕ 5 to 8.3mm	For HC-UP For HC-LP For HC-RP	EN standard compliant IP65 IP67
35)	Power supply connector set	MR-PWCNS1	Plug: CE05-6A22-23SD-B-BSS Cable clamp: CE3057-12A-2(D265) (DDK) Example of applicable cable Applicable wire size: 2mm^2 (AWG14) to 3.5mm^2 (AWG12) Cable finish: ϕ 9.5 to 13mm	For HC-UP For HC-LP For HC-RP	Be sure to use this when corresponding to EN standard IP65 IP67
36)	Power supply connector set	MR-PWCNS2	Plug: CE05-6A24-10SD-B-BSS Cable clamp: CE3057-16A-2(D265) (DDK) Example of applicable cable Applicable wire size: 5.5mm^2 (AWG10) to 8mm^2 (AWG8) Cable finish: ϕ 13 to 15.5mm	For HC-UP For HC-LP For HC-RP	

14.1.2 Encoder cable/connector sets

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

These cables are encoder cables for the HF-MP・HF-KP series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable Model	Cable Length								Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m	20m	30m	40m	50m			
MR-J3ENCBL □ M-A1-L		2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor
MR-J3ENCBL □ M-A1-H		2	5	10					IP65	Long flex	Load side lead
MR-J3ENCBL □ M-A2-L		2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor
MR-J3ENCBL □ M-A2-H		2	5	10					IP65	Long flex	Opposite-to-load side lead

(a) Connection of servo amplifier and servo motor
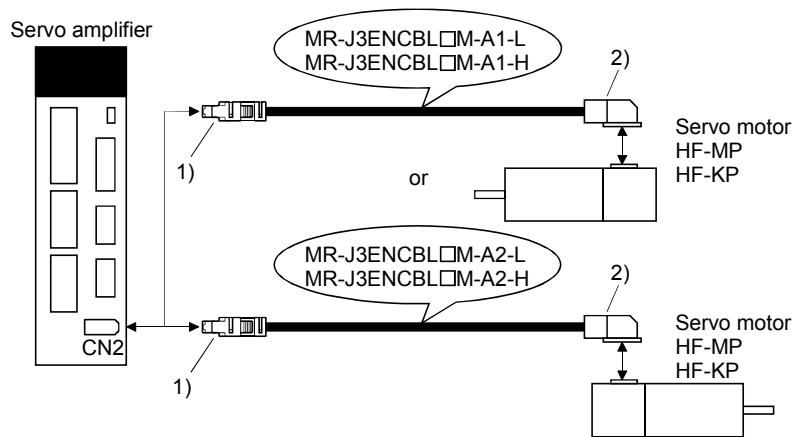
Cable Model	1) Servo Amplifier side Connector		2) Encoder side Connector
MR-J3ENCBL □ M-A1-L	Receptacle: 36210-0100FD Shell kit: 536310-3200-008 (3M)	Connector set: 54599-1019 (Molex)	Connector: 1674320-1 Crimping tool for ground clip: 1596970-1
MR-J3ENCBL □ M-A1-H	(Note) Signal layout	(Note) Signal layout	Crimping tool for receptacle contact: 1596847 (Tyco Electronics) (Note) Signal layout View seen from wiring side. Note. Keep open the pin shown with an ◢.
	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.	View seen from wiring side.	
MR-J3ENCBL □ M-A2-L			
MR-J3ENCBL □ M-A2-H			

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(b) Cable internal wiring diagram

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

	Servo amplifier side connector			Encoder side connector	
P5	1		3	P5
LG	2		6	LG
MR	3		5	MR
MRR	4		4	MRR
BAT	9		2	BAT
SD	Plate		9	SHD
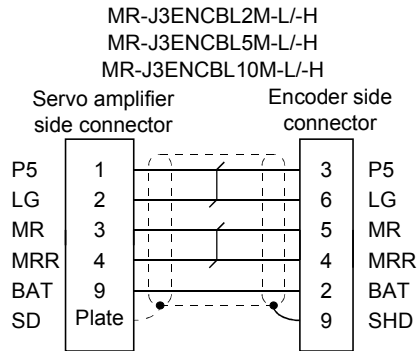
(2) MR-EKCBL □ M-L/H

```
  POINT
・The following encoder cables are of four-wire type. When using any of these
  encoder cables, set parameter No. PC22 to "1 □ □ □" to select the four-wire
  type.
  MR-EKCBL30M-L
  MR-EKCBL30M-H
  MR-EKCBL40M-H
  MR-EKCBL50M-H
```

The servo amplifier and servo motor cannot be connected with these cables only. The servo motor side encoder cable (MR-J3JCBL03M-A1-L or MR-J3JCBL03M-A2-L) is required.

The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable Model	Cable Length								Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m	20m	30m	40m	50m			
MR-EKCBL □ M-L					20	(Note) 30			IP20	Standard	For HF-MP・HF-KP servo motor
MR-EKCBL □ M-H					20	(Note) 30	(Note) 40	(Note) 50	IP20	Long flex	Use in combination with MR-J3JCBL03M-A1-L or MR-J3JCBL03M-A2-L.

Note. Four-wire type cable.

(a) Connection of servo amplifier and servo motor

Cable Model	1) Servo amplifier side Connector		2) Encoder side Connector
MR-EKCBL □ M-L MR-EKCBL □ M-H	Receptacle: 36210-0100FD Shell kit: 536310-3200-008 (3M)	Connector set: 54599-1019 (Molex)	Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industries)

(Note) Signal layout (servo amplifier side, first layout)

	4 MRR	6	8 MDR	10
2 LG	1 P5	3 MR	5	7 MD	9 BAT

View seen from wiring side.

or

(Note) Signal layout (servo amplifier side, second 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.

Signal layout (Encoder side)

1 MR	2 MRR	3 BAT
4 MD	5 MDR	6 CONT
7 P5	8 LG	9 SHD

View seen from wiring side.

(b) Internal wiring diagram

MR-EKCBL20M-L

Servo amplifier side			Encoder side
P5	1	7	P5E
LG	2	8	P5G
MR	3	1	MR
MRR	4	2	MRR
BAT	9	3	BAT
SD	Plate	9	SHD

(Note)

MR-EKCBL30M-L

Servo amplifier side			Encoder side
P5	1	7	P5E
LG	2	8	P5G
MR	3	1	MR
MRR	4	2	MRR
MD	7	4	MD
MDR	8	5	MDR
BAT	9	3	BAT
		6	CONT
SD	Plate	9	SHD

(Note)

MR-EKCBL20M-H

Servo amplifier side			Encoder side
P5	1	7	P5E
LG	2	8	P5G
MR	3	1	MR
MRR	4	2	MRR
BAT	9	3	BAT
SD	Plate	9	SHD

(Note)

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

Servo amplifier side			Encoder side
P5	1	7	P5E
LG	2	8	P5G
MR	3	1	MR
MRR	4	2	MRR
MD	7	4	MD
MDR	8	5	MDR
BAT	9	3	BAT
		6	CONT
SD	Plate	9	SHD

(Note)

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

When fabricating the cable, use the wiring diagram corresponding to the length indicated below.

Cable Flex Life	Applicable Wiring Diagram	
	Less than 10m	30m to 50m
Standard	MR-EKCBL20M-L	
Long flex	MR-EKCBL20M-H	MR-EKCBL30M-H MR-EKCBL40M-H MR-EKCBL50M-H

(c) When fabricating the encoder cable

When fabricating the cable, prepare the following parts and tool, and fabricate it according to the wiring diagram in (b). Refer to section 14.9 for the specifications of the used cable.

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

(3) MR-J3JCBL03M-A1-L · MR-J3JCLB03M-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	Protective Structure	Flex Life	Application
MR-J3JCBL03M-A1-L	0.3m	IP20	Standard	For HF-MP · HF-KP servo motor Load side lead Use in combination with MR-EKCBL □ M-L/H.
MR-J3JCBL03M-A2-L				For HF-MP · HF-KP servo motor Opposite-to-load side lead Use in combination with MR-EKCBL □ M-L/H.

(a) Connection of servo amplifier and servo motor
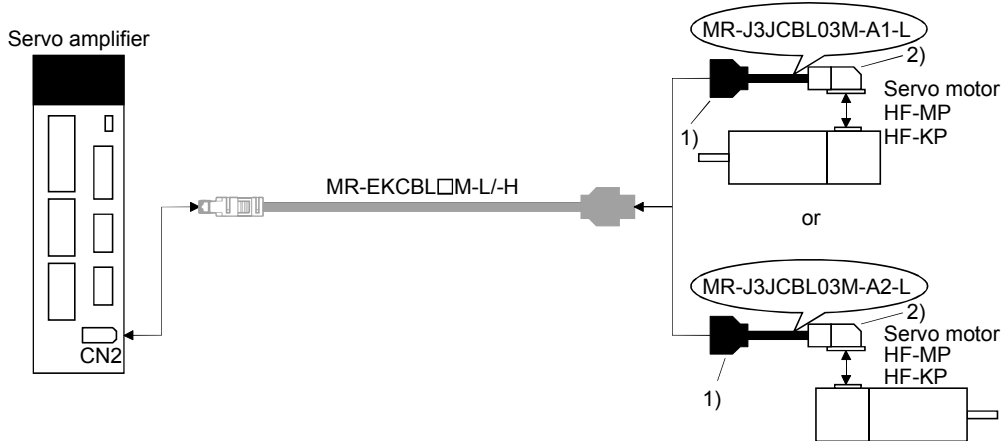
Cable Model	1) Junction Connector	2) For Encoder Connector
MR-J3JCBL03M-A1-L	Housing: 1-172169-9 Contact: 1473226-1 Cable clamp: 316454-1 (Tyco Electronics) Signal layout View seen from wiring side.	Connector: 1674320-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847 (Tyco Electronics) Signal layout View seen from wiring
MR-J3JCBL03M-A2-L		

Signal layout (Junction Connector):

3	2	1
BAT	MRR	MR
6	5	4
CONT	MDR	MD
9	8	7
SHD	LG	P5

Signal layout (Encoder Connector):

9 SHD	
7 MDR	8 MD
5 MR	6 P5G
3 P5	4 MRR
1 CONT	2 BAT

(b) Internal wiring diagram

MR-J3JCBL03M-A1-L

Junction connector			Encoder side connector
P5	7	3	P5
LG	8	6	P5G
MR	1	5	MR
MRR	2	4	MRR
MD	4	8	MD
MDR	5	7	MDR
BAT	3	2	BAT
SEL	6	1	CONT
SHD	9	9	SHD

(4) MR-J3ENSCBL □ M-L・MR-J3ENSCBL □ M-H

These cables are detector cables for HF-SP Series servomotors. The number in the cable length column of the table indicates the symbol filling the square □ in the cable model. Cable lengths corresponding to the specified symbols are prepared.

Cable Model	Cable Length							Protective Structure	Flex Life	Application
	2m	5m	10m	20m	30m	40m	50m			
MR-J3ENSCBL □ M-L	2	5	10	20	30	/	/	IP67	Standard	For HF-SP servo motor
MR- J3ENSCBL □ M-H	2	5	10	20	30	40	50	IP67	Long flex	

(a) Connection of servo amplifier and servo motor
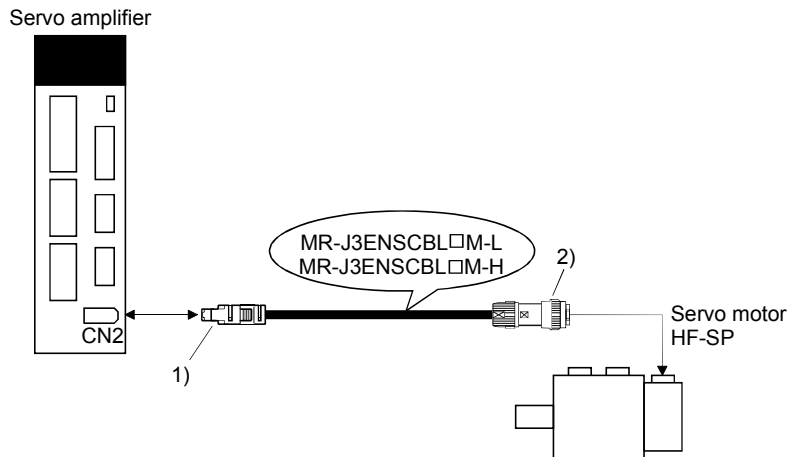
Cable Model	1) For CN2 Connector	2) For Encoder Connector
MR-J3ENSCBL □ M-L MR-J3ENSCBL □ M-H	Receptacle: 36210-0100FD Connector set: 54599-1019 Shell kit: 536310-3200-008 (Molex) (3M) (Note) Signal layout (Note) Signal layout or Note. Keep open the pins shown with ◺. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the servo amplifier cannot operate normally.	In case of 10m or shorter cables Straight plug: CM10-SP10S-M Socket contact: CM10-#22SC(C1)-100 Crimping tool: 357J-50446 (DDK) Applicable cable AWG20 to 22 In case of 20m or longer cables Straight plug: CM10-SP10S-M Socket contact: CM10-#22SC(C2)-100 Crimping tool: 357J-50447 (DDK) Applicable cable AWG23 to 28 (Note) Signal layout View seen from wiring side Note. Keep open the pin shown with an ◺.

(b) Internal wiring diagram

MR-J3ENSCBL2M-L/H
MR-J3ENSCBL5M-L/H
MR-J3ENSCBL10M-L/H

Servo amplifier side connector — Encoder side connector

P5	1		8	P5
LG	2		5	LG
MR	3		1	MR
MRR	4		2	MRR
BAT	9		4	BAT
SD	Plate		10	SHD

MR-J3ENSCBL20M-L
MR-J3ENSCBL30M-L

Servo amplifier side connector — Encoder side connector

P5	1		8	P5
LG	2		5	LG
MR	3		1	MR
MRR	4		2	MRR
BAT	9		4	BAT
SD	Plate		10	SHD

MR-J3ENSCBL20M-H
MR-J3ENSCBL30M-H
MR-J3ENSCBL40M-H
MR-J3ENSCBL50M-H

Servo amplifier side connector — Encoder side connector

P5	1		8	P5
LG	2		5	LG
MR	3		1	MR
MRR	4		2	MRR
BAT	9		4	BAT
SD	Plate		10	SHD

(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 14.9 for the specifications of the used cable.

Parts/Tool	Description
Connector set	MR- J3SCNS (Option) Servo amplifier side connector Receptacle: 36210-0100FD Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019 (Molex) — Encoder side connector Straight plug: CM10-SP10S-M Socket contact: CM10-#22SC(S1)-100 Applicable wire size: AWG20 or less Recommended tightening jig: 357J-51456T (DDK)

(5) MR-J3BTCBL03M

This cable is a battery connection cable. Use this cable to retain the current position even if the detector cable is disconnected from the servo amplifier.

Cable Model	Cable Length	Application
MR-J3BTCBL03M	0.3m	For HF-MP ᐧ HF-KP ᐧ HF-SP servo motor

(a) Connection of servo amplifier and servo motor
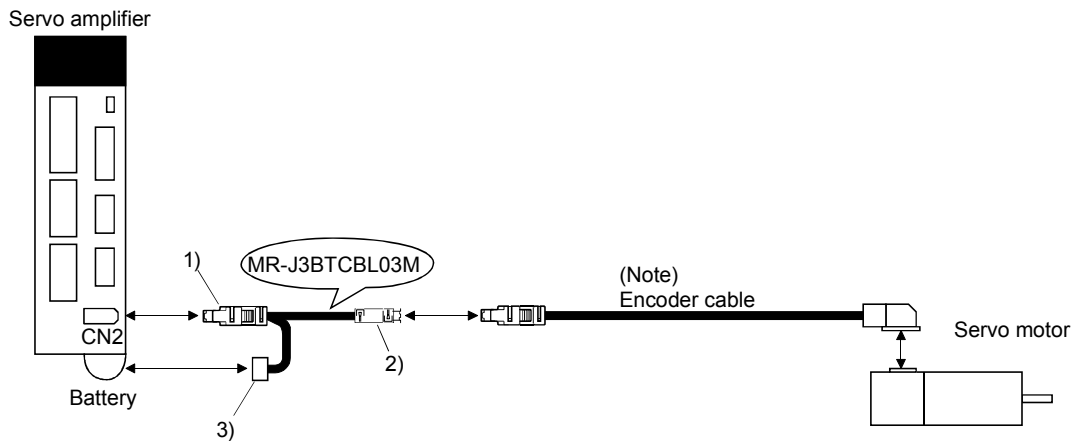
Note. For the detector cable, refer to (1), (2), (3) and (4) of this section.

Cable Model	1) For CN2 Connector	1) Junction Connector	2) For Battery Connector
MR-J3BTCBL03M	Receptacle: 36210-0100FD Shell kit: 536310-3200-008 (3M) Or Connector set: 54599-1019 (Molex)	Plug: 36110-3000FD Shell kit: 36310-F200-008 (3M)	Connector: DF3-2EP-2C Contact: DF3-EP2428PCFA (Hirose Denki)

14. OPTIONS AND AUXILIARY EQUIPMENT

14.1.3 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 4.10 when wiring.

Cable Model	Cable Length								Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m	20m	30m	40m	50m			
MR-PWS1CBL □ M-A1-L		2	5	10					IP65	Standard	For HF-MP · HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-L		2	5	10					IP65	Standard	For HF-MP · HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL □ M-A1-H		2	5	10					IP65	Long flex	For HF-MP · HF-KP servo motor Load side lead
MR-PWS1CBL □ M-A2-H		2	5	10					IP65	Long flex	For HF-MP · HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL □ M-A1-L	03								IP55	Standard	For HF-MP · HF-KP servo motor Load side lead
MR-PWS2CBL □ M-A2-L	03								IP55	Standard	For HF-MP · HF-KP servo motor Opposite-to-load side lead

(1) Connection of servo amplifier and servo motor

Cable Model	1) For Motor Power Supply Connector	
MR-PWS1CBL □ M-A1-L	Connector: JN4FT04SJ1	Signal layout
MR-PWS1CBL □ M-A2-L	Hod, socket insulator	
MR-PWS1CBL □ M-A1-H	Bushing, ground nut	
MR-PWS1CBL □ M-A2-H	Contact: ST-TMH-S-C1B-100(A534G)	1 ⊕
MR-PWS2CBL03M-A1-L	Crimping tool: CT160-3TM5B	2 U / 3 V / 4 W
MR-PWS2CBL03M-A2-L	(Japan Aviation Electronics Industry)	View seen from wiring side.

(2) Internal wiring diagram

MR-PWS1CBL□M-A1-H   MR-PWS1CBL□M-A2-H
MR-PWS2CBL03M-A1-L   MR-PWS1CBL03M-A2-L

AWG 19 (Red)   U
AWG 19 (White)   V
AWG 19 (Black)   W
AWG 19 (Green/yellow) ⊕

14.1.4 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 4.11 when wiring.

Cable Model	Cable Length								Protective Structure	Flex Life	Application
	0.3m	2m	5m	10m	20m	30m	40m	50m			
MR-PWS1CBL□M-A1-L		2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-L		2	5	10					IP65	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS1CBL□M-A1-H		2	5	10					IP65	Long flex	For HF-MP・HF-KP servo motor Load side lead
MR-PWS1CBL□M-A2-H		2	5	10					IP65	Long flex	For HF-MP・HF-KP servo motor Opposite-to-load side lead
MR-PWS2CBL□M-A1-L	03								IP55	Standard	For HF-MP・HF-KP servo motor Load side lead
MR-PWS2CBL□M-A2-L	03								IP55	Standard	For HF-MP・HF-KP servo motor Opposite-to-load side lead

(1) Connection of servo amplifier and servo motor

Cable Model	1) For Motor Brake Connector	
MR-BKS1CBL □ M-A1-L	Connector: JN4FT02SJ1	Signal layout
MR-BKS1CBL □ M-A2-L	Hod, socket insulator	
MR-BKS1CBL □ M-A1-H	Bushing, ground nut	
MR-BKS1CBL □ M-A2-H	Contact: ST-TMH-S-C1B-100(A534G)	
MR-BKS2CBL03M-A1-L	Crimping tool: CT160-3TMH5B	
MR-BKS2CBL03M-A2-L	(Japan Aviation Electronics Industry)	View seen from wiring side.

(2) Internal wiring diagram

MR-BKS1CBL□M-A1-H MR-BKS1CBL□M-A2-H
MR-BKS2CBL03M-A1-L MR-BKS1CBL03M-A2-L

14.2 Regenerative options

⚠ CAUTION	・The specified combinations of regenerative options and servo amplifiers may only be used. Otherwise, a fire may occur.

(1) Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

Servo amplifier	Regenerative power[W]							
	Built-in regenerative resistor	MR-RB032 [40Ω]	MR-RB12 [40Ω]	MR-RB30 [13Ω]	MR-RB31 [6.7Ω]	MR-RB32 [40Ω]	MR-RB50 [13Ω]	MR-MB51 [6.7Ω]
MR-J3-10T (1)		30						
MR-J3-20T (1)	10	30	100					
MR-J3-40T (1)	10	30	100					
MR-J3-60T	10	30	100					
MR-J3-70T	20	30	100			300		
MR-J3-100T	20	30	100			300		
MR-J3-200T	100			300			500	
MR-J3-350T	100			300			500	
MR-J3-500T	130				300			500
MR-J3-700T	170				300			500

Servo amplifier	(Note) Regenerative power[W]			
	External regenerative resistor (Accessory)	MR-RB5E [6Ω]	MR-RB9P [4.5Ω]	MR-RBB9F [3Ω]
MR-J3-11KT	500 (800)	500 (800)		
MR-J3-15KT	850 (1300)		850 (1300)	
MR-J3-22KT	850 (1300)			850 (1300)

Note: Values in parentheses assume the installation of a cooling fan.

(2) Selection of the regenerative option

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

(a) Regenerative energy calculation

Use the following table to calculate the regenerative energy.
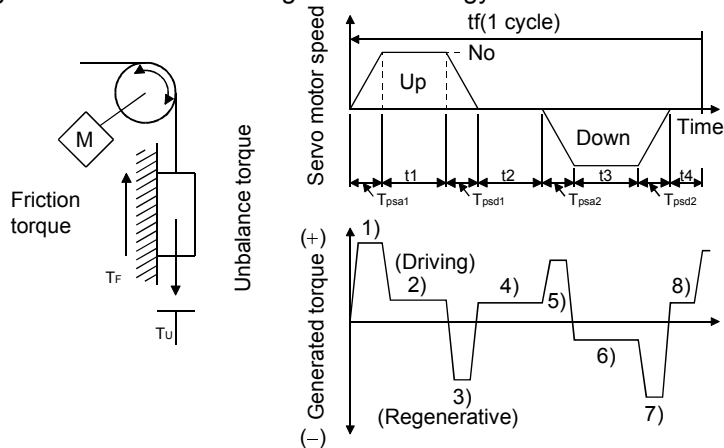
Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N・m]	Energy [J]
1)	$T_1 = \dfrac{(J_L+J_M)\cdot N_0}{9.55\times10^4} \cdot \dfrac{1}{T_{psa1}} + T_U + T_F$	$E_1 = \dfrac{0.1047}{2}\cdot N_0 \cdot T_1 \cdot T_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot N_0 \cdot T_2 \cdot t_1$
3)	$T_3 = \dfrac{-(J_L+J_M)\cdot N_0}{9.55\times10^4} \cdot \dfrac{1}{T_{psd1}} + T_U + T_F$	$E_3 = \dfrac{0.1047}{2}\cdot N_0 \cdot T_3 \cdot T_{psd1}$
4), 8)	$T_4 = T_U$	$E_4 \geqq 0$ (No regeneration)
5)	$T_5 = \dfrac{(J_L+J_M)\cdot N_0}{9.55\times10^4} \cdot \dfrac{1}{T_{psa2}} - T_U + T_F$	$E_5 = \dfrac{0.1047}{2}\cdot N_0 \cdot T_5 \cdot T_{psa2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot N_0 \cdot T_6 \cdot t_3$
7)	$T_7 = \dfrac{-(J_L+J_M)\cdot N_0}{9.55\times10^4} \cdot \dfrac{1}{T_{psd2}} - T_U + T_F$	$E_7 = \dfrac{0.1047}{2}\cdot N_0 \cdot T_7 \cdot T_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

(b) Losses of servo motor and servo amplifier in regenerative mode

The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo amplifier	Inverse efficiency[%]	Capacitor charging[J]
MR-J3-10T	55	9
MR-J3-10T1	55	4
MR-J3-20T	70	9
MR-J3-20T1	70	4
MR-J3-40T	85	11
MR-J3-40T1	85	10
MR-J3-60T	85	11
MR-J3-70T	80	18
MR-J3-100T	80	18
MR-J3-200T	85	40
MR-J3-350T	85	40
MR-J3-500T	90	45
MR-J3-700T	90	70
MR-J3-11KT	90	120
MR-J3-15KT	90	170
MR-J3-22KT	90	250

Inverse efficiency (η) : Efficiency including some efficiencies of the servo motor and servo amplifier when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec) : Energy charged into the electrolytic capacitor in the servo amplifier.

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative option.

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

Calculate the power consumption of the regenerative option on the basis of single-cycle operation period tf [s] to select the necessary regenerative option.

$$PR\ [W] = ER/tf \dotfill (14.1)$$

(3) Connection of the regenerative option

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

Parameter No. PA02
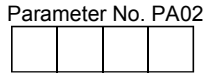
Selection of regenerative
00: Regenerative option is not used
　・For MR-J3-10T, regenerative resistor is not used.
　・For MR-J3-20T or more 700T or less, built-in regenerative resistor
　　is used.
　・Supplied regenerative resistors or regenerative option is used with
　　the MR-J3-11KT or more servo amplifier.
01: MR-BU・MR-RC・FR-CV
02: MR-RB032
03: MR-RB12
04: MR-RB32
05: MR-RB30
06: MR-RB50
08: MR-RB31
09: MR-RB51
FA: When regenerative resistors or regenerative option supplied to the
　　MR-J3-11KT or more are cooled by fans to increase capability.

(4) Connection of the regenerative option

> POINT
> ・When the MR-RB50・MR-RB51 is used, a fan is required to cool it. The
>   cooling fan should be prepared by the customer.
> ・For the sizes of wires used for wiring, refer to section 14.9.

The regenerative option will generate heat of about 100℃. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use flame-resistant cables and keep them clear of the regenerative option body. Always use twisted cables of max. 5m length for connection with the servo amplifier.

(a) MR-J3-350T or less

Always remove the wiring from across P-D and fit the regenerative option across P-C.
The G3 and G4 terminals act as a thermal sensor. G3-G4 is disconnected when the regenerative option overheats abnormally.
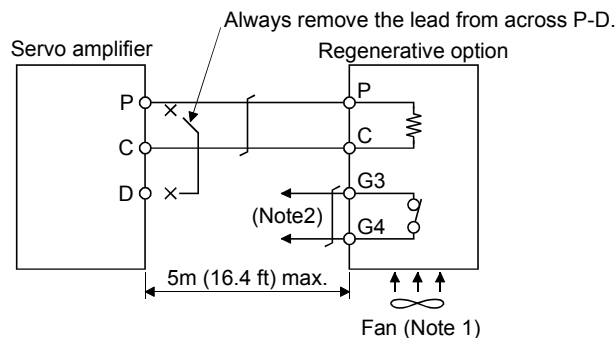
Note 1. When using the MR-RB50, forcibly cool it with a cooling fan (1.0m³/min,□92 or so).
　　 2. Make up a sequence which will switch off the magnetic contactor (MC) when
　　　　abnormal heating occurs.
　　　　G3-G4 contact specifications
　　　　Maximum voltage: 120V AC/DC
　　　　Maximum current: 0.5A/4.8VDC
　　　　Maximum capacity: 2.4VA

For the MR-RB50 install the cooling fan as shown.

[Unit : mm]

Fan installation screw hole dimensions

2-M3 screw hole
(for fan installation)
Depth 10 or less
(Screw hole already machined)

Recommended fan:
Toyo Denki's TL396A or equivalent
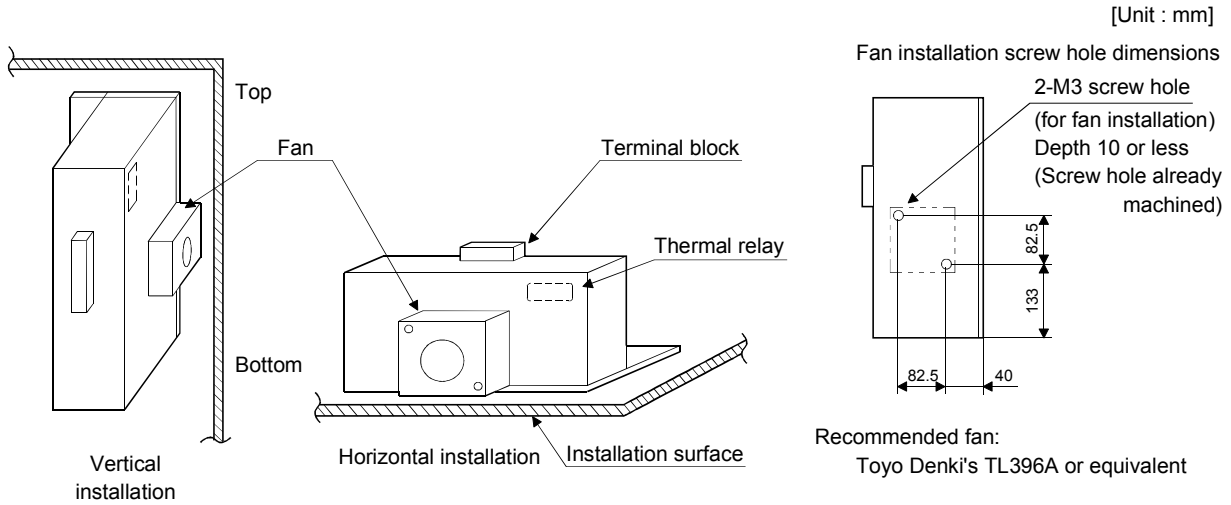
(b) MR-J3-500T・MR-J3-700T

Always remove the wiring (across P-C) of the servo amplifier built-in regenerative resistor and fit the regenerative option across P-C.

The G3 and G4 terminals act as a thermal sensor. G3-G4 is opened when the regenerative option overheats abnormally.
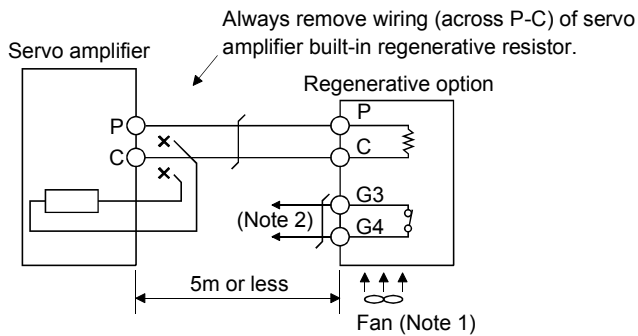
Note 1. When using the MR-RB50・MR-RB51, forcibly cool it with a cooling fan (1.0m³/min,□92 or so).
2. Make up a sequence which will switch off the magnetic contactor (MC)
when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

When using the regenerative resistor option, remove the servo amplifier's built-in regenerative resistor terminals (across P-C), fit them back to back, and secure them to the frame with the accessory screw as shown below.

Mounting method

Accessory screw
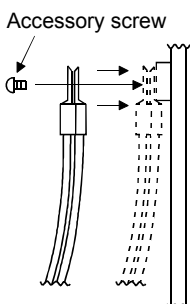
The drawing below shows the MR-J3-500B. Refer to (6) of section 12.1 Outline drawings for the position of the fixing screw for MR-J3-700T.

Built-in regenerative resistor
lead terminal fixing screw
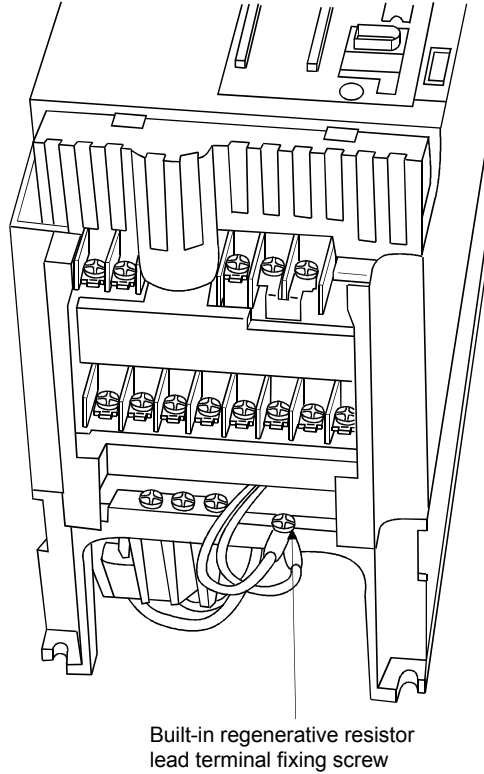
For the MR-RB51 install the cooling fan as shown.

[Unit : mm]

Fan installation screw hole dimensions

Top

Fan

Terminal block

Thermal relay

Bottom

2-M3 screw hole
(for fan installation)
Depth 10 or less
(Screw hole already
machined)

82.5

133

82.5   40

Vertical
installation

Horizontal installation   Installation surface
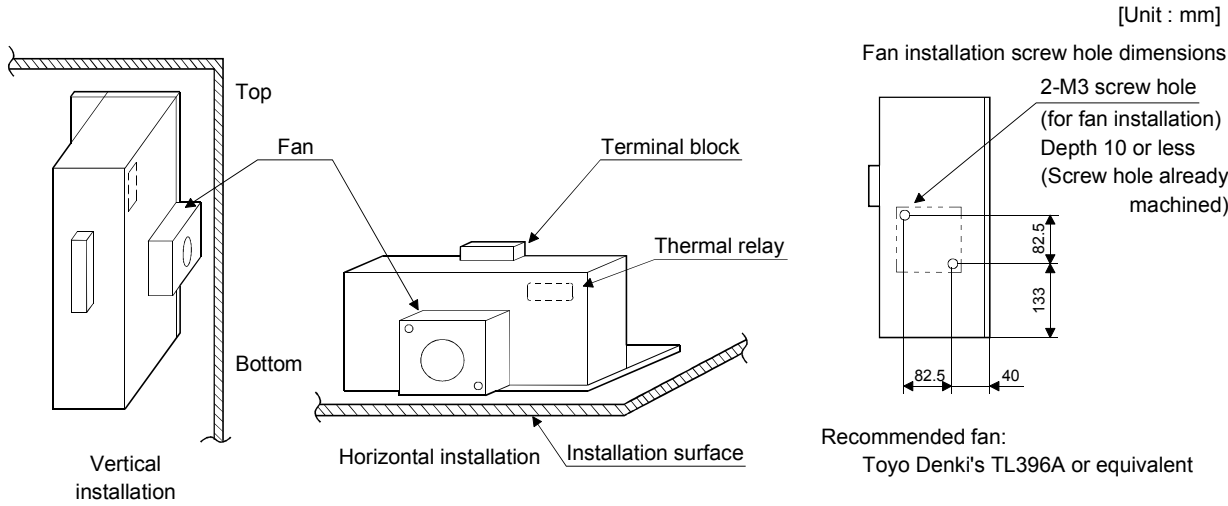
Recommended fan:
Toyo Denki's TL396A or equivalent

(c) MR-J3-11KT to MR-J3-22KT (when using the supplied regenerative resistor)

When using the regenerative resistors supplied to the servo amplifier, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the servo amplifier may become faulty and/or the regenerative resistors burn. Install the resistors at intervals of about 70mm. Cooling the resistors with fans (1.0m 3 /min, 92 (about two fans) improves the regeneration capability. In this case, set "□ □FA" in parameter No. PA02.
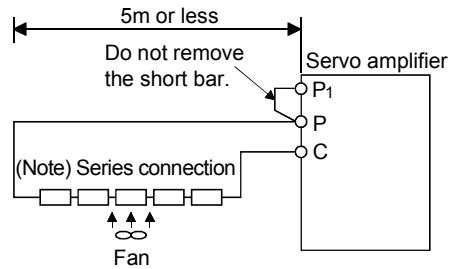
Note. The number of resistors connected in series depends on the resistor type. The thermal sensor is not mounted on the attached regenerative resistor. An abnormal heating of resistor may be generated at a regenerative circuit failure. Install a thermal sensor near the resistor and establish a protective circuit to shut off the main circuit power supply when abnormal heating occurs. The detection level of the thermal sensor varies according to the settings of the resistor. Set the thermal sensor in the most appropriate position on your design basis or use the thermal sensor built-in regenerative option (MR-RB5E, 9P, 9F) provided by Mitsubishi Electric Corporation.

Servo Amplifier	Regenerative Resistor	Regenerative Power [W]		Resistance [Ω]	Number of Resistors
		Normal	Cooling		
MR-J3-11KT	GRZG400-1.5Ω	500	800	6	4
MR-J3-15KT	GRZG400-0.9Ω	850	1300	4.5	5
MR-J3-22KT	GRZG400-0.6Ω	850	1300	3	5

(d) MR-J3-11KT-PX to MR-J3-22KT-PX (when using the regenerative option)

The MR-J3-11KT-PX to MR-J3-22KT-PX servo amplifiers are not supplied with regenerative resistors. When using any of these servo amplifiers, always use the MR-RB5E, 9P and 9F regenerative option.

The MR-RB5E, 9P and 9F are regenerative options that have encased the GRZG400-1.5Ω, GRZG400-0.9Ω, GRZG400-0.6Ω respectively. When using any of these regenerative options, make the same parameter setting as when using the GRZG400-1.5Ω, GRZG400-0.9Ω, GRZG400-0.6Ω (supplied regenerative resistors or regenerative option is used with 11kW or more servo amplifier).

Cooling the regenerative option with fans improves regenerative capability.

The G3 and G4 terminals are for the thermal protector. G3-G4 is opened when the regenerative option overheats abnormally.
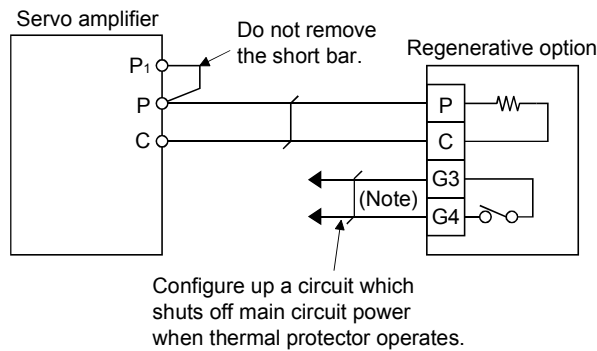
Note. Specifications of contact across G3-G4
    Maximum voltage : 120V AC/DC
    Maximum current : 0.5A/4.8VDC
    Maximum capacity : 2.4VA

Servo Amplifier	Regenerative Option	Resistance [Ω]	Regenerative Power [W]	
			Without Fans	With Fans
MR-J3-11KT-PX	MR-RB5E	6	500	800
MR-J3-15KT-PX	MR-RB9P	4.5	850	1300
MR-J3-22KT-PX	MR-RB9F	3	850	1300

When using fans, install them using the mounting holes provided in the bottom of the regenerative option. In this case, set "□□FA" in parameter No. PA02.
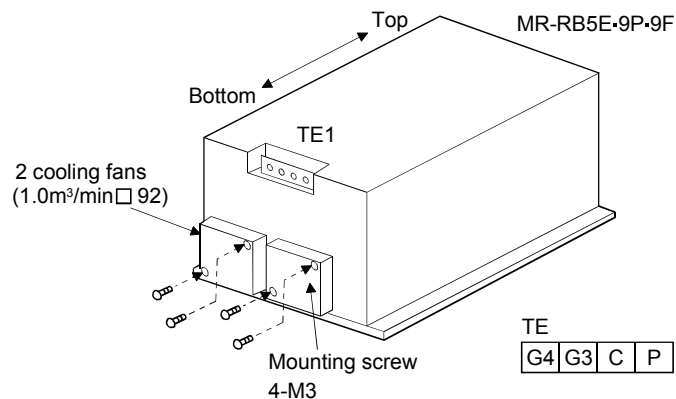
(5) Outline dimension drawings

(a) MR-RB032・MR-RB12

[Unit: mm]
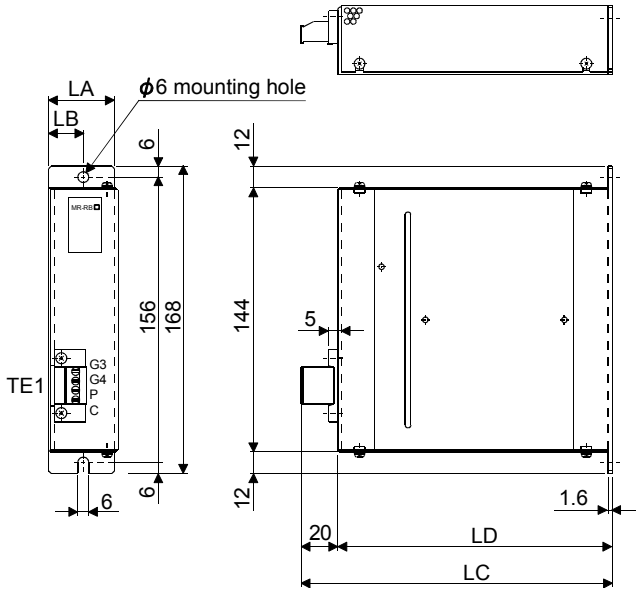
・TE1 terminal block

G3
G4
P
C

Terminal screw: M3
Tightening torque: 0.5 to 0.6 [N・m] (4 to 5 [lb・in])

・Mounting screw
Screw: M5
Tightening torque: 3.2 [N・m] (28.3 [lb・in])

Regenerative option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30	15	119	99	0.5	1.1
MR-RB12	40	15	169	149	1.1	2.4

(b) MR-RB30・MR-RB31・MR-RB32

[Unit: mm]
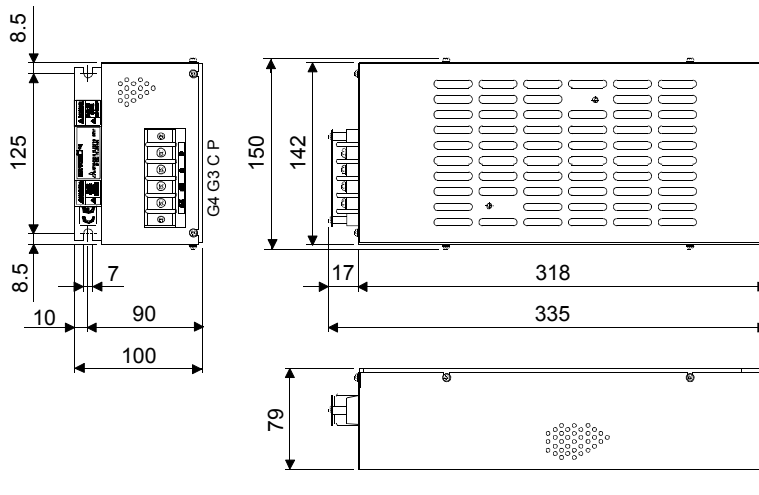
・Terminal block

P
C
G3
G4

Terminal screw: M4
Tightening torque: 1.2 [N・m] (10 [lb・in])

・Mounting screw
Screw: M6
Tightening torque: 5.4 [N・m]
(47.8 [lb・in])

Regenerative option	Mass	
	[kg]	[lb]
MR-RB30		
MR-RB31	2.9	6.4
MR-RB32		

(c) MR-RB50・MR-RB51

Fan mounting screw
(2-M3 screw)
On opposite side

7 × 14 slot

Wind blows in the
arrow direction.

G4 G3 C P

49 82.5

12.5

82.5

133

2.3

200 17

223

162.5

350

162.5

12.5

12 108

120 8

7

Approx.30
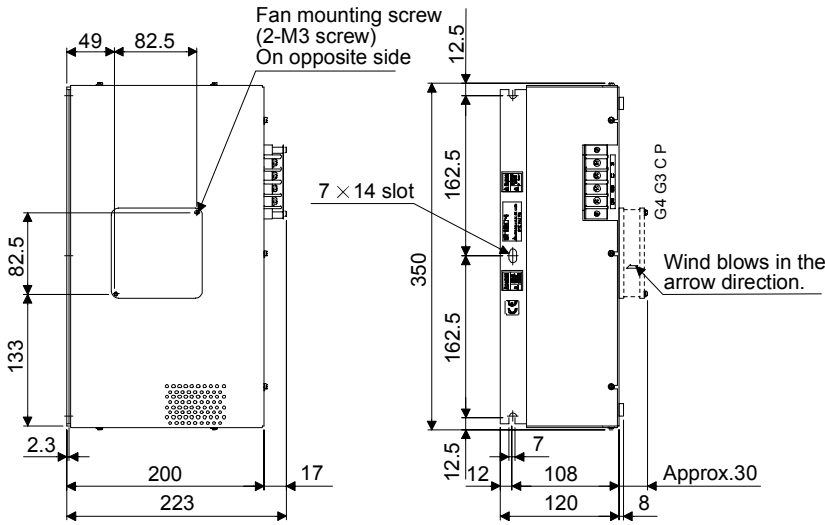
・ Terminal block

P	
C	Terminal screw: M4
G3	Tightening torque: 1.2 [N·m](10 [lb·in])
G4	

・ Mounting screw
  Screw : M6
  Tightening torque: 5.4 [N·m](47.79 [lb·in])

Regenerative option	Mass	
	[kg]	[lb]
MR-RB50	5.6	12.3
MR-RB51		

(d) MR-RB5E・MR-RB9P・MR-RB9F

[Unit: mm]

2-φ10
monutinghde

TE1

G4G3CP

15 230

10

260

230

10

30

480

500

440

10

30

2.3

215
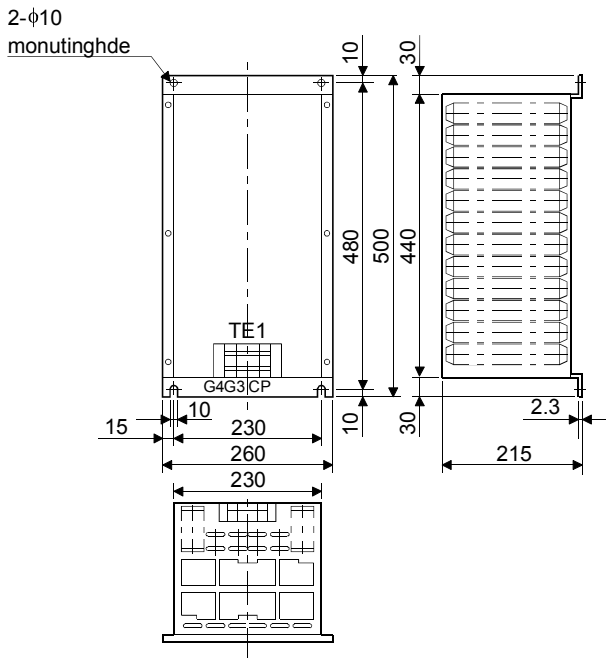
・ Terminal block

G4	G3	C	P

Terminal screw: M5
Tightening torque: 2.0 [N·m](17 [lb·in])
・ Mounting screw
  Screw size: M8
  Tightening torque: 13.2 [N·m](116.83 [lb·in])

Regenerative option	Mass	
	[kg]	[lb]
MR-RB5E	10	22.0
MR-RB9P	11	24.3
MR-RB9F	11	24.3

(e) GRZG400-1.5Ω・GRZG400-0.9Ω・GRZG400-0.6Ω (standard accessories)
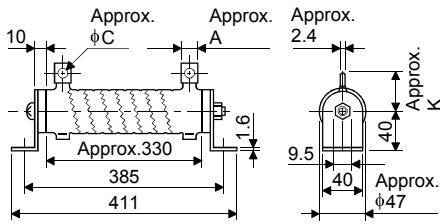
Regenerative brake	Variable dimensions			Mounting screw size	Tightening torque [N・m] ([lb・in])	Mass [kg] ([lb])
	A	C	K			
GRZG400-1.5Ω	10	5.5	39	M8	13.2 (116.83)	0.8 (1.76)
GRZG400-0.9Ω						
GRZG400-0.6Ω	16	8.2	46			

14.3 Brake Unit

```
POINT
・The brake unit and resistor unit of other than 200V class are not applicable to
 the servo amplifier.
・The brake unit and resistor unit of the same capacity must be combined.
 The units of different capacities may result in damage.
・The brake unit and resistor unit must be installed on a vertical surface in the
 vertical direction. If they are installed in the horizontal direction or on a
 horizontal surface, a heat dissipation effect reduces.
・The temperature of the resistor unit casing rises to higher than 100°C. Do not
 cause cables and combustibles to make contact with the casing.
```

The brake unit is the integration of the regenerative control and resistor and is connected to the bus (across P-N) of the servo amplifier. As compared to the MR-RB regenerative option, the brake unit can return larger power. Hence, use this brake unit when the MR-RB cannot provide sufficient regenerative capability.
When using the brake unit, set "□□01" in parameter No.PA02.

(1) Selection

Brake unit	Resistor unit	Permissible Continuous Power [kw]	Max. Instantaneous Power [kw]	Applicable Servo Amplifier
FR-BU-15K	FR-BR-15K	0.99	16.5	MR-J3-500T MR-J3-700T
FR-BU-30K	FR-BR-30K	1.99	33.4	MR-J3-11KT
FR-BU-55K	FR-BR-55K	3.91	66.8	MR-J3-15KT MR-J3-22KT

(2) Connection example
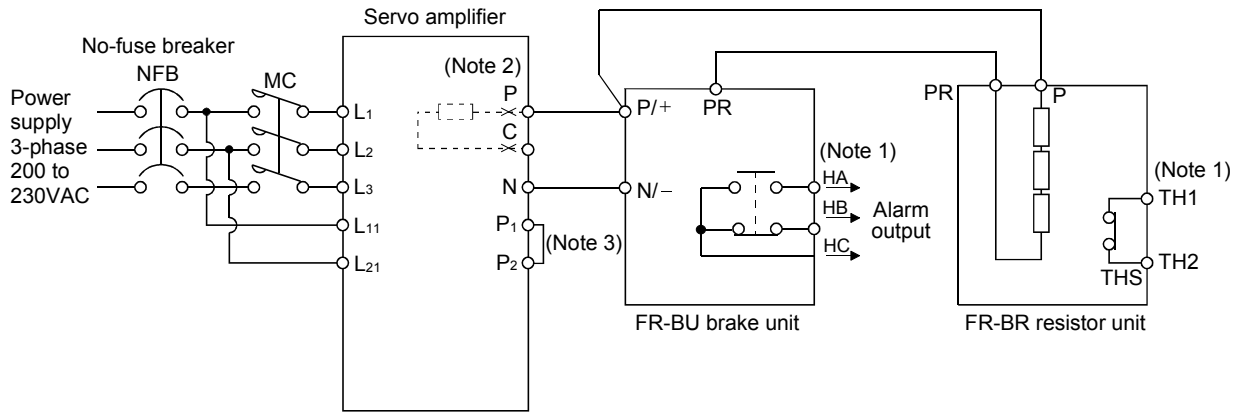
Note 1. Make up the external sequence to switch the power off when an alarm occurs or when the thermal relay is actuated.

2. When using servo amplifiers of 5kW and 7kW, always remove the lead of built-in regenerative resistor connected to P terminal and C terminal.

3. Always connect P_1-P_2 (For 11k to 22kW, connect P-P_1). (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

The cables between the servo amplifier and brake unit and between the resistor unit and brake unit should be as short as possible. The cables longer than 5m should be twisted. If twisted, the cables must not be longer than 10m.

The cable size should be equal to or larger than the recommended size. See the brake unit instruction manual. You cannot connect one set of brake unit to two servo amplifiers or two sets of brake units to one servo amplifier.
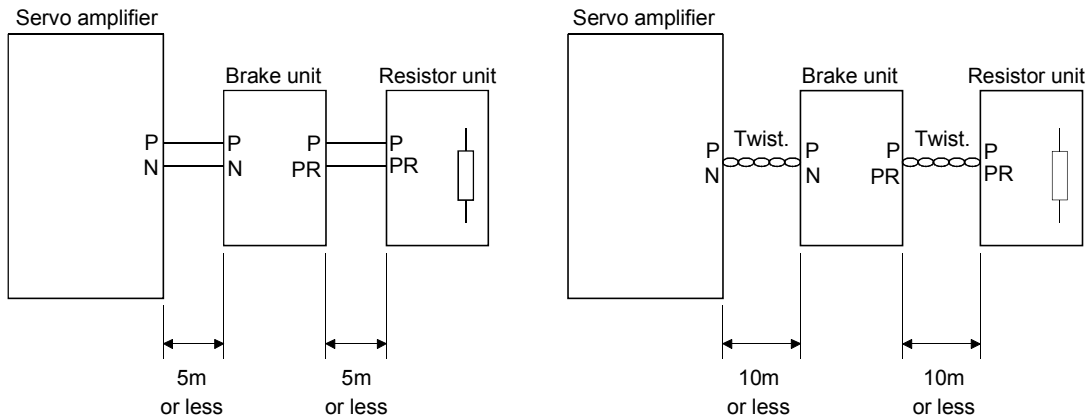
(3) Outside dimensions

(a) Brake unit (FR-BU)

[Unit : mm]
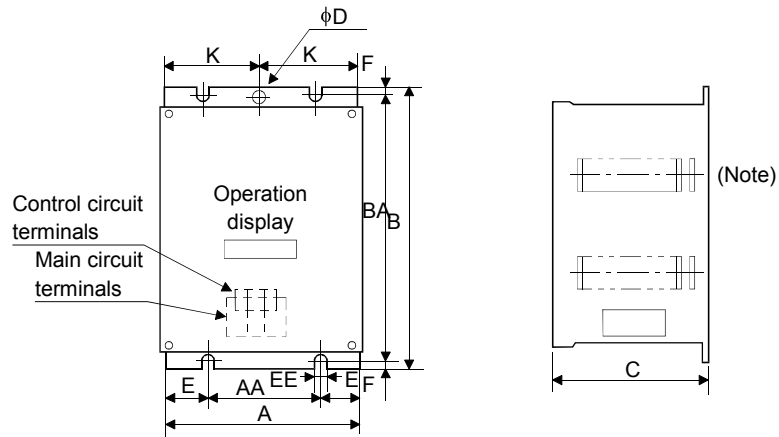
Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

Brake Unit	A	AA	B	BA	C	D	E	EE	K	F	Approx. Mass [kg(lb)]
FR-BU-15K	100	60	240	225	128	6	18.5	6	48.5	7.5	2.4 (5.291)
FR-BU-30K	160	90	240	225	128	6	33.5	6	78.5	7.5	3.2 (7.055)
FR-BU-55K	265	145	240	225	128		58.6	6		7.5	5.8 (12.79)

(b) Resistor unit (FR-BR)

[Unit : mm]

Control circuit terminals
Main circuit terminals

2-φD

BA±1

Approx.E   EE   AA±5   EE   Approx.E

C±5

A±5

Approx.F

K

BB±3

B±5

(Note)

Approx.F

• FR-BR-55K
Two eye bolts are provided (as shown below).

Eye bolt

204

40

33
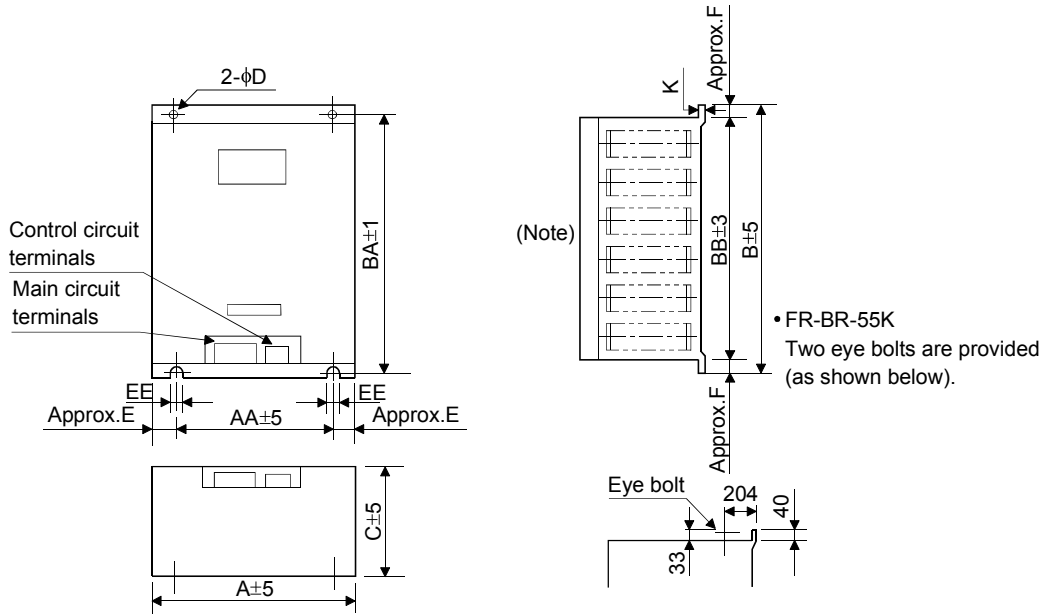
Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

Resistor Unit Model	A	AA	B	BA	BB	C	D	E	EE	K	F	Approx. Mass [kg(lb)]
FR-BR-15K	170	100	450	432	410	220	6	35	6	1.6	20	15 (66.139)
FR-BR-30K	340	270	600	582	560	220	10	35	10	2	20	30 (33.069)
FR-BR-55K	480	410	700	670	620	450	12	35	12	3.2	40	70 (154.3)

14.4 Power regeneration converter

When using the power regeneration converter, set "□□01" in parameter No.PA02.

(1) Selection

The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of the 5kW to 22kW.

Power regeneration converter	Nominal Regenerative Power (kW)	Servo Amplifier
FR-RC-15K	15	MR-J3-500T MR-J3-700T
FR-RC-30K	30	MR-J3-11KT MR-J3-15KT

Continuous energization time [sec]

500
300
200
100
50
30
20

0   50   75   100   150

Nominal regenerative power (%)
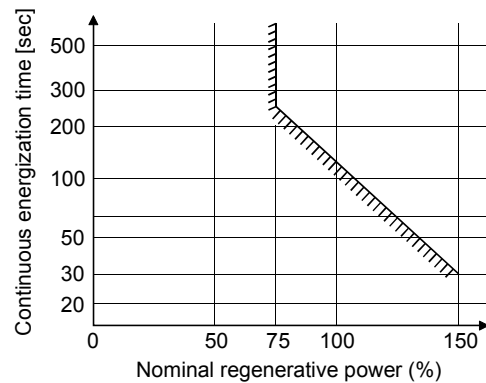
(2) Connection example
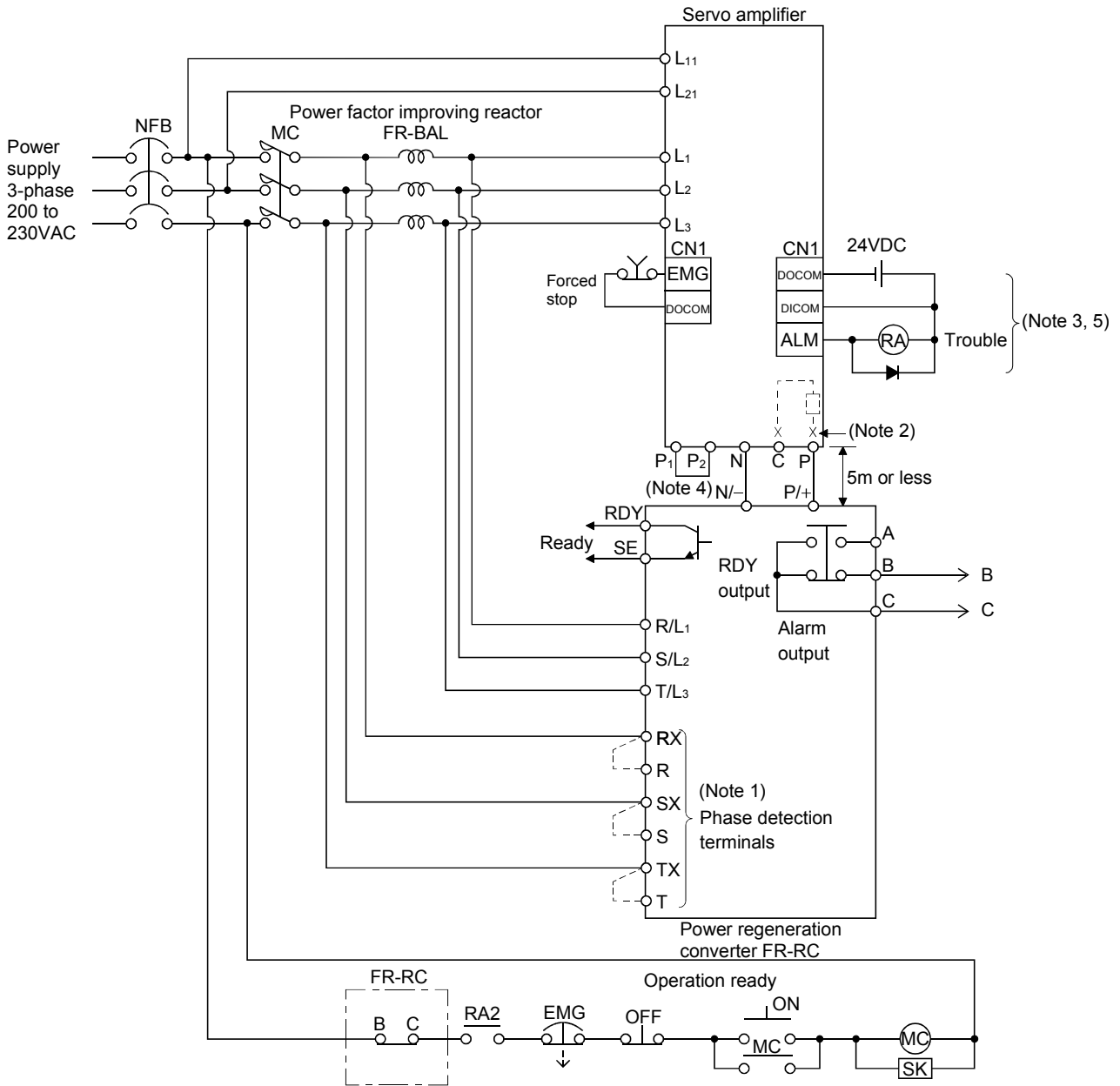
Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.

    2. When using servo amplifiers of 5kW and 7kW, always remove the lead of built-in regenerative resistor connected to P terminal and C terminal.

    3. For sink input-output interface. Refer to section 4.8.3 for source input-output interface.

    4. Always connect P_1-P_2 (For 11k to 22kW, connect P-P_1). (Factory-wired.) When using the power factor improving DC reactor, refer to section 14.11.

    5. When setting not to output Trouble (ALM) with parameter change, configure power supply circuit for turning magnet contactor off after detecting an occurrence of alarm on the controller side.

(3) Outside dimensions of the power regeneration converters

[Unit : mm]
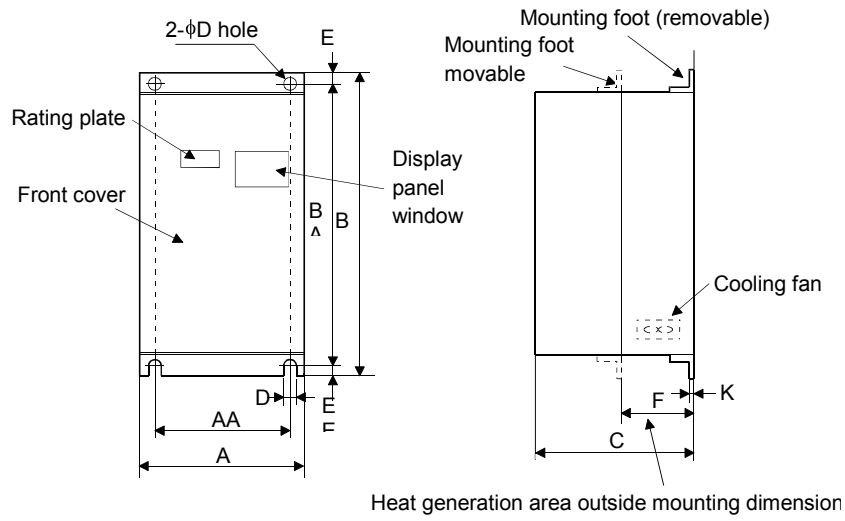
Power regeneration converter	A	AA	B	BA	C	D	E	EE	K	F	Approx. Mass [kg(lb)]
FR-RC-15K	270	200	450	432	195	10	10	8	3.2	87	19 (41.888)
FR-RC-30K	340	270	600	582	195	10	10	8	3.2	90	31 (68.343)

(4) Mounting hole machining dimensions

When the power regeneration converter is fitted to a totally enclosed type box, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole having the following dimensions is machined in the box.

[Unit : mm]
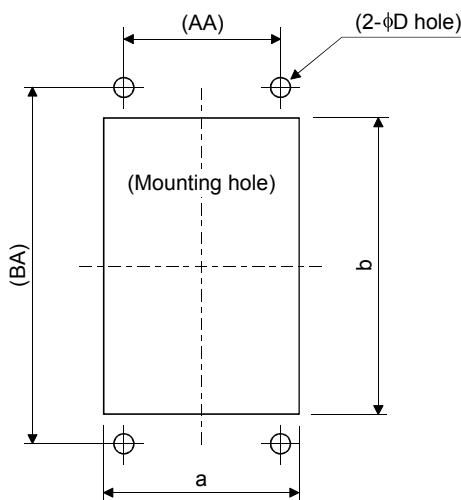
Model	a	b	D	AA	BA
FR-RC-15K	260	412	10	200	432
FR-RC-30K	330	562	10	270	582
FR-RC-55K	470	642	12	410	670

14.5 Power regeneration common converter

```
┌─────────────────────────────────────────────────────────────────┐
│  ┌──────────┐                                                     │
│  │  POINT   │                                                     │
│  └──────────┘                                                     │
│  ・For details of the power regeneration common converter FR-CV,   │
│    refer to the FR-CV Installation Guide (IB(NA)0600075).         │
│  ・Do not supply power to the main circuit power supply terminals  │
│    (L₁, L₂, L₃) of the servo amplifier. Doing so will fail the    │
│    servo amplifier and FR-CV.                                     │
│  ・Connect the DC power supply between the FR-CV and servo         │
│    amplifier with correct polarity. Connection with incorrect     │
│    polarity will fail the FR-CV and servo amplifier.             │
│  ・Two or more FR-CV's cannot be installed to improve regeneration │
│    capability. Two or more FR-CV's cannot be connected to the     │
│    same DC power supply line.                                     │
└─────────────────────────────────────────────────────────────────┘
```

When using the power regeneration common converter, set parameter No. PA02 to "□□01".

(1) Model

$$F R - C V - \square K$$

└── Applicable servo amplifier capacity [kW]

(2) Selection

The power regenerative common converter FR-CV can be used for the servo amplifier of 200VAC class with 750W to 22kW. The following shows the restrictions on using the FR-CV.

(a) Up to six servo amplifiers can be connected to one FR-CV.

(b) FR-CV capacity [W] Total of rated capacities [W] of servo amplifiers connected to FR-CV2.

(c) The total of used servo motor rated currents should be equal to or less than the applicable current [A] of the FR-CV.

(d) Among the servo amplifiers connected to the FR-CV, the servo amplifier of the maximum capacity should be equal to or less than the maximum connectable capacity [W].

The following table lists the restrictions.

Item	FR-CV-□						
	7.5K	11K	15K	22K	30K	37K	55K
Maximum number of connected servo amplifiers	6						
Total of connectable servo amplifier capacities [kW]	3.75	5.5	7.5	11	15	18.5	27.5
Total of connectable servo motor rated currents [A]	33	46	61	90	115	145	215
Maximum servo amplifier capacity [kW]	3.5	5	7	11	15	15	22

When using the FR-CV, always install the dedicated stand-alone reactor (FR-CVL (-H)).

Power regeneration common converter	Dedicated stand-alone reactor
FR-CV-7.5K (-AT)	FR-CVL-7.5K
FR-CV-11 K (-AT)	FR-CVL-11 K
FR-CV-15K (-AT)	FR-CVL-15K
FR-CV-22K (-AT)	FR-CVL-22K
FR-CV-30K (-AT)	FR-CVL-30K
FR-CV-37K	FR-CVL-37K
FR-CV-55K	FR-CVL-55K

(3) Connection diagram
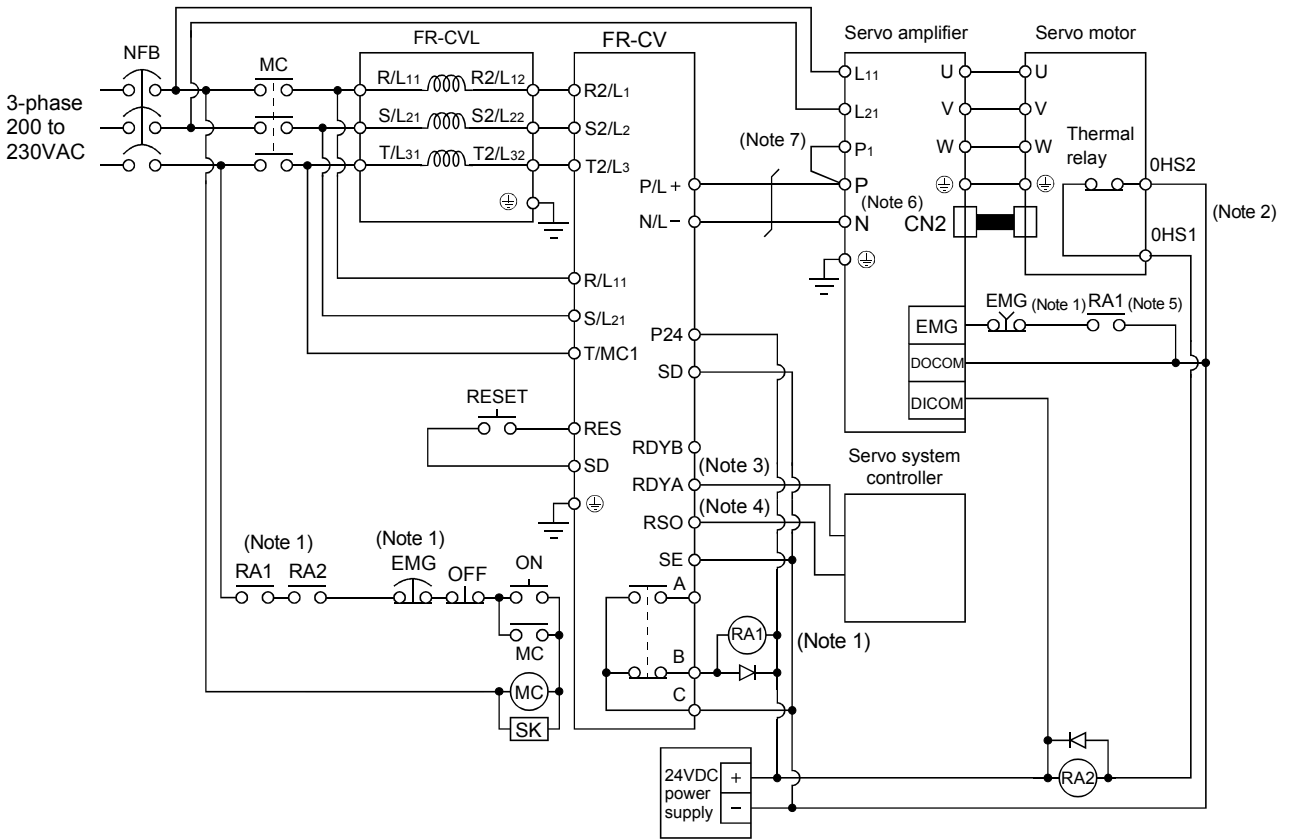
Note 1. Configure a sequence that will shut off main circuit power at an emergency stop or at FR-CV or servo amplifier alarm occurrence.

  2. For the servo motor with thermal relay, configure a sequence that will shut off main circuit power when the thermal relay operates.

  3. For the servo amplifier, configure a sequence that will switch the servo on after the FR-CV is ready.

  4. For the FR-CV, the RS0 signal turns off when it is put in a ready-to-operate status where the reset signal is input. Configure a sequence that will make the servo inoperative when the RS0 signal is on.

  5. Configure a sequence that will make a stop with the emergency stop input of the programmable controller if an alarm occurs in the FR-CV. When the programmable controller does not have an emergency stop input, use the forced stop input of the servo amplifier to make a stop as shown in the diagram.

  6. When using the servo amplifier of 7kW or less, make sure to disconnect the wiring of built-in regeneration resistor (3.5kW or less: P-D, 5k/7kW: P-C).

  7. When using the servo amplifier of 11k to 22kW, make sure to connect P-P$_1$. (Factory-wired.)

(4) Wires used for wiring
  (a) Wire sizes
    1) Across P-P, N-N
      The following table indicates the connection wire sizes of the DC power supply (P, N terminals) between the FR-CV and servo amplifier. The used wires are based on the 600V vinyl wires.

Total of servo amplifier capacities [kW]	Wires [mm^2]
1 or less	2
2	3.5
5	5.5
7	8
11	14
15	22
22	50

    2) Grounding
      For grounding, use the wire of the size equal to or greater than that indicated in the following table, and make it as short as possible.

Power regeneration common converter	Grounding wire size [mm^2]
FR-CV-7.5K TO FR-CV-15K	14
FR-CV-22K · FR-CV-30K	22
FR-CV-37K · FR-CV-55K	38

(b) Example of selecting the wire sizes

When connecting multiple servo amplifiers, always use junction terminals for wiring the servo amplifier terminals P, N. Also, connect the servo amplifiers in the order of larger to smaller capacities.
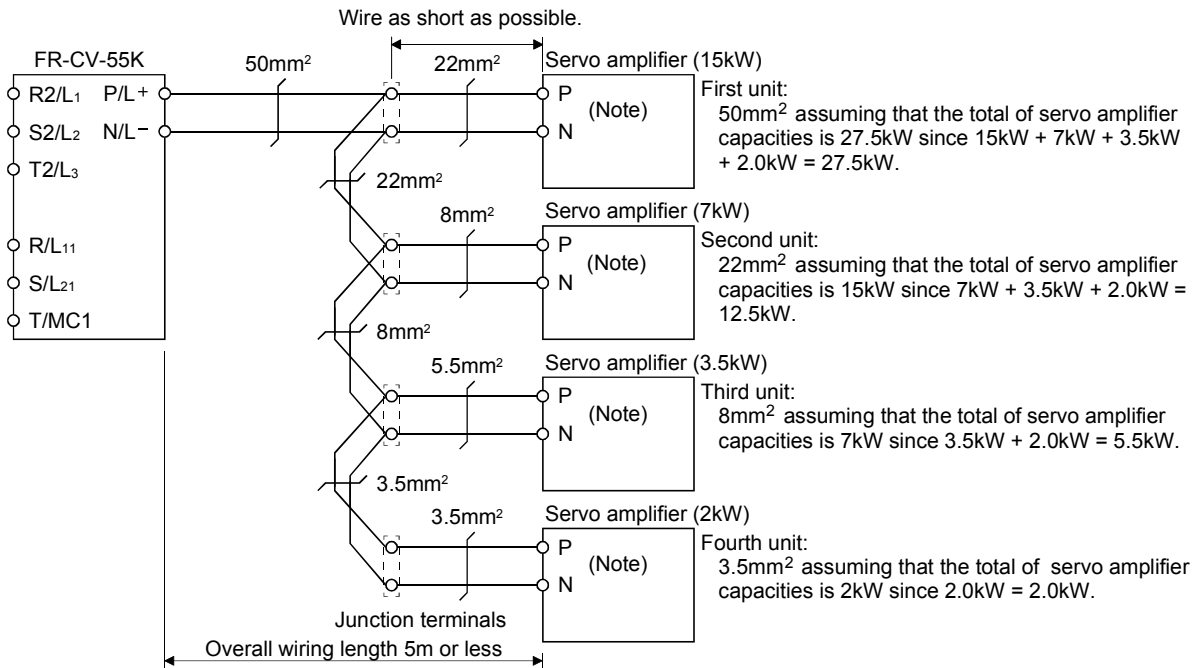
Note. When using the servo amplifier of 7kW or less, make sure to disconnect the wiring of built-in regeneration resistor (3.5kW or less: P-D, 5k/7kW: P-C).

(5) Other precautions

(a) Always use the FR-CVL as the power factor improving reactor. Do not use the FR-BAL or FR-BEL.

(b) The inputs/outputs (main circuits) of the FR-CV and servo amplifiers include high-frequency components and may provide electromagnetic wave interference to communication equipment (such as AM radios) used near them. In this case, interference can be reduced by installing the radio noise filter (FR-BIF) or line noise filter (FR-BSF01, FR-BLF).

(c) The overall wiring length for connection of the DC power supply between the FR-CV and servo amplifiers should be 5m or less, and the wiring must be twisted.

(6) Specifications

Item — Power regeneration common converter FR-CV-□			7.5K	11K	15K	22K	30K	37K	55K
Total of connectable servo amplifier capacities [kW]			3.75	5.5	7.5	11	15	18.5	27.5
Maximum servo amplifier capacity [kW]			3.5	5	7	11	15	15	22
Output	Total of connectable servo motor rated currents [A]		33	46	61	90	115	145	215
	Regenerative braking torque	Short-time rating	Total capacity of applicable servo motors, 300% torque, 60s (Note1)						
		Continuous rating	100% torque						
Power supply	Rated input AC voltage/frequency		Three-phase 200 to 220V 50Hz, 200 to 230V 60Hz						
	Permissible AC voltage fluctuation		Three-phase 170 to 242V 50Hz, 170 to 253V 60Hz						
	Permissible frequency fluctuation		±5%						
	Power supply capacity (Note2) [kVA]		17	20	28	41	52	66	100
Protective structure (JEM 1030), cooling system			Open type (IP00), forced cooling						
Environment	Ambient temperature		-10℃ to +50℃ (non-freezing)						
	Ambient humidity		90%RH or less (non-condensing)						
	Ambience		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt)						
Altitude, vibration			1000m or less above sea level, 5.9m/s^2 2 or less (compliant with JIS C 0040)						
No-fuse breaker or leakage current breaker			30AF 30A	50AF 50A	100AF 75A	100AF 100A	225AF 125A	225AF 125A	225AF 175A
Magnetic contactor			S-N20	S-N35	S-N50	S-N65	S-N95	S-N95	S-N125

Note1. This is the time when the protective function of the FR-CV is activated. The protective function of the servo amplifier is activated in the time indicated in section 13.1.

2. When connecting the capacity of connectable servo amplifier, specify the value of servo amplifier.

14.6 External dynamic brake

> POINT
>
> ・Configure up a sequence which switches off the contact of the brake unit after (or as soon as) it has turned off the servo on signal at a power failure or failure.
>
> ・For the braking time taken when the dynamic brake is operated, refer to section 13.3.
>
> ・The brake unit is rated for a short duration. Do not use it for high duty.
>
> ・When the dynamic brake is used, the power supply voltage is restricted as indicated below.
>
> 3-Phase 170 to 220VAC/50Hz
>
> 3-Phase 170 to 242VAC/60Hz

(1) Selection of dynamic brake

The dynamic brake is designed to bring the servo motor to a sudden stop when a power failure occurs or the protective circuit is activated, and is built in the 7kW or less servo amplifier. Since it is not built in the 11kW or more servo amplifier, purchase it separately if required. Assign the dynamic brake interlock (DB) to any of CN6-14, CN6-15 and CN6-16 pins in parameter No.PD12 to PD14.

Servo amplifier	Dynamic brake
MR-J3-11KT	DBU-11K
MR-J3-15KT	DBU-15K
MR-J3-22KT	DBU-22K

(2) Connection example
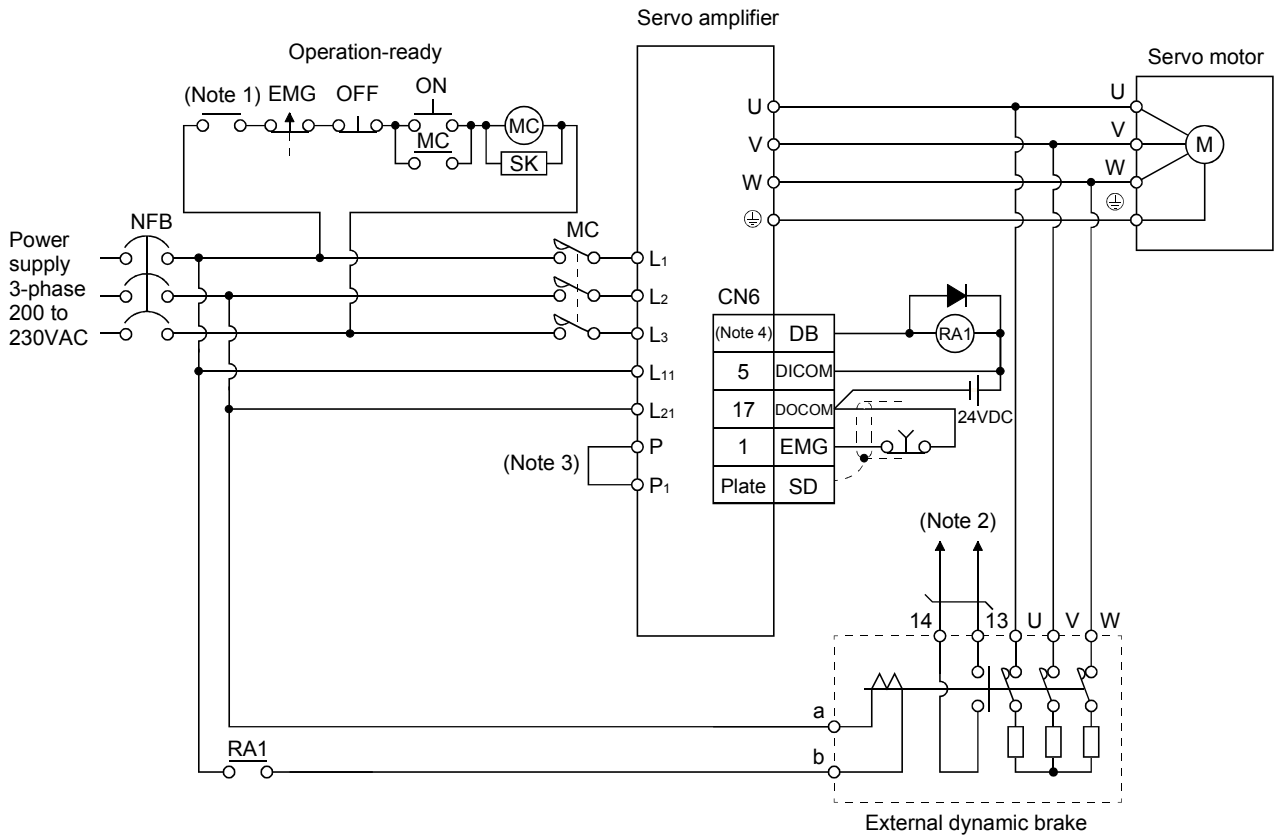
Note 1. Configure up the circuit to switch power off in the external sequence at servo alarm occurrence.
    2. Terminals 13, 14 are normally open contact outputs. If the dynamic brake is seized, terminals 13, 14 will open. Therefore, configure up an external sequence to prevent servo-on.
    3. For the servo amplifiers from 11k to 22kW, be sure to connect P - P$_1$. (Factory-wired)
       When using the power factor DC reactor, refer to Section 14.11.
    4. Assign the dynamic brake sequence (DB) in the parameters No.PD12 to PD14.

a. Timing chart at alarm occurrence

b. Timing chart at Forced stop (EMG) validity
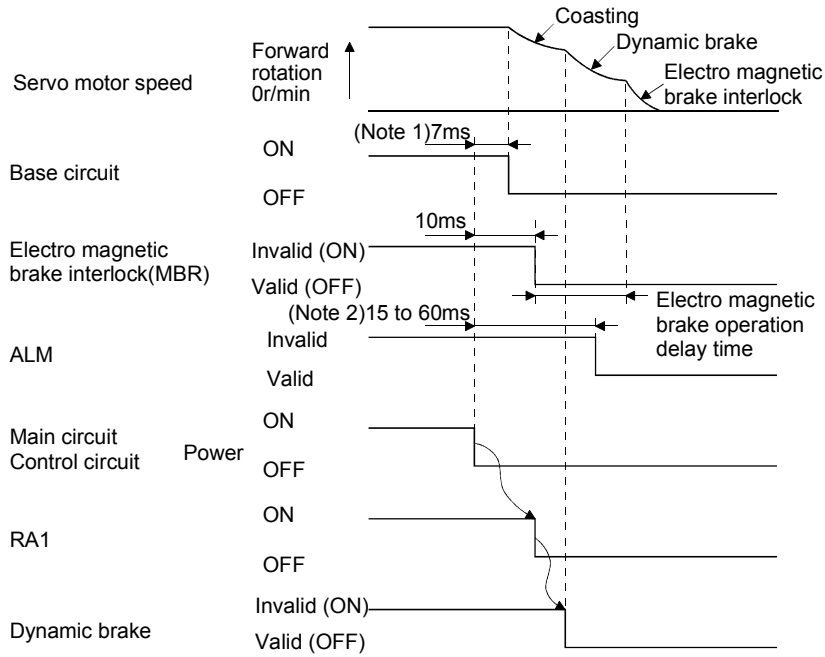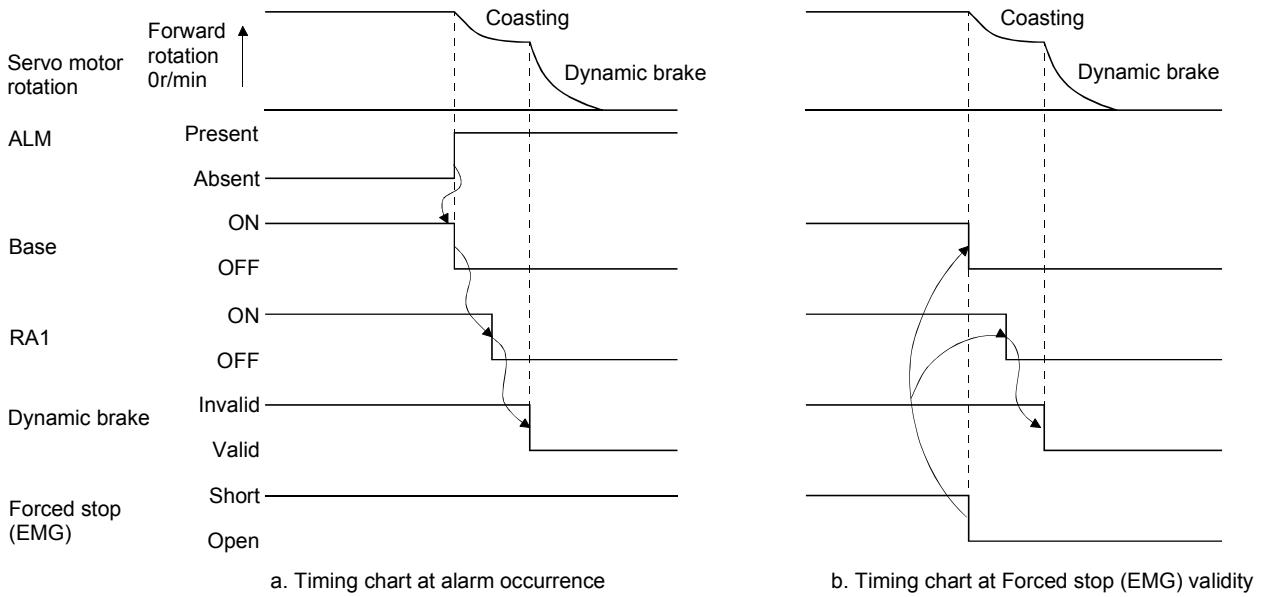
Note 1. When powering OFF, the RA1 of external dynamic brake circuit will be turned OFF,
and the base circuit is turned OFF earlier than usual before an output shortage occurs.
(Only when assigning the DB as the output signal in the parameter No.PD12 and PD14)
2. Variable according to the operation status.

c. Timing chart when both of the main and control circuit power are OFF

(3) Outline dimension drawing

[Unit: mm]

Terminal block

E (GND)		a	b	13	14
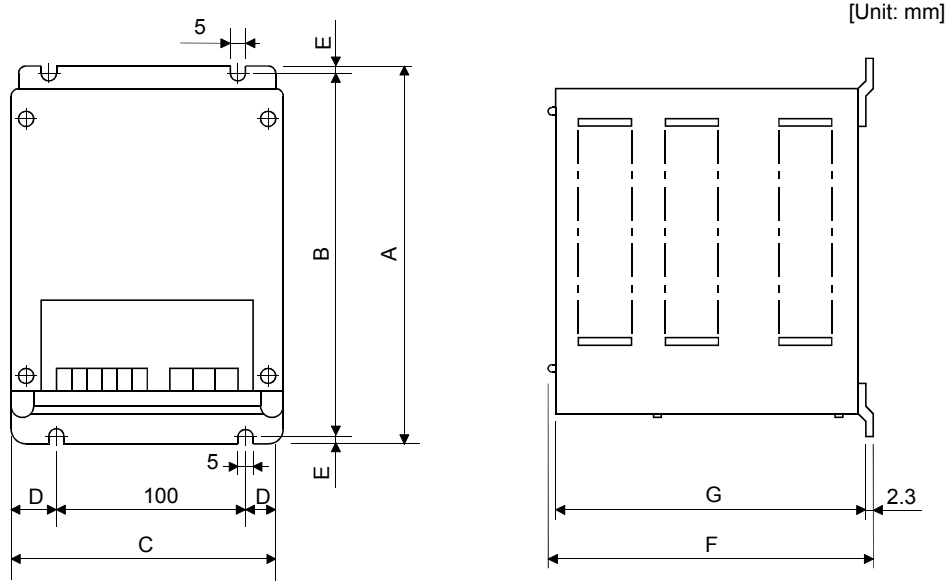
Screw : M3.5
Tightening torque: 0.8 [N·m](7 [lb·in])

U	V	W

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

Dynamic brake	A	B	C	D	E	F	G	Mass [kg]([lb])	Connection wire [mm²]
DBU-11K	200	190	140	20	5	170	163.5	2 (4.41)	5.5
DBU-15K, 22K	250	238	150	25	6	235	228	6 (13.23)	5.5

14.7 Battery MR-J3BAT

> **POINT**
>
> · The revision (Edition 44) of the Dangerous Goods Rule of the International Air Transport Association (IATA) went into effect on January 1, 2003 and was enforced immediately. In this rule, "provisions of the lithium and lithium ion batteries" were revised to tighten the restrictions on the air transportation of batteries. However, since this battery is non-dangerous goods (non-Class 9), air transportation of 24 or less batteries is outside the range of the restrictions. Air transportation of more than 24 batteries requires packing compliant with the Packing Standard 903. When a self-certificate is necessary for battery safety tests, contact our branch or representative. For more information, consult our branch or representative. (As of July, 2006).

(1) Purpose of use for MR-J3BAT

This battery is used to construct an absolute position detection system. Refer to section 14.3 for the fitting method, etc.
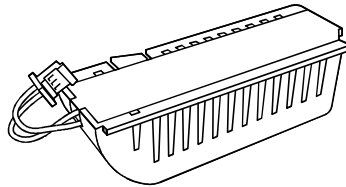
(2) Year and month when MR-J3BAT is manufactured

The year and month when MR-J3BAT is manufactured are written down in Serial No. on the name 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 □□□□□□".
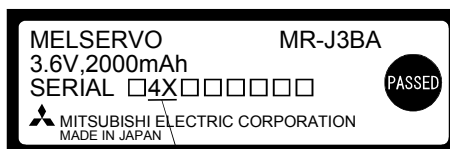
The year and month of manufacture

14.8 Heat sink outside mounting attachment (MR-J3ACN)

Use the heat sink outside mounting attachment to mount the heat generation area of the servo amplifier in the outside of the control box to dissipate servo amplifier-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed.
In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier to the control box.
The environment outside the control box when using the heat sink outside mounting attachment should be within the range of the servo amplifier operating environment conditions.
The heat sink outside mounting attachment of MR-J3ACN can be used for MR-J3-11KT to MR-J3-22KT.

(1) Panel cut dimensions

[Unit : mm]
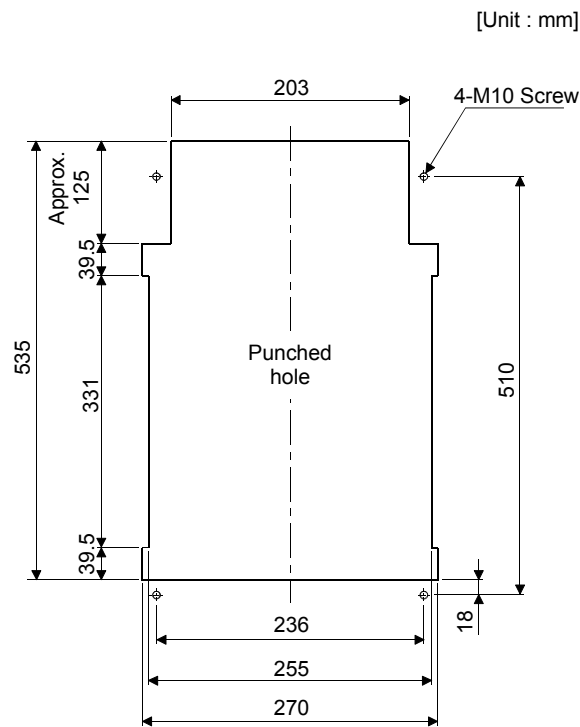
(2) How to assemble the attachment for a heat sink outside mounting attachment
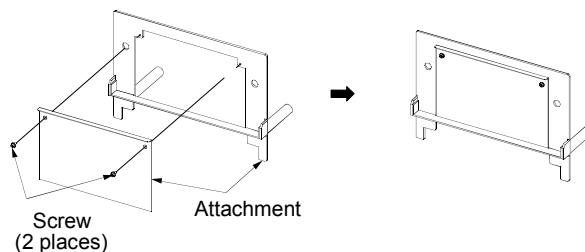
(3) Fitting method
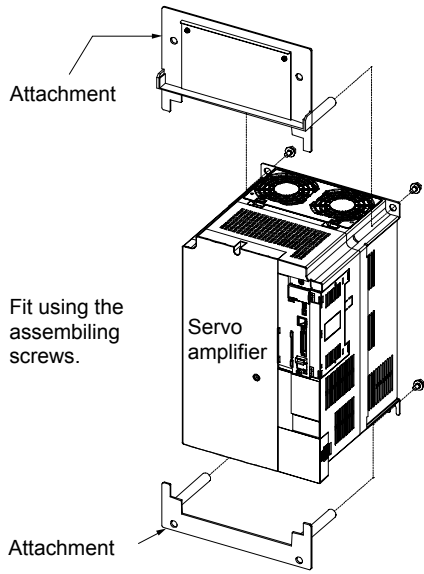
a. Assembling the heat sink outside mounting attachment   b. Installation to the control box
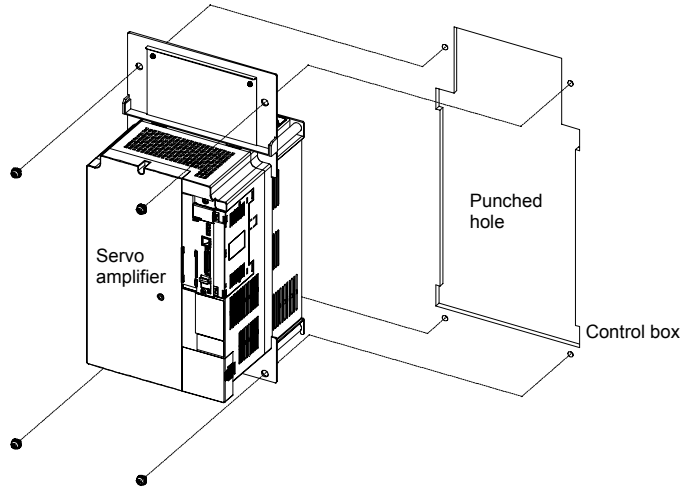
(4) Outline dimension drawing
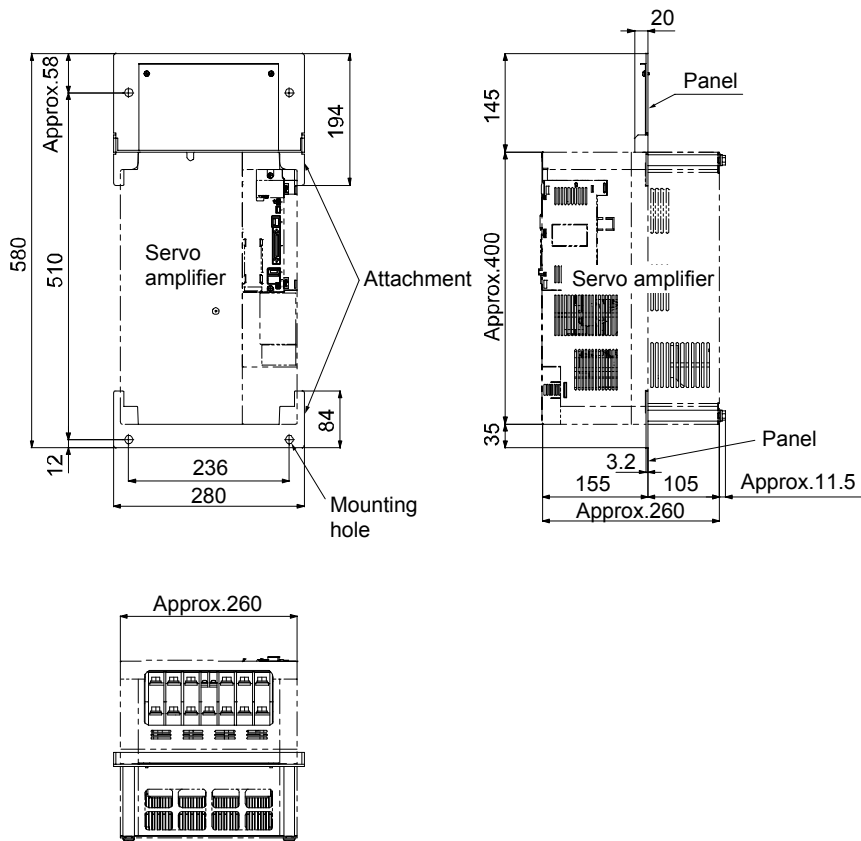
14.9 Recommended wires

(1) Wires for power supply wiring
The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.
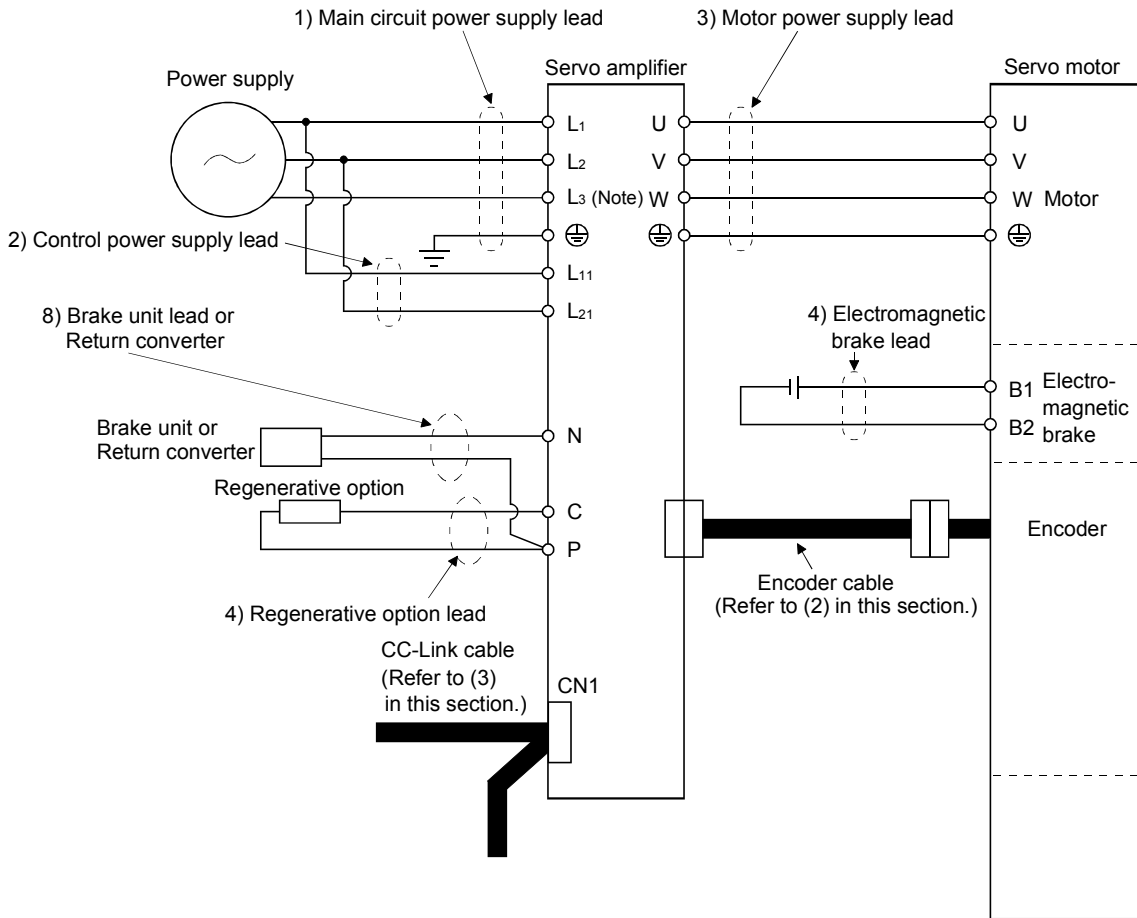
Note. There is no L_3 for 1-phase 100 to 120VAC power supply.

The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m max. If the wiring distance is over 30m, choose the wire size in consideration of voltage drop.
To comply with the UL/C-UL (CSA) Standard, use UL-recognized copper wires rated at 60°C (140°F) or more for wiring.

Table 14.1 Recommended wires

Servo amplifier	Wires [mm²]						
	1) L₁・L₂・L₃・⏚	2) L₁₁・L₂₁	3) U・V・W・⏚	4) P・C	5) B1・B2	6) BU・BV・BW	7) OHS1・OHS2
MR-J3-10T (1)	2 (AWG14)	1.25 (AWG16)	1.25 (AWG16)	2(AWG14)	1.25 (AWG16)		
MR-J3-20T (1)							
MR-J3-40T (1)							
MR-J3-60T							
MR-J3-70T							
MR-J3-100T			2 (AWG14)				
MR-J3-200T	3.5 (AWG12)		3.5 (AWG12)				
MR-J3-350T	5.5 (AWG10)		5.5 (AWG10)				
MR-J3-500T	5.5(AWG10): b(note)		5.5(AWG10): b(note)				
MR-J3-700T	8(AWG8): c(note)		8(AWG8): c(note)	3.5(AWG12): b			
MR-J3-11KT (Note2)	14(AWG6): c		22(AWG4): d	5.5(AWG10): a		2(AWG14)	1.25(AWG16)
MR-J3-15KT (Note2)	22(AWG4): d		30(AWG2): e				
MR-J3-22KT (Note2)	50(AWG1/0): f		60(AWG2/0): f				

Note 1. For crimping terminals and applicable tools, refer to Table 14.2.
2. When connecting to the terminal block, be sure to use the screws which are provided with the terminal block.

Use wires 8) of the following sizes with the brake unit (FR-BU) and power regeneration converter (FR-RC).

Model	Wires[mm^2]
FR-BU-15K	3.5(AWG12)
FR-BU-30K	5.5(AWG10)
FR-BU-55K	14(AWG6)
FR-RC-15K	14(AWG6)
FR-RC-30K	14(AWG6)
FR-RC-55K	22(AWG4)

Table 14.2 Recommended crimping terminals

Symbol	Servo amplifier side crimping terminals			Symbol	Servo amplifier side crimping terminals		
	Crimping terminal	Applicable tool	Maker name		Crimping terminal	Applicable tool	Maker name
a	32968	59239	Tyco Electronics	(Note 1･2) e	38-S6	Body YPT-60-21 Dice TD-124･TD-112	Japan Solderless Terminal
						Body YF-1･E-4 Head YET-60-1 Dice TD-124･TD-112	
b	FVD8-5	Body YF-1･E-4 Head YNE-38 Dice DH-111･DH-121	Japan Solderless Terminal		R38-6S	NOP60 NOM60	NICHIFU
c	FVD14-6	Body YF-1･E-4 Head YNE-38 Dice DH-112･DH-122		f	(Note 1) R60-8	Body YDT-60-21 Dice TD-125･TD-113	Japan Solderless Terminal
d	FVD22-6	Body YF-1･E-4 Head YNE-38 Dice DH-113･DH-123				Body YF-1･E-4 Head YET-60-1 Dice TD-125･TD-113	

Note 1. Coat the part of crimping with the insulation tube.
    2. Some crimping terminals may not be mounted depending on the size. Make sure to use the recommended ones.

(2) Wires for cables

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

Table 14.3 Wires for option cables

Type	Model	Length [m(ft)]	Core size [mm²]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulation coating ODd [mm] (Note 1)		
Encoder cable	MR-J3ENCBL☐M-A1-L	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P Ban-gi-shi-16823
	MR-J3ENCBL☐M-A2-L								
	MR-J3ENCBL☐M-A1-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETEF SVP 70/0.08 (AWG#22 or equivalent)-3P Ban-gi-shi-16824
	MR-J3ENCBL☐M-A2-H								
	MR-J3JCBL03M-A1-L	0.3	AWG26	8 (4 pairs)	30/0.08	233 or less	1.2	7.1±0.3	(Note 5) T/2464-1061/II A-SB 4P✕26AWG
	MR-J3JCBL03M-A2-L								
	MR-EKCBL☐M-L	2 to 10	0.3mm²	4 (2 pairs)	12/0.18	65.7 or less	1.3	7.3	(Note 3) 20276 composite 4-pair shielded cable (A-TYPE)
			0.08mm²	4 (2 pairs)	7/0.127	234 or less	0.67		
		20・30	0.3mm²	12 (6 pairs)	12/0.18	63.6 or less	1.2	8.2	UL20276 AWG#23 6pair(BLACK)
	MR-EKCBL☐M-H	20	0.2mm²	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) A14B2343 6P
		30 to 50	0.2mm²	14 (7 pairs)	40/0.08	105 or less	0.88	8.0	(Note 3) J14B0238(0.2*7P)
	MR-J3ENSCBL☐M-L	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (Equivalent to AWG#22)-3P Ban-gi-shi-16823
		20・30	AWG23	12 (6 pairs)	12/0.18	63.3 or less	1.2	8.2±0.3	(Note 3) 20276 VSVCAWG#23✕6P Ban-gi-shi-15038
	MR-J3ENSCBL☐M-H	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETEF SVP 70/0.08 (Equivalent to AWG#22)-3P Ban-gi-shi-16824
		20 to 50	AWG24	12 (6 pairs)	40/0.08	105 or less	0.88	7.2	(Note 3) ETFE・SVP 40/0.08mm✕6P Ban-gi-shi-15266
Motor power supply cable	MR-PWS1CBL☐M-A1-L	2 to 10	(Note 6) AWG19	4	50/0.08	25.40 or less	1.8	5.7±0.3	(Note 4) UL Style 2103 AWG19 4 cores
	MR-PWS1CBL☐M-A2-L	2 to 10							
	MR-PWS1CBL☐M-A1-H	2 to 10							
	MR-PWS1CBL☐M-A2-H	2 to 10							
	MR-PWS2CBL03M-A1-L	0.3							
	MR-PWS2CBL03M-A2-L	0.3							
Motor brake cable	MR-BKS1CBL☐M-A1-L	2 to 10	(Note 6) AWG20	2	100/0.08	38.14 or less	1.3	4.0±0.3	(Note 4) UL Style 2103 AWG20 2 cores
	MR-BKS1CBL☐M-A2-L	2 to 10							
	MR-BKS1CBL☐M-A1-H	2 to 10							
	MR-BKS1CBL☐M-A2-H	2 to 10							
	MR-BKS2CBL03M-A1-L	0.3							
	MR-BKS2CBL03M-A2-L	0.3							

Note 1. d is as shown below:
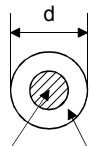
Conductor Insulation sheath

2. Purchased from Toa Electric Industry

3. Standard OD. Max. OD is about 10% greater.

4. Kurabe

5. Taiyo Electric Wire and Cable

(3) CC-Link twisted cable

POINT
・For the cables other than the one indicated here, refer to the open field network CC-Link catalog (L(NA)74108143).

The specifications of the twisted cable usable in CC-Link and the recommended cable are indicated below. If the cable used is other than the recommended cable indicated in the following table, we cannot guarantee the performance of CC-Link.

Item	Specifications
Model	Kurashige Kogyo make FANC-SB 0.5mm$^2 \times$3 (Note)
Cable type	Shielded twisted cable
Conductor sectional area	0.5mm^2
Conductor resistance (20℃)	37.8Ω/km or less
Insulation resistance	10000Ω/km or more
Withstand voltage	500VDC 1 minute
Capacitance (1kHz)	60nF/km or less
Characteristic impedance (1MHz)	100±15Ω
Section	
Outline dimension	7mm
Approx. Mass	65kg/km

Note. For any inquiry, please contact your nearest Mitsubishi Electric System Service Co., Ltd.

14.10 No-fuse breakers, fuses, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the no-fuse breaker, use the one having the specifications given in this section.

Servo amplifier	No-fuse breaker		Fuse			Magnetic contactor
	Not using power factor improving reactor	Using power factor improving reactor	(Note) Class	Current [A]	Voltage [V]	
MR-J3-10T(1)	30A frame 5A	30A frame 5A	K5	10	AC250	S-N10
MR-J3-20T	30A frame 5A	30A frame 5A	K5	10		
MR-J3-20T1	30A frame 10A	30A frame 10A	K5	15		
MR-J3-40T	30A frame 10A	30A frame 5A	K5	15		
MR-J3-60T・70T・100T・40T1	30A frame 15A	30A frame 10A	K5	20		
MR-J3-200T	30A frame 20A	30A frame 15A	K5	40		S-N18
MR-J3-350T	30A frame 30A	30A frame 30A	K5	70		S-N20
MR-J3-500T	50A frame 50A	50A frame 40A	K5	125		S-N35
MR-J3-700T	100A frame 75A	50A frame 50A	K5	150		S-N50
MR-J3-11KT	100A frame 100A	100A frame 75A	K5	200		S-N65
MR-J3-15KT	225A frame 125A	100A frame 100A	K5	250		S-N95
MR-J3-22KT	225A frame 175A	225A frame 150A	K5	350		S-N125

Note. This servo amplifier is UL/C-UL-listed when using a Class T fuse. Therefore, when using the servo amplifier as a UL/C-UL Standard compliant product, be sure to use the Class T fuse.

14.11 Power factor improving DC reactor

> **POINT**
> ・ For 100VAC class servo amplifiers, the power factor improving DC reactor cannot be used.

The power factor improving DC reactor increases the form factor of the servo amplifier's input current to improve the power factor. It can decrease the power supply capacity. As compared to the power factor improving AC reactor (FR-BAL), it can decrease the loss. The input power factor is improved to about 95%.
It is also effective to reduce the input side harmonics.
When connecting the power factor improving DC reactor to the servo amplifier, always disconnect the wiring across P_1-P_2 (For 11kW or more, disconnect the wiring across P-P_1). If it remains connected, the effect of the power factor improving DC reactor is not produced.
When used, the power factor improving DC reactor generates heat. To release heat, therefore, leave a 10cm or more clearance at each of the top and bottom, and a 5cm or more clearance on each side.

[Unit: mm]
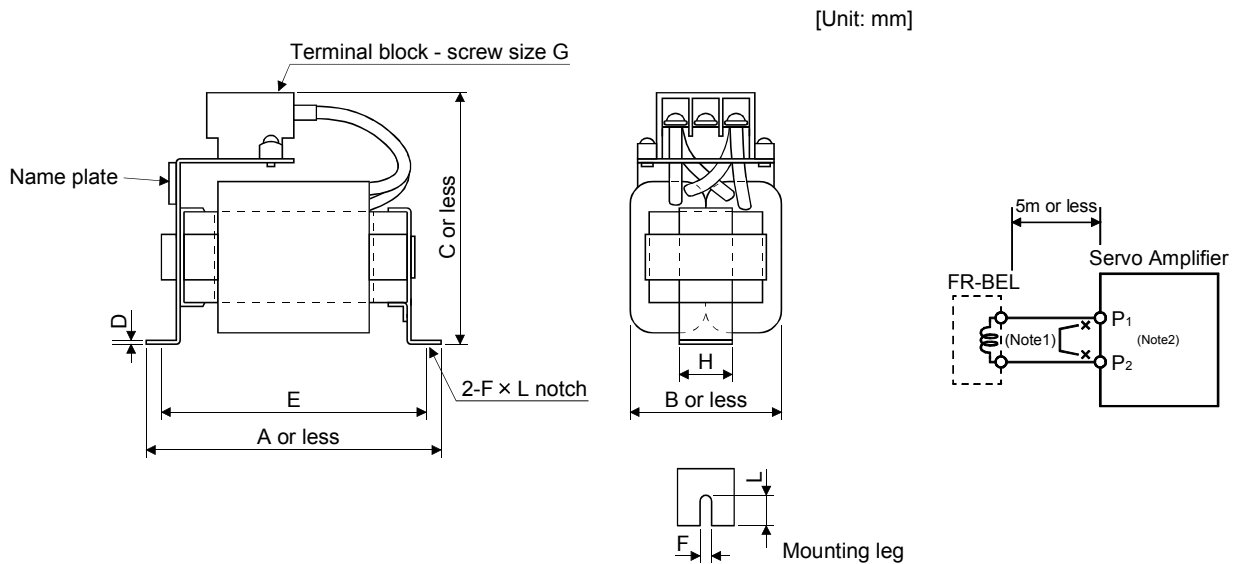
Note 1. When using the power factor improving DC reactor, disconnect the wiring across P-P_1.
2. For 11kW or more, the wiring across P-P_1 is connected.

Servo Amplifier	Power Factor Improving DC Reactor	Dimensions [mm]									Mounting Screw Size	Mass [kg(lb)]	Used Power Supply [mm²]
		A	B	C	D	E	F	L	G	H			
MR-J3-10T・20T	FR-BEL-0.4K	110	50	94	1.6	95	6	12	M3.5	25	M5	0.5 (1.10)	2 (AWG14)
MR-J3-40T	FR-BEL-0.75K	120	53	102	1.6	105	6	12	M4	25	M5	0.7 (1.54)	
MR-J3-60T・70T	FR-BEL-1.5K	130	65	110	1.6	115	6	12	M4	30	M5	1.1 (2.43)	
MR-J3-100T	FR-BEL-2.2K	130	65	110	1.6	115	6	12	M4	30	M5	1.2 (2.43)	
MR-J3-200T	FR-BEL-3.7K	150	75	102	2.0	135	6	12	M4	40	M5	1.7 (3.75)	3.5 (AWG12)
MR-J3-350T	FR-BEL-7.5K	150	75	126	2.0	135	6	12	M5	40	M5	2.3 (5.07)	5.5 (AWG10)
MR-J3-500T	FR-BEL-11K	170	93	132	2.3	155	6	14	M5	50	M5	3.1 (6.84)	5.5(AWG10)
MR-J3-700T	FR-BEL-15K	170	93	170	2.3	155	6	14	M8	56	M5	3.8 (8.38)	8(AWG8)
MR-J3-11KT	FR-BEL-15K	170	93	170	2.3	155	6	14	M8	56	M5	3.8 (8.38)	22(AWG4)
MR-J3-15KT	FR-BEL-22K	185	119	182	2.6	165	7	15	M8	70	M6	5.4 (11.91)	30(AWG2)
MR-J3-22KT	FR-BEL-30K	185	119	201	2.6	165	7	15	M8	70	M6	6.7 (14.77)	60(AWG1/0)

14.12 Power factor improving reactors

The power factor improving reactors improve the phase factor by increasing the form factor of servo amplifier's input current.
It can reduce the power capacity.
The input power factor is improved to be about 90%. For use with a 1-phase power supply, it may be slightly lower than 90%.
In addition, it reduces the higher harmonic of input side.
When using power factor improving reactors for two servo amplifiers or more, be sure to connect a power factor improving reactor to each servo amplifier.
If using only one power factor improving reactor, enough improvement effect of phase factor cannot be obtained unless all servo amplifiers are operated.

[Unit : mm]
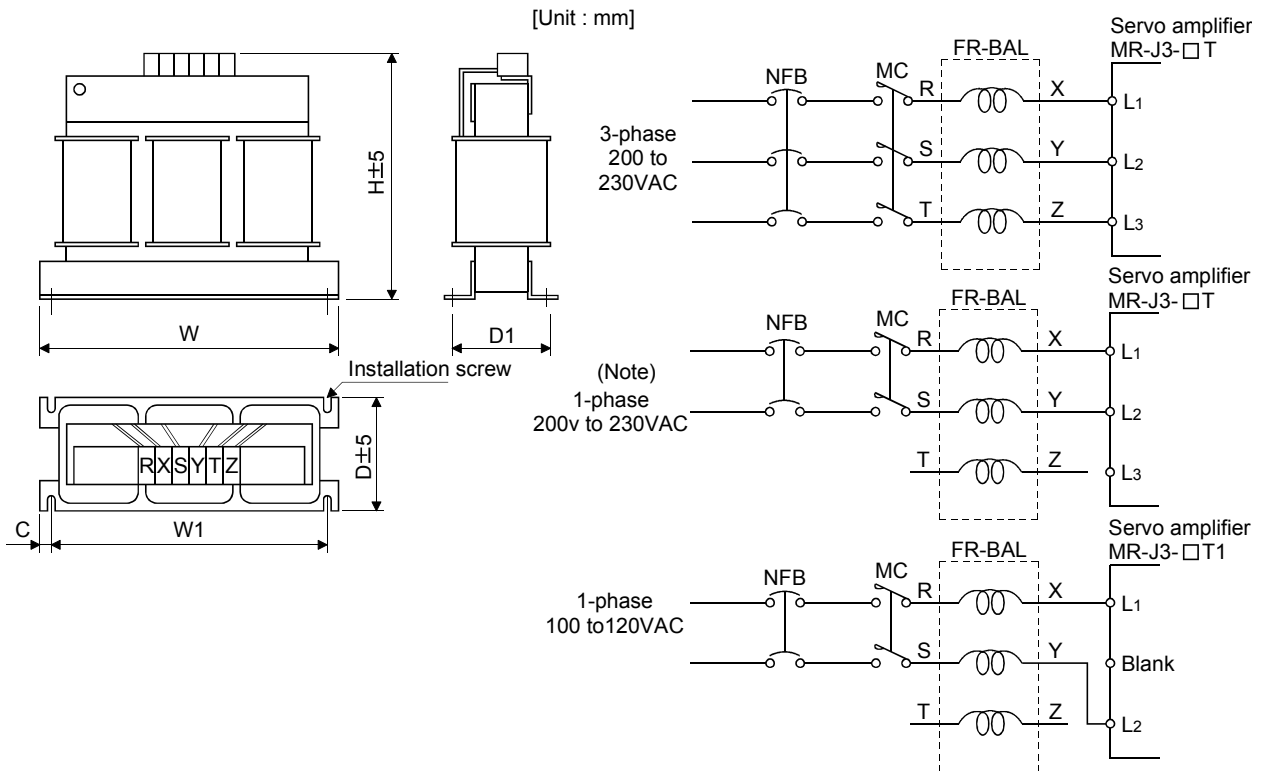
Note. For the 1-phase 200V to 230V power supply, Connect the power supply to L1, L2 and leave L3 open.

Servo amplifier	Model	Dimensions [mm]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
		W	W1	H	D	D1	C			
MR-J3-10T/20T/10T1	FR-BAL-0.4K	135	120	115	59	45$^{0}_{-2.5}$	7.5	M4	M3.5	2.0 (4.4)
MR-J3-40T/20T1	FR-BAL-0.75K	135	120	115	69	57$^{0}_{-2.5}$	7.5	M4	M3.5	2.8 (6.17)
MR-J3-60T/70T/40T1	FR-BAL-1.5K	160	145	140	71	55$^{0}_{-2.5}$	7.5	M4	M3.5	3.7 (8.16)
MR-J3-100T	FR-BAL-2.2K	160	145	140	91	75$^{0}_{-2.5}$	7.5	M4	M3.5	5.6 (12.35)
MR-J3-200T	FR-BAL-3.7K	220	200	192	90	70±5	10	M5	M4	8.5 (18.74)
MR-J3-350T	FR-BAL-7.5K	220	200	194	120	100±5	10	M5	M5	14.5 (32.0)
MR-J3-500T	FR-BAL-11K	280	255	220	135	100	12.5	M6	M6	19 (41.9)
MR-J3-700T	FR-BAL-15K	295	270	275	133	110$^{0}_{-2.5}$	12.5	M6	M6	27(59.53)
MR-J3-11KT		295	270	275	133					
MR-J3-15KT	FR-BAL-22K	290	240	301	199	170±5	25	M8	M8	35(77.16)
MR-J3-22KT	FR-BAL-30K	290	240	301	219	190±5	25	M8	M8	43(94.79)

14.13 Relays (recommended)

The following relays should be used with the interfaces:

Interface	Selection example
Relay used for digital input command signals (interface DI-1)	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) Omron : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small relay with 12VDC or 24VDC of 40mA or less (Ex.) Omron : type MY

14.14 Surge absorbers (recommended)

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. When using the surge absorber, perform insulation beforehand to prevent short-circuit.

Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC [Vma]	DC [V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198 to 242)

Note. 1 time $= 8 \times 20\mu s$

(Example) ERZV10D221 (Matsushita Electric Industry)
TNR-10V221K (Nippon chemi-con)
Outline drawing [mm] ([in]) (ERZ-C10DK221)
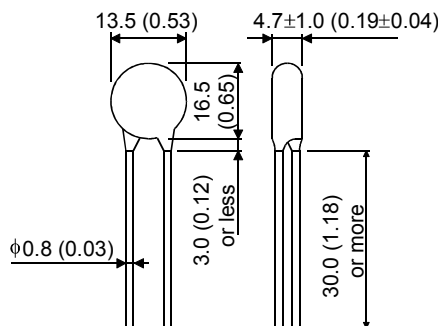
14.15 Noise reduction techniques

Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral devices to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required. Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques
   (a) General reduction techniques
      ・Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
      ・Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
      ・Ground the servo amplifier, servo motor, etc. together at one point (refer to section 4.12).

   (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.

(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.

Noises produced by servo amplifier	Noises transmitted in the air	Noise radiated directly from servo amplifier ···Route 1)
		Noise radiated from the power supply cable ···Route 2)
		Noise radiated from servo motor cable ···Route 3)
	Magnetic induction noise ···Routes 4) and 5)	
	Static induction noise ···Route 6)	
	Noises transmitted through electric channels	Noise transmitted through power supply cable ···Route 7)
		Noise sneaking from grounding cable due to leakage current ···Route 8)

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・FR-BLF) on the power cables of the servo amplifier.
8)	When the cables of peripheral devices are connected to the servo amplifier to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction products

  (a) Data line filter (Recommended)

    Noise can be prevented by installing a data line filter onto the encoder cable, etc.

    For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC TOKIN make are available as data line filters.

    As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

    This impedance is reference values and not guaranteed values.

Impedance[Ω]	
10 to 100MHz	100 to 500MHz
80	150

[Unit: mm]
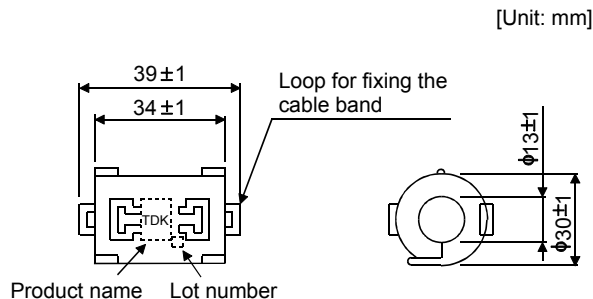
Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

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

Surge suppressor

Surge suppressor

Relay

Surge suppressor

This distance should be short (within 20cm(0.79 in.)).
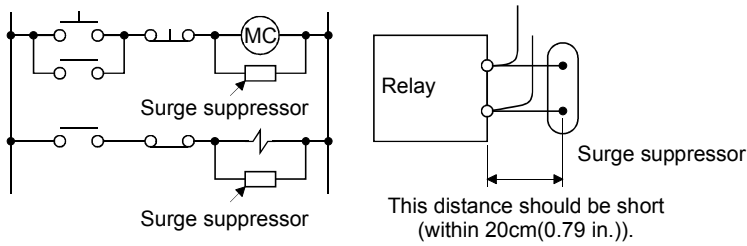
(Ex.) 972A.2003 50411
(Matsuo Electric Co.,Ltd.－200VAC rating)

Rated voltage AC[V]	C [μF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)

Outline drawing [Unit: mm] ([Unit: in.])

Vinyl sheath

Blue vinyl cord

Red vinyl cord

10 or less

10 or less

10±3

15±1

10±3

200 or more

48±1.5

200 or more

18±1.5

6

φ4

31
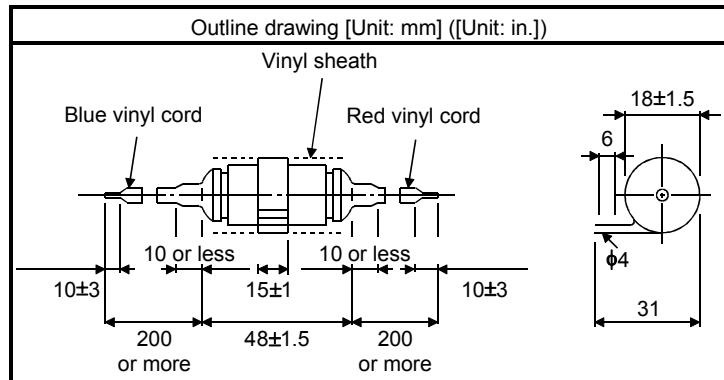
Note that a diode should be installed to a DC relay, DC valve or the like.

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

RA

Diode
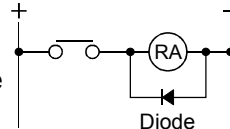
(c) Cable clamp fitting AERSBAN - □ SET

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.

Strip the cable sheath of the clamped area.

cutter

cable

Cable

Cable clamp (A,B)

Earth plate

40

External conductor

Clamp section diagram
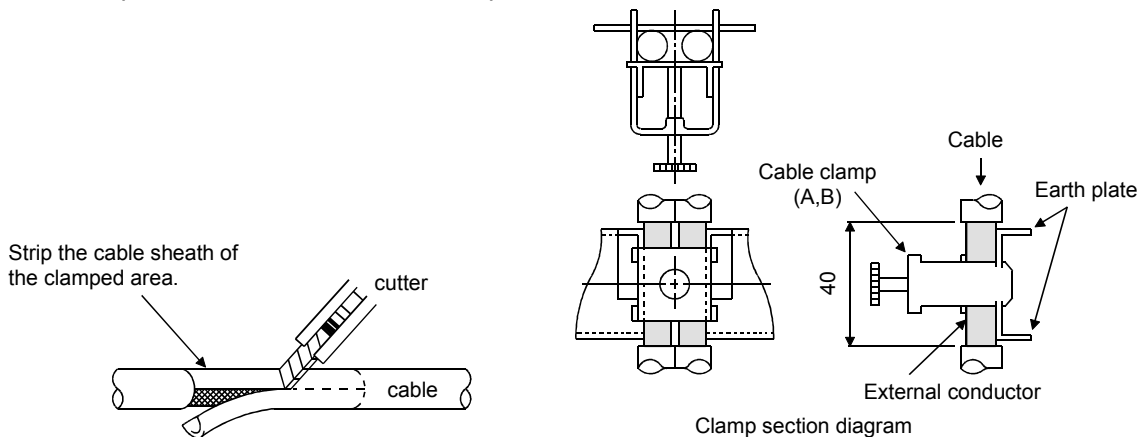
・Outline drawing

[Unit: mm]

Earth plate

Clamp section diagram
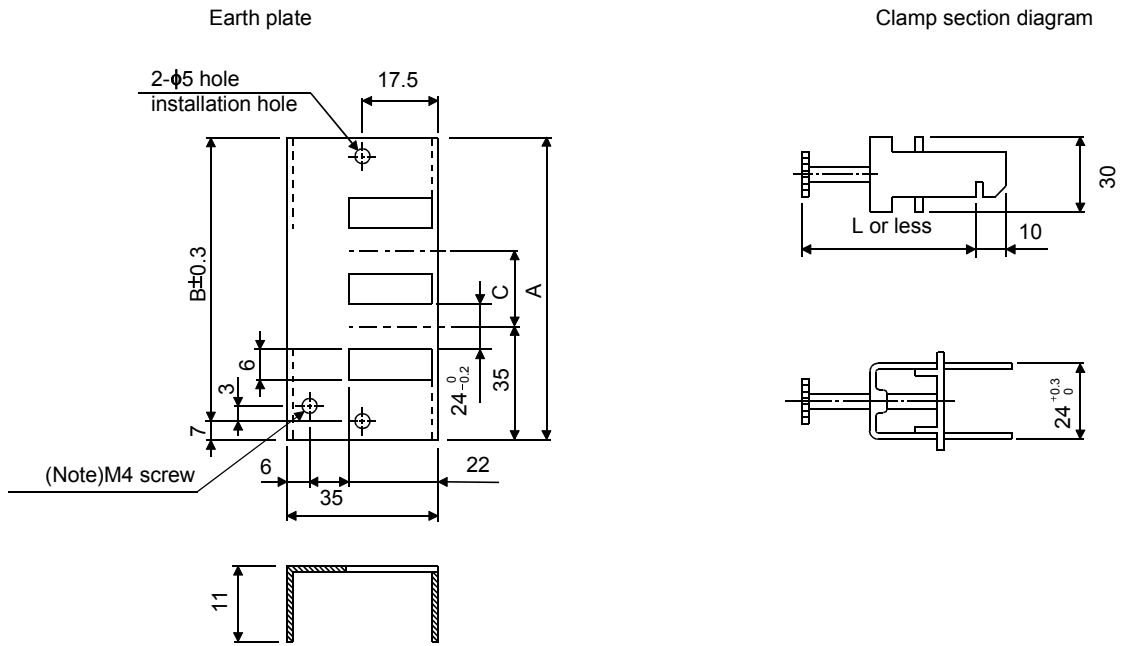
Note. Screw hole for grounding. Connect it to the earth plate of the control box.
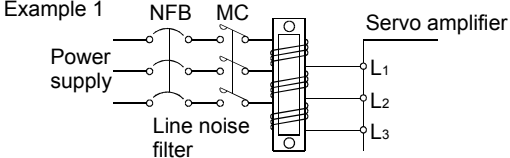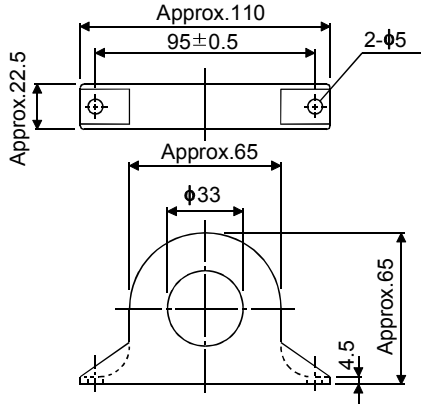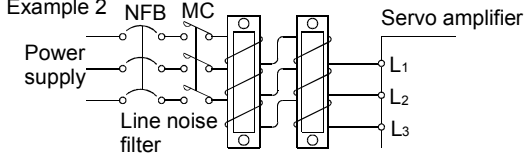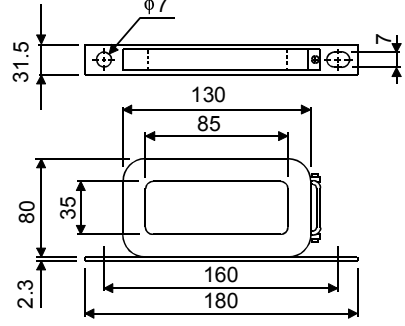
Type	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	clamp A: 2pcs.
AERSBAN-ESET	70	56		clamp B: 1pc.

Clamp fitting	L
A	70
B	45
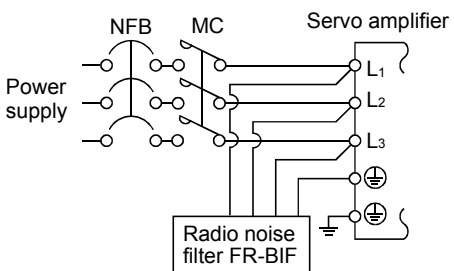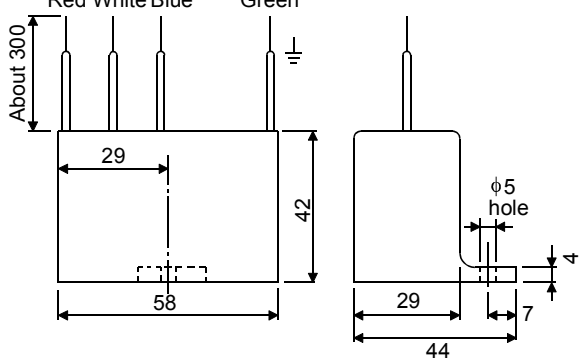
(d) Line noise filter (FR-BSF01, FR-BLF)

This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

Connection diagram	Outline drawing [Unit: mm]
Wind the 3-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the servo amplifier. The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four. If the wires are too thick to be wound, use two or more filters and make the total number of turns as mentioned above. On the output side, the number of turns must be four or less. Do not wind the grounding wire together with the 3-phase wires. The filter effect will decrease. Use a separate wire for grounding. Example 1 NFB MC Servo amplifier Power supply Line noise filter L₁ L₂ L₃ (Number of turns: 4) Example 2 NFB MC Servo amplifier Power supply Line noise filter L₁ L₂ L₃ Two filters are used (Total number of turns: 4)	FR-BSF01 (for MR-J3-200T or less) Approx.110 95±0.5 2-φ5 Approx.22.5 Approx.65 φ33 Approx.65 4.5 FR-BLF(MR-J3-350T or more) φ7 31.5 7 130 85 80 35 2.3 160 180

(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 wire, always insulate the wires that are not used for wiring. NFB MC Servo amplifier Power supply L₁ L₂ L₃ Radio noise filter FR-BIF	Leakage current: 4mA Red White Blue Green About 300 29 42 58 φ5 hole 29 4 7 44

14.16 Leakage current breaker

(1) Selection method

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

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

Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm) to minimize leakage currents.

Rated sensitivity current $\geq 10 \cdot \{Ig1+Ign+Iga+K \cdot (Ig2+Igm)\}$ [mA].................(14.2)
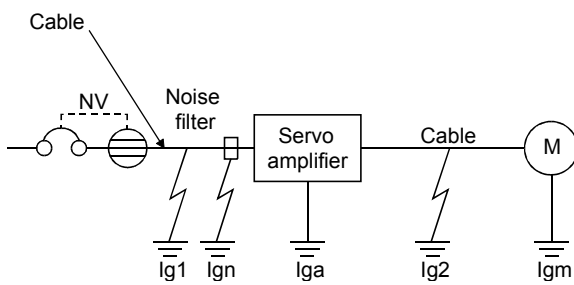
K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-L	1
General models	BV-C1 NFB NV-L	3

Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the servo amplifier (Found from Fig. 14.1.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier to the servo motor (Found from Fig. 14.1.)

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 14.5.)

Igm: Leakage current of the servo motor (Found from Table 14.4.)
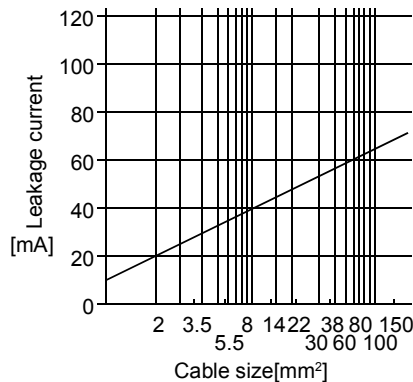
Fig14.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 14.4 Servo motor's leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 1	0.1
2	0.2
3.5	0.3
5	0.5
7	0.7
11	1.0
15	1.3
22	2.3

Table 14.5 Servo amplifier's leakage current example (Iga)

Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.75 to 3.5	0.15
5・7	2
11・15	5.5
22	7

Table 14.6 Leakage circuit breaker selection example

Servo amplifier	Rated sensitivity current of leakage circuit breaker [mA]
MR-J3-10T to MR-J3-350T MR-J3-10T1 to MR-J3-40T1	15
MR-J3-500T	30
MR-J3-700T	50
MR-J3-11KT to MR-J3-22KT	100

(2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions:
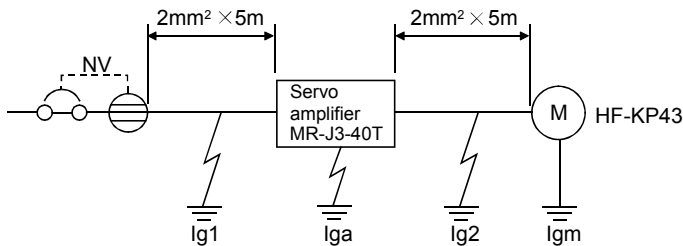
Use a leakage current breaker generally available.

Find the terms of Equation (14.2) from the diagram:

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

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

$$Ign = 0 \ (not \ used)$$

$$Iga = 0.1 \ [mA]$$

$$Igm = 0.1 \ [mA]$$

Insert these values in Equation (14.2):

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

$$\geq 4.0 \ [mA]$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 4.0[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-SP/SW/CP/CW/HW series.

14.17 EMC filter (recommended)

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

(1) Combination with the servo amplifier

Servo amplifier	Recommended filter		Mass [kg]([lb])
	Model	Leakage current [mA]	
MR-J3-10B to MR-J3-100B MR-J3-10B1 to MR-J3-40B1	(Note) HF3010A-UN	5	3 (6.61)
MR-J3-250B · MR-J3-350B	(Note) HF3030A-UN	5	5.5 (12.13)
MR-J3-500B · MR-J3-700B	(Note) HF3040A-UN	1.5	6.0 (13.23)
MR-J3-11KB to MR-J3-22KB	(Note) HF3100A-UN	6.5	15 (33.07)

Note. Soshin Electric A surge protector is separately required to use any of these EMC filters. (Refer to the EMC Installation Guidelines.)

(2) Connection example
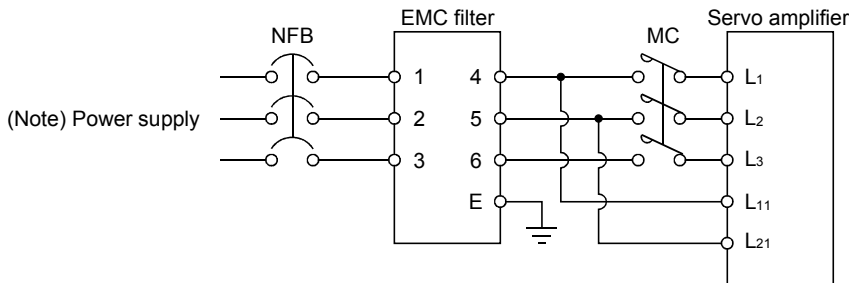
Note. For 1-phase 200V to 230VAC power supply, connect the power supply to L_1, L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply.

(3) Outline drawing
HF3010A-UN

[Unit: mm]
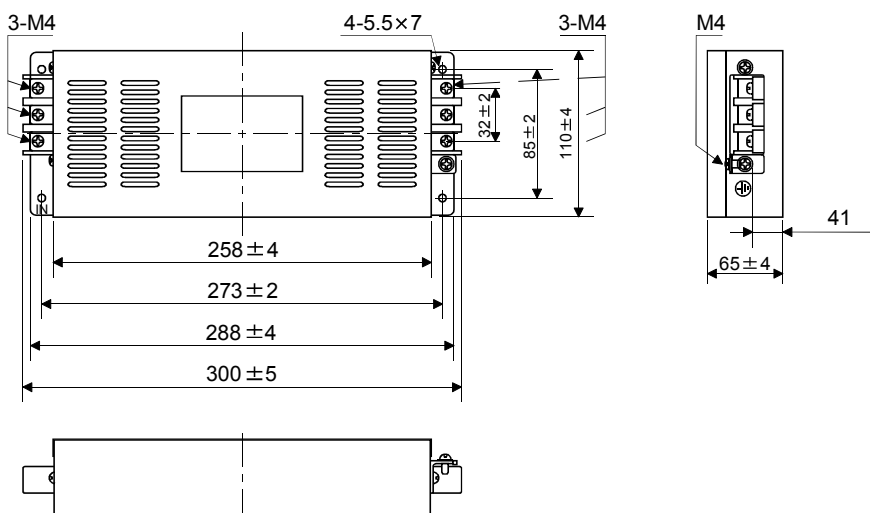
HF3030A-UN・HF-3040A-UN
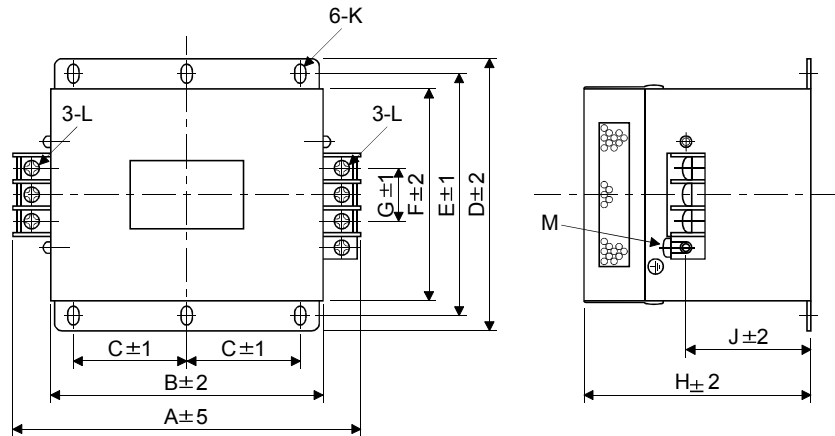
Model	Dimensions [mm]											
	A	B	C	D	E	F	G	H	J	K	L	M
HF3030A-UN	260	210	85	155	140	125	44	140	70	R3.25,	M5	M4
HF3040A-UN	260	210	85	155	140	125	44	140	70	length 8	M5	M4

HF3100A-UN
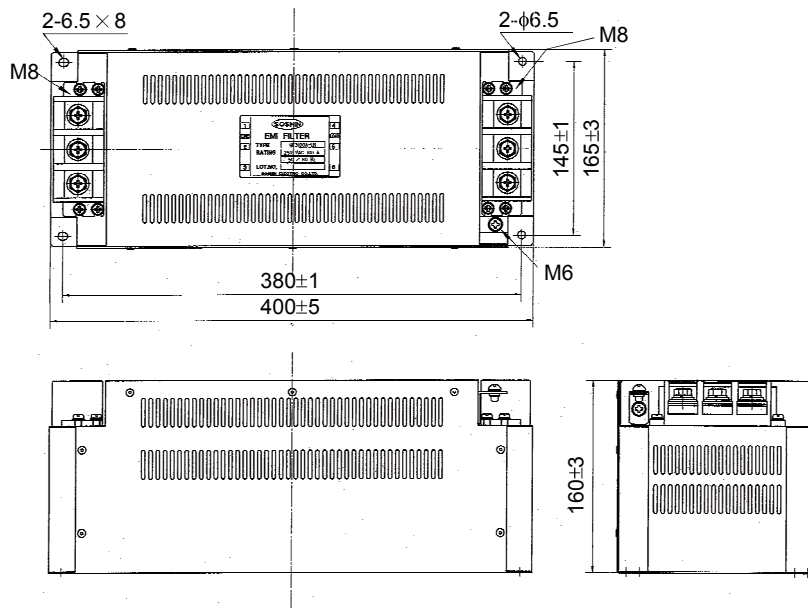
14.18 MR-HDP01 manual pulse generator

Use the MR-HDP01 manual pulse generator to rotate the servo motor. Using external input signals, the moving distance of the servo motor can be specified in accordance with pulses generated from MR-HDP01. To do this specification, in the parameter No. PD06 to PD08, assign the manual pulse generator multiplication 1 (TP0) and 2 (TP1) to the CN6 connector pins.

(1) Specifications

Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA or less
interface		Output current max. 20mA for open collector output
Pulse signal form		A phase, B phase, 2 signals of 90° phase difference
Pulse resolution		100pulse/rev
Max. speed		600r/min moment, 200r/min normally
Operating temperature range		-10℃ to +60℃
Storage temperature range		-30℃ to + 80℃

(2) Connection example
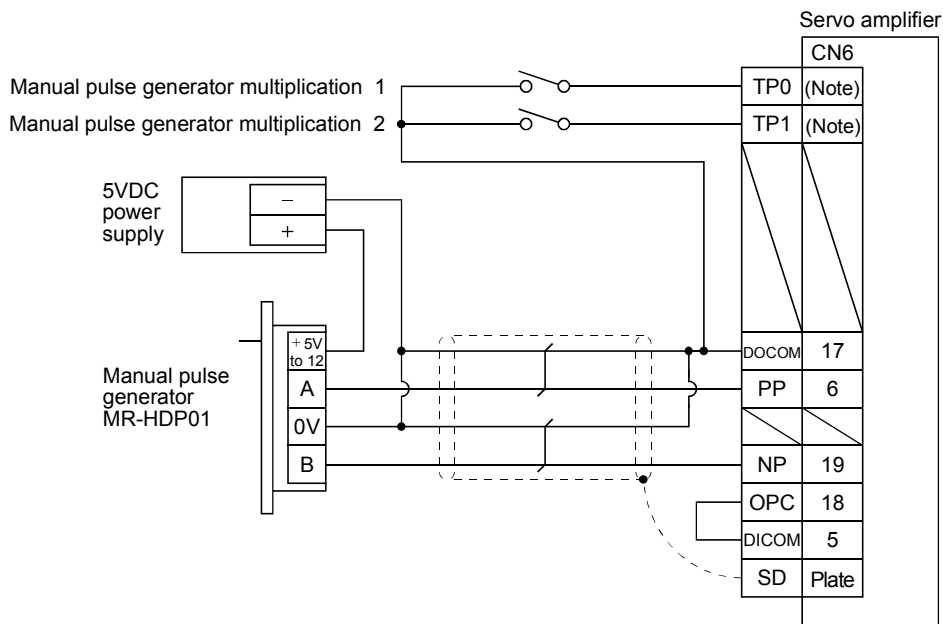
Note. Assign TP0 and PT1 using parameter No. PD06 to PD08・PD12・PD14.

(3) Terminal layout

+5 to
12V 0V A B
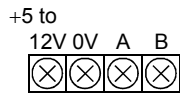
Signal	Description
+5 to 12V	Power input
0V	Common for power and signal
A	A-phase pulse output
B	B-phase pulse output

(4) Installation

Panel cut

3-φ4.8
Equally spaced

φ62⁻²·⁰

φ72±0.2

(5) Outline drawing

[Unit: mm]

3.6   Packing t2.0

φ70
φ50
φ60±0.5
φ80±1

MANUAL TYPE   SERIAL NO.

16   20   27.0±0.5

3-M4 stud L10
P.C.D72 equally spaced

5V to
12V 0V A B

M3 × 6 may only be installed.

8.89   7.6

MEMO
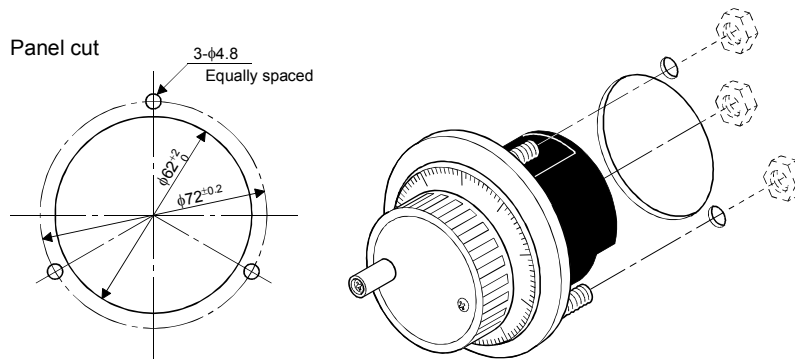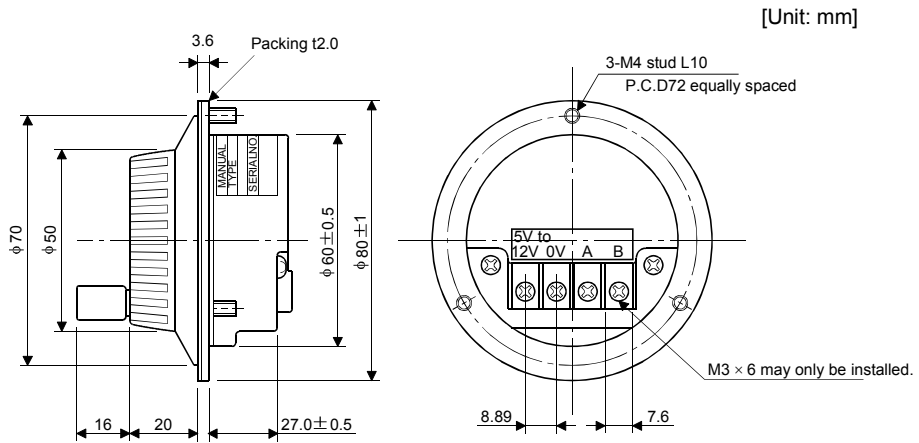
15. COMMUNICATION FUNCTION

Using the serial communication function of RS-422, this servo amplifier enables servo operation, parameter change, monitor function, etc.

15.1 Configuration

(1) Single axis

Operate the single-axis servo amplifier. It is recommended to use the following cable or RS-422/232C communication converter.
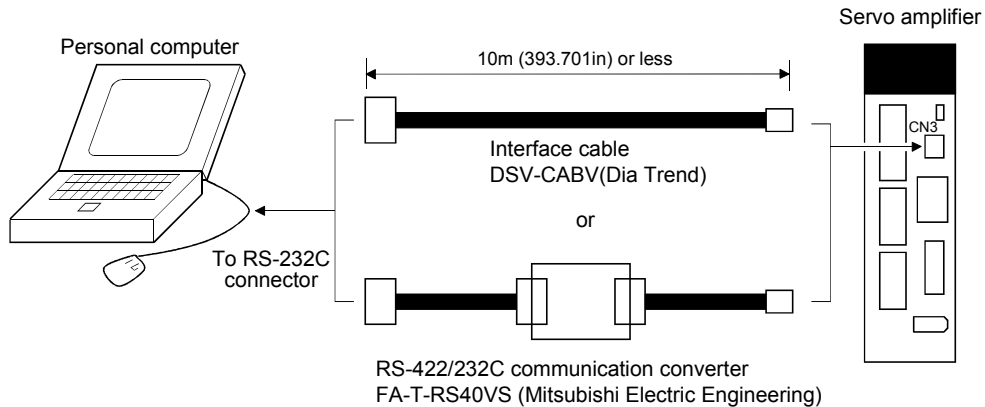
(2) Multidrop connection

(a) Diagrammatic sketch

Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.
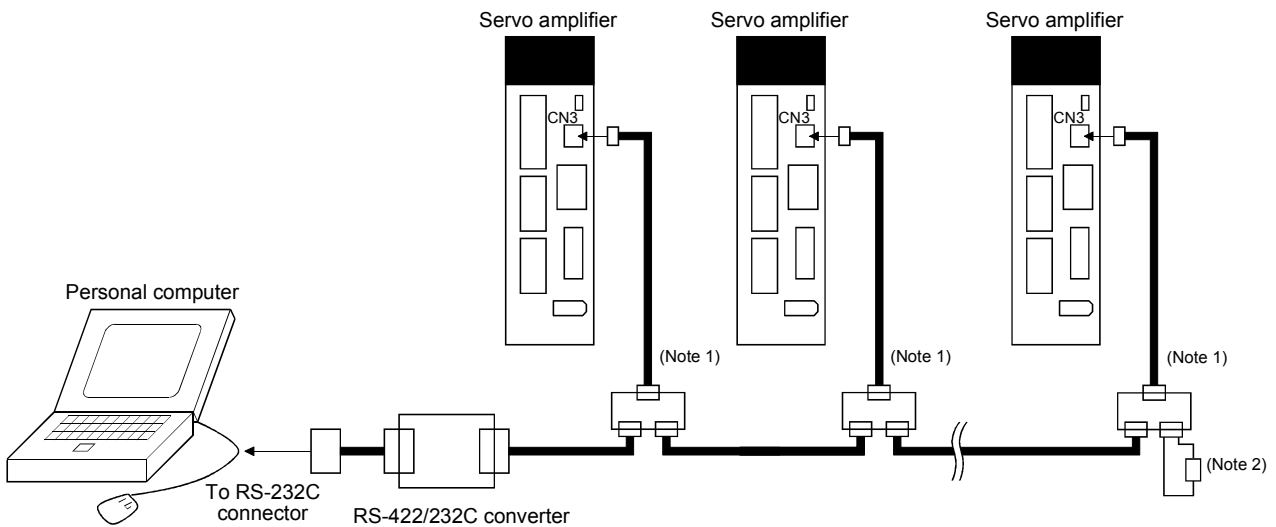
Note 1. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

2. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

(b) Cable connection diagram

Wire the cables as shown below.
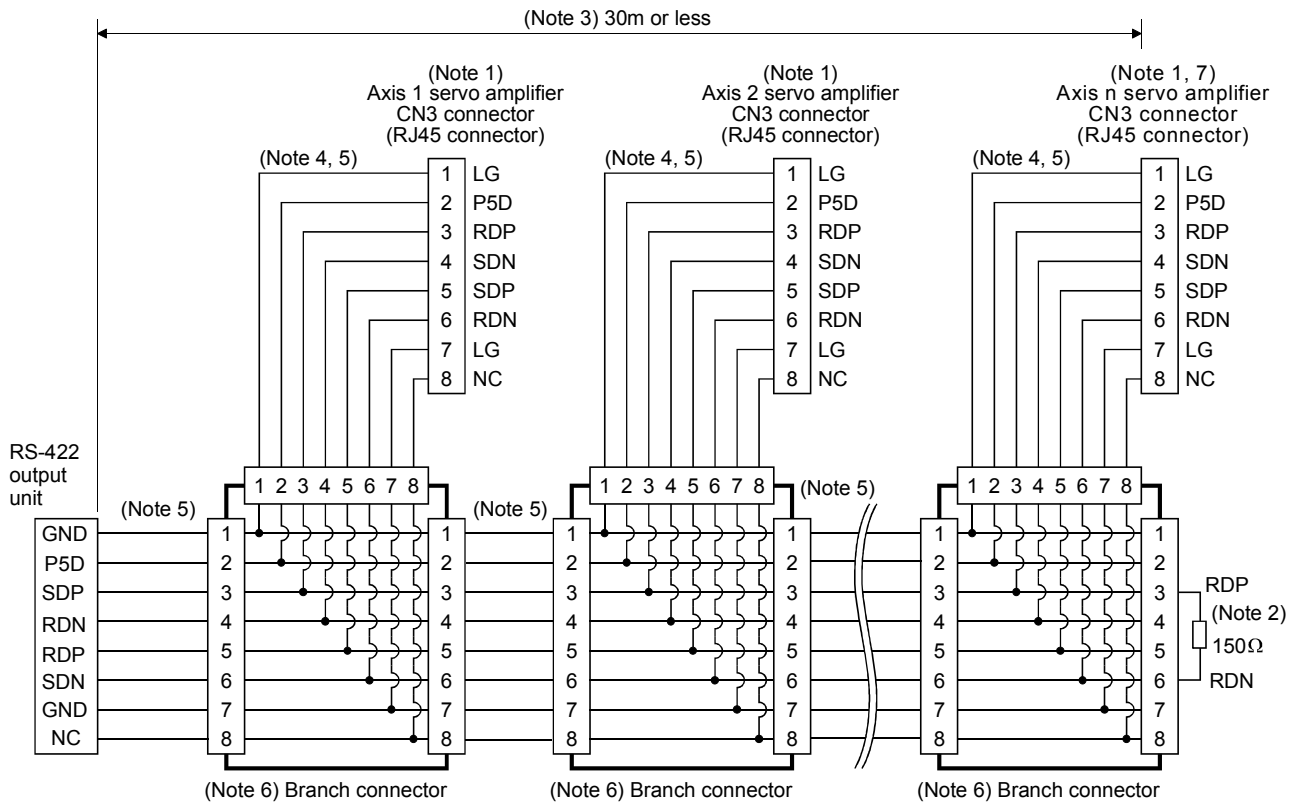
Note 1. Recommended connector (Hirose Electric)

Plug: TM10P-88P

Connection tool: CL250-0228-1

2. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (servo amplifier) with a 150Ω resistor.

3. The overall length is 30m or less in low-noise environment.

4. The wiring between the branch connector and servo amplifier should be as short as possible.

5. Use the EIA568-compliant cable (10BASE-T cable, etc.).

6. Recommended branch connector: BMJ-8 (Hakko Electric Machine Works)

7. n ≤ 32 (Up to 32 axes can be connected.)

15.2 Communication specifications

15.2.1 Communication overview

This servo amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (e.g. personal computer) is called a master station and the device which sends a reply in response to the instruction (servo amplifier) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Description
Baud rate	9600/19200/38400/57600/115200 asynchronous system
Transfer code	Start bit : 1 bit Data bit : 8 bits Parity bit : 1 bit (even) Stop bit : 1 bit
Transfer protocol	Character system, half-duplex communication system
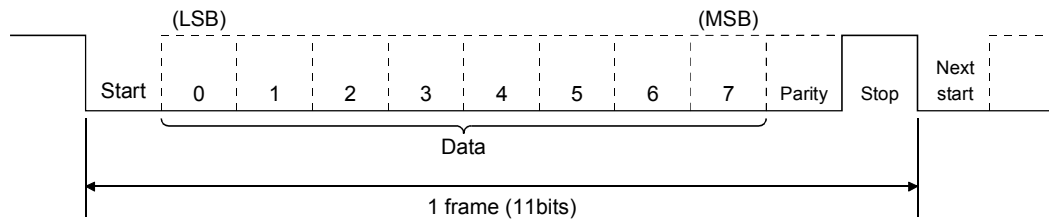
15.2.2 Parameter setting

When the USB/RS-422 communication function is used to operate the servo, set the communication specifications of the servo amplifier in the corresponding parameters.
After setting the values of these parameters, they are made valid by switching power off once, then on again.

(1) Serial communication baud rate
   Choose the communication speed. Match this value to the communication speed of the sending end (master station).

Parameter No. PC21

```
┌──┬──┬──┬──┐
│  │  │  │  │
└──┴──┴──┴──┘
      └──────── Communication baud rate
                 0:  9600[bps]
                 1: 19200[bps]
                 2: 38400[bps]
                 3: 57600[bps]
                 4: 115200[bps]
```

(2) RS-422 communication response delay time
   Set the time from when the servo amplifier (slave station) receives communication data to when it sends back data. Set "0" to send back data in less than 800μs or "1" to send back data in 800μs or more.

Parameter No. PC21

```
┌──┬──┬──┬──┐
│  │  │  │  │
└──┴──┴──┴──┘
   └──────── RS422 communication response delay time
              0: Invalid
              1: Valid, reply sent in 800$\mu$s or more
```

(3) Station number setting
   Set the station number of the servo amplifier in parameter No. PC20. The setting range is station 0 to 31.

15.3 Protocol

15.3.1 Transmission data configuration

Since up to 32 axes may be connected to the bus, add a station number or group to the command, data No., etc. to determine the destination servo amplifier of data communication. Set the station number to each servo amplifier using the parameter and set the group to each station using the communication command. Transmission data is valid for the servo amplifier of the specified station number or group.

When "*" is set as the station number added to the transmission data, the transmission data is made valid for all servo amplifiers connected. However, when return data is required from the servo amplifier in response to the transmission data, set "0" to the station number of the servo amplifier which must provide the return data.

(1) Transmission of data from the controller to the servo
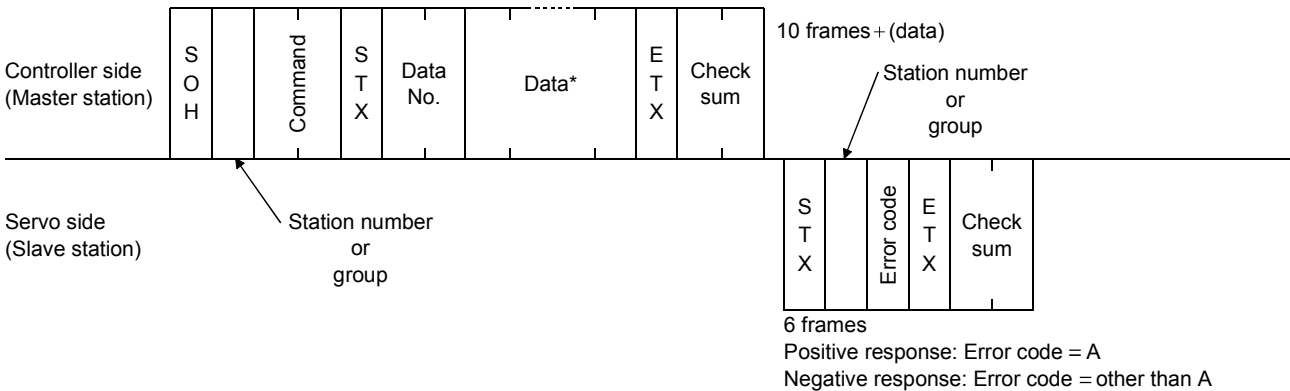
(2) Transmission of data request from the controller to the servo
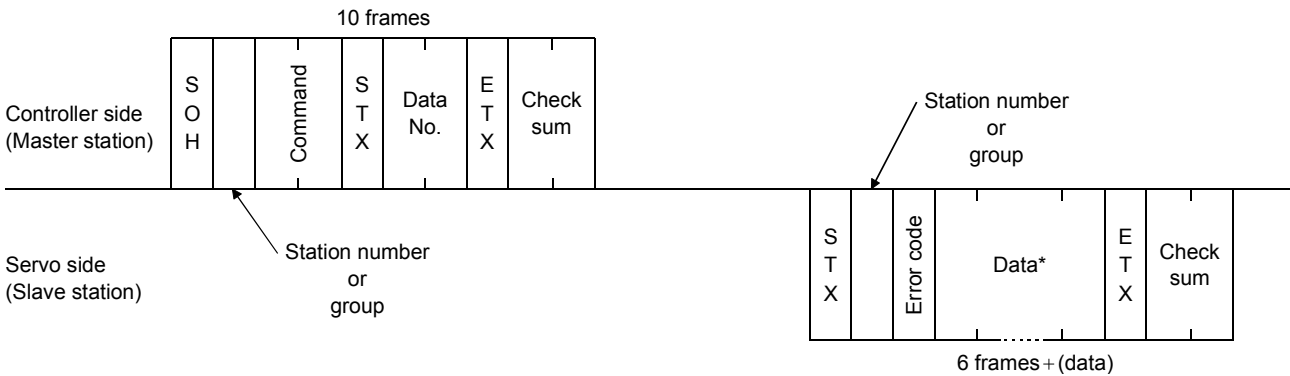
(3) Recovery of communication status by time-out
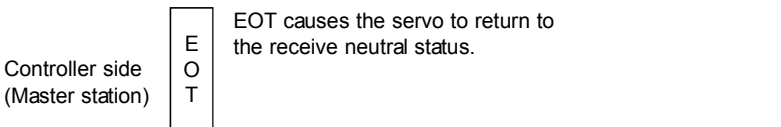
(4) Data frames

The data length depends on the command.
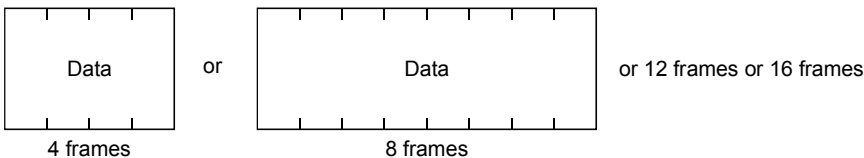
15.3.2 Character codes

(1) Control codes

Code name	Hexadecimal (ASCII code)	Description	Personal computer terminal key operation (General)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

ASCII codes are used.
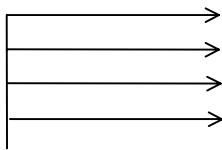
b8	0	0	0	0	0	0	0	0
b7	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1

b8 to b5	b4	b3	b2	b1	C/R	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	Space	0	@	P	`	p
	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC2	"	2	B	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
	0	1	0	0	4			$	4	D	T	d	t
	0	1	0	1	5			%	5	E	U	e	u
	0	1	1	0	6			&	6	F	V	f	v
	0	1	1	1	7			'	7	G	W	g	w
	1	0	0	0	8			(	8	H	X	h	x
	1	0	0	1	9			)	9	I	Y	i	y
	1	0	1	0	10			*	:	J	Z	j	z
	1	0	1	1	11			+	;	K	[	k	{
	1	1	0	0	12			,	<	L	¥	l		
	1	1	0	1	13			−	=	M	]	m	}
	1	1	1	0	14			.	>	N	^	n	‾
	1	1	1	1	15			/	?	O	_	o	DEL

(3) Station numbers

You may set 32 station numbers from station 0 to station 31 and the ASCII unit codes are used to specify the stations.

Station number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASCII code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Station number	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ASCII code	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

For example, "30H" is transmitted in hexadecimal for the station number of "0" (axis 1).

(4) Group

Group	a	b	c	d	e	f	All group
ASCII code	a	b	c	d	e	f	*

For example, "61H" is transmitted in hexadecimal for group a.

15.3.3 Error codes

Error codes are used in the following cases and an error code of single-code length is transmitted.
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.
The error code sent in upper case indicates that the servo is normal and the one in lower case indicates that an alarm occurred.

Error code		Error name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	Character not existing in the specifications was transmitted.	
[E]	[e]	Command error	Command not existing in the specifications was transmitted.	
[F]	[f]	Data No. error	Data No. not existing in the specifications was transmitted.	

15.3.4 Checksum

The check sum is a ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or SOH).

Station number
or
group

(Example)

STX or SOH			ETX	Check

Checksum range
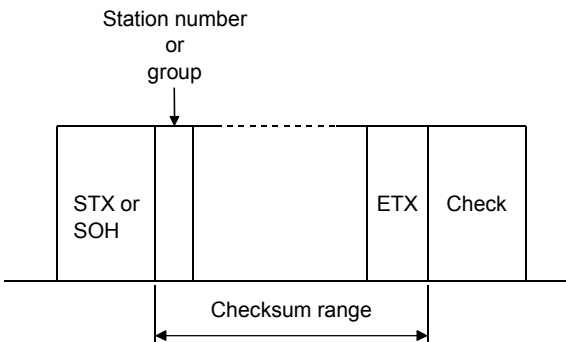
S T X	[0]	[A]	[1]	[2]	[5]	[F]	E T X	[5]	[2]
02H	30H	41H	31H	32H	35H	46H	03H		

30H+41H+31H+32H+35H+46H+03H
=152H

Lower 2 digits 52 is sent after conversion into ASCII code [5][2].

15.3.5 Time-out operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300ms after the master station has ended communication operation. 100ms after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above operation three times. (Communication error)
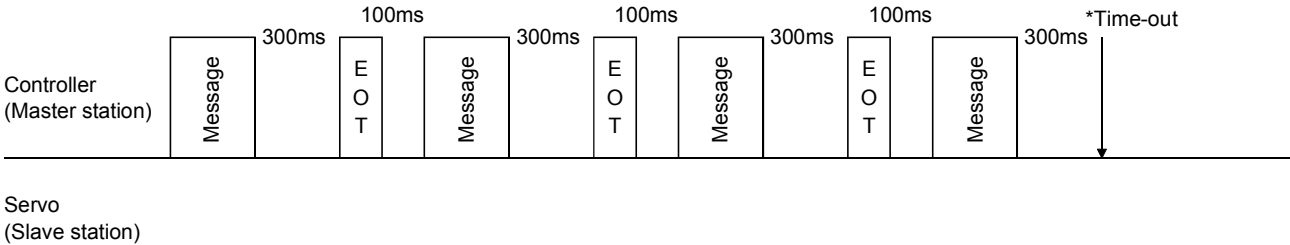
15.3.6 Retry operation

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [F], [b] to [f]). In this case, the master station retransmits the message which was sent at the occurrence of the fault (Retry operation). A communication error occurs if the above operation is repeated and results in the error three or more consecutive times.
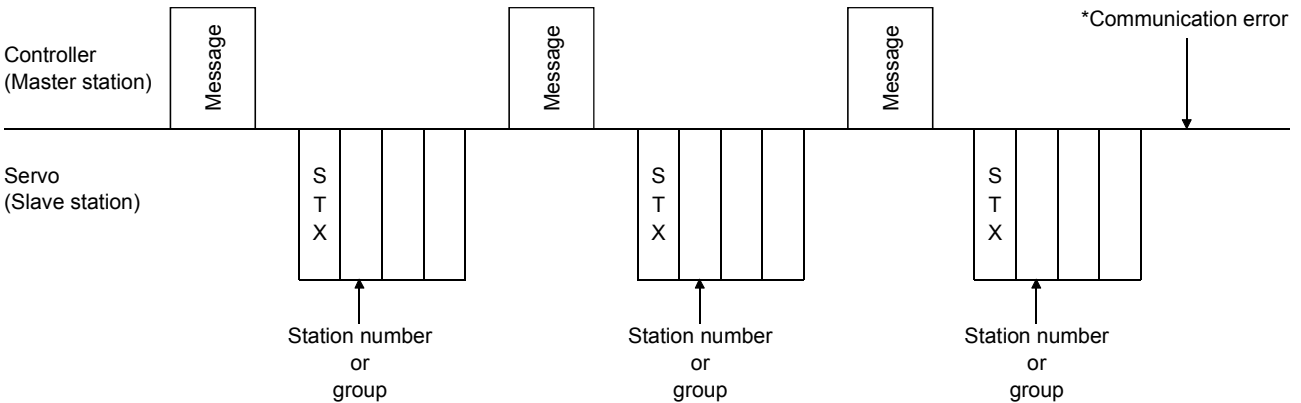
Similarly, when the master station detects a fault (e.g. checksum, parity) in the response data from the slave station, the master station retransmits the message which was sent at the occurrence of the fault. A communication error occurs if the retry operation is performed three times.

15.3.7 Initialization

After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

(1) 1s or more time has elapsed after the slave station is switched on; and

(2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

15.3.8 Communication procedure example

The following example reads the set value of alarm history (last alarm) from the servo amplifier of station 0:

Data item	Value	Description
Station number	0	Servo amplifier station 0
Command	33	Read command
Data No.	10	Alarm history (last alarm)
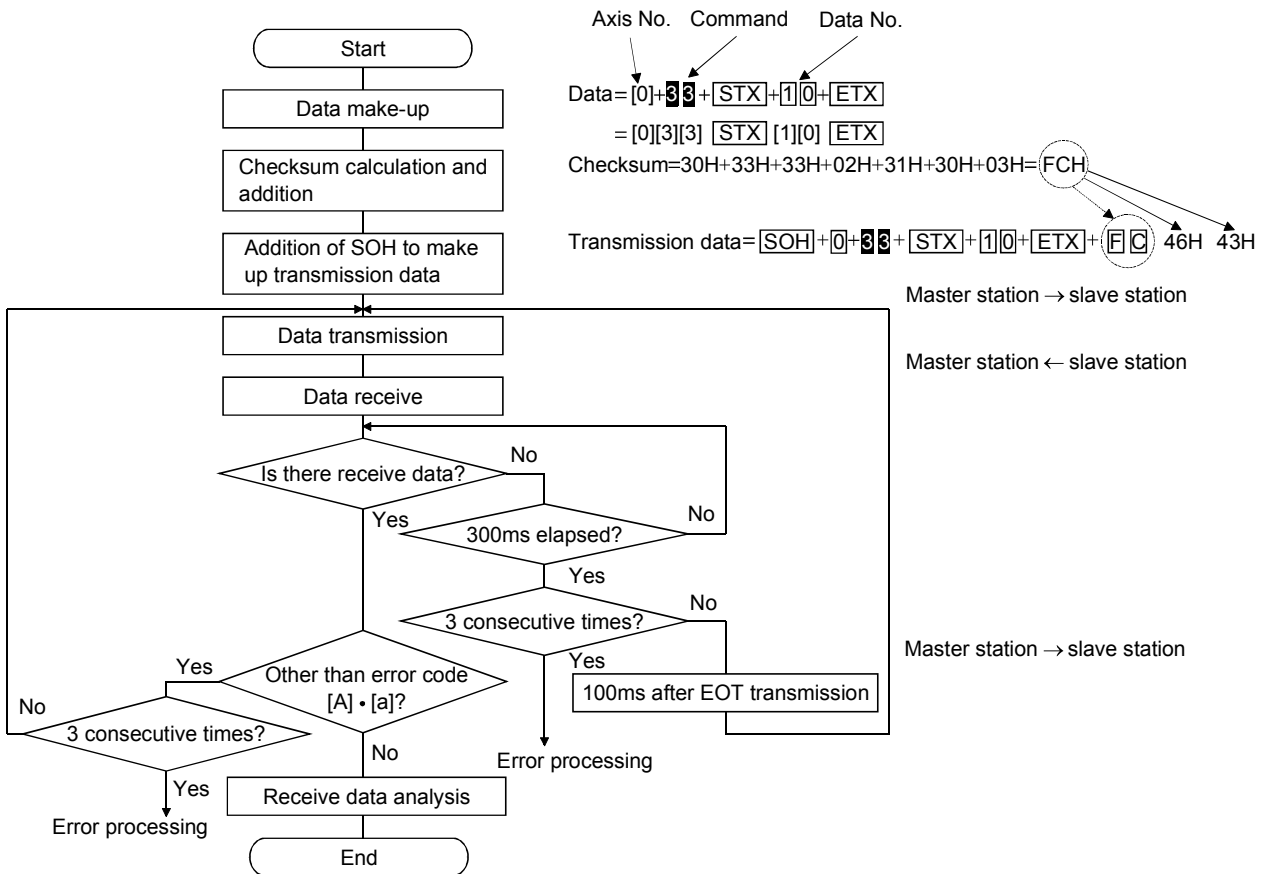
15.4 Command and data No. list

> POINT
> ・If the command and data No. are the same, the description may be different depending on models of servo amplifiers.

15.4.1 Read commands

(1) Status display (Command [0][1])

Command	Data No.	Description	Display Item	Frame Length
[0] [1]	[0] [0]	Status display name and unit	Current position	16
	[0] [1]		Command position	
	[0] [2]		Command remaining distance	
	[0] [3]		Point table No.	
	[0] [4]		Cumulative feedback pulses	
	[0] [5]		Servo motor speed	
	[0] [6]		Droop pulses	
	[0] [7]			
	[0] [8]			
	[0] [9]			
	[0] [A]		Regenerative load ratio	
	[0] [B]		Effective load ratio	
	[0] [C]		Peak load ratio	
	[0] [D]		Instantaneous torque	
	[0] [E]		Within one-revolution position	
	[0] [F]		ABS counter	
	[1] [0]		Load inertia moment ratio	
	[1] [1]		Bus voltage	
	[8] [0]	Status display data value and processing information	Current position	12
	[8] [1]		Command position	
	[8] [2]		Command remaining distance	
	[8] [3]		Point table No.	
	[8] [4]		Cumulative feedback pulses	
	[8] [5]		Servo motor speed	
	[8] [6]		Droop pulses	
	[8] [7]			
	[8] [8]			
	[8] [9]			
	[8] [A]		Regenerative load ratio	
	[8] [B]		Effective load ratio	
	[8] [C]		Peak load ratio	
	[8] [D]		Instantaneous torque	
	[8] [E]		Within one-revolution position	
	[8] [F]		ABS counter	
	[9] [0]		Load inertia moment ratio	
	[9] [1]		Bus voltage	

(2) Parameters (Command [0][4]・[0][5]・[0][6]・[0][7]・[0][8]・[0][9])

Command	Data No.	Description	Frame Length
[0] [4]	[0] [1]	Parameter group read 0000: Basic setting parameter (No.PA□□) 0001: Gain filter parameter (No.PB□□) 0002: Extension setting parameter (No.PC□□) 0003: I/O setting parameter (No.PD□□)	4
[0] [5]	[0] [1] to [F] [F]	Current values of parameters Reads the current values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the current values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [6]	[0] [1] to [F] [F]	Upper limit values of parameter setting ranges Reads the permissible upper limit values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the upper limit values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [7]	[0] [1] to [F] [F]	Lower limit values of parameter setting ranges Reads the permissible lower limit values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the lower limit values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [8]	[0] [1] to [F] [F]	Abbreviations of parameters Reads the abbreviations of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the abbreviations, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	12
[0] [9]	[0] [1] to [F] [F]	Write enable/disable of parameters Reads write enable/disable of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading write enable/disable, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. 0000: Write enabled 0001: Write disabled	4

(3) External I/O signals (Command [1][2])

Command	Data No.	Description	Frame Length
[1] [2]	[0] [0]	Input device status	8
	[0] [1]		
	[4] [0]	External input pin status	
	[6] [0]	Status of input device turned ON by communication	
	[6] [1]		
	[8] [0]	Output device status	
	[8] [1]		
	[C] [0]	External output pin status	

(4) Alarm history (Command [3][3])

Command	Data No.	Description	Alarm Occurrence Sequence	Frame Length
[3] [3]	[1] [0]	Alarm number in alarm history	most recent alarm	4
	[1] [1]		first alarm in past	
	[1] [2]		second alarm in past	
	[1] [3]		third alarm in past	
	[1] [4]		fourth alarm in past	
	[1] [5]		fifth alarm in past	
	[2] [0]	Alarm occurrence time in alarm history	most recent alarm	8
	[2] [1]		first alarm in past	
	[2] [2]		second alarm in past	
	[2] [3]		third alarm in past	
	[2] [4]		fourth alarm in past	
	[2] [5]		fifth alarm in past	

(5) Current alarm (Command [0][2])

Command	Data No.	Description		Frame Length
[0] [2]	[0][0]	Current alarm number		4
[3] [5]	[0][0]	Status display name and unit at alarm occurrence	Current position	16
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]			
	[0][8]			
	[0][9]			
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	
	[0][0]	Status display data value and processing information at alarm occurrence	Current position	12
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]			
	[0][8]			
	[0][9]			
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	

(6) Point table/position data (Command [4][0])

Command	Data No.	Description	Frame length
[4][0]	[0][1] to [F][F]	Position data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(7) Point table/speed data (Command [5][0])

Command	Data No.	Description	Frame length
[5][0]	[0][1] to [F][F]	Speed data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(8) Point table/acceleration time constant (Command [5][4])

Command	Data No.	Description	Frame length
[5][4]	[0][1] to [F][F]	Acceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(9) Point table/deceleration time constant (Command [5][8])

Command	Data No.	Description	Frame length
[5][8]	[0][1] to [F][F]	Deceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(10) Point table/dwell (Command [6][0])

Command	Data No.	Description	Frame length
[6][0]	[0][1] to [F][F]	Dwell read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(11) Point table/auxiliary function (Command [6][4])

Command	Data No.	Description	Frame length
[6][4]	[0][1] to [F][F]	Auxiliary function read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(12) Group setting (Command [1][F])

Command	Data No.	Description	Frame length
[1][F]	[0][0]	Reading of group setting value	4

(13) Test operation mode (Command [0][0])

Command	Data No.	Description	Frame length
[0] [0]	[1] [2]	Test operation mode read 0000: Normal mode (not test operation mode) 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	4

(14) Others

Command	Data No.	Description	Frame length
[0] [2]	[9] [0]	Servo motor end pulse unit absolute position	8
	[9] [1]	Command unit absolute position	8
	[7] [0]	Software version	16

15.4.2 Write commands

(1) Status display (Command [8][1])

Command	Data No.	Description	Setting Range	Frame length
[8] [1]	[0] [0]	Status display data erasure	1EA5	4

(2) Parameters (Command [8][4] · [8][5])

Command	Data No.	Description	Setting Range	Frame length
[8] [4]	[0][1] to [F][F]	Write of parameters Writes the values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before writing the values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	Depending on the parameter	8
[8] [5]	[0] [0]	Parameter group write 0000: Basic setting parameter (No. PA□□) 0001: Gain filter parameter (No. PB□□) 0002: Extension setting parameter (No. PC□□) 0003: I/O setting parameter (No. PD□□)	0000 to 0003	4

(3) External I/O signal (Command [9][2])

Command	Data No.	Description	Setting Range	Frame length
[9] [2]	[6] [0]	Communication input device signal	Refer to section 15.5.5	8
	[6] [1]			

(4) Alarm history (Command [8][2])

Command	Data No.	Description	Setting Range	Frame length
[8] [2]	[2] [0]	Alarm history erasure	1EA5	4

(5) Current alarm (Command [8][2])

Command	Data No.	Description	Setting Range	Frame length
[8] [2]	[0] [0]	Alarm erasure	1EA5	4

(6) Point table/position data (Command [C][0])

Command	Data No.	Description	Setting range	Frame length
[C][0]	[0][1] to [F][F]	Position data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	－999999 to 999999	8

(7) Point table/speed data (Command [C][6])

Command	Data No.	Description	Setting range	Frame length
[C][6]	[0][1] to [F][F]	Speed data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to Permissible instantaneous speed	8

(8) Point table/acceleration time constant (Command [C][7])

Command	Data No.	Description	Setting range	Frame length
[C][7]	[0][1] to [F][F]	Acceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(9) Point table/deceleration time constant (Command [C][8])

Command	Data No.	Description	Setting range	Frame length
[C][8]	[0][1] to [F][F]	Deceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(10) Point table/dwell (Command [C][A])

Command	Data No.	Description	Setting range	Frame length
[C][A]	[0][1] to [F][F]	Dwell write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(11) Point table/auxiliary function (Command [C][B])

Command	Data No.	Description	Setting range	Frame length
[C][B]	[0][1] to [F][F]	Auxiliary function write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 3	8

(12) External input signal disable (Command [9][0])
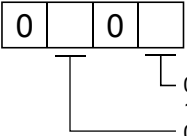
Command	Data No.	Description	Setting range	Frame length
[9][0]	[0][0]	Turns off the input devices, external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN, independently of the external ON/OFF statuses.	1EA5	4
[9][0]	[0][3]	Changes the output devices (DO) into the value of command [8][B] or command [A][0] + data No. [0][1].	1EA5	4
[9][0]	[1][0]	Enables the disabled input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][3]	Enables the disabled output devices (DO).	1EA5	4

(13) Operation mode selection (Command [8][B])

Command	Data No.	Description	Setting Range	Frame Length
[8] [B]	[0] [0]	Operation mode switching 0000: Test operation mode cancel 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	0000 to 0005	4

(14) Test operation mode data (Command [9][2] · [A][0])

Command	Data No.	Description	Setting Range	Frame Length
[9] [2]	[0] [0]	Input signal for test operation	Refer to section 15.5.7.	8
	[0] [1]			
	[A] [0]	Forced output of signal pin	Refer to section 15.5.9.	8
[A] [0]	[1] [0]	Writes the speed in the test operation mode (JOG operation, positioning operation).	0000 to 7FFF	4
	[1] [1]	Writes the acceleration/deceleration time constant in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [0]	Sets the moving distance in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [1]	Selects the positioning direction of test operation (positioning operation). 0 ⬚ 0 ⬚ 0: Forward rotation direction 1: Reverse rotation direction 0: Command pulse unit 1: Encoder pulse unit	0000 to 0001	4
	[4] [0]	Test operation (positioning operation) start command.	1EA5	4
	[4] [1]	Used to make a temporary stop during test operation (positioning operation). □in the data indicates a blank. STOP: Temporary stop G0□□: Restart for remaining distance CLR□: Remaining distance clear.	STOP G0□□ CLR□	4

(15) Group setting (Command [9][F])

Command	Data No.	Description	Setting range	Frame length
[9] [F]	[0] [0]	Setting of group	a to f	4

15.5 Detailed explanations of commands

15.5.1 Data processing

When the master station transmits a command + data No. or a command + data No. + data to a slave station, the servo amplifier returns a reply or data according to the purpose.
When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.
Therefore, data must be processed according to the application.
Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.
The following methods are how to process send and receive data when reading and writing data.

(1) Processing the read data
    When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.
    When the display type is 1, the eight-character data is used unchanged.

    The following example indicates how to process the receive data "003000000929" given to show.
    The receive data is as follows.

| 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 2 | 9 |

    Data 32-bit length (hexadecimal representation)
    (Data conversion is required as indicated in the display type)

    Display type
    0: Data must be converted into decimal.
    1: Data is used unchanged in hexadecimal.

    Decimal point position
    0: No decimal point
    1: First least significant digit (normally not used)
    2: Second least significant digit
    3: Third least significant digit
    4: Forth least significant digit
    5: Fifth least significant digit
    6: Sixth least significant digit

    Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
    00000929H→2345
    As the decimal point position is "3", a decimal point is placed in the third least significant digit.
    Hence, "23.45" is displayed.

(2) Writing the processed data

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

The data to be sent is the following value.

0						

Data is transferred in hexadecimal.

Decimal point position
0: No decimal point
1: First least significant digit
2: Second least significant digit
3: Third least significant digit
4: Forth least significant digit
5: Fifth least significant digit
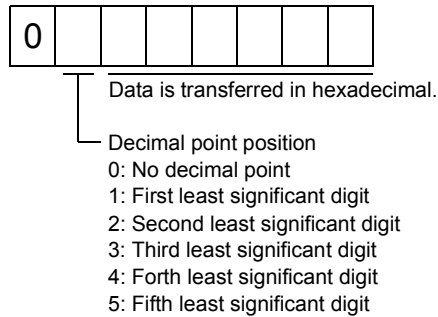
By way of example, here is described how to process the set data when a value of "15.5" is sent.

Since the decimal point position is the second digit, the decimal point position data is "2".

As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

15.5.2 Status display

(1) Reading the status display name and unit

Read the status display name and unit.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read, [0][0] to [0][E]. (Refer to section 15.4.1.)

(b) Reply

The slave station sends back the status display name and unit requested.

Unit characters (5 digits)   Name characters (9 digits)
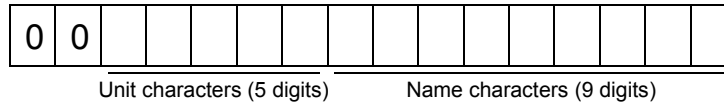
(2) Status display data read

Read the status display data and processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. Refer to section 15.4.1.

(b) Reply

The slave station sends back the status display data requested.

Data 32 bits long (represented in hexadecimal)
(Data conversion into display type is required)

Display type
[0]: Used unchanged in hexadecimal
[1]: Conversion into decimal required

Decimal point position
[0]: No decimal point
[1]: Lower first digit (usually not used)
[2]: Lower second digit
[3]: Lower third digit
[4]: Lower fourth digit
[5]: Lower fifth digit
[6]: Lower sixth digit
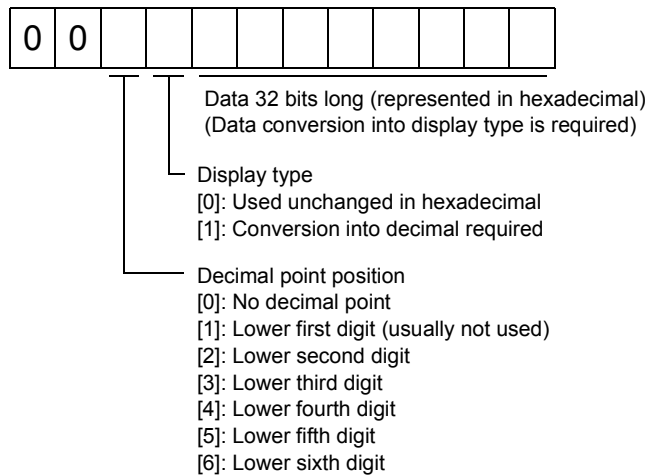
(3) Status display data clear

The cumulative feedback pulse data of the status display is cleared. Send this command immediately after reading the status display item. The data of the status display item transmitted is cleared to zero.

Command	Data No.	Data
[8][1]	[0][0]	[1][E][A][5]

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

15.5.3 Parameters

(1) Specify the parameter group

The group of the parameters to be operated must be specified in advance to read or write the parameter settings, etc. Write data to the servo amplifier as described below to specify the parameter group to be operated.

Command	Data No.	Transmission Data	Parameter Group
[8] [5]	[0] [0]	0000	Basic setting parameter (No.PA□□)
		0001	Gain filter parameter (No.PB□□)
		0002	Extension setting parameter (No.PC□□)
		0003	I/O setting parameter (No.PD□□)

(2) Reading the parameter group

Read the parameter group.

(a) Transmission

Send command [0][4] and data No.[0][1].

Command	Data No.
[0] [4]	[0] [1]

(b) Reply

The slave station sends back the preset parameter group.
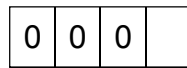
```
0 0 0 
        └─ Parameter group
           0: Basic setting parameter (No.PA□□)
           1: Gain filter parameter (No.PB□□)
           2: Extension setting parameter (No.PC□□)
           3: I/O setting parameter (No.PD□□)
```

(3) Reading the symbol

Read the parameter name. Specify the parameter group in advance (refer to (1) in this section).

(a) Transmission

Transmit command [0][8] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 15.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the name of the parameter No. requested.

```
0 0 0              
        └──────────────────┘
        Name characters (9 digits)
```

15 - 20

(4) Reading the setting

Read the parameter setting. Specify the parameter group in advance (refer to (1) in this section).

(a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 15.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.

Data is transferred in hexadecimal.

Decimal point position
[0]: No decimal point
[1]: Lower first digit
[2]: Lower second digit
[3]: Lower third digit
[4]: Lower fourth digit
[5]: Lower fifth digit

Display type
0: Used unchanged in hexadecimal.
1: Must be converted into decimal.

Parameter write type
0: Valid after write
1: Valid when power is switched on again after write

Read enable/disable
0: Read enable
1: Read disable
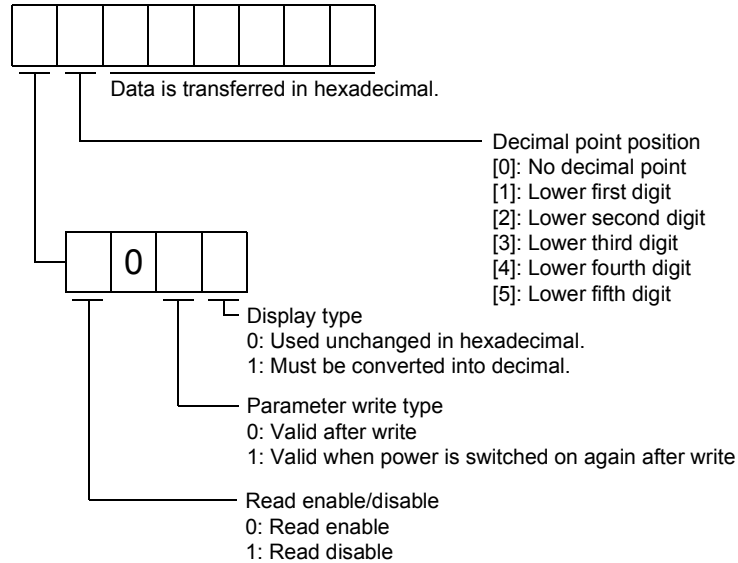
For example, data "1200270F" means 999.9 (decimal display format) and data "0003ABC" means 3ABC (hexadecimal display format).

When the display type is "0" (hexadecimal) and the decimal point position is other than 0, the display type is a special hexadecimal display format and "F" of the data value is handled as a blank. Data "01FFF053" means 053 (special hexadecimal display format).

"1 (Read disable)" is transferred to the "Read enable/disable" section and "000000" is transferred to the data section when the parameter that was read is the one inaccessible for write/reference in the parameter write disable setting of parameter No. PA19.

(5) Reading the setting range

Read the parameter setting range. Specify the parameter group in advance (refer to (1) of this section).

(a) Transmission

When reading the upper limit value, transmit command [0][6] and the data No. corresponding to the parameter No., [0][0] to [F][F]. When reading the lower limit value, transmit command [0][7] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 15.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.

Data is transferred in hexadecimal.
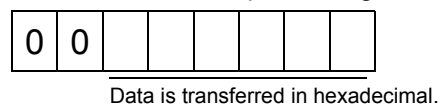
For example, data "10FFFFEC" means -20.

(6) Parameter write

```
┌─────────────────────────────────────────────────────────────────┐
│  POINT                                                            │
│ ∙ If setting values need to be changed with a high frequency (i.e.│
│   one time or more per one hour), write the setting values to the │
│   RAM, not the EEP-ROM. The EEP-ROM has a limitation in the       │
│   number of write times and exceeding this limitation causes the  │
│   servo amplifier to malfunction. Note that the number of write   │
│   times to the EEP-ROM is limited to approximately 100, 000.      │
└─────────────────────────────────────────────────────────────────┘
```

Write the parameter setting into EEP-ROM of the servo amplifier. Specify the parameter group in advance (refer to (1) of this section).

Write the value within the setting enabled range. For the setting enabled range, refer to chapter 6 or read the setting range by performing operation in (3) of this section.

Transmit command [8][4], the data No. , and the set data.

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify 0 as the decimal point position.

Write the data after making sure that it is within the upper/lower limit value range.

Read the parameter data to be written, confirm the decimal point position, and create transmission data to prevent error occurrence. On completion of write, read the same parameter data to verify that data has been written correctly.

Command	Data No.	Set data
[8][4]	[0][1] to [F][F]	See below.
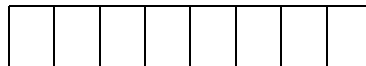
Data is transferred in hexadecimal.

Decimal point position
0: No decimal point
1: Lower first digit
2: Lower second digit
3: Lower third digit
4: Lower forth digit
5: Lower fifth digit

Write mode
0: Write to EEP-ROM
3: Write to RAM
When the parameter data is changed frequently through communication,
set "3" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

15.5.4 External I/O signal statuses (DIO diagnosis)

(1) Reading of input device statuses

Read the statuses of the input devices.

(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[0][0]
	[0][1]

(b) Reply

The slave station sends back the statuses of the input pins.

b31 -- b1 b0

1:ON
0:OFF

Command of each bit is transmitted to the master
station as hexadecimal data.

bit	Data No. [0][0] Device name	Symbol	Data No. [0][1] Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain switch	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

(2) External input pin status read

Read the ON/OFF statuses of the external output pins.

(a) Transmission

Transmit command [1][2] and data No. [4][0].

Command	Data No.
[1][2]	[4][0]

(b) Reply

The ON/OFF statuses of the input pins are sent back.
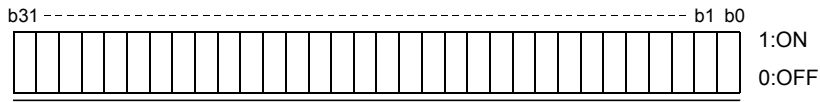
b31 -- b1 b0

1:ON
0:OFF

Command of each bit is transmitted to the master
station as hexadecimal data.

bit	CN6 connector pin
0	1
1	2
2	3
3	
4	
5	
6	
7	

bit	CN6 connector pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	CN6 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	CN6 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

(3) Read of the statuses of input devices switched on through communication

Read the ON/OFF statuses of the input devices switched on through communication.

(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[6][0]
	[6][1]

(b) Reply

The slave station sends back the statuses of the input pins.

```
b31 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - b1 b0
 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |      1:ON
                                                                      0:OFF
```

Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [6][0] Device name	Symbol	Data No. [6][1] Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain switch	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

(4) External output pin status read

Read the ON/OFF statuses of the external output pins.

(a) Transmission

Transmit command [1][2] and data No. [C][0].

Command	Data No.
[1][2]	[C][0]

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.

b31 --- b1 b0

1:ON
0:OFF

Command of each bit is transmitted to the master
station as hexadecimal data.

bit	CN6 connector pin
0	14
1	15
2	16
3	
4	
5	
6	
7	

bit	CN6 connector pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	CN6 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	CN6 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

(5) Read of the statuses of output devices

Read the ON/OFF statuses of the output devices.

(a) Transmission

Transmit command [1][2] and the data No. corresponding to the output device.

Command	Data No.
[1][2]	[8][0]
	[8][1]

(b) Reply

The slave station sends back the statuses of the output devices.

b31 --- b1 b0

1:ON
0:OFF
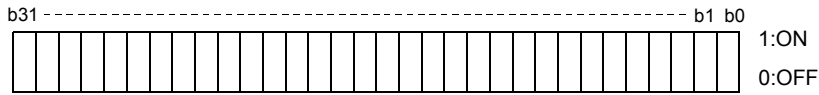
Command of each bit is transmitted to the master
station as hexadecimal data.

bit	Data No. [8][0] Device name	Symbol	Data No. [8][1] Device name	Symbol
0	Ready	RD		
1				
2	Zero speed	ZSP		
3	Limiting torque	TLC		
4				
5	In position	INP		
6				
7	Warning	WNG		
8	Trouble	ALM		
9				
10	Electromagnetic brake interlock	MBR		
11	dynamic brake interlock	DB		
12				
13				
14				
15	Battery warning	BWNG		
16	Rough match	CPO		
17	Home position return completion	ZP		
18	Position range output	POT		
19	Temporary stop	PUS		
20				
21				
22				
23				
24			Point table No. output 1	PT0
25	Variable gain selection	CDPS	Point table No. output 2	PT1
26			Point table No. output 3	PT2
27			Point table No. output 4	PT3
28	Movement finish	MEND	Point table No. output 5	PT4
29			Point table No. output 6	PT5
30			Point table No. output 7	PT6
31			Point table No. output 8	PT7

15.5.5 Device ON/OFF

```
┌─────────────────────────────────────────────────────────────┐
│ POINT                                                         │
├─────────────────────────────────────────────────────────────┤
│ ·The ON/OFF states of all devices in the servo amplifier are │
│  the states of the data received last. Hence, when there is  │
│  a device which must be kept ON, send data which turns that  │
│  device ON every time.                                       │
└─────────────────────────────────────────────────────────────┘
```

Each input device can be switched on/off. However, when the device to be switched off exists in the external input signal, also switch off that input signal.

Send command [9][2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[6][0]	See below.
	[6][1]	

b31 - b1 b0

1:ON
0:OFF

Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [6][0] Device name	Symbol	Data No. [6][1] Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain switch	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

15.5.6 Disable/enable of I/O devices (DIO)

Inputs can be disabled independently of the I/O devices ON/OFF. When inputs are disabled, the input signals (devices) are recognized as follows. Among the input devices, EMG, LSP and LSN cannot be disabled.

Signal	Status
Input devices (DI)	OFF

(1) Disabling/enabling the input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][0]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Disabling/enabling the output devices (DO)
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][3]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][3]	1EA5

15.5.7 Input devices ON/OFF (test operation)

Each input devices can be turned on/off for test operation. when the device to be switched off exists in the external input signal, also switch off that input signal.
Send command [9] [2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[0][0]	See below
	[0][1]	

b31 - b1 b0

1: ON
0: OFF

Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [0][0] Device name	Symbol	Data No. [0][1] Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain switch	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

15.5.8 Test operation mode

```
┌─────────────────────────────────────────────────────────────┐
│  POINT                                                        │
│ ・The test operation mode is used to confirm operation. Do not│
│   use it for actual operation.                                │
│ ・If communication stops for longer than 0.5s during test     │
│   operation, the servo amplifier decelerates to a stop,       │
│   resulting in servo lock. To prevent this, continue          │
│   communication all the time, e.g. monitor the status display.│
│ ・Even during operation, the servo amplifier can be put in the │
│   test operation mode.                                        │
│   In this case, as soon as the test operation mode is         │
│   selected, the base circuit is shut off, coasting the servo  │
│   amplifier.                                                  │
└─────────────────────────────────────────────────────────────┘
```

(1) Preparation and cancel of test operation mode

  (a) Preparation of test operation mode

    Set the test operation mode type in the following procedure.

    Send the command [8][B] + data No. [0][0] to select the test operation mode.

Command	Data No.	Transmission Data	Test Operation Mode Selection
[8][B]	[0][0]	0001	JOG operation
		0002	Positioning operation
		0003	Motorless operation
		0004	DO forced output
		0005	Single-step feed

  2) Confirmation of test operation mode

    Read the test operation mode set for the slave station, and confirm that it is set correctly.

    a. Transmission

      Send the command [0][0] + data No. [1][2].

Command	Data No.
[0][0]	[1][2]

    b. Return

      The slave station returns the set test operation mode.

```
┌─┬─┬─┬─┐
│0│0│0│ │
└─┴─┴─┴─┘
        └─ Test operation mode read
           0: Normal mode (not test operation mode)
           1: JOG operation
           2: Positioning operation
           3: Motorless operation
           4: DO forced output
           5: Single-step feed
```

(2) JOG operation

Send the command, data No. and data as indicated below to execute JOG operation.

Start
Command: [8][B] Data No. : [0][0] Data   : 0001(JOG operation)

Select the JOG operation in the test operation mode.

Servo motor speed setting
Command: [A][0] Data No. : [1][0] Data   : Write the speed [r/min] in   hexadecimal.

Acceleration/deceleration time constant setting

Command: [A][0]
Data No. : [1][1]
Data   : Write the acceleration/
               deceleration time constant
               [ms] in hexadecimal.

Set the operation pattern.

When LSP/LSN was turned OFF by external input signal

When LSP/LSN was turned OFF by external input signal or automatically

Start

Command : [9][2]
Data No. : [0][0]
Data   : ▪Forward rotation direction
                00000807
               (SON, LSP, LSN, ST1 turned ON)
               ▪Reverse rotation direction
                00001007
               (SON, LSP, LSN, ST2 turned ON)

Start

Command : [9][2]
Data No. : [0][0]
Data   : ▪Forward rotation direction
                00000801
               (SON, ST1 turned ON)
               ▪Reverse rotation direction
                00001001
               (SON, ST2 turned ON)

Start.

Stop
Command: [9][2] Data No. : [0][0] Data   : 00000007   (SON, LSP, LSN turned ON)

Stop
Command: [9][2] Data No. : [0][0] Data   : 00000001   (SON turned ON)

Stop.

End
Command : [8][B] Data No. : [0][0] Data   : 0000   (JOG operation cancel)

Cancel the JOG operation.

Power on the servo amplifier.

Shift to the CC-Link operation mode.

(3) Positioning operation

    (a) Operation procedure

        Send the command, data No. and data as indicated below to execute positioning operation.

Start
Command: [8][B] Data No. : [0][0] Data : 0002 (positioning operation)

          Select the positioning operation in the test operation mode.

Servo motor speed setting
Command: [A][0] Data No. : [1][0] Data : Write the speed [r/min] in hexadecimal.

Acceleration/deceleration time constant setting
Command: [A][0] Data No. : [1][1] Data : Write the acceleration /deceleration time constant [ms] in hexadecimal.

Movement distance setting
Command: [A][0] Data No. : [2][0] Data : Write the movement distance [pulse] in hexadecimal.

Rotation direction selection
Command: [A][0] Data No. : [2][0] Data : 0000(forward rotation direction) 0001(reverse rotation)

          Set the operation pattern.

When LSP/LSN was turned OFF by external input signal

When LSP/LSN was turned OFF by external input signal or automatically turned ON

Make input device valid
Command: [9][2] Data No. : [0][0] Data : 00000007 (SON, LSP, LSN turned ON)

Make input device valid
Command: [9][2] Data No. : [0][0] Data : 00000001 (SON turned ON)

          Turn ON Servo-on (SON) to make the servo amplifier ready.

(Note)

Positioning start
Command: [A][0] Data No. : [4][0] Data : 1EA5

          Start.

End
Command: [8][B] Data No. : [0][0] Data : 0000 (Positioning operation cancel)

          Cancel the positioning operation.

Power on the servo amplifier.

          Shift to the CC-Link operation mode.

Note. There is a 100ms delay.

(b) Temporary stop/restart/remaining distance clear

Send the following command, data No. and data during positioning operation to make deceleration to a stop.

Command	Data No.	Data
[A][0]	[4][1]	STOP

Send the following command, data No. and data during a temporary stop to make a restart.

Command	Data No.	(Note) Data
[A][0]	[4][1]	GO□□

Note. □ indicates a blank.

Send the following command, data No. and data during a temporary stop to stop positioning operation and erase the remaining movement distance.

Command	Data No.	(Note) Data
[A][0]	[4][1]	CLR□

Note. □ indicates a blank.

(4) Single-step feed

Set necessary items to the point table before starting the single-step feed.

Send the command, data No. and data as indicated below to execute single-step feed.

```
┌─────────────────────────────────────┐
│                Start                 │
├─────────────────────────────────────┤          ⎫
│ Command: [8][B]                      │          ⎬  Select the single-step feed in the
│ Data No.  : [0][0]                   │          ⎭  test operation mode.
│ Data      : 0005 (Single-step feed)  │
└─────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────┐
│          Point table No. setting     │
├─────────────────────────────────────┤          ⎫
│ Command: [9][2]                      │          ⎬  Set the point table No.
│ Data No.  : [0][1]                   │          ⎭
│ Data      : Write the point table No. in │
│             hexadecimal.             │
└─────────────────────────────────────┘
```

When LSP/LSN was turned OFF by external input signal | When LSP/LSN was turned OFF by external input signal or automatically turned ON

```
┌────────────────────────────────┐    ┌────────────────────────────────┐      ⎫
│      Make input device valid   │    │      Make input device valid   │      ⎪
├────────────────────────────────┤    ├────────────────────────────────┤      ⎪  Turn ON Servo-on (SON) to make
│ Command: [9][2]                │    │ Command: [9][2]                │      ⎬  the servo amplifier ready.
│ Data No.  : [0][0]             │    │ Data No.  : [0][0]             │      ⎪
│ Data      : 00000007           │    │ Data      : 00000001           │      ⎭
│        (SON, LSP, LSN turned ON)│   │        (SON turned ON)         │
└────────────────────────────────┘    └────────────────────────────────┘
```

(Note)

```
┌─────────────────────────────────────┐
│            Operation start           │
├─────────────────────────────────────┤          ⎫
│ Command: [9][2]                      │          ⎬  Start.
│ Data No.  : [0][0]                   │          ⎭
│ Data      : 000008000                │
│             (STT is ON)              │
└─────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────┐
│                 End                  │
├─────────────────────────────────────┤          ⎫
│ Command: [8][B]                      │          ⎬  Cancel the single-step feed.
│ Data No.  : [0][0]                   │          ⎭
│ Data      : 0000                     │
│             (Single-step feed cancel)│
└─────────────────────────────────────┘
                    │
                    ▼
```

Power on the servo amplifier.   ⎬ Shift to the CC-Link operation mode.

Note. Start operation after home position return completion (ZP) is confirmed. Refer to 17th bit of the data read with command [1][2] and data No.[8][0].

(5) Output signal pin ON/OFF output signal (DO) forced output

In the test operation mode, the output signal pins can be turned on/off independently of the servo status.

Using command [9][0], disable the output signals in advance.

(a) Choosing DO forced output in test operation mode

Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.
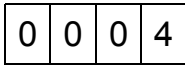
```
0 0 0 4
```
Selection of test operation mode
4: DO forced output (output signal forced output)

(b) External output signal ON/OFF

Transmit the following communication commands:

Command	Data No.	Setting data
[9][2]	[A][0]	See below.

b31 -- b1 b0

1: ON
0: OFF
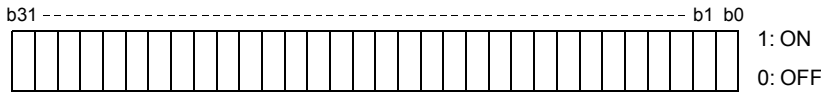
Command of each bit is sent to the slave station in hexadecimal.

bit	CN6 connector pin
0	14
1	15
2	16
3	
4	
5	
6	
7	

bit	CN6 connector pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	CN6 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	CN6 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

(c) Canceling DO forced output

Transmit command [8][B] + data No. [0][0] + data to cancel DO forced output.

Command	Data No.	Transmission data	Description
[8][B]	[0][0]	0000	Cancel DO forced output

(6) Motorless operation

(a) Performing motorless operation

Transmit command [8][B] + data No. [0][0] + data "0003" to perform motorless operation.
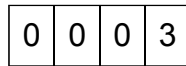
```
0 0 0 3
```
Selection of test operation mode
3: Motorless operation

To perform operation after performing the motorless operation, issue a command from the host controller.

(b) Canceling motorless operation

The motorless operation cannot be canceled in the same way as the test operation mode (transmit command [8][B] + data No. [0][0] + data "0000"). To cancel the motorless operation, power on the servo amplifier and shift to the CC-Link operation mode beforehand.

15.5.9 Alarm history

(1) Alarm No. read

Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No. 0 (last alarm) to No. 5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to section 15.4.1.

(b) Reply

The alarm No. corresponding to the data No. is provided.

0	0		
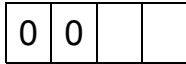
└─ Alarm No. is transferred in decimal.

For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][5].

Refer to section 15.4.1.

(b) Reply

└─ The alarm occurrence time is transferred in decimal.
Hexadecimal must be converted into decimal.

For example, data "01F5" means that the alarm occurred in 501 hours after start of operation.

(3) Alarm history clear

Erase the alarm history.

Send command [8][2] and data No. [2][0].

Command	Data No.	Data
[8][2]	[2][0]	1EA5

15.5.10 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

(a) Transmission

Send command [0][2] and data No. [0][0].

Command	Data No.
[0][2]	[0][0]

(b) Reply

The slave station sends back the alarm currently occurring.

0	0		

└─ Alarm No. is transferred in decimal.

For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Read of the status display at alarm occurrence

Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][E] corresponding to the status display item to be read. Refer to section 15.4.1.

(b) Reply

The slave station sends back the requested status display data at alarm occurrence.

0	0								

Data 32 bits long (represented in hexadecimal)
(Data conversion into display type is required)

Display type
0: Conversion into decimal required
1: Used unchanged in hexadecimal

Decimal point position
0: No decimal point
1: Lower first digit (usually not used)
2: Lower second digit
3: Lower third digit
4: Lower fourth digit
5: Lower fifth digit
6: Lower sixth digit

(3) Current alarm clear

As by the reset (RES) on, reset the servo amplifier alarm to make the servo amplifier ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

Command	Data No.	Data
[8][2]	[0][0]	1EA5

15.5.11 Point table

(1) Data read

    (a) Position data

        Read the position data of the point table.

        1) Transmission

        Transmit command [4][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

        2) Reply

        The slave station sends back the position data of the requested point table.

        Hexadecimal data

        Decimal point position
        0: No decimal point
        1: Lower first digit (usually not used)
        2: Lower second digit
        3: Lower third digit
        4: Lower fourth digit
        5: Lower fifth digit
        6: Lower sixth digit

        Display type
        0: Used unchanged in hexadecimal
        1: Conversion into decimal required

        Position data write type
        0: Valid after write
        1: Valid when power is switched on again after write

    (b) Speed data

        Read the speed data of the point table.

        1) Transmission

        Transmit command [5][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

        2) Reply

        The slave station sends back the speed data of the requested point table.

        Hexadecimal data

        Display type
        0: Used unchanged in hexadecimal
        1: Conversion into decimal required

        Speed data write type
        0: Valid after write
        1: Valid when power is switched on again after write

(c) Acceleration time constant

Read the acceleration time constant of the point table.

1) Transmission

Transmit command [5][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

2) Reply

The slave station sends back the acceleration time constant of the requested point table.

```
┌───┬───┬───┬───┬───┬───┐
│ 0 │   │   │   │   │   │
└─┬─┴───┴───┴───┴───┴───┘
  │       Hexadecimal data
  │
┌─┴─┬───┬───┬───┐
│ 0 │ 0 │   │   │
└───┴───┴─┬─┴─┬─┘
          │   │
          │   └── Display type
          │       0: Used unchanged in hexadecimal
          │       1: Conversion into decimal required
          └────── Deceleration time constant write type
                  0: Valid after write
                  1: Valid when power is switched on again after write
```

(d) Deceleration time constant

Read the deceleration time constant of the point table.

1) Transmission

Transmit command [5][8] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

2) Reply

The slave station sends back the deceleration time constant of the requested point table.

```
┌───┬───┬───┬───┬───┬───┐
│ 0 │   │   │   │   │   │
└─┬─┴───┴───┴───┴───┴───┘
  │       Hexadecimal data
  │
┌─┴─┬───┬───┬───┐
│ 0 │ 0 │   │   │
└───┴───┴─┬─┴─┬─┘
          │   │
          │   └── Display type
          │       0: Used unchanged in hexadecimal
          │       1: Conversion into decimal required
          └────── Deceleration time constant write type
                  0: Valid after write
                  1: Valid when power is switched on again after write
```

(e) Dwell

Read the dwell of the point table.

1) Transmission

Transmit command [6][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

2) Reply

The slave station sends back the dwell of the requested point table.

```
┌──┬──┬──┬──┬──┬──┐
│  │0 │  │  │  │  │
└──┴──┴──┴──┴──┴──┘
   └────────────────
      Hexadecimal data

   ┌──┬──┬──┬──┐
   │0 │0 │  │  │
   └──┴──┴──┴──┘
            │  └── Display type
            │       0: Used unchanged in hexadecimal
            │       1: Conversion into decimal required
            └───── Dwell write type
                    0: Valid after write
                    1: Valid when power is switched on again after write
```

(f) Auxiliary function

Read the auxiliary function of the point table.

1) Transmission

Transmit command [6][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 15.4.1.

2) Reply

The slave station sends back the auxiliary function of the requested point table.

```
┌──┬──┬──┬──┬──┬──┐
│  │0 │  │  │  │  │
└──┴──┴──┴──┴──┴──┘
   └────────────────
      Hexadecimal data

   ┌──┬──┬──┬──┐
   │0 │0 │  │  │
   └──┴──┴──┴──┘
            │  └── Display type
            │       0: Used unchanged in hexadecimal
            │       1: Conversion into decimal required
            └───── Auxiliary function write type
                    0: Valid after write
                    1: Valid when power is switched on again after write
```

(2) Data write

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ┌─────────────┐                                                          │
│  │   POINT     │                                                          │
│  └─────────────┘                                                          │
│  · If setting values need to be changed with a high frequency (i.e. one   │
│    time or more per one hour), write the setting values to the RAM, not   │
│    the EEP-ROM. The EEP-ROM has a limitation in the number of write       │
│    times and exceeding this limitation causes the servo amplifier to      │
│    malfunction. Note that the number of write times to the EEP-ROM is     │
│    limited to approximately 100, 000.                                     │
└─────────────────────────────────────────────────────────────────────────┘
```

(a) Position data

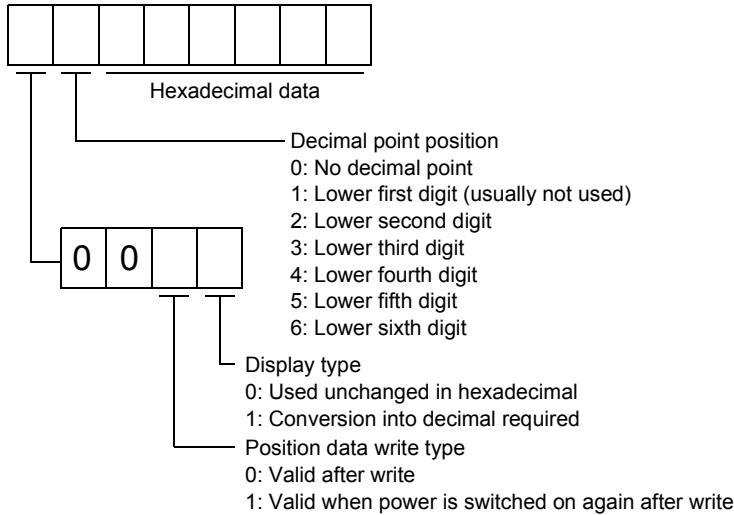Write the position data of the point table.

Transmit command [C][0], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][0]	[0][1] to [F][F]	See below.

Hexadecimal data

Decimal point position
0: No decimal point
1: Lower first digit
2: Lower second digit
3: Lower third digit
4: Lower fourth digit
5: Lower fifth digit
6: Lower sixth digit

The decimal point position should be the same as the feed length multiplication (STM) set in parameter No. 1. The slave station will not accept the decimal point position which is different from the STM setting.

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the position data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier.
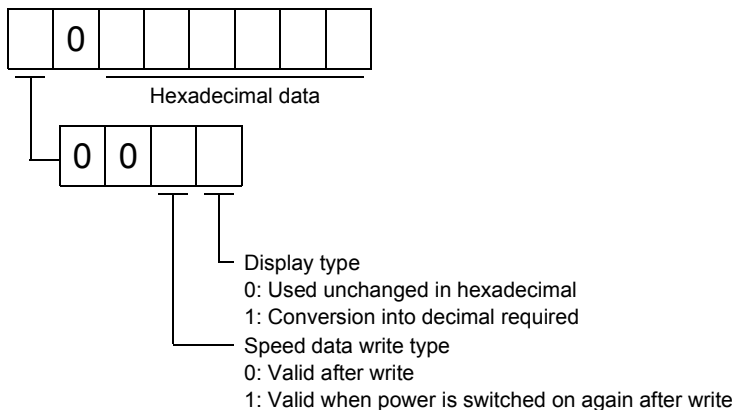When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(b) Speed data

Write the speed data of the point table.

Transmit command [C][6], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][6]	[0][1] to [F][F]	See below.

0

Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the speed data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(c) Acceleration time constant

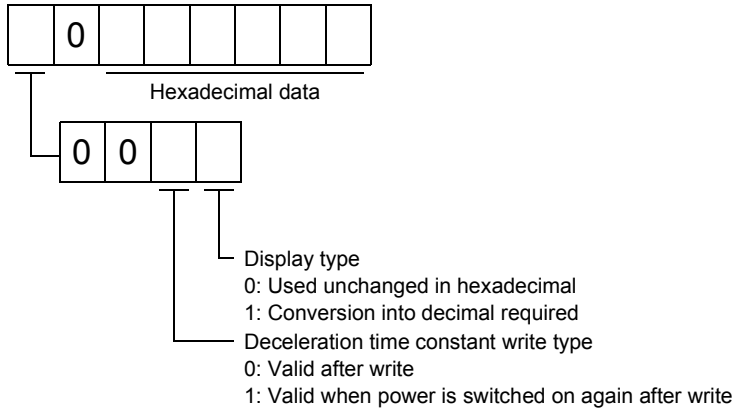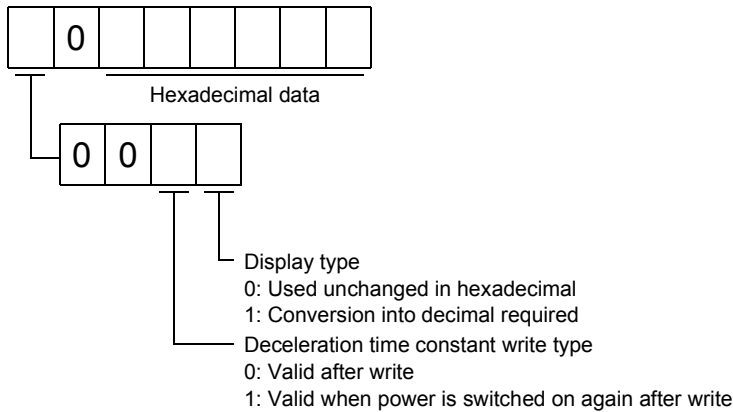Write the acceleration time constant of the point table.

Transmit command [C][7], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][7]	[0][1] to [F][F]	See below.

	0					

Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the acceleration time constant is changed frequently through communication,
set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

(d) Deceleration time constant

Write the deceleration time constant of the point table.

Transmit command [C][8], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][8]	[0][1] to [F][F]	See below.

	0					

Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the deceleration time is changed frequently through communication,
set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

(e) Dwell

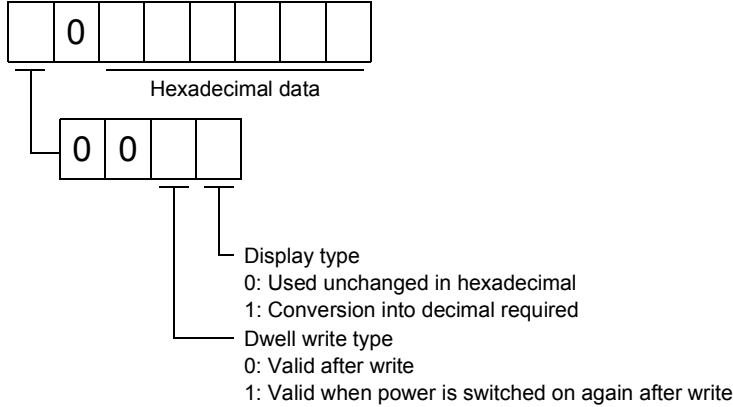Write the dwell of the point table.

Transmit command [C][A], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][A]	[0][1] to [F][F]	See below.

	0					

Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the dwell constant is changed frequently through communication,
set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
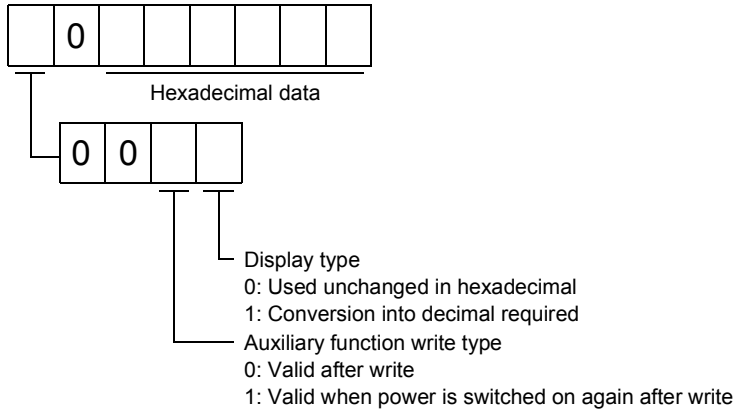do not write it to the EEP-ROM.

(f) Auxiliary function

Write the auxiliary function of the point table.

Transmit command [C][B], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 15.4.2.

Command	Data No.	Data
[C][B]	[0][1] to [F][F]	See below.

	0					

Hexadecimal data
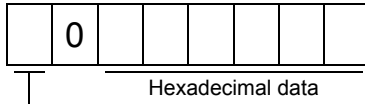
Write mode
0: EEP-ROM, RAM write
1: RAM write

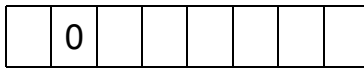When the auxiliary function constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

15.5.12 Servo amplifier group designation

With group setting made to the slave stations, data can be transmitted simultaneously to two or more slave stations set as a group.

(1) Group setting write

Write the group designation value to the slave station.

(a) Transmission

Transmit command [9][F], data No. [0][0] and data.

Command	Data No.	Data
[9][F]	[0][0]	See below.
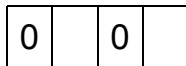
```
┌───┬───┬───┐
│ 0 │ 0 │   │
└───┴───┴───┘
          │   └─── Group designation
          │        0: No group designation
          │        1: Group a
          │        2: Group b
          │        3: Group c
          │        4: Group d
          │        5: Group e
          │        6: Group f
          └─── Response command enable
               Set whether data can be sent back or not in
               response to the read command of the master station.
               0: Response disable
                   Data cannot be set back.
               1: Response enable
                   Data can be set back.
```

(2) Group setting read

Read the set group designation value from the slave station.

(a) Transmission

Transmit command [1][F] and data No. [0][0].

Command	Data No.
[1][F]	[0][0]

(b) Reply

The slave station sends back the group setting of the point table requested.
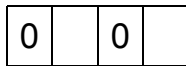
```
┌───┬───┬───┐
│ 0 │ 0 │   │
└───┴───┴───┘
          │   └─── Group designation
          │        0: No group designation
          │        1: Group a
          │        2: Group b
          │        3: Group c
          │        4: Group d
          │        5: Group e
          │        6: Group f
          └─── Response command enable
               0: Response disable
               1: Response enable
```

15.5.13 Other commands

(1) Servo motor end pulse unit absolute position

Read the absolute position in the servo motor end pulse unit.

Note that overflow will occur in the position of 8192 or more revolutions from the home position.

(a) Transmission

Send command [0][2] and data No. [9][0].

Command	Data No.
[0][2]	[9][0]

(b) Reply

The slave station sends back the requested servo motor end pulses.

Absolute value is sent back in hexadecimal in
the servo motor end pulse unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the motor end pulse unit.

(2) Command unit absolute position

Read the absolute position in the command unit.

(a) Transmission

Send command [0][2] and data No. [9][1].

Command	Data No.
[0][2]	[9][1]

(b) Reply

The slave station sends back the requested command pulses.

Absolute value is sent back in hexadecimal in the
command unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the command unit.

(3) Software version

Reads the software version of the servo amplifier.

(a) Transmission

Send command [0][2] and data No.[7][0].

Command	Data No.
[0][2]	[7][0]

(b) Reply

The slave station returns the software version requested.

Space Software version (15 digits)

Appendix

App 1. Parameter list

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

Basic setting parameters (PA □ □)		
No.	Symbol	Name
PA01	*STY	Control mode
PA02	*REG	Regenerative option
PA03	*ABS	Absolute position detection system
PA04	*AOP1	Function selection A-1
PA05	*FTY	Feeding function selection
PA06	*CMX	Electronic gear numerator
PA07	*CDV	Electronic gear denominator
PA08	ATU	Auto tuning
PA09	RSP	Auto tuning response
PA10	INP	In-position range
PA11	TLP	Forward torque limit
PA12	TLN	Reverse torque limit
PA13		For manufacturer setting
PA14	*POL	Rotation direction selection
PA15	*ENR	Encoder output pulses
PA16 to PA18		For manufacturer setting
PA19	*BLK	Parameter write inhibit

Gain/filter parameters (PB □ □)		
No.	Symbol	Name
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)
PB02	VRFT	Vibration suppression control filter tuning mode (Advanced vibration suppression control)
PB03		For manufacturer setting
PB04	FFC	Feed forward gain
PB05		For manufacturer setting
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB11	VDC	Speed differential compensation
PB12		For manufacturer setting
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch form selection 1
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch form selection 2
PB17		Automatic setting parameter
PB18	LPF	Low-pass filter
PB19	VRF1	Vibration suppression control vibration frequency setting
PB20	VRF2	Vibration suppression control resonance frequency setting
PB21 PB22		For manufacturer setting
PB23	VFBF	Low-pass filter selection
PB24	*MVS	Slight vibration suppression control selection
PB25		For manufacturer setting
PB26	*CDP	Gain changing selection
PB27	CDL	Gain changing condition
PB28	CDT	Gain changing time constant
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment
PB30	PG2B	Gain changing position loop gain
PB31	VG2B	Gain changing speed loop gain
PB32	VICB	Gain changing speed integral compensation
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting
PB35 to PB45		For manufacturer setting

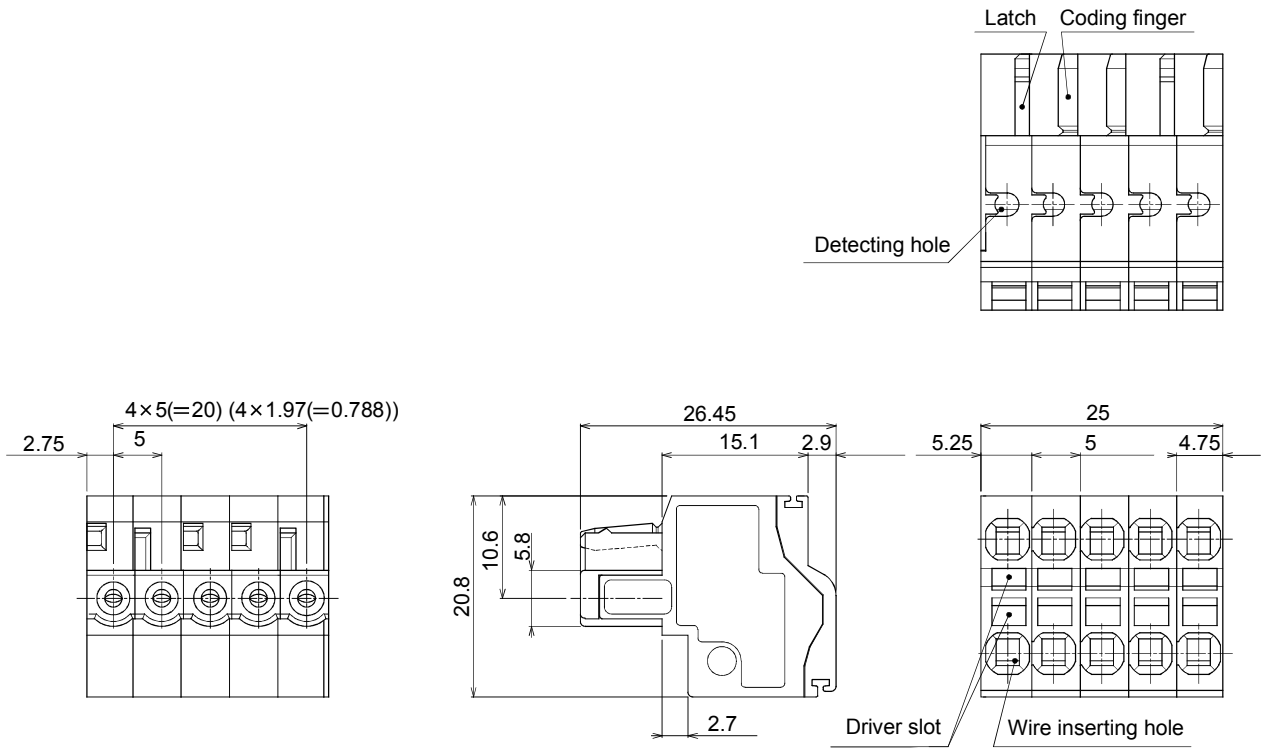| Extension setting parameters (PC□□)				I/O setting parameters (PD□□)		
No.	Symbol	Name		No.	Symbol	Name
PC01		For manufacturer setting		PD01	*DIA1	Input signal automatic ON selection 1
PC02	*ZTY	Home position return type		PD02		For manufacturer setting
PC03	*ZDIR	Home position return direction		PD03	*DIA3	Input signal automatic ON selection 3
PC04	ZRF	Home position return speed		PD04	*DIA4	Input signal automatic ON selection 4
PC05	CRF	Creep speed		PD05		For manufacturer setting
PC06	ZST	Home position shift distance		PD06	*DI2	Input signal device selection 2 (CN6-2)
PC07	*ZPS	Home position return position data		PD07	*DI3	Input signal device selection 3 (CN6-3)
PC08	DCT	Moving distance after proximity dog		PD08	*DI4	Input signal device selection 4 (CN6-4)
PC09	ZTM	Stopper type home position return stopper time		PD09	*DO1	Input signal device selection 1 (CN6-pin 14)
PC10	ZTT	Stopper type home position return torque limit value		PD10	*DO2	Input signal device selection 2 (CN6-pin 15)
				PD11	*DO3	Input signal device selection 3 (CN6-pin 16)
PC11	CRP	Rough match output range		PD12	DIN1	External DI function selection 1
PC12	JOG	Jog speed		PD13		For manufacturer setting
PC13	*STC	S-pattern acceleration/deceleration time constant		PD14	DIN3	External DI function selection 3
				PD15		For manufacturer setting
PC14	*BKC	Backlash compensation		PD16	*DIAB	Input polarity selection
PC15		For manufacturer setting		PD17		For manufacturer setting
PC16	MBR	Electromagnetic brake sequence output		PD18		
				PD19	*DIF	Response level setting
PC17	ZSP	Zero speed		PD20	*DOP1	Function selection D-1
PC18	*BPS	Alarm history clear		PD21		For manufacturer setting
PC19	*ENRS	Encoder output pulse selection		PD22	*DOP3	Function selection D-2
PC20	*SNO	Station number setting		PD23		For manufacturer setting
PC21	*SOP	RS-422 communication function selection		PD24	*DOP5	Function selection D-5
PC22	*COP1	Function selection C-1		PD25 to PD30		For manufacturer setting
PC23		For manufacturer setting				
PC24	*COP3	Function selection C-3				
PC25		For manufacturer setting				
PC26	*COP5	Function selection C-5				
PC27 to PC29		For manufacturer setting				
PC30	*DSS	Remote register-based position/speed specifying system selection				
PC31	LMPL	Software limit +				
PC32	LMPH					
PC33	LMNL	Software limit −				
PC34	LMNH					
PC35	TL2	Internal torque limit 2				
PC36		For manufacturer setting				
PC37	*LPPL	Position range output address +				
PC38	*LPPH					
PC39	*LNPL	Position range output address −				
PC40	*LNPH					
PC41 to PC50		For manufacturer setting				

App 2. Signal layout recording paper

CN6

	1		14
2		15	
	3		16
4		17	
	5	DOCOM	18
6	DICOM	19 OPC	
PP	7	NP	20
8		21	
	9		22
10		23	
	11	LG	24
12	LA	25	LAR
LB	13	LBR	26
	LZ		LZR
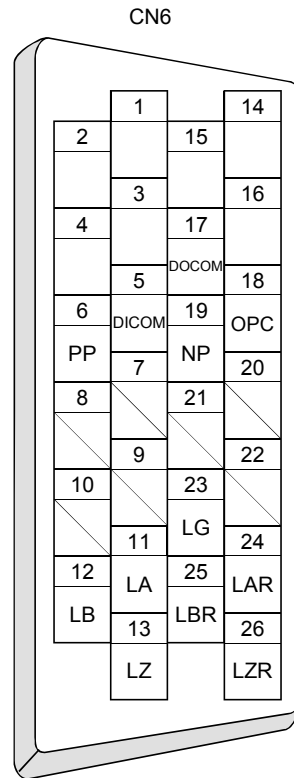
App 3. Twin type connector: outline drawing for 721-2105/026-000(WAGO)

Latch   Coding finger

Detecting hole

4×5(=20) (4×1.97(=0.788))

2.75   5

26.45

15.1   2.9

20.8   10.6   5.8

2.7

25

5.25   5   4.75

Driver slot   Wire inserting hole

App 4. Combination of servo amplifier and servo motor

The servo amplifier software versions compatible with the servo motors are indicated in the parentheses.
The servo amplifiers whose software versions are not indicated can be used regardless of the versions.

Servo motor	Servo amplifier (Software version)
HF-KP053	MR-J3-10T
	MR-J3-10T1
HF-KP13	MR-J3-10T
	MR-J3-10T1
HF-KP23	MR-J3-20T
	MR-J3-20T1
HF-KP43	MR-J3-40T
	MR-J3-40T1
HF-KP73	MR-J3-70T
HF-SP52	MR-J3-60T
HF-SP102	MR-J3-100T
HF-SP152	MR-J3-200T
HF-SP202	MR-J3-200T
HF-SP352	MR-J3-350T
HF-SP502	MR-J3-500T
HF-SP702	MR-J3-700T
HF-SP51	MR-J3-60T
HF-SP81	MR-J3-100T
HF-SP121	MR-J3-200T
HF-SP201	MR-J3-200T
HF-MP053	MR-J3-10T
	MR-J3-10T1
HF-MP13	MR-J3-10T
	MR-J3-10T1
HF-MP23	MR-J3-20T
	MR-J3-20T1
HF-MP43	MR-J3-40T
	MR-J3-40T1
HF-MP73	MR-J3-70T
HA-LP801	MR-J3-11KT
HA-LP12K1	MR-J3-11KT
HA-LP11K1M	MR-J3-11KT
HA-LP11K2	MR-J3-11KT
HA-LP15K1	MR-J3-15KT
HA-LP15K1M	MR-J3-15KT
HA-LP15K2	MR-J3-15KT
HA-LP20K1	MR-J3-22KT
HA-LP25K1	MR-J3-22KT
HA-LP22K1M	MR-J3-22KT
HA-LP22K2	MR-J3-22KT

Servo motor	Servo amplifier (Software version)
HC-RP103	MR-J3-200T
HC-RP153	MR-J3-200T
HC-RP203	MR-J3-350T
HC-RP353	MR-J3-500T
HC-RP503	MR-J3-500T
HC-UP72	MR-J3-70T
HC-UP152	MR-J3-200T
HC-UP203	MR-J3-350T
HC-UP352	MR-J3-500T
HC-UP502	MR-J3-500T
HC-LP52	MR-J3-60T
HC-LP102	MR-J3-100T
HC-LP152	MR-J3-200T
HC-LP202	MR-J3-350T
HC-LP302	MR-J3-500T
HF-SP301	MR-J3-350T
HF-SP421	MR-J3-500T
HA-LP502	MR-J3-500T
HA-LP601	MR-J3-700T
HA-LP701M	MR-J3-700T
HA-LP702	MR-J3-700T

REVISIONS

Print Data	*Manual Number	Revision
Apr., 2006	SH(NA)030058-A	First edition

Jul., 2006	SH(NA)030058-B	Chapter 2 CAUTION added
		Section 3.5.2(2) Description of DB changed
		Section 3.5.3 Note deleted
		Section 3.6.3(1) On duration: 5ms of RYn1 and RYn2 in diagram modified
		Section 3.6.3(2) On duration: 5ms of RYn1 and RYn2 in diagram modified
		Section 3.6.3(3) On duration: 5ms of RYn1 and RYn2 in diagram modified
		Section 3.7.1 Diagram partly modified
		Section 4.8.2(3)(b) Parameter No.19 in diagram changed
		Section 4.10.2(2) POINT added
		Section 5.6.5(2) NOTE added
		Section 5.6.8 POINT changed
		Section 5.8(1) Restrictions changed
		Section 5.8(5)(a) POINT added
		Section 6.2.1 Name of parameter No.PB17: For manufacturer setting
		                      changed
		Section 6.2.2 Name of parameter No.PB17: For manufacturer setting
		                      changed
		Section 6.3.5 Parameter No.12 in diagram changed
		Section 6.4.2 Initial value: 0000h of parameter No. PD20 modified
		                      Sentence of parameter No. PD24 changed
		Section 9.3(1)(a) Parameter No. PB07 added
		Section 9.5 Section title modified
		Section 13.1 Diagrams added
		Section 14.1.1 Model: MR-CCN1 of No.33 modified
		Section 15.4.1(5) Commands: [3] and [5] added
		Section 15.4.2 (15) Group setting (Command [9][F]) added
		App 1 Name of parameter No.PB17: For manufacturer setting
		                      changed

MODEL	
MODEL CODE	

MITSUBISHI ELECTRIC CORPORATION

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Specifications subject to change without notice.