General-Purpose AC Servo

MELSERVO-J2-Super Series

Built-In Positioning Function

MODEL

MR-J2S-□CP

SERVO AMPLIFIER
INSTRUCTION MANUAL

G

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ WARNING

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

2. To prevent fire, note the following:

⚠ CAUTION

- Install the servo amplifier, servo motor and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Always connect a magnetic contactor (MC) between the main circuit power supply and L1, L2, and L3 of the servo amplifier, and configure the wiring to be able to shut down the power supply on the side of the servo amplifier's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the servo amplifier malfunctions.
- When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

3. To prevent injury, note the follow

⚠ CAUTION

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

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

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

Environment			Conditions		
			Servo amplifier	Servo motor	
Ambient temperature	In operation	[℃]	0 to +55 (non-freezing)	0 to +40 (non-freezing)	
		[°F]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
	In storage	[℃]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)	
		[°F]	−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/s^2]		5.9 or less	HC-KFS Series HC-MFS Series HC-UFS13 to 73	X・Y : 49
				HC-SFS81 HC-SFS52 to 152 HC-SFS53 to 153 HC-RFS Series HC-UFS 72・152	X・Y : 24.5
				HC-SFS121・201 HC-SFS202・352 HC-SFS203・353 HC-UFS202	X : 24.5 Y : 49
				HC-SFS301	X : 24.5 Y : 29.4
	[ft/s^2]		19.4 or less	HC-KFS Series HC-MFS Series HC-UFS 13 to 73	X・Y : 161
				HC-SFS81 HC-SFS52 to 152 HC-SFS53 to 153 HC-RFS Series HC-UFS 72・152	X・Y : 80
				HC-SFS121・201 HC-SFS202・352 HC-SFS203・353 HC-UFS202	X : 80 Y : 161
				HC-SFS301	X : 80 Y : 96

Note. Except the servo motor with reduction gear.

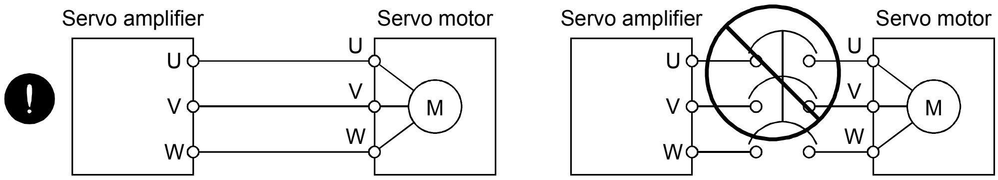
⚠ CAUTION

- 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.

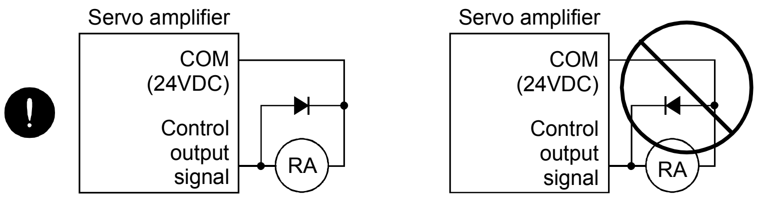
(2) Wiring

⚠ 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 emergency stop (EMG) and other protective circuits may not operate.



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

(3) Test run adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- The parameter settings must not be changed excessively. Operation will be insatiable.

(4) Usage

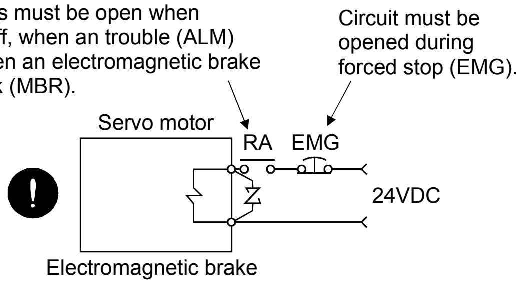
⚠ CAUTION

- 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 (MBR).

Circuit must be opened during forced stop (EMG).

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

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

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

(7) General instruction

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

● About processing of waste ●

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

⚠ FOR MAXIMUM SAFETY

- These products have been manufactured as a general-purpose part for general industries, and have not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine, passenger movement vehicles or underwater 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.

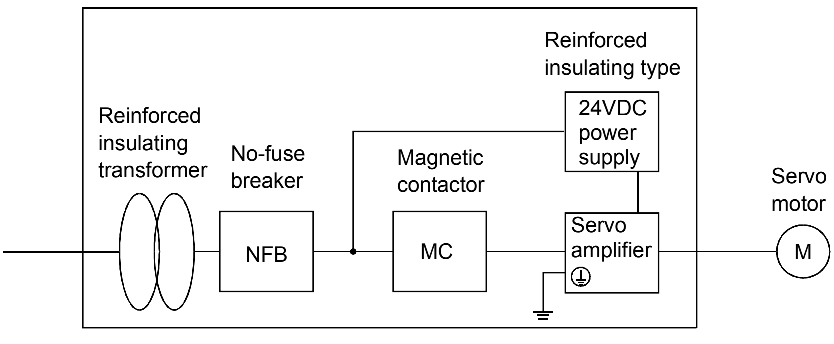
2. PRECAUTIONS FOR COMPLIANCE

(1) Servo amplifiers and servo motors used

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

Servo amplifier series	:MR-J2S-10CP to MR-J2S-700CP MR-J2S-10CP1 to MR-J2S40CP1
Servo motor series	:HC-KFS☐ HC-MFS☐ HC-SFS☐ HC-RFS☐ HC-UFS☐ HA-LFS☐ HC-LFS☐

(2) Configuration



(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

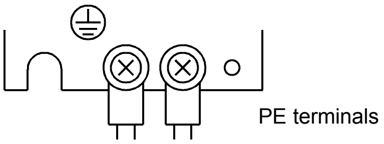
(a) Operate the servo amplifier to meet the requirements of the overvoltage category II set forth in IEC60664-1. For this purpose, a reinforced insulating transformer conforming to the IEC or EN Standard should be used in the power input section.

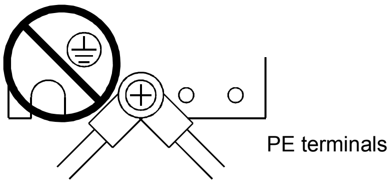
(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(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 (marked ⏚). Always connect the cables to the terminals one-to-one.

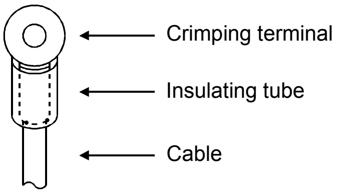




(c) If a leakage current breaker is used to prevent an electric shock, the protective earth (PE) terminals (marked ⏚) of the servo amplifier must be connected to the corresponding earth terminals.

(6) Wiring

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



(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard compliant power connector sets are available from us as options. (Refer to section 14.1.4)

(7) Auxiliary equipment and options

(a) The circuit breaker and magnetic contactor used should be the EN or IEC standard-compliant products of the models described in section 14.2.2.

(b) The sizes of the cables described in section 14.2.1 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 series :MR-J2S-10CP to MR-J2S-700CP
MR-J2S-10CP1 to MR-J2S-40CP1
Servo motor series :HC-KFS□
HC-MFS□
HC-SFS□
HC-RFS□
HC-UFS□
HA-LFS□
HC-LFS□

(2) Installation

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

(3) Short circuit rating

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-J2S-10CP(1) · 20CP(1)	1
MR-J2S-40CP(1) · 60CP	2
MR-J2S-70CP to 350CP	3
MR-J2S-500CP · 700CP	5

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

(6) Attachment of a servo motor

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

(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 MR-J2S-CP for the first time. Always purchase them and use the MR-J2S-CP safely.

Relevant manuals

Manual name	Manual No.
MELSERVO-J2-Super Series To Use the AC Servo Safely	IB(NA)0300010
MELSERVO Servo Motor Instruction Manual	SH(NA)3181
EMC Installation Guidelines	IB(NA)67310

MEMO

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Optional Servo Motor Instruction Manual CONTENTS

The rough table of contents of the optional MELSERVO Servo Motor Instruction Manual is introduced here for your reference. Note that the contents of the Servo Motor Instruction Manual are not included in the Servo Amplifier Instruction Manual.

MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The MR-J2S-CP AC servo amplifier with built-in positioning functions is the MR-J2S-A general-purpose AC servo amplifier which incorporate single-axis positioning functions. These functions 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 3 points of point tables as standard, and they can be increased up to 31 points by using the MR Configurator (servo configuration software).

You can choose a configuration suitable for your purpose, e.g. simple positioning system using external I/O signals (DI/O), operation using DI/O and RS-422 serial communication, or multi drop operation using RS-422 serial communication.

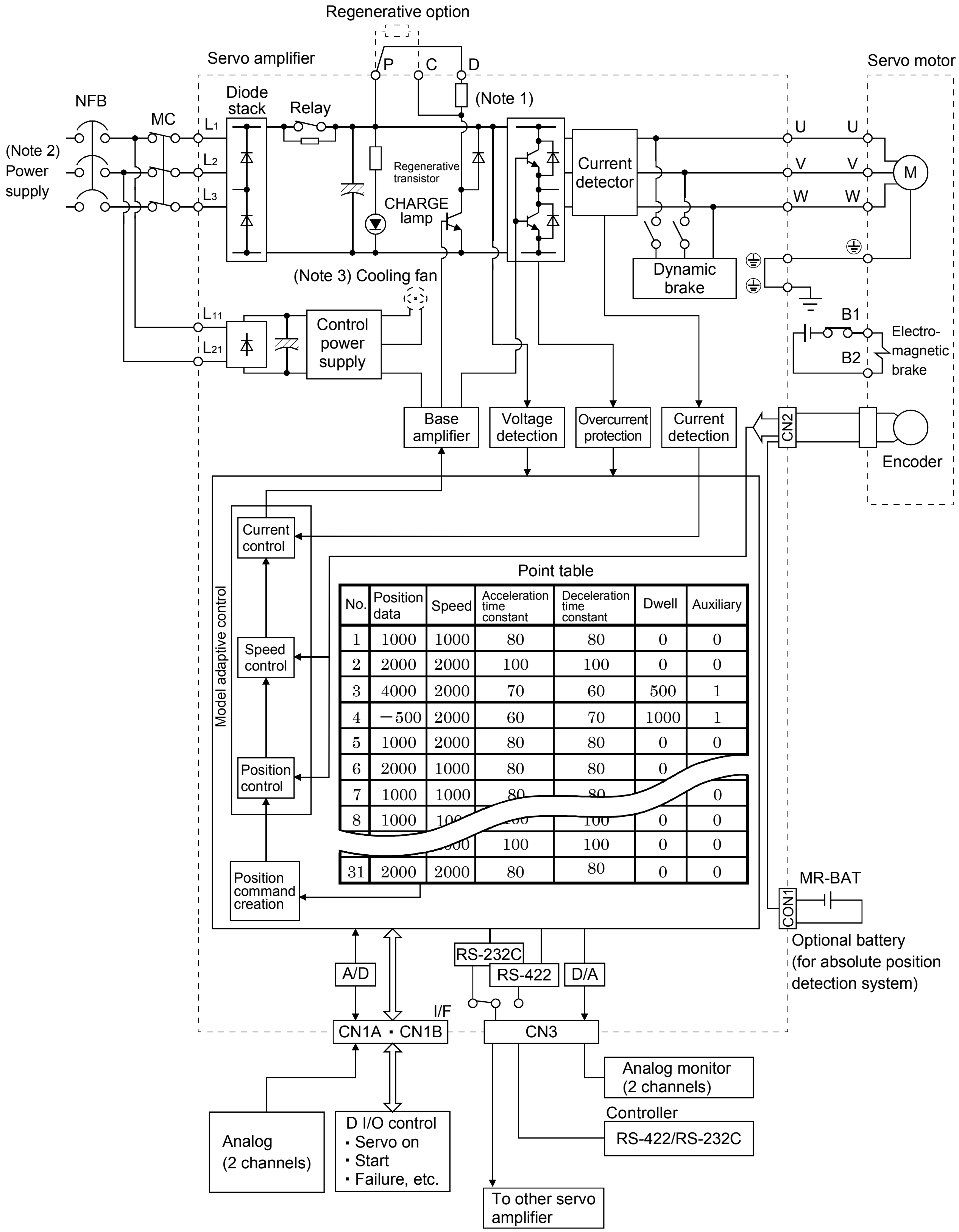
All servo motors are equipped with an absolute position encoder as standard. An absolute position detection system can be configured by merely adding a battery to the servo amplifier. Once the home position has been set, home position return is not required at power on, alarm occurrence, etc.

The MR-J2S-CP AC servo amplifier with positioning function is made easier to use and higher in function by using it with the MR Configurator (servo configuration software).

1.1.1 Function block diagram

The function block diagram of this servo is shown below.

(1) MR-J2S-350CP or less



Point table

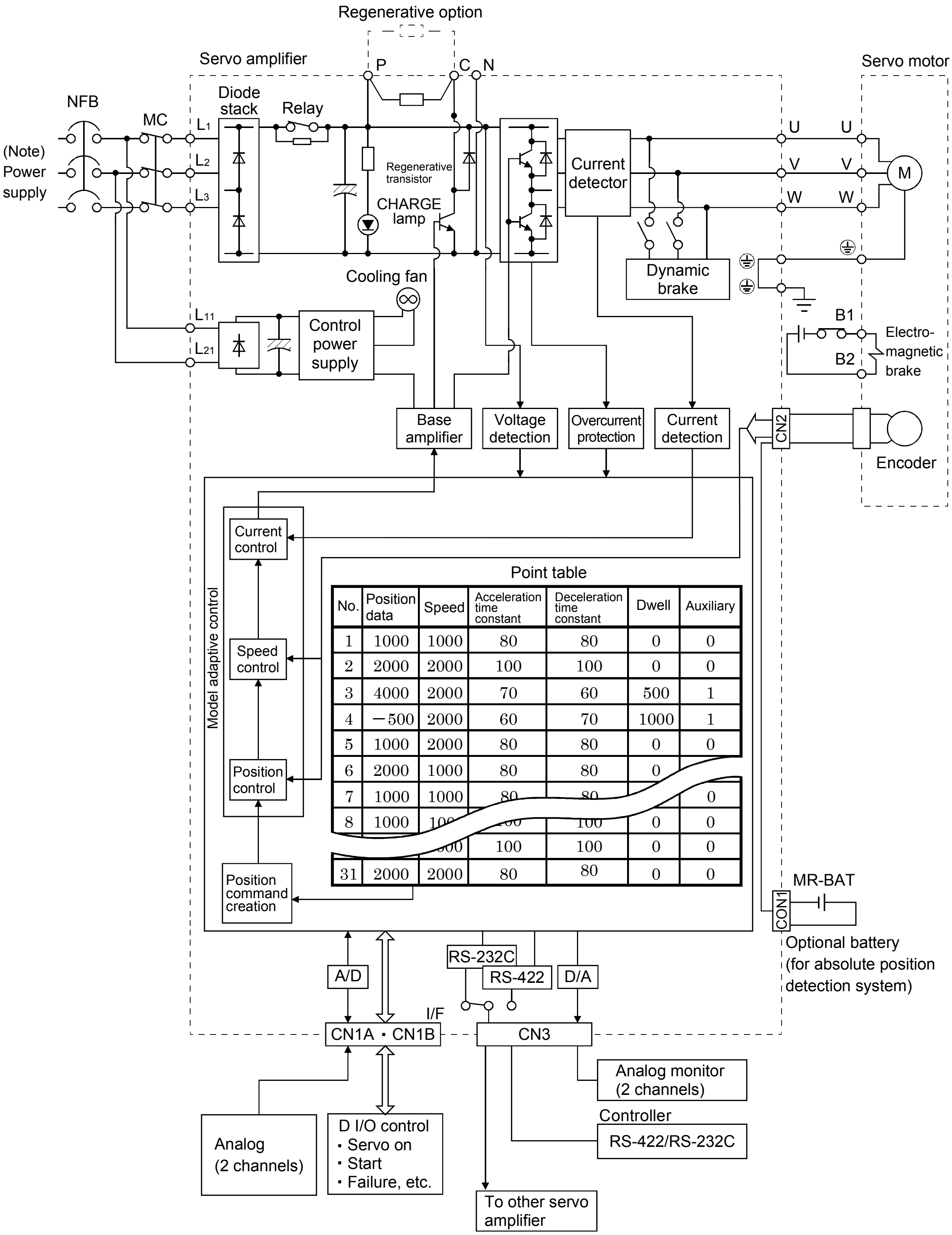
No.	Position data	Speed	Acceleration time constant	Deceleration time constant	Dwell	Auxiliary
1	1000	1000	80	80	0	0
2	2000	2000	100	100	0	0
3	4000	2000	70	60	500	1
4	−500	2000	60	70	1000	1
5	1000	2000	80	80	0	0
6	2000	1000	80	80	0	
7	1000	1000	80	80		0
8	1000	10	100	100	0	0
		000	100	100	0	0
31	2000	2000	80	80	0	0

Note 1. The built-in regenerative resistor is not provided for the MR-J2S-10CP (1).

2. For 1-phase 230VAC, connect the power supply to L_1, L_2 and leave L_3 open. Refer to section 1.2 for the power supply specification. L_3 is not provided for a 1-phase 100 to120VAC power supply.

3. Servo amplifiers MR-J2S-200CP have a cooling fan.

(2) MR-J2S-500CP・700CP



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	10		100	0	0
		000	100	100	0	0
31	2000	2000	80	80	0	0

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

1.1.2 System configuration

This section describes operations using this servo.

You can arrange any configurations from a single-axis to max. 32-axis systems. Further, the connector pins in the interface section allow you to assign the optimum signals to respective systems. (Refer to sections 1.1.3 and 3.3.2.) The MR Configurator (servo configuration software) (refer to chapter 6) and personal computer are required to change or assign devices.

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)	

(1) Operation using external input signals

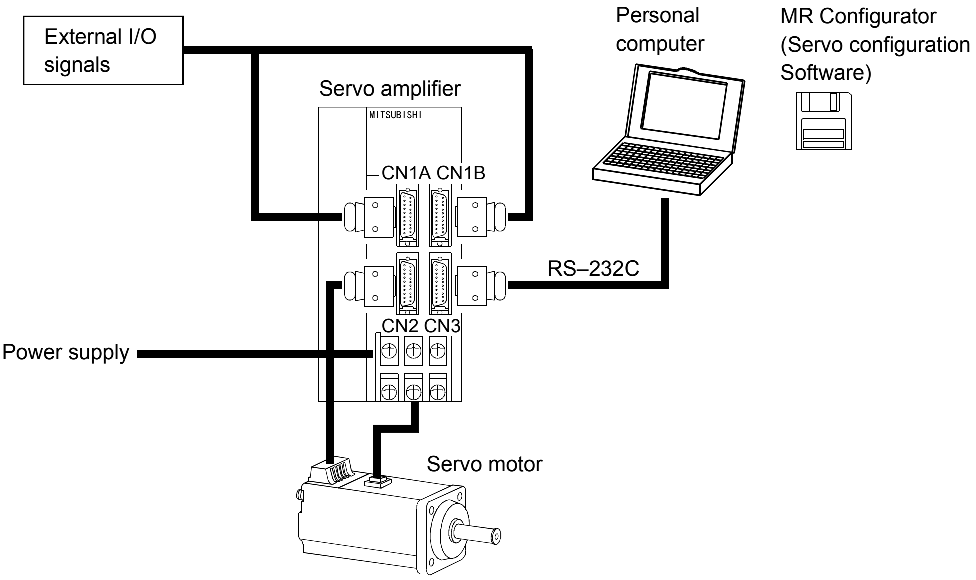
(a) Description

The following configuration example assumes that external input signals are used to control all signals (devices).

The I/O signals are as factory-set.

(b) Configuration

The following configuration uses external I/O signals. The personal computer is used with MR Configurator (servo configuration software) to set, change and monitor the parameters and point tables.



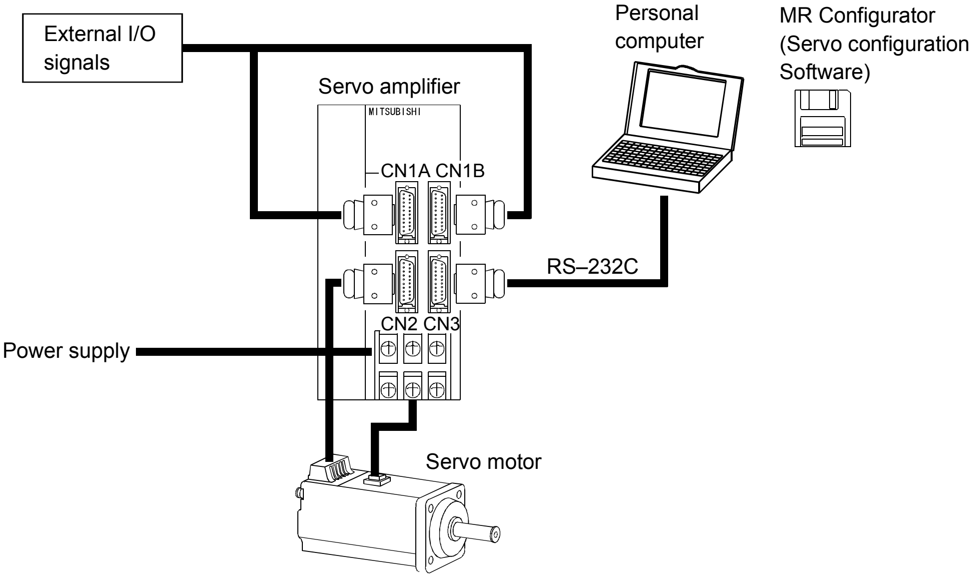
(2) Operation using external input signals and communication

(a) Description

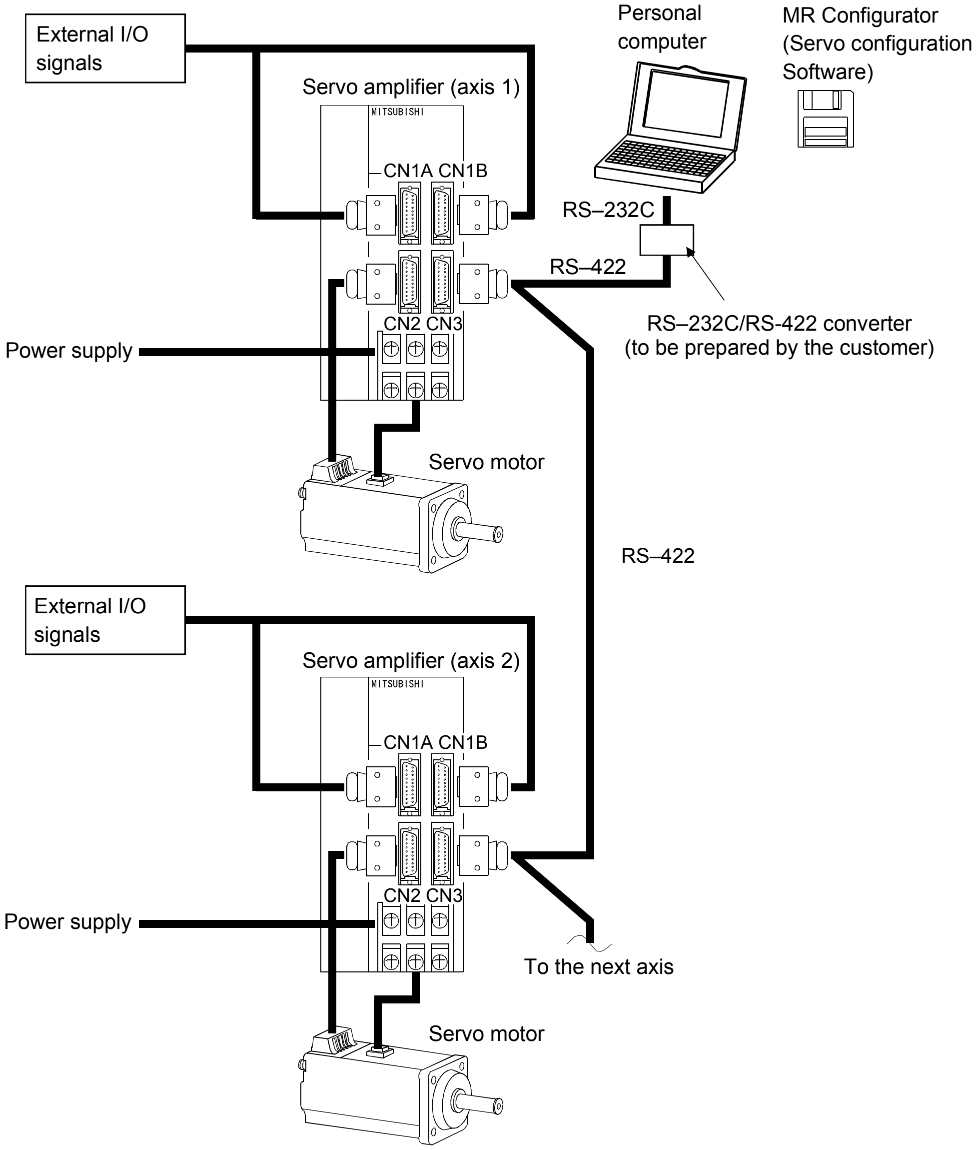
Communication can be used to change the point table data, choose the point table, change parameter values, and confirm monitor data, for example. Enter a forward rotation start (ST1) or reverse rotation start (ST2) through the external I/O. Use this system when position data/speed setting or the host personal computer or the like is used to change the parameter values, for example.

(b) Configuration

1) One servo amplifier is connected with the personal computer by RS-232C.



2) Several (up to 32) servo amplifiers are connected with the personal computer by RS-422.
Use parameter No. 16 to change the communication system.



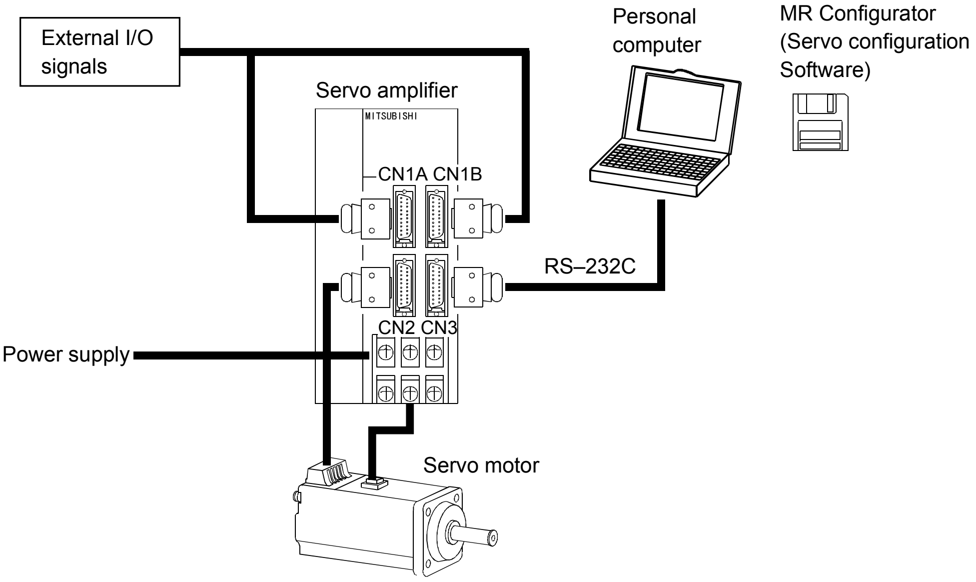
(3) Operation using communication

(a) Description

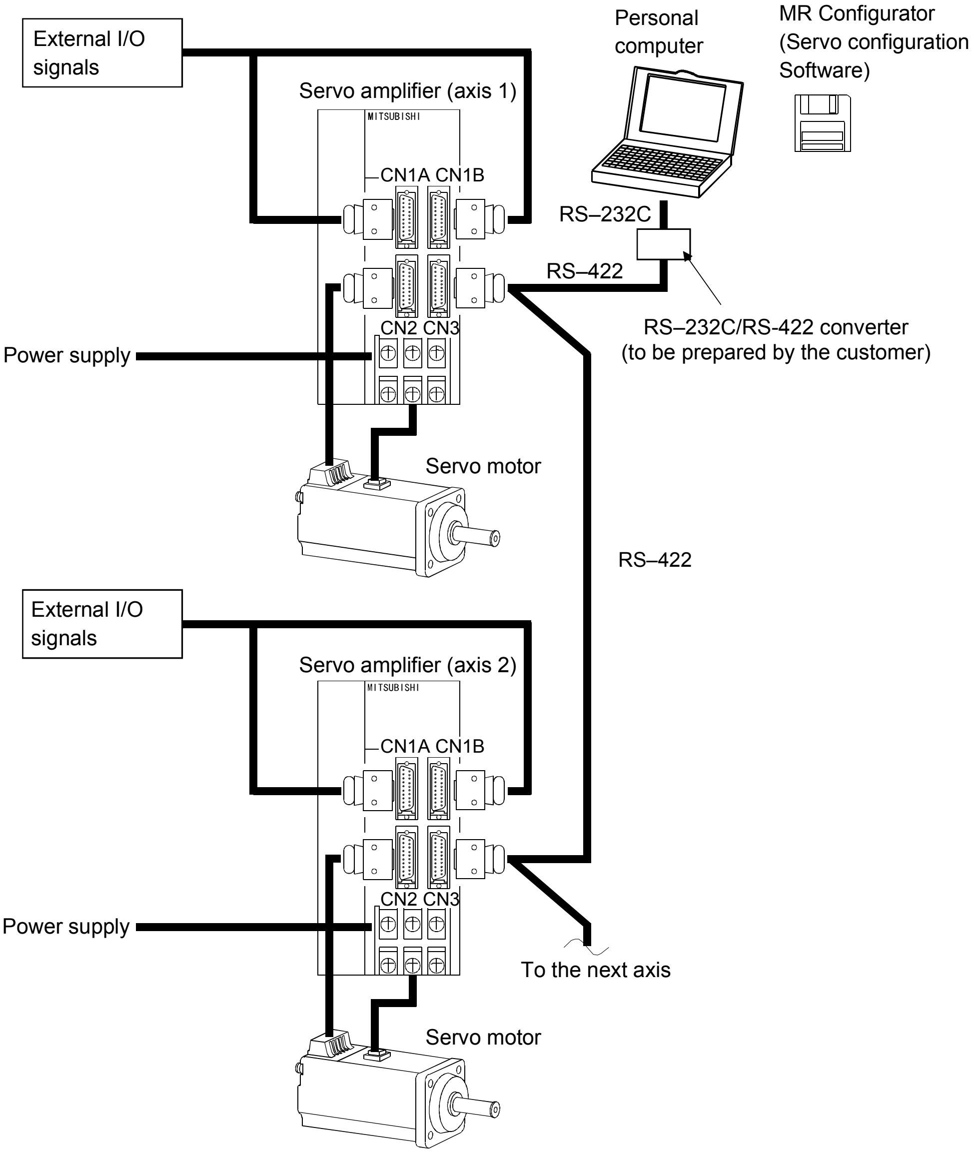
Analog input, forced stop (EMG) and other signals are controlled by external I/O signals and the other devices controlled through communication. Also, you can set each point table, choose the point table, and change or set parameter values, for example. Up to 32 axes may be controlled.

(b) Configuration

1) One servo amplifier is connected with the personal computer by RS-232C.



2) Several (up to 32) servo amplifiers are connected with the personal computer by RS-422.
Use parameter No. 16 to change the communication system.



1.1.3 I/O devices

This servo amplifier allows devices to be allocated to the pins of connector CN1A/CN1B as desired. The following devices can be allocated. For device details, refer to section 3.3.2.

Input device	Symbol	Factory-allocated pin
Proximity dog	DOG	CN1A-8
Servo-on	SON	CN1B-15
Forward rotation stroke end	LSP	CN1B-16
Reverse rotation stroke end	LSN	CN1B-17
Forward rotation start	ST1	CN1B-8
Reverse rotation start	ST2	CN1B-9
Automatic/manual selection	MD0	CN1B-7
Point table No. selection 1	DI0	CN1B-5
Point table No. selection 2	DI1	CN1B-14
Point table No. selection 3	DI2	
Point table No. selection 4	DI3	
Point table No. selection 5	DI4	
Forced stop	EMG	
Reset	RES	
Override selection	OVR	
External torque limit selection	TL	
Internal torque limit selection	TL2	
Proportion control	PC	
Temporary stop/restart	STP	
Manual pulse generator multiplication 1	TP0	
Manual pulse generator multiplication 2	TP1	
Gain switch	CDP	
Teach	TCH	

Output device	Symbol	Factory-allocated pin
Home position return completion	ZP	CN1A-18
Rough match	CPO	CN1B-4
Movement finish	MEND	CN1B-6
Trouble	ALM	CN1B-18
Ready	RD	CN1B-19
Electromagnetic brake interlock	MBR	
Position range output	POT	
Warning output	WNG	
Battery warning output	BWNG	
Limiting torque	TLC	
Temporary stop	PUS	
In position	INP	
Point No. output 1	PT0	
Point No. output 2	PT1	
Point No. output 3	PT2	
Point No. output 4	PT3	
Point No. output 5	PT4	

1.2 Servo amplifier standard specifications

Item		Servo amplifier MR-J2S-□	10CP	20CP	40CP	60CP	70CP	100CP	200CP	350CP	500CP	700CP	10CP1	20CP1	40CP1
Power supply	Voltage/frequency		3-phase 200 to 230VAC, 50/60Hz or 1-phase 230VAC, 50/60Hz					3-phase 200 to 230VAC, 50/60Hz					1-phase 100 to 120VAC 50/60Hz		
	Permissible voltage fluctuation		3-phase 200 to 230VAC: 170 to 253VAC 1-phase 230VAC: 207 to 253VAC					3-phase 170 to 253VAC					1-phase 85 to 127VAC		
	Permissible frequency fluctuation		Within ±5%												
	Power supply capacity		Refer to section13.2												
	Inrush current		Refer to section13.5												
Control system			Sine-wave PWM control, current control system												
Dynamic brake			Built-in												
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative 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. (31 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.14.												
		System	Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system												
	Position data input	Operational specifications	Positioning using RS-422 (232C) communication data												
		Position command input	Setting through RS-422 (232C) communication 1-point feed length setting range: ±1[μm] to ±999.999[mm]												
		Speed command input	Setting through RS-422 (232C) communication Acceleration/deceleration time is also set through RS-422 (232C) communication. S-pattern acceleration/deceleration time constant is set in parameter No.14.												
		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 31 speeds), automatic continuous positioning operation (2 to 31 points)												
	Manual operation mode	Jog	Jog operation is performed in accordance with the parameter-set speed command by contact input or through RS-422 (232C) communication.												
		Manual pulse generator	Manual feed is made by manual pulse generator. Command pulse multiplication: ×1, ×10 or ×100 is selected using parameter.												
	Manual 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.												

<table>
<tr><td colspan="4">Servo amplifier MR-J2S-□
Item</td><td>10CP</td><td>20CP</td><td>40CP</td><td>60CP</td><td>70CP</td><td>100CP</td><td>200CP</td><td>350CP</td><td>500CP</td><td>700CP</td><td>10CP1</td><td>20CP1</td><td>40CP1</td></tr>
<tr><td rowspan="5">Operation mode</td><td rowspan="4">Manual home position return mode</td><td colspan="2">Home position ignorance (Servo-on position as home position)</td><td colspan="13">Position where servo-on (SON) is switched on is defined as home position.
Home position address may be set.</td></tr>
<tr><td colspan="2">Dog type rear end reference</td><td colspan="13">Home position return is made with respect to the rear end of a proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Count type front end reference</td><td colspan="13">Home position return is made with respect to the front end of a proximity dog.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="2">Dog cradle type</td><td colspan="13">Home position return is made with respect to the front end of a proximity dog by the first Z-phase pulse.
Home position address may be set. Home position shift value may be set. Home position return direction may be set.
Automatic at-dog home position return return/automatic stroke return function</td></tr>
<tr><td colspan="3">Automatic positioning to home position</td><td colspan="13">High-speed automatic return to a defined home position.</td></tr>
<tr><td colspan="4">Other functions</td><td colspan="13">Absolute position detection, backlash function
Overtravel prevention using external limit switch
Software stroke limit, override using external analog signal
Amplifier front button-operated teaching function/external teaching pendant input signal interface</td></tr>
<tr><td colspan="4">Structure</td><td colspan="5">Self-cooled, open (IP00)</td><td colspan="5">Force-cooling, open (IP00)</td><td colspan="3">Self-cooled, open (IP00)</td></tr>
<tr><td rowspan="10">Environment</td><td rowspan="4">Ambient temperature</td><td rowspan="2">In Operation</td><td>[℃]</td><td colspan="13">0 to +55 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="13">32 to +131 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[℃]</td><td colspan="13">−20 to +65 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="13">−4 to +149 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In Operation</td><td rowspan="2" colspan="13">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td></tr>
<tr><td colspan="3">Ambient</td><td colspan="13">Indoors (no direct sunlight)
Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="3">Altitude</td><td colspan="13">Max. 1000m (3280ft) above sea level</td></tr>
<tr><td colspan="3" rowspan="2">Vibration</td><td colspan="13">5.9 [m/s^2] or less</td></tr>
<tr><td colspan="13">19.4 [ft/s^2] or less</td></tr>
<tr><td colspan="2" rowspan="2">Mass</td><td colspan="2">[kg]</td><td>0.7</td><td>0.7</td><td>1.1</td><td>1.1</td><td>1.7</td><td>1.7</td><td>2.0</td><td>2.0</td><td>4.9</td><td>7.2</td><td>0.7</td><td>0.7</td><td>1.1</td></tr>
<tr><td colspan="2">[lb]</td><td>1.5</td><td>1.5</td><td>2.4</td><td>2.4</td><td>3.75</td><td>3.75</td><td>4.4</td><td>4.4</td><td>10.8</td><td>15.87</td><td>1.5</td><td>1.5</td><td>2.4</td></tr>
</table>

1.3 Function list

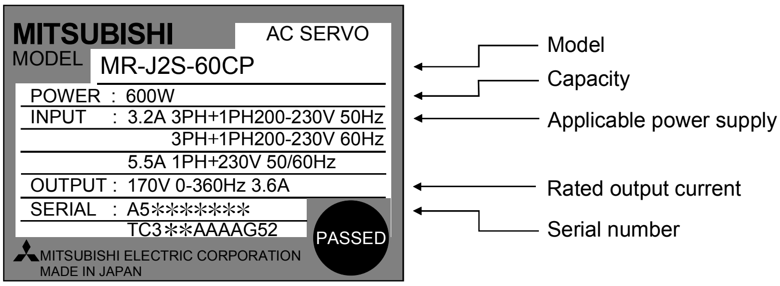
The following table lists the functions of this servo. For details of the functions, refer to the reference field.

Function	Description	Reference
Positioning by automatic operation	Select the required ones from among 31 preset point tables and perform operation in accordance with the set values. Use the external input signal or communication function to choose the point tables.	Section 4.2
Varied speed operation	Servo motor speed can be varied continuously until the preset moving distance is reached. (Max. set speeds: 31 speeds)	Section 4.2.6 (2)
Automatic continuous positioning operation	By merely choosing one point table and starting operation, positioning can be executed continuously in accordance with several point tables.	Section 4.2.6 (1)
Manual home position return	Dog type, count type, data setting type, stopper type, home position ignorance, dog type rear end reference, count type front end reference, dog cradle type	Section 4.4
Multidrop communication	Up to 32 axes of MR-J2S-CP are controllable simultaneously by RS-422 communication.	Section 4.6.3 Chapter 15
High-resolution encoder	High-resolution encoder of 131072 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	By merely setting the home position once, home position return need not be done at each power on.	Section 4.5
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 9.5
Adaptive vibration suppression control	Servo amplifier detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 9.3
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 9.4
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a MR Configurator (servo configuration software)-installed personal computer and servo amplifier.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time.	
Slight vibration suppression control	Vibration of ±1 pulse at servo motor stop is suppressed.	Parameter No. 20
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.	Section 5.2.1
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies. Higher in performance than MR-J2 series servo amplifier.	Chapter 8
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Section 5.2.3
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 14.1.1
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the MR-J2S-500CP・MR-J2S-700CP.	Section 14.1.2
Return converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the MR-J2S-500CP・MR-J2S-700CP.	Section 14.1.3

Function	Description	Reference
Analog monitor	The servo status is output in terms of voltage in real time.	Section 5.2.4
Alarm history	By using the MR Configurator (servo configuration software), the current alarm and five past alarm numbers are stored and displayed.	Section 6.8
I/O signal selection (Device setting)	By using the MR Configurator (servo configuration software), any devices can be assigned to 9 input, 5 output and 1 I/O pins.	Section 6.6
Torque limit	Servo motor-torque is limited. Parameter × 2 limit value Analog input × 1 limit value	Section 3.4.4
Override (speed limit)	The servo motor speed is limited by analog input. The ratio of override to the set speed can be changed between 0 to 200%.	Section 3.4.3
Status display	The servo status is displayed.	Section 7.2
Test operation mode	Jog operation, positioning operation, motor-less operation, DO forced output, 1-step feed	Section 6.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP)/reverse rotation stroke end (LSN).	Section 5.2.5
Software limit	The travel region is limited using parameters in terms of address. The function similar to that of a limit switch is limited by parameter.	Section 5.2.8

1.4 Model code definition

(1) Rating plate



(2) Model

MR–J2S– □ CP □

Series

Power Supply

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

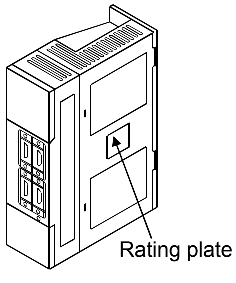
Note 1. 1-phase 230V is supported by 750W or less.
2. 1-phase 100V to 120V is supported by 400W or less.

Built-in positioning functions

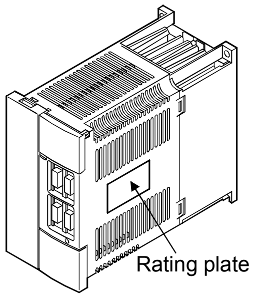
Rated output

Symbol	Rated output [W]	Symbol	Rated output [W]
10	100	100	1000
20	200	200	2000
40	400	350	3500
60	600	500	5000
70	750	700	7000

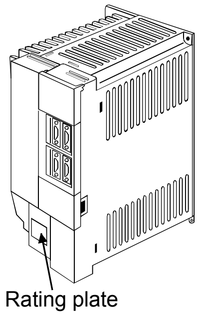
MR–J2S–100CP or less



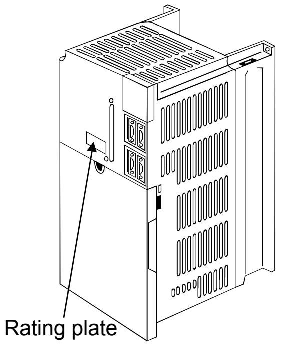
MR–J2S–200CP・350CP



MR-J2S-500CP



MR-J2S-700CP



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 and the models with reduction gears.

Servo amplifier	Servo motors							
	HC-KFS□	HC-MFS□	HC-SFS□			HC-RFS□	HC-UFS□	
			1000r/min	2000r/min	3000r/min		2000r/min	3000r/min
MR-J2S-10CP(1)	053・13	053・13						13
MR-J2S-20CP (1)	23	23						23
MR-J2S-40CP (1)	43	43						43
MR-J2S-60CP				52	53			
MR-J2S-70CP	73	73					72	73
MR-J2S-100CP			81	102	103			
MR-J2S-200CP			121・201	152・202	153・203	103・153	152	
MR-J2S-350CP			301	352	353	203	202	
MR-J2S-500CP				502		353・503	352・502	
MR-J2S-700CP				702				

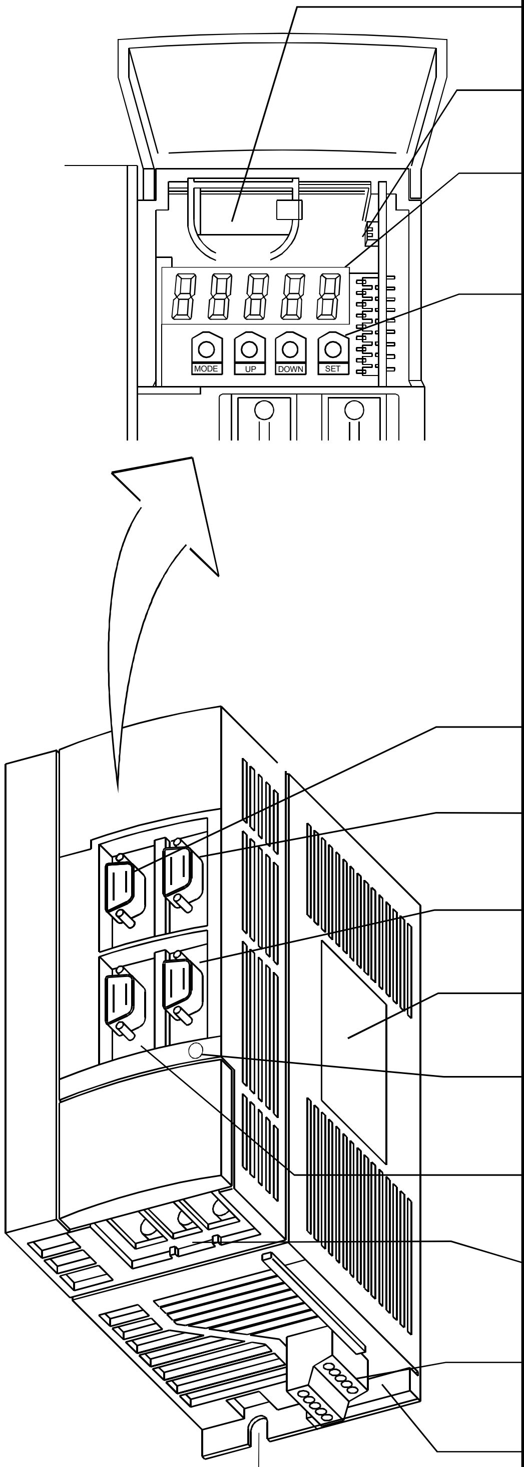
Servo amplifier	Servo motors			
	HA-LFS□			(Note 1) HC-LFS□
	1000r/min	1500r/min	2000r/min	
MR-J2S-60CP				52
MR-J2S-100CP				102
MR-J2S-200CP				152
MR-J2S-350CP				202
MR-J2S-500CP			502	302
MR-J2S-700CP	(Note 2)601	(Note 2)701M	702	

Note 1. These servo motors may not be connected depending on the production time of the servo amplifier. Please refer to Appendix 3.
2. Consult us since the servo amplifier to be used with any of these servo motors is optional.

1.6 Structure

1.6.1 Part names

(1) MR-J2S-100CP or less



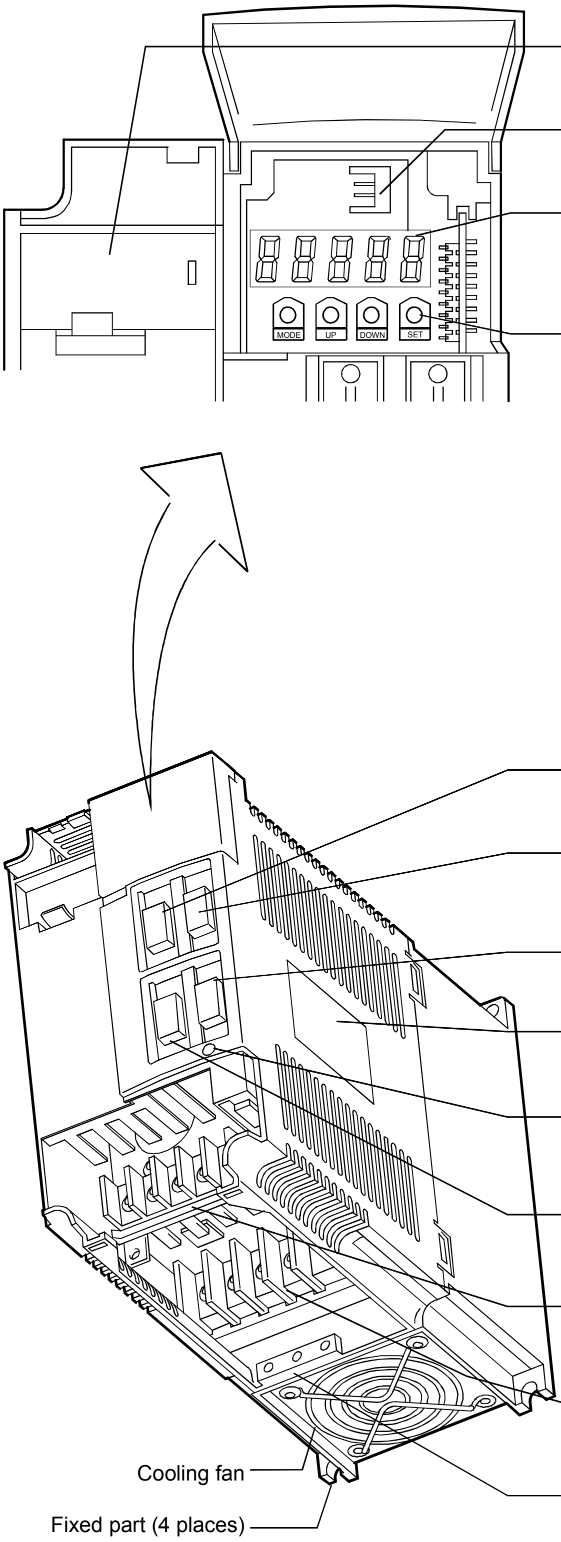
Fixed part (2 places)
(For MR-J2S-70CP・100CP 3 places)

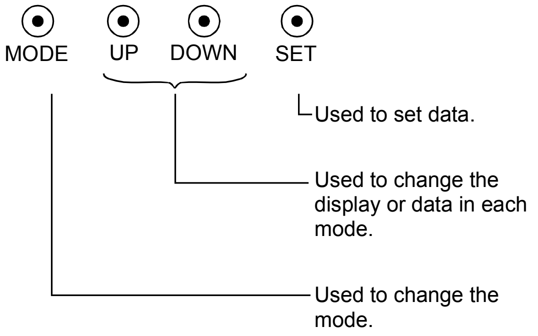
Name/Application	Reference
Battery holder Contains the battery for absolute position data backup.	Section4.5
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Display The 5-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm, parameter and point table setting operations. ⊙ MODE ⊙ UP ⊙ DOWN ⊙ SET SET: Used to set data. UP, DOWN: Used to change the display or data in each mode. MODE: Used to change the mode.	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.3
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.3
Communication connector (CN3) Used to connect a command device (RS-422/RS-232C) and output analog monitor data.	Chapter6 Chapter15 Section14.1.4
Name plate	Section1.4
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Encoder connector (CN2) Used to connect the servo motor encoder.	Section3.3 Section14.1.4
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section3.7.2 Section12.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative option.	Section3.7.2 Section12.1 Section14.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.10

(2) MR-J2S-200CP · MR-J2S-350CP

POINT

- This servo amplifier is shown without the front cover. For removal of the front cover, refer to section 1.6.2.

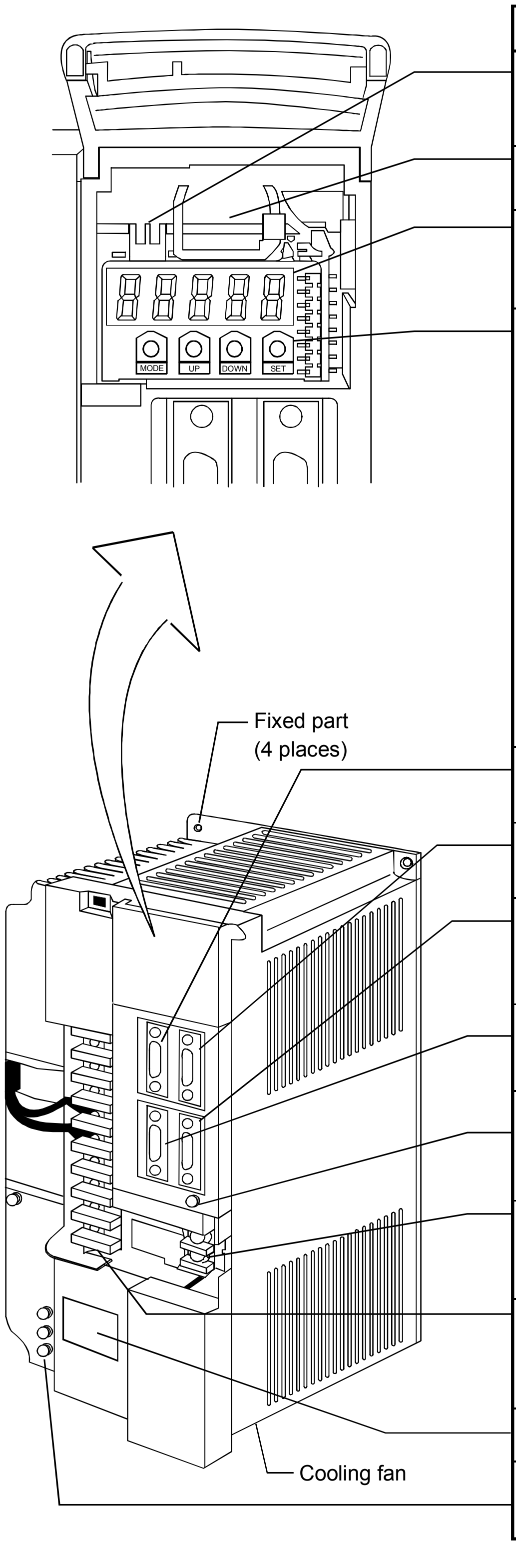


Name/Application	Reference
Battery holder Contains the battery for absolute position data backup.	Section4.5
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Display The 5-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm, parameter and point table setting operations.  	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.3
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.3
Communication connector (CN3) Used to connect a command device (RS-422/RS-232C) and output analog monitor data.	Chapter6 Chapter15 Section14.1.4
Name plate	Section1.4
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Encoder connector (CN2) Used to connect the servo motor encoder.	Section3.3 Section14.1.4
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section3.7.2 Section12.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative option.	Section3.7.2 Section12.1 Section14.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.10

(3) MR-J2S-500CP

POINT

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

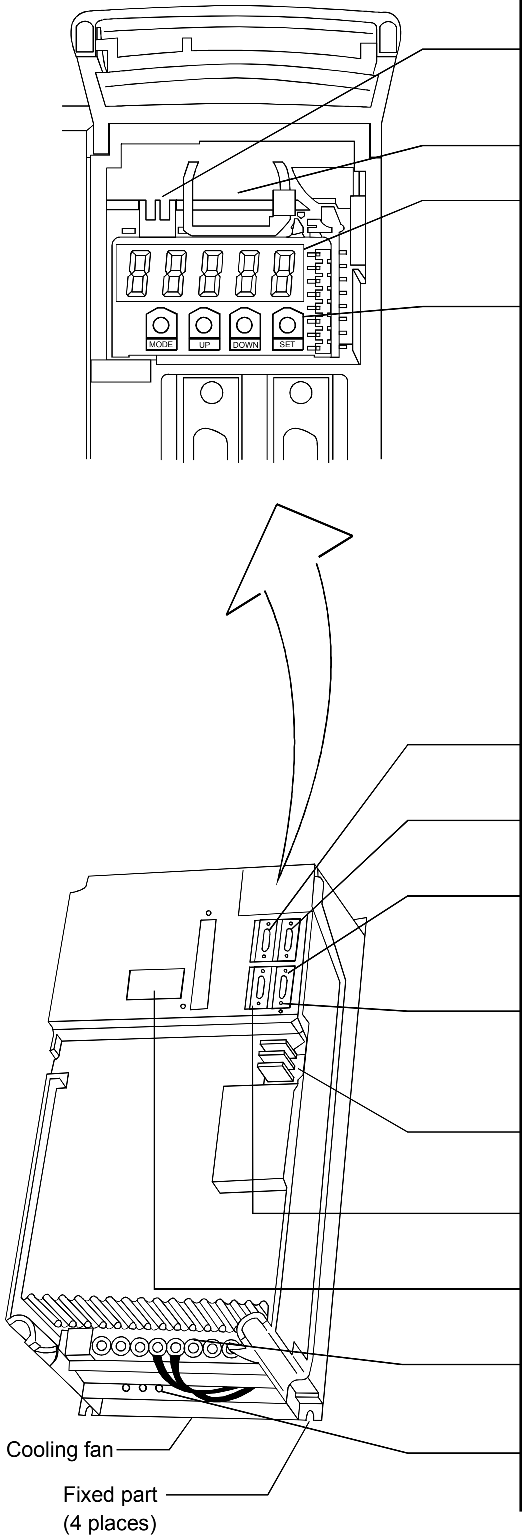


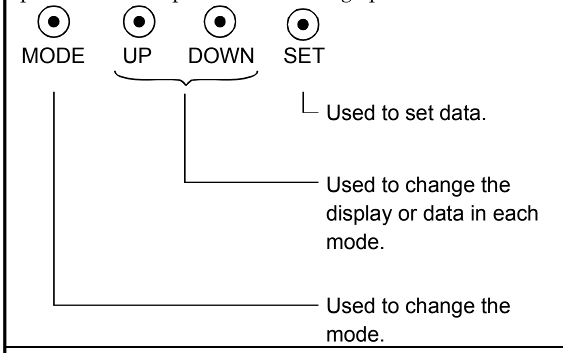
Name/Application	Reference
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Battery holder Contains the battery for absolute position data backup.	Section4.5
Display The 5-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm, parameter and point table setting operations. ⦿ MODE ⦿ UP ⦿ DOWN ⦿ SET SET: Used to set data. UP, DOWN: Used to change the display or data in each mode. MODE: Used to change the mode.	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.3
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.3
Communication connector (CN3) Used to connect a command device (RS-422/RS-232C) and output analog monitor data.	Chapter6 Chapter15 Section14.1.4
Encoder connector (CN2) Used to connect the servo motor encoder.	Section3.3 Section14.1.4
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 and regenerative option.	Section3.7.2 Section12.1
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section3.7.2 Section12.1 Section14.1.1
Name plate	Section1.4
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.10

(4) MR-J2S-700CP

POINT

- The servo amplifier is shown without the front cover. For removal of the front cover, refer to next page.



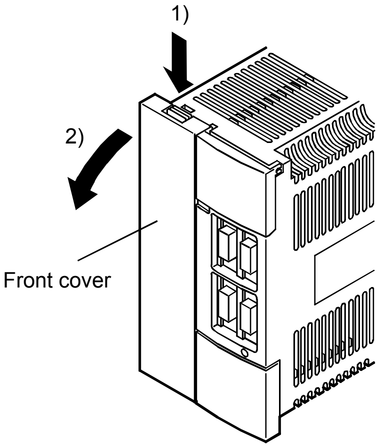
Name/Application	Reference
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Battery holder Contains the battery for absolute position data backup.	Section4.5
Display The 5-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm, parameter and point table setting operations. 	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.3
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.3
Communication connector (CN3) Used to connect a command device (RS-422/RS-232C) and output analog monitor data.	Chapter6 Chapter15 Section14.1.4
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.	Section3.7.2 Section12.1
Encoder connector (CN2) Used to connect the servo motor encoder.	Section3.3 Section14.1.4
Name plate	Section1.4
Main circuit terminal block (TE1) Used to connect the input power supply, regenerative option and servo motor.	Section3.7.2 Section12.1 Section14.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.10

1.6.2 Removal and reinstallation of the front cover

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

(1) For MR-J2S-200CP or more

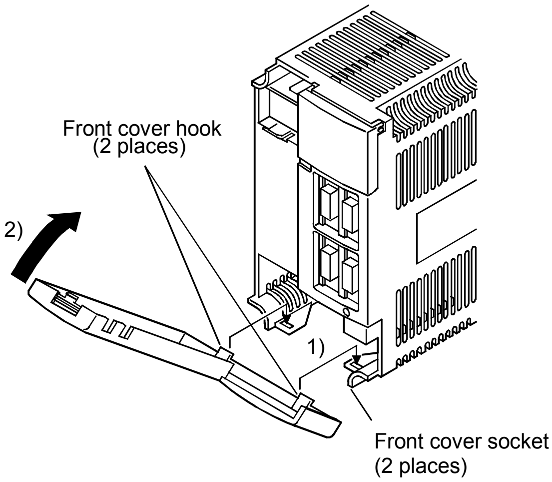
Removal of the front cover



1) Hold down the removing knob.

2) Pull the front cover toward you.

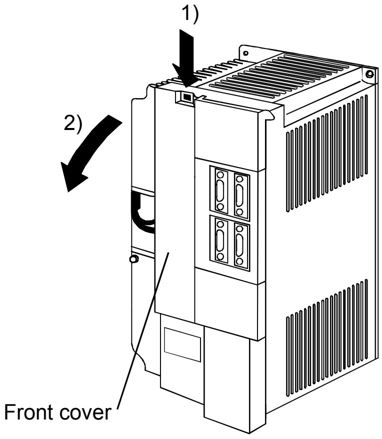
Reinstallation of the front cover



1) Insert the front cover hooks into the front cover sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

(2) For MR-J2S-500CP

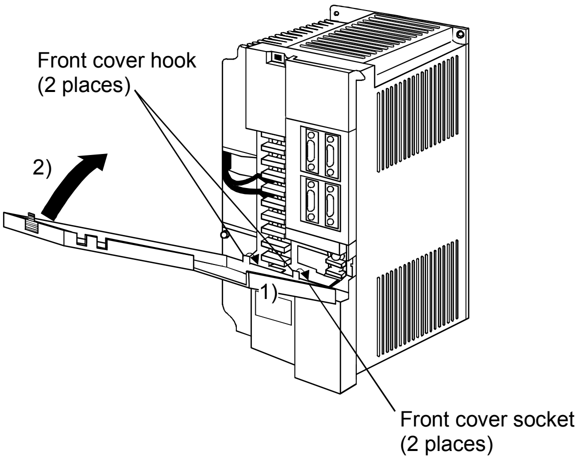
Removal of the front cover



1) Hold down the removing knob.

2) Pull the front cover toward you.

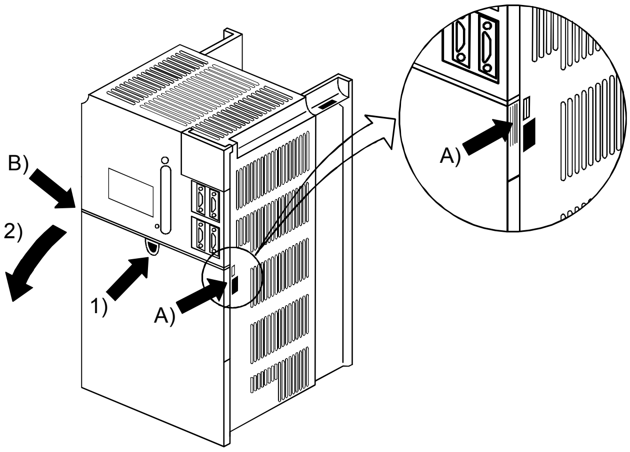
Reinstallation of the front cover



1) Insert the front cover hooks into the front cover sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

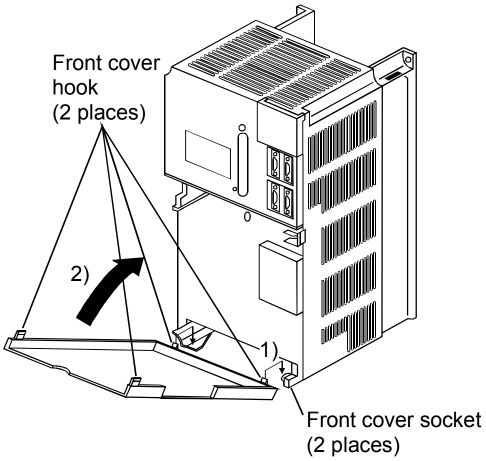
(3) For MR-J2S-700CP

Removal of the front cover



1) Push the removing knob A) or B), and put you finger into the front hole of the front cover.
2) Pull the front cover toward you.

Reinstallation of the front cover



1) Insert the two front cover hooks at the bottom into the sockets of the servo amplifier.
2) Press the front cover against the servo amplifier until the removing knob clicks.

1.7 Servo system with auxiliary equipment

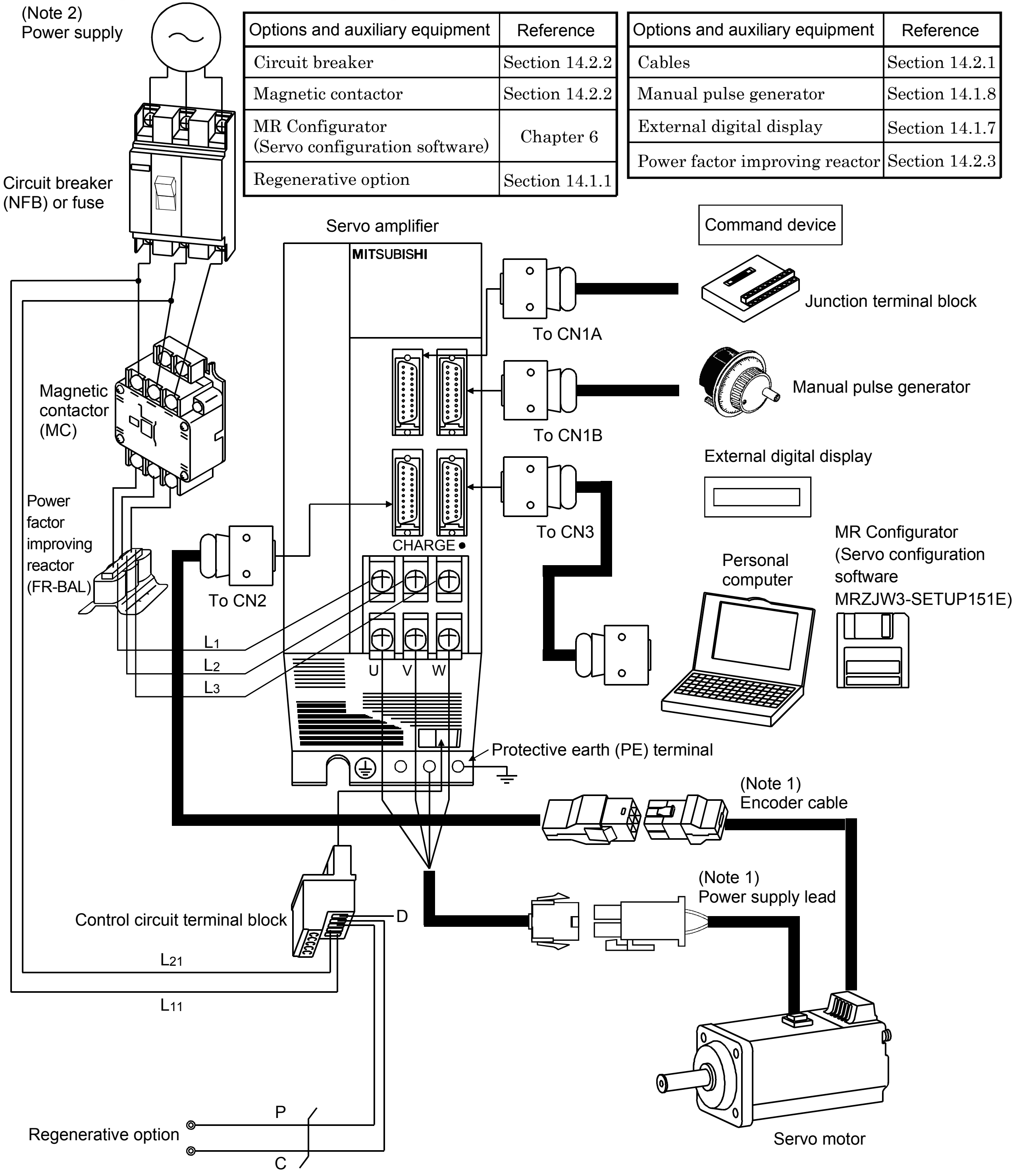
⚠WARNING	To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

(1) MR-J2S-100CP or less

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

Options and auxiliary equipment	Reference
Circuit breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
MR Configurator (Servo configuration software)	Chapter 6
Regenerative option	Section 14.1.1

Options and auxiliary equipment	Reference
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.8
External digital display	Section 14.1.7
Power factor improving reactor	Section 14.2.3



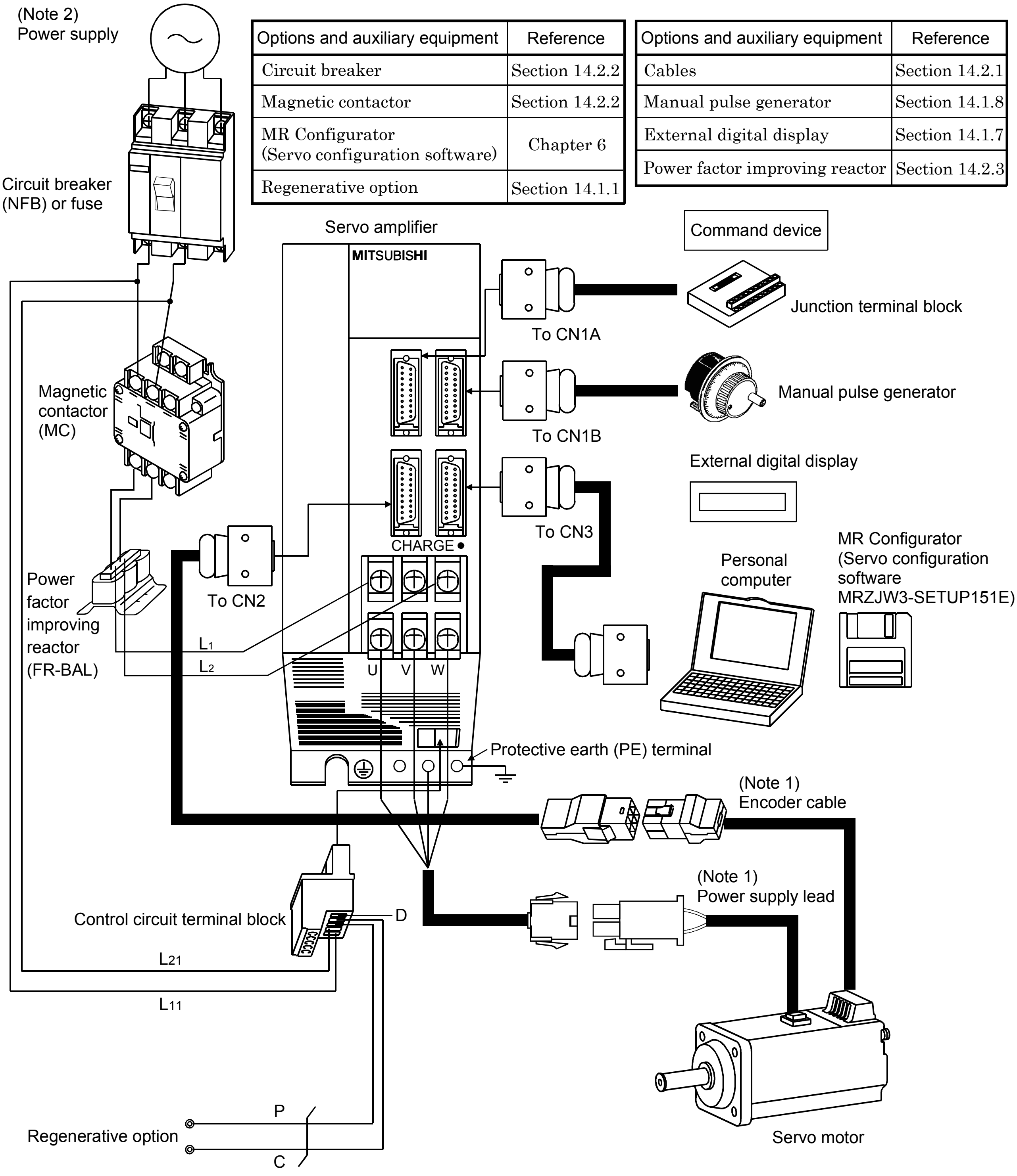
Note 1. The HC-SFS, HC-RFS, HC-UFS 2000r/min series have cannon connectors.

2. A 1-phase 230VAC power supply may be used with the servo amplifier of MR-J2S-70CP or less.
For 1-phase 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.2 for the power supply specification.

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

Options and auxiliary equipment	Reference
Circuit breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
MR Configurator (Servo configuration software)	Chapter 6
Regenerative option	Section 14.1.1

Options and auxiliary equipment	Reference
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.8
External digital display	Section 14.1.7
Power factor improving reactor	Section 14.2.3



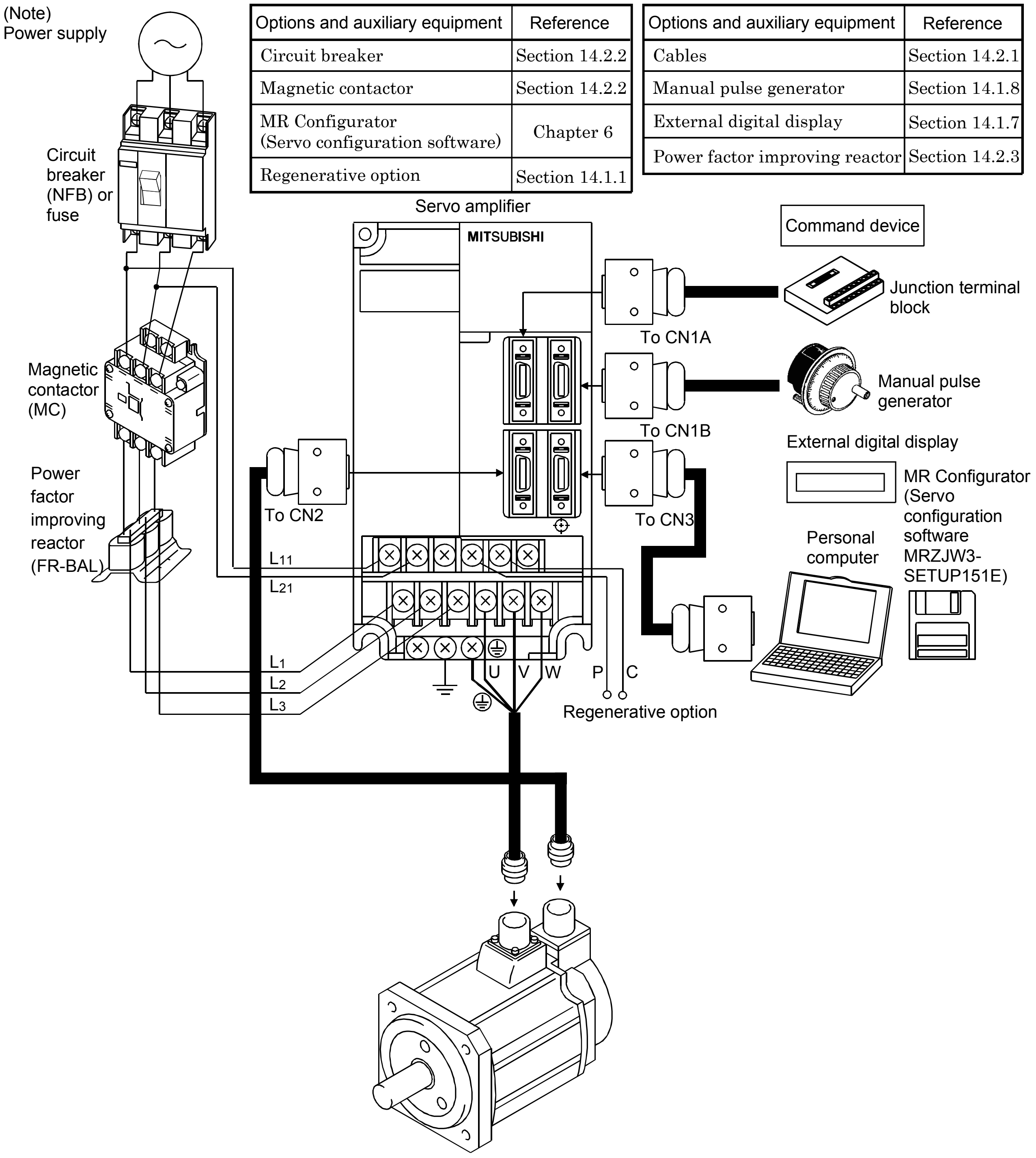
Note 1. The HC-SFS, HC-RFS, HC-UFS 2000 r/min series have cannon connectors.

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

(2) MR-J2S-200CP・MR-J2S-350CP

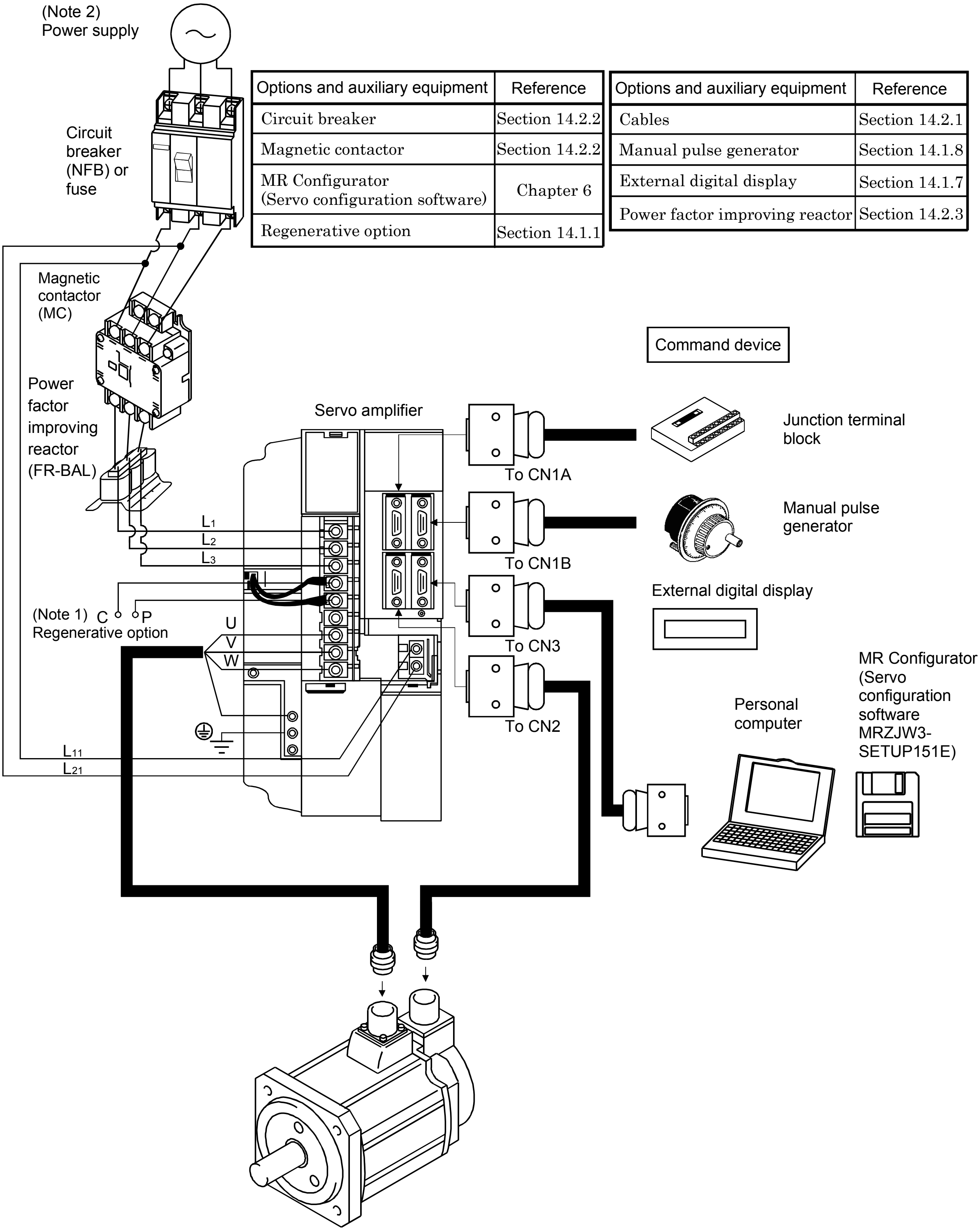
Options and auxiliary equipment	Reference
Circuit breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
MR Configurator (Servo configuration software)	Chapter 6
Regenerative option	Section 14.1.1

Options and auxiliary equipment	Reference
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.8
External digital display	Section 14.1.7
Power factor improving reactor	Section 14.2.3



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

(3) MR-J2S-500CP



Options and auxiliary equipment	Reference
Circuit breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
MR Configurator (Servo configuration software)	Chapter 6
Regenerative option	Section 14.1.1

Options and auxiliary equipment	Reference
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.8
External digital display	Section 14.1.7
Power factor improving reactor	Section 14.2.3

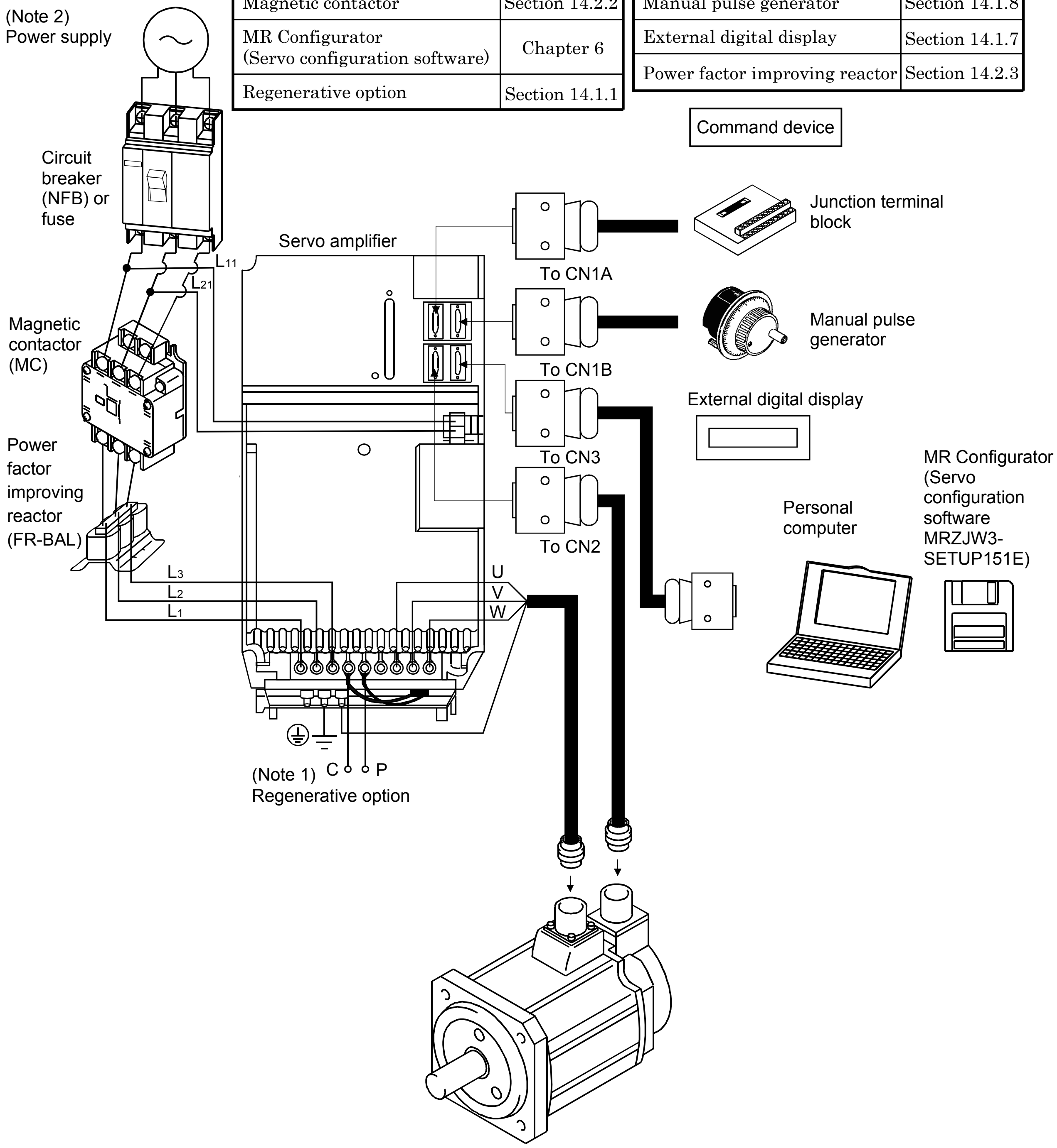
Note 1. When using the regenerative option, remove the lead wires of the built-in regenerative resistor.

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

(4) MR-J2S-700CP

Options and auxiliary equipment	Reference
Circuit breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
MR Configurator (Servo configuration software)	Chapter 6
Regenerative option	Section 14.1.1

Options and auxiliary equipment	Reference
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.8
External digital display	Section 14.1.7
Power factor improving reactor	Section 14.2.3



Note 1. When using the regenerative option, remove the lead wires of the built-in regenerative resistor.

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

MEMO

2. INSTALLATION

⚠ CAUTION	
	- Stacking in excess of the limited number of products is not allowed. - Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire. - Install the equipment in a load-bearing place in accordance with this Instruction Manual. - Do not get on or put heavy load on the equipment to prevent injury. - Use the equipment within the specified environmental condition range. (For the environmental conditions, refer to section 2.1.) - 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.

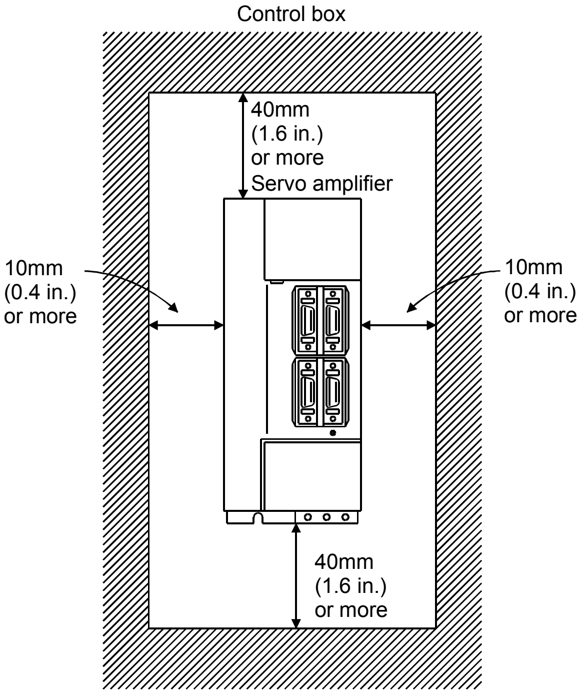
2.1 Environmental conditions

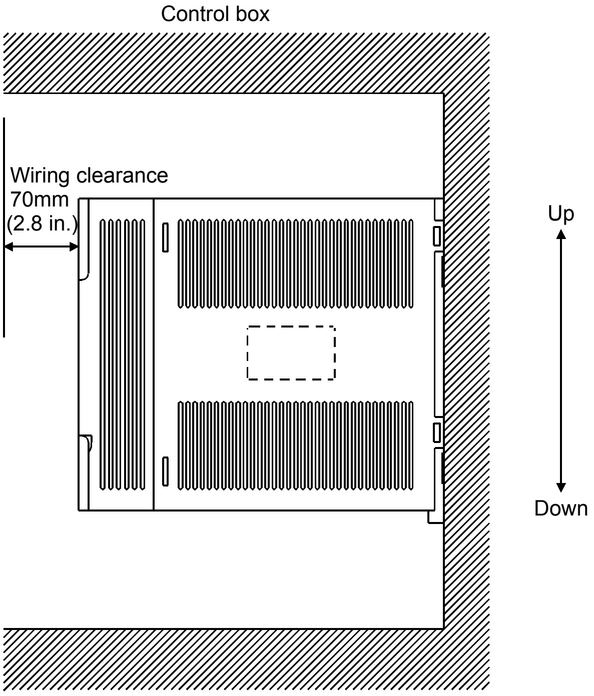
Environment			Conditions
Ambient temperature	In operation	[°C]	0 to +55 (non-freezing)
		[°F]	32 to +131 (non-freezing)
	In storage	[°C]	−20 to +65 (non-freezing)
		[°F]	−4 to +149 (non-freezing)
Ambient humidity	In operation		90%RH or less (non-condensing)
	In storage		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
Altitude			Max. 1000m (3280 ft) above sea level
Vibration		[m/s^2]	5.9 [m/s^2] or less
		[ft/s^2]	19.4 [ft/s^2] or less

2.2 Installation direction and clearances

⚠ CAUTION	･Do not hold the front cover to transport the servo amplifier. The servo amplifier may drop. ･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.

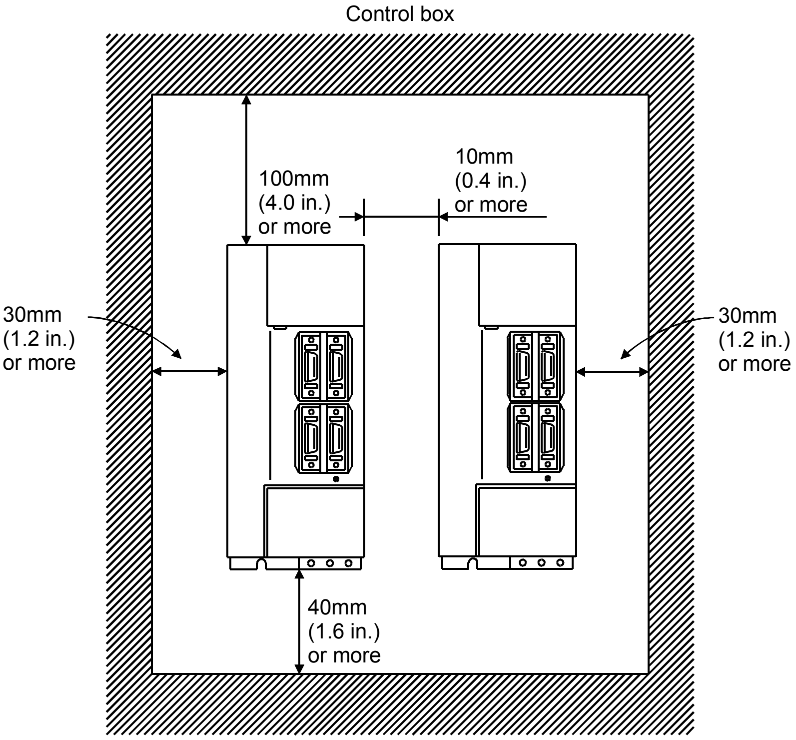
(1) Installation of one servo amplifier





(2) Installation of two or more servo amplifiers

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



(3) Others

When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the servo amplifier is not affected.

Install the servo amplifier on a perpendicular wall in the correct vertical direction.

2.3 Keep out foreign materials

(1) When installing the unit in a control box, prevent drill chips and wire fragments from entering the servo amplifier.

(2) Prevent oil, water, metallic dust, etc. from entering the servo amplifier through openings in the control box or a cooling fan installed on the ceiling.

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

2.4 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) The flexing lives of the cables are shown below. In actuality, provide a little allowance for these values. For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 13.4 for the flexing life.

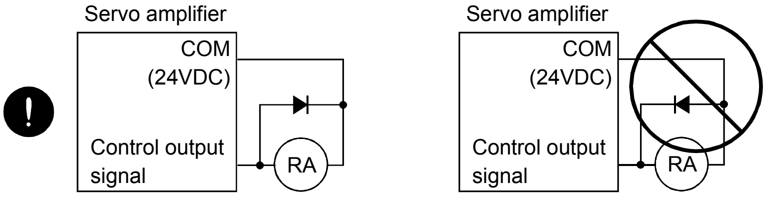
3. SIGNALS AND WIRING

WARNING

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

CAUTION

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

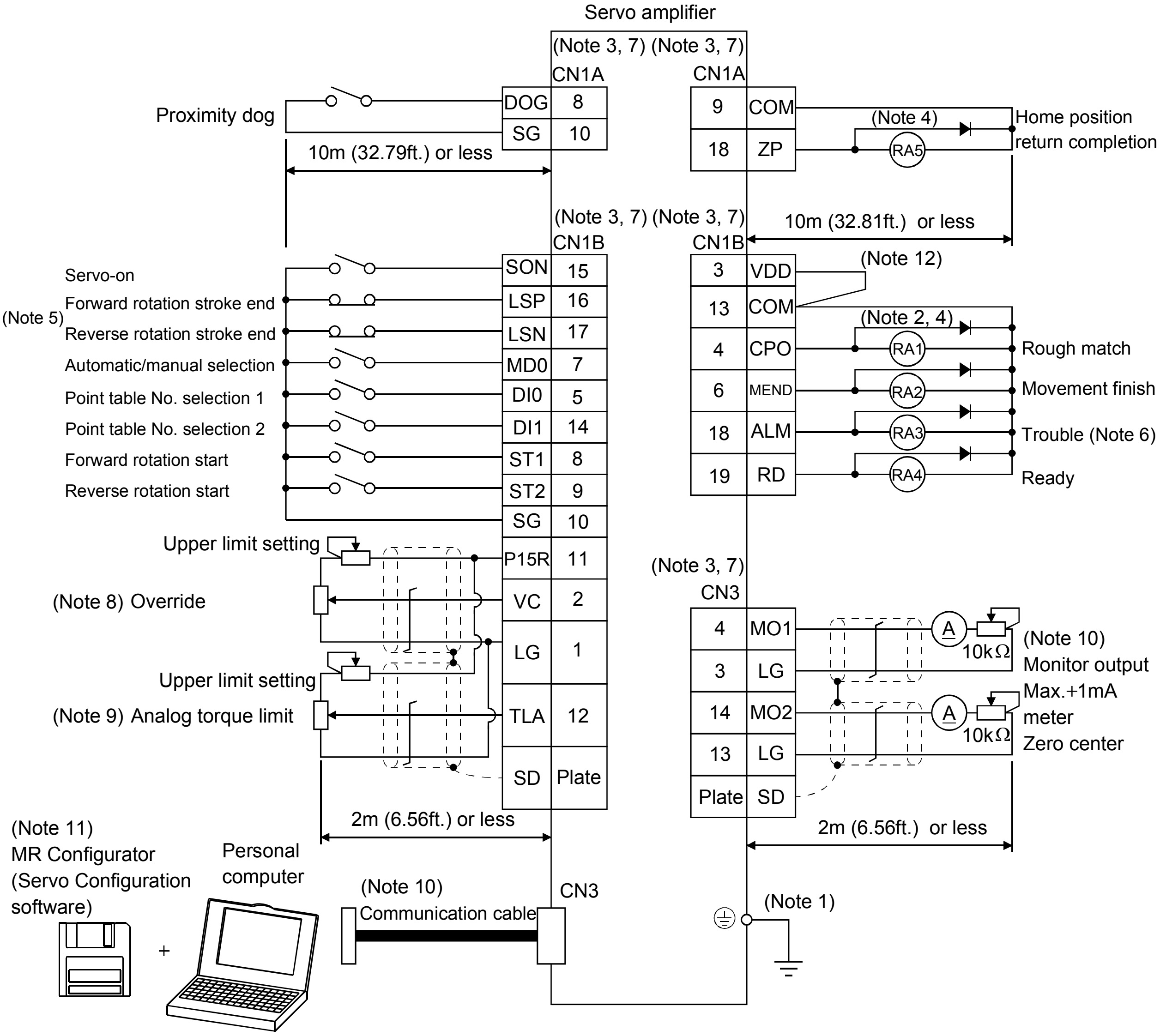


- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo motor.
- When using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

POINT

- CN1A, CN1B, CN2 and CN3 have the same shape. Wrong connection of the connectors will lead to a failure. Connect them correctly.

3.1 Standard connection example

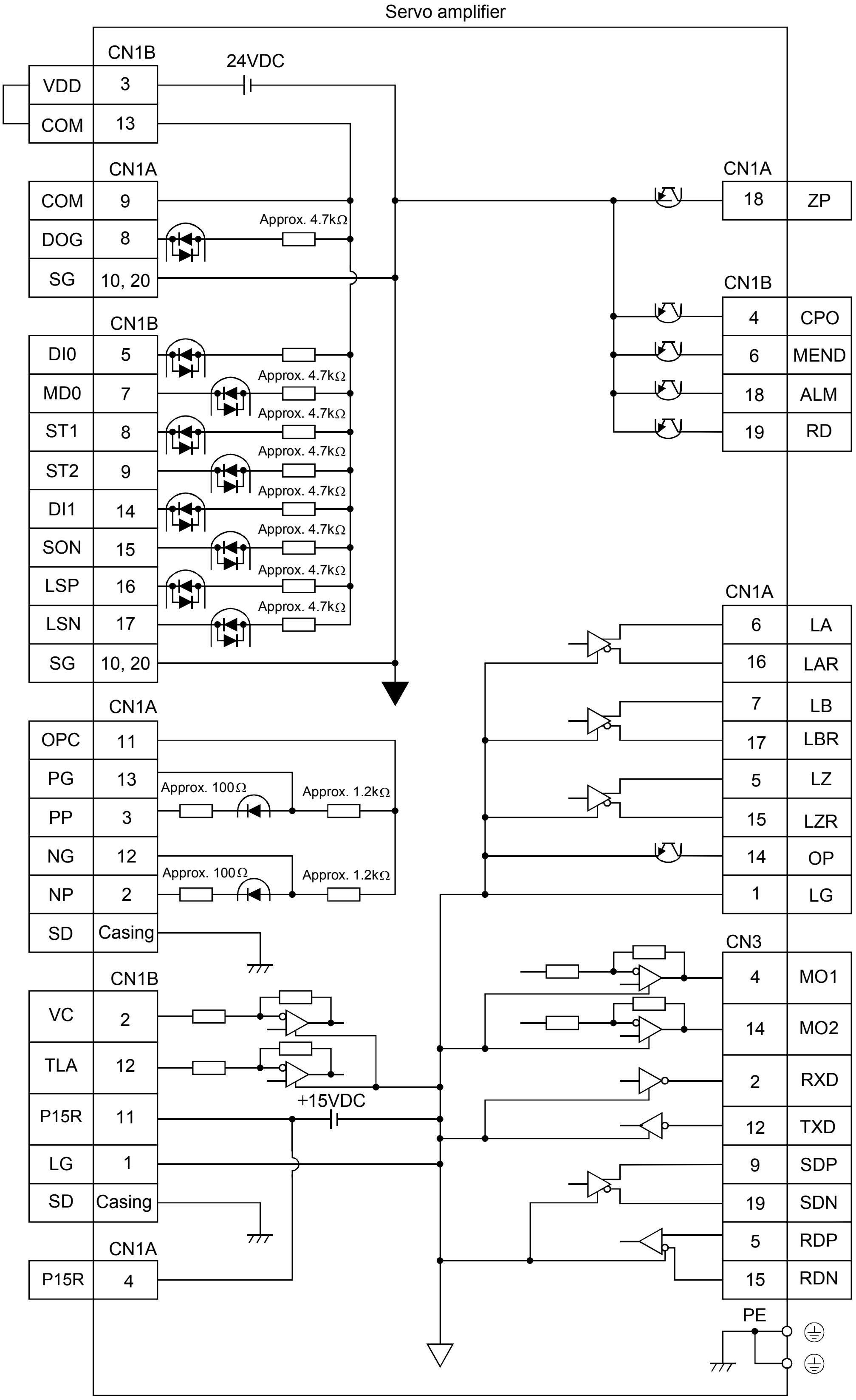


Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal of the servo amplifier to the protective earth (PE) of the control box.

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 forced stop and other protective circuits.
3. CN1A, CN1B, CN2 and CN3 have the same shape. Wrong connection of the connectors will lead to a fault.
4. The sum of currents that flow in the external relays should be 80mA max. If it exceeds 80mA, supply interface power from external.
5. When starting operation, always connect the forward/reverse rotation stroke end (LSN/LSP) with SG. (Normally closed contacts)
6. Trouble (ALM) is connected with COM in normal alarm-free condition.
7. The pins with the same signal name are connected in the servo amplifier.
8. When using override (VC), make the override selection (OVR) device available.
9. When using analog torque limit (TLA), make the external torque limit selection (TL) devices available.
10. When connecting the personal computer together with monitor outputs 1, 2, use the maintenance junction card (MR-J2CN3TM). (Refer to section 14.1.6).
11. Use MRZJW3-SETUP 151E.
12. When using the internal power supply (VDD), always connect VDD-COM. Do not connect them when supplying external power. Refer to section 3.6.2.

3.2 Internal connection diagram of servo amplifier

This section gives the internal connection diagram where the signal assignment is in the initial status.



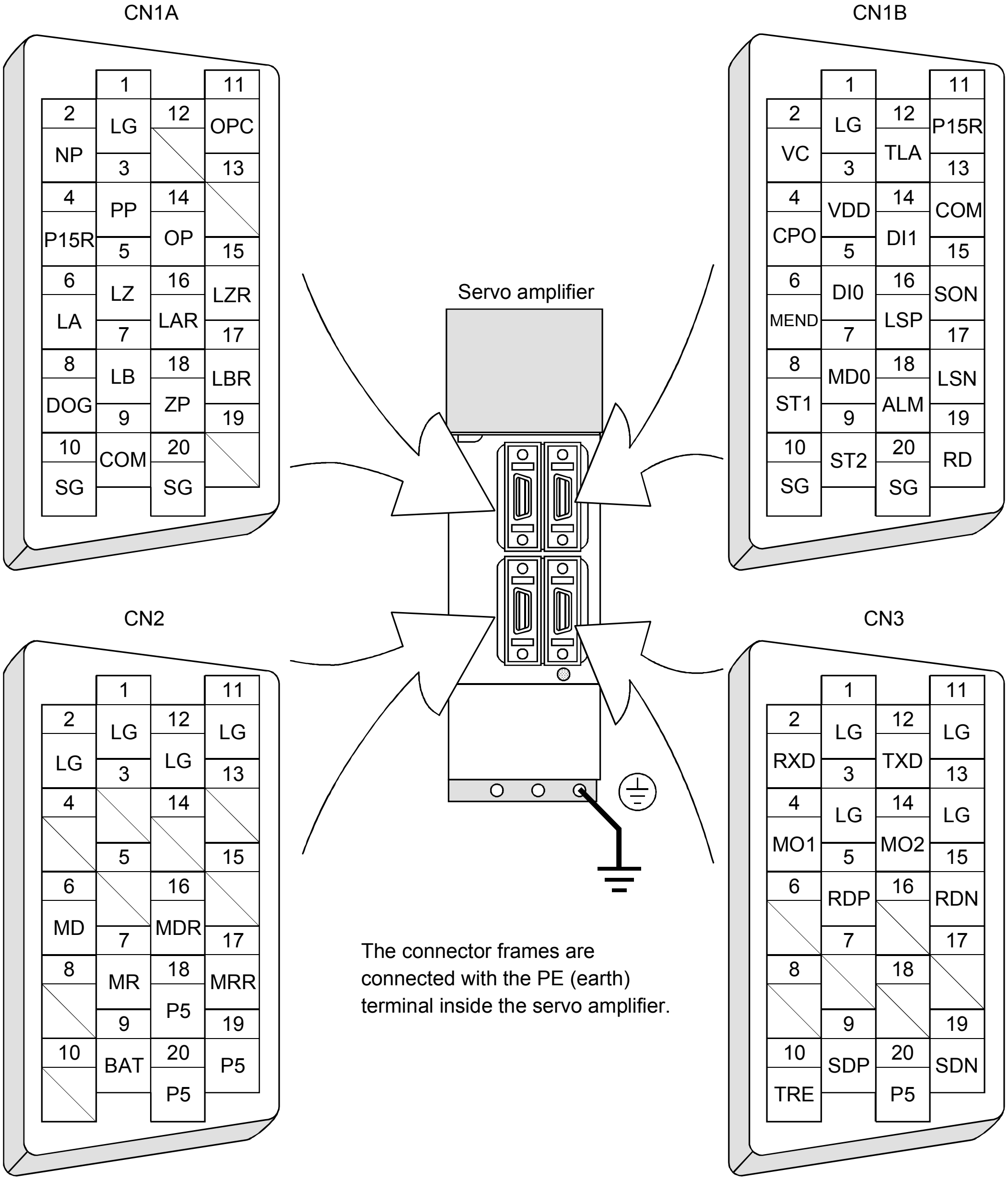
3.3 I/O signals

3.3.1 Connectors and signal arrangements

POINT

- The connector pin-outs shown above are viewed from the cable connector wiring section side.

(1) Signal arrangement



The connector frames are connected with the PE (earth) terminal inside the servo amplifier.

3.3.2 Signal (devices) explanations

(1) I/O devices

POINT

- The devices not indicated in the Connector Pin No. field of the I/O devices can be assigned to the connector CN1A/CN1B using the MR Configurator (servo configuration software).

(a) Pins whose devices can be changed

Refer to section 3.6.2 for the I/O interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Pin type	Connector pin No.	I/O division	Device in initial status
Input-only pins	CN1B-5	DI-1	Point table No. selection 1 (DI0)
	CN1B-14		Point table No. selection 2 (DI1)
	CN1A-8		Proximity dog (DOG)
	CN1B-15		Servo-on (SON)
	CN1B-16		Forward rotation stroke end (LSP)
	CN1B-17		Reverse rotation stroke end (LSN)
	CN1B-7		Automatic/manual selection (MD0)
	CN1B-8		Forward rotation start (ST1)
	CN1B-9		Reverse rotation start (ST2)
I/O pin	CN1A-19	DI-1 or DO-1	No device has been assigned in the initial status. You can assign an I/O device using the MR Configurator (servo configuration software).
Output-only pins	CN1B-4	DO-1	Rough match (CPO)
	CN1B-6		Movement finish (MEND)
	CN1B-18		Trouble (ALM)
	CN1B-19		Ready (RD)
	CN1A-18		Home position return completion(ZP)

(b) Input devices

Device name	Devices symbol	Connector pin No.	Functions/Applications
Forced stop	EMG		When EMG-SG are opened, the servo amplifier is placed in the forced stop status, the servo switches off, and the dynamic brake is operated to bring the servo motor to a sudden stop. Short EMG-SG in the forced stop status to cancel the forced stop status.
Servo-on	SON	CN1B 15	Connect SON-SG to switch on the base circuit and make the servo amplifier ready to operate (servo-on). Disconnect SON-SG to shut off the base circuit and coast the servo motor (servo-off) .
Reset	RES		Disconnect RES-SG for more than 50ms to reset the alarm. Some alarms cannot be deactivated by the reset signal. Refer to section 11.2.1 If RES-SG are shorted in no alarm status, the base circuit is not shut off. Set "□1□□" in parameter No. 55 to shut off the base circuit. Since this device is not designed for stopping. Do not switch it on during operation.

<table>
<tr><th>Device name</th><th>Devices symbol</th><th>Connector pin No.</th><th>Functions/Applications</th></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>CN1B
16</td><td rowspan="2">To start operation, short LSP-SG and/or LSN-SG. Open them to bring the motor to a sudden stop and make it servo-locked.
Set "□□□1" in parameter No. 22 to make a slow stop.
(Refer to section 5.2.5.)
<table>
<tr><th colspan="2">(Note) Input signal</th><th colspan="2">Operation</th></tr>
<tr><th>LSP</th><th>LSN</th><th>CCW direction</th><th>CW direction</th></tr>
<tr><td>1</td><td>1</td><td>○</td><td>○</td></tr>
<tr><td>0</td><td>1</td><td></td><td>○</td></tr>
<tr><td>1</td><td>0</td><td>○</td><td></td></tr>
<tr><td>0</td><td>0</td><td></td><td></td></tr>
</table>
Note. 0: LSP/LSN-SG off (open)
1: SP/LSN-SG on (short)</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>CN1B
17</td></tr>
<tr><td>Forward rotation start</td><td>ST1</td><td>CN1B
8</td><td>1. In the case of the absolute value command system.
When ST1-SG are shorted in the automatic operation mode, positioning is executed once on the basis of the position data set to the point table.
In home position return mode, home position return starts as soon as ST1-SG are shorted.
In jog operation mode, the servo motor rotates in the forward rotation direction while ST1-SG are shorted.
2. In the case of the incremental value command system.
When ST1-SG are shorted in the automatic operation mode, positioning is executed once on the basis of the position data set to the point table.
In home position return mode, home position return starts as soon as ST1-SG are shorted.
In jog operation mode, the servo motor rotates in the forward rotation direction while ST1-SG are shorted.
Forward rotation denotes the direction in which the address is incremented.
3. In absolute value command /incremental value command specifying system
When ST1-SG are shorted in the automatic operation mode, positioning is executed once on the basis of the position data set to the point table.
In home position return mode, home position return starts as soon as ST1-SG are shorted.
In jog operation mode, the servo motor rotates in the forward rotation direction while ST1-SG are shorted.</td></tr>
<tr><td>Reverse rotation start</td><td>ST2</td><td>CN1B
9</td><td>This device is used in the incremental value command system.
When ST2-SG are shorted in the automatic operation mode, positioning is executed once in the reverse rotation direction on the basis of the position data set to the point table.
In jog operation mode, the servo motor rotates in the reverse rotation direction while ST2-SG are shorted.
Reverse rotation denotes the direction in which the address is decremented.
The reverse rotation start (ST2) is also used as the start signal of the function to perform high-speed positioning to the home position. (Refer to section 4.4.11.)</td></tr>
<tr><td>Automatic/manual selection</td><td>MD0</td><td>CN1B
7</td><td>Short MD0-SG to choose the automatic operation mode, or open them to choose the manual operation mode.</td></tr>
<tr><td>Proximity dog</td><td>DOG</td><td>CN1A
8</td><td>When terminals DOG-SG are shorted, the proximity dog signal is detected. The polarity of dog detection input can be changed with the parameter.
<table>
<tr><th>Parameter No.8</th><th>Polarity of proximity dog detection input</th></tr>
<tr><td>□0□□(initial value)</td><td>DOG-SG are opened.</td></tr>
<tr><td>□1□□</td><td>DOG-SG are shorted.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Device name</th><th>Devices symbol</th><th>Connector pin No.</th><th>Functions/Applications</th></tr>
<tr><td>Point table No. selection 1</td><td>DI0</td><td>CN1B
5</td><td rowspan="5">The following table lists the point table numbers that may be chosen by the combinations of DI0, DI1, DI2, DI3 and DI4.
<table>
<tr><th colspan="5">(Note)Input signal</th><th rowspan="2">Point table No.</th></tr>
<tr><th>DI4</th><th>DI3</th><th>DI2</th><th>DI1</th><th>DI0</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0 (Manual home position return)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>5</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>7</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>8</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>9</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>10</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>11</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>12</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>13</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>14</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>15</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>16</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>17</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>18</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>19</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>20</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>21</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>22</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>23</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>24</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>25</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>26</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>27</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>28</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>29</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>30</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>31</td></tr>
</table>
Note. 0: DI0/DI1/DI2/DI3/DI4-SG off (open)
1: DI0/DI1/DI2/DI3/DI4-SG on (short)</td></tr>
<tr><td>Point table No. selection 2</td><td>DI1</td><td>CN1B
14</td></tr>
<tr><td>Point table No. selection 3</td><td>DI2</td><td></td></tr>
<tr><td>Point table No. selection 4</td><td>DI3</td><td></td></tr>
<tr><td>Point table No. selection 5</td><td>DI4</td><td></td></tr>
<tr><td>Override selection</td><td>OVR</td><td></td><td>Short OVR-SG to make override (VC) valid.</td></tr>
<tr><td>External torque limit selection</td><td>TL</td><td></td><td>Short TL-SG to make external analog torque limit valid.
For more information, refer to section 3.4.4.</td></tr>
<tr><td>Internal torque limit selection</td><td>TL2</td><td></td><td>Open TL2-SG to make the torque limit value set in parameter No.28 (TL1) valid, or short them to make the value set in parameter No.29 (TL2) valid.
For more information, refer to section 3.4.4.</td></tr>
<tr><td>Proportion control</td><td>PC</td><td></td><td>Connect PC-SG to switch the speed amplifier from the proportional integral type to the proportional type.
If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. In such a case where the axis will be locked mechanically after Movement finish (MEND) has turned off, turning Proportion control (PC) on as soon as Movement finish (MEND) turns off can suppress unnecessary torque that attempts to compensate for a position shift.
When the shaft is to be locked for a long time, switch on the proportion control (PC) and torque (TL) at the same time to make the torque less than the rated by the analog torque limit (TLA).</td></tr>
</table>

<table>
<tr><th>Device name</th><th>Devices symbol</th><th>Connector pin No.</th><th>Functions/Applications</th></tr>
<tr><td>Temporary stop/Restart</td><td>STP</td><td></td><td>Short STP-SG during automatic operation to make a temporary stop. Short STP-SG again to make a restart.
Shorting the forward rotation start (ST1) or reverse rotation start (ST2) during a temporary stop is ignored. Switching from automatic operation mode to manual operation mode during a temporary stop clears the remaining moving distance.
During home position return and jog operation, the temporary stop/restart input is ignored. Refer to section 4.2.6 (3).</td></tr>
<tr><td>Manual pulse generator multiplication 1</td><td>TP0</td><td></td><td rowspan="2">Used to select the multiplication factor of the manual pulse generator.
When it is not selected, the parameter No.1 setting is made valid.
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Manual pulse generator multiplication factor</th></tr>
<tr><th>TP1</th><th>TP0</th></tr>
<tr><td>0</td><td>0</td><td>Parameter No.1 setting</td></tr>
<tr><td>0</td><td>1</td><td>1 time</td></tr>
<tr><td>1</td><td>0</td><td>10 times</td></tr>
<tr><td>1</td><td>1</td><td>100 times</td></tr>
</table>
Note. 0: TP1/TP0-SG open
1: TP1/TP0-SG shorted</td></tr>
<tr><td>Manual pulse generator multiplication 2</td><td>TP1</td><td></td></tr>
<tr><td>Gain switch</td><td>CDP</td><td></td><td>Connect CDP-SG to change the load inertia moment ratio into the parameter No. 64 setting and the gain values into the values multiplied by the parameter No. 65 to 67 settings.</td></tr>
<tr><td>Teach</td><td>TCH</td><td></td><td>Used when performing teaching. Shorting TCH-SG in the teaching setting mode chooses this device and changes the position data of the point table No. to the current position. (Refer to section 7.10.)</td></tr>
</table>

(c) Output devices

Device name	Devices symbol	Connector pin No.	Functions/Applications
Trouble	ALM	CN1B 18	ALM-SG are disconnected when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm, ALM-SG are connected within about 1s after power-on.
Ready	RD	CN1B 19	RD-SG are connected when the servo is switched on and the servo amplifier is ready to operate.
Movement finish	MEND	CN1B 6	MEND-SG are connected when the in-position device (INP) turns on and the command remaining distance is "0". (Refer to section 3.4.2.) MEND-SG are connected at servo on.
Rough match	CPO	CN1B 4	CPO-SG are connected when the remaining command distance falls within the parameter-set rough match output range. This signal is not output while the base circuit is off. Servo-on connects CPO-SG. During home position return and manual operation, CPO-SG are kept connected.
Home position return completion	ZP	CN1A 18	ZP-SG are connected on completion of home position return. In the absolute position system, ZP-SG are connected when the servo amplifier is ready to operate but are disconnected if. 1) SON-SG are opened. 2) EMG-SG are opened. 3) RES-SG are shorted. 4) Alarm occurs. 5) Limit switch opens. 6) Home position return has not been made after the purchase of the product. 7) Home position return has not been made after the occurrence of absolute position erasure (AL. 25) or absolute position counter warning (AL. E3). 8) Home position return has not been made after the changing of the electronic gear value. 9) Home position return has not been made after the absolute position system was made valid. 10) The ST1 coordinate system (000 □ in parameter No.1) has been changed. 11) Software limit is valid. 12) Home position return completion. If the status is not any of 1) to 12) and the home position setting has already been completed at least once, home position return completion (ZP) is placed in the same output status as ready (RD).
Electromagnetic brake interlock	MBR		In the servo-off or alarm status, MBR-SG are disconnected. When an alarm occurs, they are disconnected independently of the base circuit status.
Position range	POT		Position range (POT) is on when the current position is within the range set in parameters No. 50 to 53. If the current position is within the set range, the device is off when a home position return is not yet complete or while the base circuit is off (during servo off, alarm occurrence or alarm reset).
Warning	WNG		When warning has occurred, WNG-SG are connected. When there is no warning, WNG-SG are disconnected within about 1s after power-on.
Battery warning	BWNG		BWNG-SG are connected when battery cable breakage warning (AL.92) or battery warning (AL.9F) has occurred. When there is no battery warning, BWNG-SG are disconnected within about 1s after power-on.
Limiting torque	TLC		TLC-SG are connected when the torque generated reaches the value set to the internal torque limit 1 (parameter No. 28), internal torque limit 1 (parameter No. 29) or analog torque limit (TLA).
Temporary stop	PUS		PUS-SG are connected when deceleration to a stop is started by the temporary stop signal. PUS-SG is disconnected when operation is resumed by making the temporary stop signal valid again.
In position	INP		INP-SG are connected when the number of droop pulses is in the preset in-position range. The in-position range can be changed using parameter No. 6. When the in-position range is increased, INP-SG may be kept connected during low-speed rotation. Servo-on connects INP-SG.

<table>
<tr><th>Device name</th><th>Devices symbol</th><th>Connector pin No.</th><th>Functions/Applications</th></tr>
<tr><td>Point table No. output 1</td><td>PT0</td><td></td><td rowspan="5">As soon as Movement finish (MEND) turns on, the point table No. is output as a 5-bit code.
<table>
<tr><th rowspan="2">Point table No.</th><th colspan="5">(Note) Output signal</th></tr>
<tr><th>PT4</th><th>PT3</th><th>PT2</th><th>PT1</th><th>PT0</th></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>5</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>6</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>7</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>8</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>9</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>10</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>11</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>12</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>13</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>14</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>15</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>16</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>17</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>18</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>19</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>20</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>21</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>22</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>23</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>24</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>25</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>26</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>27</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>28</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>29</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>30</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>31</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
Note. 0: DI-SG open
1: DI-SG shorted
In any of the following states, PT0 to PT4-SG are opened.
・Power on
・Servo off
・During home position return
・Home position return completion
In any of the following states, PT0 to PT4 maintain the status (shorted/open) prior to a change.
・At operation mode changing
When the automatic/manual selection device (MD0) is turned from OFF to ON or from ON to OFF to switch the operation mode.
・During manual operation
・During execution of automatic positioning to the home position</td></tr>
<tr><td>Point table No. output 2</td><td>PT1</td><td></td></tr>
<tr><td>Point table No. output 3</td><td>PT2</td><td></td></tr>
<tr><td>Point table No. output 4</td><td>PT3</td><td></td></tr>
<tr><td>Point table No. output 5</td><td>PT4</td><td></td></tr>
</table>

(2) Input signal

For the input interfaces (symbols in I/O column in the table), refer to section 3.6.2.

Signal	Signal symbol	Connector pin No.	Functions/Applications	I/O division
Manual pulse generator	PP	CN1A-3	Used to connect the manual pulse generator (MR-HDP01). For details, refer to section 14.1.8.	
	NP	CN1A-2		
Override	VC	CN1B-2	−10 to +10V is applied to across VC-LG to limit the servo motor speed. Apply −10[V] for 0[%] override, 0[V] for 100[%], or 10[V] for 200[%].	Analog input
Analog torque limit	TLA	CN1B 12	To use this signal, set any of MR Configurator (servo configuration software) to make the external torque limit selection (TL) available. When the analog torque limit (TLA) is valid, torque is limited in the full servo motor output torque range. Apply 0 to +10VDC across TLA-LG. Connect the positive terminal of the power supply to TLA. Maximum torque is generated at +10V. (Refer to in section 3.4.4.) Resolution:10bits	Analog input

(3) Output signal

For the output interfaces (symbols in I/O column in the table), refer to section 3.6.2.

Signal	Signal symbol	Connector pin No.	Functions/Applications	I/O division
Encoder Z-phase pulse (open collector)	OP	CN1A 14	Outputs the zero-point signal of the encoder. One pulse is output per servo motor revolution. OP and LG are connected 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
Encoder A-phase pulse (differential line driver)	LA LAR	CN1A 6 CN1A 16	Outputs pulses per servo motor revolution set in parameter No. 27 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 π/2. The relationships between rotation direction and phase difference of the A- and B-phase pulses can be changed using parameter No. 58.	DO-2
Encoder B-phase pulse (differential line driver)	LB LBR	CN1A 7 CN1A 17		DO-2
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN1A 5 CN1A 15	The same signal as OP is output in the differential line driver system.	DO-2
Analog monitor 1	MO1	CN3 4	Used to output the data set in parameter No.17 to across MO1-LG in terms of voltage. Resolution 10 bits	Analog output
Analog monitor 2	MO2	CN3 14	Used to output the data set in parameter No.17 to across MO2-LG in terms of voltage. Resolution 10 bits	Analog output

(4) Communication

POINT

- Refer to chapter 15 for the communication function.

Signal	Signal symbol	Connector pin No.	Functions/Applications
RS-422 I/F	SDP SDN RDP RDN	CN3 9 CN3 19 CN3 5 CN3 15	RS-422 and RS-232C functions cannot be used together. Choose either one in parameter No. 16.
RS-422 termination	TRE	CN3 10	Termination resistor connection terminal of RS-422 interface. When the servo amplifier is the termination axis, connect this terminal to RDN (CN3-15).
RS-232C I/F	TXD RXD	CN3 2 CN3 12	RS-422 and RS-232C functions cannot be used together. Choose either one in parameter No. 16.

(5) Power supply

Signal	Signal symbol	Connector pin No.	Functions/Applications
I/F internal power supply	VDD	CN1B 3	Used to output +24V±10% to across VDD-SG. When using this power supply for digital interface, connect it with COM. Permissible current : 80mA
Digital I/F power supply input	COM	CN1A 9 CN1B 13	Used to input 24VDC (200mA or more) for input interface. Connect the positive (+) terminal of the 24VDC external power supply. 24VDC 10%
Open collector power input	OPC	CN1A 11	When you use a manual pulse generator , supply this terminal with the positive (+) power of 24VDC.
Digital I/F common	SG	CN1A 10 20 CN1B 10 20	Common terminal for input signals such as SON and EMG. Pins are connected internally. Separated from LG.
15VDC power supply	P15R	CN1A 4 CN1B 11	Outputs 15VDC to across P15R-LG. Available as power for VC and VLA. Permissible current: 30mA
Control common	LG	CN1A 1 CN1B 1 CN3 1, 11 3, 13	Common terminal for TLA, VC, OP, MO1, MO2 and P15R. Pins are connected internally.
Shield	SD	Plate	Connect the external conductor of the shield cable.

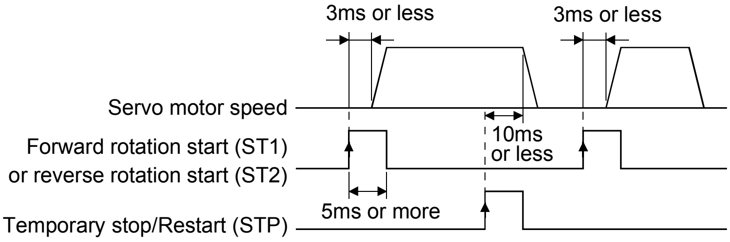
3.4 Detailed description of signals (devices)

3.4.1 Forward rotation start · Reverse rotation start · Temporary stop/restart

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

Normally, it is interlocked with the ready signal (RD).

(2) A start in the servo amplifier is made when the external start signal 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 the start/stop signal should be 5ms or longer to prevent a malfunction.

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

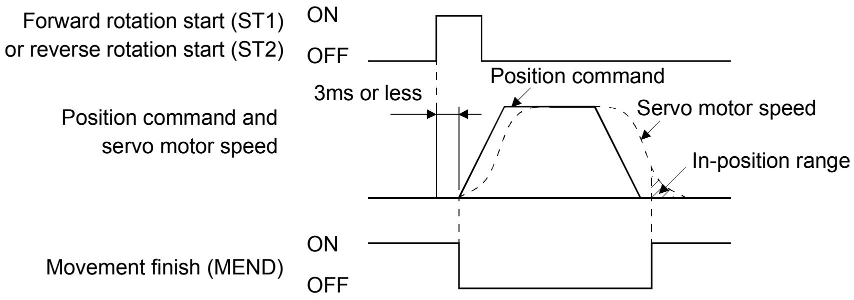
3.4.2 Movement finish · Rough match · In position

POINT

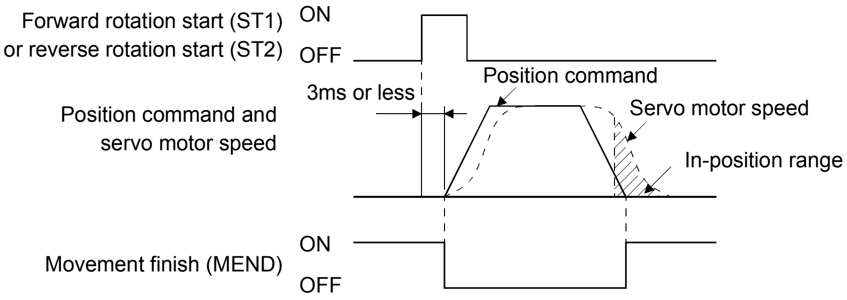
- If an alarm cause, etc. are removed and servo-on occurs after a stop is made by servo-off, alarm occurrence or Forced stop (EMG) ON during automatic operation, Movement finish (MEND), Rough-match, (CPO) and In position (INP) are turned on. To resume operation, confirm the current position and the selected 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 (MEND). This timing can be changed using parameter No. 6 (in-position range). MEND-SG are connected in the servo-on status.



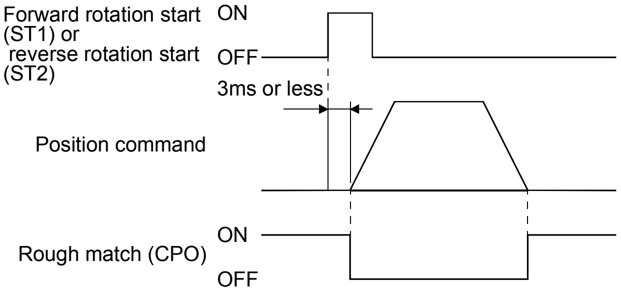
When parameter No. 6 is small



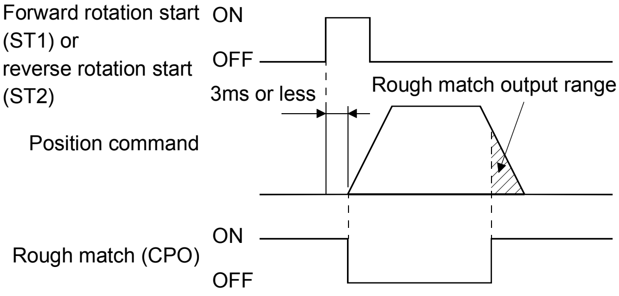
When parameter No. 6 is large

(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. 12 (rough match output range). CPO-SG are connected in the servo-on status.



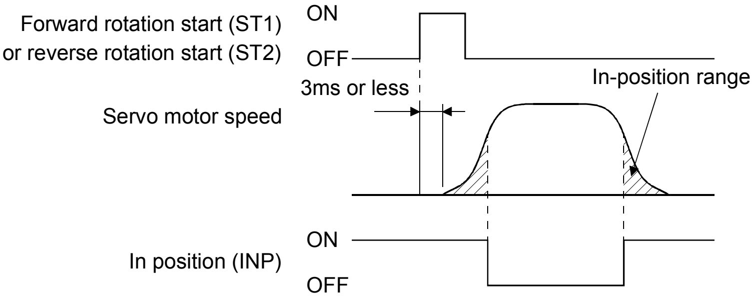
When "0" is set in parameter No. 12



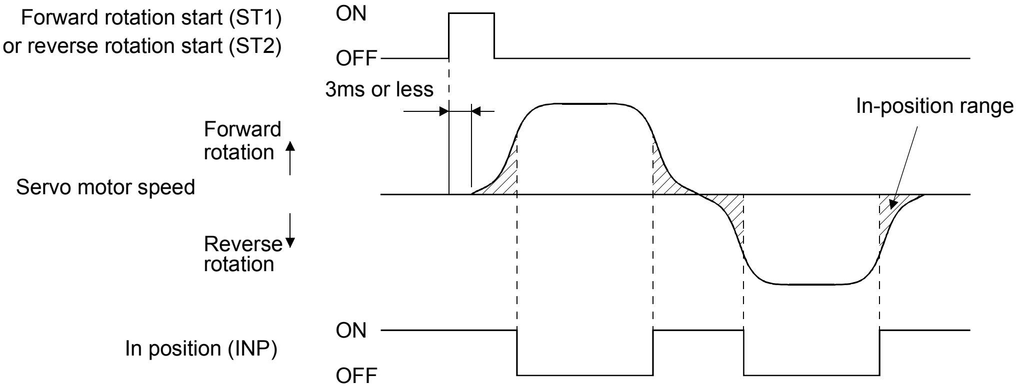
When more than "0" is set in parameter No. 12

(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. 6 (in-position range). INP-SG are connected in the servo-on status.



When positioning operation is performed once



When servo motor reverses rotation direction during automatic continuous operation

3.4.3 Override

POINT

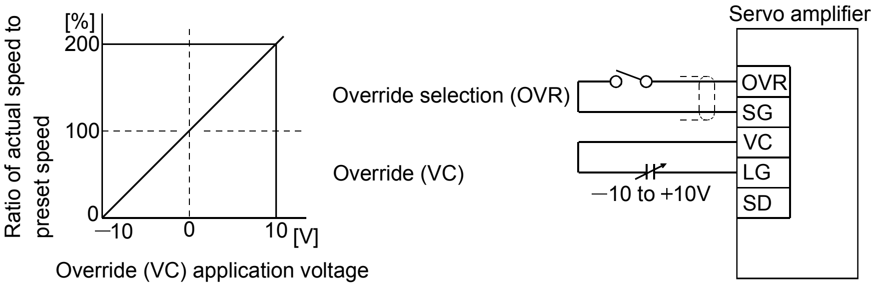
- When using the override (VC), make the override selection (OVR) device available.

The override (VC) may be used to change the servo motor speed. The following table lists the signals and parameter related to the override.

Item	Name	Remarks
Analog input signal	Override (VC)	
Contact input signal	Override selection (OVR)	MR Configurator (servo configuration software) setting required.
Parameter	No.25 override offset	−999 to 999mV

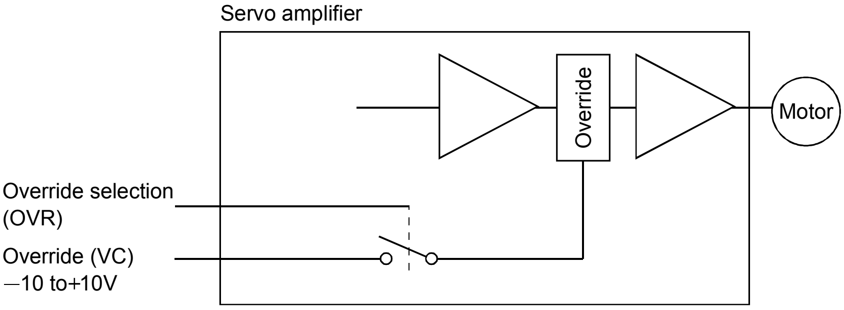
(1) Override (VC)

By applying a voltage (−10 to +10V) to the override (VC) terminal, change values can be set from outside consecutively. The following graph shows the relationship between the input voltage and the ratio of actual speed to preset speed.



(2) Override selection (OVR)

Used to make the override (VC) valid or invalid.



Using the override selection (OVR), choose a change value as follows.

(Note) External input signal	Speed change value
OVR	
0	No change
1	Override (VC) setting is made valid.

Note. 0 : Off (open) across OVR-SG
1 : On (shorted) across OVR-SG

(3) Override offset (parameter No.25)

Using parameter No.25, the offset voltage can be set relative to the input voltage for the override (VC). The setting is between −999 to 999mV.

3.4.4 Torque limit

POINT

- To use the torque limit, make the external torque limit selection (TL) and internal torque limit selection (TL2) available.

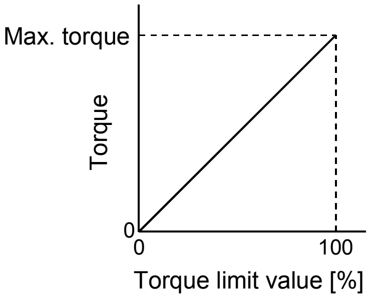
The following table lists the signals and parameters related to the torque limit.

Item	Name	Remarks
Analog input signal	Analog torque limit (TLA)	
Contact input signals	External torque limit selection (TL)	MR Configurator (servo configuration software) setting required.
	Internal torque limit selection (TL2)	
Contact output signal	Limiting torque (TLC)	
Parameters	No.28 (internal torque limit 1)	0 to 100%
	No.29 (internal torque limit 2)	0 to 100%
	No.26 (torque limit offset)	−999 to 999mV
	No.59 (function selection 2)	Selection of the rotation direction in which torque limit is executed

The torque limit is available in two types: internal torque limit set in parameters and analog torque limit (TLA) using analog input signal. This function limits torque on the assumption that the maximum torque of the servo motor is 100%.

(1) Internal torque limits 1, 2

Use parameter No.28 and 29 to set the internal torque limit values. The following graph shows the torque relative to the setting.

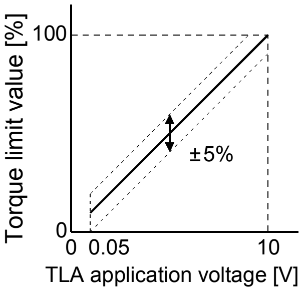


(2) Analog torque limit (TLA)

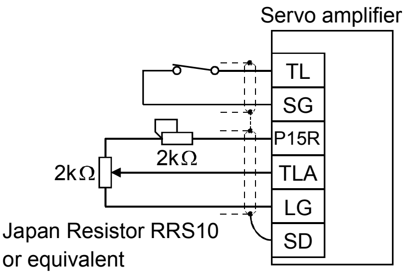
By applying a voltage (0 to 10V) to the analog torque limit (TLA) terminal, limit values can be set from outside consecutively. The following graph shows the relationship between input voltage and limit value.

Depending on the servo amplifier, the limit value has about 5% variations to the input voltage. As this may not cause torque to be limited sufficiently at less than 0.05V, use this function at the voltage of 0.05V or more.

Refer to the following diagram when using the 15V power output (P15R) of the servo amplifier:



TLA Application Voltage vs. Torque Limit Value



Connection Example

(3) External torque limit selection (TL), internal torque limit selection (TL2)

To use the external torque limit selection (TL) and internal torque limit selection (TL2), make them available using the MR Configurator (servo configuration software) (refer to chapter 6).

These input signals may be used to choose the torque limit values made valid.

(Note) External input signals		Torque limit value made valid
TL2	TL	
0	0	Internal torque limit value 1 (parameter No. 28)
0	1	TLA > Parameter No. 28: Parameter No. 28 TLA < Parameter No. 28: TLA
1	0	Parameter No. 29 > Parameter No. 28: Parameter No. 28 Parameter No. 29 < Parameter No. 28: Parameter No. 29
1	1	TLA > Parameter No. 29: Parameter No. 29 TLA < Parameter No. 29: TLA

Note. 0: TL/TL2-SG off (open)
1: TL/TL2-SG on (short)

(4) External torque limit offset (parameter No.26)

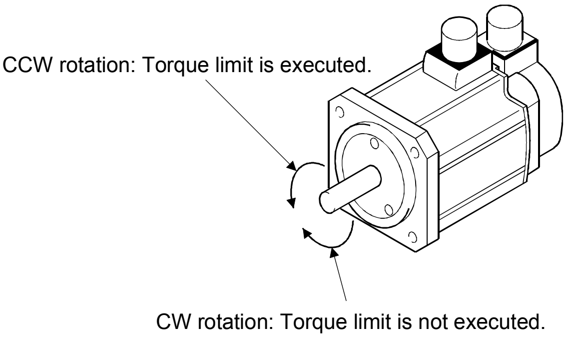
Using parameter No.26, the offset voltage can be set relative to the input voltage of the analog torque limit (TLA). The setting is between −999 to 999mV.

(5) Selection of rotation direction for torque limit execution (parameter No.59)

Using parameter No.59, the rotation direction for torque limit execution can be selected.

Parameter No.59 setting	Rotation direction for torque limit execution	
	CCW direction	CW direction
□0□□ (initial value)	○	○
□1□□	○	
□2□□		○

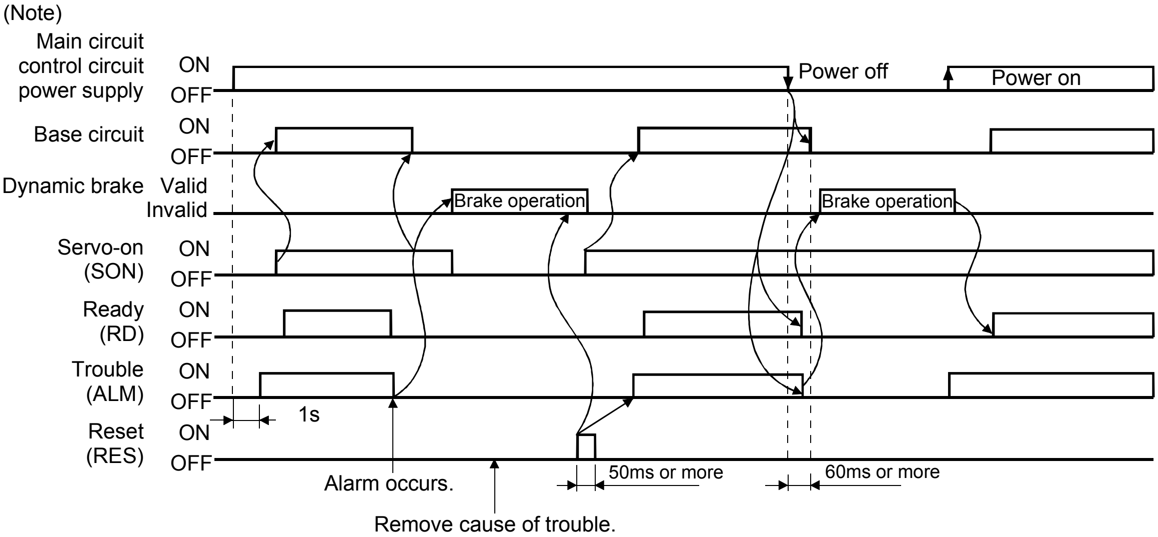
For example, when "□1□□" is set in parameter No.59, torque limit is executed in the CCW direction but not in CW direction.



3.5 Alarm occurrence timing chart

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

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



Note. Switch off the main circuit power as soon as an alarm occurs.

(1) Overcurrent, overload 1 or overload 2

If operation is repeated by switching control circuit power off, then on to reset the overcurrent (AL.32), overload 1 (AL.50) or overload 2 (AL.51) alarm after its occurrence, without removing its cause, the servo amplifier and servo motor may become faulty due to temperature rise. Securely remove the cause of the alarm and also allow about 30 minutes for cooling before resuming operation.

(2) Regenerative alarm

If operation is repeated by switching control circuit power off, then on to reset the regenerative (AL.30) alarm after its occurrence, the external regenerative resistor will generate heat, resulting in an accident.

(3) Instantaneous power failure

Undervoltage (AL.10) 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-J2S-□CP, or to 158VDC or less for the MR-J2S-□CP1.

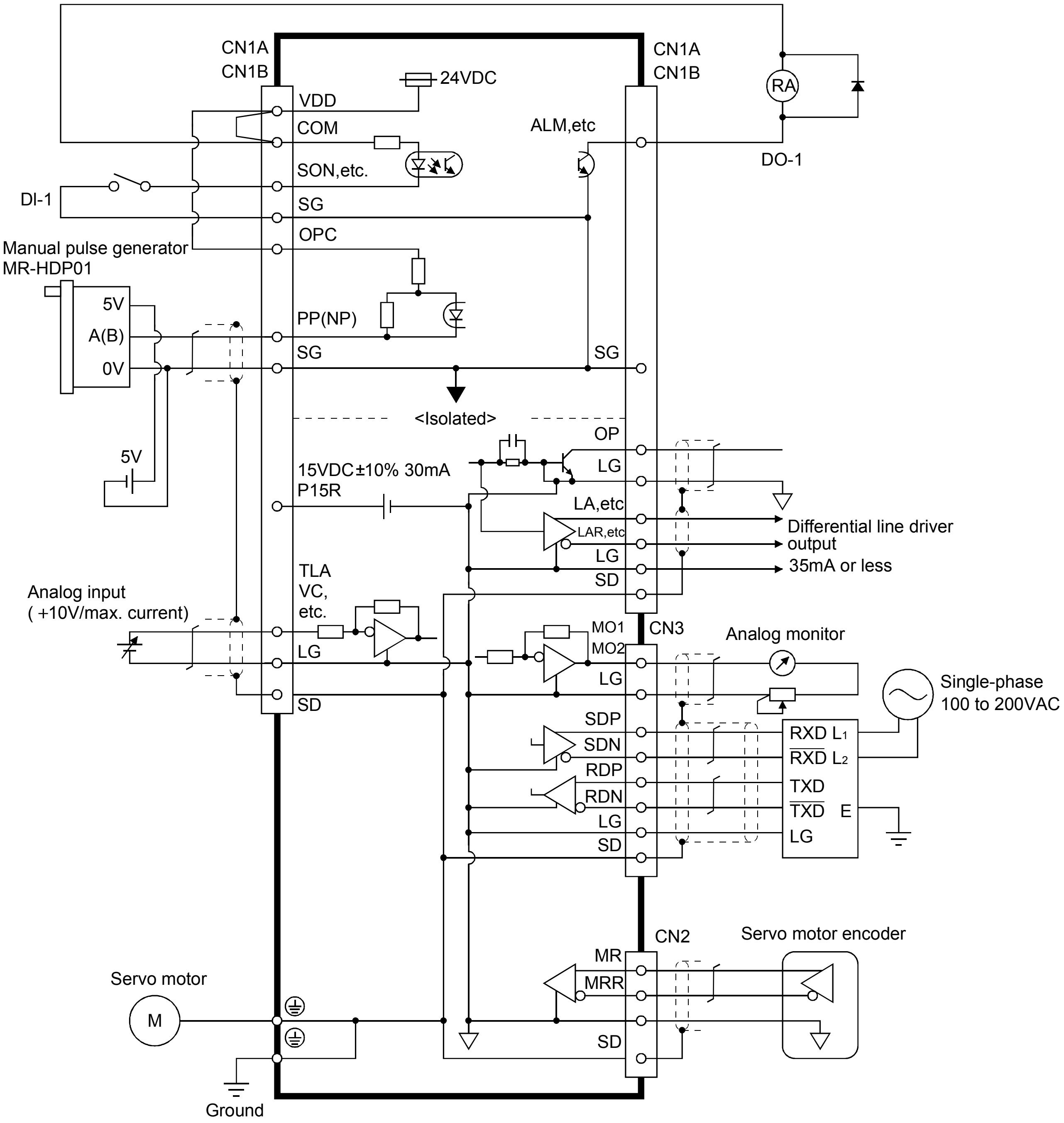
(4) Incremental system

When an alarm occurs, the home position is lost. When resuming operation after deactivating the alarm, make a home position return.

3.6 Interfaces

3.6.1 Common line

The following diagram shows the power supply and its common line.



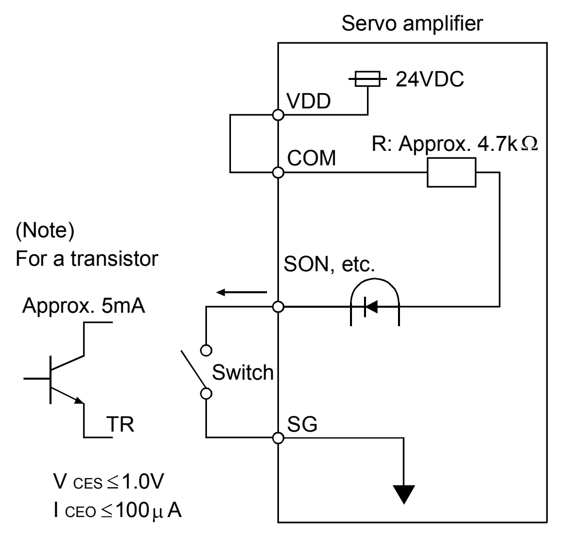
3.6.2 Detailed description of the interfaces

This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in sections 3.3.2. Refer to this section and connect the interfaces with the external equipment.

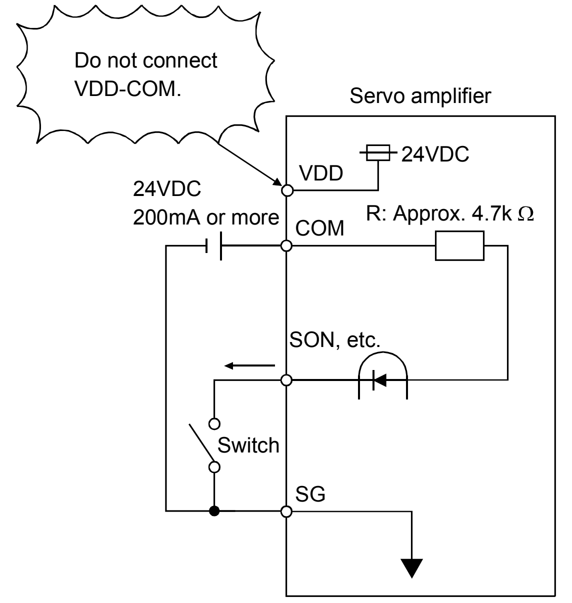
(1) Digital input interface DI-1

Give a signal with a relay or open collector transistor. Source input is also possible. Refer to (6) of this section.

For use of internal power supply



For use of external power supply



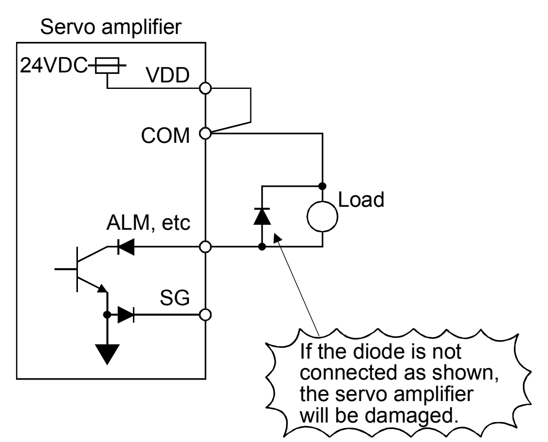
Note. This also applies to the use of the external power supply.

(2) Digital output interface DO-1

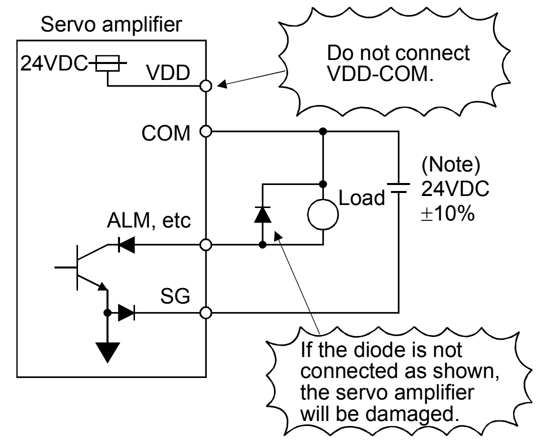
A lamp, relay or photocoupler can be driven. Provide a diode (D) for an inductive load, or an inrush current suppressing resister (R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less) A maximum of 2.6V voltage drop occurs in the servo amplifier.

(a) Inductive load

For use of internal power supply

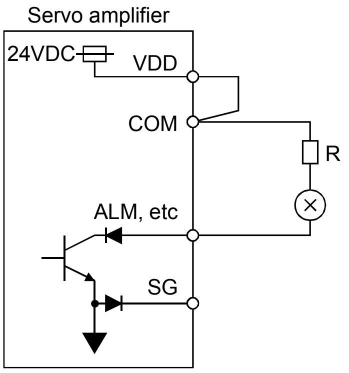
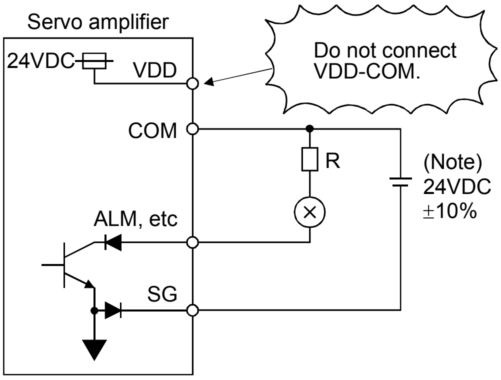


For use of external power supply



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

(b) Lamp load

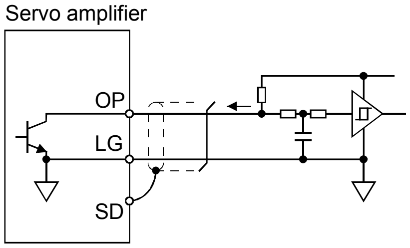
For use of internal power supply	For use of external power supply
	 Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

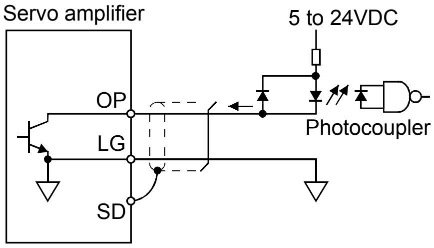
(3) Encoder pulse output DO-2

(a) Open collector system

Interface

Max. output current : 35mA

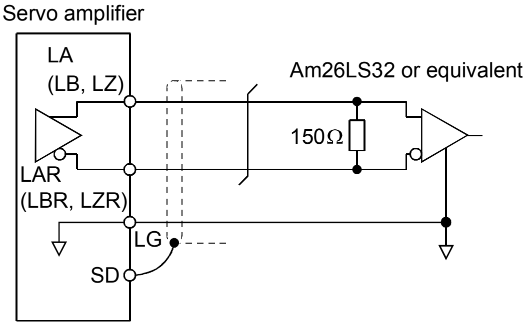


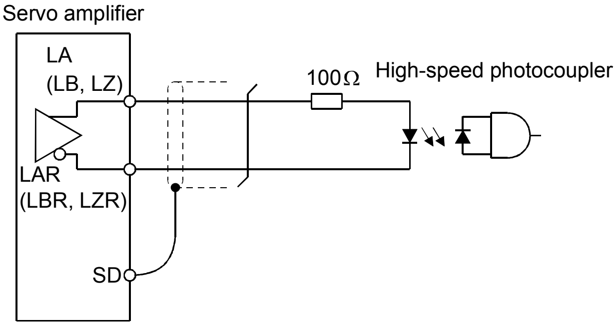


(b) Differential line driver system

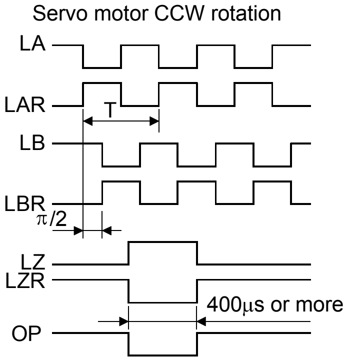
1) Interface

Max. output current: 35mA





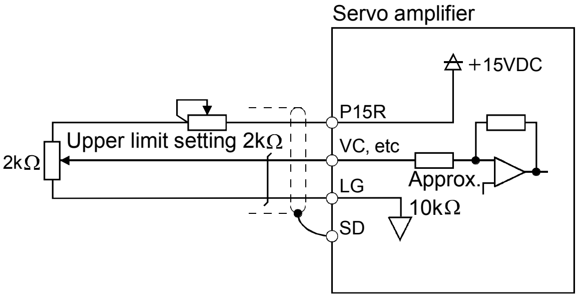
2) Output pulse



The time cycle (T) is determined by the setting of the parameter No. 27 and 58.

(4) Analog input

Input impedance 10k to 12kΩ



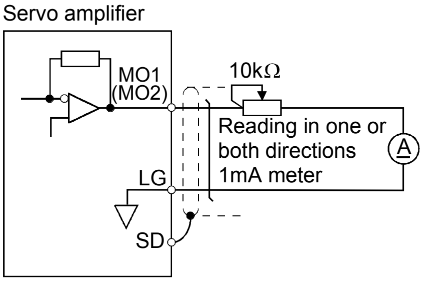
(5) Analog output

Output voltage ±10V

Max.1mA

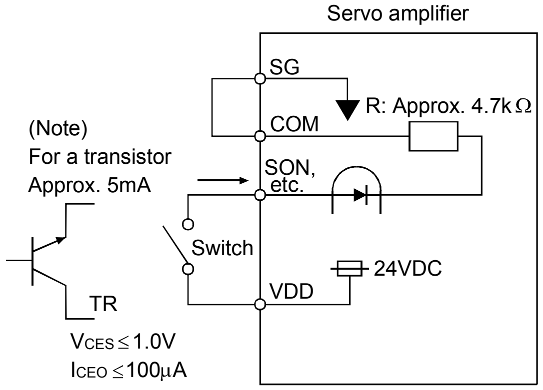
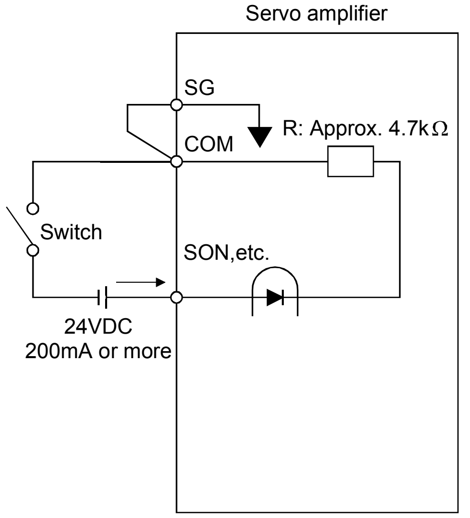
Max. output current

Resolution : 10bits



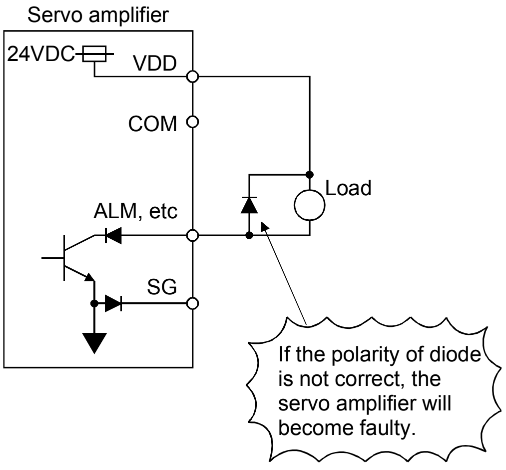
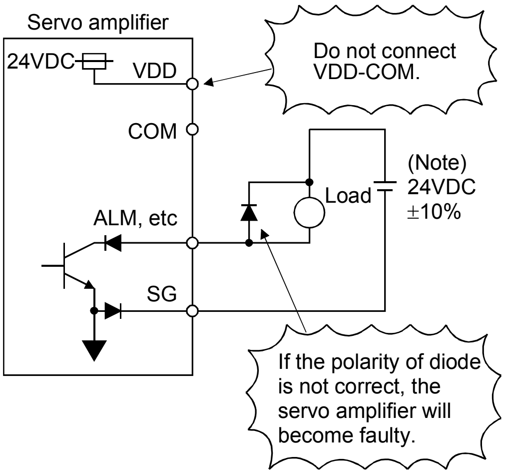
(6) Source input interface

When using the input interface of source type, all Dl-1 input signals are of source type. Source output cannot be provided.

For use of internal power supply	For use of external power supply
	

Note. This also applies to the use of the external power supply.

Since source output is not provided, make the following circuit.

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

3.7 Input power supply circuit

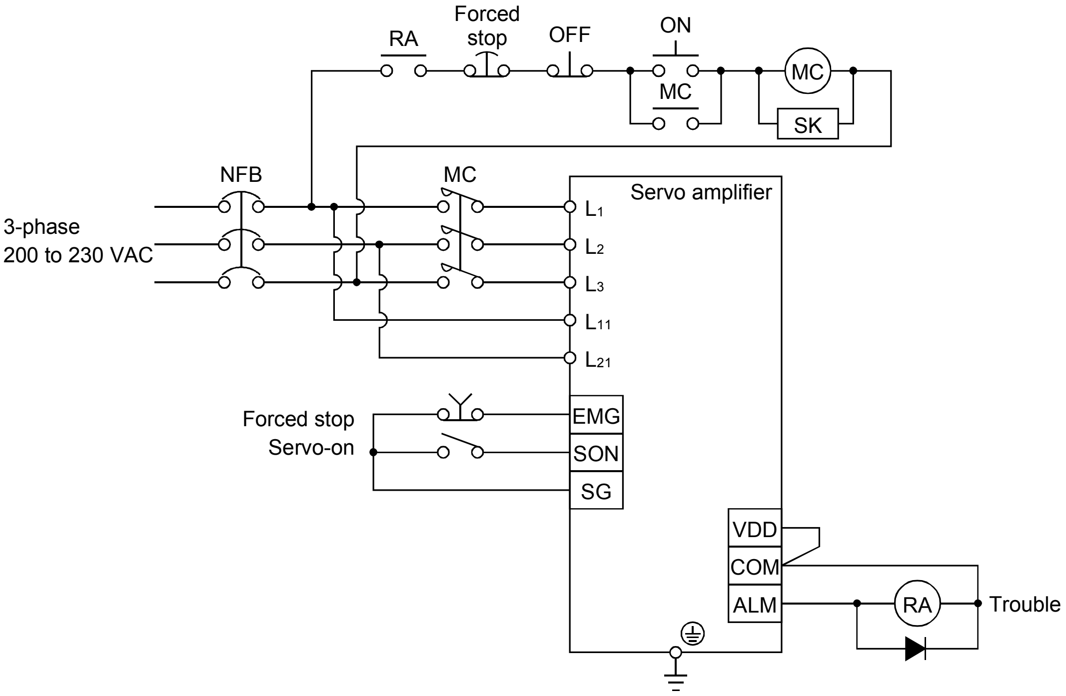
⚠ CAUTION

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

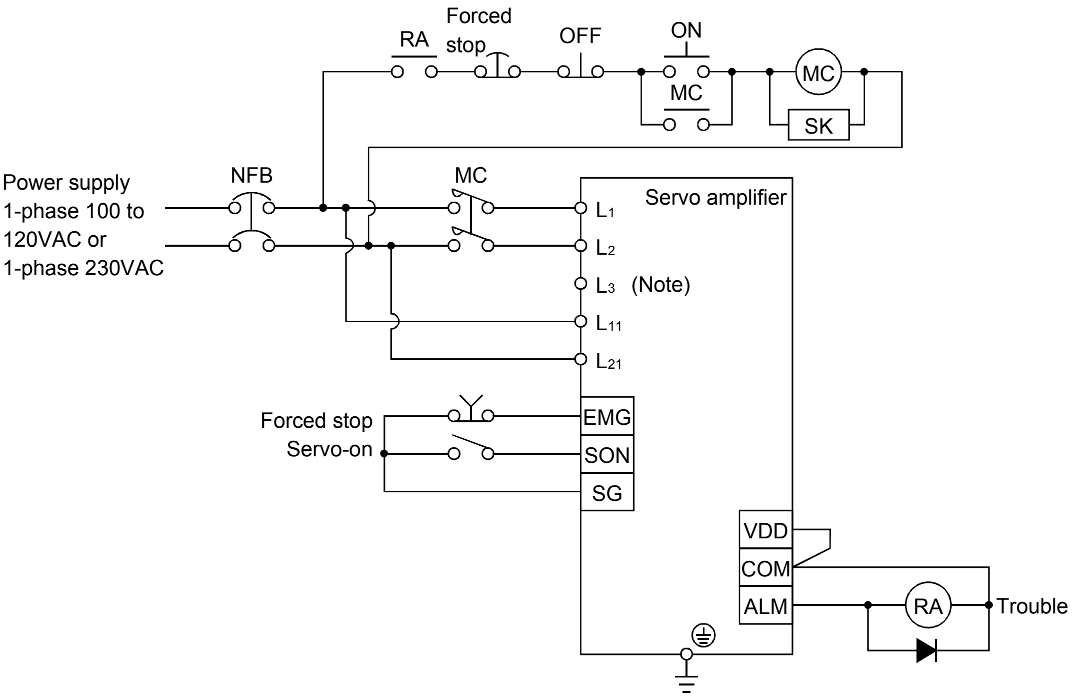
3.7.1 Connection example

Wire the power supply and main circuit as shown below so that the servo-on (SON) turns off as soon as alarm occurrence is detected and power is shut off.
A circuit breaker (NFB) must be used with the input cables of the power supply.

(1) For 3-phase 200 to 230VAC power supply



(2) For 1-phase 100 to 120VAC or 1-phase 230VAC power supply



Note : Not provided for 1-phase 100 to 120VAC.

3.7.2 Terminals

The positions and signal arrangements of the terminal blocks change with the capacity of the servo amplifier. Refer to section 12.1.

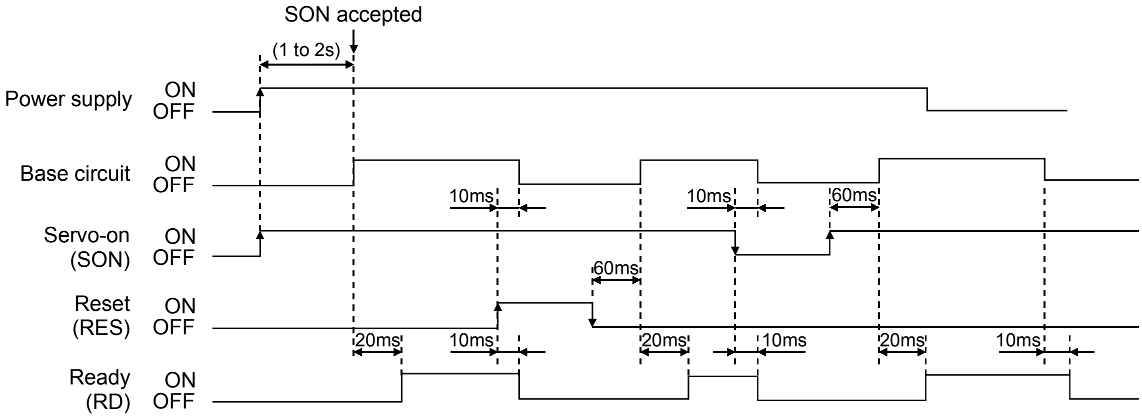
<table>
<tr><th>Symbol</th><th>Connection Target (Application)</th><th>Description</th></tr>
<tr><td>L_1, L_2, L_3</td><td>Main circuit power supply</td><td>Supply L_1, L_2 and L_3 with the following power.
For 1-phase 230VAC, connect the power supply to L_1/L_2 and leave L_3 open.
<table>
<tr><th>Servo amplifier / Power supply</th><th>MR-J2S-10CP to 70CP</th><th>MR-J2S-100CP to 700CP</th><th>MR-J2S-10CP1 to 40CP1</th></tr>
<tr><td>3-phase 200 to 230VAC, 50/60Hz</td><td colspan="2">L_1 · L_2 · L_3</td><td></td></tr>
<tr><td>1-phase 230VAC, 50/60Hz</td><td>L_1 · L_2</td><td></td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td></td><td>L_1 · L_2</td></tr>
</table></td></tr>
<tr><td>U, V, W</td><td>Servo motor output</td><td>Connect to the servo motor power supply terminals (U, V, W).
During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.</td></tr>
<tr><td>L_{11}, L_{21}</td><td>Control circuit power supply</td><td>
<table>
<tr><th>Servo amplifier / Power supply</th><th>MR-J2S-10CP to 700CP</th><th>MR-J2S-10CP1 to 40CP1</th></tr>
<tr><td>1-phase 200 to 230VAC, 50/60Hz</td><td>L_{11} · L_{21}</td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td>L_{11} · L_{21}</td></tr>
</table></td></tr>
<tr><td>P, C, D</td><td>Regenerative option</td><td>1) MR-J2S-350CP 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-J2S-500CP or 700CP
MR-J2S-500CP and 700CP 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.
Refer to section 14.1.1 for details.</td></tr>
<tr><td>N</td><td>Return converter
Brake unit</td><td>When using brake unit, connect to P terminal and N terminal.
Do not connect to servo amplifier MR-J2S-200CP or less.
For details, refer to section 14.1.2, 14.1.3.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.</td></tr>
</table>

3.7.3 Power-on sequence

(1) Power-on procedure

1) Always wire the power supply as shown in above section 3.7.1 using the magnetic contactor with the main circuit power supply (three-phase 200V: L_1, L_2, L_3, single-phase 230V・ single-phase 100V: L_1, L_2). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.
2) Switch on the control circuit power supply L_{11}, L_{21} simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the servo amplifier will operate properly.
3) The servo amplifier can accept the servo-on (SON) about 1 to 2s after the main circuit power supply is switched on. Therefore, when servo-on (SON) is switched on simultaneously with the main circuit power supply, the base circuit will switch on in about 1 to 2s, and the ready (RD) will switch on in further about 20ms, making the servo amplifier ready to operate. (Refer to paragraph (2) of this section.)
4) When the reset (RES) is switched on, the base circuit is shut off and the servo motor shaft coasts.

(2) Timing chart



(3) Forced stop

⚠ CAUTION

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

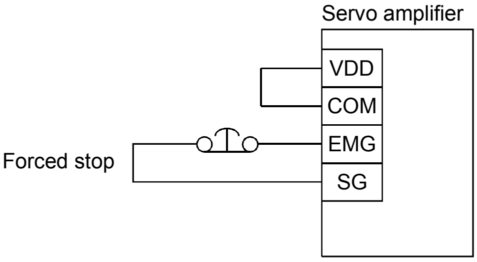
Forced stop (EMG) can be used by making device setting on the MR Configurator (servo configuration software).

Make up a circuit which shuts off main circuit power as soon as EMG-SG are opened at a forced stop.

To ensure safety, always install an external forced stop switch across EMG-SG. By disconnecting EMG-SG, 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 (AL.E6).

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

The servo amplifier life may be shortened.



3.8 Connection of servo amplifier and servo motor

3.8.1 Connection instructions

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

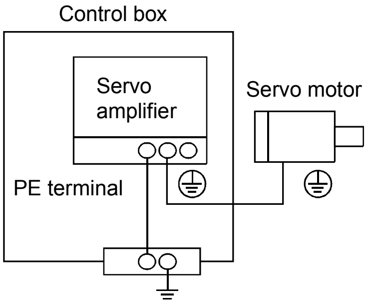
⚠CAUTION	▪Connect the wires to the correct phase terminals (U, V, W) of the servo amplifier and servo motor. Otherwise, the servo motor will operate improperly. ▪Do not connect AC power supply directly to the servo motor. Otherwise, a fault may occur.

POINT

- Do not apply the test lead bars or like of a tester directly to the pins of the connectors supplied with the servo motor. Doing so will deform the pins, causing poor contact.

The connection method differs according to the series and capacity of the servo motor and whether or not the servo motor has the electromagnetic brake. Perform wiring in accordance with this section.

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



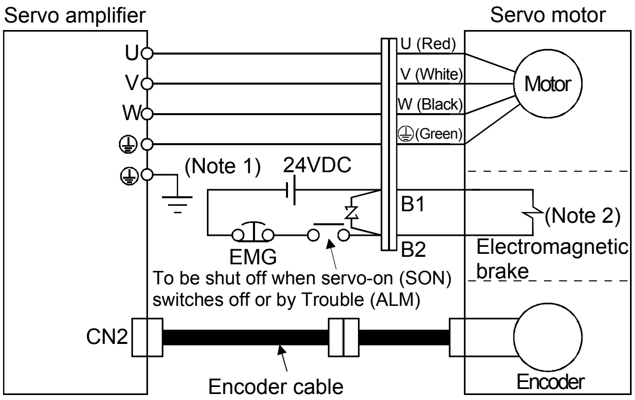
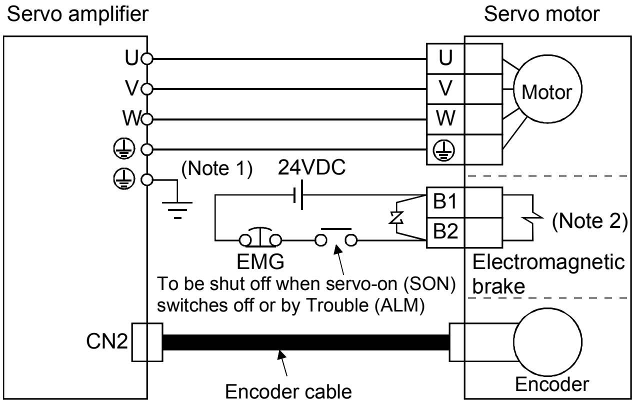
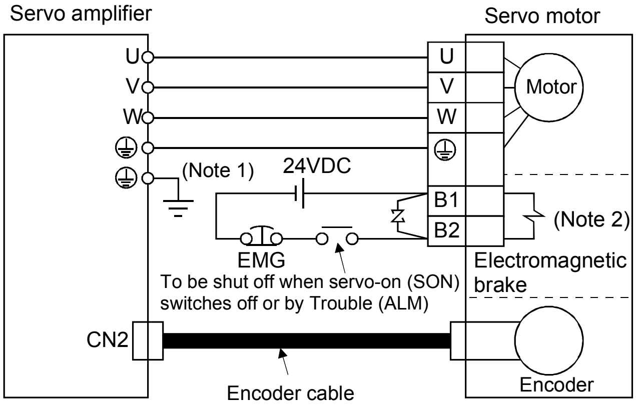
(2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.

3.8.2 Connection diagram

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

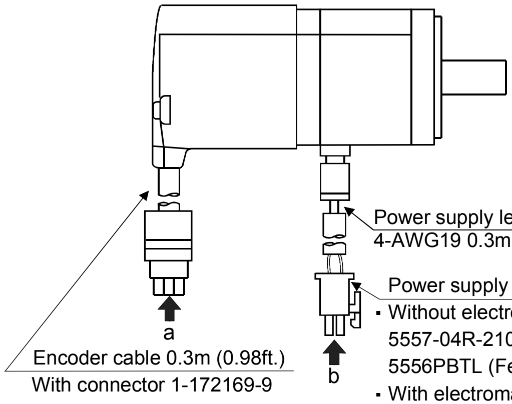
The following table lists wiring methods according to the servo motor types. Use the connection diagram which conforms to the servo motor used. For cables required for wiring, refer to section 14.2.1. For encoder cable connection, refer to section 14.1.4. For the signal layouts of the connectors, refer to section 3.8.3.

For the servo motor connector, refer to chapter 3 of the Servo Motor Instruction Manual.

Servo motor	Connection diagram
HC-KFS053 (B) to 73 (B) HC-MFS053 (B) to 73 (B) HC-UFS13 (B) to 73 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.
HC-SFS121 (B) to 301 (B) HC-SFS202 (B) to 702 (B) HC-SFS203 (B) · 353 (B) HC-UFS202 (B) to 502 (B) HC-RFS353 (B) to 503 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.
HC-SFS81(B) HC-SFS52 (B) to 152 (B) HC-SFS53 (B) to 153 (B) HC-RFS103 (B) to 203 (B) HC-UFS72 (B) · 152 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (⏚) of the servo amplifier to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.

3.8.3 I/O terminals

(1) HC-KFS・HC-MFS・HC-UFS3000r/min series

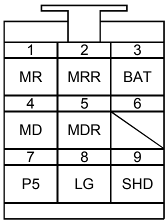


Power supply lead
4-AWG19 0.3m (0.98ft.)

Encoder cable 0.3m (0.98ft.)
With connector 1-172169-9
(Tyco Electronics)

Power supply connector (Molex)
- Without electromagnetic brake
  5557-04R-210 (receptacle)
  5556PBTL (Female terminal)
- With electromagnetic brake
  5557-06R-210 (receptacle)
  5556PBTL (Female terminal)

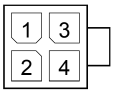
Encoder connector signal arrangement



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

View a

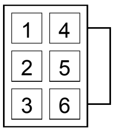
Power supply
connector
5557-04R-210



View b

Pin	Signal
1	U
2	V
3	W
4	⏚(Earth)

Power supply
connector
5557-06R-210

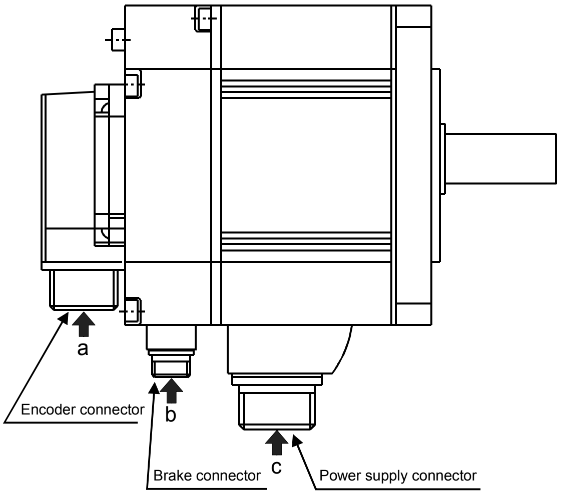


View b

Pin	Signal
1	U
2	V
3	W
4	⏚(Earth)
5	(Note) B1
6	(Note) B2

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

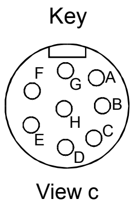
(2) HC-SFS・HC-RFS・HC-UFS2000 r/min series



Servo motor	Servo motor side connectors		
	For power supply	For encoder	Electromagnetic brake connector
HC-SFS81(B) HC-SFS52(B) to 152(B) HC-SFS53(B) to 153(B)	CE05-2A22-23PD-B	MS3102A20-29P	The connector for power is shared.
HC-SFS121(B) to 301(B) HC-SFS202(B) to 502 (B) HC-SFS203(B)・353(B)	CE05-2A24-10PD-B		MS3102A10SL-4P
HC-SFS702(B)	CE05-2A32-17PD-B		
HC-RFS103(B) to 203 (B)	CE05-2A22-23PD-B		The connector for power is shared.
HC-RFS353(B)・503(B)	CE05-2A24-10PD-B		
HC-UFS72(B)・152(B)	CE05-2A22-23PD-B		
HC-UFS202(B) to 502(B)	CE05-2A24-10PD-B		MS3102A10SL-4P

Power supply connector signal arrangement

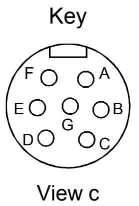
CE05-2A22-23PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	
F	
G	(Note) B1
H	(Note) B2

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

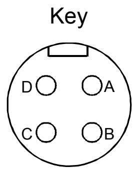
CE05-2A24-10PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	(Note) B1
F	(Note) B2
G	

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

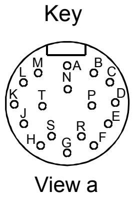
CE05-2A32-17PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

Encoder connector signal arrangement

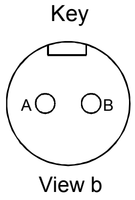
MS3102A20-29P



Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	
K	
L	
M	
N	SD
P	
R	LG
S	P5
T	

Electromagnetic brake connector signal arrangement

MS3102A10SL-4P



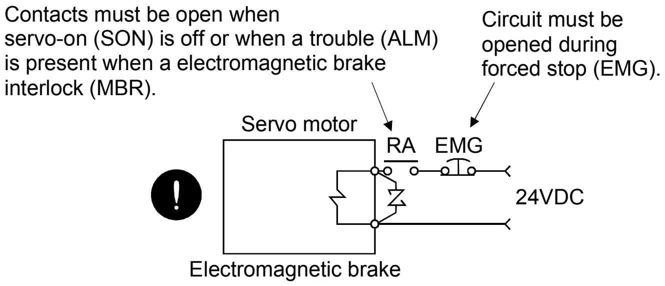
Pin	Signal
A	(Note)B1
B	(Note)B2

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

3.9 Servo motor with electromagnetic brake

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 (EMG).



- The electromagnetic brake is provided for holding the motor shaft. Do not use it for ordinary braking.
- Before performing the operation, be sure to confirm that the electromagnetic brake operates properly.

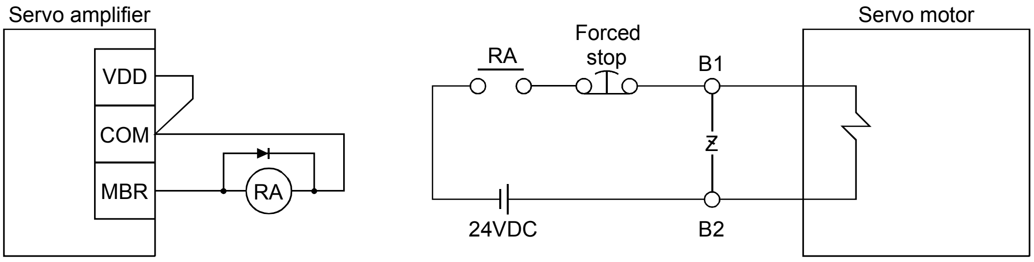
POINT

- For the power supply capacity, operation delay time and other specifications of the electromagnetic brake, refer to the Servo Motor Instruction Manual.

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

1) In the device setting of the MR Configurator (servo configuration software), make the electromagnetic brake interlock (MBR) available.
2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.
3) The brake will operate when the power (24VDC) switches off.
4) While the reset (RES) is on, the base circuit is shut off. When using the servo motor with a vertical shaft, use the electromagnetic brake interlock (MBR).
5) Turn off the servo-on (SON) after the servo motor has stopped.

(1) Connection diagram



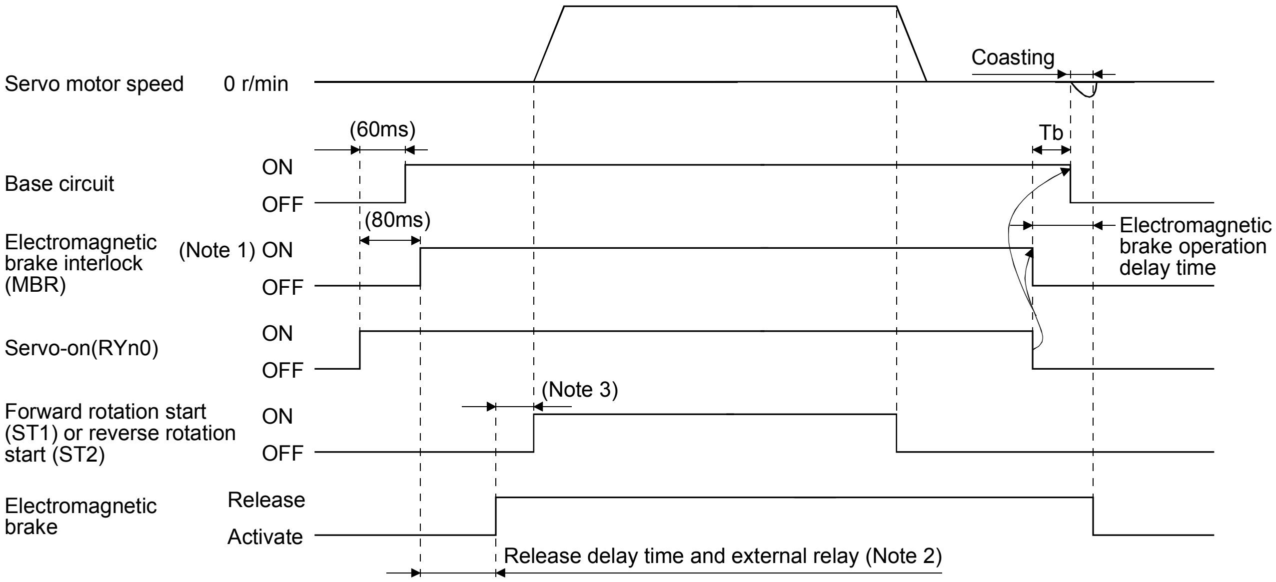
(2) Setting

1) In the device setting of the MR Configurator (servo configuration software), make the electromagnetic brake interlock (MBR) available.
2) Using parameter No. 33 (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 (3) of this section.

(3) Timing charts

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

Tb (ms) after servo-on (SON) is switched off, 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. For use in vertical lift and similar applications, therefore, set delay time (Tb) to the time which is about equal to the electromagnetic brake operation delay time and during which the load will not drop.

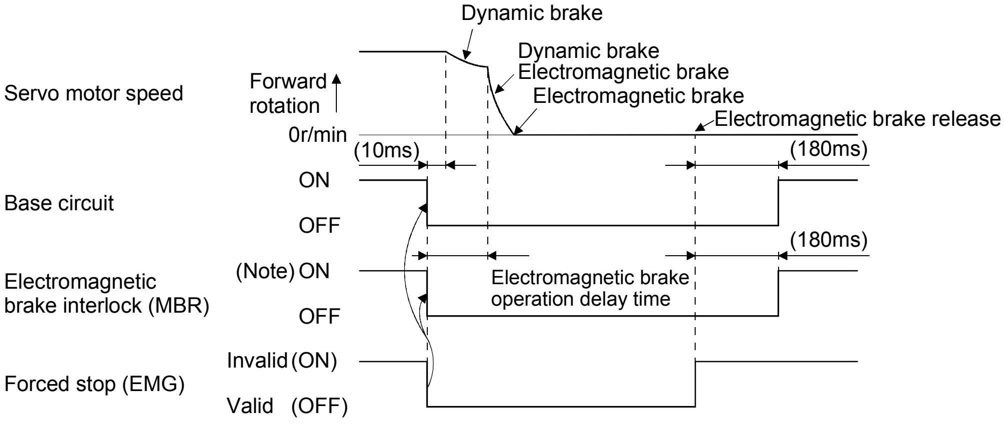


Note 1. ON: Electromagnetic brake is not activated.

OFF: Electromagnetic brake is activated.

2. Electromagnetic brake is released after delaying for the release delay time of electromagnetic brake and operation time of external circuit relay. For the release delay time of electromagnetic brake, refer to the Servo Motor Instruction Manual.
3. After the electromagnetic brake is released, turn ON the ST1 or ST2.

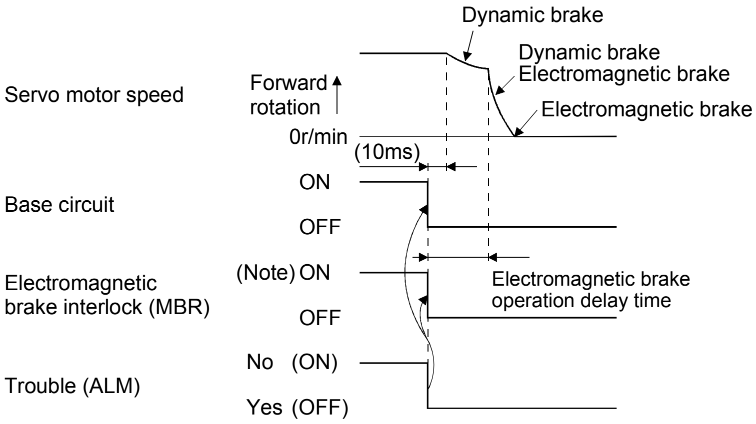
(b) Forced stop (EMG) ON/OFF



Note. ON: Electromagnetic brake is not activated.

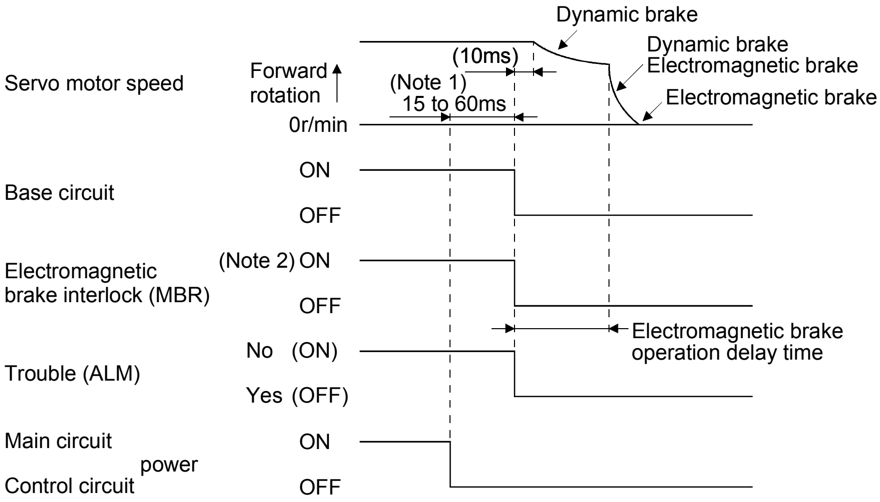
OFF: Electromagnetic brake is activated.

(c) Alarm occurrence



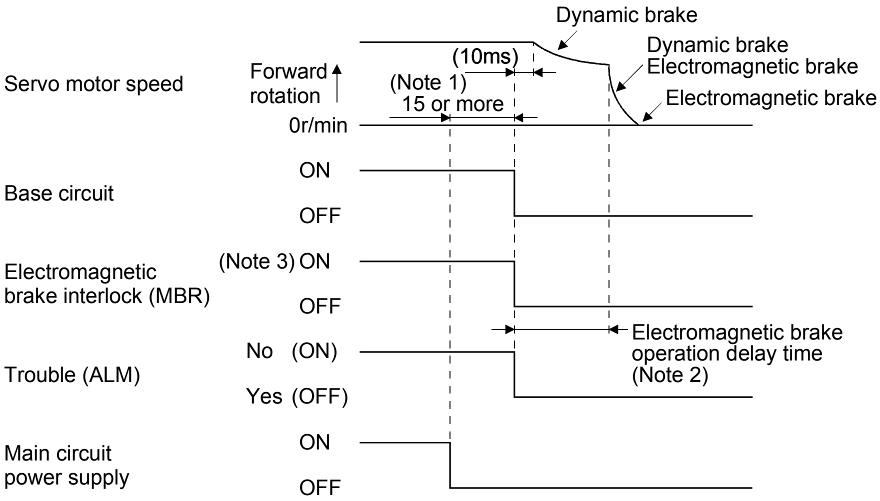
Note. ON: Electromagnetic brake is not activated.
OFF: Electromagnetic brake is activated.

(d) Both main and control circuit power supplies off



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

(e) 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 (AL.E9) occurs and the trouble (ALM) does not turn off.

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

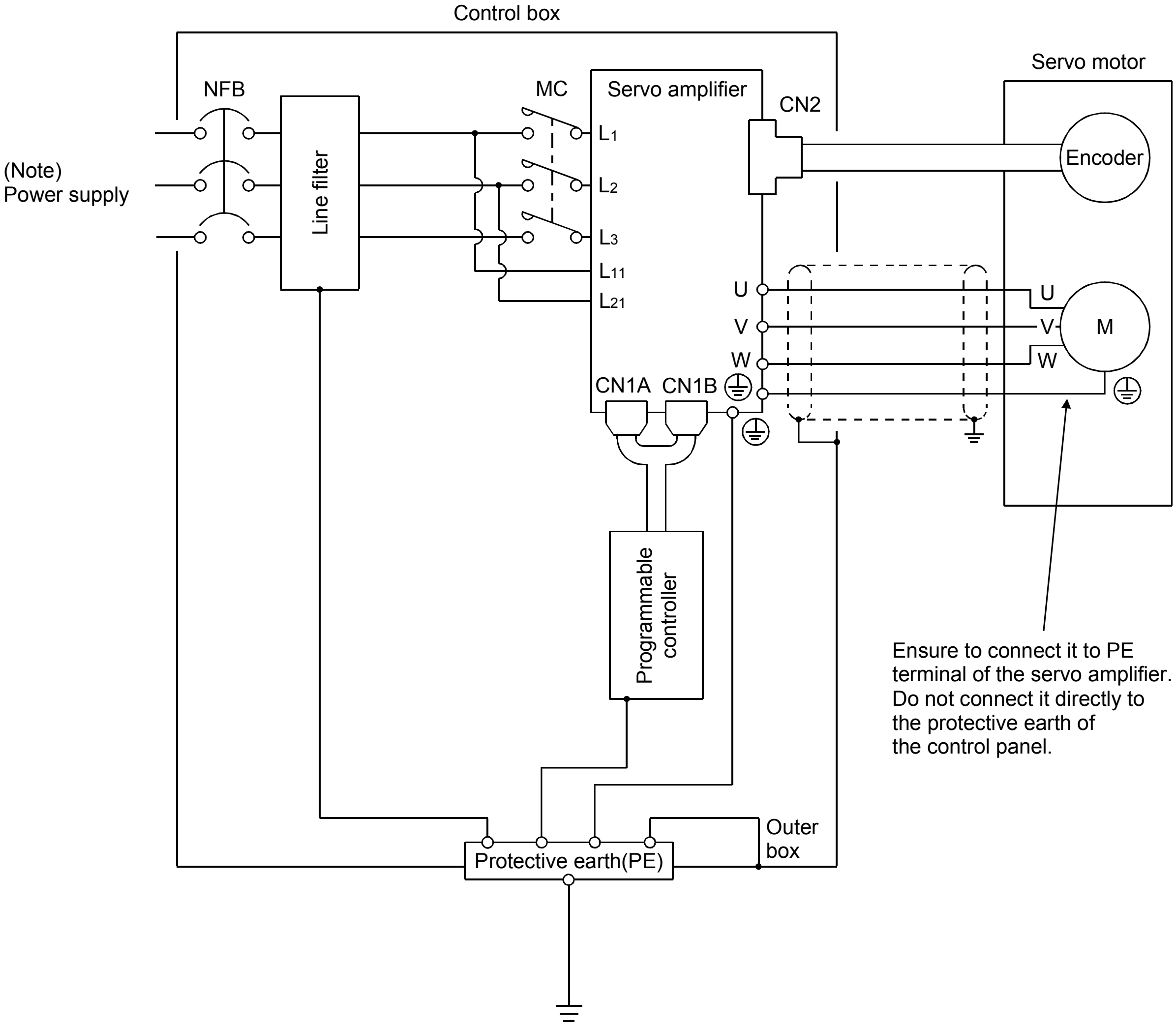
3.10 Grounding

⚠ **WARNING**

- 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.

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

3.11 Servo amplifier terminal block (TE2) wiring method

POINT

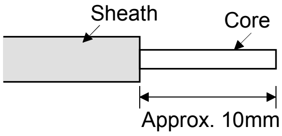
- Refer to Table 14.1 in section 14.2.1 for the wire sizes used for wiring.

3.11.1 For the servo amplifier produced later than Jan. 2006

(1) Termination of the cables

(a) Solid wire

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



(b) Twisted wire

1) When the wire is inserted directly

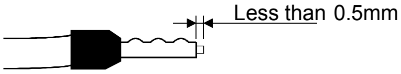
Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

2) When the wires are put together

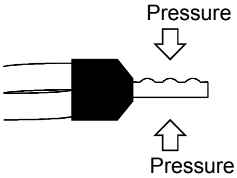
Using a bar terminal.

Cable Size		Bar Terminal Type		Crimping Tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-10BK	AI-TWIN × 1.5-10BK	CRIMPFOX ZA 3	Phoenix Contact
2/2.5	14	AI2.5-10BU			

Cut the wire running out of bar terminal to less than 0.5mm.



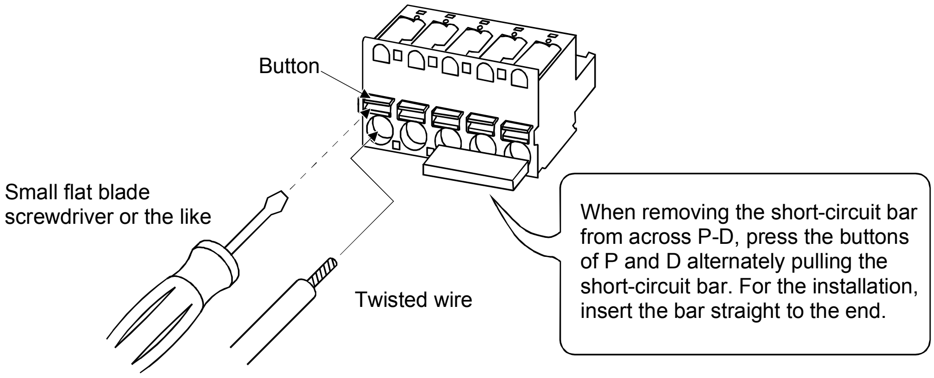
When using a bar terminal for two wires, insert the wires in the direction where the insulation sleeve does not interfere with the next pole and pressure them.



(2) Termination of the cables

(a) When the wire is inserted directly

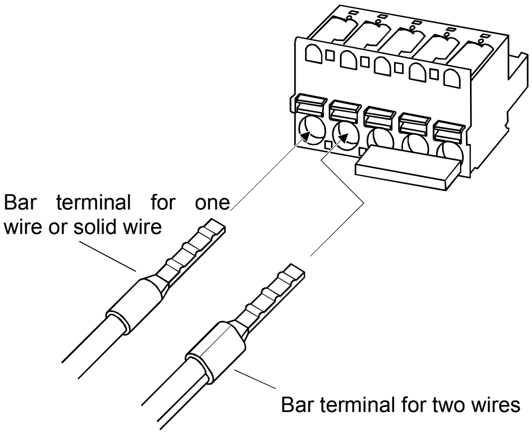
Insert the wire to the end pressing the button with a small flat blade screwdriver or the like.



When removing the short-circuit bar from across P-D, press the buttons of P and D alternately pulling the short-circuit bar. For the installation, insert the bar straight to the end.

(b) When the wires are put together using a bar terminal

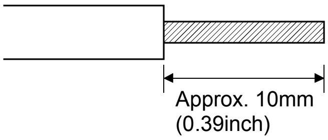
Insert a bar terminal with the odd-shaped side of the pressured terminal on the button side.



3.11.2 For the servo amplifier produced earlier than Dec. 2005

1) Termination of the cables

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



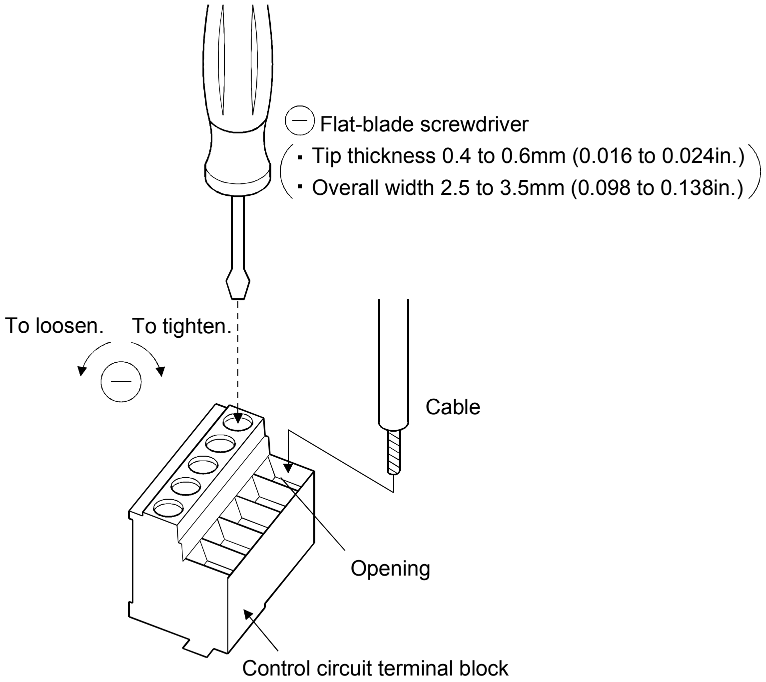
Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool	Manufacturer
[mm^2]	AWG	For 1 cable	For 2 cables		
1.25/1.5	16	AI1.5-10BK	AI-TWIN × 1.5-10BK	CRIMPFOX ZA3 or CRIMPFOX UD 6	Phoenix Contact
2/2.5	14	AI2.5-10BU			

2) Connection

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: 0.3 to 0.4N・m (2.7 to 3.5Ib・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.

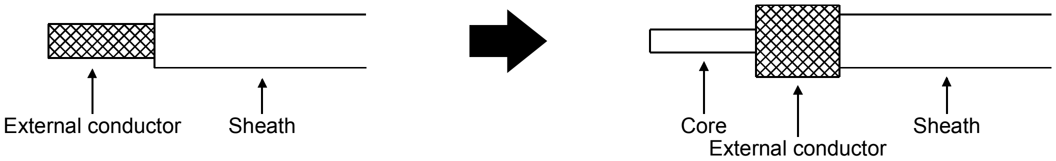


Use of a flat-blade torque screwdriver is recommended to manage the screw tightening torque. The following table indicates the recommended products of the torque screwdriver for tightening torque management and the flat-blade bit for torque screwdriver. When managing torque with a Phillips bit, please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

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

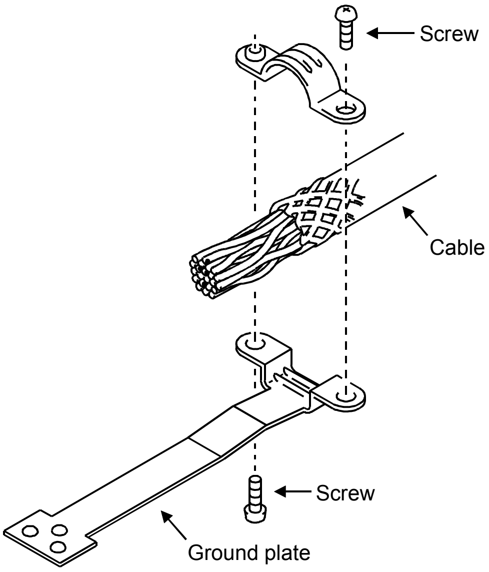
3.12 Instructions for the 3M connector

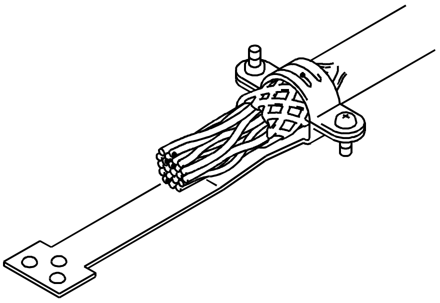
When fabricating an encoder cable or the like, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.



Strip the sheath.

Pull back the external conductor to cover the sheath





4. OPERATION

4.1 When switching power on for the first time

4.1.1 Pre-operation checks

Before starting operation, check the following.

(1) Wiring

(a) A correct power supply is connected to the power input terminals (L_1, L_2, L_3, L_{11}, L_{21}) of the servo amplifier.

(b) 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.

(c) The servo motor power supply terminals (U, V, W) of the servo amplifier are not shorted to the power input terminals (L_1, L_2, L_3) of the servo motor.

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

(e) Note the following when using the regenerative option, brake unit or power regeneration converter.

1) For the MR-J2S-350CP or less, the lead has been removed from across D-P of the control circuit terminal block, and twisted cables are used for its wiring.

2) For the MR-J2S-500CP or more, the lead has been removed from across P-C of the servo amplifier built-in regenerative resistor, and twisted cables are used for its wiring.

(f) When stroke end limit switches are used, the signals across LSP-SG and LSN-SG are on during operation.

(g) 24VDC or higher voltages are not applied to the pins of connectors CN1A and CN1B.

(h) SD and SG of connectors CN1A and CN1B are not shorted.

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

(2) Environment

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

(3) Machine

(a) The screws in the servo motor installation part and shaft-to-machine connection are tight.

(b) The servo motor and the machine connected with the servo motor can be operated.

4.1.2 Startup

⚠ WARNING

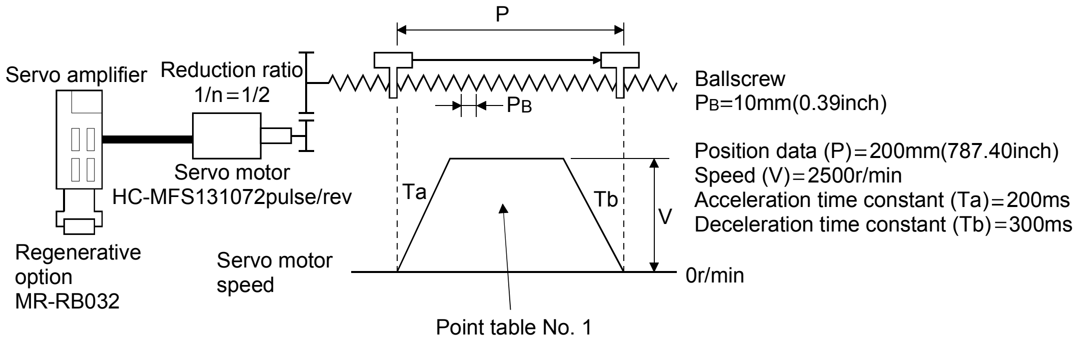
- Do not operate the switches with wet hands. You may get an electric shock.

⚠ 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.

Connect the servo motor with a machine after confirming that the servo motor operates properly alone. For startup reference, a single machine structure will be described. Refer to this section and start up the machine safely.

(1) Machine conditions



1) Absolute position detection system used
2) Command resolution: 10μm
3) Command system: Absolute value command system
4) Electronic gear calculation

$$\frac{\text{CMX(pulse)}}{\text{CDV}(\mu\text{m})}=\frac{131072}{\frac{1}{n}\cdot P_B\cdot 1000}=\frac{131072}{\frac{1}{2}\cdot 10\cdot 1000}=\frac{131072}{5000}=\frac{32768}{1250} \quad\text{...}(4.1)$$

CMX=32768
CDV=1250

5) For the device command method, external input signals are used by the point table selection, forward rotation start (ST1), servo-on (SON) and other commands.
6) Point table No.1 is used to execute automatic operation once.

(2) Startup procedure

(a) Power on

1) Switch off the servo-on (SON).

2) When main circuit power/control circuit power is switched on, "PoS" (Current position) appears on the servo amplifier display.
In the absolute position detection system, first power-on results in the absolute position lost (AL.25) alarm and the servo system cannot be switched on. This is not a failure and takes place due to the uncharged capacitor in the encoder.
The alarm can be deactivated by keeping power on for a few minutes in the alarm status and 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 500r/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.

(b) Test operation

Using jog operation in the "test operation mode" of the MR Configurator (servo configuration software), confirm that the servo motor operates at the slowest speed. (Refer to section 6.7.1, 7.9.2)

(c) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to chapter 5 for the parameter definitions and to sections 6.4 and 7.6 for the setting method.

Parameter	Name	Setting	Description
No.0	Command system, regenerative option selection	□20□	Absolute value command system. MR-RB032 regenerative option is used.
No.1	Feeding function selection	□□10	When forward rotation start (ST1) is valid, address is incremented in CCW direction. Since command resolution is 10 times, feed length multiplication factor of 10 times is selected.
No.2	Function selection 1	1□□□	Absolute position detection system.
No.4	Electronic gear numerator (CMX)	32768	From calculation result of formula (4.1)
No.5	Electronic gear denominator (CDV)	1250	From calculation result of formula (4.1)

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

(d) Point table setting

Set the point table according to the operation pattern. Refer to section 4.2 for the point table definitions and to sections 6.5 and 7.5 for the setting method.

Position data [$\times 10^{STM}$μm]	Servo motor speed□[r/min]	Acceleration time constant□[ms]	Deceleration time constant□[ms]	Dwell [ms]	Auxiliary function
20000	2500	200	300	0	0

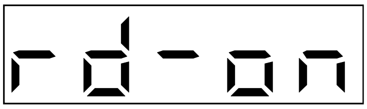
(e) Servo-on

Switch the servo-on in the following procedure.

1) Switch on main circuit/control circuit power.

2) Switch on the servo-on (SON).

When placed in the servo-on status, the servo amplifier is ready to operate and the servo motor is locked. By using the sequence in the diagnostic mode in section 7.3, the ready status can be shown on the servo amplifier display. In the operation-ready status, the following screen appears.



(f) Home position return

Perform home position return as required. Refer to section 4.4 for home position return types. A parameter setting example for dog type home position return is given here.

Parameter	Name	Setting	Description
No.8	Home position return type	□000	Dog type home position return is selected. Home position return is started in address incremented direction. Proximity dog (DOG) is valid when DOG-SG are opened.
No.9	Home position return speed	1000	Motion is made up to proximity dog at 1000r/min.
No.10	Creep speed	10	Motion is made up to home position at 10r/min.
No.11	Home position shift distance	0	No home position shift
No.42	Home position return position data		Use to set the current position on completion of home position return.
No.43	Moving distance after proximity dog		Not used in dog type home position return.

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

Set the input signals as listed below and switch on the forward rotation start (ST1) to execute home position return.

Device name	Symbol	ON/OFF	Description
Automatic/manual selection	MD0	ON	Home position return mode is selected.
Point table No. selection 1	DI0	OFF	
Point table No. selection 2	DI1	OFF	
Forward rotation stroke end	LSP	ON	CCW rotation side limit switch is turned on.
Reverse rotation stroke end	LSN	ON	CW rotation side limit switch is turned on.
Servo-on	SON	ON	Servo is switched on.

(g) Automatic operation

Set the input signals as listed below and switch on the forward rotation start (ST1) to execute automatic operation in accordance with point table No.1.

Device name	Symbol	ON/OFF	Description
Automatic/manual selection	MD0	ON	Automatic operation mode is selected.
Servo-on	SON	ON	Servo is switched on.
Forward rotation stroke end	LSP	ON	CCW rotation side limit switch is turned on.
Reverse rotation stroke end	LSN	ON	CW rotation side limit switch is turned on.
Point table No. selection 1	DI0	ON	Point table No.1 is selected.
Point table No. selection 2	DI1	OFF	

(h) Stop

In any of the following statuses, the servo amplifier interrupts and stops the operation of the servo motor.

When the servo motor used is equipped with an electromagnetic brake, refer to section 3.9 (3). Note that forward rotation stroke end (LSP), reverse rotation stroke end (LSN) off has the same stopping pattern as described below.

1) Servo-on (SON) OFF

The base circuit is shut off and the servo motor coasts.

2) 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.

3) 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. Servo forced warning (AL.E6) occurs.

4) Forward rotation stroke end (LSP), reverse rotation stroke end (LSN) OFF

The droop pulse value is erased and the servo motor is stopped and servo-locked. It can be run in the opposite direction.

4.2 Automatic operation mode

4.2.1 What is automatic operation mode?

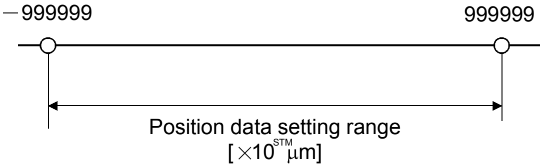
(1) Command system

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

(a) Absolute value command system

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

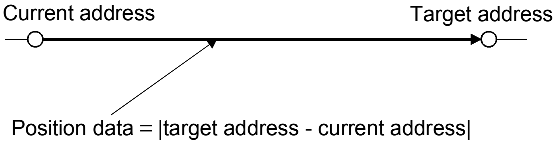
Setting range: −999999 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.1)



(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.1)



(c) Absolute value command/incremental value command specifying system

You can set the absolute value address or incremental value address to each point table as position data. After the axis has been positioned at the target address, it can be moved a given distance.

(2) Point table

(a) Point table setting

Up to 15 point tables may be set. To use point table No.s 4 to 31, however, the point table No. selection 3 (DI2), point table No. selection 4 (DI3) and point table No. selection 5 (DI4) should be made valid in "I/O Devices" on the MR Configurator (servo configuration software).

Set the point tables using the MR Configurator (servo configuration software) or the servo amplifier operation section.

The following table lists what to set. Refer to section 4.2.2, section 4.2.3 and section 4.2.4 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 communication function, select the point table No. with a command from the command device (controller) such as a personal computer.

The following table lists the point table No. selected in response to the input signals/commands. Note that when the input signals are used, the point tables used as standard are No.1 to 3. To use No.4 to 31, the point table No. selection 3 (DI2), point table No. selection 4 (DI3) and point table No. selection 5 (DI4) should be made valid in "I/O Devices" (Refer to chapter 6) on the MR Configurator (servo configuration software).

When the communication function is used to select the point tables, refer to chapter 15 for details of the command transmission method, etc.

(Note 2) Input signals					Selected point table No.
(Note 1) DI4	(Note 1) DI3	(Note 1) DI2	DI1	DI0	
0	0	0	0	0	0 (Manual home position return mode)
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	0	1	1	0	22
1	0	1	1	1	23
1	1	0	0	0	24
1	1	0	0	1	25
1	1	0	1	0	26
1	1	0	1	1	27
1	1	1	0	0	28
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

Note 1. Make signals valid in "I/O Devices" on the MR Configurator (servo configuration software).

2. "1": short

"0": open

4.2.2 Absolute value command system

(1) Point table

Set the point table values using the MR Configurator (servo configuration software) or from the operating section.

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.

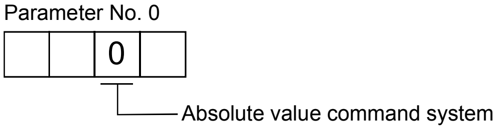
Name	Setting range	Unit	Description
Position data	−999999 to 999999	[$\times 10^{STM}$μm]	Set the target address (absolute value). This value can also be set using the teaching function. (Refer to section 7.10.) The unit can be changed using feed length multiplication factor selection of parameter No. 1.
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 acceleration time constant. Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the deceleration time constant. Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	Set the dwell. 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		Set the auxiliary function. 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.31 results in an error. For full information, refer to section 4.2.6.

(2) Parameter setting

Set the following parameters to perform automatic operation.

(a) Command mode selection (parameter No.0)

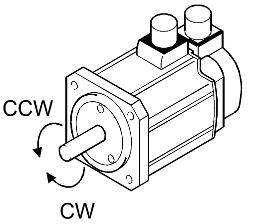
Select the absolute value command system.



(b) ST1 coordinate system selection (parameter No.1)

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) is switched on.

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



(c) Feed length multiplication selection (parameter No.1)

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

Parameter No.1 setting	Position data input range [mm]
□□0□	−999.999 to +999.999
□□1□	−9999.99 to +9999.99
□□2□	−99999.9 to +99999.9
□□3□	−999999 to +999999

(3) Operation

Choose the point table using DI0 to DI4 and short ST1-SG to perform positioning to the position data under the conditions of the preset speed, acceleration time constant and deceleration time constant. At this time, reverse rotation start (ST2) is invalid.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (MD0)	MD0 is turned on.
Point table selection	Point table No. selection 1 (DI0) Point table No. selection 2 (DI1) Point table No. selection 3 (DI2) Point table No. selection 4 (DI3) Point table No. selection 5 (DI4)	Refer to section 4.2.1, (2).
Start	Forward rotation start (ST1)	Short ST1-SG (ON) to start.

4.2.3 Incremental value command system

(1) Point table

Set the point table values using the MR Configurator (servo configuration software) or from the operating section.

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.

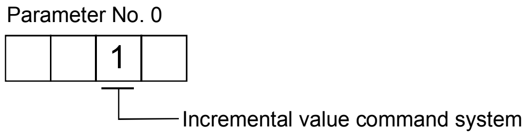
Name	Setting range	Unit	Description
Position data	0 to 999999	$\times 10^{STM}$μm	Set the moving distance. The teaching function is unusable. The unit can be changed using feed length multiplication factor selection of parameter No. 1.
Servo motor speed	0 to permissible speed	r/min	Set the command speed 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 acceleration time constant. Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the deceleration time constant. Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	Set the dwell. 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		Set the auxiliary function. 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. Setting "1" in point table No.31 results in an error. For full information, refer to section 4.2.6.

(2) Parameter setting

Set the following parameters to perform automatic operation.

(a) Command mode selection (parameter No.0)

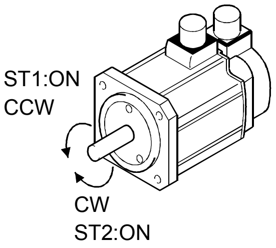
Select the incremental value command system.



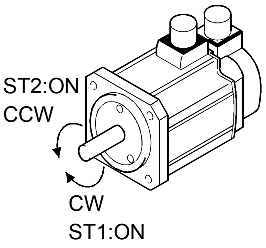
(b) ST1 coordinate system selection (parameter No.1)

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) signal or reverse rotation start (ST2) signal is switched on.

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



Parameter No. 1 □□□0



Parameter No. 1 □□□1

(c) Feed length multiplication selection (parameter No.1) Set the unit multiplication factor (STM) of position data.

Parameter No.1 setting	Position data input range [mm]
□□0□	0 to 999.999
□□1□	0 to 9999.99
□□2□	0 to 99999.9
□□3□	0 to 999999

(3) Operation

Choose the point table using DI0 to DI4 and short ST1-SG to make a motion in the forward rotation direction over the distance of the position data under the conditions of the preset speed, acceleration time constant and deceleration time constant. Short ST2-SG to make a motion in the reverse rotation direction in accordance with the point table settings.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (MD0)	MD0 is turned on.
Point table selection	Point table No. selection 1 (DI0) Point table No. selection 2 (DI1) Point table No. selection 3 (DI2) Point table No. selection 4 (DI3) Point table No. selection 5 (DI4)	Refer to section 4.2.1, (2).
Start	Forward rotation start (ST1)	Short ST1-SG (ON) to start motion in forward rotation direction.
	Reverse rotation start (ST2)	Short ST2-SG (ON) to start motion in reverse rotation direction.

4.2.4 Absolute value command/incremental value command specifying system

This system is an auxiliary function for point tables to use them by specifying the absolute value command and incremental value command.

(1) Point table

Set each value of point tables by using MR Configurator (Setup software) or operation section.

Set to point tables the following, "Position data", "Servo motor speed", "Acceleration time constant", "Deceleration time constant", "Dwell time" and "Auxiliary function".

To specify the command system, set "Auxiliary function" as shown below.

For absolute value command system, set "0" or "1".

For incremental value command system, set "2" or "3".

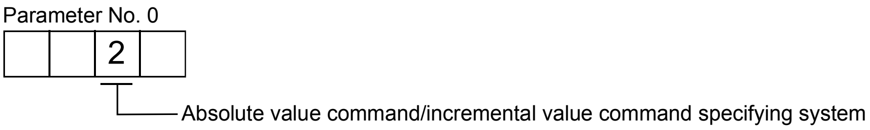
Name	Setting range	Unit	Description
Position data	−999999 to 999999	×10^{STM}μm	(1) When this point table is used in an absolute value command system Set the target address (absolute value). This value can also be set using the teaching function. (Refer to section 7.10.) (2) When this point table is used in an incremental value command system Set the moving distance. A "−" sign indicates a reverse rotation command. The teaching function is unusable.
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 acceleration time constant. Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the deceleration time constant. Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	Set the dwell. Set "0" or "2" in the auxiliary function to make the dwell invalid. Set "1" or "3" 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		Set the auxiliary function. (1) When this point table is used in an 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 this point table is used in an 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" or "3" in point table No.31 results in an error. For full information, refer to section 4.2.6.

(2) Parameter setting

Set the following parameters to perform automatic operation.

(a) Command mode selection (parameter No.0)

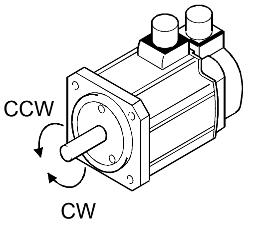
Choose the absolute value command/incremental value command specifying system.



(b) ST1 coordinate system selection (parameter No.1)

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) is switched on.

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



(c) Feed length multiplication selection (parameter No.1) Set the unit multiplication factor (STM) of position data.

Parameter No.1 setting	Position data input range [mm]
□□0□	0 to 999.999
□□1□	0 to 9999.99
□□2□	0 to 99999.9
□□3□	0 to 999999

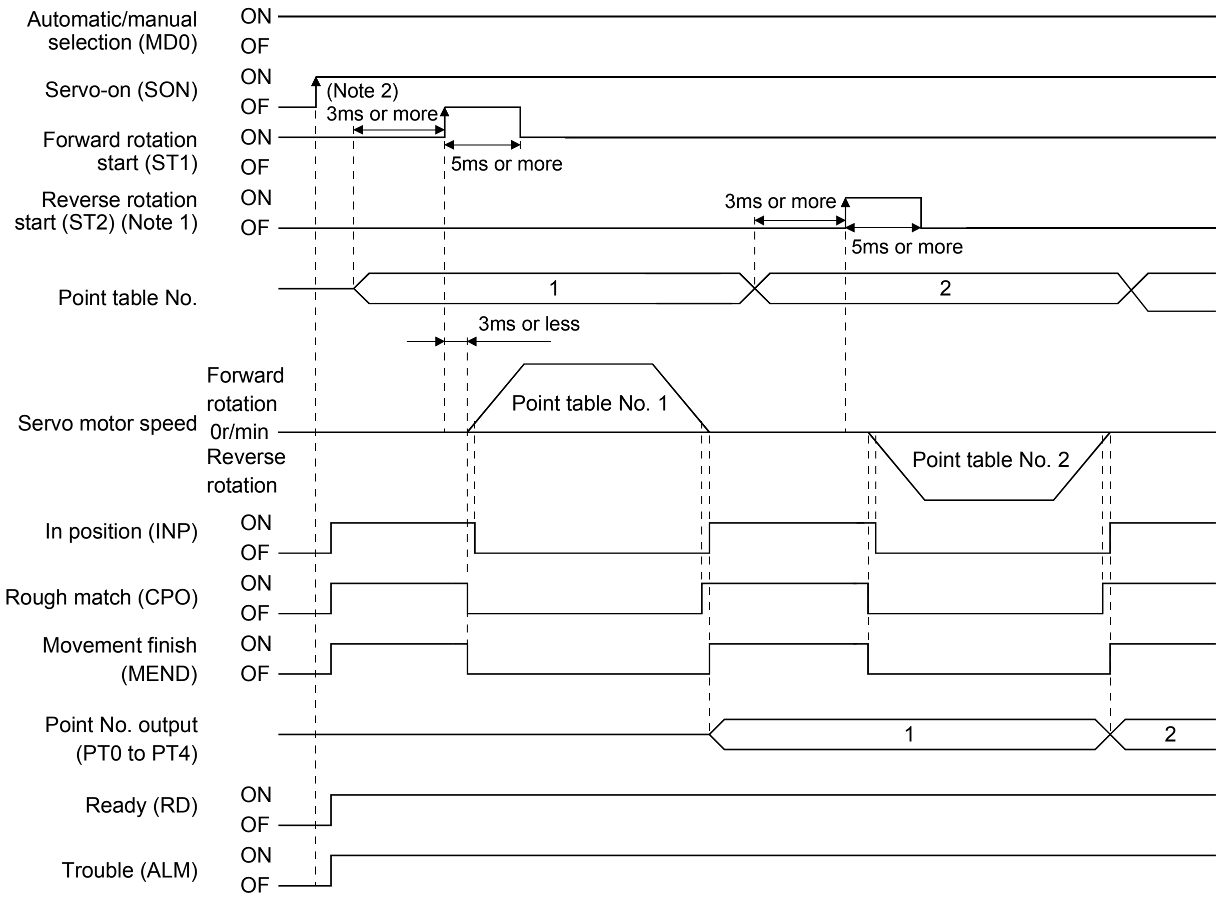
(3) Operation

Choose the point table using DI0 to DI4 and short ST1-SG to perform positioning to the position data under the conditions of the preset speed, acceleration time constant and deceleration time constant. At this time, reverse rotation start (ST2) is invalid.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (MD0)	MD0 is turned on.
Point table selection	Point table No. selection 1 (DI0) Point table No. selection 2 (DI1) Point table No. selection 3 (DI2) Point table No. selection 4 (DI3) Point table No. selection 5 (DI4)	Refer to section 4.2.1, (2).
Start	Forward rotation start (ST1)	Short ST1-SG (ON) to start.

4.2.5 Automatic operation timing chart

The timing chart is shown below.



Note 1: Reverse rotation start (ST2) is invalid in the absolute value command system and absolute value command/incremental value command specifying system.

2: External input signal detection delays by the input filter setting time of parameter No. 2. 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.

4.2.6 Automatic continuous operation

(1) What is automatic continuous operation?

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

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

Either type may be selected as follows.

(a) In absolute value command system or incremental value command system

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

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

(b) In absolute value command /incremental value command specifying system

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

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

(2) 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.30, operation can be performed at a maximum of 31 speeds. Set "0" to the auxiliary function of the last point table.

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

The following table gives a setting example.

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

Note 1. Always set "0".

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

(a) Absolute value command system

1) Positioning in single direction

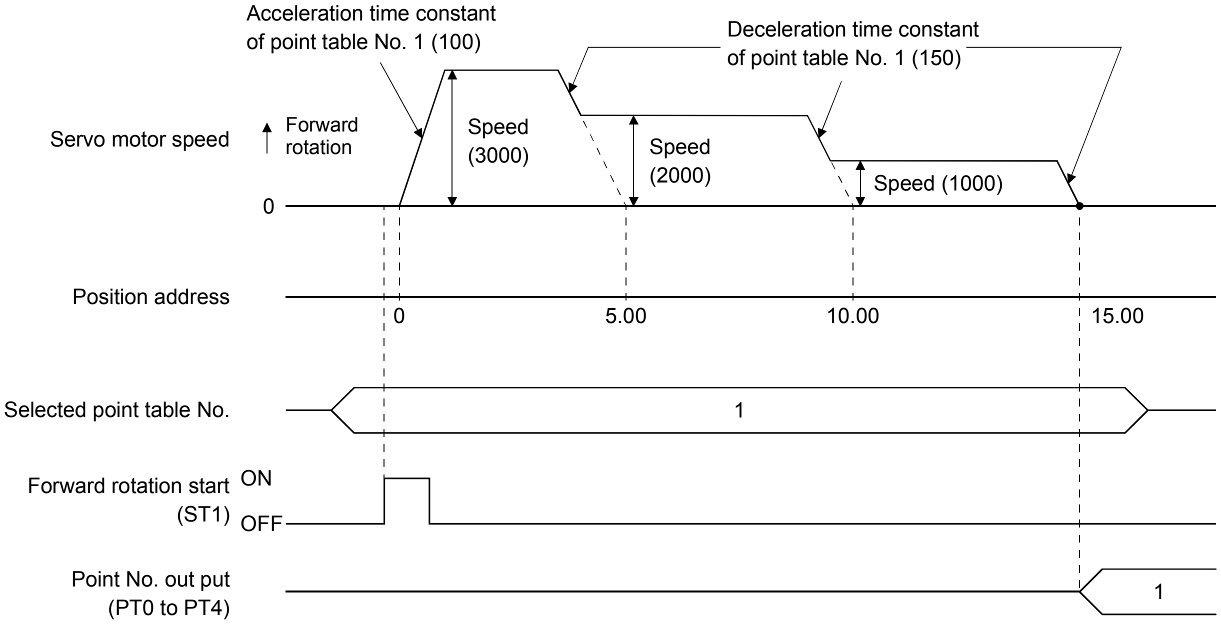
The position data (addresses) of the midway point tables are not used for positioning and speed is changed continuously to move to the set address in the last point table.

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	10.00	2000	Invalid	Invalid	0	1
3	15.00	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.



2) Positioning that reverses the direction midway

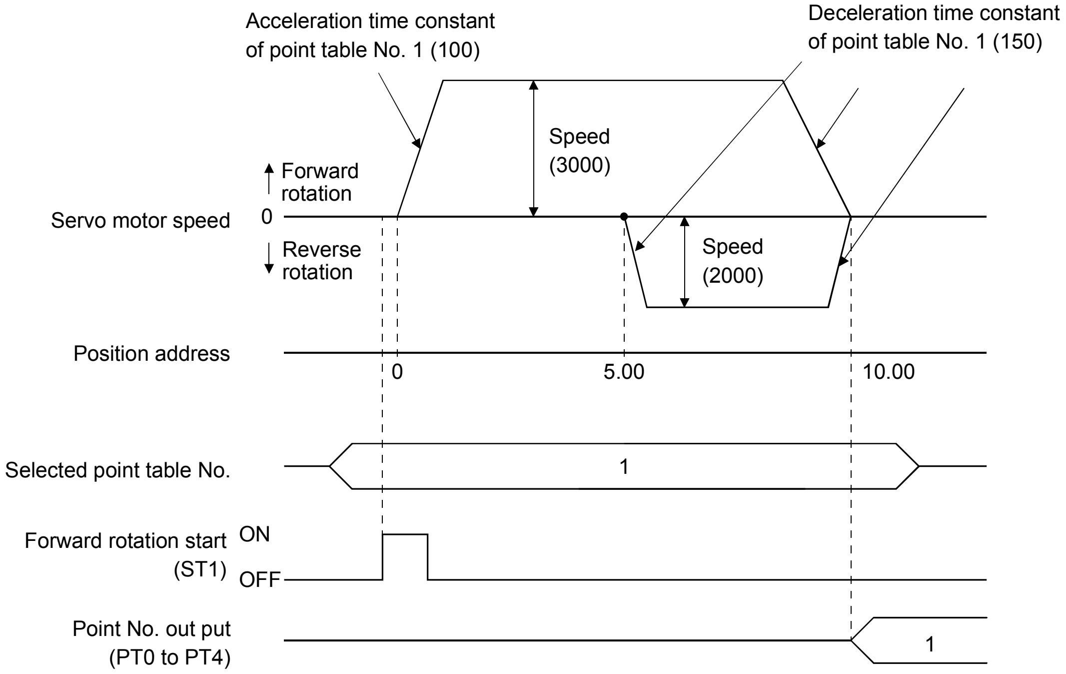
The position data (addresses) of the midway point tables are used for positioning and the direction is reversed to reach the positioning address set in the last point table.

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	10.00	3000	100	150	0	1
2	5.00	2000	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.



(b) Incremental value command system

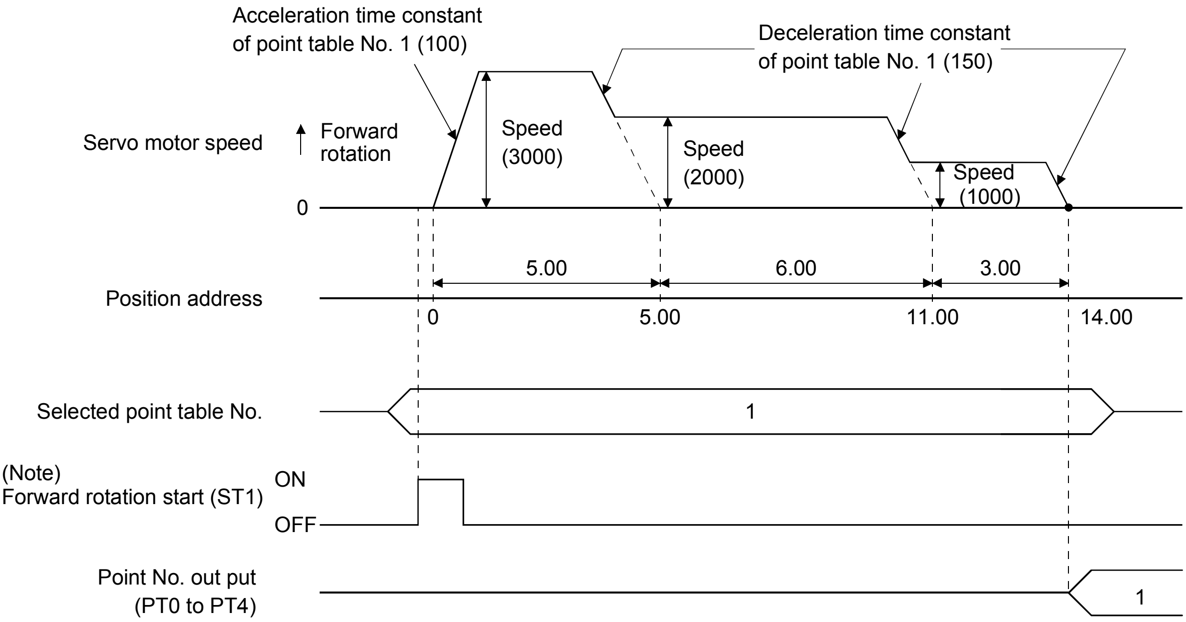
The position data of the incremental value command system is the sum of the position data of the consecutive point tables.

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 (ST2) starts positioning in the reverse rotation direction.

(c) Absolute value command/incremental 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.

1) Positioning in single direction

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

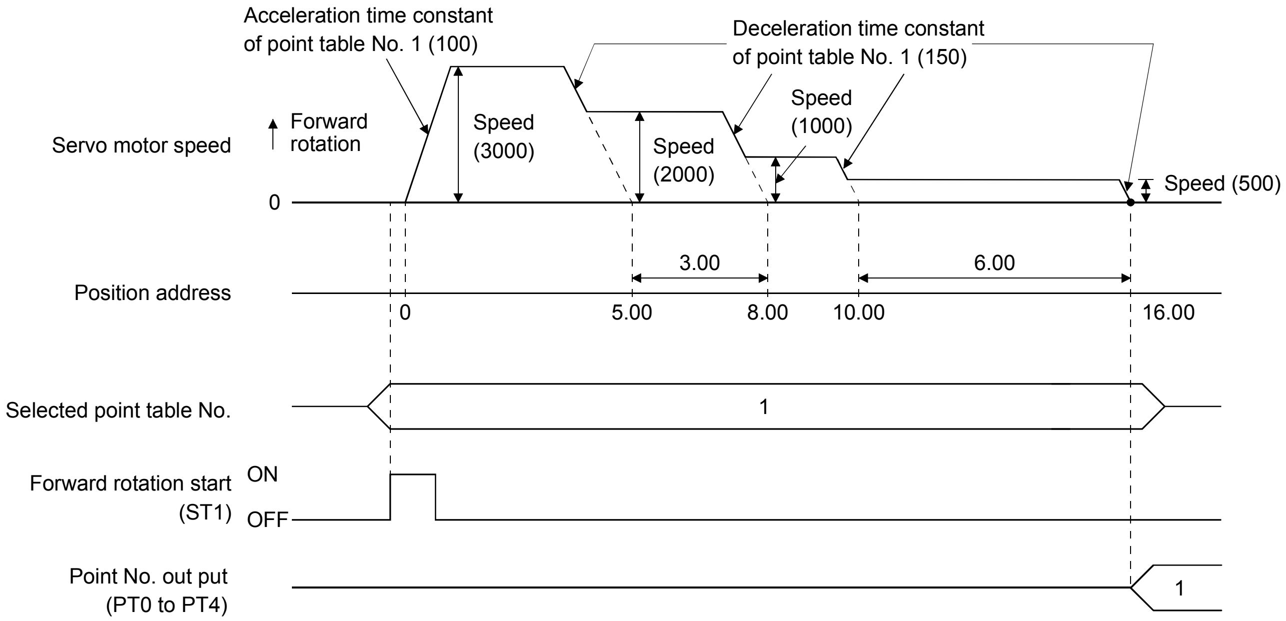
Point table No.	Position data $[\times 10^{STM}\mu m]$	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	3.00	2000	Invalid	Invalid	0	3
3	10.00	1000	Invalid	Invalid	0	1
4	6.00	500	Invalid	Invalid	0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



2) 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.

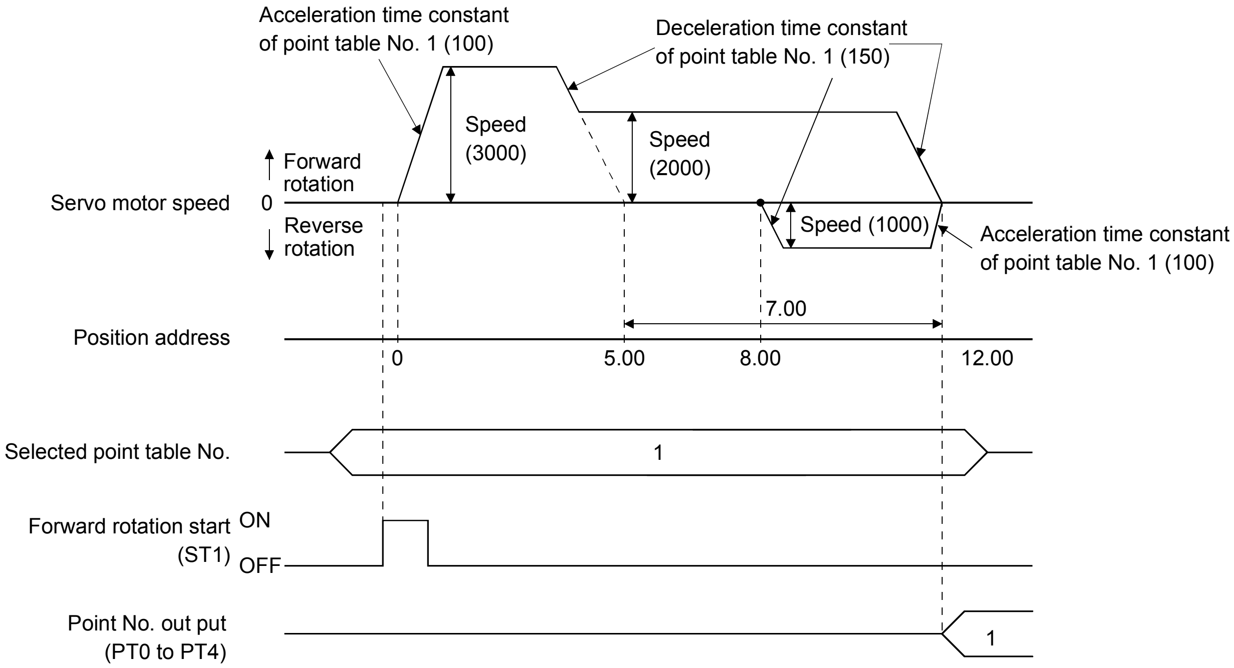
Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	7.00	2000	Invalid	Invalid	0	1
3	8.00	1000	Invalid	Invalid	0	0 (Note 2)

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



(4) Temporary stop/restart

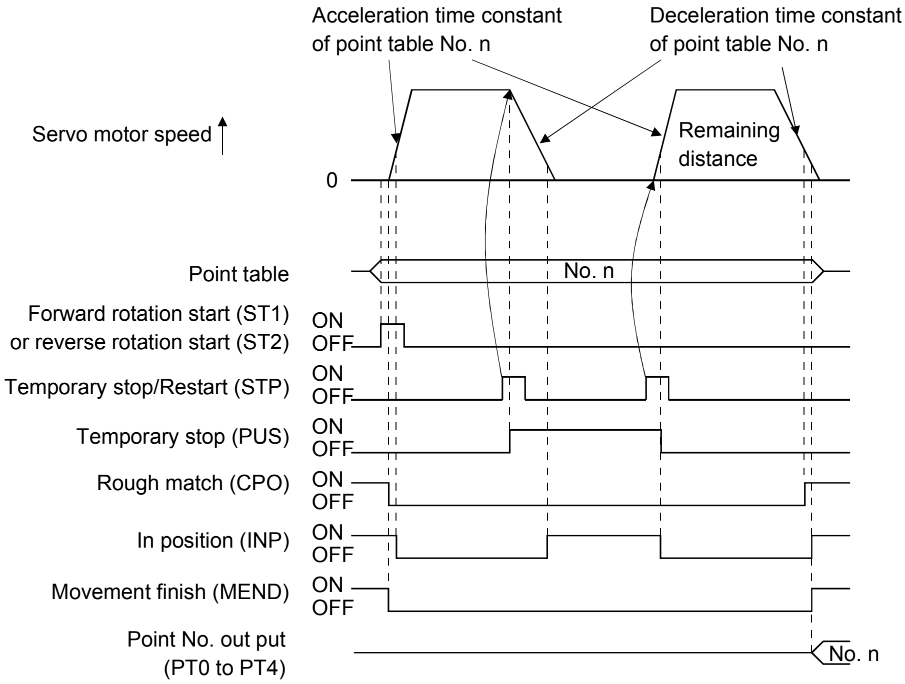
When STP-SG are connected during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When STP-SG are connected again, the remaining distance is executed.

If the forward/reverse rotation start signal is ignored if it is switched on during a temporary stop.

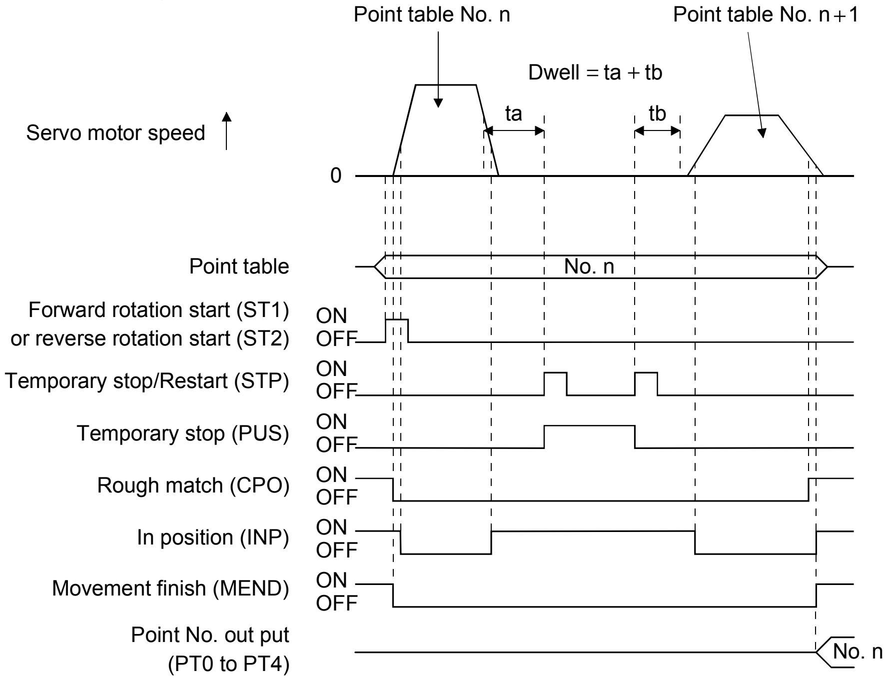
The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

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

(a) When the servo motor is rotating



(b) During dwell



4.3 Manual operation mode

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

4.3.1 Jog operation

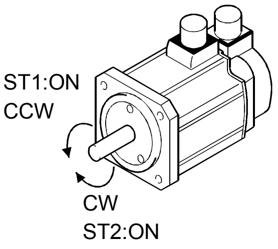
(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 5 (DI0 to DI4) are invalid.

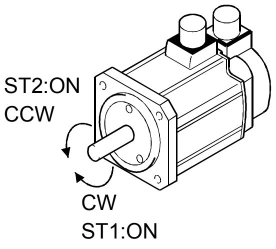
Item	Setting method	Description
Manual operation mode selection	Automatic/manual selection (MD0)	Open MD0-SG (OFF).
Servo motor rotation direction	Parameter No.1	Refer to (2) of this section.
Jog speed	Parameter No.13	Set the speed of the servo motor.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constants in point table No.1.

(2) Servo motor rotation direction

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



Parameter No. 1 □□□0

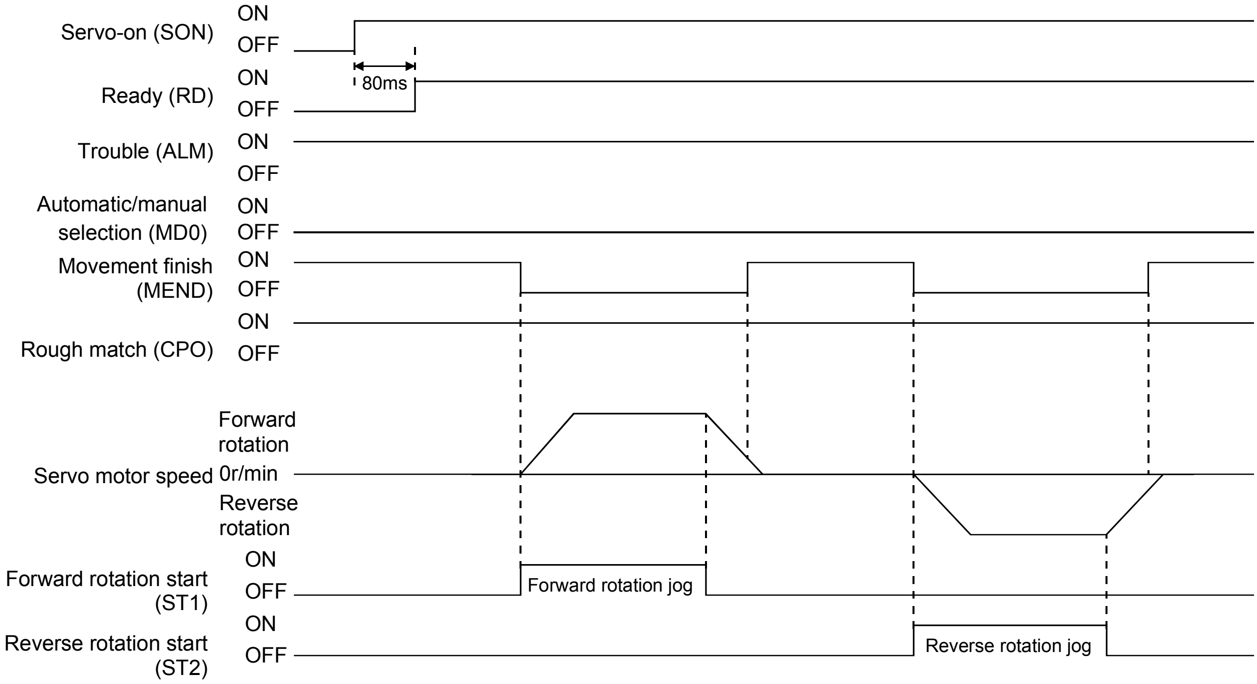


Parameter No. 1 □□□1

(3) Operation

By shorting ST1-SG, 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 shorting ST2-SG, the servo motor rotates in the reverse direction to forward rotation start (ST1).

(4) Timing chart



4.3.2 Manual pulse generator operation

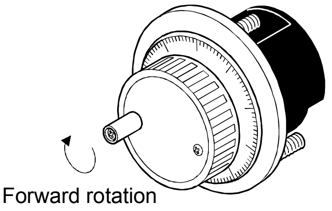
(1) Setting

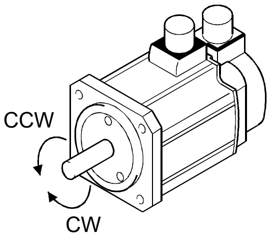
Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 5 (DI0 to DI4) are invalid.

Item	Setting method	Description
Manual operation mode selection	Automatic/manual selection (MD0)	Open MD0-SG (OFF).
Manual pulse generator multiplication	Parameter No.1	Set the multiplication ratio of servo motor rotation to the pulses generated by the manual pulse generator. For more information, refer to (3) of this section.
Servo motor rotation direction	Parameter No.1	Refer to (2) of this section.

(2) Servo motor rotation direction

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





(3) Manual pulse generator multiplication

(a) Using the parameter for setting

Use parameter No.1 to set the multiplication ratio of the servo motor rotation to the manual pulse generator rotation.

Parameter No. 1 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

Set the pulse generator multiplication 1 (TP0) and pulse generator multiplication 2 (TP1) to the input signals in "Device setting" on the MR Configurator (servo configuration software) (refer to chapter 6).

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

Note. 0: Open across TP1/TP0-SG

1: Shorted across TP1/TP0-SG

(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.

4.4 Manual home position return mode

4.4.1 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) Manual 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	The position reached after any automatic motion 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.	

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 parameter No.8 as follows.

Parameter No. 8

0 □ □ □

Home position return method ······························ 1)
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

Home position return direction ······························ 2)
0: Address increment direction
1: Address decrement direction

Proximity dog input polarity ······························ 3)
0: Dog is detected when DOG-SG are opened.
1: Dog is detected when DOG-SG are shorted.

1) Choose the home position return method.
2) Choose the starting direction of home position return. 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.
3) Choose the polarity at which the proximity dog is detected. Set "0" to detect the dog when the proximity dog device (across DOG-SG) is opened, or "1" to detect the dog when the device is shorted.

(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.

4.4.2 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 signals and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short MD0-SG (ON).
	Point table No. selection 1 (DI0)	Open DI0-SG (OFF).
	Point table No. selection 2 (DI1)	Open DI1-SG (OFF).
Dog type home position return	Parameter No.8	□□□0 :Dog type home position return is selected.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.8	Refer to section 4.4.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.9	Set speed until detection of dog.
Creep speed	Parameter No.10	Set speed after detection of dog.
Home position shift distance	Parameter No.11	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.42	Use to set the current position on completion of home position return.

(2) Length of proximity dog

To ensure that the Z-phase signal of the servo motor is generated during detection of the proximity dog (DOG), the proximity dog should have the length which satisfies formulas (4.2) and (4.3).

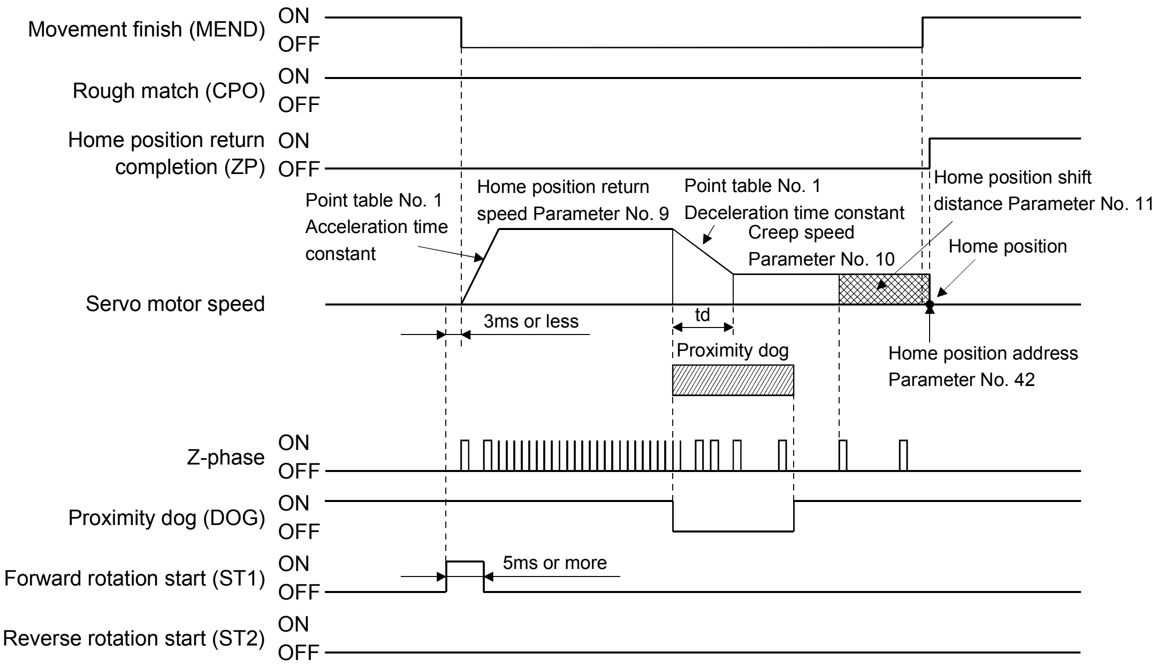
$$L_1 \geq \frac{V}{60} \cdot \frac{td}{2} \quad \text{.......} \quad (4.2)$$

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

$$L_2 \geq 2 \cdot \Delta S \quad \text{.......} \quad (4.3)$$

L_2 : Proximity dog length [mm]
ΔS : Moving distance per servo motor revolution [mm]

(3) Timing chart

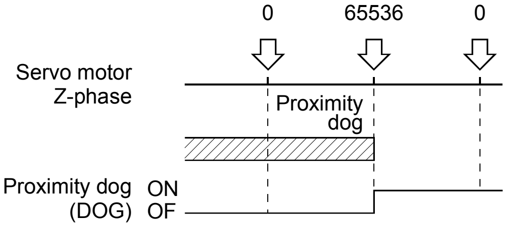


The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

(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".



4.4.3 Count type home position return

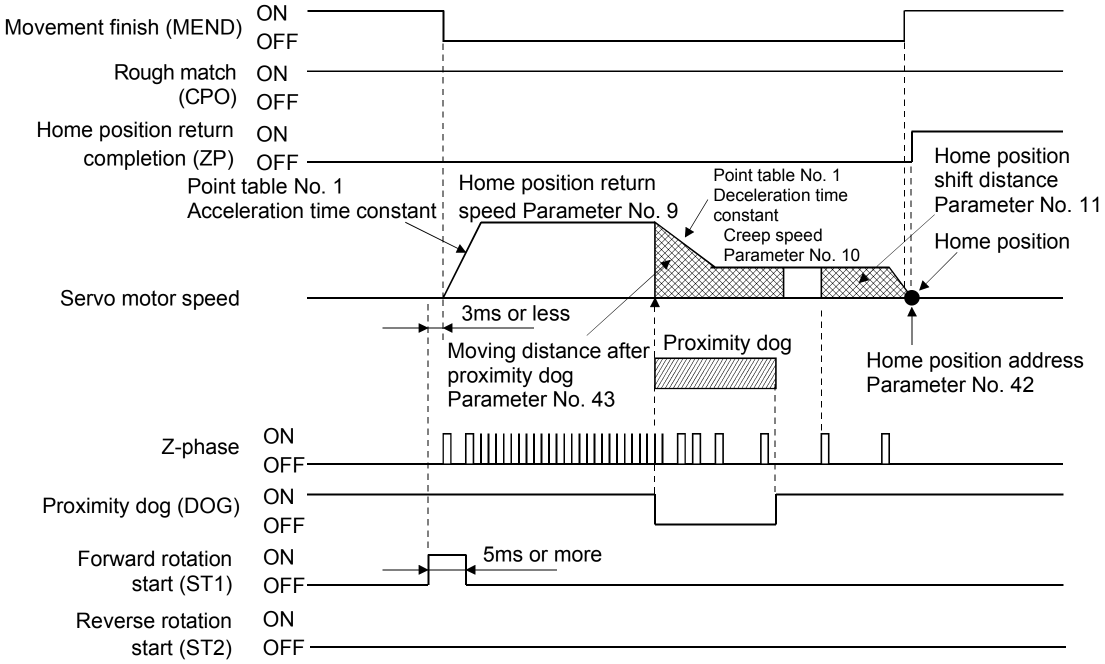
In count type home position return, a motion is made over the distance set in parameter No.43 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the proximity dog (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 signals and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short MD0-SG (ON).
	Point table No. selection 1 (DI0)	Open DI0-SG (OFF).
	Point table No. selection 2 (DI1)	Open DI1-SG (OFF).
Count type home position return	Parameter No.8	□□□1 : Count type home position return is selected.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.8	Refer to section 4.4.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.9	Set speed until detection of dog.
Creep speed	Parameter No.10	Set speed after detection of dog.
Home position shift distance	Parameter No.11	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.43	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.42	Use to set the current position on completion of home position return.

(2) Timing chart



The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.4 Data setting type home position return

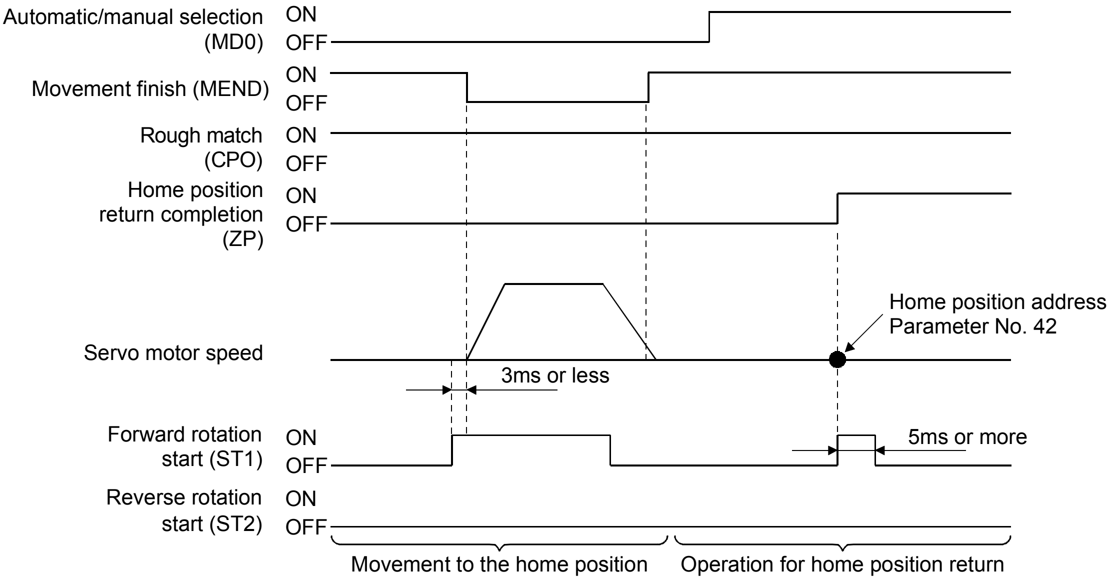
Data setting type home position return is used when it is desired to determine any position as a home position. JOG operation, manual pulse generator operation or like can be used for movement.

(1) Signals, parameters

Set the input signals and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short MD0-SG (ON).
	Point table No. selection 1 (DI0)	Open DI0-SG (OFF).
	Point table No. selection 2 (DI1)	Open DI1-SG (OFF).
Data setting type home position return	Parameter No.8	□□□2 : Data setting type home position return is selected.
Home position return position data	Parameter No.42	Use to set the current position on completion of home position return.

(2) Timing chart



The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.5 Stopper type home position return

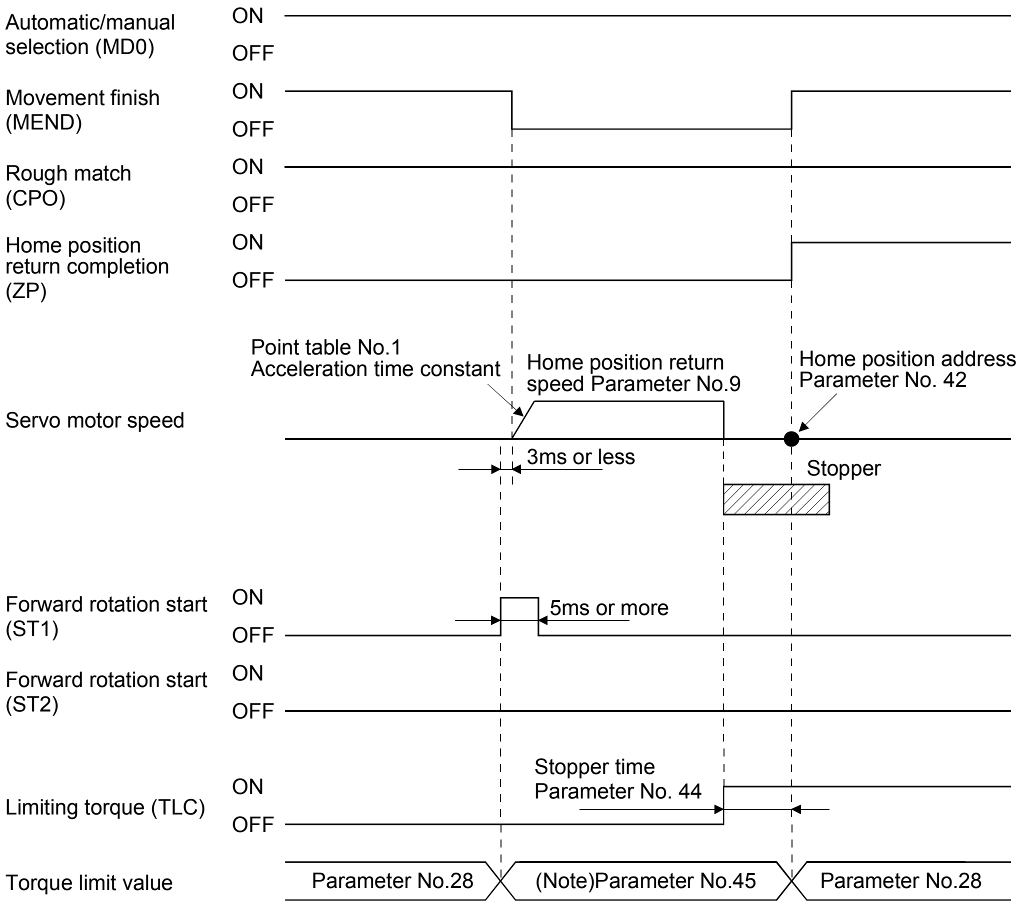
In stopper type home position return, a machine part is pressed against a stopper or the like by jog operation, manual pulse generator operation or the like to make a home position return and that position is defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short MD0-SG (ON).
	Point table No. selection 1 (DI0)	Open DI0-SG (OFF).
	Point table No. selection 2 (DI1)	Open DI1-SG (OFF).
Stopper type home position return	Parameter No.8	□□□3 : Stopper type home position return is selected.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and choose the home position return direction.
Home position return speed	Parameter No.9	Set the speed till contact with the stopper.
Stopper time	Parameter No.44	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.45	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.42	Use to set the current position on completion of home position return.

(2) Timing chart



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

(Note) I/O devices		Limit value status	Torque limit to be enabled
TL1	TL		
0	0		Parameter No.45
0	1	TLA □ Parameter No.45	Parameter No.45
		TLA □ Parameter No.45	TLA
1	0	Parameter No.29 □ Parameter No.45	Parameter No.45
		Parameter No.29 □ Parameter No.45	Parameter No.45
1	1	TLA □ Parameter No.45	Parameter No.45
		TLA □ Parameter No.45	TLA

Note. 0: OFF
1: ON

The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

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

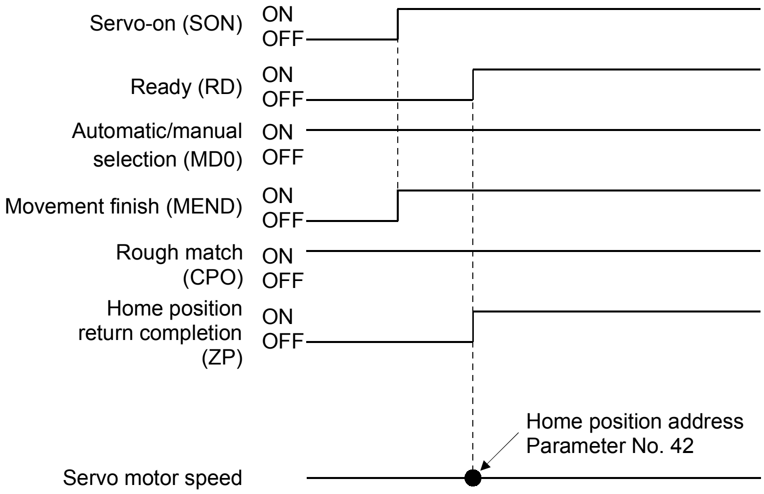
The position where servo is switched on is defined as a home position.

(1) Signals, parameter

Set the input signals and parameter as follows.

Item	Device/Parameter used	Description
Home position ignorance	Parameter No.8	□□□4 : Home position ignorance is selected.
Home position return position data	Parameter No.42	Use to set the current position on completion of home position return.

(2) Timing chart



The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.7 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 ±200 pulses will occur in the home position. The error of the home position is larger as the creep speed is higher.

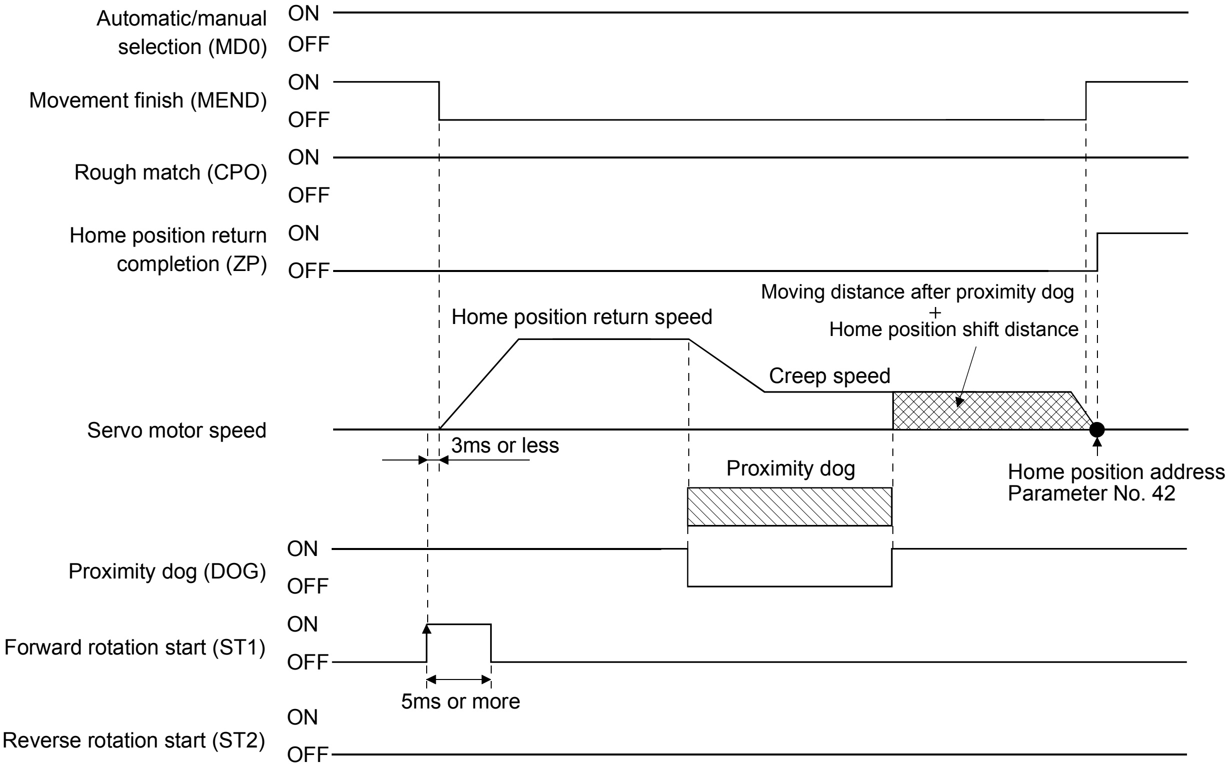
The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance after it passed the rear end is defined as a home position. A home position return that does not depend on the Z-phase signal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

(1) Signals, parameters

Set the input signals and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short (turn on) MD0-SG.
	Point table No. selection 1 (DI0)	Open (turn off) DI0-SG.
	Point table No. selection 2 (DI1)	Open (turn off) DI1-SG.
Dog type rear end reference home position return	Parameter No.8	□□□5: Select the dog type rear end reference.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.8	Refer to section 4.4.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.9	Set the speed till the dog is detected.
Creep speed	Parameter No.10	Set the speed after the dog is detected.
Home position shift distance	Parameter No.11	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.43	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.42	Use to set the current position on completion of home position return.

(2) Timing chart



The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.8 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 ±200 pulses will occur in the home position. The error of the home position is larger as the home position return speed is higher.

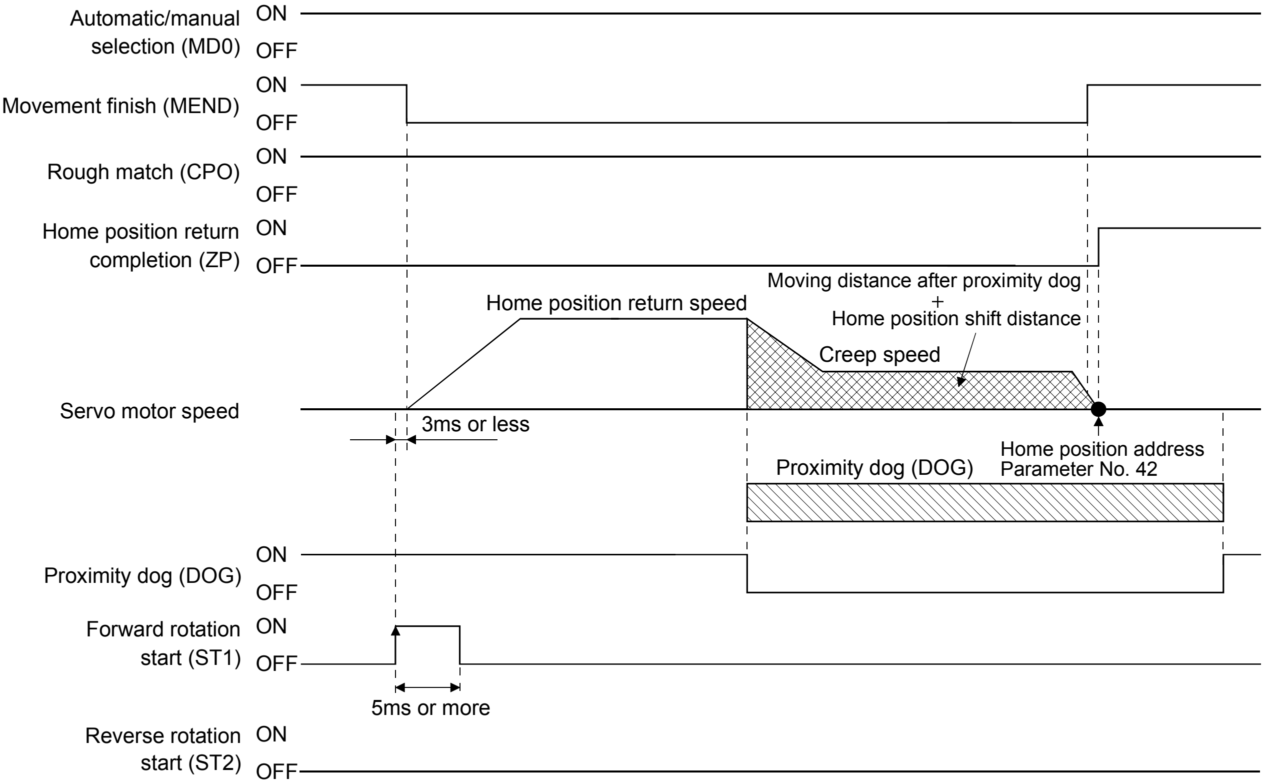
The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance is defined as a home position. A home position return that does not depend on the Z-phase signal can be made. The home position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

(1) Signals, parameters

Set the input signals and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short (turn on) MD0-SG.
	Point table No. selection 1 (DI0)	Open (turn off) DI0-SG.
	Point table No. selection 2 (DI1)	Open (turn off) DI1-SG.
Count type dog front end reference home position return	Parameter No.8	□□□6: Select the count type dog front end reference.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.8	Refer to section 4.4.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.9	Set the speed till the dog is detected.
Creep speed	Parameter No.10	Set the speed after the dog is detected.
Home position shift distance	Parameter No.11	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.43	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.42	Use to set the current position on completion of home position return.

(2) Timing chart



The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.9 Dog cradle type home position return

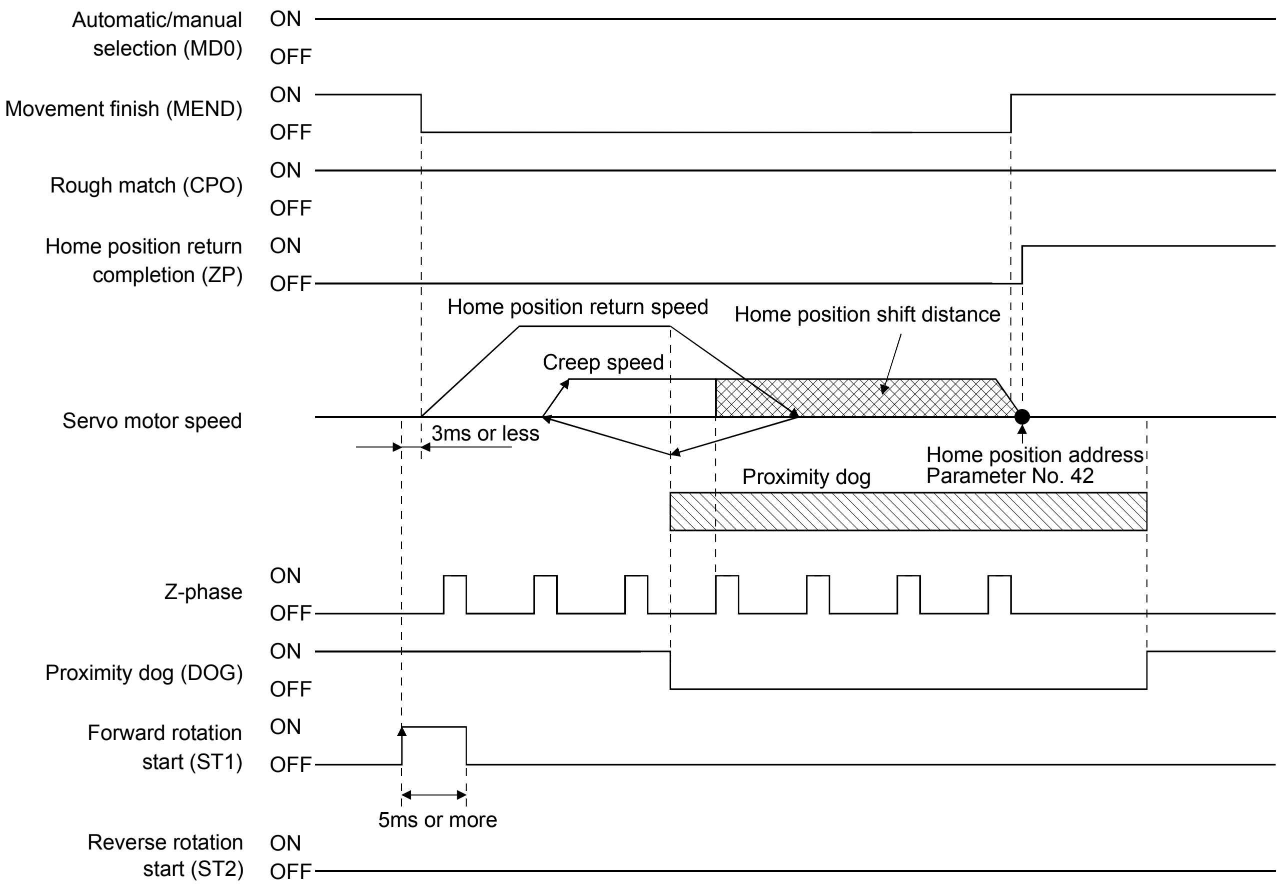
The position where the first Z-phase signal is issued after detection of the proximity dog front end can be defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short (turn on) MD0-SG.
	Point table No. selection 1 (DI0)	Open (turn off) DI0-SG.
	Point table No. selection 2 (DI1)	Open (turn off) DI1-SG.
Dog cradle type home position return	Parameter No.8	□□□7: Select the dog cradle type.
Home position return direction	Parameter No.8	Refer to section 4.4.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.8	Refer to section 4.4.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.9	Set the speed till the dog is detected.
Creep speed	Parameter No.10	Set the speed after the dog is detected.
Home position shift distance	Parameter No.11	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.42	Use to set the current position on completion of home position return.

(2) Timing chart



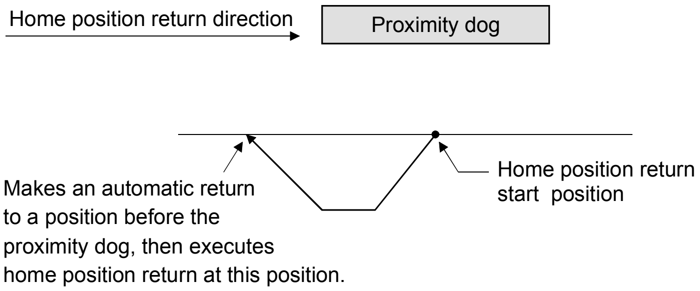
The parameter No.42 (home position return position data) setting value is the positioning address after the home position return is completed.

4.4.10 Home position return automatic return function

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

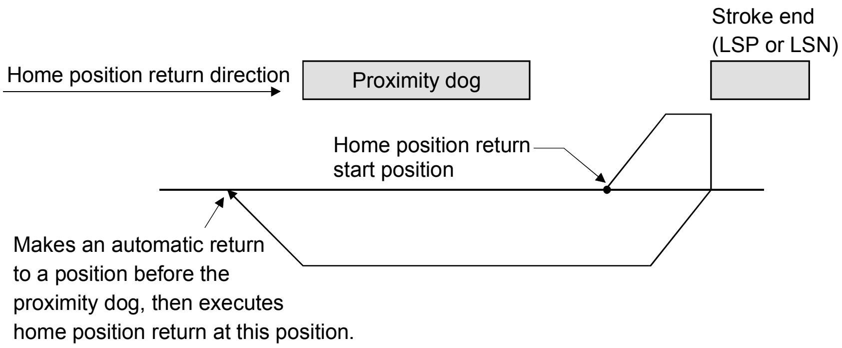
(1) When the current position is at the proximity dog

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



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

At a start, a motion is made in the home position return direction and an automatic return is made on detection of the stroke end (LSP or LSN). The motion stops past the front end of the proximity dog, and home position return is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the opposite LSP or LSN and home position return incomplete warning (AL. 90) occurs.



Software limit cannot be used with these functions.

4.4.11 Automatic positioning function to the home position

POINT

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

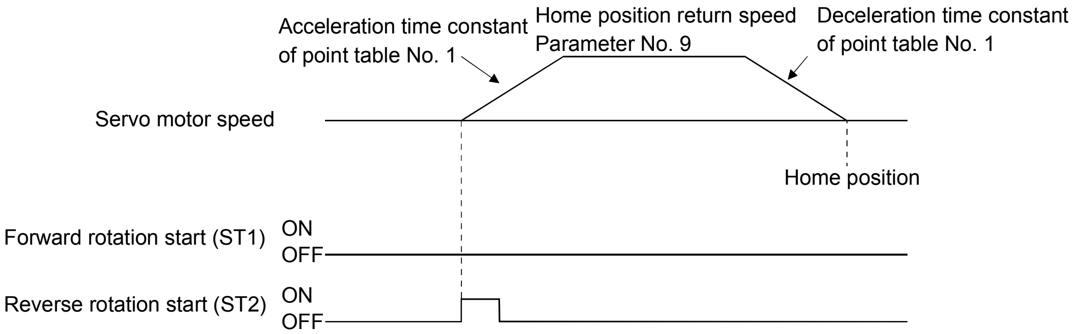
If this function is used when returning to the home position again after performing a manual home position return after a power-on and deciding the home position, automatic positioning can be carried out to the home position at high speed. In an absolute position system, manual home position return is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

Please perform a manual home position return beforehand after a power-on.

Set the input signals and parameter as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (MD0)	Short MD0-SG (ON).
	Point table No. selection 1 (DI0)	Open DI0-SG (OFF).
	Point table No. selection 2 (DI1)	Open DI1-SG (OFF).
Home position return speed	Parameter No.9	Speed is set up.
Home position return acceleration time constant	Point table No.1	Use the acceleration 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.9. Use the data of point table No.1 to set the acceleration time constant and deceleration time constant. When reverse rotation start (ST2) is ON, it will position automatically at the home position.



4.5 Absolute position detection system

⚠CAUTION

- If an absolute position erase alarm (AL.25) or an absolute position counter warning (AL.E3) has occurred, always perform home position setting again. Not doing so can cause runaway.

POINT

- When the following parameters are changed, the home position is lost when turning on the power after the change. Execute the home position return again when turning on the power.
  - First digit of parameter No.1 (ST1 coordinate system selection)
  - Parameter No. 4 (Electronic gear numerator)
  - Parameter No. 5 (Electronic gear denominator)
  - Parameter No. 42 (Home position return position data)

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

(1) Restrictions

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

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

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

(2) Specifications

Item	Description
System	Electronic battery backup system
Battery	1 piece of lithium battery (primary battery, nominal + 3.6V) Type: MR-BAT or A6BAT
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	500r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
(Note 3) Data holding time during battery replacement	2 hours at delivery, 1 hour in 5 years after delivery
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. Period during which data can be held by the super capacitor in the encoder after power-off, with the battery voltage low or the battery removed, or during which data can be held with the encoder cable disconnected.
Battery replacement should be finished within this period.

(3) Structure

Component	Description
Servo amplifier	Use standard models.
Servo motor	
Battery	MR-BAT or A6BAT
Encoder cable	Use a standard model. When fabricating, refer to (2), section 14.1.4.

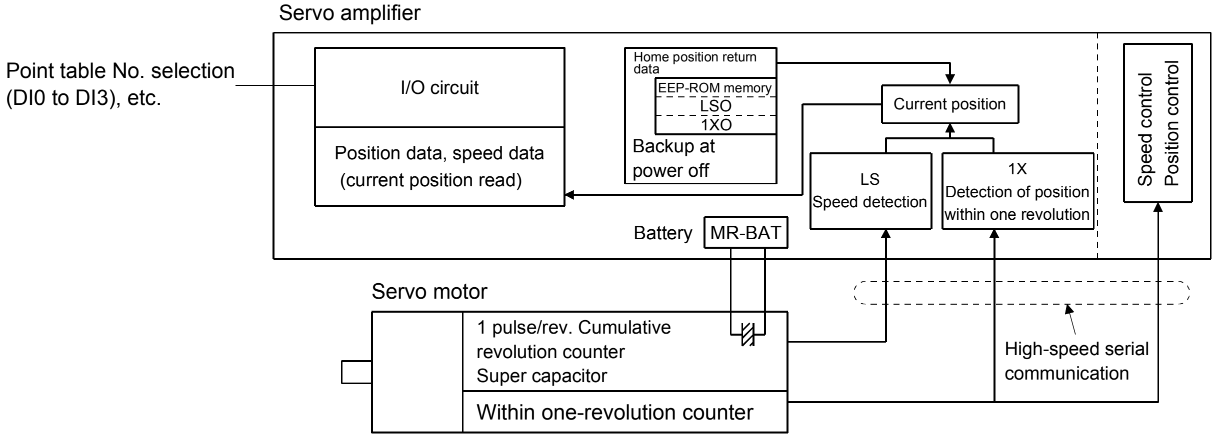
(4) Outline of absolute position detection data communication

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.

Also, the absolute position data, which is battery-backed by the super capacitor in the encoder, can be retained within the specified period (cumulative revolution counter value retaining time) if the cable is unplugged or broken.



(5) Battery installation procedure

⚠ WARNING

- Before installing a battery, turn off the main circuit power while keeping the control circuit power on. Wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P and N is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not.

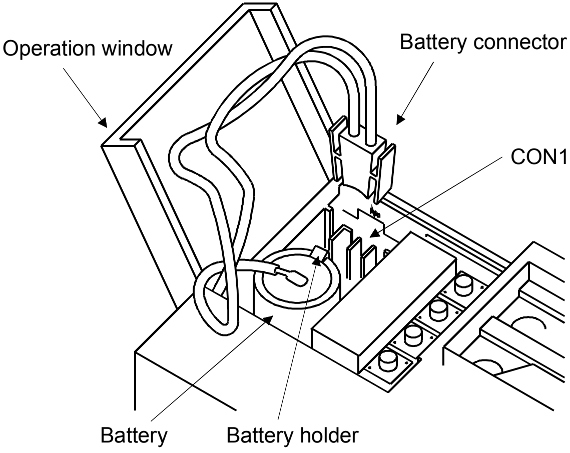
POINT

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

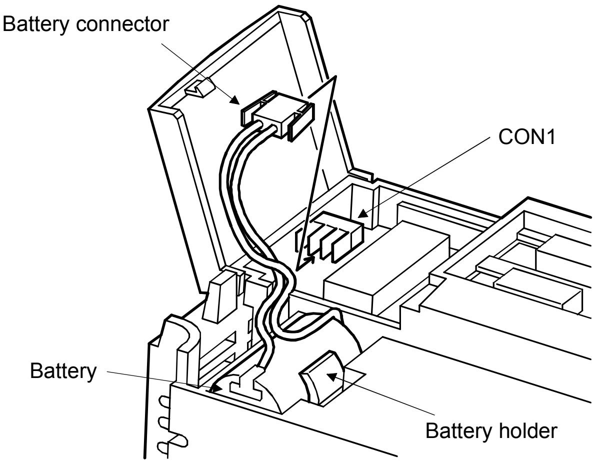
  Always take the following precautions.

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

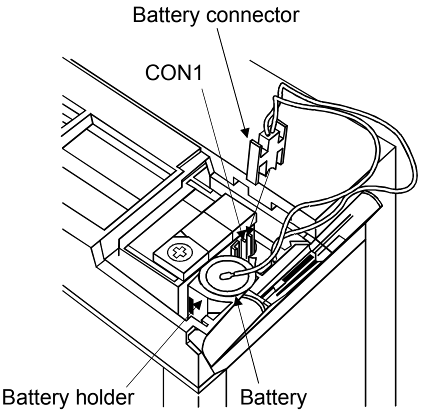
1) Open the operation window. (When the model used is the MR-J2S-200CP・MR-J2S-350CP or more, also remove the front cover.)
2) Install the battery in the battery holder.
3) Install the battery connector into CON1 until it clicks.



For MR-J2S-100CP or less



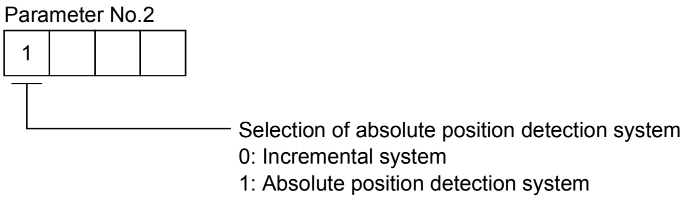
For MR-J2S-200CP・MR-J2S-350CP



For MR-J2S-500CP・MR-J2S-700CP

(6) Parameter setting

Set parameter No.2 (Function selection 1) as indicated below to make the absolute position detection system valid.



4.6 Serial communication operation

The RS-422 or RS-232C communication function may be used to operate the servo amplifier from a command device (controller) such as a personal computer. Positioning operation can be performed with the positioning operation/position specified by selection of the point tables. Note that the RS-422 and RS-232C communication functions cannot be used at the same time.

This section provides a data transfer procedure. Refer to chapter 15 for full information on the connection and transferred data between the controller and servo amplifier.

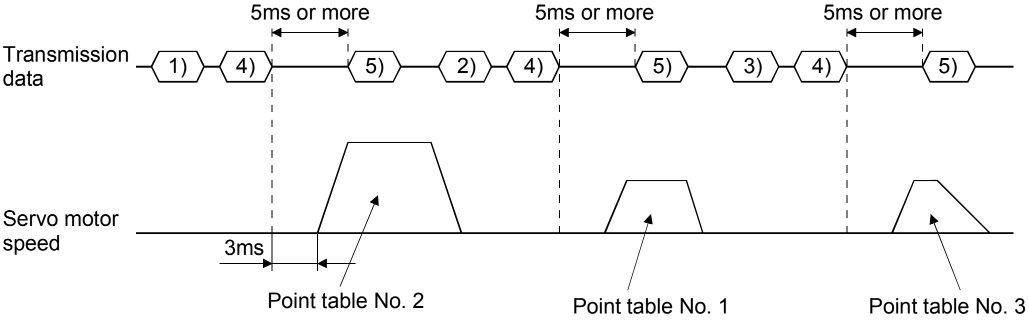
4.6.1 Positioning operation in accordance with point tables

By selecting the point table No. and switching on the forward rotation start (ST1) or reverse rotation start (ST2) using the communication function, positioning operation in accordance with point tables can be started.

(1) Selection of point tables

Using the device forced output from the controller (command [9][2], data No. [6][0]), choose point tables from among No.1 to 31.

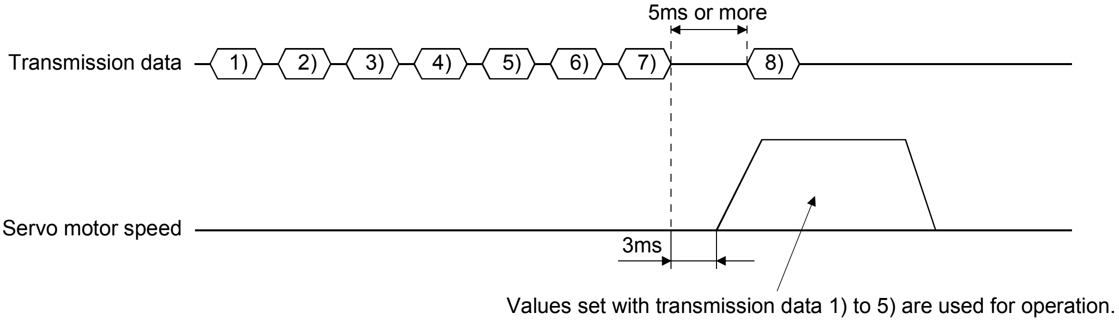
(2) Timing chart



No.	Transmission data	Command	Data No.
1)	Point table No.2 selection	[9] [2]	[6] [0]
2)	Point table No.1 selection	[9] [2]	[6] [0]
3)	Point table No.3 selection	[9] [2]	[6] [0]
4)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
5)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]

4.6.2 Positioning operation

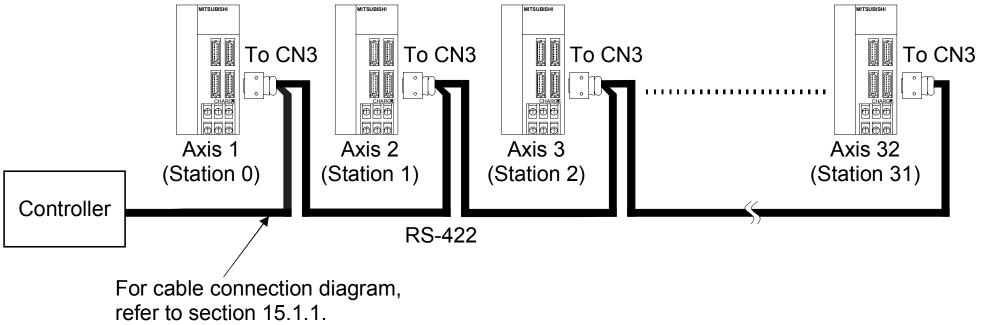
Positioning operation can be performed by changing the point table settings and making a start. For example, positioning operation can be performed by writing the data of point table No.1, then specifying point table No.1, and making a start.
For transmission data details, refer to chapter 15.



No.	Transmission data	Command	Data No.
1)	Point table No.1 position data write	[C] [0]	[0] [1]
2)	Point table No.1 speed	[C] [6]	[0] [1]
3)	Point table No.1 acceleration time constant	[C] [7]	[0] [1]
4)	Point table No.1 deceleration time constant	[C] [8]	[0] [1]
5)	Point table No.1 auxiliary function	[C] [B]	[0] [1]
6)	Point table No.1 selection	[9] [2]	[6] [0]
7)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
8)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]

4.6.3 Multidrop system

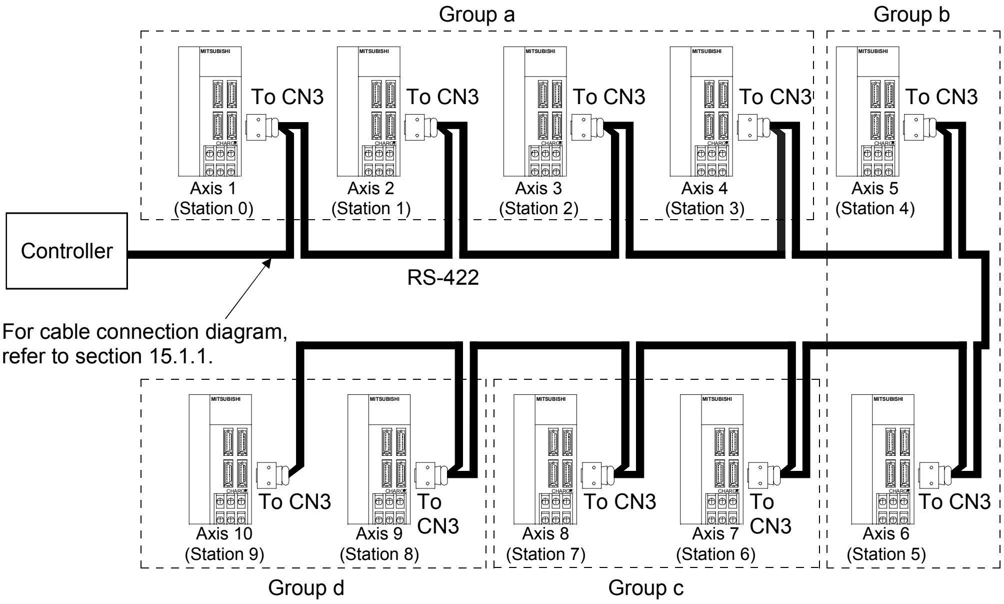
The RS-422 communication function can be used to operate several servo amplifiers on the same bus. In this case, set the station numbers to the servo amplifiers to determine the destination servo amplifier of the currently transmitted data. Use parameter No.15 to set the station numbers.
Always set one station number to one servo amplifier. Normal communication cannot be made if one station number is set to two or more servo amplifiers. When using one command to operate several servo amplifiers, use the group designation function described in section 4.6.4.



4.6.4 Group designation

When using several servo amplifiers, command-driven parameter settings, etc. can be made on a group basis.
You can set up to six groups, a to f. Set the group to each station using the communication command.

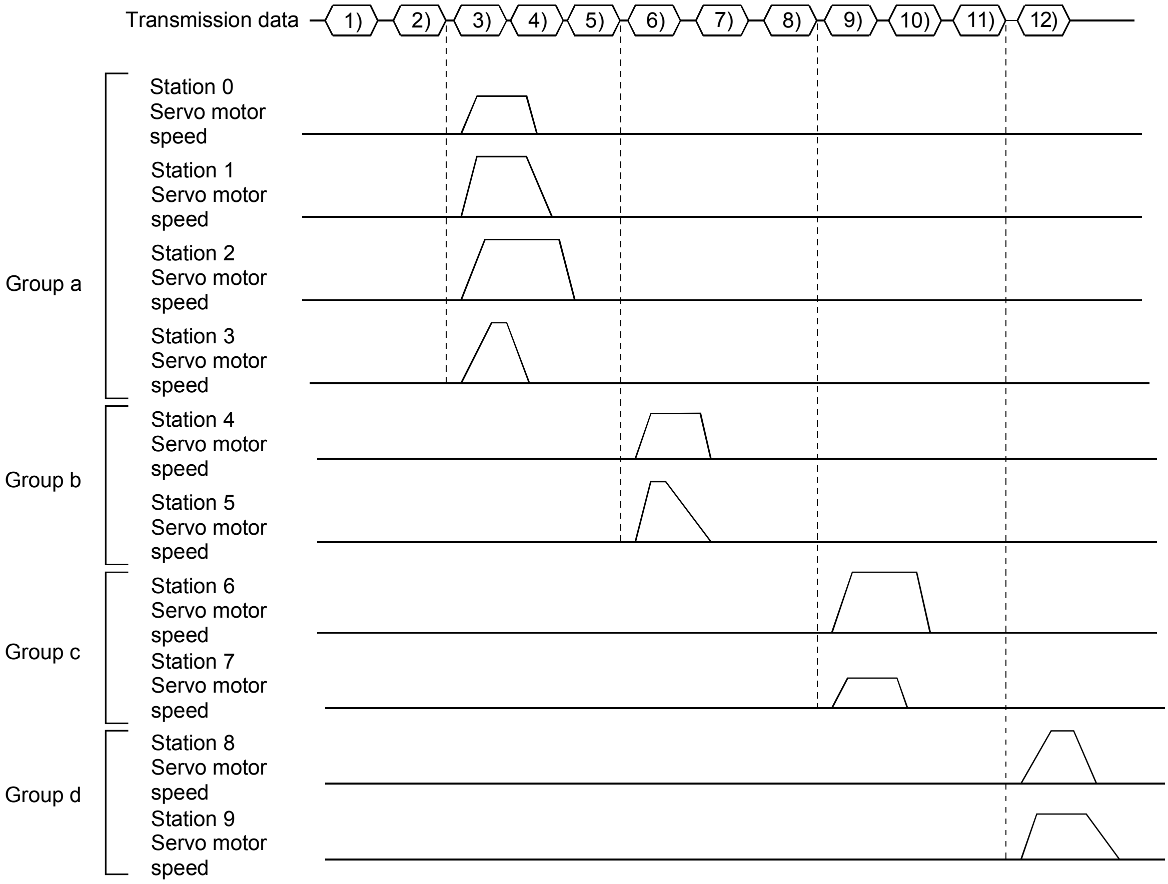
(1) Group setting example



Servo amplifier station No.	Group setting
Station 0	a
Station 1	
Station 2	
Station 3	
Station 4	b
Station 5	
Station 6	c
Station 7	
Station 8	d
Station 9	

(2) Timing chart

In the following timing chart, operation is performed group-by-group in accordance with the values set in point table No.1.



No.	Transmission data	Command	Data No.
1)	Selection of point table No.1 of group a	[9] [2]	[6] [0]
2)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
3)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]
4)	Selection of point table No.1 of group b	[9] [2]	[6] [0]
5)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
6)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]
7)	Selection of point table No.1 of group c	[9] [2]	[6] [0]
8)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
9)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]
10)	Selection of point table No.1 of group d	[9] [2]	[6] [0]
11)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
12)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]

In addition, parameter values common to the stations of each group can be written and alarm reset can be made, for example.

(3) Group setting instructions

Only one servo amplifier may send a reply in any group. If two or more servo amplifiers send reply data at the same time, they may become faulty.

5. PARAMETERS

⚠ **CAUTION**

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

5.1 Parameter list

5.1.1 Parameter write inhibit

POINT

- Set "000E" when using the MR Configurator (servo configuration software) to make device setting.
- After setting the parameter No.19 value, switch power off, then on to make that setting valid.

In the servo amplifier, its parameters are classified into the basic parameters (No.0 to 19), expansion parameters 1 (No.20 to 53), expansion parameters 2 (No.54 to 77) and special parameters (No.78 to 90) according to their safety aspects and frequencies of use. In the factory setting condition, the customer can change the basic parameter values but cannot change the expansion parameter 1,2 values and special parameter values. When fine adjustment, e.g. gain adjustment, is required, change the parameter No.19 setting to make the expansion parameters write-enabled.
The following table lists the parameters whose values are made valid for reference/write by setting parameter No. 19. Operation can be performed for the parameters marked ○.

Parameter No.19 setting	Operation	Basic parameters No.0 to No.19	Expansion parameters 1 No.20 to No.53	Expansion parameters 2 No.54 to No.77 special parameters (No.78 to 90)
0000 (initial value)	Reference	○		
	Write	○		
000A	Reference	No.19 only		
	Write	No.19 only		
000B	Reference	○	○	
	Write	○		
000C	Reference	○	○	
	Write	○	○	
000E	Reference	○	○	○
	Write	○	○	○

5.1.2 List

POINT

- The parameters marked * before their symbols are made valid by switching power off once and then switching it on again after parameter setting.

Refer to the corresponding reference items for details of the parameters.

(1) Item list

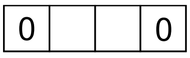
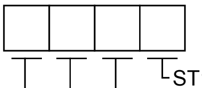
Class	No.	Symbol	Name and Function	Initial value	Unit	Customer setting
Basic parameters	0	*STY	Command system/regenerative option selection	0000		
	1	*FTY	Feeding function selection	0000		
	2	*OP1	Function selection 1	0002		
	3	ATU	Auto tuning	0105		
	4	*CMX	Electronic gear numerator	1		
	5	*CDV	Electronic gear denominator	1		
	6	INP	In-position range	100	pulse	
	7	PG1	Position control gain 1	35	rad/s	
	8	*ZTY	Home position return type	0010		
	9	ZRF	Home position return speed	500	r/min	
	10	CRF	Creep speed	10	r/min	
	11	ZST	Home position shift distance	0	μm	
	12	CRP	Rough match output range	0	$\times 10^{\mathrm{STM}}$μm	
	13	JOG	Jog speed	100	r/min	
	14	*STC	S-pattern acceleration/deceleration time constant	0	ms	
	15	*SNO	Station number setting	0	station	
	16	*BPS	Communication baud rate selection, alarm history clear	0000		
	17	MOD	Analog monitor output	0100		
	18	*DMD	Status display selection	0000		
	19	*BLK	Parameter write inhibit	0000		

Class	No.	Symbol	Name and Function	Initial value	Unit	Customer setting
Expansion parameters 1	20	*OP2	Function selection 2	0000		
	21		For manufacturer setting	0002		
	22	*OP4	Function selection 4	0000		
	23	SIC	Serial communications time-out selection	0		
	24	FFC	Feed forward gain	0	%	
	25	VCO	Override offset	0	mV	
	26	TLO	Torque limit offset	0	mV	
	27	*ENR	Encoder output pulses	4000	pulse/rev	
	28	TL1	Internal torque limit 1	100	%	
	29	TL2	Internal torque limit 2	100	%	
	30	*BKC	Backlash compensation	0	pulse	
	31	MO1	Analog monitor 1 offset	0	mV	
	32	MO2	Analog monitor 2 offset	0	mV	
	33	MBR	Electromagnetic brake sequence output	100	ms	
	34	GD2	Ratio of load inertia moment to Servo motor inertia moment	70	0.1 times	
	35	PG2	Position control gain 2	35	rad/s	
	36	VG1	Speed control gain 1	177	rad/s	
	37	VG2	Speed control gain 2	817	rad/s	
	38	VIC	Speed integral compensation	48	ms	
	39	VDC	Speed differential compensation	980		
	40		For manufacturer setting	0		
	41			0		
	42	*ZPS	Home position return position data	0	×10^{STM}μm	
	43	DCT	Moving distance after proximity dog	1000	×10^{STM}μm	
	44	ZTM	Stopper type home position return stopper time	100	ms	
	45	ZTT	Stopper type home position return torque limit value	15	%	
	46	*LMP	Software limit +	0	×10^{STM}μm	
	47					
	48	*LMN	Software limit－	0	×10^{STM}μm	
	49					
	50	*LPP	Position range output address+	0	×10^{STM}μm	
	51					
	52	*LNP	Position range output address－	0	×10^{STM}μm	
	53					

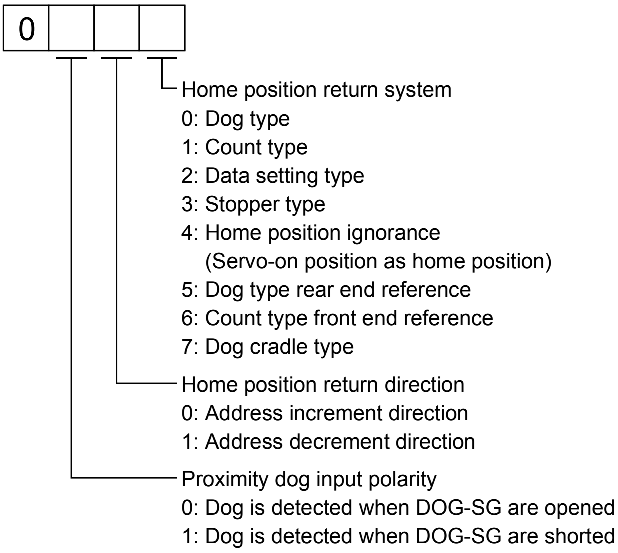
Class	No.	Symbol	Name and Function	Initial value	Unit	Customer setting
Expansion parameters 2	54		For manufacturer setting	0000		
	55	*OP6	Function selection 6	0000		
	56		For manufacturer setting	0000		
	57	*OP8	Function selection 8	0000		
	58	*OP9	Function selection 9	0000		
	59	*OPA	Function selection A	0000		
	60		For manufacturer setting	0000		
	61	NH1	Machine resonance suppression filter 1	0000		
	62	NH2	Machine resonance suppression filter 2	0000		
	63	LPF	Low-pass filter, adaptive vibration suppression control	0000		
	64	GD2B	Ratio of load inertia moment to Servo motor inertia moment 2	70	0.1 times	
	65	PG2B	Position control gain 2 changing ratio	100	%	
	66	VG2B	Speed control gain 2 changing ratio	100	%	
	67	VICB	Speed integral compensation changing ratio	100	%	
	68	*CDP	Gain changing selection	0000		
	69	CDS	Gain changing condition	10	(Note)	
	70	CDT	Gain changing time constant	1	ms	
	71		For manufacturer setting	100		
	72			10000		
	73			10		
	74			10		
	75			100		
	76			100		
	77			100		
Special parameters	78		For manufacturer setting	0000		
	79			0009		
	80			080A		
	81			0706		
	82			020B		
	83			0504		
	84			0002		
	85			0000		
	86			0005		
	87			0D04		
	88			0102		
	89			0		
	90			0		

Note. Depends on the parameter No. 68 setting.

(2) Detail list

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Basic parameters	0	*STY	Command system, regenerative option selection Used to select the command system and regenerative option.  Selection of command system (Refer to section 4.2) 0: Absolute value command system 1: Incremental value command system 2: Absolute value command/incremental value command specifying system Selection of regenerative option (Refer to section 14.1.1) 0: Not used (The built-in regenerative resistor is used. However, the MR-J2S-10CP does not have a built-in regenerative resistor and therefore cannot use it.) 1: FR-RC, FR-BU2 2: MR-RB032 3: MR-RB12 4: MR-RB32 5: MR-RB30 6: MR-RB50 (Cooling fan is required) 8: MR-RB31 9: MR-RB51 (Cooling fan is required) If the regenerative option selected is not for use with the servo amplifier, parameter error occurs	0000		Refer to Name and function column.
	1	*FTY	Feeding function selection Used to set the feed length multiplication factor and manual pulse generator multiplication factor.  ST1 coordinate system selection (Refer to section 4.2.2 to 4.2.4) 0: Address is incremented in CCW direction 1: Address is incremented in CW direction Feed length multiplication factor (STM) (Refer to section 4.2.2 to 4.2.4) 0: 1 time 1: 10 times 2: 100 times 3: 1000 times Manual pulse generator multiplication factor (Refer to section 4.3.2) 0: 1 time 1: 10 times 2: 100 times Servo-on (SON) -off, forced stop (EMG) -off follow-up for absolute value command in incremental system or absolute value command/ incremental value command specifying 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. Operation can be resumed when servo-on (SON) is turned on again or forced stop (EMG) is canceled.	0000		Refer to Name and function column.

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td rowspan="2">Basic parameters</td><td>2</td><td>*OP1</td><td>Function selection 1
Used to select the input filter and absolute position detection system.
<table><tr><td></td><td>0</td><td>0</td><td></td></tr></table>
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]
Selection of absolute position detection system
(Refer to section 4.5)
0: Incremental system
1: Absolute position detection system</td><td>0002</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>3</td><td>ATU</td><td>Auto tuning
Used to selection the response level, etc. for execution of auto tuning.
(Refer to chapter 7)
<table><tr><td>0</td><td></td><td>0</td><td></td></tr></table>
Auto tuning response level setting
<table>
<tr><th>Set value</th><th>Response level</th><th>Machine resonance frequency guideline</th></tr>
<tr><td>1</td><td>Low response</td><td>15Hz</td></tr>
<tr><td>2</td><td></td><td>20Hz</td></tr>
<tr><td>3</td><td>↑</td><td>25Hz</td></tr>
<tr><td>4</td><td></td><td>30Hz</td></tr>
<tr><td>5</td><td></td><td>35Hz</td></tr>
<tr><td>6</td><td>↓</td><td>45Hz</td></tr>
<tr><td>7</td><td>Middle response</td><td>55Hz</td></tr>
<tr><td>8</td><td></td><td>70Hz</td></tr>
<tr><td>9</td><td>↑</td><td>85Hz</td></tr>
<tr><td>A</td><td></td><td>105Hz</td></tr>
<tr><td>B</td><td></td><td>130Hz</td></tr>
<tr><td>C</td><td></td><td>160Hz</td></tr>
<tr><td>D</td><td>↓</td><td>200Hz</td></tr>
<tr><td>E</td><td>High response</td><td>240Hz</td></tr>
<tr><td>F</td><td></td><td>300Hz</td></tr>
</table>
・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.
Gain adjustment mode selection
(For more information, refer to section 8.1.1.)
<table>
<tr><th>Set value</th><th>Gain adjustment mode</th><th>Description</th></tr>
<tr><td>0</td><td>Interpolation mode</td><td>Fixes position control gain 1 (parameter No. 6).</td></tr>
<tr><td>1</td><td>Auto tuning mode 1</td><td>Ordinary auto tuning.</td></tr>
<tr><td>2</td><td>Auto tuning mode 2</td><td>Fixes the load inertia moment ratio set in parameter No. 34.
Response level setting can be changed.</td></tr>
<tr><td>3</td><td>Manual mode 1</td><td>Simple manual adjustment.</td></tr>
<tr><td>4</td><td>Manual mode 2</td><td>Manual adjustment of all gains.</td></tr>
</table></td><td>0105</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Basic parameters	4	*CMX	Electronic gear numerator Set the value of electronic gear numerator. Setting "0" automatically sets the resolution of the servo motor connected. (Refer to section 5.2.1)	1		0 to 65535
	5	*CDV	Electronic gear denominator Set the value of electronic gear denominator. (Refer to section 5.2.1)	1		1 to 65535
	6	INP	In-position range Used to set the droop pulse range when the in-position (INP) is output.	100	μm	0 to 10000
	7	PG1	Position control gain 1 Used to set the gain of position loop 1. (Refer to chapter 8) Increase the gain to improve tracking performance in response to the position command.	36	rad/s	4 to 1000
	8	*ZTY	Home position return type Used to set the home position return system, home position return direction and proximity dog input polarity.  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 Home position return direction 0: Address increment direction 1: Address decrement direction Proximity dog input polarity 0: Dog is detected when DOG-SG are opened 1: Dog is detected when DOG-SG are shorted	0010		Refer to Name and function column.
	9	ZRF	Home position return speed Used to set the servo motor speed for home position return. (Refer to section 4.4)	500	r/min	0 to permissible speed
	10	CRF	Creep speed Used to set the creep speed after proximity dog detection. (Refer to section 4.4)	10	r/min	0 to permissible speed
	11	ZST	Home position shift distance Used to set the shift distance starting at the Z-phase pulse detection position inside the encoder.	0	μm	0 to 65535
	12	CRP	Rough match output range Used to set the command remaining distance range where the rough match (CPO) is output.	0	$\times 10^{STM}$ μm	0 to 65535
	13	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to permissible speed
	14	*STC	S-pattern acceleration/deceleration time constant Set when inserting S-pattern time constant into the acceleration/deceleration time constant of the point table. (Refer to section 5.2.3) This time constant is invalid for home position return.	0	ms	0 to 100
	15	*SNO	RS-422 station number setting Used to specify the station number for RS-422 multidrop communication. (Refer to section 4.6.3) 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

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Basic parameters</td><td>16</td><td>*BPS</td><td>Serial communication function selection, alarm history clear
Used to select the serial communication baud rate, select various communication conditions, and clear the alarm history.

Serial baud rate selection
(Refer to section 15.2.2)
0: 9600 [bps]
1: 19200[bps]
2: 38400[bps]
3: 57600[bps]
4: 4800[bps] (For MR-DP60)

Alarm history clear (Refer to section 5.2.6)
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).

Serial communication standard selection
(Refer to section 15.2.2)
0: RS-232C used
1: RS-422 used

Serial communication response delay time
(Refer to section 15.2.2)
0: Invalid
1: Valid, reply sent after delay time of 800μs or more</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td></td><td>17</td><td>MOD</td><td>Analog monitor output
Used to select the signals to be output to the analog monitor 1 (MO2) and analog monitor 2 (MO2). (Refer to section 5.2.4)

0 0
<table>
<tr><th>Setting</th><th>Analog monitor 2 (MO2)</th><th>Analog monitor 1 (MO1)</th></tr>
<tr><td>0</td><td colspan="2">Servo motor speed (±8V/max. speed)</td></tr>
<tr><td>1</td><td colspan="2">Torque (±8V/max. torque) (Note)</td></tr>
<tr><td>2</td><td colspan="2">Servo motor speed (+8V/max. speed)</td></tr>
<tr><td>3</td><td colspan="2">Torque (+8V/max. torque) (Note)</td></tr>
<tr><td>4</td><td colspan="2">Current command (±8V/max. current command)</td></tr>
<tr><td>5</td><td colspan="2">Command pulse frequency (±10V/500kpulse/s)</td></tr>
<tr><td>6</td><td colspan="2">Droop pulses (±10V/128 pulses)</td></tr>
<tr><td>7</td><td colspan="2">Droop pulses (±10V/2048 pulses)</td></tr>
<tr><td>8</td><td colspan="2">Droop pulses (±10V/8192 pulses)</td></tr>
<tr><td>9</td><td colspan="2">Droop pulses (±10V/32768 pulses)</td></tr>
<tr><td>A</td><td colspan="2">Droop pulses (±10V/131072 pulses)</td></tr>
<tr><td>B</td><td colspan="2">Bus voltage (+8V/400V)</td></tr>
</table>
Note. 8V is outputted at the maximum torque. However, when parameter No. 28・29 are set to limit torque, 8V is outputted at the torque highly limited.</td><td>0100</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

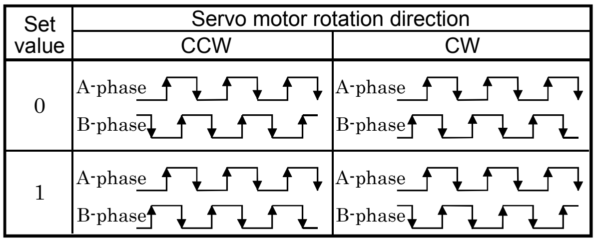
Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Basic parameters	18	*DMD	Status display selection Used to select the status display shown at power-on. (Refer to section 7.2) Status display on servo amplifier display at power-on 00: Current position (initial value) 01: Command position 02: Command remaining distance 03: Point table No. 04: Cumulative feedback pulses 05: Servo motor speed 06: Droop pulses 07: Override voltage 08: Analog torque limit voltage 09: Regenerative load ratio 0A: Effective load ratio 0B: Peak load ratio 0C: Instantaneous torque 0D: Within one-revolution position low 0E: Within one-revolution position high 0F: ABS counter 10: Load inertia moment ratio 11: Bus voltage Status display of MR-DP60 at power-on 00: Current position (initial value) 01: Command position 02: Command remaining distance 03: Point table No. 04: Cumulative feedback pulses 05: Servo motor speed 06: Droop pulses 07: Override voltage 08: Analog torque limit voltage 09: Regenerative load ratio 0A: Effective load ratio 0B: Peak load ratio 0C: Instantaneous torque 0D: Within one-revolution position 0E: ABS counter 0F: Load inertia moment ratio 10: Bus voltage	0000		Refer to Name and function column.

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Basic parameters</td><td>19</td><td>*BLK</td><td>Parameter write inhibit
Used to select the reference and write ranges of the parameters.
Operation can be performed for the parameters marked ○.
<table>
<tr><th>Set value</th><th>Operation</th><th>Basic parameters No.0 to 19</th><th>Expansion parameters 1 No.20 to 53</th><th>Expansion parameters 2 No.54 to 77 special parameters (No. 78 to 90)</th></tr>
<tr><td rowspan="2">0000 (initial value)</td><td>Reference</td><td>○</td><td></td><td></td></tr>
<tr><td>Write</td><td>○</td><td></td><td></td></tr>
<tr><td rowspan="2">000A</td><td>Reference</td><td>No.19 only</td><td></td><td></td></tr>
<tr><td>Write</td><td>No.19 only</td><td></td><td></td></tr>
<tr><td rowspan="2">000B</td><td>Reference</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>○</td><td></td><td></td></tr>
<tr><td rowspan="2">000C</td><td>Reference</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td></td></tr>
<tr><td rowspan="2">(Note) 000E</td><td>Reference</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Write</td><td>○</td><td>○</td><td>○</td></tr>
</table>
Note. Set this parameter when making device setting using the MR Configurator (servo configuration software).</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td rowspan="4">Expansion parameters 1</td><td>20</td><td>*OP2</td><td>Function selection 2
Used to select slight vibration suppression control.
<table><tr><td>0</td><td></td><td>0</td><td>0</td></tr></table>
Slight vibration suppression control selection
0: Invalid
1: Valid</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>21</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0002</td><td></td><td></td></tr>
<tr><td>22</td><td>*OP4</td><td>Function selection 4
Used to select stop processing at forward rotation stroke end (LSP), reverse rotation stroke end (LSN) off.
<table><tr><td>0</td><td>0</td><td>0</td><td></td></tr></table>
Stopping method used when forward rotation stroke end (LSP), reverse rotation stroke end (LSN) device or software limit is valid (Refer to section 5.2.5)
0: Sudden stop
1: Slow stop</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>23</td><td>SIC</td><td>Serial communication time-out selection
Used to choose the time-out period of communication protocol.
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>0</td><td>No time-out check</td></tr>
<tr><td>1 to 60</td><td>Time-out check period setting
Check period = setting [s]</td></tr>
</table></td><td>0</td><td></td><td>0 to 60</td></tr>
</table>

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 1	24	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
	25	VCO	Override offset Used to set the offset voltage to analog override.	0	mV	−999 to 999
	26	TLO	Torque limit offset Used to set the offset voltage to analog torque limit (TLA).	0	mV	−999 to 999
	27	*ENR	Encoder output pulses 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. 58 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 1.3Mpps (after multiplication by 4). Use this parameter within this range. ・For output pulse designation Set " 0□□□ " (initial value) in parameter No. 58. Set the number of pulses per servo motor revolution. Output pulse = set value [pulses/rev] At the setting of 5600, for example, the actually output A/B-phase pulses are as indicated below. A・B-phase output pulses = $\frac{5600}{4}$ = 1400[pulse] ・For output division ratio setting Set " 1□□□ " in parameter No. 58. The number of pulses per servo motor revolution is divided by the set value. Output pulse = $\frac{\text{Resolution per servo motor revolution}}{\text{Set value}}$ [pulses/rev] At the setting of 8, for example, the actually output A/B-phase pulses are as indicated below. A・B-phase output pulses = $\frac{131072}{8} \cdot \frac{1}{4}$ = 4096[pulse]	4000	pulse/ rev	1 to 65535
	28	TL1	Internal torque limit 1 Used to limit servo motor-torque on the assumption that the maximum torque is 100%. When 0 is set, torque is not produced.	100	%	0 to 100
	29	TL2	Internal torque limit 2 Used to limit servo motor-torque on the assumption that the maximum torque is 100%. When 0 is set, torque is not produced. Made valid by switching on the internal torque limit selection (TL2).	100	%	0 to 100
	30	*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. 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. Note. The setting range differs depending on the software version of servo amplifiers. Version A4 or later: 0 to 1600 Version A3 or before: 0 to 1000	0	pulse	(Note) 0 to 1600

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 1	31	MO1	Analog monitor 1 (MO1) offset Used to set the offset voltage of the analog monitor 1 (MO1) output.	0	mV	−999 to 999
	32	MO2	Analog monitor 2 (MO2) offset Used to set the offset voltage of the analog monitor 2 (MO2) output.	0	mV	−999 to 999
	33	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake interlock (MBR) switches off and when the base circuit is shut off. (Refer to section 3.9)	100	ms	0 to 1000
	34	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. (Refer to chapter 8) When auto tuning is selected, the result of auto tuning is automatically set.	70	×0.1 times	0 to 1000
	35	PG2	Position control gain 2 Used to set the gain of the position loop. (Refer to chapter 8) Set this parameter to increase the position response level to load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning is selected, the result of auto tuning is automatically set.	35	rad/s	1 to 1000
	36	VG1	Speed control gain 1 Normally this parameter value need not be changed. Higher setting increases the response level but is liable to generate vibration and/or noise. (Refer to chapter 8) When auto tuning is selected, the result of auto tuning is automatically set.	177	rad/s	20 to 8000
	37	VG2	Speed control gain 2 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. (Refer to chapter 8) When auto tuning is selected, the result of auto tuning is automatically set.	817	rad/s	20 to 20000
	38	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. (Refer to chapter 8) When auto tuning is selected, the result of auto tuning is automatically set.	48	ms	1 to 1000
	39	VDC	Speed differential compensation Used to set the differential compensation. (Refer to chapter 8) Made valid when the proportion control (PC) is switched on.	980		0 to 1000
	40		For manufacturer setting Do not change this value by any means.	0		
	41			0		
	42	*ZPS	Home position return position data Used to set the current position on completion of home position return. (Refer to section 4.4)	0	$\times 10^{STM}$ μm	−32768 to 32767
	43	DCT	Moving distance after proximity dog Used to set the moving distance after proximity dog in count type home position return. (Refer to section 4.4.3)	1000	$\times 10^{STM}$ μm	0 to 65535
	44	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.45 is reached to when the home position is set. (Refer to section 4.4.5)	100	ms	5 to 1000
	45	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 4.4.5)	15	%	1 to 100

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 1	46 47	*LMP	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 5.2.8) Set the same sign to parameters No.46 and 47. Setting of different signs will result in a parameter error. Set address:$\underbrace{□□□}_{\text{Upper 3 digits}}\underbrace{□□□}_{\text{Lower 3 digits}}$ Parameter No. 47 Parameter No. 46	0	$\times 10^{STM}$ μm	−999999 to 999999
	48 49	*LMN	Software limit − Used to set the address decrement side software stroke limit. The software limit is made invalid if this value is the same as in "software limit +". (Refer to section 5.2.8) Set the same sign to parameters No.48 and 49. Setting of different signs will result in a parameter error. Set address: $\underbrace{□□□}_{\text{Upper 3 digits}}\underbrace{□□□}_{\text{Lower 3 digits}}$ Parameter No. 49 Parameter No. 48	0	$\times 10^{STM}$ μm	−999999 to 999999
	50 51	*LPP	Position range output address + Used to set the address increment side position range output address. Set the same sign to parameters No.50 and 51. Setting of different signs will result in a parameter error. In parameters No. 50 to 53, set the range where position range (POT) turns on. Set address:$\underbrace{□□□}_{\text{Upper 3 digits}}\underbrace{□□□}_{\text{Lower 3 digits}}$ Parameter No. 51 Parameter No. 50	0	$\times 10^{STM}$ μm	−999999 to 999999
	52 53	*LNP	Position range output address − Used to set the address decrement side position range output address. Set the same sign to parameters No.52 and 53. Setting of different signs will result in a parameter error. Set address:$\underbrace{□□□}_{\text{Upper 3 digits}}\underbrace{□□□}_{\text{Lower 3 digits}}$ Parameter No. 53 Parameter No. 52	0	$\times 10^{STM}$ μm	−999999 to 999999

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 2	54		For manufacturer setting Do not change this value by any means.	0000		
	55	*OP6	Function selection 6 Used to select how to process the base circuit when reset (RES) is valid. 0 □ 0 0 Processing of the base circuit when reset (RES) is valid. 0: Base circuit shut off 1: Base circuit not shut off	0000		Refer to Name and function column.
	56		For manufacturer setting Do not change this value by any means.	0000		
	57	*OP8	Function selection 8 Used to select the protocol of serial communication. 0 □ □ 0 Protocol checksum selection 0: Yes (checksum added) 1: No (checksum not added) Protocol checksum selection 0: With station numbers 1: No station numbers	0000		Refer to Name and function column.
	58	*OP9	Function selection 9 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 .  Encoder output pulse setting selection (Refer to parameter No. 27) 0: Output pulse designation 1: Division ratio setting	0000		Refer to Name and function column.

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr>
<td>Expansion parameters 2</td>
<td>59</td>
<td>*OPA</td>
<td>Function selection A
Used to select the alarm code.
☐ ☐ 0 0
<table>
<tr><th rowspan="2">Setting</th><th colspan="2">Rotation direction in which torque limit is made valid</th></tr>
<tr><th>CCW direction</th><th>CW direction</th></tr>
<tr><td>0</td><td>○</td><td>○</td></tr>
<tr><td>1</td><td>○</td><td></td></tr>
<tr><td>2</td><td></td><td>○</td></tr>
</table>
Setting of alarm code output
<table>
<tr><th rowspan="2">Set value</th><th colspan="3">Connector pins</th></tr>
<tr><th>CN1B-19</th><th>CN1A-18</th><th>CN1A-19</th></tr>
<tr><td>0</td><td colspan="3">Signals assigned to corresponding pins are output.</td></tr>
<tr><td>1</td><td colspan="3">Alarm code is output at alarm occurrence.</td></tr>
</table>
<table>
<tr><th colspan="3">(Note) Alarm code</th><th rowspan="2">Alarm display</th><th rowspan="2">Name</th></tr>
<tr><th>CN1B pin 19</th><th>CN1A pin 18</th><th>CN1A pin 19</th></tr>
<tr><td rowspan="9">0</td><td rowspan="9">0</td><td rowspan="9">0</td><td>88888</td><td>Watchdog</td></tr>
<tr><td>AL.12</td><td>Memory error 1</td></tr>
<tr><td>AL.13</td><td>Clock error</td></tr>
<tr><td>AL.15</td><td>Memory error 2</td></tr>
<tr><td>AL.17</td><td>Board error 2</td></tr>
<tr><td>AL.19</td><td>Memory error 3</td></tr>
<tr><td>AL.37</td><td>Parameter error</td></tr>
<tr><td>AL.8A</td><td>Serial communication time-out error</td></tr>
<tr><td>AL.8E</td><td>Serial communication error</td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">1</td><td>AL.30</td><td>Regenerative error</td></tr>
<tr><td>AL.33</td><td>Overvoltage</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>AL.10</td><td>Undervoltage</td></tr>
<tr><td rowspan="4">0</td><td rowspan="4">1</td><td rowspan="4">1</td><td>AL.45</td><td>Main circuit device overheat</td></tr>
<tr><td>AL.46</td><td>Servo motor overheat</td></tr>
<tr><td>AL.50</td><td>Overload 1</td></tr>
<tr><td>AL.51</td><td>Overload 2</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">0</td><td rowspan="2">0</td><td>AL.24</td><td>Main circuit</td></tr>
<tr><td>AL.32</td><td>Overcurrent</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">0</td><td rowspan="4">1</td><td>AL.31</td><td>Overspeed</td></tr>
<tr><td>AL.35</td><td>Command pulse frequency error</td></tr>
<tr><td>AL.52</td><td>Error excessive</td></tr>
<tr><td>AL.61</td><td>Home operation alarm</td></tr>
<tr><td rowspan="4">1</td><td rowspan="4">1</td><td rowspan="4">0</td><td>AL.16</td><td>Encoder error 1</td></tr>
<tr><td>AL.1A</td><td>Motor combination error</td></tr>
<tr><td>AL.20</td><td>Encoder error 2</td></tr>
<tr><td>AL.25</td><td>Absolute position erase</td></tr>
</table>
Note: 0:Pin-SG off (open)
1:Pin-SG on (short)
</td>
<td>0000</td>
<td></td>
<td>Refer to Name and function column.</td>
</tr>
</table>

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Expansion parameters 2</td><td>60</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000</td><td></td><td></td></tr>
<tr><td></td><td>61</td><td>NH1</td><td>Machine resonance suppression filter 1
Used to selection the machine resonance suppression filter.
(Refer to section 9.1.)
0□□□
Notch frequency selection
Set "00" when you have set adaptive vibration suppression control to be "valid" or "held" (parameter No. 63: □1□□or□2□□).
<table>
<tr><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th></tr>
<tr><td>00</td><td>Invalid</td><td>08</td><td>562.5</td><td>10</td><td>281.3</td><td>18</td><td>187.5</td></tr>
<tr><td>01</td><td>4500</td><td>09</td><td>500</td><td>11</td><td>264.7</td><td>19</td><td>180</td></tr>
<tr><td>02</td><td>2250</td><td>0A</td><td>450</td><td>12</td><td>250</td><td>1A</td><td>173.1</td></tr>
<tr><td>03</td><td>1500</td><td>0B</td><td>409.1</td><td>13</td><td>236.8</td><td>1B</td><td>166.7</td></tr>
<tr><td>04</td><td>1125</td><td>0C</td><td>375</td><td>14</td><td>225</td><td>1C</td><td>160.1</td></tr>
<tr><td>05</td><td>900</td><td>0D</td><td>346.2</td><td>15</td><td>214.3</td><td>1D</td><td>155.2</td></tr>
<tr><td>06</td><td>750</td><td>0E</td><td>321.4</td><td>16</td><td>204.5</td><td>1E</td><td>150</td></tr>
<tr><td>07</td><td>642.9</td><td>0F</td><td>300</td><td>17</td><td>195.7</td><td>1F</td><td>145.2</td></tr>
</table>
Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep to Shallow</td><td>−40dB</td></tr>
<tr><td>1</td><td></td><td>−14dB</td></tr>
<tr><td>2</td><td></td><td>−8dB</td></tr>
<tr><td>3</td><td></td><td>−4dB</td></tr>
</table>
</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td></td><td>62</td><td>NH2</td><td>Machine resonance suppression filter 2
Used to set the machine resonance suppression filter.
0□□□
Notch frequency
Same setting as in parameter No. 61
However, you need not set "00" if you have set adaptive vibration suppression control to be "valid" or "held".
Notch depth
Same setting as in parameter No. 61</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 2	63	LPF	Low-pass filter/adaptive vibration suppression control Used to selection the low-pass filter and adaptive vibration suppression control. (Refer to chapter 9) ☐☐☐0 Low-pass filter selection 0: Valid (Automatic adjustment) 1: Invalid When you choose "valid", the filter of the handwidth represented by the following expression is set automatically. For 1kW or less $\frac{\text{VG2 setting}\times 10}{2\pi\times(1+\text{GD2 setting}\times 0.1)}$ [Hz] For 2kW or more $\frac{\text{VG2 setting}\times 5}{2\pi\times(1+\text{GD2 setting}\times 0.1)}$ [Hz] Adaptive vibration suppression control selection Choosing "valid" or "held" in adaptive vibration suppression control selection makes the machine resonance control filter 1 (parameter No. 61) invalid. 0: Invalid 1: Valid Machine resonance frequency is always detected and the filter is generated in response to resonance to suppress machine vibration. 2: Held The characteristics of the filter generated so far are held, and detection of machine resonance is stopped. Adaptive vibration suppression control sensitivity selection Used to set the sensitivity of machine resonance detection. 0: Normal 1: Large sensitivity	0000		Refer to Name and function column.
	64	GD2B	Ratio of load inertia moment to servo motor inertia moment 2 Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid.	70	×0.1 times	0 to 3000
	65	PG2B	Position control gain 2 changing ratio Used to set the ratio of changing the position control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	66	VG2B	Speed control gain 2 changing ratio Used to set the ratio of changing the speed control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	67	VICB	Speed integral compensation changing ratio Used to set the ratio of changing the speed integral compensation when gain changing is valid. Made valid when auto tuning is invalid.	100	%	50 to 1000

Class	No.	Symbol	Name and Function	Initial value	Unit	Setting range
Expansion parameters 2	68	*CDP	Gain changing selection Used to select the gain changing condition. (Refer to section 9.5) 0 0 0 ☐ Gain changing selection Gains are changed in accordance with the settings of parameters No. 64 to 67 under any of the following conditions: 0: Invalid 1: Gain changing (CDP) signal is ON 2: Command frequency is equal to higher than parameter No. 69 setting 3: Droop pulse value is equal to higher than parameter No. 69 setting 4: Servo motor speed is equal to higher than parameter No. 69 setting	0000		Refer to Name and function column.
	69	CDS	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No. 68. The set value unit changes with the changing condition item. (Refer to section 9.5)	10	kpps pulse r/min	10 to 9999
	70	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. 68 and 69. (Refer to section 9.5)	1	ms	0 to 100
	71		For manufacturer setting Do not change this value by any means.	10		
	72			10000		
	73			10		
	74			10		
	75			100		
	76			100		
	77			100		
Special parameters	78		For manufacturer setting The settings are automatically changed.	0000		
	79			0009		
	80			080A		
	81			0706		
	82			020B		
	83			0504		
	84			0002		
	85			0000		
	86			0005		
	87			0D04		
	88			0102		
	89		For manufacturer setting Do not change this value by any means.	0		
	90			0		

5.2 Detailed explanation

5.2.1 Electronic gear

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

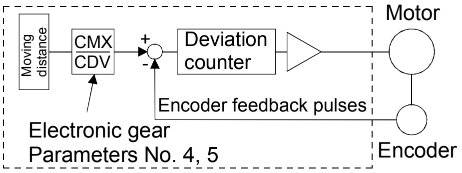
POINT

- 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 $\frac{1}{10} < \frac{CMX}{CDV} < 1000$. If you set any value outside this range, a parameter error (A37) occurs.
- After setting the parameter No.4, 5 value, switch power off, then on to make that setting valid.

(1) Concept of electronic gear

Use the electronic gear (parameters No.4, 5) 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.

$$\frac{CMX}{CDV} = \frac{\text{Parameter No. 4}}{\text{Parameter No. 5}}$$



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

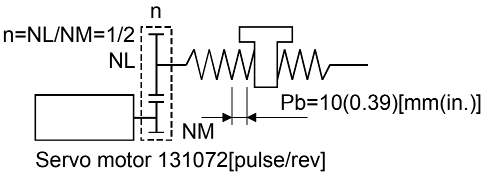
POINT

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

Pb : Ballscrew lead [mm(in.)]
n : Reduction ratio
Pt : Servo motor resolution [pulse/rev]
ΔS : Travel per servo motor revolution [mm/rev]

(a) Ballscrew setting example

Machine specifications



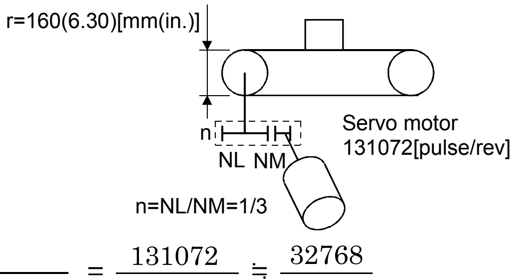
Ballscrew lead: Pb = 10 (0.39) [mm(in.)]
Reduction ratio: n = 1/2
Servo motor resolution: Pt = 131072 [pulse/rev]

$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot p_b \cdot 1000} = \frac{131072}{1/2 \cdot 10 \cdot 1000} = \frac{131072}{5000} = \frac{32768}{1250}$$

Hence, set 32768 to CMX and 1250 to CDV.

(b) Conveyor setting example

Machine specifications



Pulley diameter: r = 160 (6.30) [mm(in.)]
Reduction ratio: n = 1/3
Servo motor resolution: Pt = 131072 [pulse/rev]

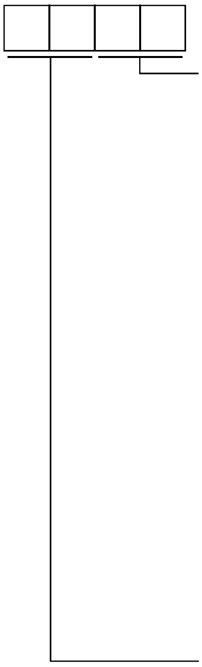
$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{131072}{1/3 \cdot 160 \cdot \pi \cdot 1000} = \frac{131072}{167551.61} \fallingdotseq \frac{32768}{41888}$$

Reduce CMX and CDV to the setting range or less, and round off the first decimal place.
Hence, set 32768 to CMX and 41888 to CDV.

5.2.2 Changing the status display screen

The status display item of the servo amplifier display and the display item of the external digital display (MR-DP60) shown at power-on can be changed by changing the parameter No.18 (status display selection) settings. In the initial condition, the servo amplifier display shows the servo motor speed and the MR-DP60 shows the current position.
For display details, refer to section 7.2.

Parameter No. 18

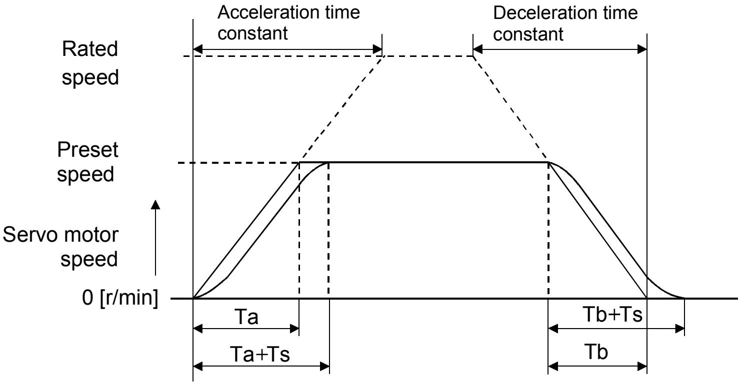


Status display on servo amplifier display at power-on
00: Current position (initial value)
01: Command position
02: Command remaining distance
03: Point table No.
04: Cumulative feedback pulses
05: Servo motor speed
06: Droop pulses
07: Override voltage
08: Analog torque limit voltage
09: Regenerative load ratio
0A: Effective load ratio
0B: Peak load ratio
0C: Instantaneous torque
0D: Within one-revolution position low
0E: Within one-revolution position high
0F: ABS counter
10: Load inertia moment ratio
11: Bus voltage

Status display of MR-DP60 at power-on
00: Current position (initial value)
01: Command position
02: Command remaining distance
03: Point table No.
04: Cumulative feedback pulses
05: Servo motor speed
06: Droop pulses
07: Override voltage
08: Analog torque limit voltage
09: Regenerative load ratio
0A: Effective load ratio
0B: Peak load ratio
0C: Instantaneous torque
0D: Within one-revolution position
0E: ABS counter
0F: Load inertia moment ratio
10: Bus voltage

5.2.3 S-pattern acceleration/deceleration

In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern acceleration/deceleration time constant (parameter No.14), a smooth start/stop can be made. When the S-pattern time constant is set, smooth positioning is executed as shown below. When the S-pattern acceleration/deceleration time constant is set, the time from when the positioning starts until the movement finish (MEND) is output will increase by the time equivalent to the S-pattern time constant setting.



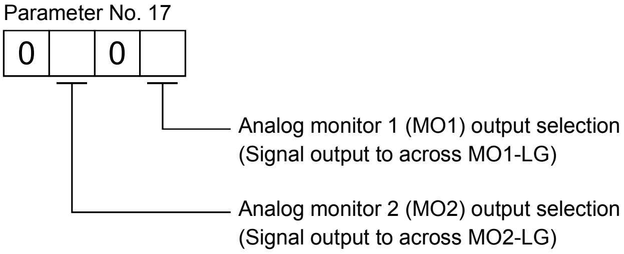
Ta: Time until preset speed is reached
Tb: Time until stop
Ts: S-pattern acceleration/deceleration time constant
(parameter No. 14)
Setting range 0 to 100ms

5.2.4 Analog output

The servo status can be output to two channels in terms of voltage. The servo status can be monitored using an ammeter.

(1) Setting

Change the following digits of parameter No.17.



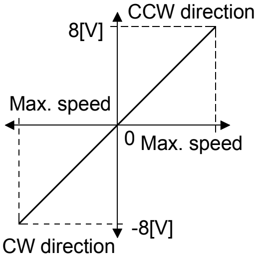
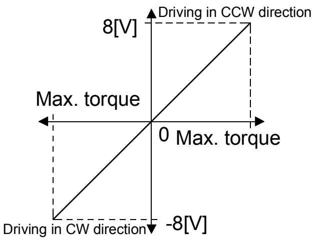
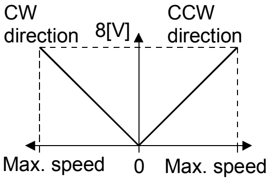
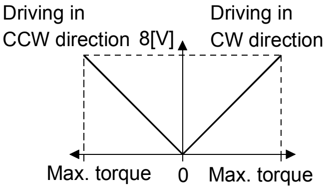
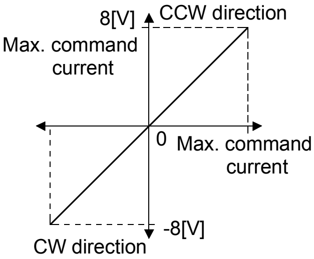
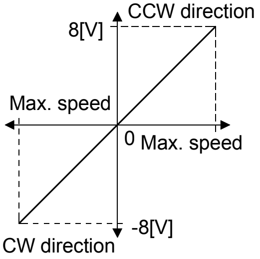
Parameters No.31 and 32 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

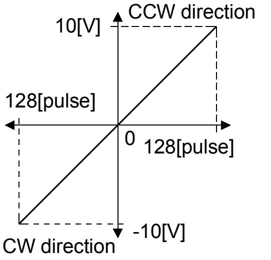
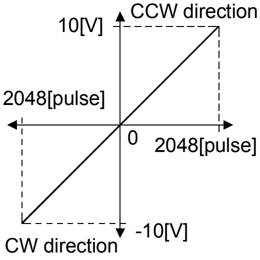
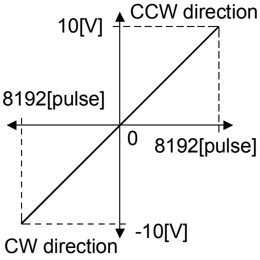
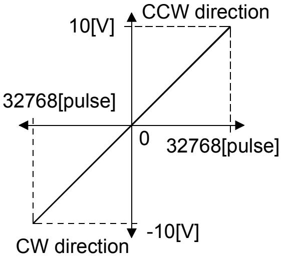
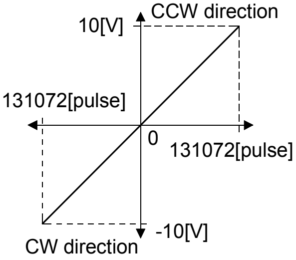
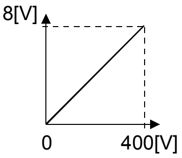
Parameter	Description	Setting range [mV]
Parameter No.31	Used to set the offset voltage for the analog monitor 1 (MO1) output.	−999 to 999
Parameter No.32	Used to set the offset voltage for the analog monitor 2 (MO2) output.	

(2) Contents of a setting

The servo amplifier is factory-set to output the servo motor speed to analog monitor 1 and the torque to analog monitor 2. The setting can be changed as listed below by changing the parameter No.17 (analog monitor output) value.

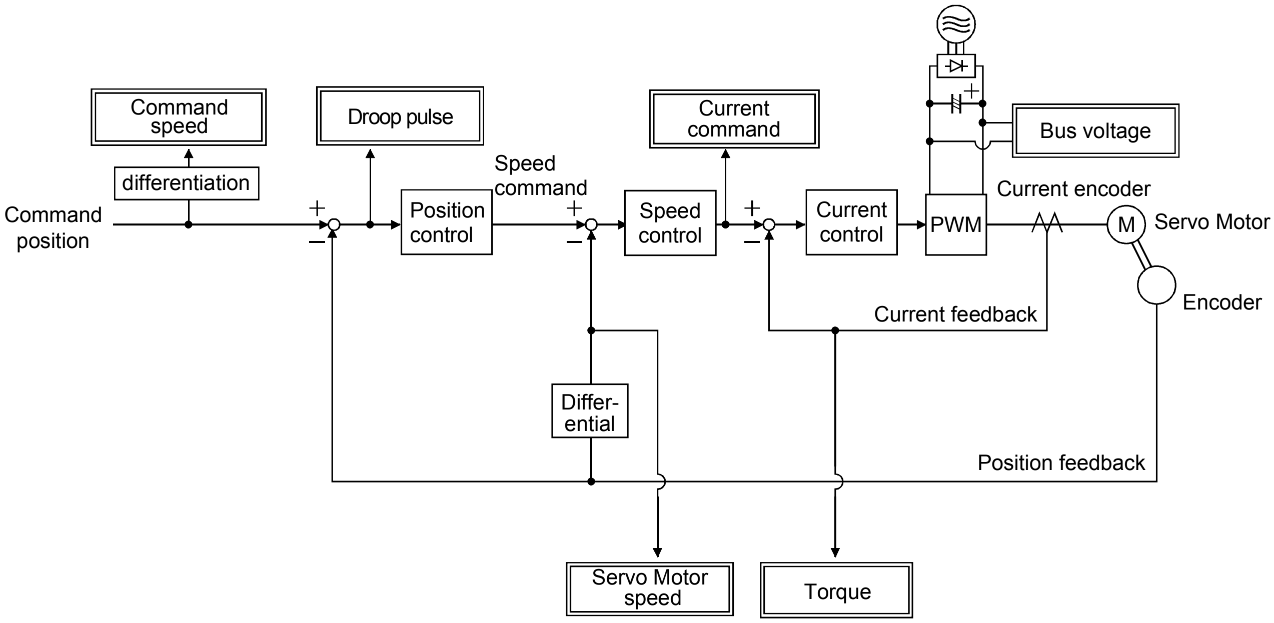
Refer to (3) for the measurement point.

Setting	Output item	Description
0	Servo motor speed	
1	Torque (Note 2)	
2	Servo motor speed	
3	Torque (Note 2)	
4	Current command	
5	Speed command	

Setting	Output item	Description
6	Droop pulses (Note 1) (±10V/128pulse)	
7	Droop pulses (Note 1) (±10V/2048pulse)	
8	Droop pulses (Note 1) (±10V/8192pulse)	
9	Droop pulses (Note 1) (±10V/32768pulse)	
A	Droop pulses (Note 1) (±10V/131072pulse)	
B	Bus voltage	

Note 1. Encoder pulse unit.

2. 8V is outputted at the maximum torque. However, when parameter No. 28 • 29 are set to limit torque, 8V is outputted at the torque highly limited.


Command speed
Droop pulse
Current command
Bus voltage
differentiation
Speed command
Current encoder
Command position
Position control
Speed control
Current control
PWM
M
Servo Motor
Encoder
Current feedback
Differ-ential
Position feedback
Servo Motor speed
Torque

5.2.5 Changing the stop pattern using a limit switch

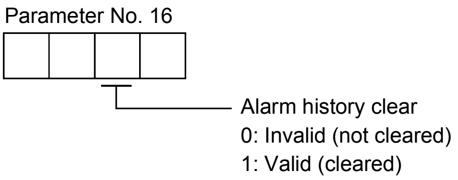
The servo amplifier is factory-set to make a sudden stop when the limit switch or software limit is made valid. When a sudden stop is not required, e.g. when there is an allowance from the limit switch installation position to the permissible moving range of the machine, a slow stop may be selected by changing the parameter No.22 setting.

Parameter No. 22 setting	Description
□□□0(initial value)	Droop pulses are reset to make a stop. (Sudden stop)
□□□1	Droop pulses are drawn out to make a slow stop. (Slow stop)

5.2.6 Alarm history clear

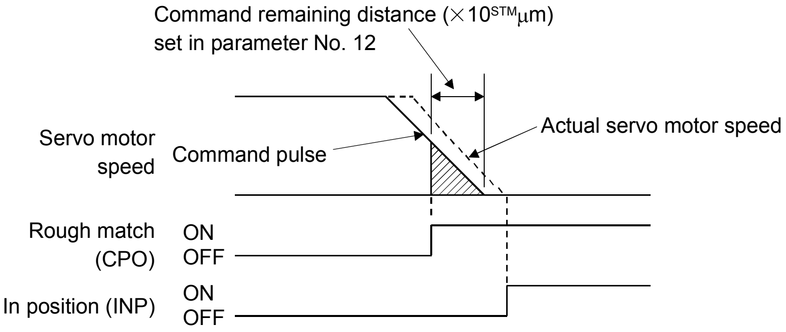
The alarm history can be confirmed by using the MR Configurator (Set-up Software) or communication function. The servo amplifier stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using parameter No.16 (alarm history clear) before starting operation. Clearing the alarm history automatically returns to "□□0□".

This parameter is made valid by switching power off, then on after setting.



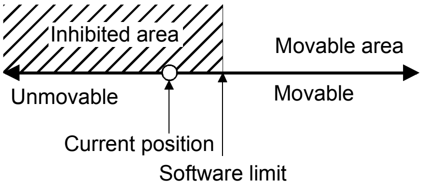
5.2.7 Rough match output

Rough match (CPO) is output when the command remaining distance reaches the value set in parameter No. 12 (rough match output range). The set remaining distance is 0 to 65535 [$\times 10^{STM}\mu m$].



5.2.8 Software limit

A limit stop using a software limit 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 (AL. 37) will occur if the software limit + setting is less than the software limit − setting.



6. MR Configurator (SERVO CONFIGURATION SOFTWARE)

> **POINT**
> - Some functions of the MR Configurator (servo configuration software) may be unavailable for some versions. For details, please contact us.

The MR Configurator (servo configuration software) (MR2JW3-SETUP151E or more) uses the communication function of the servo amplifier to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

6.1 Specifications

Item	Description
Communication signal	Conforms to RS-232C.
Baud rate[bps]	57600, 38400, 19200, 9600
System	Station selection
Monitor	Batch display, high-speed display, graph display Minimum resolution changes with the processing speed of the personal computer.
Alarm	Alarm display, alarm history, data display at alarm occurrence
Diagnostic	I/O display, function device display, no-rotation reason display, cumulative power-on time display, software number display, motor information display, tuning data display, ABS data display, shaft name setting.
Parameters	Parameter setting, list display, change list display, detailed display, turning, device setting.
Test operation	Jog operation, positioning operation, motor-less operation, DO forced output, single-step feed.
Advanced function	Machine analyzer, gain search, machine simulation.
Position-Data	Point Tables
File operation	Data read, save, print
Others	Station setting, help display

6.2 System configuration

(1) Components

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

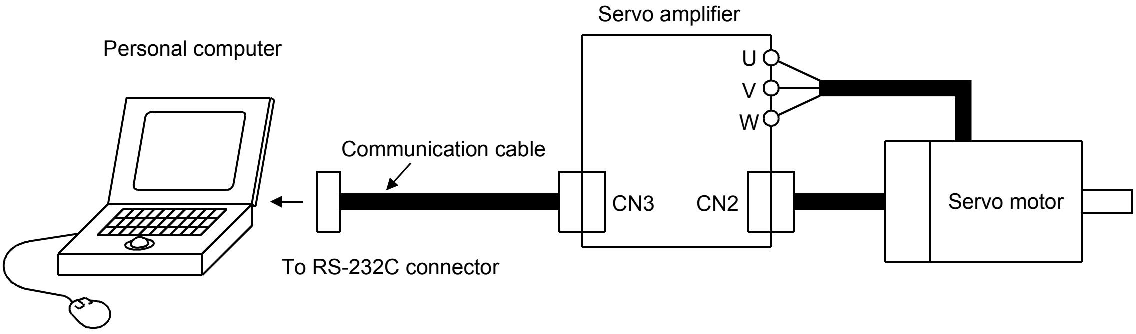
Model	(Note 1) Description
(Note 2) Personal computer	IBM PC-AT compatible where the English version of Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional, Windows® XP Professional or Windows® XP Home Edition operates Processor: Pentium® 133MHz or more (Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows® 2000 Professional) Pentium® 150MHz or more (Windows® Me) Pentium® 300MHz or more (Windows® XP Professional, Windows® XP Home Edition) Memory: 16MB or more (Windows® 95), 24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) 128MB or more (Windows® XP Professional, Windows® XP Home Edition) Free hard disk space: 60MB or more Serial port used
OS	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, 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. Note that a serial mouse is not used.
Printer	Connectable with the above personal computer.
Communication cable	MR-CPCATCBL3M When this cannot be used, refer to section 14.1.4 (3) and fabricate.

Note 1. Windows and Windows NT are the registered trademarks of Microsoft Corporation in the United State and other countries. Pentium is the registered trademarks of Intel Corporation.

2. On some personal computers, this software may not run properly.

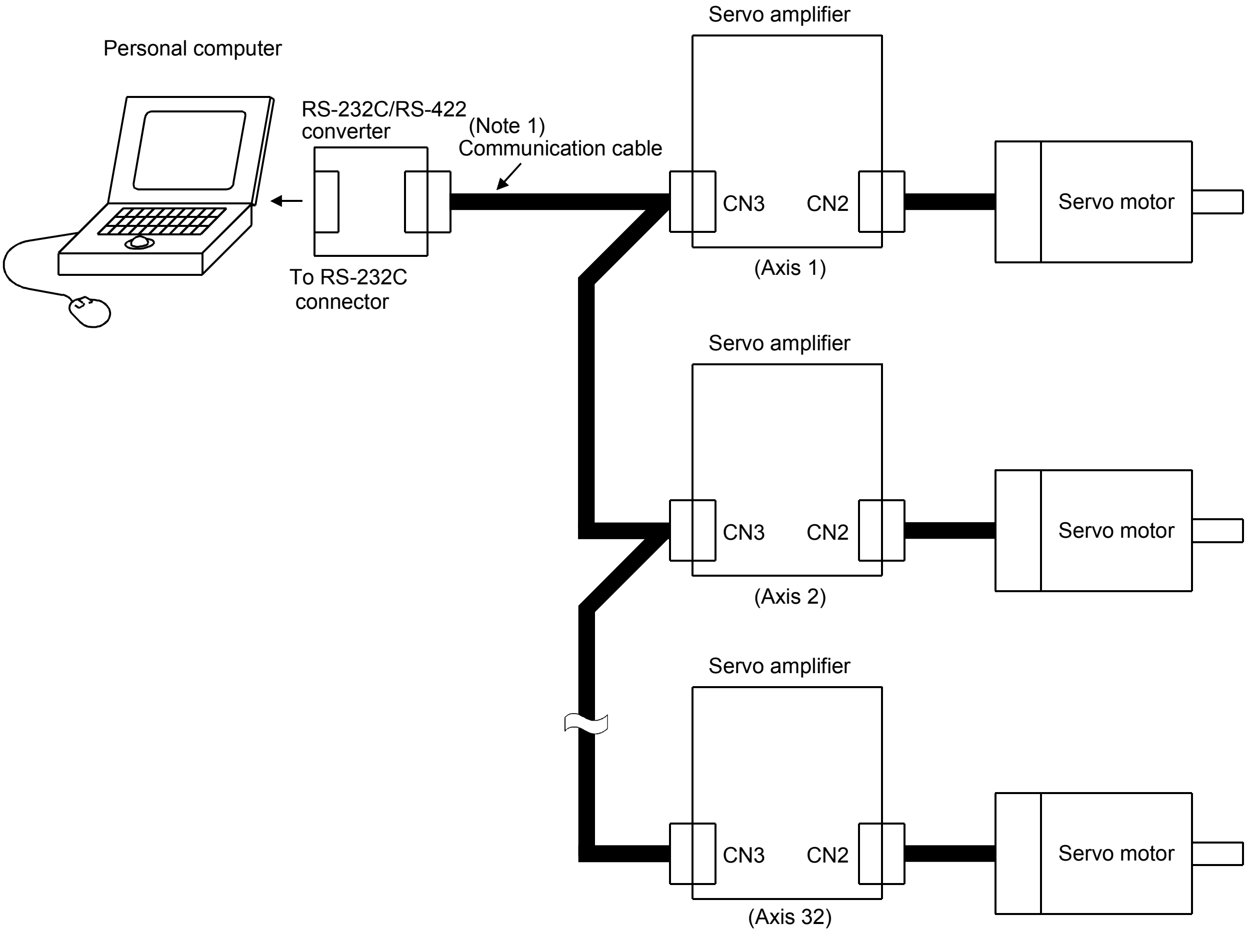
(2) Configuration diagram

(a) For use of RS-232C



(b) For use of RS-422

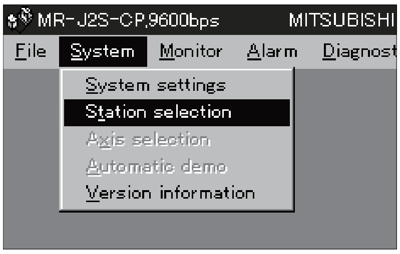
Up to 32 axes may be multidropped.



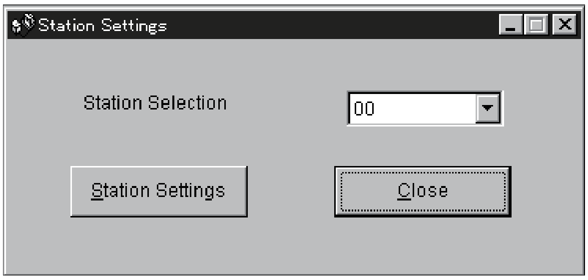
Note. Refer to Section 15.1.1 for cable connections.

6.3 Station setting

Click “System” on the menu bar and click “Station Selection” on the menu.



When the above choices are made, the following window appears.



Station Selection 00

(1) Station number setting

Choose the station number in the combo box and click the “Station Settings” button to set the station number.

POINT

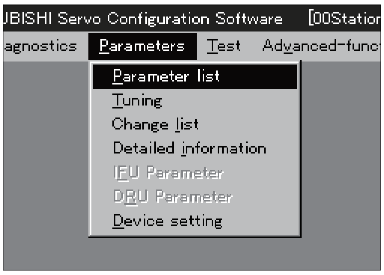
- This setting should be the same as the station number which has been set in the parameter in the servo amplifier used for communication.

(2) Closing of the station setting window

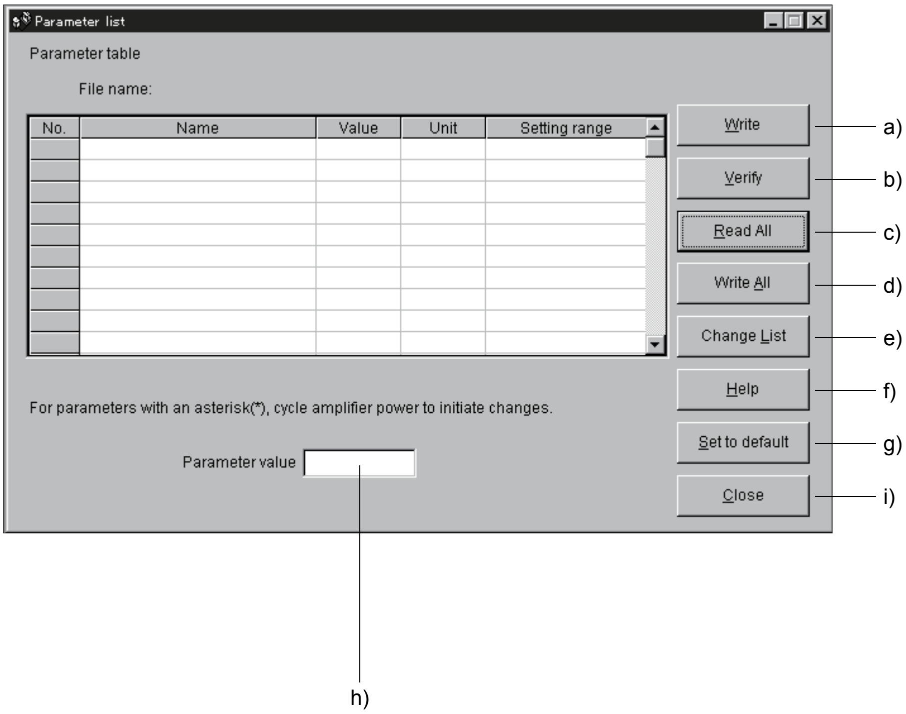
Click the “Close” button to close the window.

6.4 Parameters

Click "Parameters" on the menu bar and click "Parameter List" on the menu.



When the above choices are made, the following window appears.



For parameters with an asterisk(*), cycle amplifier power to initiate changes.

(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 change list display (e))

Click the "Change List" button to show the numbers, names, initial values and current values of the parameters whose initial value and current value are different. In the offline mode, the parameter change list is not shown.

(6) Parameter detail information (f))

Click the "Help" button or double-click the display field to show the detailed explanation of each parameter.

(7) Parameter default value indication (g))

Click the "Set to default" button to show the initial value of each parameter.

(8) Parameter value change (h))

Choose the parameter to be changed, enter a new value into the "Parameter value" input field, and press the enter key or Enter Data button.

(9) Parameter data file read

Used to read and display the parameter values stored in the file. Use the file selection window to read.

(10) Parameter value storage

Used to store all parameter values being displayed on the window into the specified file. Use the file selection window to store.

(11) Parameter data list print

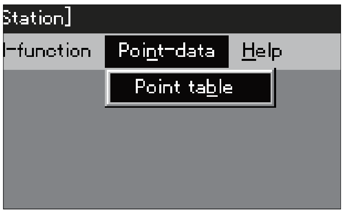
Used to print all parameter values being displayed on the window. Use the "File" menu on the menu bar to print.

(12) Parameter list window closing (i))

Click the "Close" button to close the window. If the "Close" button is clicked without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

6.5 Point table

Click "Position-Data" on the menu bar and click "Point Tables" 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 Row” 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 Row” 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 “Setting” 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 “File” 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 “File” 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 “File” menu on the menu bar to print.

(11) Point table data list window closing (h))

Click the “Close” button to close the window.

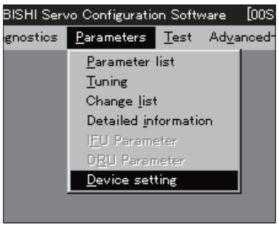
6.6 Device assignment method

POINT

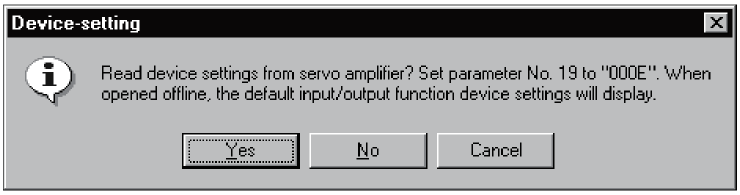
When using the device setting, preset “000E” in parameter No. 19.

(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.



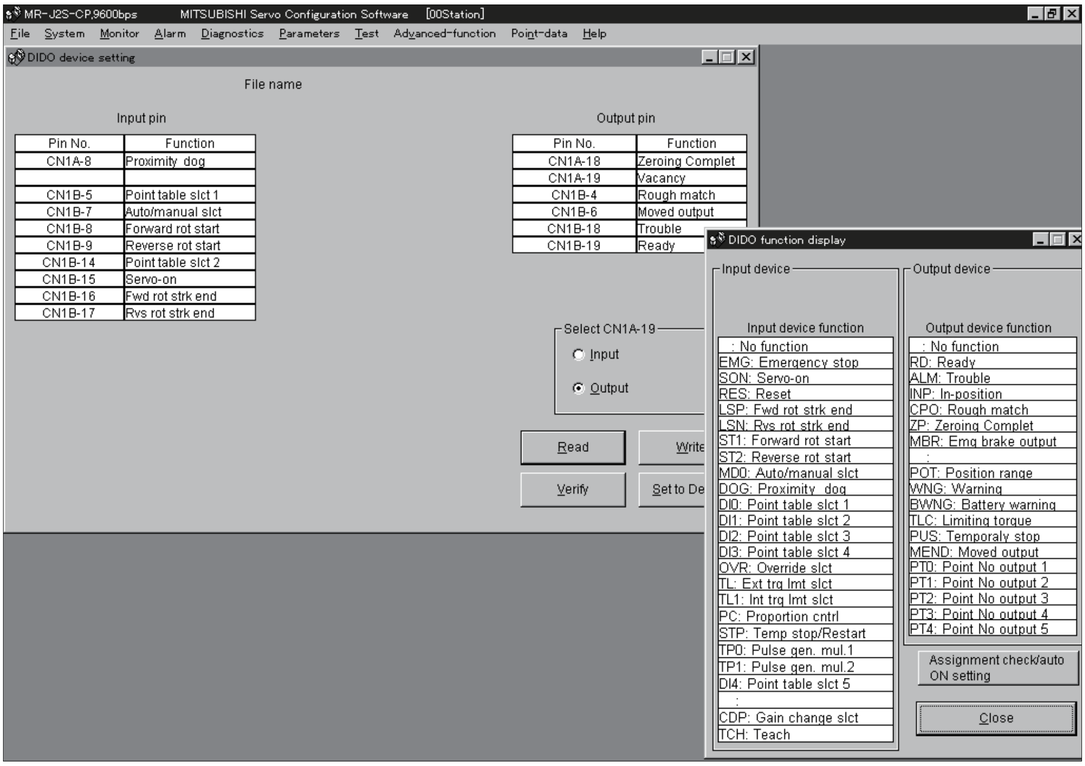
Read device settings from servo amplifier? Set parameter No. 19 to "000E". When opened offline, the default input/output function device settings will display.

Click “Yes” button reads and displays the function assigned to each pin from the interface unit and extension IO unit.

Click “No” button displays the initial status of the interface unit and extension IO unit.

Click “Cancel” button terminates the processing.

Click “Yes” button or “No” button displays the following two windows.



Input pin

Pin No.	Function
CN1A-8	Proximity dog
CN1B-5	Point table slct 1
CN1B-7	Auto/manual slct
CN1B-8	Forward rot start
CN1B-9	Reverse rot start
CN1B-14	Point table slct 2
CN1B-15	Servo-on
CN1B-16	Fwd rot strk end
CN1B-17	Rvs rot strk end

Output pin

Pin No.	Function
CN1A-18	Zeroing Complet
CN1A-19	Vacancy
CN1B-4	Rough match
CN1B-6	Moved output
CN1B-18	Trouble
CN1B-19	Ready

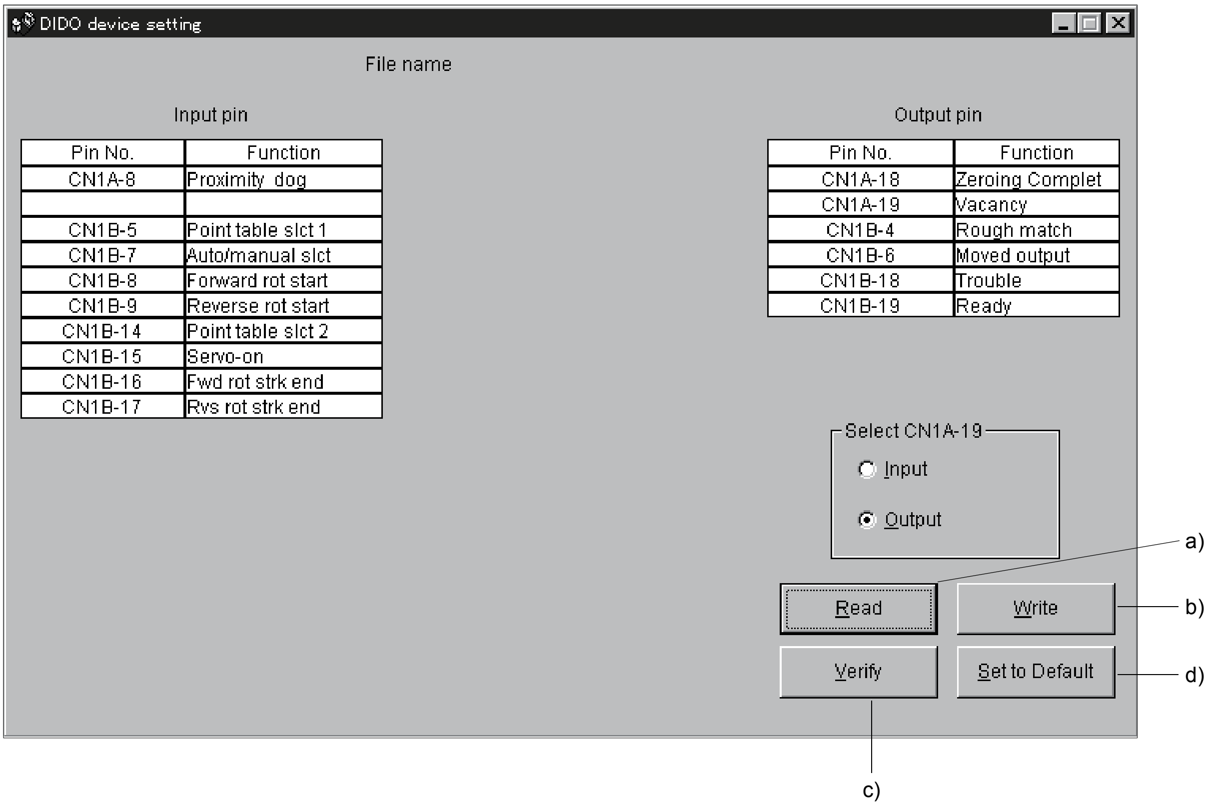
Input device function
: No function
EMG: Emergency stop
SON: Servo-on
RES: Reset
LSP: Fwd rot strk end
LSN: Rvs rot strk end
ST1: Forward rot start
ST2: Reverse rot start
MD0: Auto/manual slct
DOG: Proximity dog
DI0: Point table slct 1
DI1: Point table slct 2
DI2: Point table slct 3
DI3: Point table slct 4
OVR: Override slct
TL: Ext trq lmt slct
TL1: Int trq lmt slct
PC: Proportion cntrl
STP: Temp stop/Restart
TP0: Pulse gen. mul.1
TP1: Pulse gen. mul.2
DI4: Point table slct 5
:
CDP: Gain change slct
TCH: Teach

Output device function
: No function
RD: Ready
ALM: Trouble
INP: In-position
CPO: Rough match
ZP: Zeroing Complet
MBR: Emg brake output
:
POT: Position range
WNG: Warning
BWNG: Battery warning
TLC: Limiting torque
PUS: Temporaly stop
MEND: Moved output
PT0: Point No output 1
PT1: Point No output 2
PT2: Point No output 3
PT3: Point No output 4
PT4: Point No output 5

(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.



Input pin

Pin No.	Function
CN1A-8	Proximity dog
CN1B-5	Point table slct 1
CN1B-7	Auto/manual slct
CN1B-8	Forward rot start
CN1B-9	Reverse rot start
CN1B-14	Point table slct 2
CN1B-15	Servo-on
CN1B-16	Fwd rot strk end
CN1B-17	Rvs rot strk end

Output pin

Pin No.	Function
CN1A-18	Zeroing Complet
CN1A-19	Vacancy
CN1B-4	Rough match
CN1B-6	Moved output
CN1B-18	Trouble
CN1B-19	Ready

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.

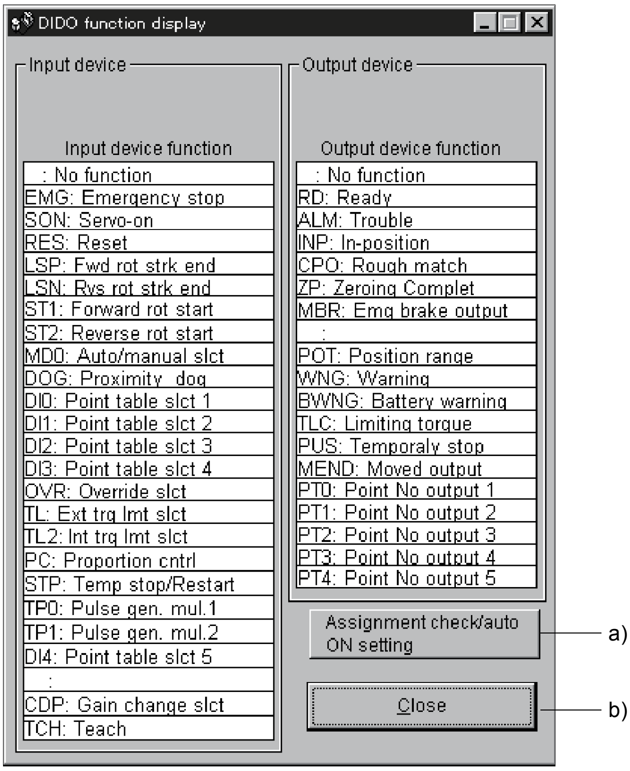
4) Initial setting of function assignment (d))

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.



Input device function

: No function
EMG: Emergency stop
SON: Servo-on
RES: Reset
LSP: Fwd rot strk end
LSN: Rvs rot strk end
ST1: Forward rot start
ST2: Reverse rot start
MD0: Auto/manual slct
DOG: Proximity dog
DI0: Point table slct 1
DI1: Point table slct 2
DI2: Point table slct 3
DI3: Point table slct 4
OVR: Override slct
TL: Ext trq lmt slct
TL2: Int trq lmt slct
PC: Proportion cntrl
STP: Temp stop/Restart
TP0: Pulse gen. mul.1
TP1: Pulse gen. mul.2
DI4: Point table slct 5
:
CDP: Gain change slct
TCH: Teach

Output device function

: No function
RD: Ready
ALM: Trouble
INP: In-position
CPO: Rough match
ZP: Zeroing Complet
MBR: Emg brake output
:
POT: Position range
WNG: Warning
BWNG: Battery warning
TLC: Limiting torque
PUS: Temporaly stop
MEND: Moved output
PT0: Point No output 1
PT1: Point No output 2
PT2: Point No output 3
PT3: Point No output 4
PT4: Point No output 5

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.

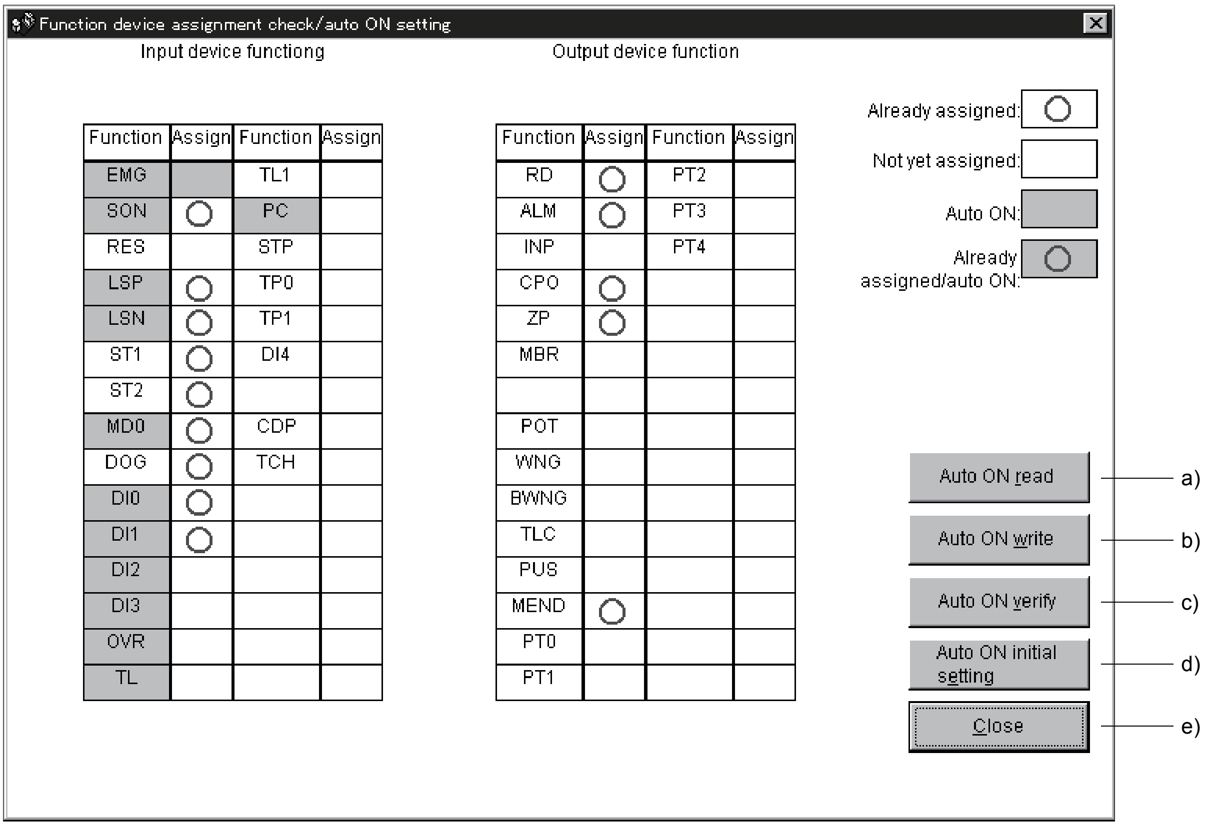
Refer to (4) of this section for more information.

2) Quitting

Click “Close” button to exit from the window. (b))

(c) Function device assignment checking・auto ON setting display

Click the “ / ” button in the DIDO function display window displays the following window.



Function	Assign	Function	Assign
EMG		TL1	
SON	○	PC	
RES		STP	
LSP	○	TP0	
LSN	○	TP1	
ST1	○	DI4	
ST2	○		
MD0	○	CDP	
DOG	○	TCH	
DI0	○		
DI1	○		
DI2			
DI3			
OVR			
TL			

Function	Assign	Function	Assign
RD	○	PT2	
ALM	○	PT3	
INP		PT4	
CPO	○		
ZP	○		
MBR			
POT			
WNG			
BWNG			
TLC			
PUS			
MEND	○		
PT0			
PT1			

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 “Auto ON 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 “Auto ON 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 “Auto ON 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 “Auto ON initial setting” button initializes the auto ON setting.

5) Quitting the function device assignment checking/auto ON setting window (e))

Click “Close” button exits from the window.

6.7 Test operation

CAUTION	- When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates. - If any operational fault has occurred, stop operation using the forced stop (EMG).

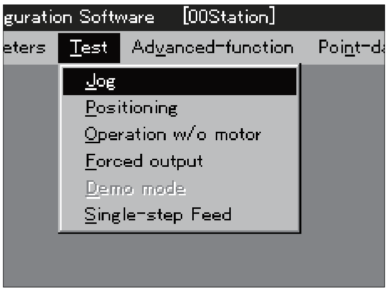
6.7.1 Jog operation

POINT

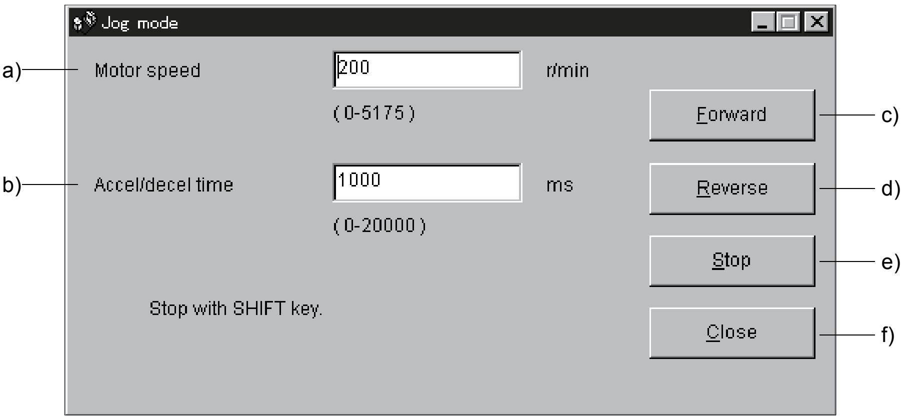
- For the program operation, refer to the manual of MR Configurator.
- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn ON across these signals and SG. (Refer to section 6.6.)
- When an alarm occurs, the JOG operation is automatically canceled.

Hold down the "Forward" or "Reverse" button to rotate the servo motor. Release the "Forward" or "Reverse" button to stop.

Click "Test" on the menu bar and choose "Jog" on the menu.



When the above choices are made, the following window appears.



Motor speed: 200 r/min (0-5175)

Accel/decel time: 1000 ms (0-20000)

Stop with SHIFT key.

(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))

Release the "Forward" or "Reverse" button to stop the rotation of the servo motor.

(5) Jog operation window closing (f))

Click the "Close" button to cancel the jog operation mode and close the window.

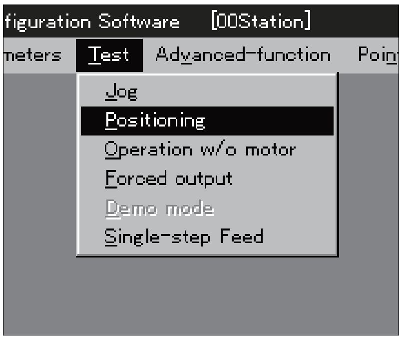
6.7.2 Positioning operation

POINT

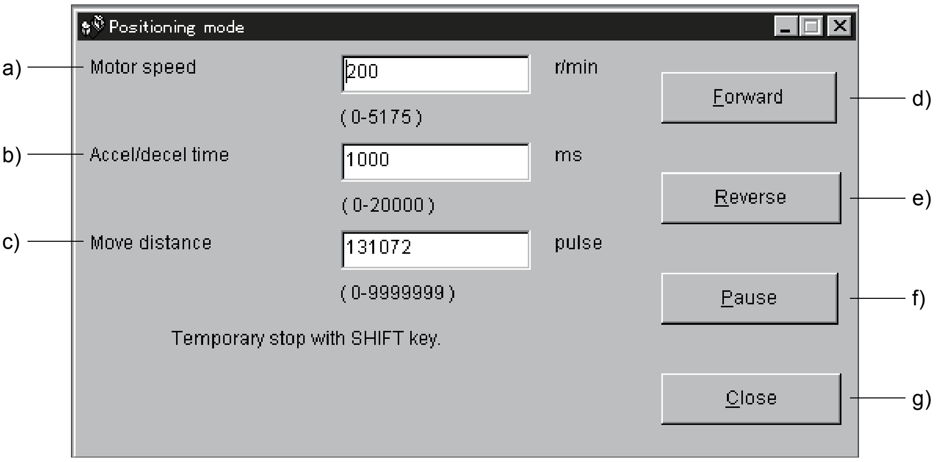
- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn ON across these signals and SG. (Refer to section 6.6.)
- When an alarm occurs, the positioning operation is automatically canceled.

Click the "Forward" or "Reverse" button to start and rotate the servo motor by the preset moving distance and then stop.

Click "Test" on the menu bar and click "Positioning" on the menu.



When the above choices are made, the following window appears.



Motor speed 200 r/min (0-5175)

Accel/decel time 1000 ms (0-20000)

Move distance 131072 pulse (0-9999999)

Temporary stop with SHIFT key.

(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) Positioning operation window closing (g))

Click the “Close” button to cancel the positioning operation mode and close the window.

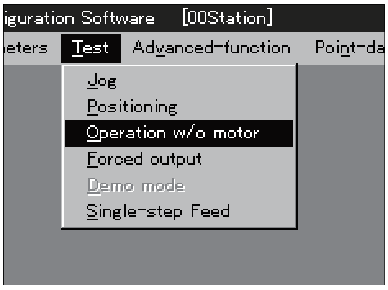
6.7.3 Motor-less operation

POINT

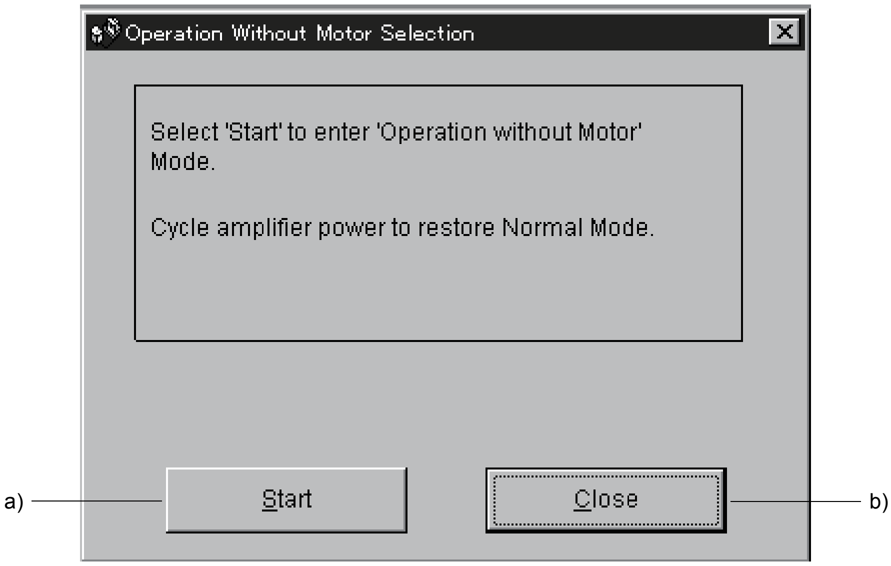
- When this operation is used in an absolute position detection system, the home position cannot be restored properly.

Without a servo motor being connected, the output signals are provided and the servo amplifier display shows the status as if a servo motor is actually running in response to the external I/O signals.
The sequence of the host programmable controller can be checked without connection of a servo motor.

Click “Test” on the menu bar and click “Operation w/o Motor” on the menu.



When the above choices are made, the following window appears.



Select 'Start' to enter 'Operation without Motor' Mode.

Cycle amplifier power to restore Normal Mode.

(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.

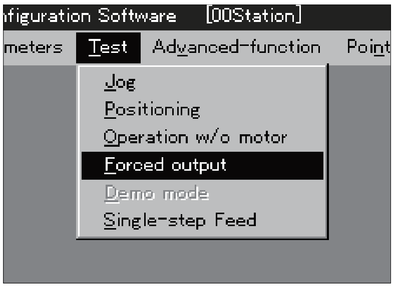
(3) Cancel of motor-less operation
To cancel motor-less operation, switch off the power of the servo amplifier.

6.7.4 Output signal (DO) forced output

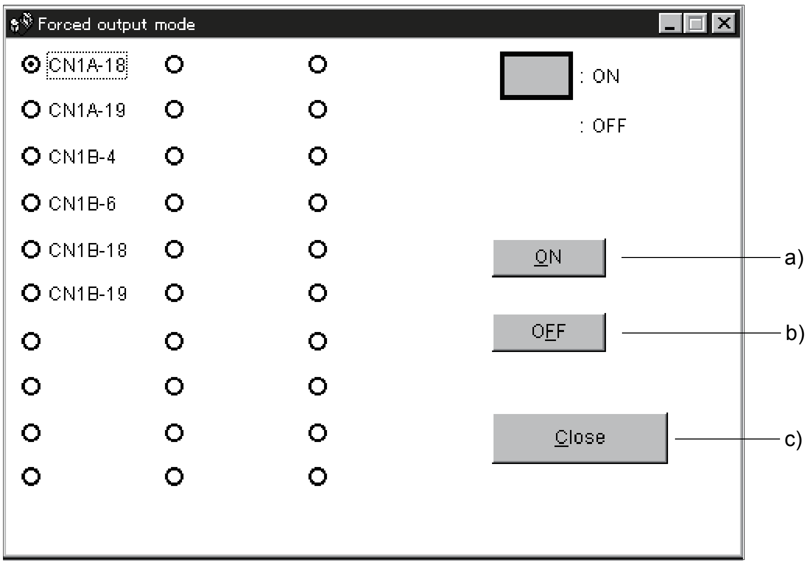
POINT
- When an alarm occurs, the DO forced output is automatically canceled.

Each servo amplifier output signal is forcibly switched on/off independently of the output condition of the output signal.

Click "Test" on the menu bar and click "Forced Output" on the menu.



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))

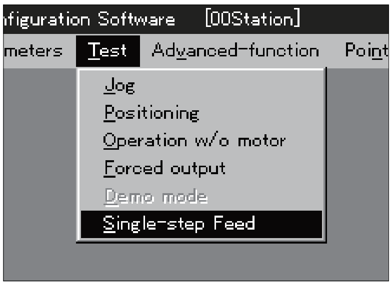
Click the "Close" button to cancel the DO forced output mode and close the window.

6.7.5 Single-step feed

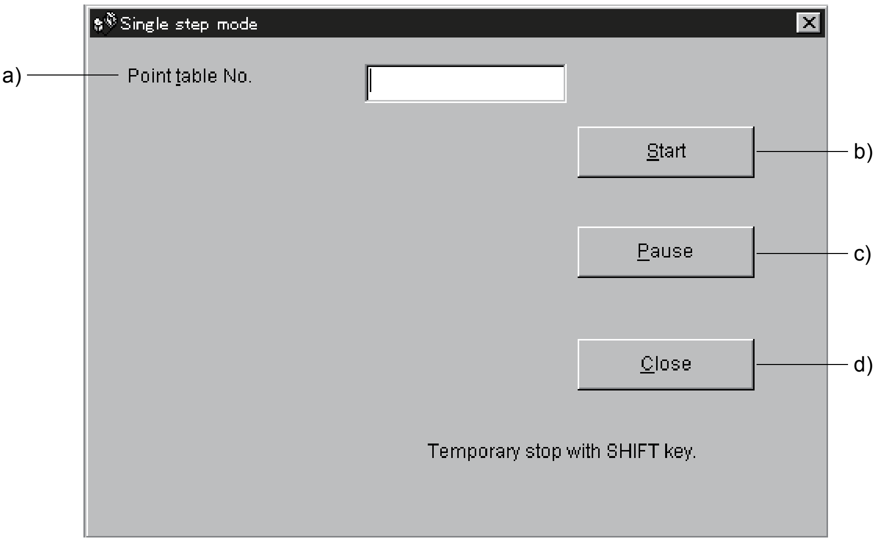
POINT

- In the jog operation mode, do not rewrite data from the point table list screen or the servo amplifier's front panel. Otherwise, the set values are made invalid.
- 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 6.6.)

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.



When the above choices are made, the following window appears.



(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.

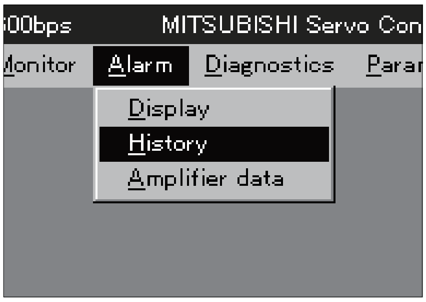
(3) Temporary stop of servo motor (c))
Press the "Pause" button to stop the servo motor temporarily.
Click the "Start" button to resume rotation.

(4) Servo motor stop (d))
Click the "Pause" button again during a temporary stop of the servo motor to clear the remaining moving distance.

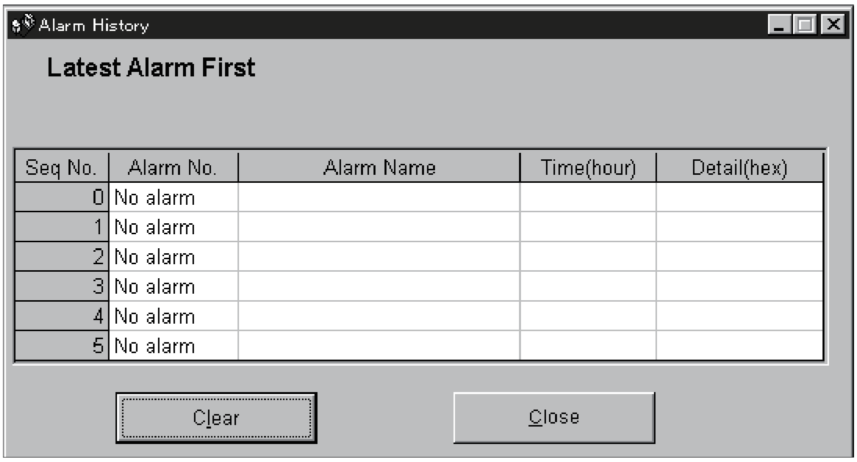
(5) Single-step feed window closing (e))
Click the "Close" button to cancel the single-step feed mode and close the window.

6.8 Alarm history

Click “Alarms” on the menu bar and click “History” on the menu.



When the above choices are made, the following window appears.



Seq No.	Alarm No.	Alarm Name	Time(hour)	Detail(hex)
0	No alarm			
1	No alarm			
2	No alarm			
3	No alarm			
4	No alarm			
5	No alarm			

(1) Alarm history display

The most recent six alarms are displayed. The smaller numbers indicate newer alarms.

(2) Alarm history clear

Click the “Clear” button to clear the alarm history stored in the servo amplifier.

(3) Closing of alarm history window

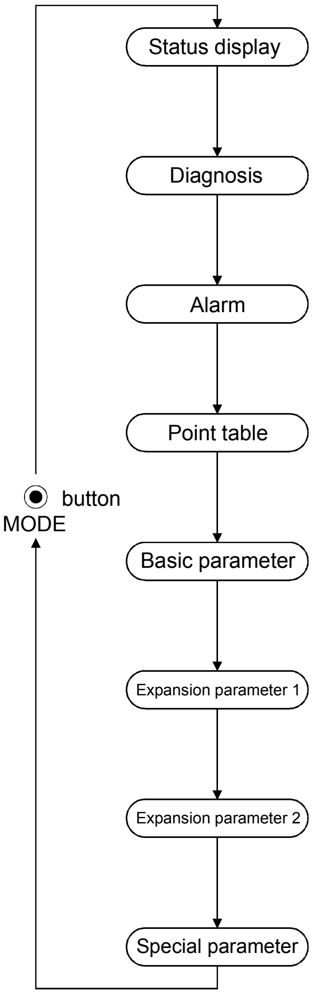
Click the “Close” button to close the window.

MEMO

7. DISPLAY AND OPERATION

7.1 Display flowchart

Use the display (5-digit, 7-segment LED) on the front panel of the servo amplifier for status display, parameter setting, etc. Set the parameters before operation, diagnose an alarm, confirm external sequences, and/or confirm the operation status. Press the "MODE" "UP" or "DOWN" button once to move to the next screen. Refer to section 7.2 and later for the description of the corresponding display mode.
To refer to or set the expansion parameters 1, expansion parameters 2 and special parameters, make them valid with parameter No.19 (parameter write disable).

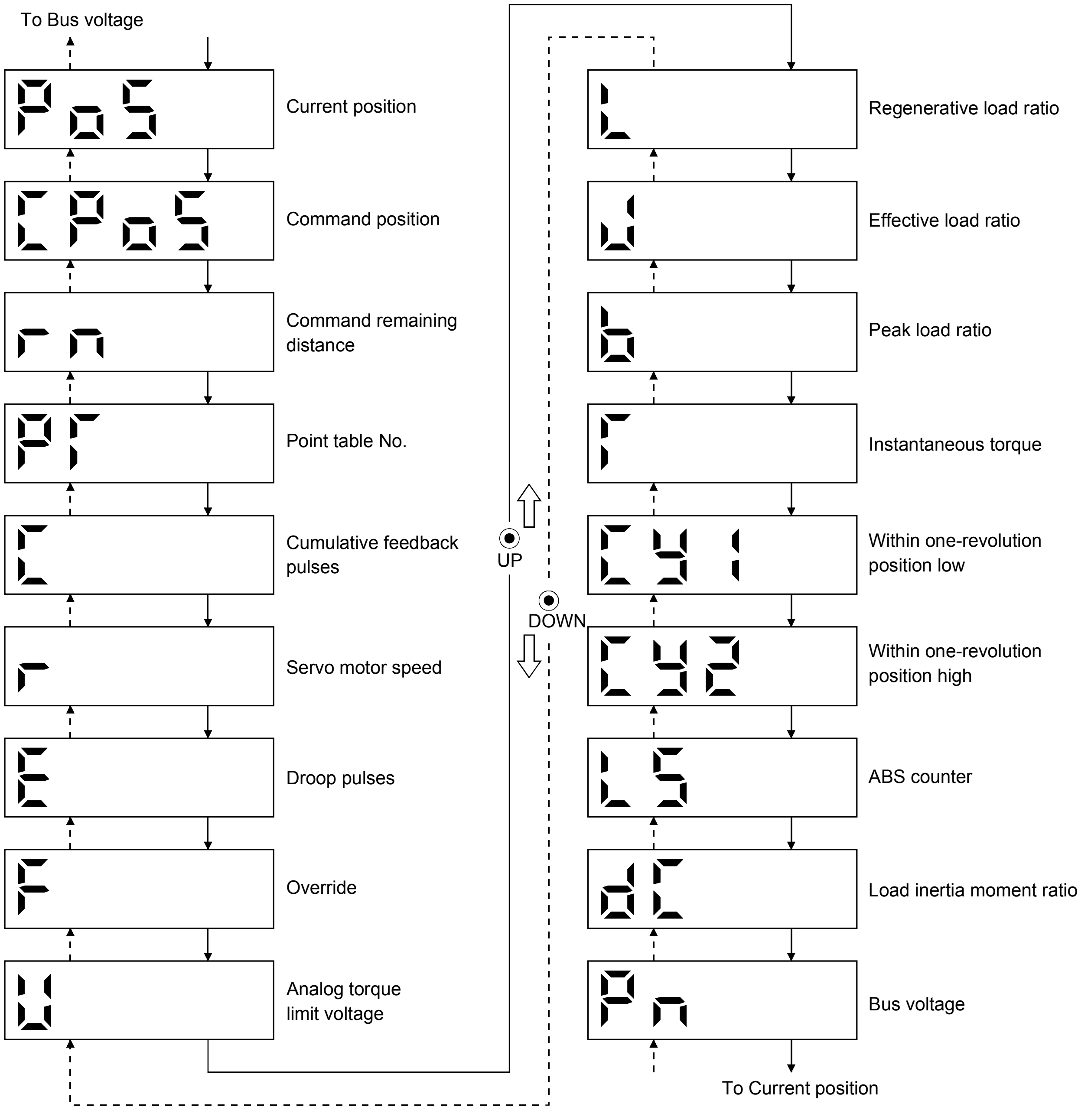
Display mode transition	Initial screen	Function	Reference
	PoS	Servo status display. PoS appears at power-on.	Section 7.2
	rd-oF	Alarm display, external signal display, output signal (DO) forced output, test operation, software version display, VC automatic offset, motor series ID display, motor type ID display, encoder ID display	Section 7.3
	AL --	Current alarm display, alarm history display, parameter error No. display, point table error No. display.	Section 7.4
	Po001	Display and setting of point table data.	Section 7.5
	P 00	Display and setting of basic parameters.	Section 7.6
	P 20	Display and setting of expansion parameters 1.	
	P 54	Display and setting of expansion parameters 2.	
	P 78	Display and setting of special parameters.	

7.2 Status display

The servo status during operation is shown on the 5-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol appears. Press the "SET" button to display its data. At only power-on, however, data appears after the symbol of the status display selected in parameter No. 18 has been shown for 2[s].
The servo amplifier display shows the lower five digits of 16 data items such as the motor speed.

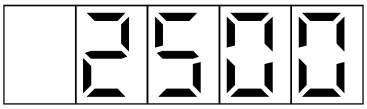
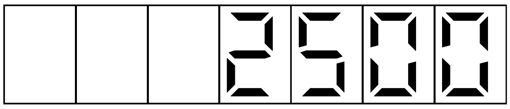
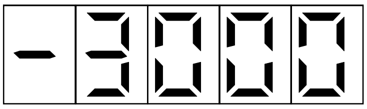
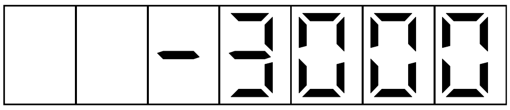
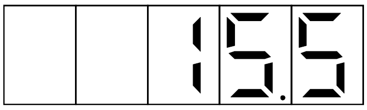
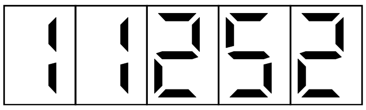
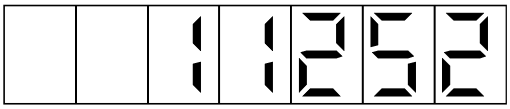
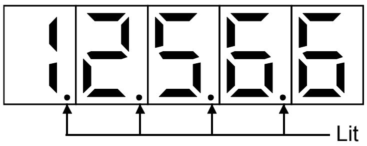
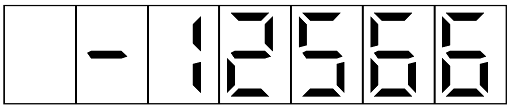
7.2.1 Display transition

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



7.2.2 Display examples

The following table lists display examples.

Item	Status	Displayed data	
		Servo amplifier display	MR-DP60
Servo motor speed	Forward rotation at 2500r/min		
	Reverse rotation at 3000r/min	 Reverse rotation is indicated by "−".	
Load inertia moment	15.5 times		
Multi-revolution counter	11252pulse		
	−12566pulse	 Negative value is indicated by the lit decimal points in the upper four digits.	

7.2.3 Status display list

The following table lists the servo statuses that may be shown.

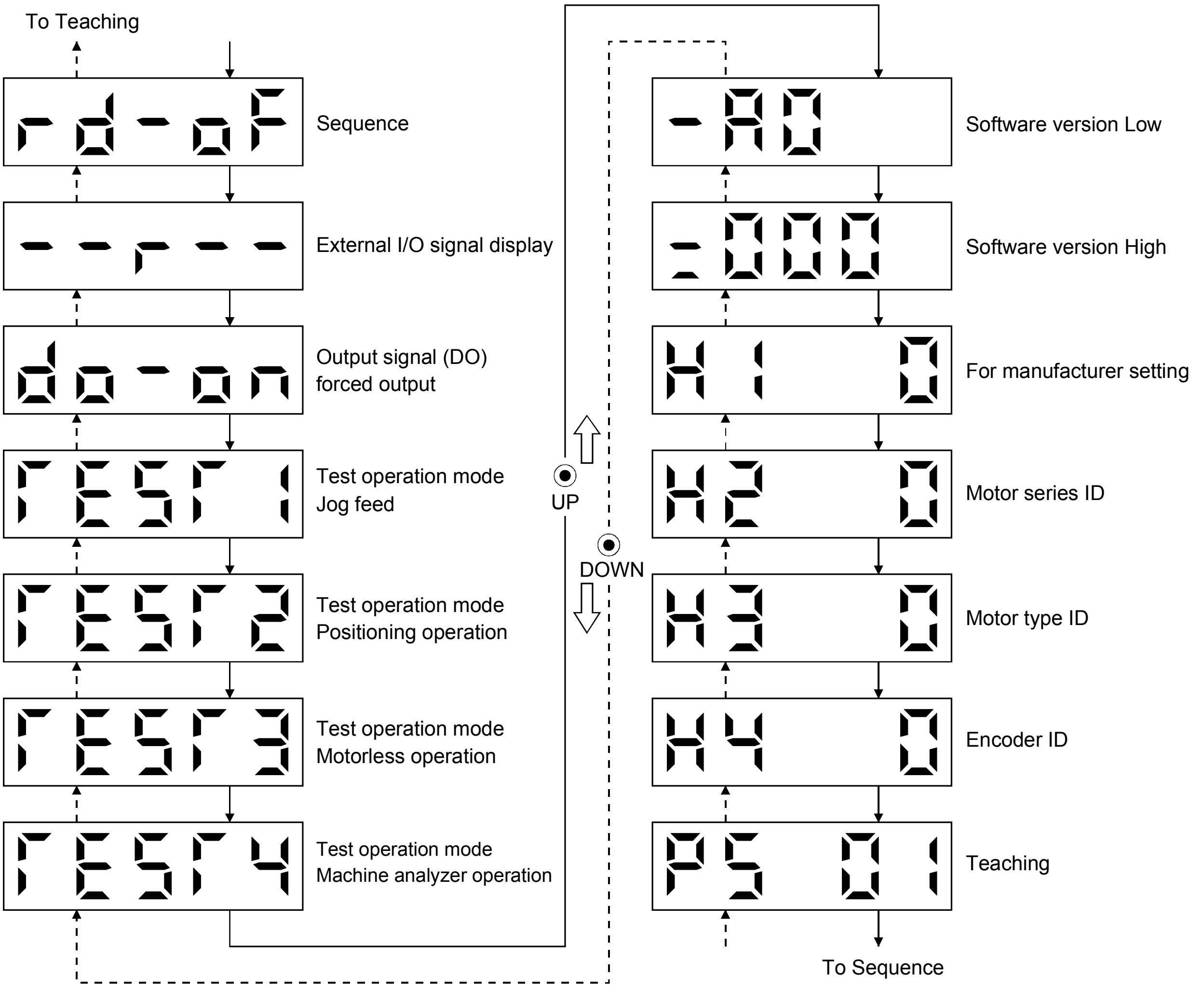
Status display	Symbol	Unit	Description	Display range	
				Servo amplifier display	MR-DP60
Current position	PoS	$\times 10^{STM}$ mm	The current position from the machine home position of 0 is displayed.	−99999 to 99999	−999999 to 999999
Command position	CPoS	$\times 10^{STM}$ mm	The command position is displayed.	−99999 to 99999	−999999 to 999999
Command remaining distance	rn	$\times 10^{STM}$ mm	The command remaining distance of the currently selected point table is displayed.	−99999 to 99999	−999999 to 999999
Point table No.	PT		The point table No. being executed is displayed.	0 to 31	0 to 31
Cumulative feedback pulses	C	pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the value exceeds ±9999999, it returns to zero. Press the "SET" button to reset the display value to zero.	−99999 to 99999	−999999 to 999999
Servo motor speed	r	r/min	The servo motor speed is displayed. "−" is added to the speed of the servo motor rotating in the CW rotation.	−5400 to 5400	−5400 to 5400
Droop pulses	E	pulse	The number of droop pulses in the deviation counter is displayed. "−" is added to the droop pulses in the CW rotation. The displayed number of pulses is not yet multiplied by the electronic gear value.	−99999 to 99999	−999999 to 999999
Override	F	%	The override setting is displayed. 100% is displayed when override is invalid.	0 to 200	0 to 200
Analog torque limit voltage	u	V	The voltage of the Analog torque limit (TLA) is displayed.	0.00 to 10.00	0.00 to 10.00
Regenerative load ratio	L	%	The ratio of regenerative power to permissible regenerative power is displayed in %.	0 to 100	0 to 100
Effective load ratio	J	%	The continuous effective load torque is displayed. The effective value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 300	0 to 300
Peak load ratio	b	%	The maximum torque generated during acceleration/deceleration, etc. The highest value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 300	0 to 300
Instantaneous torque	T	%	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	0 to 400
Within one-revolution position low	Cy1	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 99999	(Note) 0 to 131071
Within one-revolution position high	Cy2	100 pulse	The within one-revolution position is displayed in 100 pulse increments of the encoder. 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 1310	
ABS counter	LS	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	−32768 to 32767
Load inertia moment ratio	dC	times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0.0 to 300.0	0.0 to 300.0
Bus voltage	Pn	V	The voltage (across P-N) of the main circuit converter is displayed.	0 to 450	0 to 450

Note. The MR-DP60 can display the status without dividing it into the high and low orders. The unit is [pulse].

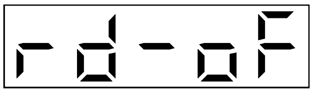
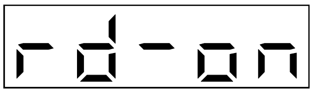
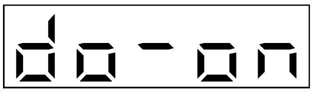
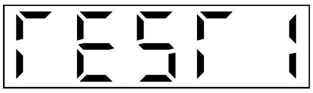
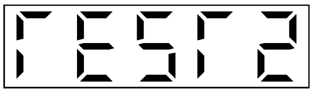
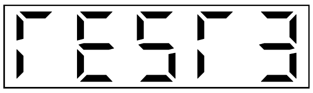
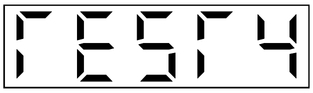
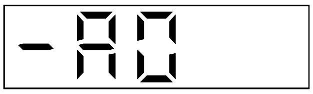
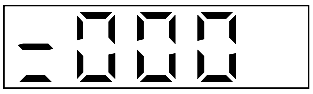
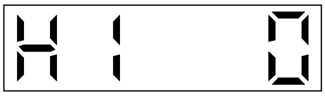
7.3 Diagnosis mode

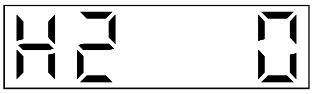
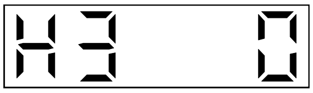
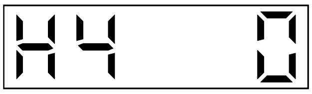
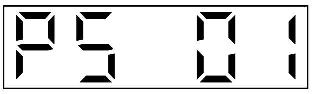
7.3.1 Display transition

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



7.3.2 Diagnosis mode list

Name		Display	Description
Sequence			Not ready. Indicates that the servo amplifier is being initialized or an alarm has occurred.
			Ready. Indicates that the servo was switched on after completion of initialization and the servo amplifier is ready to operate.
External I/O signal display		Refer to section 7.7.	Indicates the ON-OFF states of the external I/O signals. The upper segments correspond to the input signals and the lower segments to the output signals. Lit: ON Extinguished: OFF The I/O signals can be changed using the MR Configurator (servo configuration software).
Output signal (DO) forced output			The digital output signal can be forced on/off. (Refer to section 7.8)
Test operation mode	Jog feed		Jog operation can be performed when there is no command from the external command device. (Refer to section 7.9.2)
	Positioning operation		The MR Configurator (servo configuration software MRZJW3-SETUP151E) is required for positioning operation. This operation cannot be performed from the operation section of the servo amplifier. Positioning operation can be performed once when there is no command from the external command device.
	Motorless operation		Without connection of the servo motor, the servo amplifier provides output signals and displays the status as if the servo motor is running actually in response to the external input signal. (Refer to section 7.9.4)
	Machine analyzer operation		Merely connecting the servo amplifier allows the resonance point of the mechanical system to be measured. The MR Configurator (servo configuration software MRZJW3-SETUP151E or later) is required for machine analyzer operation.
Software version Low			Indicates the version of the software.
Software version High			Indicates the system number of the software.
For manufacturer setting			Manufacturer setting screen. Do not perform operation on this screen.

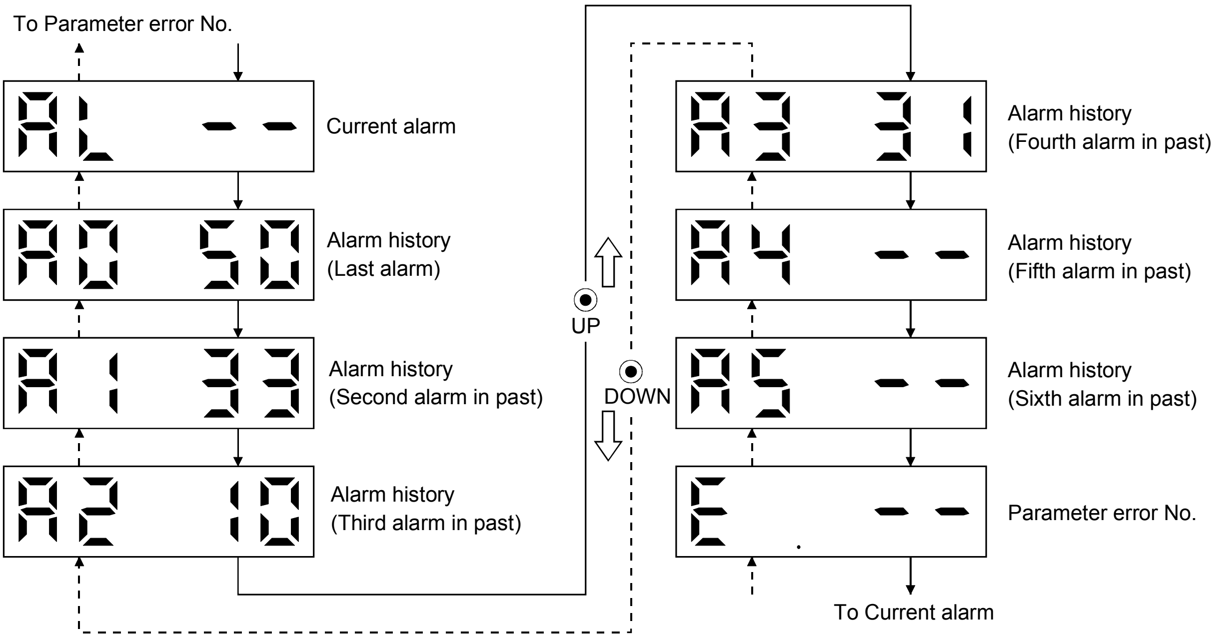
Name	Display	Description
Motor series		Press the "SET" button to show the motor series ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.
Motor type		Press the "SET" button to show the motor type ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.
Encoder		Press the "SET" button to show the encoder ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.
Teaching		Pressing the "SET" button selects the teaching mode. Refer to Section 7.10 for details.

7.4 Alarm mode

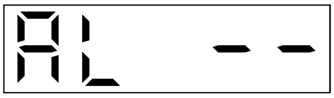
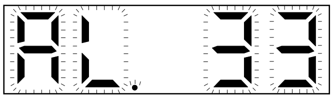
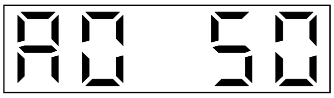
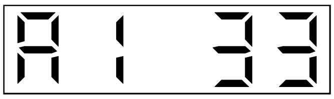
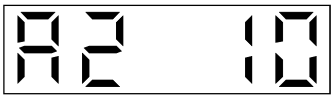
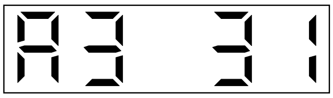
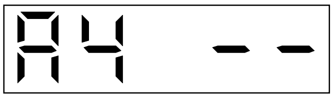
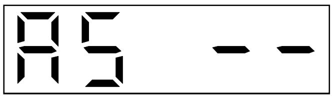
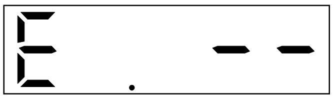
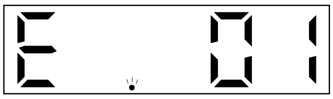
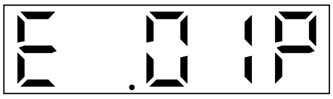
The current alarm, past alarm history and parameter error are displayed. The lower 2 digits on the display indicate the alarm number that has occurred or the parameter number in error. Display examples are shown below.

7.4.1 Display transition

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



7.4.2 Alarm mode list

Name	Display	Description
Current alarm		Indicates no occurrence of an alarm.
		Indicates the occurrence of overvoltage (AL.33). Flickers at occurrence of the alarm.
Alarm history		Indicates that the last alarm is overload 1 (AL.50).
		Indicates that the second alarm in the past is overvoltage (AL.33).
		Indicates that the third alarm in the past is undervoltage (AL.10).
		Indicates that the fourth alarm in the past is overspeed (AL.31).
		Indicates that there is no fifth alarm in the past.
		Indicates that there is no sixth alarm in the past.
Parameter error No.		Indicates no occurrence of parameter error.
		Indicates that the data of parameter No. 1 is faulty.
		Displayed when any of the set point table values exceeds the setting range. The display given on the left indicates an error in the position data of point table No. 1. P: Position data, d: Servo motor speed, A: Acceleration time constant, b: Deceleration time constant, n: Dwell, H: Auxiliary function

Functions at occurrence of an alarm

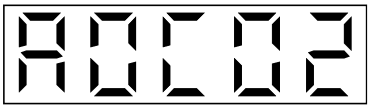
(1) Any mode screen displays the current alarm.

(2) Even during alarm occurrence, the other screen can be viewed by pressing the button in the operation area. At this time, the decimal point in the fourth digit remains flickering.

(3) For any alarm, remove its cause and clear it in any of the following methods (for clearable alarms, refer to section 11.2.1).
   (a) Switch power OFF, then ON.
   (b) Press the "SET" button on the current alarm screen.
   (c) Turn on the reset (RES) signal.

(4) Use parameter No. 16 to clear the alarm history.

(5) Pressing "SET" on the alarm history display screen for 2s or longer shows the following detailed information display screen. Note that this is provided for maintenance by the manufacturer.



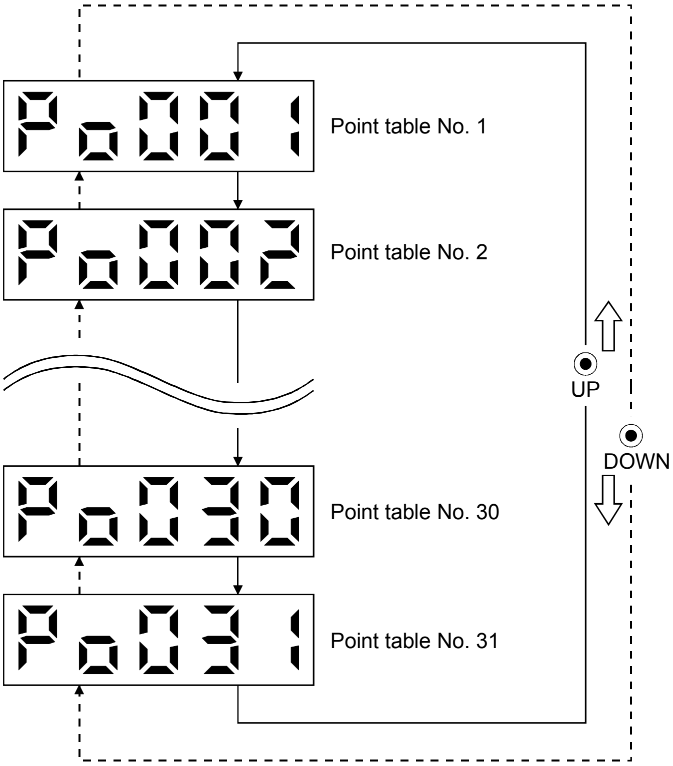
(6) Press "UP" or "DOWN" to move to the next history.

7.5 Point table mode

You can set the target position, servo motor speed, acceleration time, deceleration time, dwell and auxiliary function.

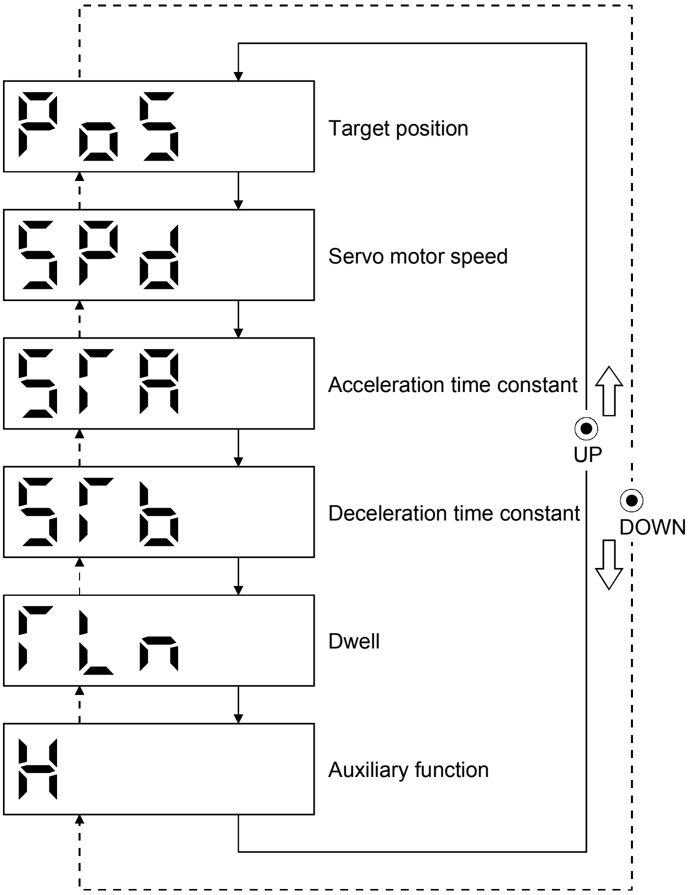
7.5.1 Point table transition

After choosing the point table mode with the "MODE" button, pressing the "UP" or "DOWN" button changes the display as shown below.



7.5.2 Point table mode setting screen sequence

Press "SET" in the point table mode. The following screen appears.
Press "UP" or "DOWN" to move to the next screen.

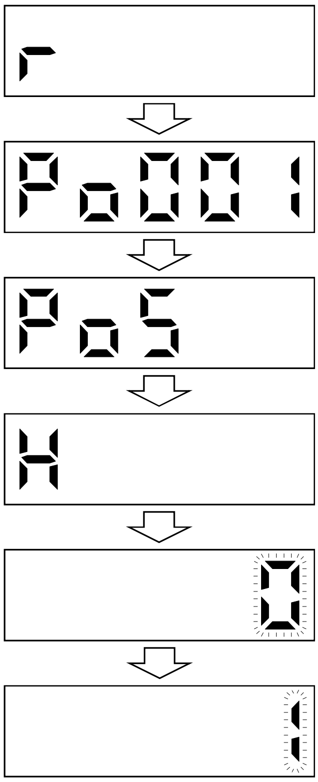


7.5.3 Operation method

(1) Setting of 5 or less-digit value

The following example provides the after-power-on operation procedure to set "1" in the auxiliary function of point table No.1.

(Note)



Press MODE three times.

··········The point table No. appears.

Press UP or DOWN to choose point table No. 1.

Press SET once.

Press UP five times.

Press SET twice.

··········The setting of the specified point table No. flickers.

Press UP once.

··········The setting can be changed during flickering.

Use UP or DOWN to change the setting.

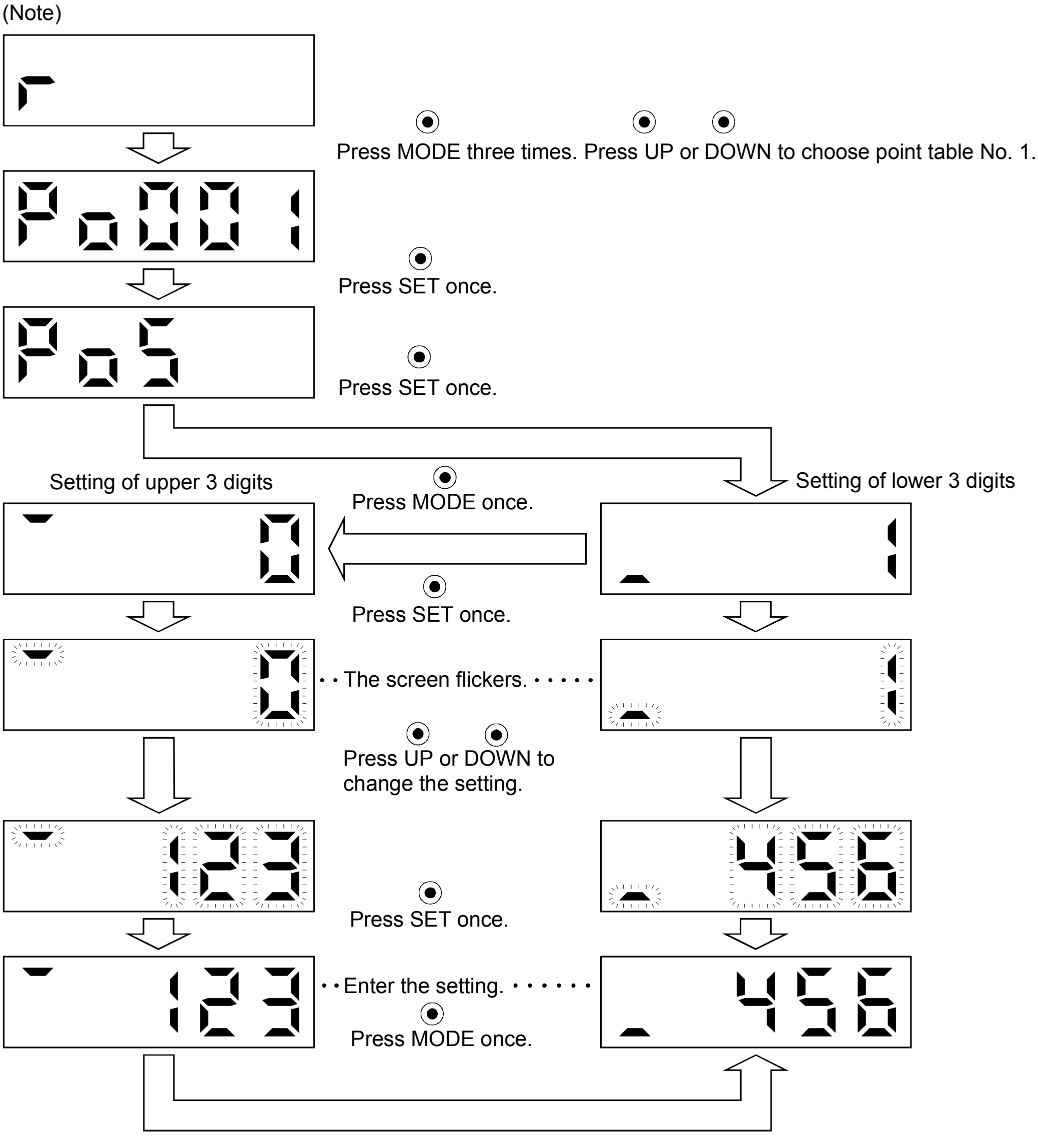
Press SET to enter the value.

Note. The example assumes that the status display screen that appears at power-on has been set to the servo motor speed in parameter No. 18.

Press "UP" or "DOWN" after completion of the setting to return to the setting item screen. Further, press "UP" and "DOWN" together to return to the point table No. display screen.

(2) Setting of 6 or more-digit value

The following example gives the after-power-on operation procedure to change the target value of point table No.1 to "123456".



Note. The example assumes that the status display screen that appears at power-on has been set to the servo motor speed in parameter No. 18.

Press "UP" or "DOWN" after completion of the setting to return to the setting item screen. Further, press "UP" and "DOWN" together to return to the point table No. display screen.

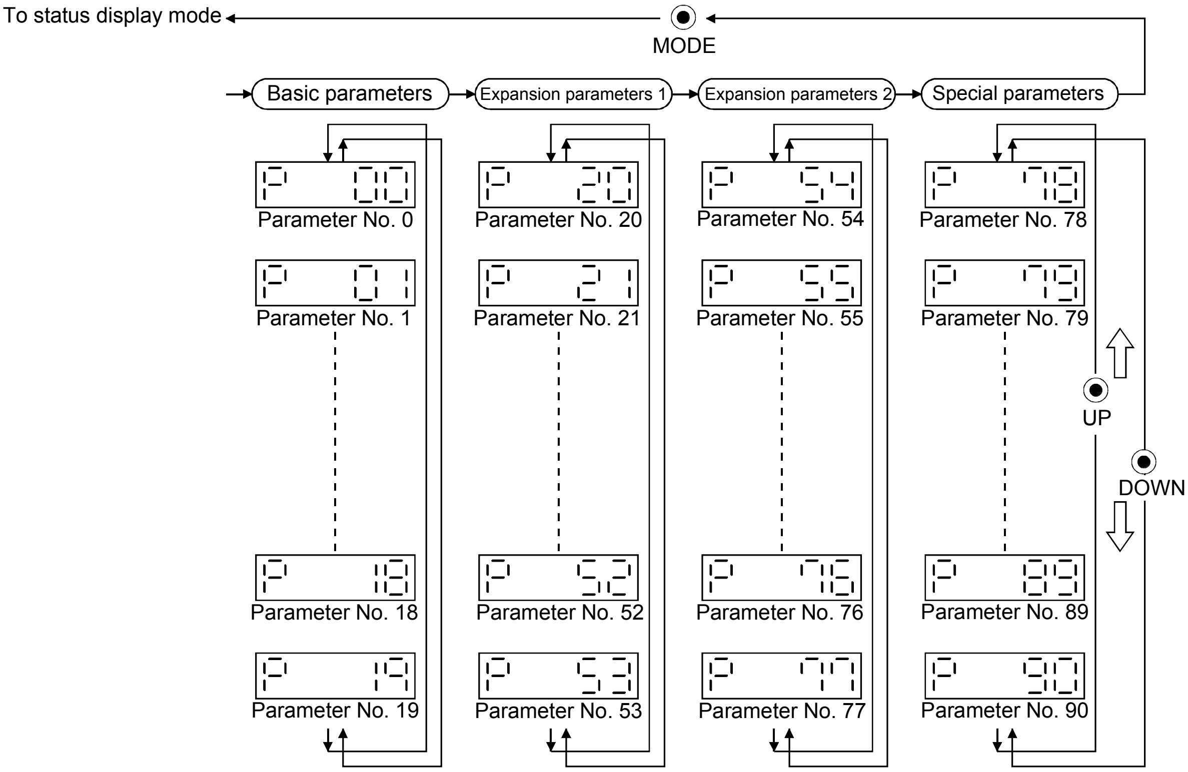
7.6 Parameter mode

POINT

- To use the expansion parameters, change the parameter No. 19 (parameter write inhibit) value. (Refer to section 5.1.1)

7.6.1 Parameter mode transition

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

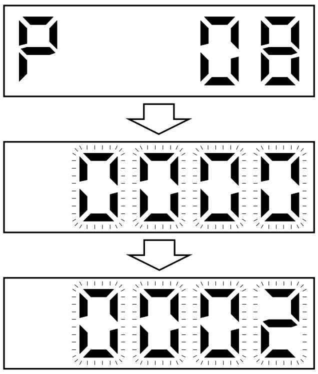


The parameter whose abbreviation is marked * is made valid by switching power off, then on after changing its setting. (Refer to section 5.1.2)

7.6.2 Operation example

(1) Parameter of 5 or less digits

The following example shows the operation procedure performed after power-on to change the home position setting method (Parameter No.8) into the data setting type. Press "MODE" to switch to the basic parameter screen.



Press MODE four times. Select parameter No.8 with UP or DOWN.

······The parameter number is displayed.

Press UP or DOWN to change the number.

Press SET twice.

······The set value of the specified parameter number flickers.

Press UP twice.

······During flickering, the set value can be changed.

Use UP or DOWN .
(□□□2: Data setting type)

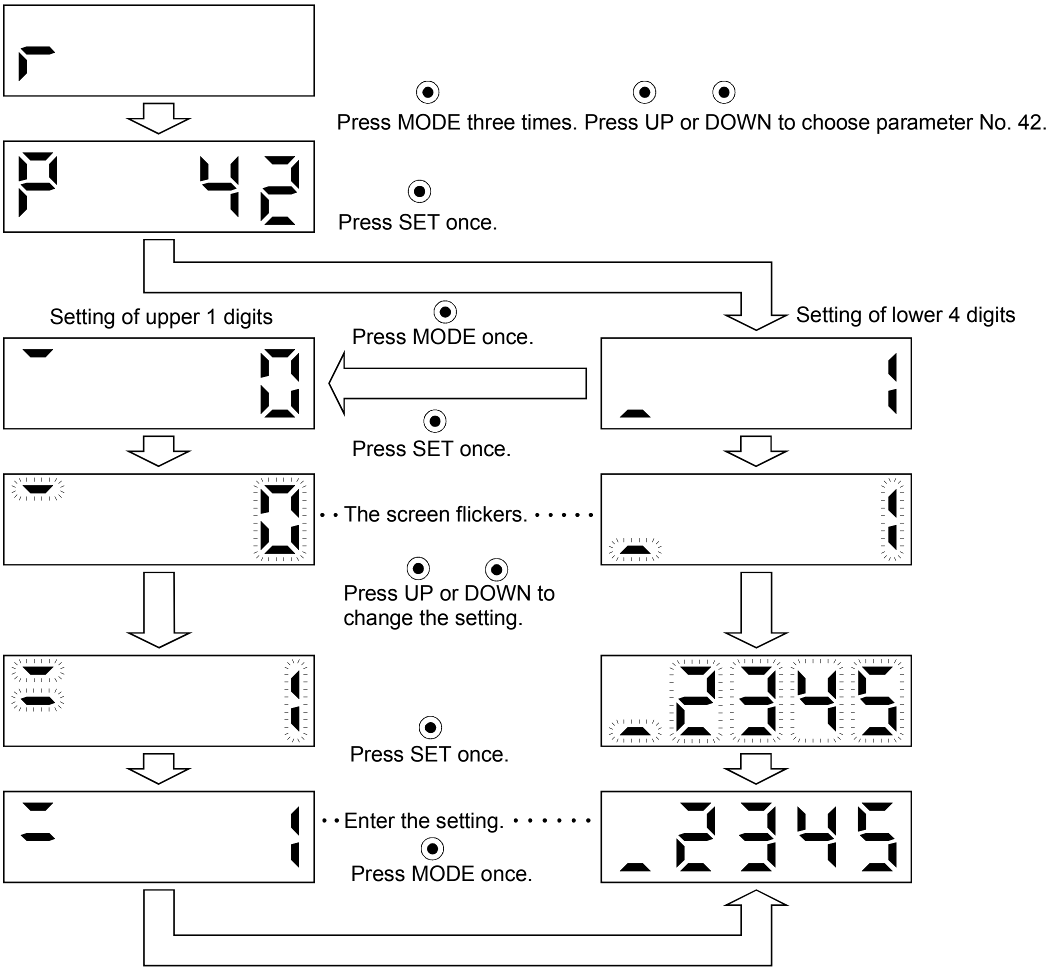
Press SET to enter.

To shift to the next parameter, press the "UP" or "DOWN" button.
When changing the parameter No.8 (home position return type) setting, change its set value, then switch power off once and switch it on again to make the new value valid.

(2) Signed 5-digit parameter

The following example gives the operation procedure to change the home position return position data (parameter No. 42) to "-12345".

(Note)



Press MODE three times. Press UP or DOWN to choose parameter No. 42.

Press SET once.

Setting of upper 1 digits

Press MODE once.

Setting of lower 4 digits

Press SET once.

• • The screen flickers. • • • • •

Press UP or DOWN to change the setting.

Press SET once.

• • Enter the setting. • • • • • •

Press MODE once.

Note. The example assumes that the status display screen that appears at power-on has been set to the servo motor speed in parameter No. 18.

When changing the parameter No. 42 setting, change its set value, then switch power off once and switch it on again to make the new value valid.

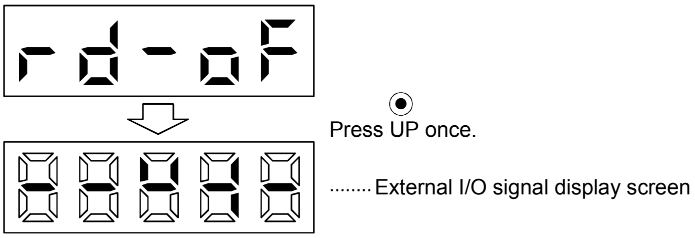
7.7 External I/O signal display

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

(1) Operation

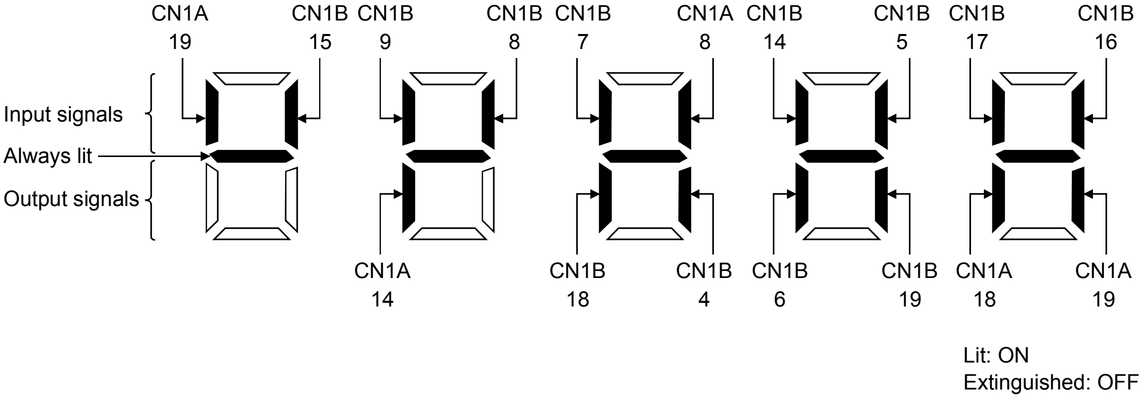
Call the display screen shown after power-on.

Using the "MODE" button, show the diagnostic screen.



(2) Display definition

The segments of the seven-segment LEDs correspond to the pins.



The 7-segment LED shown above indicates ON/OFF.

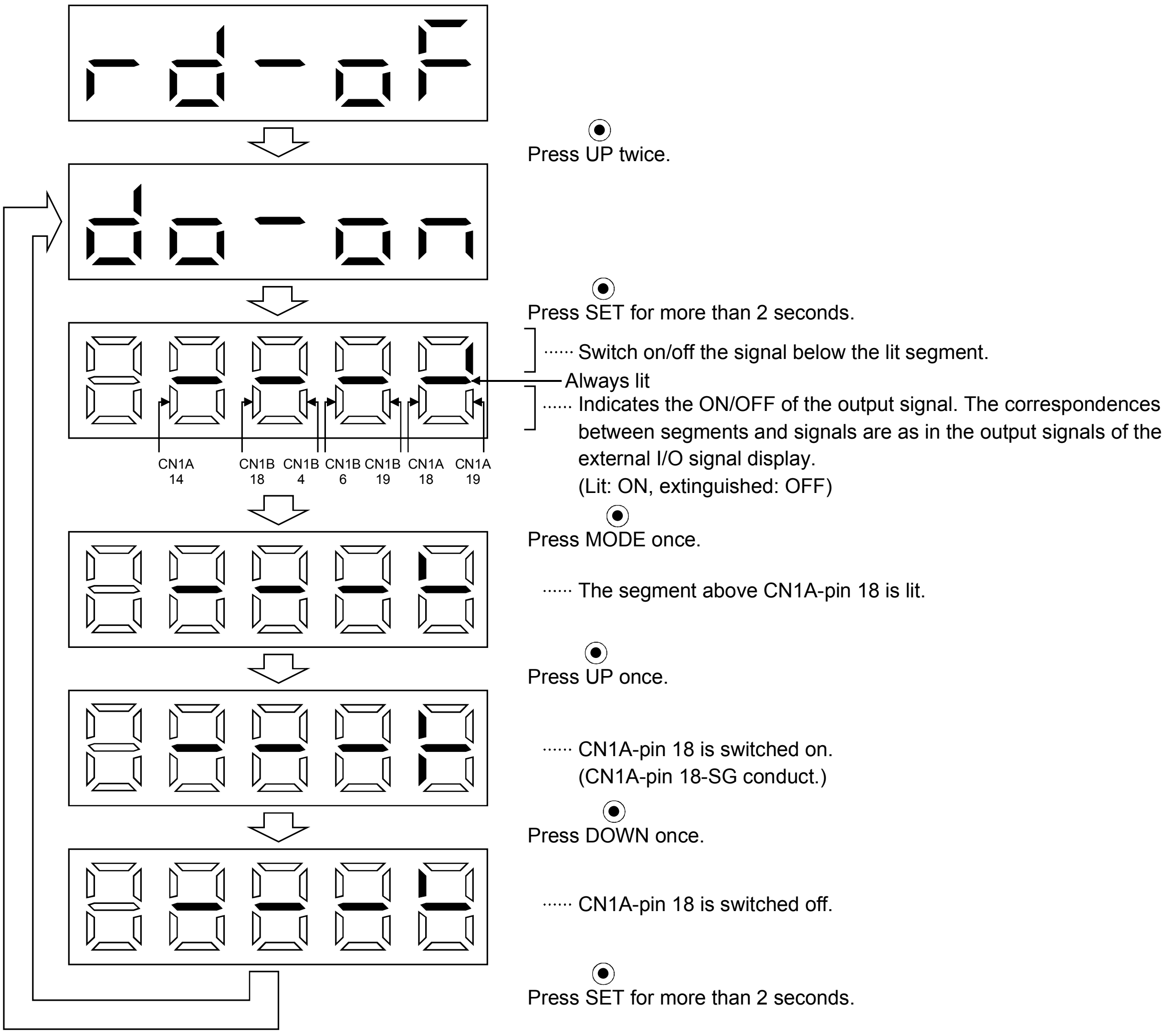
Each segment at top indicates the input signal and each segment at bottom indicates the output signal. The signals corresponding to the pins in the respective control modes are indicated below.

7.8 Output signal (DO) forced output

POINT

- When the servo system is used in a vertical lift application, turning on the electromagnetic brake interlock (MBR) after assigning it to pin CN1B-19 will release the electromagnetic brake, causing a drop. Take drop preventive measures on the machine side.

The output signal can be forced on/off independently of the servo status. This function is used for output signal wiring check, etc. This operation must be performed in the servo off state (SON off).
Call the display screen shown after power-on.
Using the "MODE" button, show the diagnostic screen.



Press UP twice.

Press SET for more than 2 seconds.

······ Switch on/off the signal below the lit segment.

······ Indicates the ON/OFF of the output signal. The correspondences between segments and signals are as in the output signals of the external I/O signal display.
(Lit: ON, extinguished: OFF)

Press MODE once.

······ The segment above CN1A-pin 18 is lit.

Press UP once.

······ CN1A-pin 18 is switched on.
(CN1A-pin 18-SG conduct.)

Press DOWN once.

······ CN1A-pin 18 is switched off.

Press SET for more than 2 seconds.

7.9 Test operation mode

⚠ CAUTION

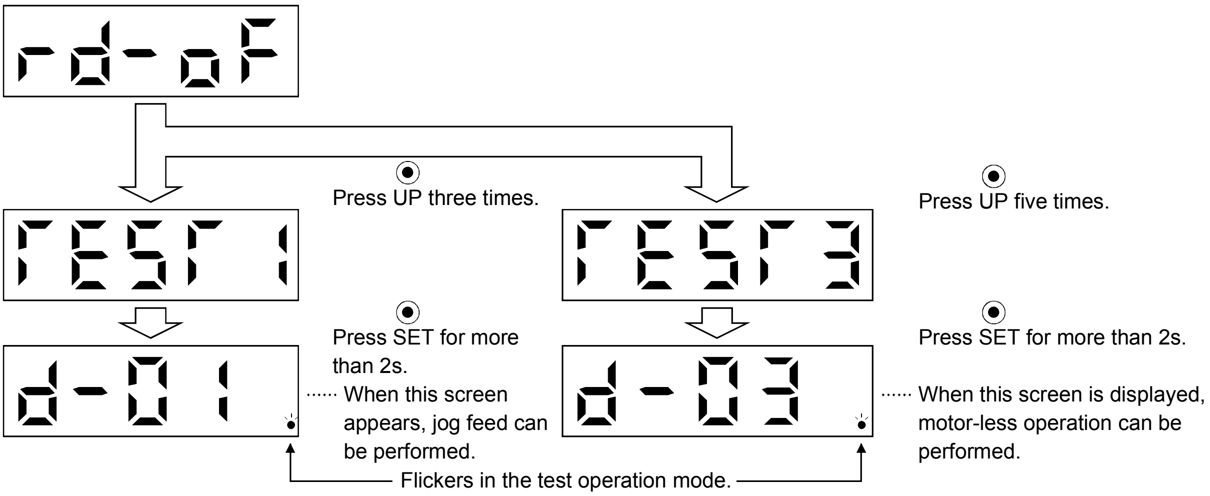
- The test operation mode is designed to confirm servo operation and not to confirm machine operation. In this mode, do not use the servo motor with the machine. Always use the servo motor alone.
- If any operational fault has occurred, stop operation using the forced stop (EMG) .

POINT

- The test operation mode cannot be used in the absolute position detection system. Use it after choosing "Incremental system" in parameter No. 1.
- The MR Configurator (servo configuration software) is required to perform positioning operation.
- Test operation cannot be performed if the servo-on (SON) signal is not turned OFF.

7.9.1 Mode change

Call the display screen shown after power-on. Choose jog operation/motor-less operation in the following procedure. Using the "MODE" button, show the diagnostic screen.



7.9.2 Jog operation

Jog operation can be performed when there is no command from the external command device.

(1) Operation

Connect EMG-SG to start jog operation and connect VDD-COM to use the internal power supply.

Hold down the "UP" or "DOWN" button to run the servo motor. Release it to stop. When using the MR Configurator (servo configuration software), you can change the operation conditions. 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
Acceleration/deceleration time constant [ms]	1000	0 to 50000

How to use the buttons is explained below.

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

If the communication cable is disconnected during jog operation performed by using the MR Configurator (servo configuration software), the servo motor will be decelerated to a stop.

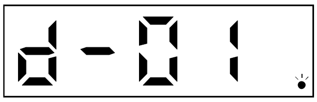
(2) Status display

You can confirm the servo status during jog operation.

Pressing the "MODE" button in the jog operation-ready status calls the status display screen. With this screen being shown, perform jog operation with the "UP" or "DOWN" button. Every time you press the "MODE" button, the next status display screen appears, and on completion of a screen cycle, pressing that button returns to the jog operation-ready status screen. For full information of the status display, refer to section 7.2. In the test operation mode, you cannot use the "UP" and "DOWN" buttons to change the status display screen from one to another.

(3) Termination of jog operation

To end the jog operation, switch power off once or press the "MODE" button to switch to the next screen and then hold down the "SET" button for 2 or more seconds.



7.9.3 Positioning operation

POINT

- The MR Configurator (servo configuration software) is required to perform positioning operation.

Positioning operation can be performed once when there is no command from the external command device.

(1) Operation

Connect EMG-SG to start positioning operation and connect VDD-COM to use the internal power supply.

Pressing the "Forward" or "Reverse" button on the MR Configurator (servo configuration software) starts the servo motor, which will then stop after moving the preset travel distance. You can change the operation conditions on the MR Configurator (servo configuration software). The initial conditions and setting ranges for operation are listed below.

Item	Initial setting	Setting range
Travel distance [pulse]	10000	0 to 9999999
Speed [r/min]	200	0 to instantaneous permissible speed
Acceleration/deceleration time constant [ms]	1000	0 to 50000

How to use the keys is explained below.

Key	Description
"Forward"	Click to start positioning operation CCW.
"Reverse"	Click to start positioning operation CW.
"Pause"	Click during operation to make a temporary stop. Clicking the "Pause" button again erases the remaining distance. To resume operation, press the button that was pressed to start the operation.

If the communication cable is disconnected during positioning operation, the servo motor will come to a sudden stop.

(2) Status display

You can monitor the status display even during positioning operation.

7.9.4 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 host programmable controller or the like.

(1) Operation

After turning off the signal across SON-SG, choose motor-less operation. After that, perform external operation as in ordinary operation.

(2) Status display

You can confirm the servo status during motor-less operation.

Pressing the "MODE" button in the motor-less operation-ready status calls the status display screen. With this screen being shown, perform motor-less operation. Every time you press the "MODE" button, the next status display screen appears, and on completion of a screen cycle, pressing that button returns to the motor-less operation-ready status screen. For full information of the status display, refer to section 7.2. In the test operation mode, you cannot use the "UP" and "DOWN" buttons to change the status display screen from one to another.

(3) Termination of motor-less operation

To terminate the motor-less operation, switch power off.

7.10 Teaching function

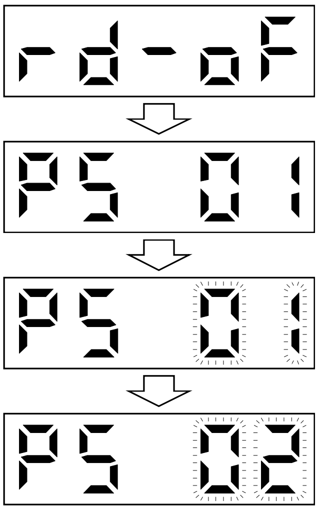
POINT

- This function is available for the absolute value command system. It is not available for the incremental value command system.
- This function is enabled after a home position return.
- After making sure that the servo motor has stopped, press the "SET" button in the operation section or turn teach (TCH) ON and set the position data.

Position data can be imported by pressing the "SET" button in the operation section or turning teach (TCH) ON after moving the axis to the target position by JOG operation or manual pulse generator operation.

7.10.1 Preparations for teaching

Press the "MODE" button to choose the diagnosis mode.



······ This screen displays the servo off status.

Press ◉ UP or ◉ DOWN to switch to the teaching setting initial screen.

Press ◉ SET for 2s or longer to choose the teaching setting mode.

······The lower two digits flicker in the teaching setting mode.

Press ◉ UP or ◉ DOWN to call the point table No. where position data will be set.

······ For example, point table No. 2 is called here.

7.10.2 Position data setting method

When the preparations for teaching are over, set position data in the following procedure.

(1) When determining position data by JOG operation

1) Turn automatic/manual selection (MD0) OFF to choose the manual operation mode. (Refer to section 4.3)
2) Turn forward rotation start (ST1) or reverse rotation start (ST2) ON to rotate the servo motor until the target position is reached. (Refer to section 4.3.1)
3) When positioning is completed, press the "SET" button in the operation section or turn teach (TCH) ON. This sets the address of positioning as the position data of the point table.

(2) When determining position data by manual pulse generator operation

1) Turn automatic/manual selection (MD0) OFF to choose the manual operation mode. (Refer to section 4.3)
2) Turn the manual pulse generator to rotate the servo motor until the target position is reached. (Refer to section 4.3.2)
3) When positioning is completed, press the "SET" button in the operation section or turn teach (TCH) ON. This sets the address of positioning as the position data of the point table.

When the setting is completed correctly, the upper digits in the display section flicker as shown below.

Press the "MODE" button on the flickering screen to return to the teaching initial screen.

MEMO

8. GENERAL GAIN ADJUSTMENT

8.1 Different adjustment methods

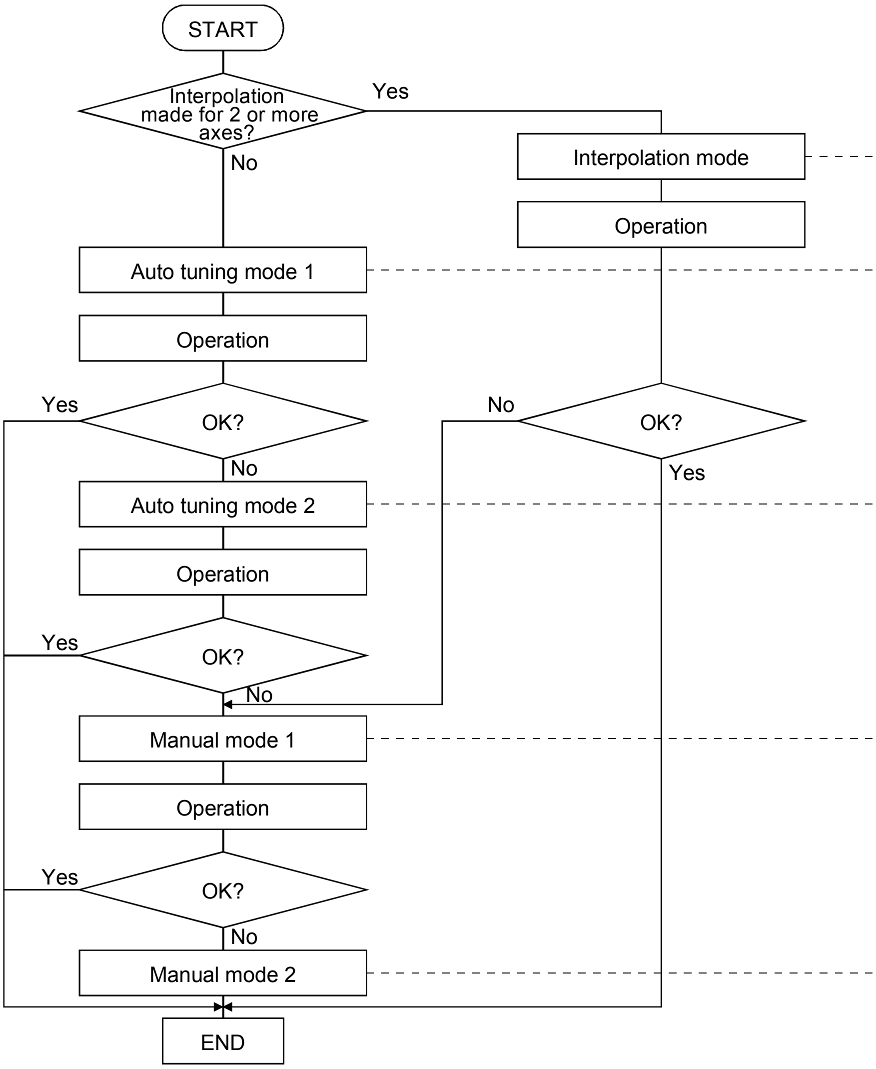
8.1.1 Adjustment on a single servo amplifier

The gain adjustment in this section can be made on a single servo amplifier. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2, manual mode 1 and manual mode 2 in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	Parameter No. 3 setting	Estimation of load inertia moment ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	010□	Always estimated	PG1 (parameter No. 7) GD2 (parameter No. 34) PG2 (parameter No. 35) VG1 (parameter No. 36) VG2 (parameter No. 37) VIC (parameter No. 38)	Response level setting of parameter No. 3
Auto tuning mode 2	020□	Fixed to parameter No. 34 value	PG1 (parameter No. 7) PG2 (parameter No. 35) VG1 (parameter No. 36) VG2 (parameter No. 37) VIC (parameter No. 38)	GD2 (parameter No. 34) Response level setting of parameter No. 3
Manual mode 1	030□		PG2 (parameter No. 35) VG1 (parameter No. 36)	PG1 (parameter No. 7) GD2 (parameter No. 34) VG2 (parameter No. 37) VIC (parameter No. 38)
Manual mode 2	040□			PG1 (parameter No. 7) GD2 (parameter No. 34) PG2 (parameter No. 35) VG1 (parameter No. 36) VG2 (parameter No. 37) VIC (parameter No. 38)
Interpolation mode	000□	Always estimated	GD2 (parameter No. 34) PG2 (parameter No. 35) VG2 (parameter No. 37) VIC (parameter No. 38)	PG1 (parameter No. 7) VG1 (parameter No. 36)

(2) Adjustment sequence and mode usage



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

8.1.2 Adjustment using MR Configurator (servo configuration software)

This section gives the functions and adjustment that may be performed by using the servo amplifier with the MR Configurator (servo configuration software) which operates on a personal computer.

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from the personal computer to the servo and measuring the machine response.	・You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter. ・You can automatically set the optimum gains in response to the machine characteristic. This simple adjustment is suitable for a machine which has large machine resonance and does not require much settling time.
Gain search	Executing gain search under to-and-fro positioning command measures settling characteristic while simultaneously changing gains, and automatically searches for gains which make settling time shortest.	・You can automatically set gains which make positioning settling time shortest.
Machine simulation	Response at positioning settling of a machine can be simulated from machine analyzer results on personal computer.	・You can optimize gain adjustment and command pattern on personal computer.

8.2 Auto tuning

8.2.1 Auto tuning mode

The servo amplifier has a real-time auto tuning function which estimates the machine characteristic (load inertia moment ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the servo amplifier.

(1) Auto tuning mode 1

The servo amplifier is factory-set to the auto tuning mode 1.

In this mode, the load inertia moment ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in the auto tuning mode 1.

Parameter No.	Abbreviation	Name
7	PG1	Position control gain 1
34	GD2	Ratio of load inertia moment to servo motor inertia moment
35	PG2	Position control gain 2
36	VG1	Speed control gain 1
37	VG2	Speed control gain 2
38	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 motor inertia moment is not more than 100 times.
  - 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 1,2 to make gain adjustment.

(2) Auto tuning mode 2

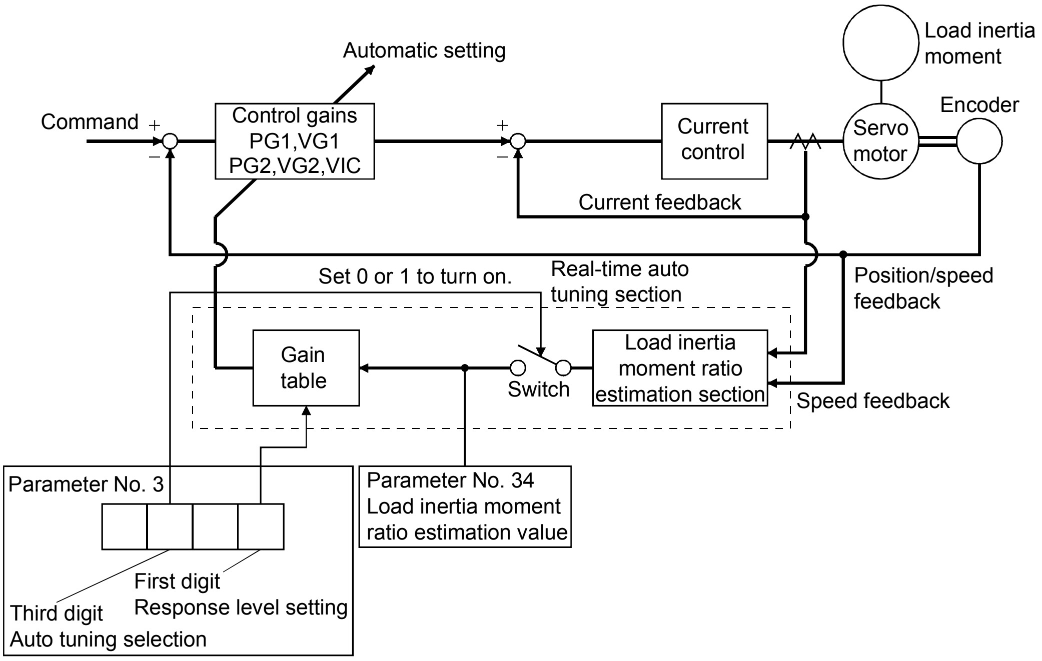
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No. 34).

The following parameters are automatically adjusted in the auto tuning mode 2.

Parameter No.	Abbreviation	Name
7	PG1	Position control gain 1
35	PG2	Position control gain 2
36	VG1	Speed control gain 1
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

8.2.2 Auto tuning mode operation

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



When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No. 34 (load inertia moment ratio). These results can be confirmed on the status display screen of the servo amplifier display 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.3：□2□□) 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. 34) value and response level (The first digit of parameter No. 3), the optimum control gains are automatically set on the basis of the internal gain tale.

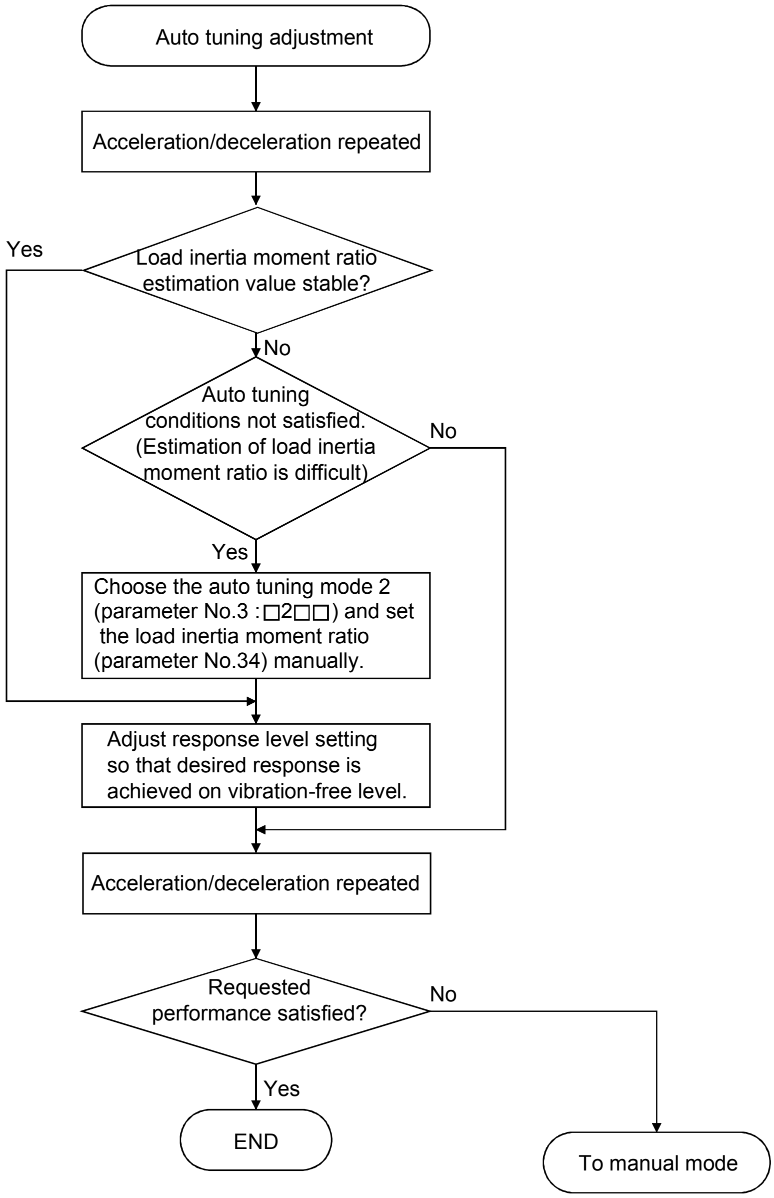
The auto tuning results are saved in the EEP-ROM of the servo amplifier every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each control gain saved in the EEP-ROM being used as an initial value.

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. 3: □2□□) and set the correct load inertia moment ratio in parameter No. 34.
- When any of the auto tuning mode 1, auto tuning mode 2 and manual mode 1 settings is changed to the manual mode 2 setting, the current control gains and load inertia moment ratio estimation value are saved in the EEP-ROM.

8.2.3 Adjustment procedure by auto tuning

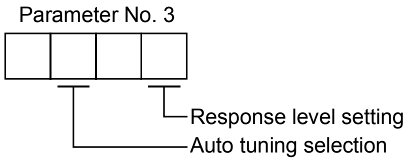
Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.

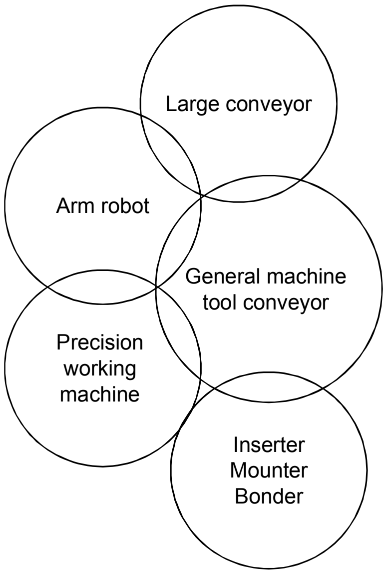


8.2.4 Response level setting in auto tuning mode

Set the response (The first digit of parameter No.3) 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, adaptive vibration suppression control (parameter No. 63) or machine resonance suppression filter (parameter No. 61・62) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 9.3 for adaptive vibration suppression control and section 9.2 for machine resonance suppression filter.



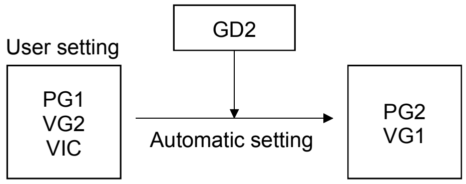
Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	15Hz	
2		20Hz	
3		25Hz	
4	↑	30Hz	
5		35Hz	
6		45Hz	
7		55Hz	
8	Middle	70Hz	
9		85Hz	
A		105Hz	
B		130Hz	
C	↓	160Hz	
D		200Hz	
E		240Hz	
F	High	300Hz	

8.3 Manual mode 1 (simple manual adjustment)

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

8.3.1 Operation of manual mode 1

In this mode, setting the three gains of position control gain 1 (PG1), speed control gain 2 (VG2) and speed integral compensation (VIC) automatically sets the other gains to the optimum values according to these gains.



Therefore, you can adjust the model adaptive control system in the same image as the general PI control system (position gain, speed gain, speed integral time constant). Here, the position gain corresponds to PG1, the speed gain to VG2 and the speed integral time constant to VIC. When making gain adjustment in this mode, set the load inertia moment ratio (parameter No. 34) correctly.

8.3.2 Adjustment by manual mode 1

POINT

- If machine resonance occurs, adaptive vibration suppression control (parameter No. 63) or machine resonance suppression filter (parameter No. 61 · 62) may be used to suppress machine resonance. (Refer to section 9.2, 9.3.)

(1) For speed control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
7	PG1	Position control gain 1
34	GD2	Ratio of load inertia moment to servo motor inertia moment
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment (parameter No. 34).	
2	Increase the speed control gain 2 (parameter No. 37) within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed control gain.
3	Decrease the speed integral compensation (parameter No. 38) within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
4	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 adaptive vibration suppression control or machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance. Refer to section 9.2, 9.3.
5	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed control gain 2 (parameter No. 37)

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.

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

2) Speed integral compensation (VIC: parameter No. 38)

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load inertia moment ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed control gain 2 setting}/(1+\text{ratio of load inertia moment to servo motor inertia moment setting}\times 0.1)}$$

(2) For position control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
7	PG1	Position control gain 1
34	GD2	Ratio of load inertia moment to servo motor inertia moment
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment (parameter No. 34).	
2	Set a slightly smaller value to the position control gain 1 (parameter No. 7).	
3	Increase the speed control gain 2 (parameter No. 37) within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed control gain.
4	Decrease the speed integral compensation (parameter No. 38) within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
5	Increase the position control gain 1 (parameter No. 7).	Increase the position control gain.
6	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 adaptive vibration suppression control or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to section 9.2, 9.3.
7	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Position control gain 1 (parameter No. 7)

This parameter determines the response level of the position control loop. Increasing position control 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.

$$\begin{array}{l}\text{Position control}\\ \text{gain 1 guideline}\end{array} \leq \frac{\text{Speed control gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})} \times \left(\frac{1}{3}\text{ to }\frac{1}{5}\right)$$

2) Speed control gain 2 (VG2: parameter No. 37)

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.

$$\begin{array}{l}\text{Speed loop response}\\ \text{frequency(Hz)}\end{array} = \frac{\text{Speed control gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})\times 2\pi}$$

3) Speed integral compensation (parameter No. 38)

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.

$$\begin{array}{l}\text{Speed integral}\\ \text{compensation setting(ms)}\end{array} \geq \frac{\text{2000 to 3000}}{\begin{array}{r}\text{Speed control gain 2 setting/ (1+ ratio of load inertia moment to}\\ \text{servo motor inertia moment 2 setting}\times 0.1)\end{array}}$$

8.4 Interpolation mode

The interpolation mode is used to match the position control 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 position control gain 2 and speed control gain 2 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
34	GD2	Ratio of load inertia moment to servo motor inertia moment
35	PG2	Position control gain 2
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

(b) Manually adjusted parameters

The following parameters are adjustable manually.

Parameter No.	Abbreviation	Name
7	PG1	Position control gain 1
36	VG1	Speed control gain 1

(2) Adjustment procedure

Step	Operation	Description
1	Set 15Hz (parameter No. 3: 010☐) as the machine resonance frequency of response in the auto tuning mode 1.	Select the auto tuning mode 1.
2	During operation, increase the response level setting (parameter No. 2), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of position control gain 1 (parameter No. 7) and speed control gain 1 (parameter No. 36).	Check the upper setting limits.
4	Set the interpolation mode (parameter No. 3: 000☐).	Select the interpolation mode.
5	Set the position control gain 1 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 position control gain 1.	Set position control gain 1.
6	Using the speed control gain 1 value checked in step 3 as the guideline of the upper limit, look at the rotation status and set in speed control gain 1 the value three or more times greater than the position control gain 1 setting.	Set speed control gain 1.
7	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

(a) Position control gain 1 (parameter No.7)

This parameter determines the response level of the position control loop. Increasing position control 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. The droop pulse value is determined by the following expression.

$$\text{Droop pulse value (pulse)} = \frac{\text{Rotation speed (r/min)} \times 131{,}072\text{(pulse)}}{\text{Position control gain 1 setting}}$$

(b) Speed control gain 1 (parameter No. 36)

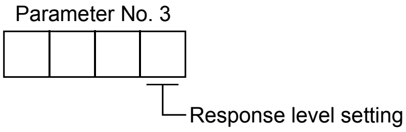
Set the response level of the speed loop of the model. Make setting using the following expression as a guideline.

Speed control gain 1 setting ≥ Position control gain 1 setting×3

8.5 Differences in auto tuning between MELSERVO-J2 and MELSERVO-J2-Super

8.5.1 Response level setting

To meet higher response demands, the MELSERVO-J2-Super series has been changed in response level setting range from the MELSERVO-J2 series. The following table lists comparison of the response level setting.

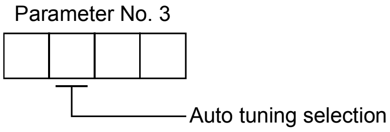


MELSERVO-J2 series		MELSERVO-J2-Super series	
Response level setting	Machine resonance frequency	Response level setting	Machine resonance frequency guideline
		1	15Hz
1	20Hz	2	20Hz
		3	25Hz
		4	30Hz
		5	35Hz
2	40Hz	6	45Hz
		7	55Hz
3	60Hz	8	70Hz
4	80Hz	9	85Hz
5	100Hz	A	105Hz
		B	130Hz
		C	160Hz
		D	200Hz
		E	240Hz
		F	300Hz

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.

8.5.2 Auto tuning selection

The MELSERVO-J2-Super series has an addition of the load inertia moment ratio fixing mode. It also has the addition of the manual mode 1 which permits manual adjustment with three parameters.



Gain adjustment mode		Auto tuning selection		Remarks
		MELSERVO-J2 series	MELSERVO-J2-Super series	
Interpolation mode		0	0	Position control gain 1 is fixed.
Auto tuning	Auto tuning mode 1	1	1	Ordinary auto tuning
	Auto tuning mode 2		2	Estimation of load inertia moment ratio stopped. Response level setting valid.
Auto tuning invalid	Manual mode 1		3	Simple manual adjustment
	Manual mode 2	2	4	Manual adjustment of all gains

MEMO

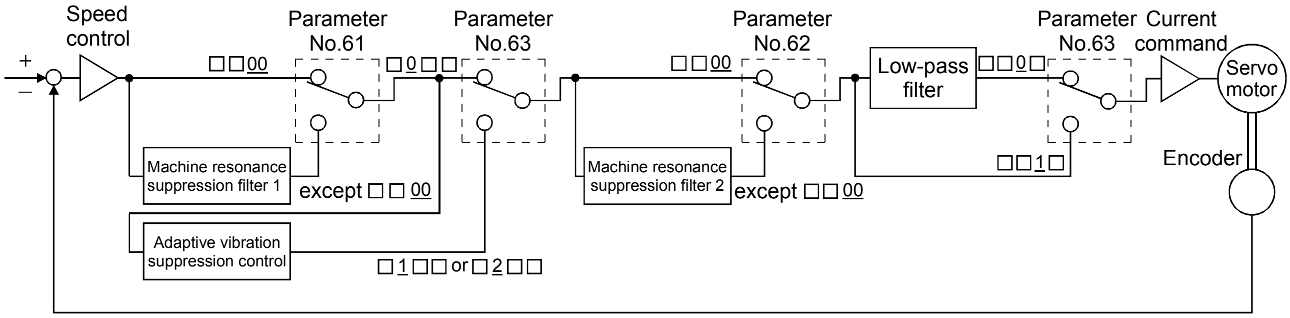
9. SPECIAL ADJUSTMENT FUNCTIONS

POINT

- The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 8.

If a mechanical system has a natural resonance point, increasing the servo system response may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency. Using the machine resonance suppression filter and adaptive vibration suppression control functions can suppress the resonance of the mechanical system.

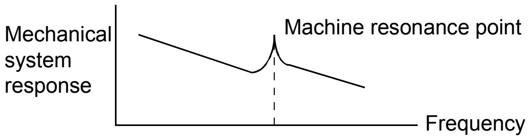
9.1 Function block diagram

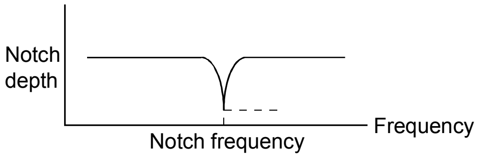


9.2 Machine resonance suppression filter

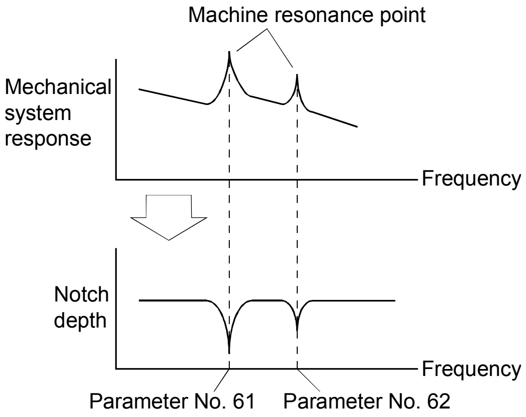
(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency) and gain decreasing depth.





You can use the machine resonance suppression filter 1 (parameter No. 61) and machine resonance suppression filter 2 (parameter No. 62) to suppress the vibration of two resonance frequencies. Note that if adaptive vibration suppression control is made valid, the machine resonance suppression filter 1 (parameter No. 61) is made invalid.



POINT

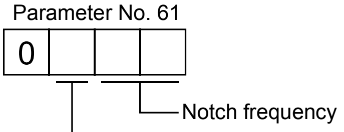
- The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.

(2) Parameters

(a) Machine resonance suppression filter 1 (parameter No. 61)

Set the notch frequency and notch depth of the machine resonance suppression filter 1 (parameter No. 61)

When you have made adaptive vibration suppression control selection (parameter No. 63) "valid" or "held", make the machine resonance suppression filter 1 invalid (parameter No. 61: 0000).



Setting value	Frequency	Setting value	Frequency	Setting value	Frequency	Setting value	Frequency
00	Invalid	08	562.5	10	281.3	18	187.5
01	4500	09	500	11	264.7	19	180
02	2250	0A	450	12	250	1A	173.1
03	1500	0B	409.1	13	236.8	1B	166.7
04	1125	0C	375	14	225	1C	160.1
05	900	0D	346.2	15	214.3	1D	155.2
06	750	0E	321.4	16	204.5	1E	150
07	642.9	0F	300	17	195.7	1F	145.2

Notch depth

Setting value	Depth (Gain)
0	Deep (−40dB)
1	↑ (−14dB)
2	↓ (−8dB)
3	Shallow(−4dB)

POINT

- 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.
- 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.
- Resonance may occur if parameter No. 61・62 is used to select a close notch frequency and set a deep notch.

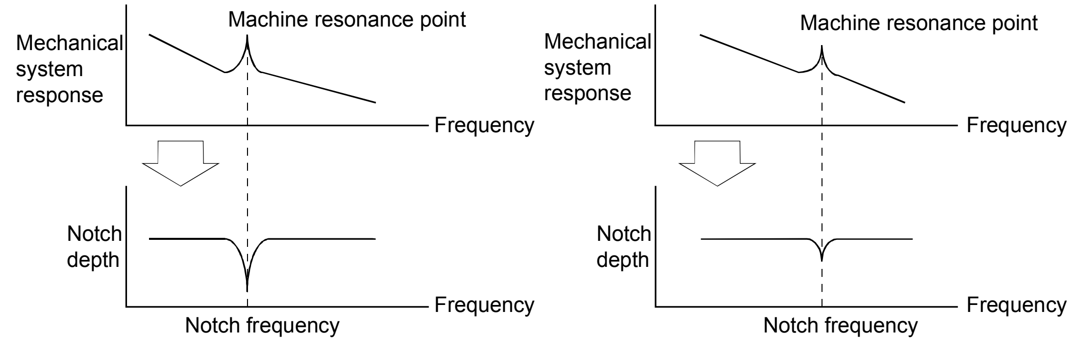
(b) Machine resonance suppression filter 2 (parameter No. 62)

The setting method of machine resonance suppression filter 2 (parameter No. 62) is the same as that of machine resonance suppression filter 1 (parameter No. 61). However, the machine resonance suppression filter 2 can be set independently of whether adaptive vibration suppression control is valid or invalid.

9.3 Adaptive vibration suppression control

(1) Function

Adaptive vibration suppression control is a function in which the servo amplifier detects machine resonance 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. Also, while adaptive vibration suppression control is valid, the servo amplifier always detects machine resonance, and if the resonance frequency changes, it changes the filter characteristics in response to that frequency.



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 vibration suppression control can respond to is about 150 to 500Hz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range. Use the machine resonance suppression filter for the machine resonance of such frequency.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics or which has too large resonance.
- Under operating conditions in which sudden disturbance torque is imposed during operation, the detection of the resonance frequency may malfunction temporarily, causing machine vibration. In such a case, set adaptive vibration suppression control to be "held" (parameter No. 63: □2□□) to fix the characteristics of the adaptive vibration suppression control filter.

(2) Parameters

The operation of adaptive vibration suppression control selection (parameter No.63).

Parameter No. 63

Adaptive vibration suppression control selection
Choosing "valid" or "held" in adaptive vibration suppression control selection makes the machine resonance suppression filter 1 (parameter No. 61) invalid.
0: Invalid
1: Valid
Machine resonance frequency is always detected to generate the filter in response to resonance, suppressing machine vibration.
2: Held
Filter characteristics generated so far is held, and detection of machine resonance is stopped.

Adaptive vibration suppression control sensitivity selection
Set the sensitivity of detecting machine resonance.
0: Normal
1: Large sensitivity

POINT

- Adaptive vibration suppression control is factory-set to be invalid (parameter No. 63: 0000).
- The filter characteristics generated are saved in the EEP-ROM every 60 minutes since power-on. At next power-on, vibration suppression control is performed with this data saved in the EEP-ROM being used as an initial value.
- Setting the adaptive vibration suppression control sensitivity can change the sensitivity of detecting machine resonance. Setting of "large sensitivity" detects smaller machine resonance and generates a filter to suppress machine vibration. However, since a phase delay will also increase, the response of the servo system may not increase.

9.4 Low-pass filter

(1) Function

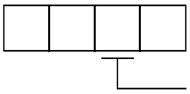
When a ballscrew or the like is used, resonance of high frequency may occur as the response of the servo system is increased. To prevent this, the low-pass filter is factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value in the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

$$\text{Filter frequency(Hz)} = \frac{\text{Speed control gain 2 setting}\times 10}{2\pi\times(1+\text{Ratio of load inertia moment to servo motor inertia moment setting}\times 0.1)}$$

(2) Parameter

Set the operation of the low-pass filter (parameter No. 63.)

Parameter No. 63



Low-pass filter selection
0: Valid (automatic adjustment) ← initial value
1: Invalid

POINT

- In a mechanical system where rigidity is extremely high and resonance is difficult to occur, setting the low-pass filter to be "invalid" may increase the servo system response to shorten the settling time.

9.5 Gain changing function

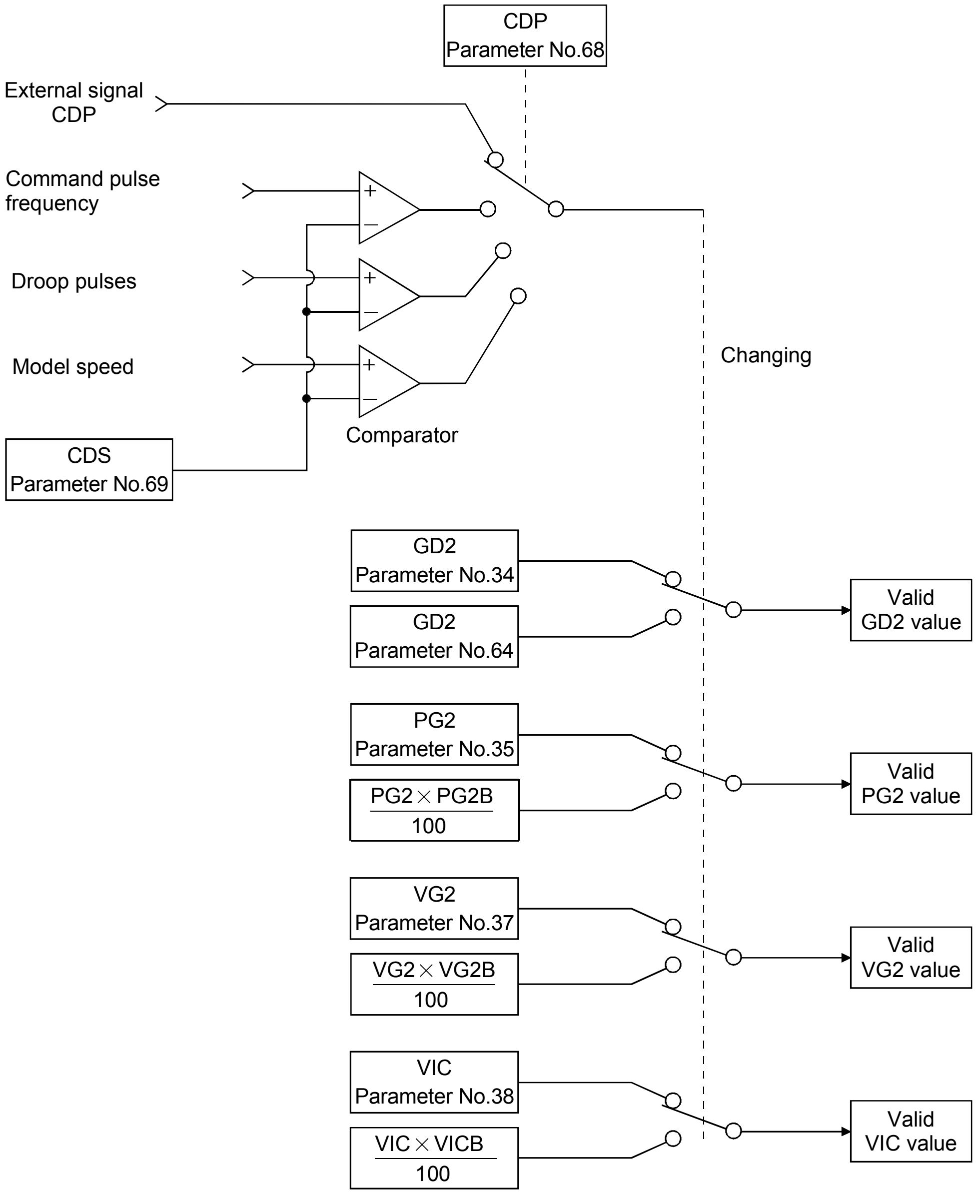
This function can change the gains. You can change between gains during rotation and gains during stop or can use an external signal to change gains during operation.

9.5.1 Applications

This function is used when.
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.
(2) You want to increase the gains during settling to shorten the stop settling time.
(3) You want to change the gains using an 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).

9.5.2 Function block diagram

The valid control gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection CDP (parameter No. 68) and gain changing condition CDS (parameter No. 69).



9.5.3 Parameters

When using the gain changing function, always set "□4□□" in parameter No.3 (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
7	PG1	Position control gain 1	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
36	VG1	Speed control gain 1	rad/s	
34	GD2	Ratio of load inertia moment to servo motor inertia moment	0.1 times	Control parameters before changing
35	PG2	Position control gain 2	rad/s	
37	VG2	Speed control gain 2	rad/s	
38	VIC	Speed integral compensation	ms	
64	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	0.1 times	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
65	PG2B	Position control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing position control gain 2 to position control gain 2.
66	VG2B	Speed control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing speed control gain 2 to speed control gain 2.
67	VICB	Speed integral compensation changing ratio	%	Used to set the ratio (%) of the after-changing speed integral compensation to speed integral compensation.
68	CDP	Gain changing selection		Used to select the changing condition.
69	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
70	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.

(1) Parameters No. 7, 34 to 38

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 control gain 2, speed control gain 2 and speed integral compensation to be changed.

(2) Ratio of load inertia moment to servo motor inertia moment 2 (GD2B: parameter No. 64)

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. 34).

(3) Position control gain 2 changing ratio (parameter No. 65), speed control gain 2 changing ratio (parameter No. 66), speed integral compensation changing ratio (parameter No. 67)

Set the values of after-changing position control gain 2, speed control gain 2 and speed integral compensation in ratio (%). 100% setting means no gain change.

For example, at the setting of position control gain 2 = 100, speed control gain 2 = 2000, speed integral compensation = 20 and position control gain 2 changing ratio = 180%, speed control gain 2 changing ratio = 150% and speed integral compensation changing ratio = 80%, the after-changing values are as follows.

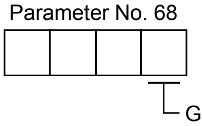
Position control gain 2 = Position control gain 2 × Position control gain 2 changing ratio /100=180rad/s

Speed control gain 2 = Speed control gain 2 × Speed control gain 2 changing ratio /100 = 3000rad/s

Speed integral compensation = Speed integral compensation × Speed integral compensation changing ratio /100 = 16ms

(4) Gain changing selection (parameter No. 68)

Used to set the gain changing condition. Choose the changing condition in the first digit. If you set "1" here, you can use the gain changing (CDP) external input signal for gain changing. The gain changing signal (CDP) can be assigned to the pins using the MR Configurator (servo configuration software).



Gain changing selection
Gains are changed in accordance with the settings of parameters No. 64 to 67 under any of the following conditions:
0: Invalid
1: Gain changing (CDP) input is ON
2: Command frequency is equal to higher than parameter No. 69 setting
3: Droop pulse value is equal to higher than parameter No. 69 setting
4: Servo motor speed is equal to higher than parameter No. 69 setting

(5) Gain changing condition (parameter No. 69)

When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (parameter No.68), 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. 70)

You can set the primary delay filter to each gain at gain changing. This parameter is used to suppress shock given to the machine if the gain difference is large at gain changing, for example.

9.5.4 Gain changing operation

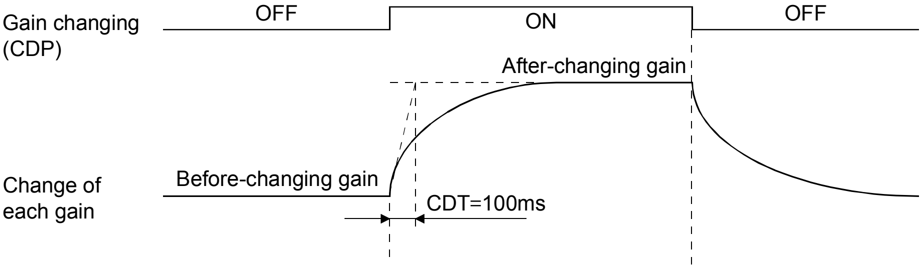
This operation will be described by way of setting examples.

(1) When you choose changing by external input

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
7	PG1	Position control gain 1	100	rad/s
36	VG1	Speed control gain 1	1000	rad/s
34	GD2	Ratio of load inertia moment to servo motor inertia moment	40	0.1 times
35	PG2	Position control gain 2	120	rad/s
37	VG2	Speed control gain 2	3000	rad/s
38	VIC	Speed integral compensation	20	ms
64	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	100	0.1 times
65	PG2B	Position control gain 2 changing ratio	70	%
66	VG2B	Speed control gain 2 changing ratio	133	%
67	VICB	Speed integral compensation changing ratio	250	%
68	CDP	Gain changing selection	0001 (Changed by ON/OFF of pin CN1A-8)	
70	CDT	Gain changing time constant	100	ms

(b) Changing operation



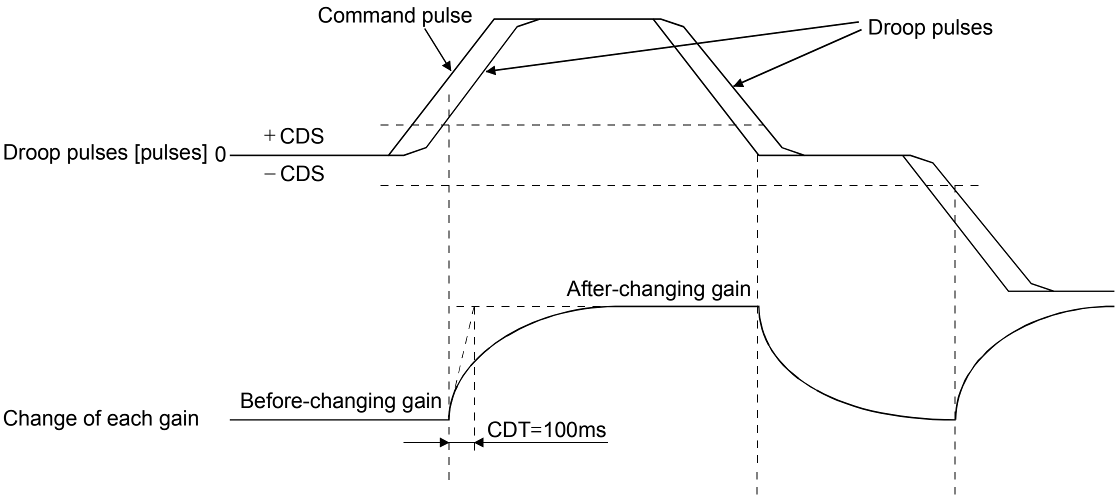
Position control gain 1			100		
Speed control gain 1			1000		
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0
Position control gain 2	120	→	84	→	120
Speed control gain 2	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20

(2) When you choose changing by droop pulses

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
7	PG1	Position control gain 1	100	rad/s
36	VG1	Speed control gain 1	1000	rad/s
34	GD2	Ratio of load inertia moment to servo motor inertia moment	40	0.1 times
35	PG2	Position control gain 2	120	rad/s
37	VG2	Speed control gain 2	3000	rad/s
38	VIC	Speed integral compensation	20	ms
64	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	100	0.1 times
65	PG2B	Position control gain 2 changing ratio	70	%
66	VG2B	Speed control gain 2 changing ratio	133	%
67	VICB	Speed integral compensation changing ratio	250	%
68	CDP	Gain changing selection	0003 (Changed by droop pulses)	
69	CDS	Gain changing condition	50	pulse
70	CDT	Gain changing time constant	100	ms

(b) Changing operation



Position control gain 1	100						
Speed control gain 1	1000						
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0	→	10.0
Position control gain 2	120	→	84	→	120	→	84
Speed control gain 2	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

MEMO

10. INSPECTION

⚠WARNING

- Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P and N is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the servo amplifier whether the charge lamp is off or not.
- Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

POINT

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

(1) Inspection

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) Life

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

Part name		Life guideline
Servo amplifier	Smoothing capacitor	10 years
	Relay	Number of power-on and number of forced stop times : 100,000 times
	Cooling fan	10,000 to 30,000hours (2 to 3 years)
	Absolute position battery	Refer to section 4.5

(a) Smoothing capacitor

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

(b) Relays

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

(c) Servo amplifier cooling fan

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

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

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 (servo configuration software), 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 CN1A, CN1B, CN2 and CN3 are disconnected.	1. Power supply voltage fault 2. Servo amplifier is faulty.	
			Improved when connectors CN1A and CN1B are disconnected.	Power supply of CN1 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 11.2 and remove cause.		Section 11.2
2	Switch on servo-on signal.	Alarm occurs.	Refer to section 11.2 and remove cause.		Section 11.2
		Servo motor shaft is not servo-locked (is free).	1. Check the display to see if the servo amplifier is ready to operate. 2. Check the external I/O signal indication to see if the servo-on (SON) signal is ON.	1. Servo-on signal is not input. (Wiring mistake) 2. 24VDC power is not supplied to COM.	Section 7.3.2
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 7
		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 7
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 When alarm or warning has occurred

> **POINT**
>
> - Configure up a circuit which will detect the trouble (ALM) signal and turn off the servo-on (SON) signal at occurrence of an alarm.

11.2.1 Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 11.2.2 or 11.2.3 and take the appropriate action.
Set "1□□□" in parameter No. 59 to output the alarm code in ON/OFF status across the corresponding pin and SG. Warnings (AL.90 to AL.E9) have no alarm codes. Any alarm code is output at occurrence of the corresponding alarm. In the normal status, the signals available before alarm code setting (CN1B-19, CN1A-18, CN1A-19) are output.
After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	(Note 2) Alarm code			Name	Alarm deactivation		
		CN1B-19 pin	CN1A-18 pin	CN1A-19 pin		Power OFF→ON	Press "SET" on current alarm screen.	Alarm reset (RES) signal
Alarms	AL.10	0	1	0	Undervoltage	○	○	○
	AL.12	0	0	0	Memory error 1	○		
	AL.13	0	0	0	Clock error	○		
	AL.15	0	0	0	Memory error 2	○		
	AL.16	1	1	0	Encoder error 1	○		
	AL.17	0	0	0	Board error	○		
	AL.19	0	0	0	Memory error 3	○		
	AL.1A	1	1	0	Motor combination error	○		
	AL.20	1	1	0	Encoder error 2	○		
	AL.24	1	0	0	Main circuit error	○		
	AL.25	1	1	0	Absolute position erase	○		
	AL.30	0	0	1	Regenerative error	○ (Note 1)	○ (Note 1)	○ (Note 1)
	AL.31	1	0	1	Overspeed	○	○	○
	AL.32	1	0	0	Overcurrent	○	○	○
	AL.33	0	0	1	Overvoltage	○		
	AL.35	1	0	1	Command pulse frequency error	○	○	○
	AL.37	0	0	0	Parameter error	○		
	AL.45	0	1	1	Main circuit device overheat	○ (Note 1)	○ (Note 1)	○ (Note 1)
	AL.46	0	1	1	Servo motor overheat	○ (Note 1)	○ (Note 1)	○ (Note 1)
	AL.50	0	1	1	Overload 1	○ (Note 1)	○ (Note 1)	○ (Note 1)
	AL.51	0	1	1	Overload 2	○ (Note 1)	○ (Note 1)	○ (Note 1)
	AL.52	1	0	1	Error excessive	○	○	○
	AL.61	1	0	1	Home operation alarm	○	○	○
	AL.8A	0	0	0	Serial communication time-out error	○	○	○
	AL.8E	0	0	0	Serial communication error	○	○	○
	88888	0	0	0	Watchdog	○		
Warnings	AL.90				Home position return incomplete	Removing the cause of occurrence deactivates the alarm automatically.		
	AL.92				Open battery cable warning			
	AL.96				Home position setting warning			
	AL.98				Software limit warning			
	AL.9F				Battery warning			
	AL.E0				Excessive regenerative warning			
	AL.E1				Overload warning			
	AL.E3				Absolute position counter warning			
	AL.E6				Servo forced stop warning			
	AL.E9				Main circuit off warning			

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. 0: Pin-SG off (open)
1: Pin-SG on (short)

11.2.2 Remedies for alarms

⚠ **CAUTION**

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.
- If an absolute position erase alarm (AL.25) occurred, always make home position setting again. Otherwise, misoperation may occur.

POINT

- When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the servo amplifier and servo motor may become faulty.
  - Regenerative error (AL.30)
  - Overload 1 (AL.50)
  - Overload 2 (AL.51)
- The alarm can be deactivated by switching power off, then on press the "SET" button on the current alarm screen or by turning on the reset (RES). For details, refer to section 11.2.1.

When an alarm occurs, the trouble (ALM) switches off and the dynamic is operated to stop the servo motor. At this time, the display indicates the alarm No.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. The optional MR Configurator (servo configuration software) may be used to refer to the cause.

Display	Name	Definition	Cause	Action
AL.10	Undervoltage	Power supply voltage dropped. MR-J2S-☐CP: 160VAC or less MR-J2S-☐CP1: 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 folllowing value or less. MR-J2S-☐CP: 200VDC MR-J2S-☐CP1: 158VDC	
			5. Faulty parts in the servo amplifier Checking method Alarm (AL.10) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
AL.12	Memory error 1	RAM, memory fault	Faulty parts in the servo amplifier Checking method Alarm (any of AL.12 and 13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the servo amplifier.
AL.13	Clock error	Printed board fault		
AL.15	Memory error 2	EEP-ROM fault	1. Faulty parts in the servo amplifier Checking method Alarm (AL.15) 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.	
AL.16	Encoder error 1	Communication error occurred between encoder and servo amplifier.	1. Encode connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (wire breakage or short)	Repair or change the cable.

Display	Name	Definition	Cause	Action
AL.17	Board error	CPU/parts fault	1. Faulty parts in the servo amplifier. Checking method Alarm (AL.17) occurs if power is switched on after disconnection of all cable but the control circuit power supply cable.	Change the servo amplifier.
		The output terminals U, V, W of the servo amplifier and the input terminals U, V, W of the servo motor are not connected.	2. The wiring of U, V, W is disconnected or not connected.	Correctly connect the output terminals U, V, W of the servo amplifier and the input terminals U, V, W of the servo motor.
AL.19	Memory error 3	ROM memory fault	Faulty parts in the servo amplifier. Checking method Alarm (AL.19) occurs if power is switched on after disconnection of all cable but the control circuit power supply cable.	Change the servo amplifier.
AL.1A	Motor combination error	Wrong combination of servo amplifier and servo motor.	Wrong combination of servo amplifier and servo motor connected.	Use correct combination.
AL.20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (wire breakage or shorted)	Repair or change the cable.
		Encoder detected acceleration error.	4. Excessive acceleration is occurred due to oscillation and others.	1. Decrease the speed control gain 2. 2. Decrease the auto tuning response level.
AL.24	Main circuit error	Ground fault occurred at the servo motor outputs (U,V and W phases) of the servo amplifier.	1. Power input wires and servo motor output wires are in contact at main circuit terminal block (TE1).	Connect correctly.
			2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of servo amplifier failed. Checking method AL.24 occurs if the servo is switched on after disconnecting the U, V, W power cables from the servo amplifier.	Change the servo amplifier.
AL.25	Absolute position erase	Absolute position data in error	1. Reduced voltage of super capacitor in encoder	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. Super capacitor of the absolute position encoder is not charged	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
AL.30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Wrong setting of parameter No. 0	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-J2S-□CP:260VAC or more MR-J2S-□CP1:135VAC or more	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.
AL.31	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. 4, 5)	Set correctly.
			5. Encoder faulty.	Change the servo motor.

Display	Name	Definition	Cause	Action
AL.32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier. (If the alarm (AL.32) occurs again when turning ON the servo after resetting the alarm by turning OFF/ON the power when the alarm (AL.32) first occurred, the transistor (IPM, IGBT) of the servo amplifier may be at fault. In the case, do not repeat to turn OFF/ON the power. Check the transistor with the checking method of "Cause 2".)	1. Short occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			2. Transistor (IPM) of the servo amplifier faulty. Checking method Alarm (AL.32) occurs if power is switched on after U,V and W are disconnected.	Change the servo amplifier.
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
AL.33	Overvoltage	Converter bus voltage exceeded 400VDC.	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No. 0 setting is "□0□□ (not used)".	Make correct setting.
			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. The jumper across BUE-SD of the FR-BU2 brake unit is removed.	Fit the jumper across BUE-SD.
AL.35	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.

Display	Name	Definition	Cause	Action
AL.37	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.0.	Set parameter No.0 correctly.
			3. Value outside setting range has been set in some parameter.	Set the parameter correctly.
			4. Value outside setting range has been set in electronic gear.	Set parameters No. 4, 5 correctly.
			5. Opposite sign has been set in software limit increasing side (parameters No. 46, 47). Similarly, opposite sign has been set in software limit decreasing side (parameters No. 48, 49).	Set parameters No. 46 to 49 correctly.
			6. Opposite sign has been set in position range output address increasing side (parameters No. 50, 51). Similarly, opposite sign has been set in position range output address decreasing side (parameters No. 52, 53).	Set parameters No. 50 to 53 correctly.
			7. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, program write, etc.	Change the servo amplifier.
AL.45	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. Air cooling fan of servo amplifier stops.	1. Exchange the cooling fan or the servo amplifier. 2. Reduce ambient temperature.
AL.46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40°C (104°F).	Review environment so that ambient temperature is 0 to 40°C (32 to 104°F).
			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.
AL.50	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.

Display	Name	Definition	Cause	Action
AL.51	Overload 2	Machine collision or the like caused max. For the time of the alarm occurrence, refer to the section 13.1.	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.
AL.52	Error excessive	The difference between the model position and the actual servo motor position exceeds 2.5 rotations. (Refer to the function block diagram in section 1.1.1)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Internal torque limit 1 (parameter No.28) is 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 control gain 1 (parameter No.7) 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.
AL.61	Operation alarm	"1" or more has been set to auxiliary function of point table No. 31.	Setting mistake of auxiliary function of point table No. 31.	Set "0" to auxiliary function of point table No. 31.
AL.8A	Serial communication time-out error	RS-232C or RS-422 communication stopped for longer than the time set in parameter No.23.	1. Communication cable breakage.	Repair or change communication cable
			2. Communication cycle longer than parameter No. 23 setting.	Set correct value in parameter.
			3. Wrong protocol.	Correct protocol.
AL.8E	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).
88888	Watchdog	CPU, parts faulty	Fault of parts in servo amplifier Checking method Alarm (88888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change servo amplifier.

11.2.3 Remedies for warnings

CAUTION

- If an absolute position counter warning (AL.E3) 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 (AL.E0)
  - Overload warning 1 (AL.E1)

If AL.E6 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 MR Configurator (servo configuration software) to refer to the cause of warning.

Display	Name	Definition		Cause	Action
AL.90	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 (AL.25) 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. Always make home position setting again.
				6. Battery cable or battery is faulty.	
AL.92	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 3.2V or less. (Detected with the encoder)	Change battery.
AL.96	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
AL.98	Software limit warning	Software limit set in parameter is reached.	1. Software limit was set within actual operation range.	Set parameter No. 48 to 51 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.
AL.9F	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.
AL.E0	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.
AL.E1	Overload warning	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 AL.50,51.	Refer to AL.50, AL.51.
AL.E3	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.
AL.E6	Servo forced stop warning	EMG-SG are open.	External forced stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate forced stop.
AL.E9	Main circuit off warning	Servo was switched on with main circuit power off.		Switch on main circuit power.

11.3 MR-DP60 external digital display error

When MR-DP60 external digital display detects an error, the following alarms are displayed. The alarms are displayed only on the MR-DP60, but not on the servo amplifier display.

Display	Name	Definition	Cause	Action
AL. CPU	CPU error	CPU error	Faulty parts in the MR-D60.	Exchange the MR-D60.
AL. C0	Communication error	Communication error occurred between MR-DP60 and MR-J2S-CP.	1. CN3 connector disconnected.	Connect correctly.
			2. Wire breakage of the cable.	Repair or exchange the cable.

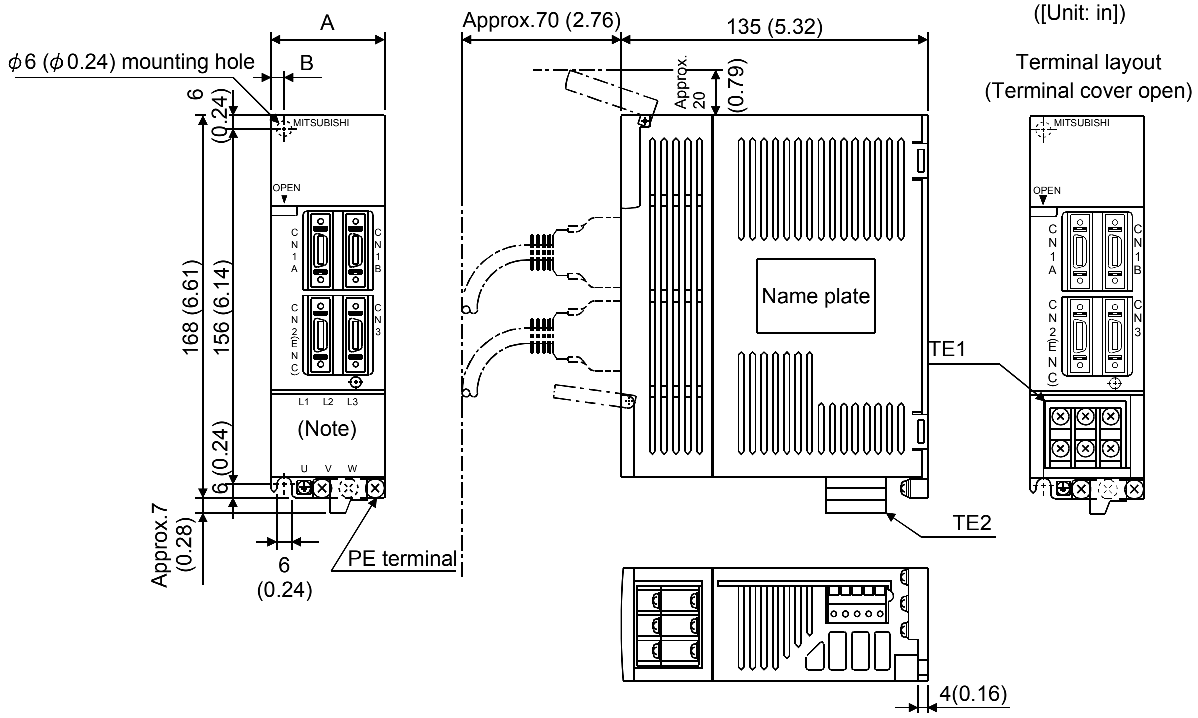
12. OUTLINE DIMENSION DRAWINGS

12.1 Servo amplifiers

(1) MR-J2S-10CP to MR-J2S-60CP
MR-J2S-10CP1 to MR-J2S-40CP1

[Unit: mm]

([Unit: in])



Servo amplifier	Variable dimensions		Mass
	A	B	[kg]([lb])
MR-J2S-10CP(1) MR-J2S-20CP(1)	50 (1.97)	6 (0.24)	0.7 (1.54)
MR-J2S-40CP(1) MR-J2S-60CP	70 (2.76)	22 (0.87)	1.1 (2.43)

Note. This data applies to the 3-phase 200 to 230VAC and 1-phase 230VAC power supply models.

Terminal signal layout

TE1

- For 3-phase 200 to 230VAC and 1-phase 230VAC

L_1	L_2	L_3
U	V	W

Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

- For 1-phase 100 to 120VAC

L_1		L_2
U	V	W

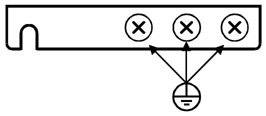
Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

TE2

←Front

D	C	P	L_{21}	L_{11}

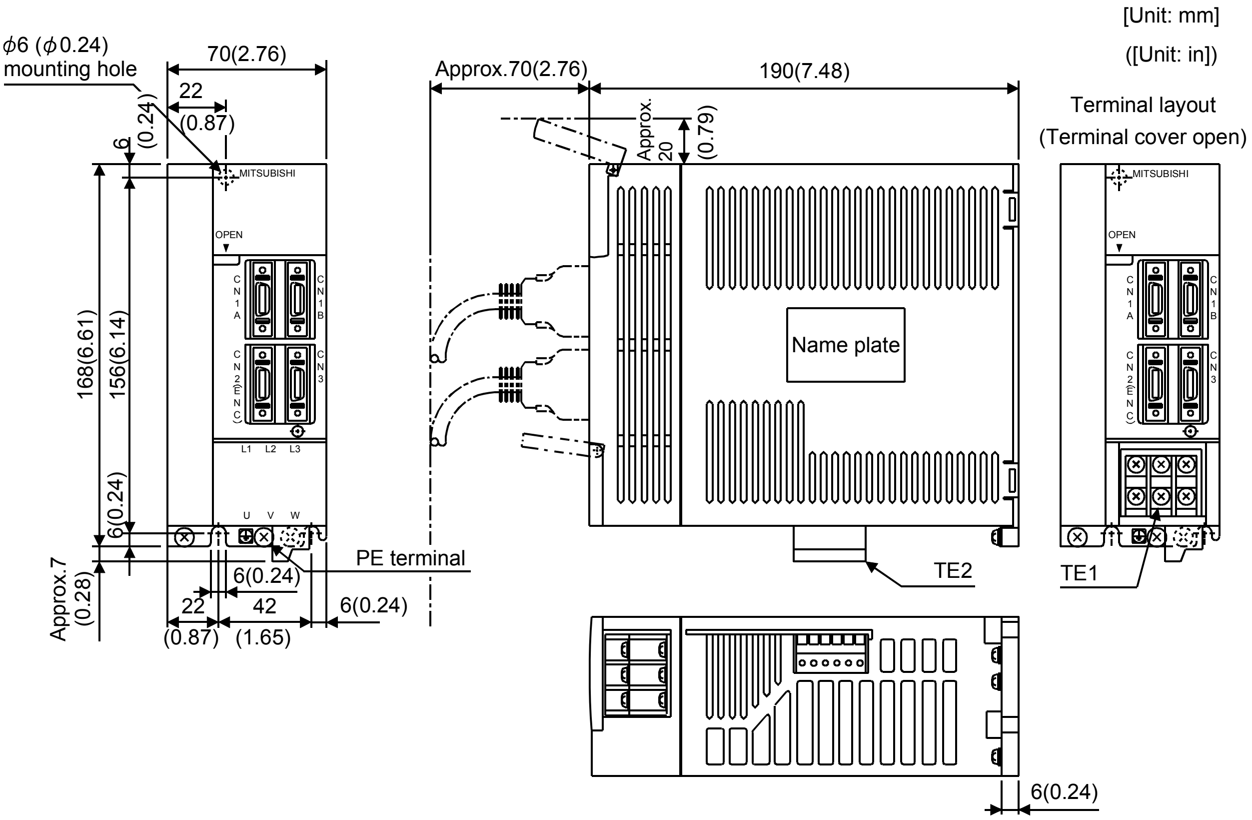
PE terminals



Terminal screw: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

(2) MR-J2S-70CP・MR-J2S-100CP



Servo amplifier	Mass [kg]([lb])
MR-J2S-70CP	1.7 (3.75)
MR-J2S-100CP	

Terminal signal layout

TE1

L1	L2	L3
U	V	W

Terminal screw: M4

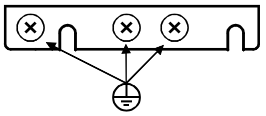
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

TE2

← Front

D	C	P	L21	L11	N

PE terminals



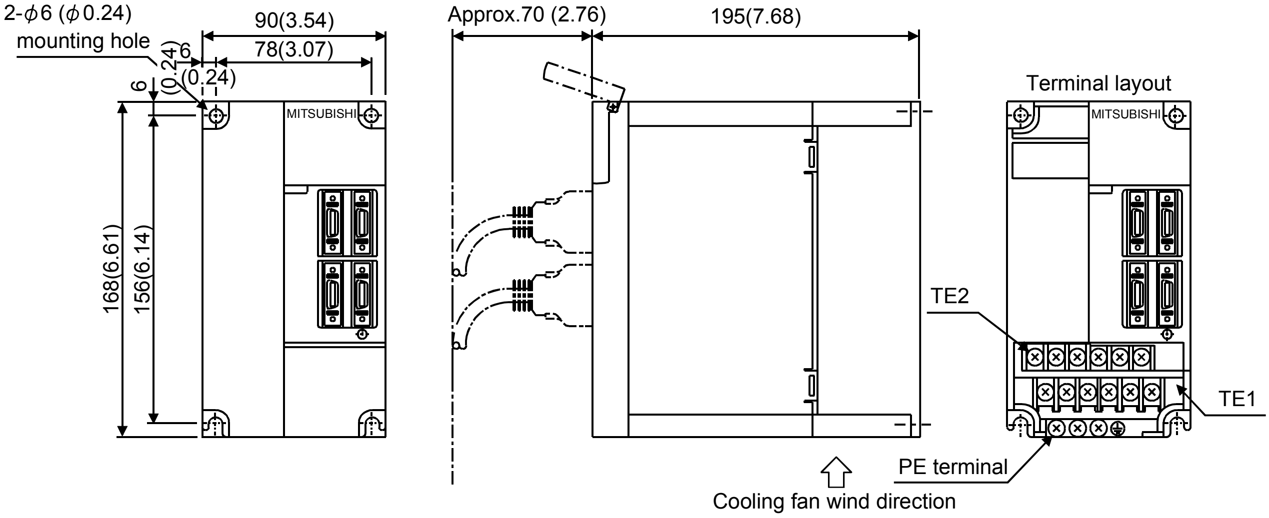
Terminal screw: M4

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

Mounting Screw
Screw Size:M5
Tightening torque:3.24[N・m](28.676 [lb・in])

(3) MR-J2S-200CP・MR-J2S-350CP

[Unit: mm]
([Unit: in])



Servo amplifier	Mass [kg]([lb])
MR-J2S-200CP	2.0 (4.41)
MR-J2S-350CP	

Terminal signal layout

TE1

L_1	L_2	L_3	U	V	W

Terminal screw: M4

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

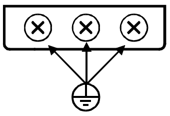
TE2

L_{11}	L_{21}	D	P	C	N

Terminal screw: M4

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

PE terminals

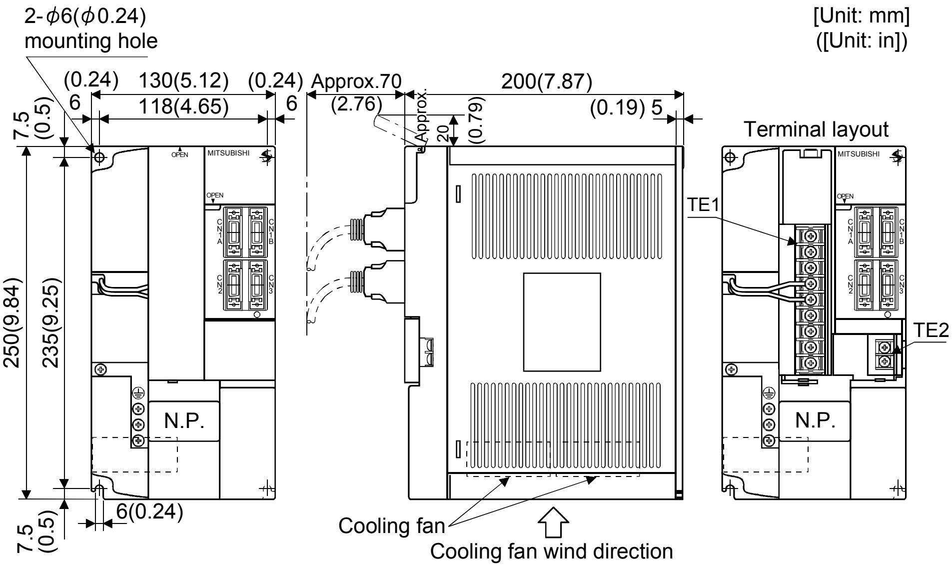


Terminal screw: M4

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

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

(4) MR-J2S-500CP



Servo amplifier	Mass [kg]([lb])
MR-J2S-500CP	4.9(10.8)

Terminal signal layout

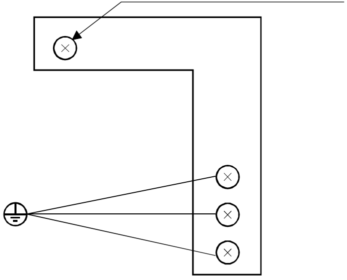
TE1

L_1
L_2
L_3
C
P
N
U
V
W

Terminal screw : M4
Tightening torque : 1.2 [N・m](10.6 [lb・in])

PE terminals

Built-in regenerative resistor lead terminal fixing screw



Terminal screw : M4
Tightening torque : 1.2 [N・m](10[lb・in])

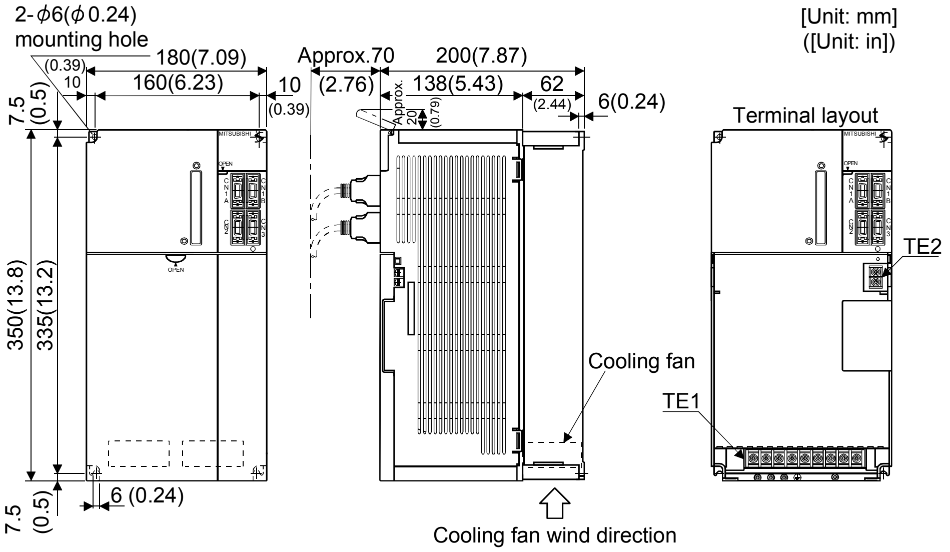
TE2

L_{11}
L_{21}

Terminal screw : M3.5
Tightening torque : 0.8 [N・m](7[lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

(5) MR-J2S-700CP



Servo amplifier	Mass [kg]([lb])
MR-J2S-700CP	7.2(15.9)

Terminal signal layout

TE1

L_1	L_2	L_3	C	P	N	U	V	W

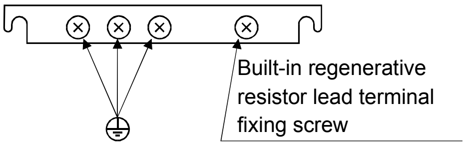
Terminal screw : M4
Tightening torque : 1.2 [N・m](10.6 [lb・in])

TE2

L_{11}
L_{21}

Terminal screw : M3.5
Tightening torque : 0.8 [N・m](7 [lb・in])

PE terminals



Terminal screw : M4
Tightening torque : 1.2 [N・m](10.6 [lb・in])

Mounting Screw
Screw Size:M5
Tightening torque:
3.24[N・m]
(28.676 [lb・in])

12.2 Connectors

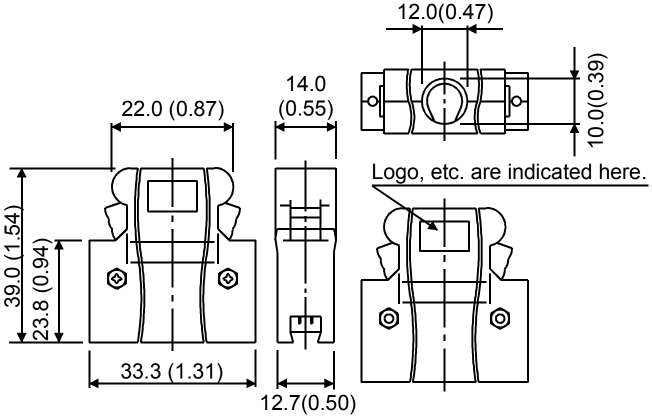
(1) Servo amplifier side

<3M >

(a) Soldered type

Model
Connector : 10120-3000VE
Shell kit : 10320-52F0-008

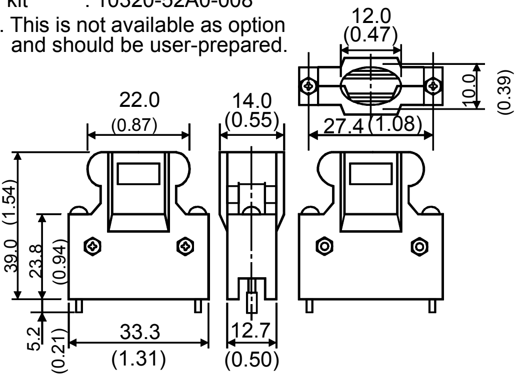
[Unit: mm]
([Unit: in])



(b) Threaded type

Model
Connector : 10120-3000VE
Shell kit : 10320-52A0-008
Note. This is not available as option
and should be user-prepared.

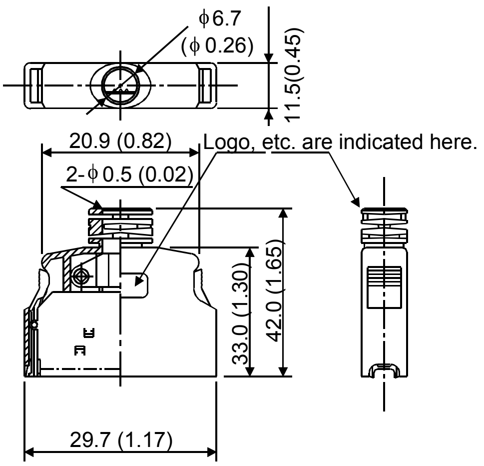
[Unit: mm]
([Unit: in])



(c) Insulation displacement type

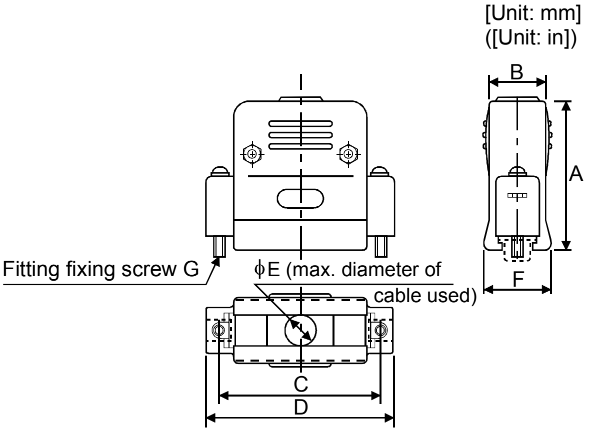
Model
Connector : 10120-6000EL
Shell kit : 10320-3210-000

[Unit: mm]
([Unit: in])



(2) Communication cable connector

<JAE>



Type	A ±1	B ±1	C ±0.25	D ±1	ϕE	F reference	G
DE-C1-J6-S6	34.5 (1.36)	19 (0.75)	24.99 (0.98)	33 (1.30)	6 (0.24)	18 (0.71)	#4-40

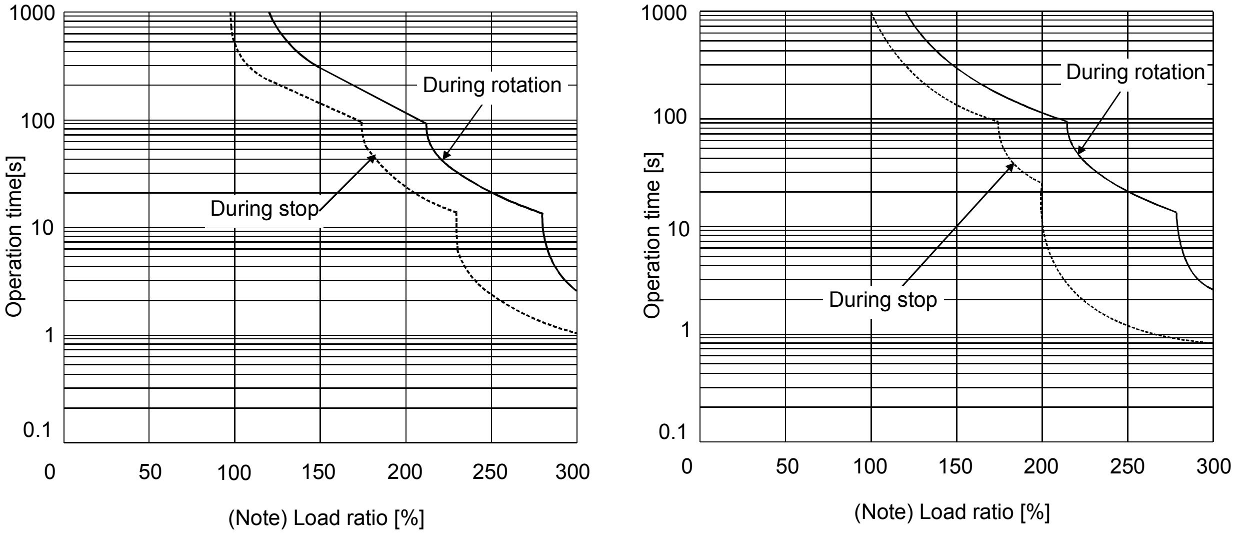
MEMO

13. CHARACTERISTICS

13.1 Overload protection characteristics

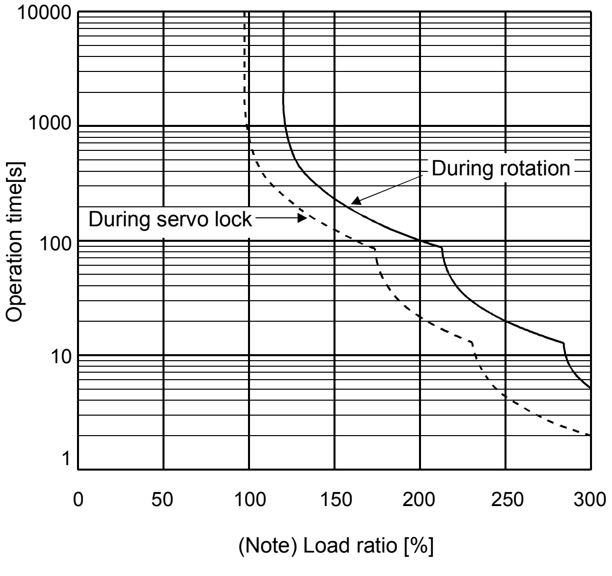
An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. Overload 1 alarm (AL.50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 13.1. Overload 2 alarm (AL.51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.



a. MR-J2S-10CP to MR-J2S-100CP

b. MR-J2S-200CP to MR-J2S-350CP



c. MR-J2S-500CP・MR-J2S-700CP

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

13.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the servo amplifier

Table 12.1 indicates servo amplifier's 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	
			At rated torque	With servo off	[m²]	[ft²]
MR-J2S-10CP(1)	HC-KFS053 ・ 13	0.3	25	15	0.5	5.4
	HC-MFS053 ・ 13	0.3	25	15	0.5	5.4
	HC-UFS13	0.3	25	15	0.5	5.4
MR-J2S-20CP(1)	HC-KFS23	0.5	25	15	0.5	5.4
	HC-MFS23	0.5	25	15	0.5	5.4
	HC-UFS23	0.5	25	15	0.5	5.4
MR-J2S-40CP(1)	HC-KFS43	0.9	35	15	0.7	7.5
	HC-MFS43	0.9	35	15	0.7	7.5
	HC-UFS43	0.9	35	15	0.7	7.5
MR-J2S-60CP	HC-SFS52	1.0	40	15	0.8	8.6
	HC-SFS53	1.0	40	15	0.8	8.6
	HC-LFS52	1.0	40	15	0.8	8.6
MR-J2S-70CP	HC-KFS73	1.3	50	15	1.0	10.8
	HC-MFS73	1.3	50	15	1.0	10.8
	HC-UFS72 ・ 73	1.3	50	15	1.0	10.8
MR-J2S-100CP	HC-SFS81	1.5	50	15	1.0	10.8
	HC-SFS102 ・ 103	1.7	50	15	1.0	10.8
	HC-LFS102	1.7	50	15	1.0	10.8
MR-J2S-200CP	HC-SFS121	2.1	90	20	1.8	19.4
	HC-SFS201	3.5	90	20	1.8	19.4
	HC-SFS152 ・ 153	2.5	90	20	1.8	19.4
	HC-SFS202 ・ 203	3.5	90	20	1.8	19.4
	HC-RFS103	1.8	50	15	1.0	10.8
	HC-RFS153	2.5	90	20	1.8	19.4
	HC-UFS152	2.5	90	20	1.8	19.4
	HC-LFS152	2.5	90	20	1.8	19.4
MR-J2S-350CP	HC-SFS301	4.8	120	20	2.7	29.1
	HC-SFS352 ・ 353	5.5	130	20	2.7	29.1
	HC-RFS203	3.5	90	20	1.8	19.4
	HC-UFS202	3.5	90	20	1.8	19.4
	HC-LFS202	3.5	90	20	1.8	19.4
MR-J2S-500CP	HC-SFS502	7.5	195	25	3.9	42.0
	HC-RFS353	5.5	135	25	2.7	29.1
	HC-RFS503	7.5	195	25	3.9	42.0
	HC-UFS352	5.5	195	25	3.9	42.0
	HC-UFS502	7.5	195	25	3.9	42.0
	HC-LFS302	4.5	120	25	2.4	25.8
	HA-LFS502	7.5	195	25	3.9	42.0
MR-J2S-700CP	HC-SFS702	10.0	300	25	6.0	64.6
	HA-LFS702	10.6	300	25	6.0	64.6

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value assumes that the power factor improving reactor is not used.

2. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated by the regenerative option, Refer to section 14.1.1.

(2) Heat dissipation area for enclosed servo amplifier

The enclosed control box (hereafter called the control box) which will contain the servo amplifier should be designed to ensure that its temperature rise is within +10°C (+50°F) at the ambient temperature of 40°C (104°F). (With a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 13.1.

$$A=\frac{P}{K\cdot\Delta T} \cdots\cdots (13.1)$$

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

When calculating the heat dissipation area with Equation 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 cooling 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°C (104°F) under rated load.

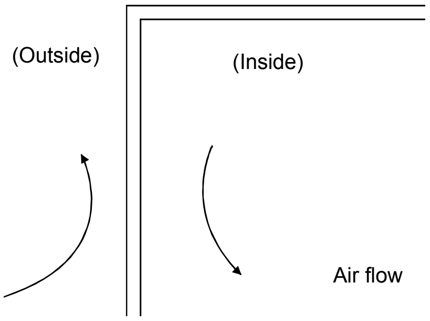


Fig. 13.2 Temperature distribution in enclosure

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

13.3.1 Dynamic brake operation

(1) Calculation of coasting distance

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 (2) of this section.)

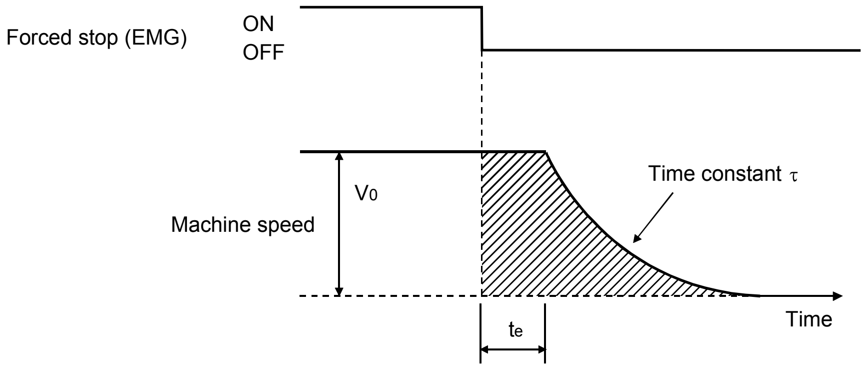


Fig. 13.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left[1 + \frac{J_L}{J_M} \right] \right\} \cdots\cdots (13.2)$$

L_{max} : Maximum coasting distance ....[mm][in]

V_0 : Machine rapid feed rate .... [mm/min][in/min]

J_M : Servo motor inertial moment .... [kg・cm²][oz・in²]

J_L : Load inertia moment converted into equivalent value on servo motor shaft..... [kg・cm²][oz・in²]

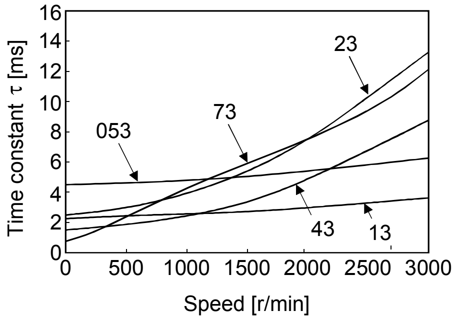
τ : Brake time constant .... [s]

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

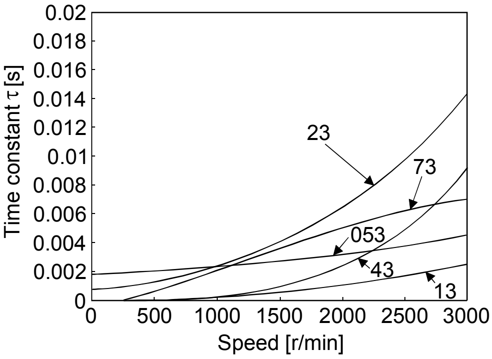
(There is internal relay delay time of about 30ms.)

(2) Dynamic brake time constant

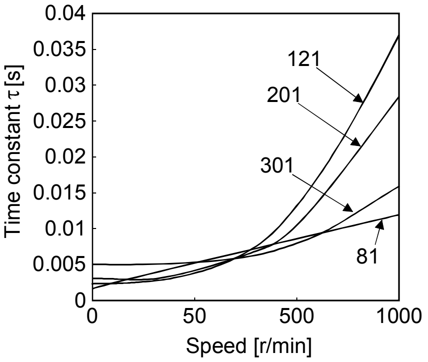
The following shows necessary dynamic brake time constant τ for the equations (13.2).



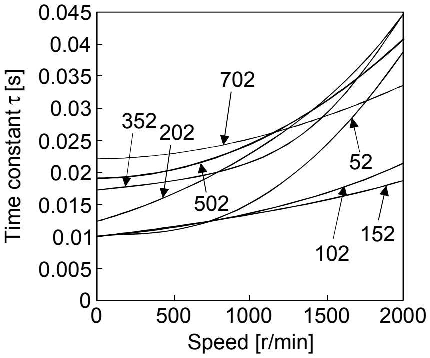
a. HC-KFS series



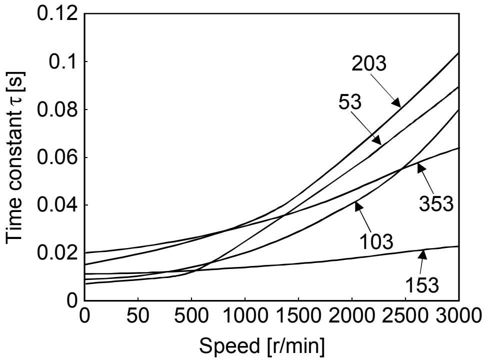
b. HC-MFS series



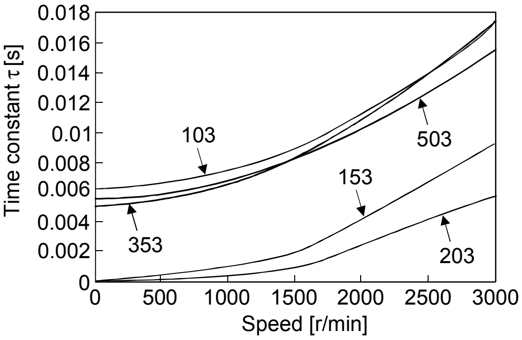
c. HC-SFS1000r/min series



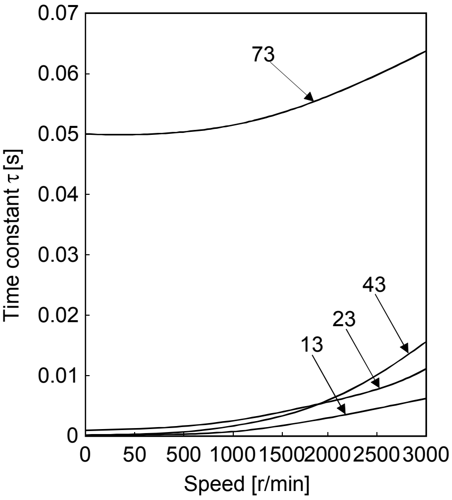
d. HC-SFS2000r/min series

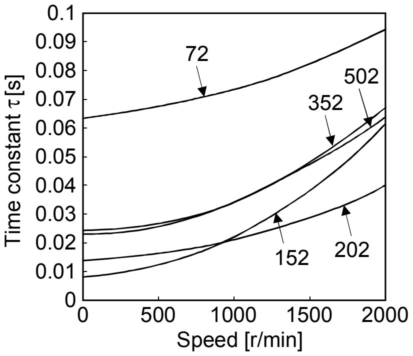


e. HC-SFS3000r/min series



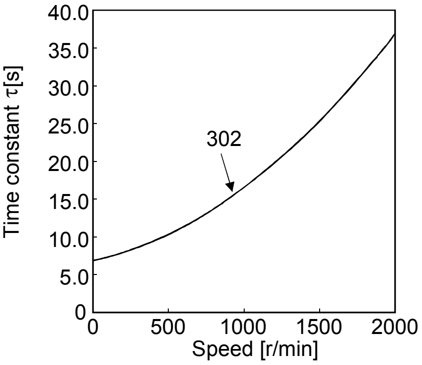
f. HC-RFS series





g. HC-UFS 2000r/min series

h. HC-UFS3000r/min series



i. HC-LFS series

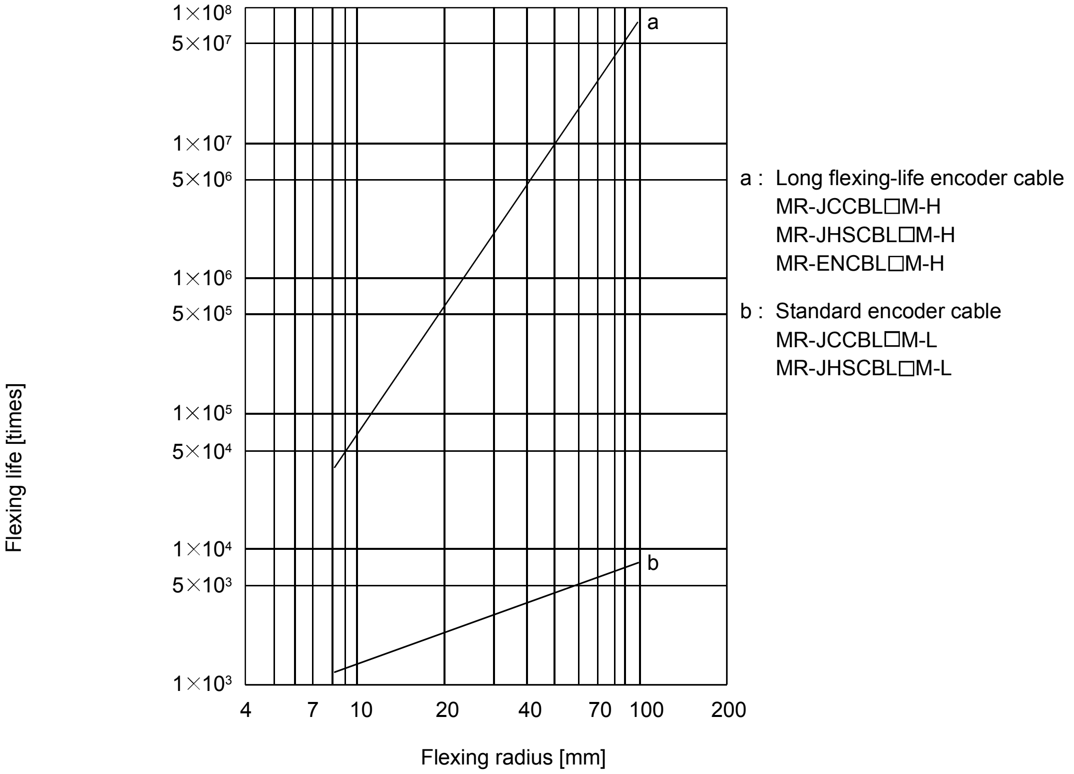
13.3.2 The dynamic brake at the load inertia moment

Use the dynamic brake under the load inertia moment ratio indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact Mitsubishi.

Servo amplifier	Load inertia moment ratio [times]
MR-J2S-10CP to MR-J2S-200CP MR-J2S-10CP1 to MR-J2S-40CP1	30
MR-J2S-350CP	16
MR-J2S-500CP・MR-J2S-700CP	15

13.4 Encoder 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.



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

The following table indicates the inrush currents (reference value) that will flow when the maximum permissible voltage (253VAC) is applied at the power supply capacity of 2500kVA and the wiring length of 1m.

Servo Amplifier	Inrush Currents ($A_{0\text{-}p}$)	
	Main circuit power supply (L_1, L_2, L_3)	Control circuit power supply (L_{11}, L_{21})
MR-J2S-10CP・20CP	30A (Attenuated to approx. 5A in 10ms)	70 to 100A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-40CP・60CP	30A (Attenuated to approx. 5A in 10ms)	
MR-J2S-70CP・100CP	54A (Attenuated to approx. 12A in 10ms)	
MR-J2S-200CP・350CP	120A (Attenuated to approx. 12A in 20ms)	100 to 130A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-500CP	44A (Attenuated to approx. 20A in 20ms)	30A (Attenuated to approx. 0A in several ms)
MR-J2S-700CP	88A (Attenuated to approx. 20A in 20ms)	
MR-J2S-10CP1・20CP1	59A (Attenuated to approx. 5A in 4ms)	100 to 130A (Attenuated to approx. 0A in 0.5 to 1ms)
MR-J2S-40CP1	72A (Attenuated to approx. 5A in 4ms)	

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 14.2.2.)

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

MEMO

14. OPTIONS AND AUXILIARY EQUIPMENT

WARNING

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

CAUTION

- Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

14.1 Options

14.1.1 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-RB32 [40Ω]	MR-RB30 [13Ω]	(Note) MR-RB50 [13Ω]	MR-RB31 [6.7Ω]	(Note) MR-RB51 [6.7Ω]
MR-J2S-10CP(1)		30						
MR-J2S-20CP (1)	10	30	100					
MR-J2S-40CP (1)	10	30	100					
MR-J2S-60CP	10	30	100					
MR-J2S-70CP	20	30	100	300				
MR-J2S-100CP	20	30	100	300				
MR-J2S-200CP	100				300	500		
MR-J2S-350CP	100				300	500		
MR-J2S-500CP	130				300	500		
MR-J2S-700CP	170						300	500

Note. Always install a cooling fan.

(2) Selection of the regenerative option

(a) Simple selection method

In horizontal motion applications, select the regenerative option as described below. When the servo motor is run without load in the regenerative mode from the running speed to a stop, the permissible duty is as indicated in section 5.1 of the separately available Servo Motor Instruction Manual.

For the servo motor with a load, the permissible duty changes according to the inertia moment of the load and can be calculated by the following formula.

$$\text{Permissible duty} = \frac{\text{Permissible duty for servo motor with no load (value indication section 5.1 in Servo Motor Instruction Manual)}}{(m+1)}$$

$$\times \left(\frac{\text{ratedspeed}}{\text{running speed}} \right)^2 \text{[times/min]}$$

where m = load inertia moment/servo motor inertia moment

From the permissible duty, find whether the regenerative option is required or not.

Permissible duty < number of positioning times [times/min]

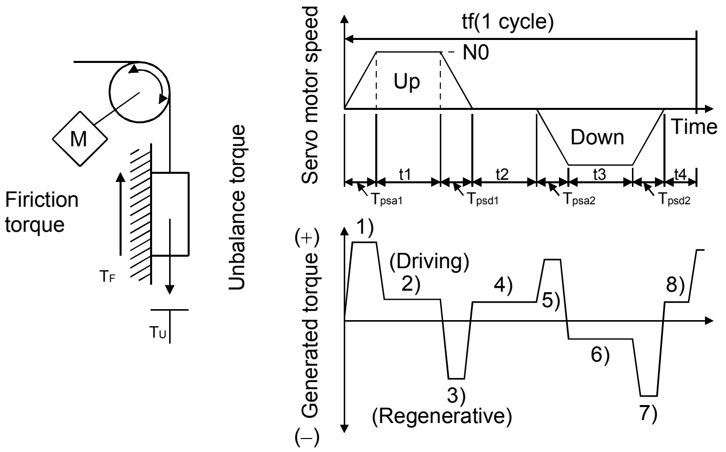
Select the regenerative option out of the combinations in (1) of this section.

(b) To make selection according to regenerative energy

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

a. Regenerative energy calculation

Use the following table to calculate the regenerative energy.



Formulas for calculating torque and energy in operation

Regenerative power	Torque applied to servo motor [N・m]	Energy [J]
1)	$T_1 = \frac{(J_L + J_M) \cdot N_0}{9.55 \times 10^4} \cdot \frac{1}{T_{psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \cdot N_0 \cdot T_1 \cdot T_{psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot N_0 \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{-(J_L + J_M) \cdot N_0}{9.55 \times 10^4} \cdot \frac{1}{T_{psd1}} + T_U + T_F$	$E_3 = \frac{0.1047}{2} \cdot N_0 \cdot T_3 \cdot T_{psd1}$
4), 8)	$T_4 = T_U$	$E_4 \geq 0$ (N0 regeneration)
5)	$T_5 = \frac{(J_L + J_M) \cdot N_0}{9.55 \times 10^4} \cdot \frac{1}{T_{psa2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \cdot N_0 \cdot T_5 \cdot T_{psa2}$
6)	$T_6 = -T_U + T_F$	$E_6 = 0.1047 \cdot N_0 \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{-(J_L + J_M) \cdot N_0}{9.55 \times 10^4} \cdot \frac{1}{T_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \cdot N_0 \cdot T_7 \cdot T_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

b. Losses of servo motor and servo amplifier in regenerative mode

The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo amplifier	Inverse efficiency[%]	Capacitor charging[J]
MR-J2S-10CP	55	9
MR-J2S-10CP1	55	4
MR-J2S-20CP	70	9
MR-J2S-20CP1	70	4
MR-J2S-40CP	85	11
MR-J2S-40CP1	85	12
MR-J2S-60CP	85	11
MR-J2S-70CP	80	18
MR-J2S-100CP	80	18
MR-J2S-200CP	85	40
MR-J2S-350CP	85	40
MR-J2S-500CP	90	45
MR-J2S-700CP	90	70

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.

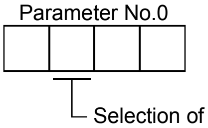
$$\text{ER [J]} = \eta \cdot \text{Es} - \text{Ec}$$

Calculate the power consumption of the regenerative option on the basis of single-cycle operation period tf [s] to select the necessary regenerative option.

$$\text{PR [W]} = \text{ER/tf}$$

(3) Connection of the regenerative option

Set parameter No.0 according to the option to be used.



Selection of regenerative
0: Not used. (The built-in regenerative resistor is used. However, the MR-J2S-10CP does not have a built-in regenerative resistor and therefore cannot use it.)
1: FR-RC, FR-BU2
2: MR-RB032
3: MR-RB12
4: MR-RB32
5: MR-RB30
6: MR-RB50(Cooling fan is required)
8: MR-RB31
9: MR-RB51(Cooling fan is required)

(4) Connection of the regenerative option

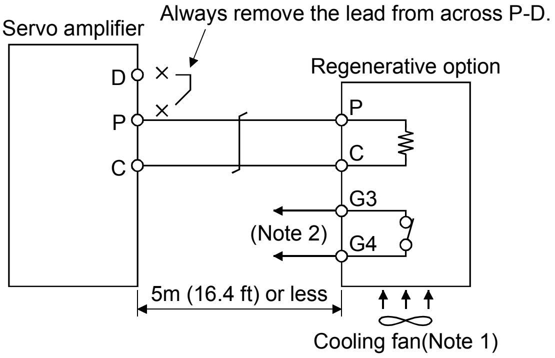
POINT
- When the MR-RB50 ・ MR-RB51 is used, a cooling fan is required to cool it. The cooling fan should be prepared by the customer.

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 (16.4ft) length for connection with the servo amplifier.

(a) MR-J2S-350CP 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 opened when the regenerative option overheats abnormally.

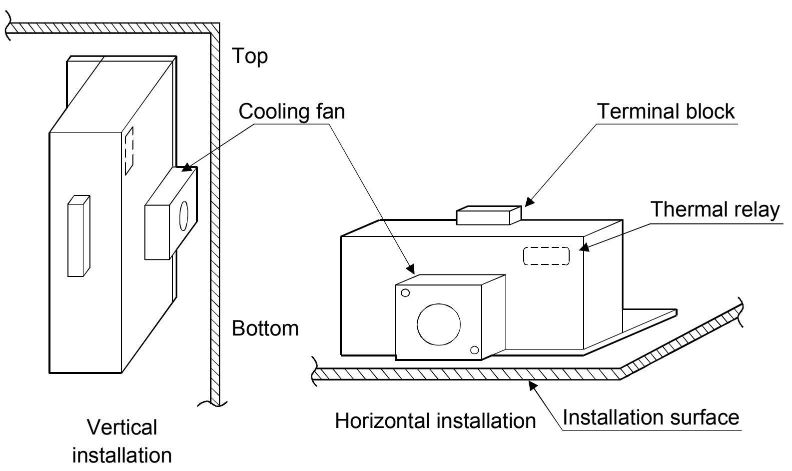


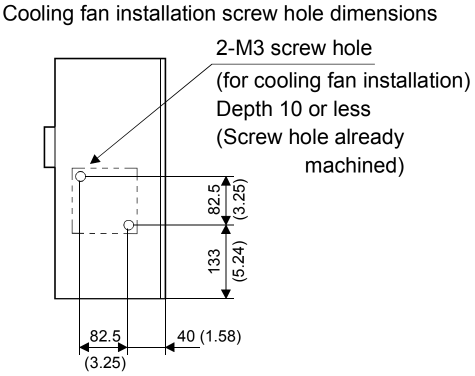
Note 1. When using the MR-RB50, forcibly cool it with a cooling fan (92×92, minimum air flow : $1.0m^3$).

2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

For the MR-RB50 install the cooling fan as shown.

[Unit : mm(in)]

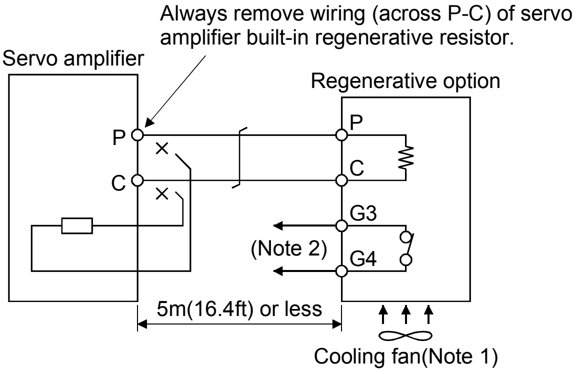




(b) MR-J2S-500CP・MR-J2S-700CP

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.

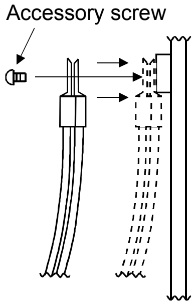


Note 1. When using the MR-RB50 MR-RB51, forcibly cool it with a cooling fan (92×92, minimum air flow : 1.0m^3).

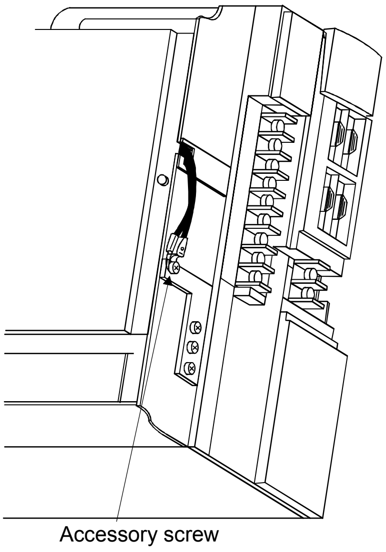
2. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

When using the regenerative resistor option, remove the servo amplifier's built-in regenerative resistor terminals (across P-C), fit them back to back, and secure them to the frame with the accessory screw as shown below.

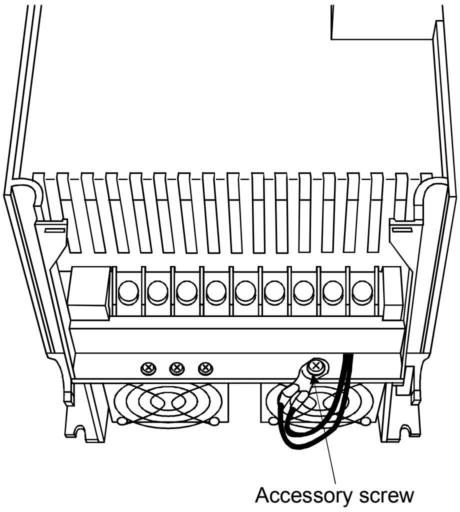
Mounting method



For MR-J2S-500CP

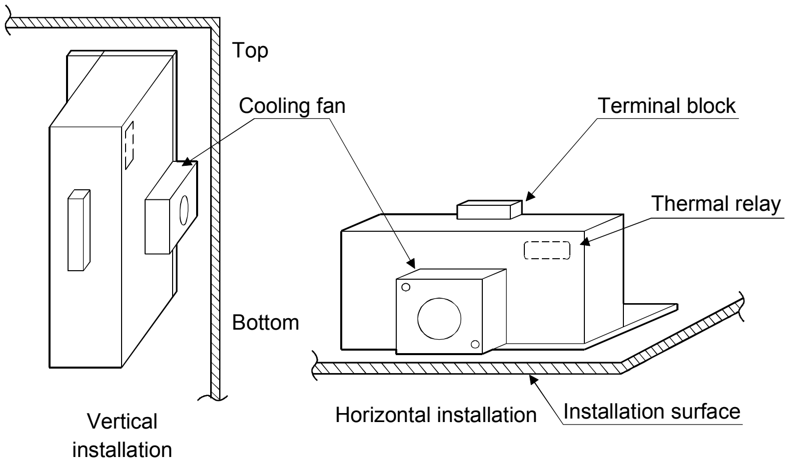


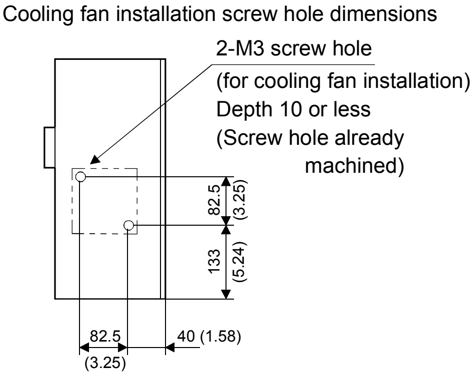
For MR-J2S-700CP



For the MR-RB50 · MR-RB51 install the cooling fan as shown.

[Unit : mm(in)]

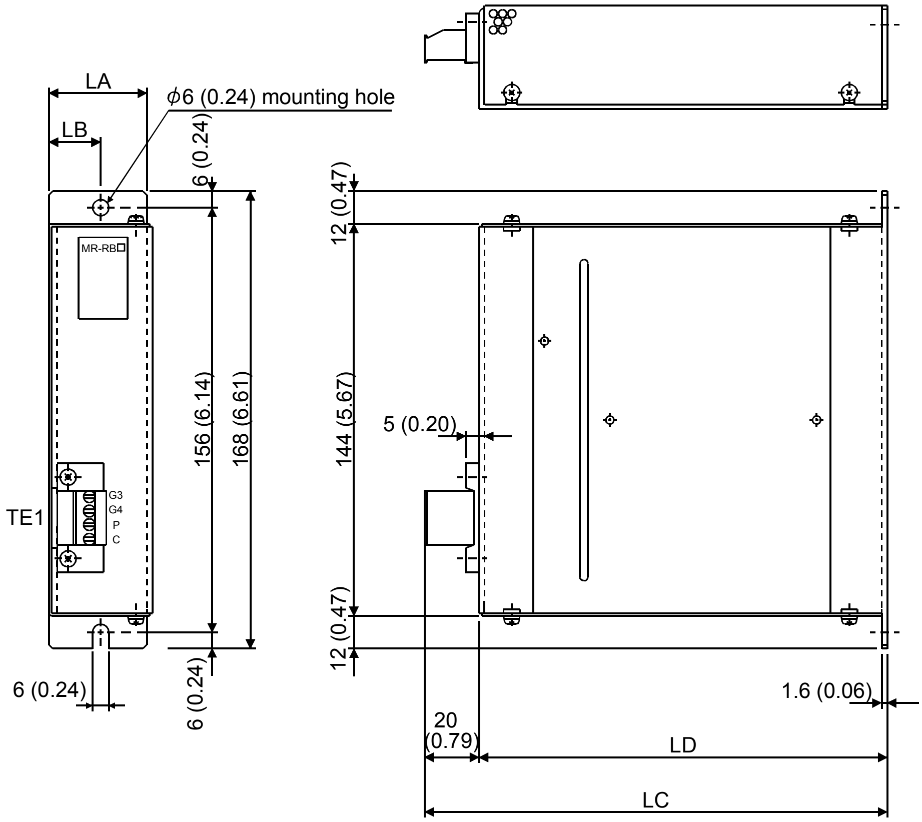




(5) Outline drawing

(a) MR-RB032 · MR-RB12

[Unit: mm (in)]



· TE1
Terminal block

G3
G4
P
C

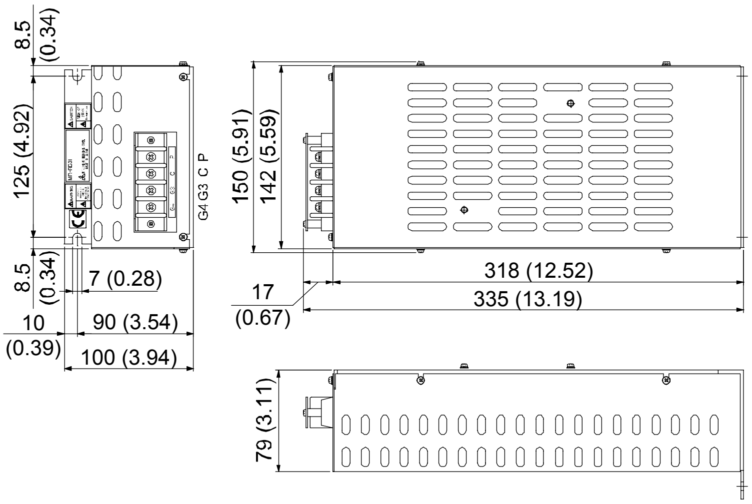
Terminal screw: M3
Tightening torque:
0.5 to 0.6 [N•m](4 to 5 [lb•in])

· Mounting screw
Screw size: M5
Tightening torque:
3.24 [N•m](28.676 [lb•in])

Regenerative option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30 (1.18)	15 (0.59)	119 (4.69)	99 (3.9)	0.5	1.1
MR-RB12	40 (1.58)	15 (0.59)	169 (6.69)	149 (5.87)	1.1	2.4

(b) MR-RB30 · MR-RB31 · MR-RB32

[Unit: mm (in)]



· Terminal block

P
C
G3
G4

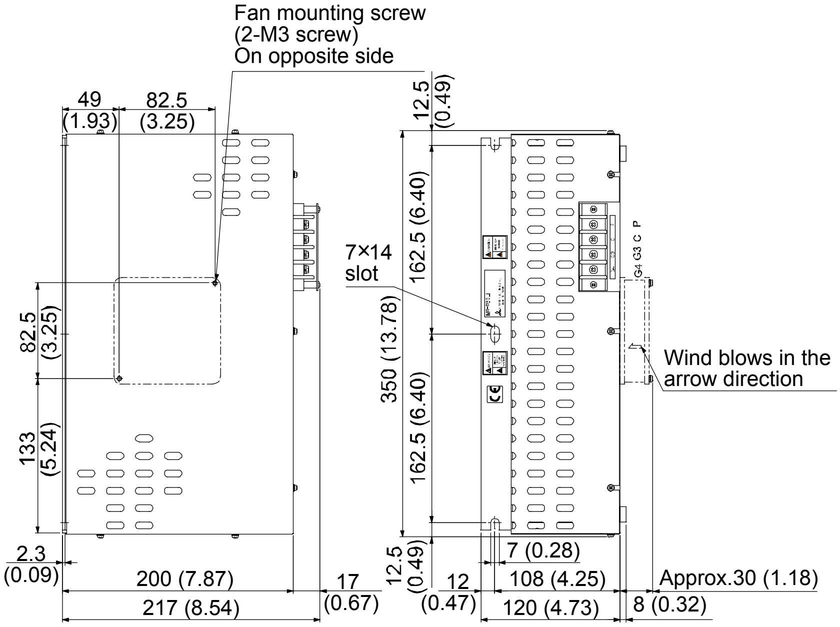
Terminal screw: M4
Tightening torque: 1.2 [N · m] (10.6 [lb · in])

· Mounting screw
Screw: M6
Tightening torque: 5.4 [N · m] (47.79 [lb · in])

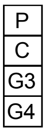
Regenerative option	Mass [kg] (lb)
MR-RB30	2.9 (6.4)
MR-RB31	
MR-RB32	

(c) MR-RB50・MR-RB51

[Unit: mm (in)]



・Terminal block



Terminal screw: M4
Tightening torque: 1.2 [N・m]
(10.6 [lb・in])

・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	

14.1.2 FR-BU2 brake unit

POINT

- Use a 200V class brake unit and a resistor unit with a 200V class servo amplifier. Combination of different voltage class units and servo amplifier cannot be used.
- Install a brake unit and a resistor unit on a flat surface vertically. When the unit is installed horizontally or diagonally, the heat dissipation effect diminishes.
- Temperature of the resistor unit case rises to higher than 100℃. Keep cables and flammable materials away from the case.
- Ambient temperature condition of the brake unit is between －10℃ (14℉) and ＋50℃ (122℉). Note that the condition is different from the ambient temperature condition of the servo amplifier (between 0℃ (32℉) and ＋55℃ (131℉)).
- Configure the circuit to shut down the power-supply with the alarm output of the brake unit and resistor unit under abnormal condition.
- Use the brake unit with a combination indicated in this section (1).
- For executing a continuous regenerative operation, use FR-RC power regeneration converter.
- Brake unit and regenerative options (Regenerative resistor) cannot be used simultaneously.

Connect the brake unit to the bus of the servo amplifier. As compared to the MR-RB regenerative option, the brake unit can return larger power. Use the brake unit when the regenerative option cannot provide sufficient regenerative capability.
When using the brake unit, set the parameter No.0 of the servo amplifier to " 01□□".
When using the brake unit, always refer to the FR-BU2-(H) Brake Unit Instruction Manual.

(1) Selection

Use a combination of servo amplifier, brake unit and resistor unit listed below.

Brake unit	Resistor unit	Number of connected units	Permissible continuous power [kW]	Total resistance [Ω]	Applicable servo amplifier
FR-BU2-15K	FR-BR-15K	1	0.99	8	MR-J2S-350CP MR-J2S-500CP
FR-BU2-30K	FR-BR-30K	1	1.99	4	MR-J2S-500CP MR-J2S-700CP

(2) Brake unit parameter setting

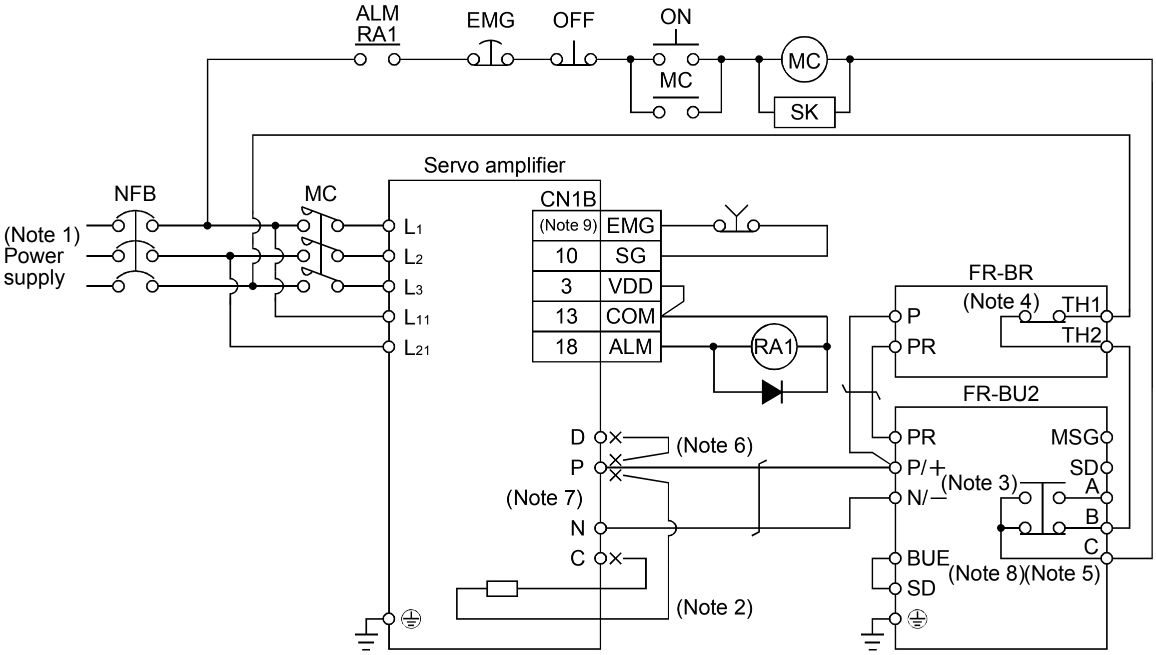
Normally, when using the FR-BU2, changing parameters is not necessary. Whether a parameter can be changed or not is listed below.

Parameter		Change possible/ impossible	Remarks
No.	Name		
0	Brake mode switchover	Impossible	Do not change the parameter.
1	Monitor display data selection	Possible	Refer to the FR-BU2-(H) Brake Unit Instruction Manual.
2	Input terminal function selection 1	Impossible	Do not change the parameter.
3	Input terminal function selection 2		
77	Parameter write selection		
78	Cumulative energization time carrying-over times		
CLr	Parameter clear		
ECL	Alarm history clear		
C1	For manufacturer setting		

(3) Connection example

POINT

- Connecting PR terminal of the brake unit to P terminal of the servo amplifier results in brake unit malfunction. Always connect the PR terminal of the brake unit to the PR terminal of the resistor unit.

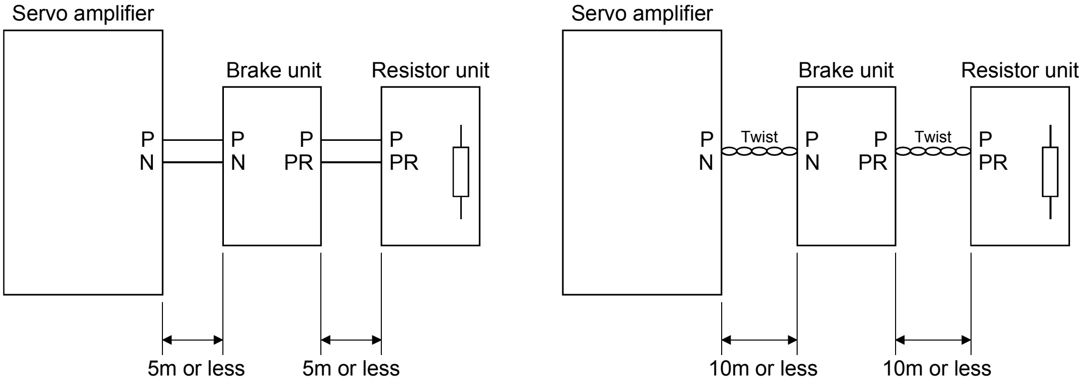


Note 1. For power supply specifications, refer to section 1.2.

2. For the servo amplifier of 5k and 7kW, always disconnect the lead of built-in regenerative resistor, which is connected to the P and C terminals.
3. Connect the P/＋ and N/－ terminals of the brake unit to a correct destination. Wrong connection results in servo amplifier and brake unit malfunction.
4. Contact rating: 1b contact, 110VAC_5A/220VAC_3A
   Normal condition: TH1-TH2 is conducting. Abnormal condition: TH1-TH2 is not conducting.
5. Contact rating: 230VAC_0.3A/30VDC_0.3A
   Normal condition: B-C is conducting/A-C is not conducting. Abnormal condition: B-C is not conducting/A-C is conducting.
6. For the servo amplifier of 3.5kW, always disconnect the wiring between P and D terminals.
7. Do not connect more than one cable to each P to N terminals of the servo amplifier.
8. Always connect between BUE and SD terminals (Factory-wired).
9. In the device setting, assign the forced stop (EMG) to any pin (Refer to section 6.6).

(a) Precautions for wiring

The cables between the servo amplifier and the brake unit, and between the resistor unit and the brake unit should be as short as possible. Always twist the cable longer than 5m (twist five times or more per one meter). Even when the cable is twisted, the cable should be less than 10m. Using cables longer than 5m without twisting or twisted cables longer than 10m, may result in the brake unit malfunction.

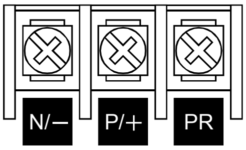


(b) Cables

1) Cables for the brake unit

For the brake unit, HIV cable (600V grade heat-resistant PVC insulated wire) is recommended.

a) Main circuit terminal



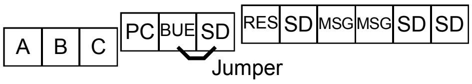
Terminal block

Brake unit	Main circuit terminal screw size	Crimping terminal	Tightening torque [N・m] ([lb・in])	Cable size	
				N/−, P/+, PR, ⏚	
		N/−, P/+, PR, ⏚		HIV cables, etc. [mm^2]	AWG
FR-BU2-15K	M4	5.5-4	1.5(13.3)	3.5	12
FR-BU2-30K	M5	5.5-5	2.5(22.1)	5.5	10

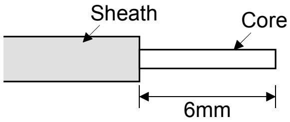
b) Control circuit terminal

POINT

- Undertightening can cause a cable disconnection or malfunction. Overtightening can cause a short circuit or malfunction due to damage to the screw or the brake unit.



Terminal block



Wire the stripped cable after twisting to prevent the cable from becoming loose. In addition, do not solder it.
Screw size: M3
Tightening torque: 0.5N・m to 0.6N・m
Cable size: 0.3mm^2 to 0.75 mm^2
Screw driver: Small flat-blade screwdriver
(Tip thickness: 0.4mm/Tip width 2.5mm)

(c) Crimping terminals for P and N terminals of servo amplifier

POINT

- Always use recommended crimping terminals or equivalent since some crimping terminals cannot be installed depending on the size.

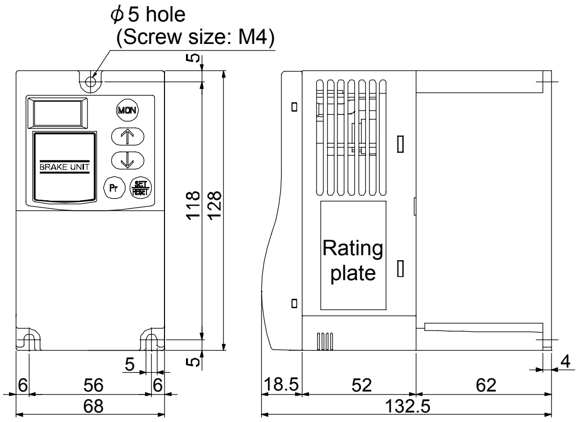
Servo amplifier	Brake unit	Number of connected units	Crimping terminal	Applicable tool	Manufacturer
MR-J2S-350CP	FR-BU2-15K	1	FVD5.5-S4	YNT-1210S	Japan Solderless Terminal
MR-J2S-500CP	FR-BU2-15K	1			
	FR-BU2-30K	1			
MR-J2S-700CP	FR-BU2-30K	1			

(4) Outline dimension drawings

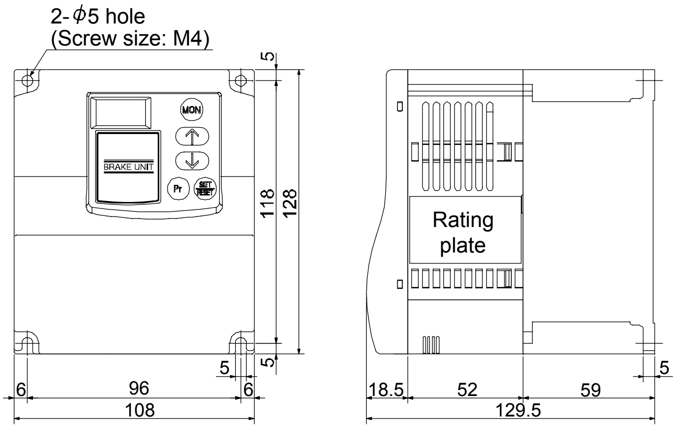
(a) FR-BU2 brake unit

[Unit: mm]

FR-BU2-15K

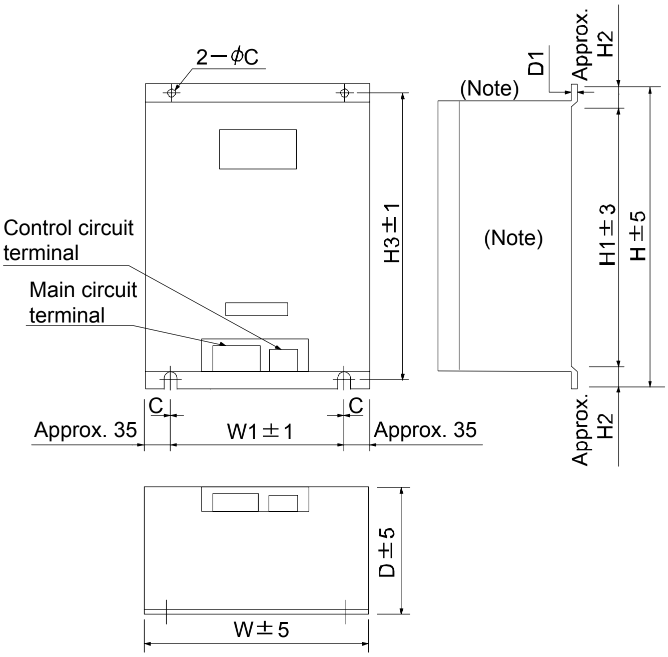


FR-BU2-30K



(b) FR-BR resistor unit

[Unit: mm]



Note. Ventilation ports are provided on both sides and the top. The bottom is open.

Resistor unit	W	W1	H	H1	H2	H3	D	D1	C	Approximate mass [kg]([lb])
FR-BR-15K	170	100	450	410	20	432	220	3.2	6	15(33.1)
FR-BR-30K	340	270	600	560	20	582	220	4	10	30(66.1)

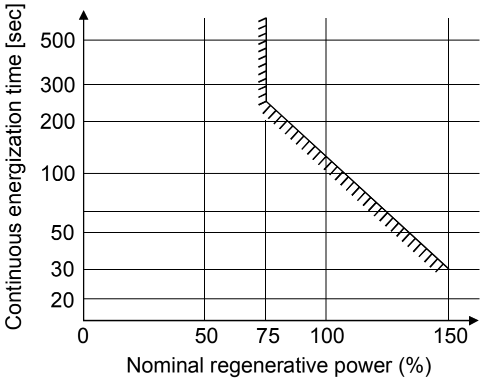
14.1.3 Power regeneration converter

When using the power regeneration converter, set "01□□" in parameter No.0.

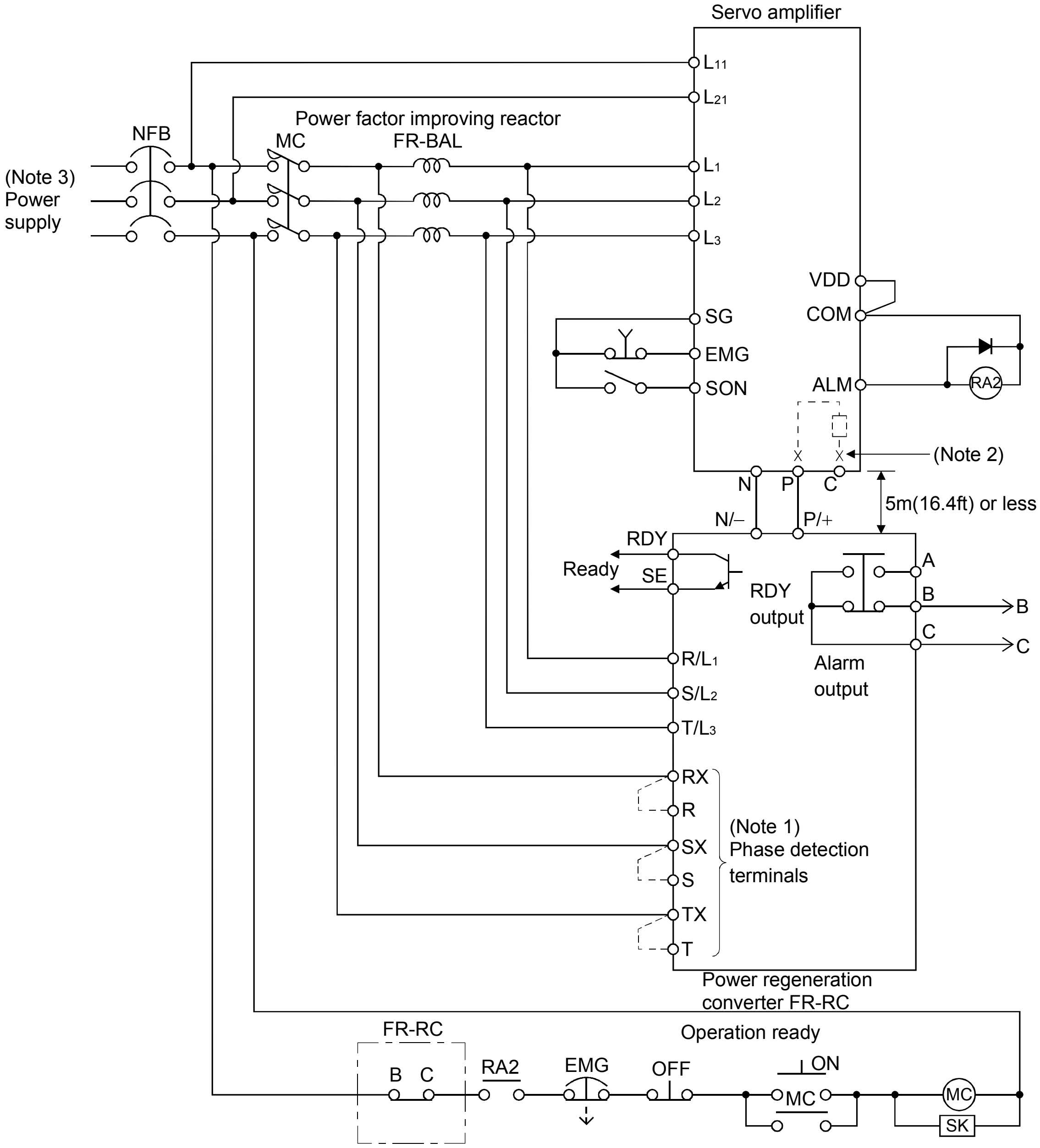
(1) Selection

The converters can continuously return 75% of the nominal regenerative power. They are applied to the servo amplifiers of the MR-J2S-500CP and MR-J2S-700CP.

Power regeneration converter	Nominal regenerative power (kW)	Servo amplifier
FR-RC15	15	MR-J2S-500CP
FR-RC30	30	MR-J2S-700CP



(2) Connection example



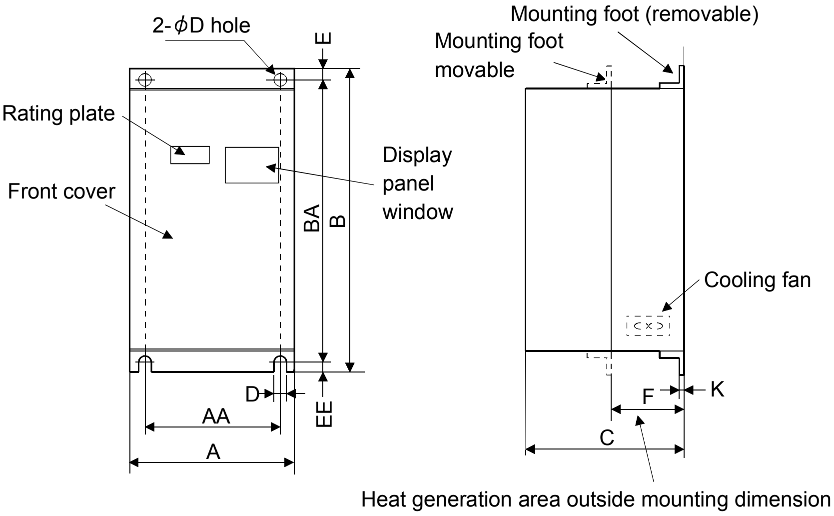
Note 1. When not using the phase detection terminals, fit the jumpers across RX-R, SX-S and TX-T. If the jumpers remain removed, the FR-RC will not operate.

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. Refer to section 1.2 for the power supply specification.

(3) Outside dimensions of the power regeneration converters

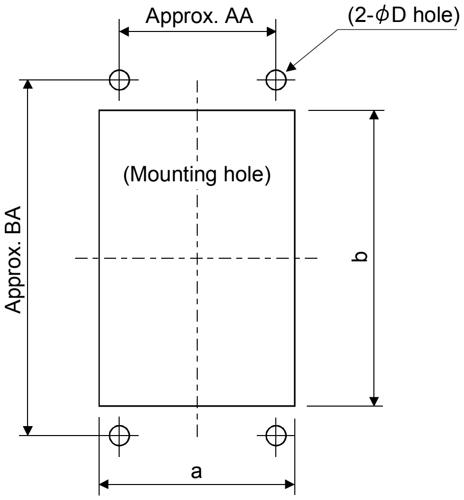
[Unit : mm(in)]



Power regeneration converter	A	AA	B	BA	C	D	E	EE	K	F	Approx. Mass [kg(lb)]
FR-RC-15K	270 (10.630)	200 (7.874)	450 (17.717)	432 (17.008)	195 (7.677)	10 (0.394)	10 (0.394)	8 (0.315)	3.2 (0.126)	87 (3.425)	19 (41.888)
FR-RC-30K	340 (13.386)	270 (10.630)	600 (23.622)	582 (22.913)	195 (7.677)	10 (0.394)	10 (0.394)	8 (0.315)	3.2 (0.126)	90 (3.543)	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.



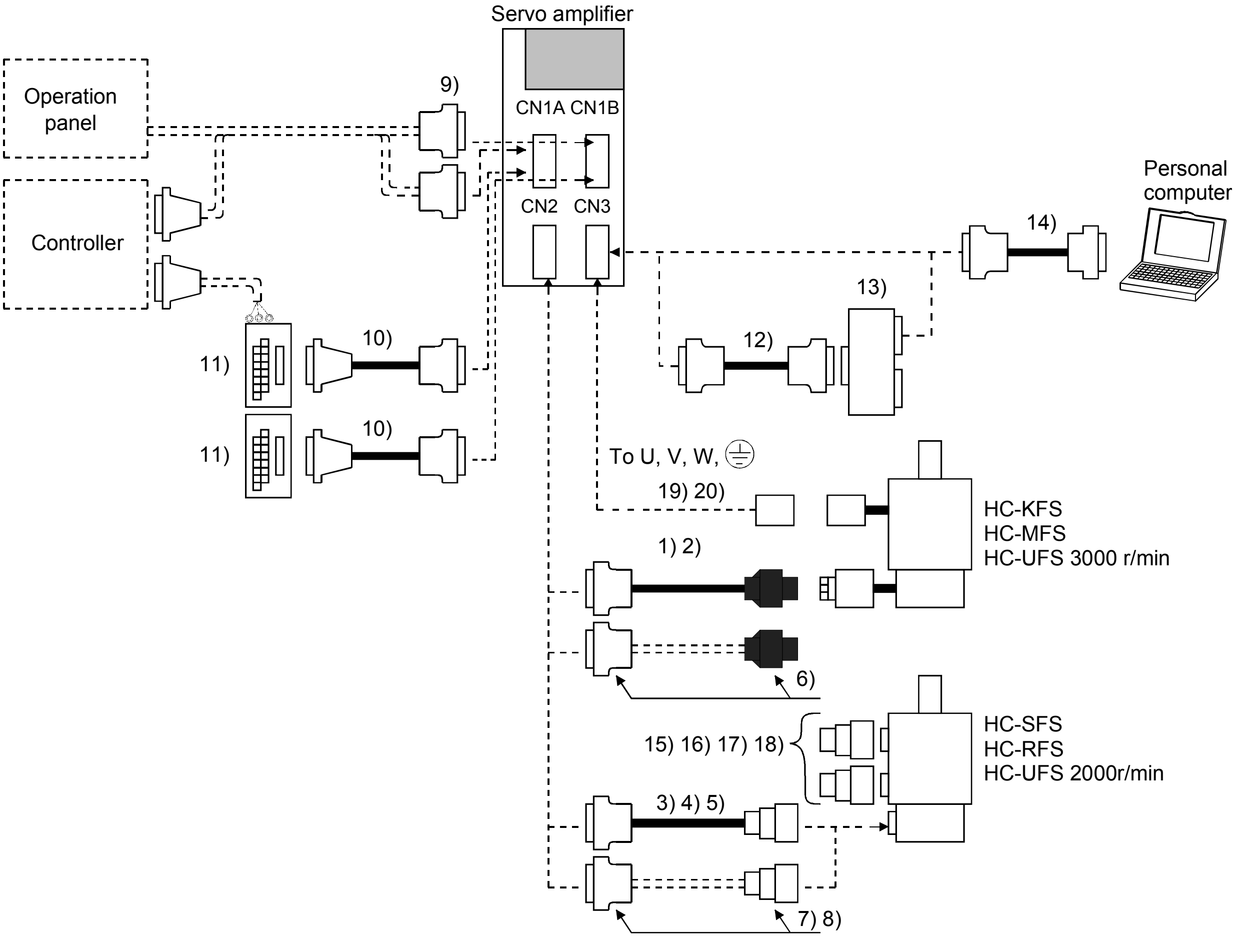
[Unit : mm(in)]

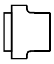
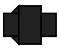
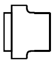
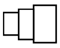
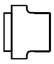
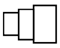
Model	A	B	D	AA	BA
FR-RC-15K	260 (10.236)	412 (16.220)	10 (0.394)	200 (7.874)	432 (17.009)
FR-RC-30K	330 (12.992)	562 (22.126)	10 (0.394)	270 (10.630)	582 (22.913)

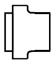
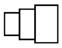
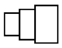
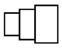
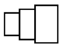
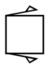
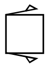
14.1.4 Cables and connectors

(1) Cable make-up

The following cables are used for connection with the servo motor and other models. Those indicated by broken lines in the figure are not options.



No.	Product	Model	Description	Application
1)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) of this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Connector pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry) 	Standard flexing life IP20
2)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) of this section.		Long flexing life IP20
3)	Standard encoder cable	MR-JHSCBL□M-L Refer to (2) of this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Connector: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK) 	Standard flexing life IP20
4)	Long flexing life encoder cable	MR-JHSCBL□M-H Refer to (2) of this section.		Long flexing life
5)	IP65-compliant encoder cable	MR-ENCBL□M-H Refer to (2) of this section.	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Connector: D/MS3106A20-29S (D190) Cable clamp: CE3057-12A-3-D Back shell: CE02-20BS-S-D (DDK) 	Long flexing life IP65 IP67 Not oil-resistant.
6)	Encoder connector set	MR-J2CNM	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry)  	IP20
7)	Encoder connector set	MR-J2CNS	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Connector: D/MS3106B20-29S Cable clamp: D/MS3057-12A (DDK)  	IP20
8)	Encoder connector set	MR-ENCNS	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent) Connector: D/MS3106A20-29S (D190) Cable clamp: CE3057-12A-3-D Back shell: CE02-20BS-S-D (DDK)  	IP65 IP67

No.	Product	Model	Description	Application
9)	Control signal connector set	MR-J2CN1	Connector: 10120-3000PE Shell kit: 10320-52F0-008 (3M or equivalent)  Qty: 2 each	
10)	Junction terminal block cable	MR-J2TBL□M Refer to section14.1.5.	Connector: HIF3BA-20D-2.54R (Hirose Electric) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	For junction terminal block connection
11)	Junction terminal block	MR-TB20	Refer to section 14.1.5.	
12)	Bus cable	MR-J2HBUS□M Refer to section14.1.6.	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	For maintenance junction card connection
13)	Maintenance junction card	MR-J2CN3TM	Refer to section 14.1.6.	
14)	Communication cable	MR-CPCATCBL3M Refer to (3) of this section.	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: DE-9SF-N Case: DE-C1-J6-S6 (JAE) 	For connection with PC-AT-compatible personal computer
15)	Power supply connector set	MR-PWCNS1 Refer to the Servo Motor Instruction Manual.	 Connector: CE05-6A22-23SD-D-BSS Cable clamp:CE3057-12A-2-D (DDK)	Must be used to comply with the EN Standard. IP65 IP67
16)	Power supply connector set	MR-PWCNS2 Refer to the Servo Motor Instruction Manual.	 Connector: CE05-6A24-10SD-D-BSS Cable clamp: CE3057-16A-2-D (DDK)	
17)	Power supply connector set	MR-PWCNS3 Refer to the Servo Motor Instruction Manual.	 Plug: CE05-6A32-17SD-D-BSS Cable clamp: CE3057-20A-1-D (DDK)	
18)	Brake connector set	MR-BKCN Refer to the Servo Motor Instruction Manual.	 Plug: D/MS3106A10SL-4S (D190) (DDK) Cable connector: YS010-5-8 (Daiwa Dengyo)	EN Standard-compliant IP65 IP67
19)	Power supply connector set	MR-PWCNK1 Refer to the Servo Motor Instruction Manual.	 Plug: 5559-04P-210 Terminal: 5558PBT3L (For AWG16)(6 pcs.) (Molex)	IP20
20)	Power supply connector set	MR-PWCNK2	 Plug: 5559-06P-210 Terminal: 5558PBT3L (For AWG16)(8 pcs.) (Molex)	For motor with brake IP20

(2) Encoder cable

> **⚠CAUTION**
> - If you have fabricated the encoder cable, connect it correctly. Otherwise, misoperation or explosion may occur.

> **POINT**
> - The encoder cable is not oil resistant.
> - Refer to section 13.4 for the flexing life of the encoder cable.
> - When the encoder cable is used, the sum of the resistance values of the cable used for P5 and the cable used for LG should be within 2.4Ω.
> - When soldering the wire to the connector pin, insulate and protect the connection portion using heat-shrinkable tubing.

Generally use the encoder cable available as our options. If the required length is not found in the options, fabricate the cable on the customer side.

(a) MR-JCCBL□M-L・MR-JCCBL□M-H

These encoder cables are used with the HC-KFS・HC-MFS・HC-UFS3000r/min series servo motors.

1) Model explanation

Model: MR-JCCBL□M-□

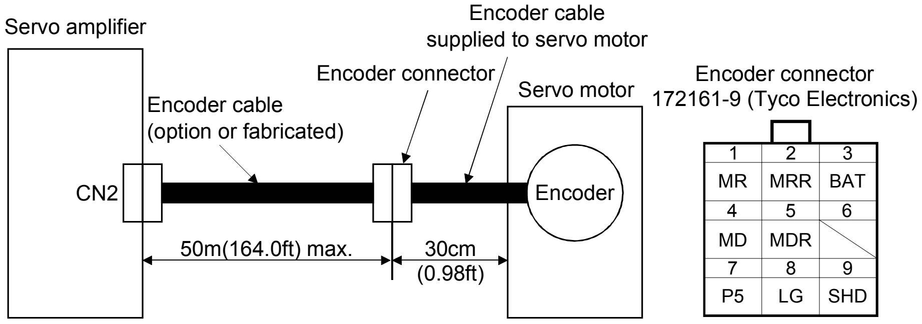
Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	(Note) Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

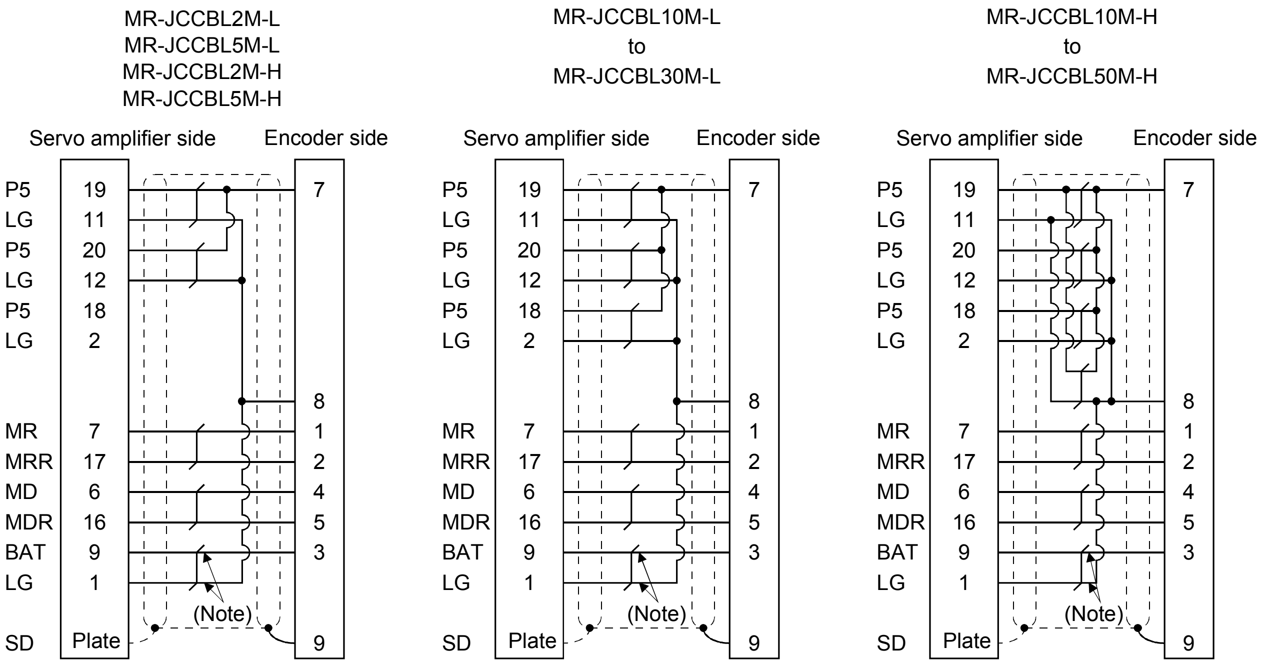
Note: MR-JCCBL□M-H has no 40m(131.2ft) and 50m(164.0ft) sizes.

2) Connection diagram

For the pin assignment on the servo amplifier side, refer to section 3.3.1.

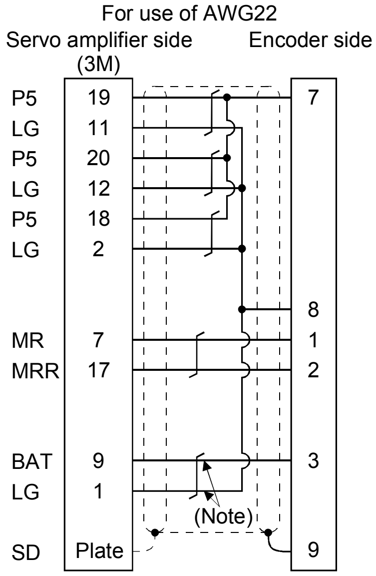


1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	
7	8	9
P5	LG	SHD



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

When fabricating an encoder cable, use the recommended wires given in section 14.2.1 and the MR-J2CNM connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m(164.0ft) length including the length of the encoder cable supplied to the servo motor.
When the encoder cable is to be fabricated by the customer, the wiring of MD and MDR is not required.
Refer to chapter 3 of the servo motor instruction guide and choose the encode side connector according to the servo motor installation environment.



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

(b) MR-JHSCBL□M-L・MR-JHSCBL□M-H・MR-ENCBL□M-H

These encoder cables are used with the HC-SFS・HC-RFS・HC-UFS2000r/min series servo motors.

1) Model explanation

Model: MR-JHSCBL□M- □

Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

Note: MR-JHSCBL□M-L has no 40(131.2) and 50m(164.0ft) sizes.

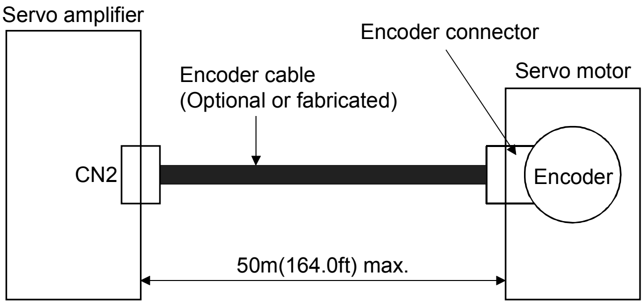
Model: MR-ENCBL□M-H

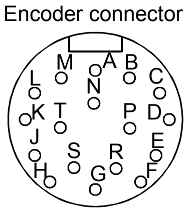
Long flexing life

Symbol	Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

2) Connection diagram

For the pin assignment on the servo amplifier side, refer to section 3.3.1.

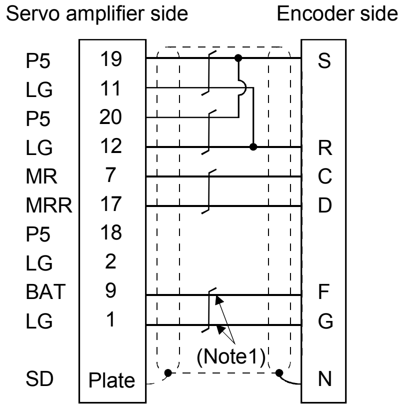




Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

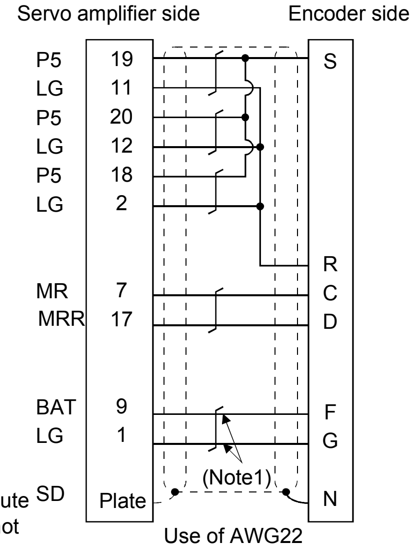
Pin	Signal
K	
L	
M	
N	SHD
P	
R	LG
S	P5
T	

MR-JHSCBL2M-L
MR-JHSCBL5M-L
MR-JHSCBL2M-H
MR-JHSCBL5M-H
MR-ENCBL2M-H
MR-ENCBL5M-H



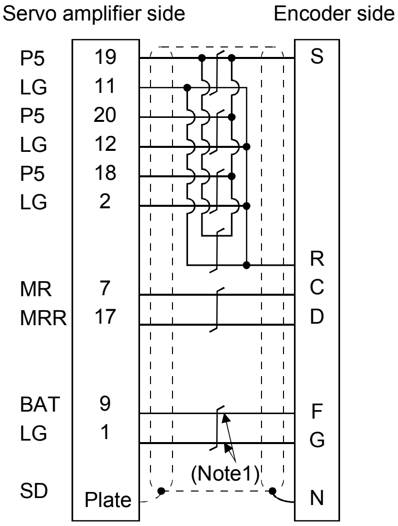
(Note2) Use of AWG24
(Less than 10m(32.8ft))

MR-JHSCBL10M-L
to
MR-JHSCBL30M-L



Use of AWG22
(10m(32.8ft) to 50m(164.0ft))

MR-JHSCBL10M-H
to
MR-JHSCBL50M-H
MR-ENCBL10M-H
to
MR-ENCBL50M-H



Use of AWG24
(10m(32.8ft) to 50m(164.0ft))

Note1: This wiring is required for use in the absolute position detection system. This wiring is not needed for use in the incremental system.

2: AWG28 can be used for 5m(16.4ft) or less.

When fabricating an encoder cable, use the recommended wires given in section 14.2.1 and the MR-J2CNS connector set for encoder cable fabrication, and fabricate an encoder cable in accordance with the optional encoder cable wiring diagram given in this section. You can fabricate an encoder cable of up to 50m(164.0ft) length.

Refer to chapter 3 of the servo motor instruction guide and choose the encode side connector according to the servo motor installation environment.

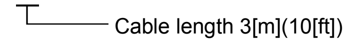
(3) Communication cable

POINT

- This cable may not be used with some personal computers. After fully examining the signals of the RS-232C connector, refer to this section and fabricate the cable.

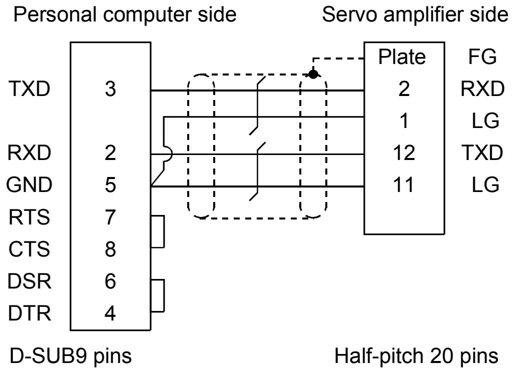
(a) Model definition

Model : MR-CPCATCBL3M



(b) Connection diagram

- MR-CPCATCBL3M



When fabricating the cable, refer to the connection diagram in this section.

The following must be observed in fabrication.

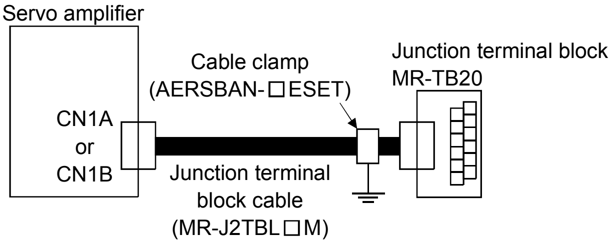
1) Always use a shielded, multi-core cable and connect the shield with FG securely.
2) The optional communication cable is 3m(10ft) long. When the cable is fabricated, its maximum length is 15m(49ft) in offices of good environment with minimal noise.

14.1.5 Junction terminal block (MR-TB20)

> POINT
>
> - When using the junction terminal block, you cannot use SG of CN1A-20 and CN1B-20. Use SG of CN1A-4 and CN1B-4.

(1) How to use the junction terminal block

Always use the junction terminal block (MR-TB20) with the junction terminal block cable (MR-J2TBL□M) as a set. A connection example is shown below.



Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-□ESET). For the use of the cable clamp fitting, refer to section 13.2.6, (2)(c).

(2) Terminal labels

The junction terminal block does not include the terminal block labels which indicate the signal layouts for MR-J2S-CP. Cut off the terminal block label in Appendix 2 at the dotted line and fold it up at the centerline for use.

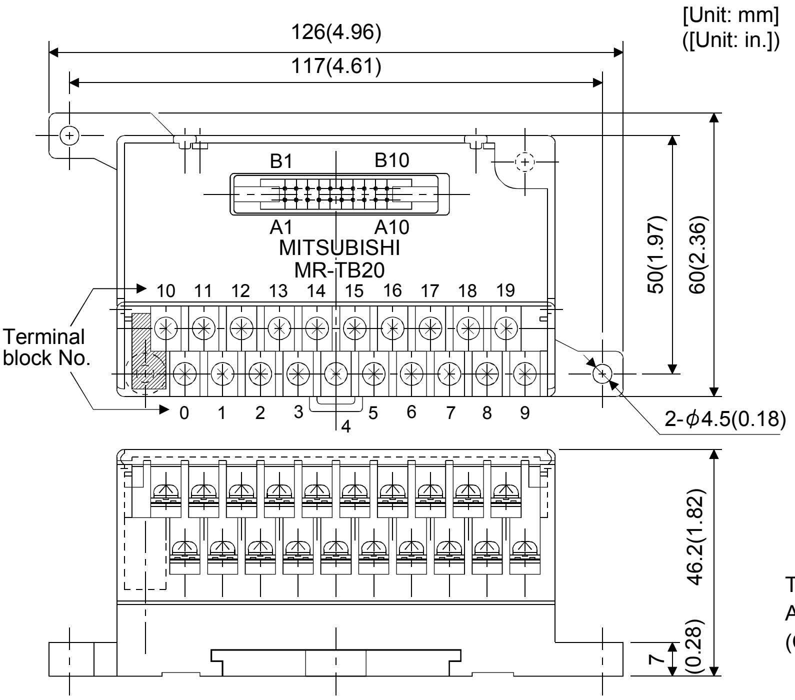
1) For CN1A

LG	PP			COM	OPC	PG			
10	11	12	13	14	15	16	17	18	19
NP	P15R		DOG	SG	NG			ZP	SD
0	1	2	3	4	5	6	7	8	9

2) For CN1B

LG	VDD	DIO	MD0	ST2	P15R	COM	SON	LSN	RD
10	11	12	13	14	15	16	17	18	19
VC	CPO	MEND	ST1	SG	TLA	DI1	LSP	ALM	SD
0	1	2	3	4	5	6	7	8	9

(3) Outline drawing



Terminal screw: M3.5
Applicable cable: Max. 2mm^2
(Crimping terminal width: 7.2mm (0.283 in) max.)

(4) Junction terminal block cable (MR-J2TBL□M)

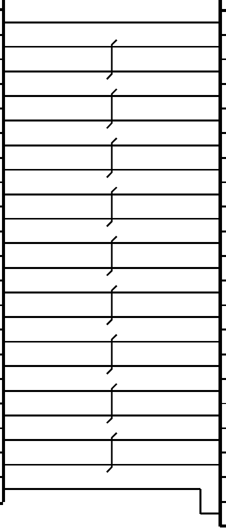
Model : MR-J2TBL□M

Symbol	Cable length[m(ft)]
05	0.5 (1.64)
1	1 (3.28)

Junction terminal block side connector (Hirose Electric)
HIF3BA-20D-2.54R (connector)

Servo amplifier side (CN1A・CN1B) connector (3M)
10120-6000EL (connector)
10320-3210-000 (shell kit)

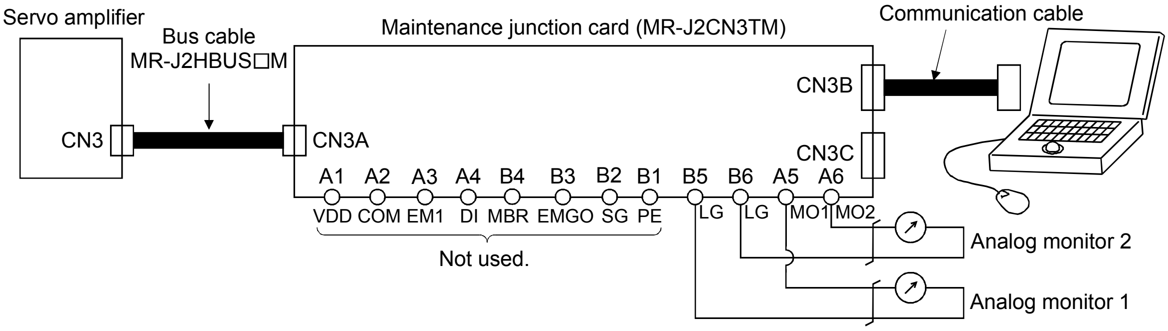
Terminal block label		Junction terminal block terminal No.	Pin No.	Pin No.
For CN1A	For CN1B			
LG	LG	10	B1	1
NP	VC	0	A1	2
PP	VDD	11	B2	3
P15R	CPO	1	A2	4
	DI0	12	B3	5
	MEND	2	A3	6
	MD0	13	B4	7
DOG	ST1	3	A4	8
COM	ST2	14	B5	9
SG	SG	4	A5	10
OPC	P15R	15	B6	11
NG	TLA	5	A6	12
PG	COM	16	B7	13
	DI1	6	A7	14
	SON	17	B8	15
	LSP	7	A8	16
	LSN	18	B9	17
ZP	ALM	8	A9	18
	RD	19	B10	19
SD	SD	9	A10	20
				Plate



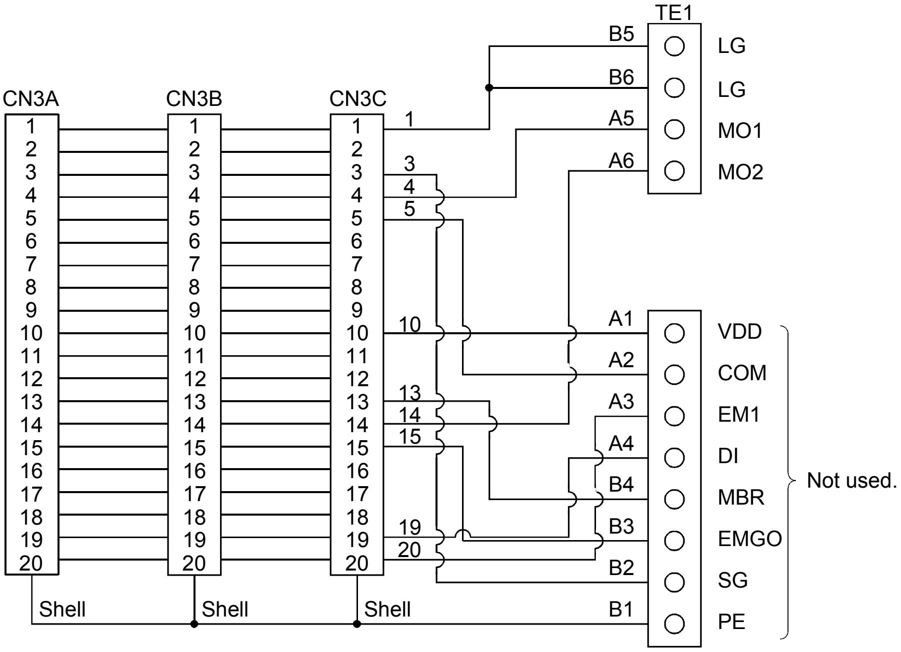
14.1.6 Maintenance junction card (MR-J2CN3TM)

(1) Usage

The maintenance junction card (MR-J2CN3TM) is designed for use when a personal computer and analog monitor are used at the same time.

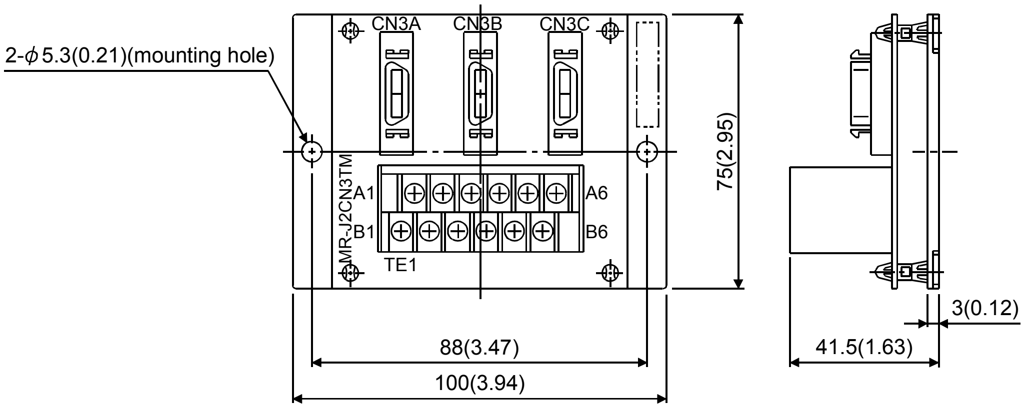


(2) Connection diagram



(3) Outline drawing

[Unit: mm]
([Unit: in])



Mass: 110g(0.24lb)

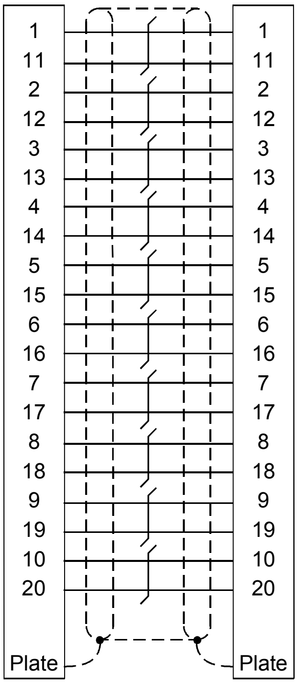
(4) Bus cable (MR-J2HBUS□M)

Model: MR-J2HBUS□M

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

MR-J2HBUS05M
MR-J2HBUS1M
MR-J2HBUS5M

10120-6000EL (connector)	10120-6000EL (connector)
10320-3210-000 (shell kit)	10320-3210-000 (shell kit)



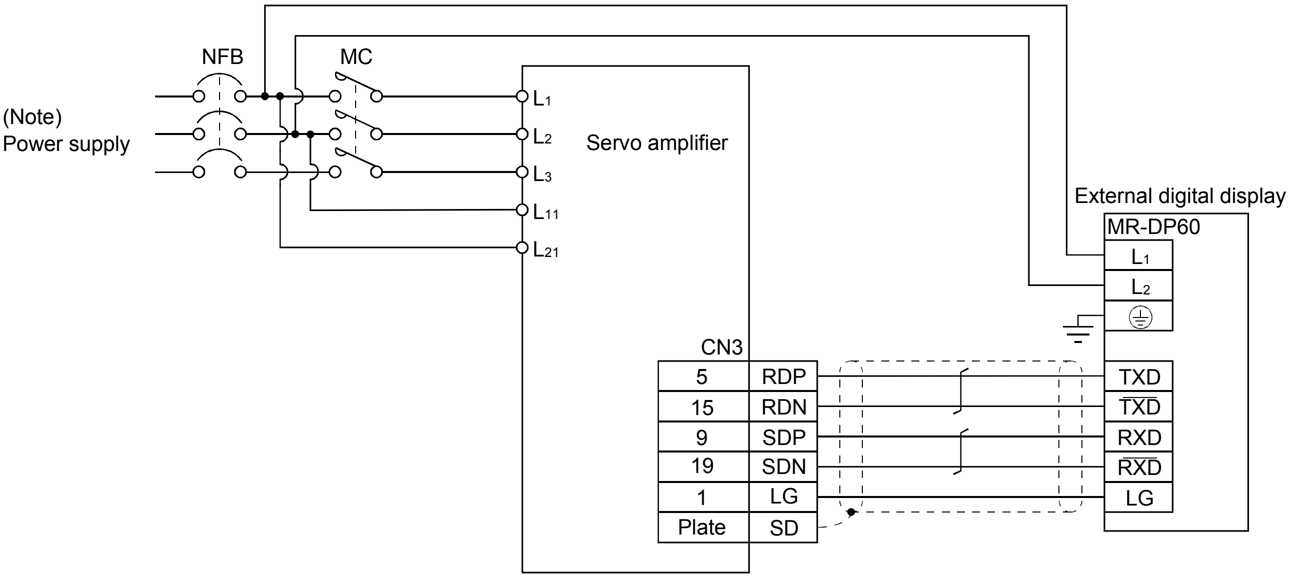
14.1.7 External digital display (MR-DP60)

The data equivalent to the servo amplifier status display can be displayed on the MR-DP60. When using the MR-DP60, set "□ 1 □ 4" in parameter No. 16. The items that appear at the time of power-on can be selected in parameter No.18.

(1) Specifications

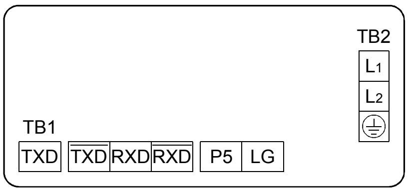
Item		Specifications
Display		Red seven-segment LED, signed, six digits
Power supply	Permissible voltage fluctuation	Single-phase, 85 to 253VAC, 50/60Hz
	Current consumption	Within 200mA
Communication	Interface	Conforms to RS-422
	Baud rate	4800bps, asynchronous
	Bit length	Start bit=1, date bit=8, parity bit=1, stop bit=1
	Protocol	MELSERVO protocol
	Communication commands	Commands dedicated to MELSERVO
Operating temperature / humidity range		0℃ to + 60℃ (32 to 140°F), 90%RH or less, non-condensing
Storage temperature range		−5℃ to + 70℃ (23 to 158°F)

(2) Connection example



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

(3) Terminal arrangement

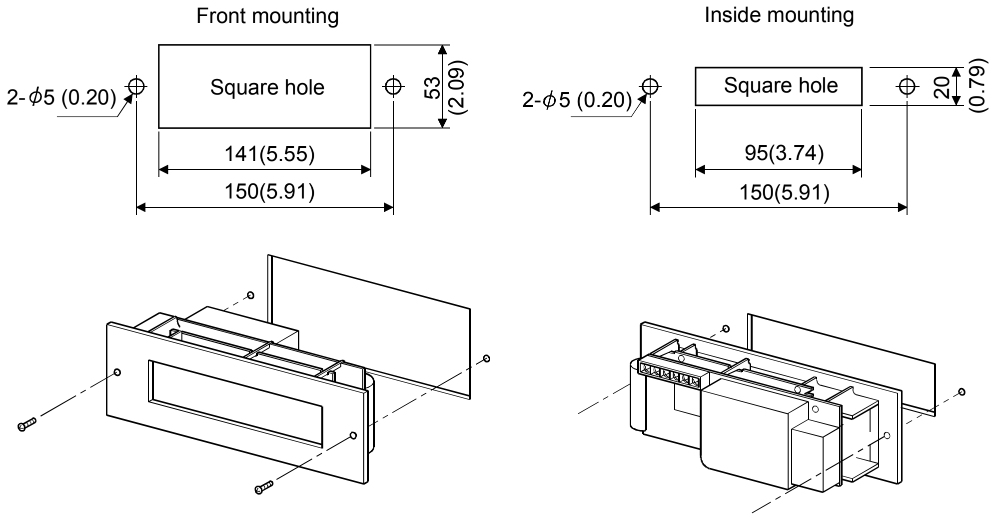


Signal	Description
L1	100 to 230VAC power input
L2	
○	Ground
RXD	Receive signal input
RXD	Inverse receive signal input
TXD	Inverse transmission signal output
$\overline{TXD}$	Transmission signal output
P5	5VDC output (Note)
LG	Control common

Note. The 5VDC output is designed for the internal control circuit and used to make a voltage check, etc. Do not use this terminal to supply a voltage to the other equipment.

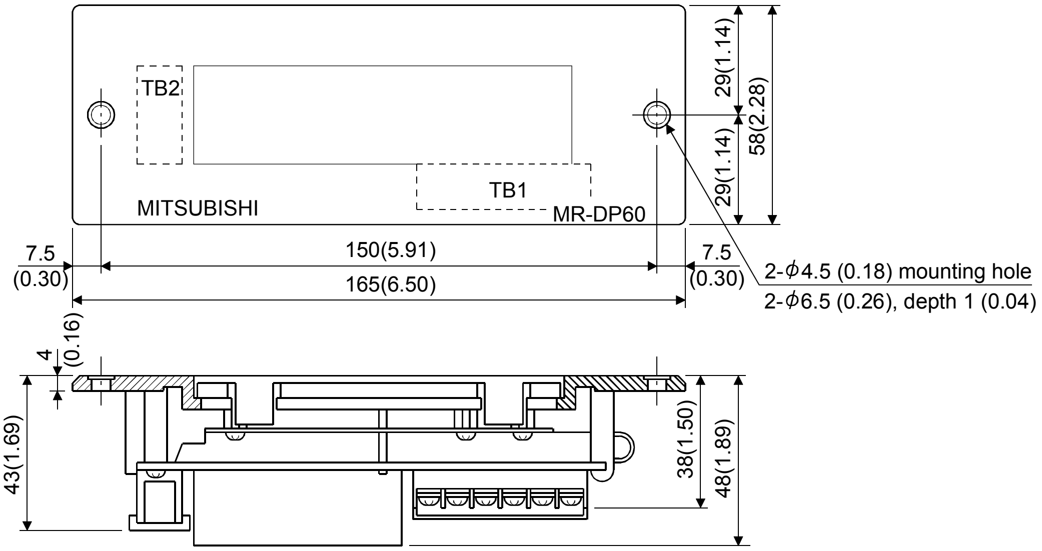
(4) Mounting

[Unit: mm (in)]



(5) Outline dimension drawing

[Unit: mm (in)]



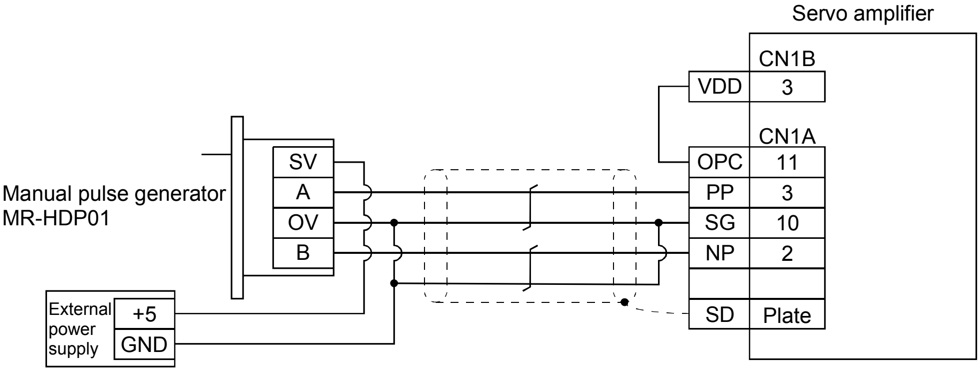
14.1.8 Manual pulse generator (MR-HDP01)

(1) Specifications

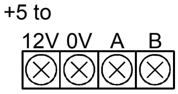
Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA max.
Interface		Output current max. 20mA for open collector output
Pulse signal form		A-phase and B-phase signals with 90°phase difference
Pulse resolution		100pulse / rev
Max. speed		Instantaneous max. 600r/min, ordinary 200r/min
Operating temperature range		−10℃ to +60℃ (14 to 140°F)
Storage temperature range		−30℃ to +80℃ (−22 to 176°F)

(2) Connection example

Use an external power supply to supply power to the manual pulse generator.



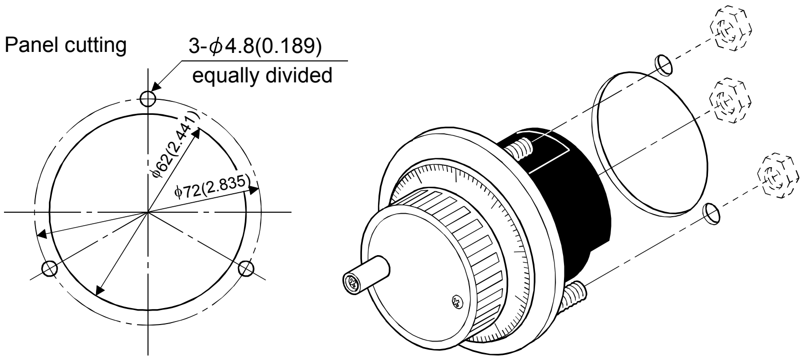
(3) Terminal arrangement



Signal name	Description
+5 to 12V	Power input
0V	Power and signal common
A	A-phase pulse output
B	B-phase pulse output

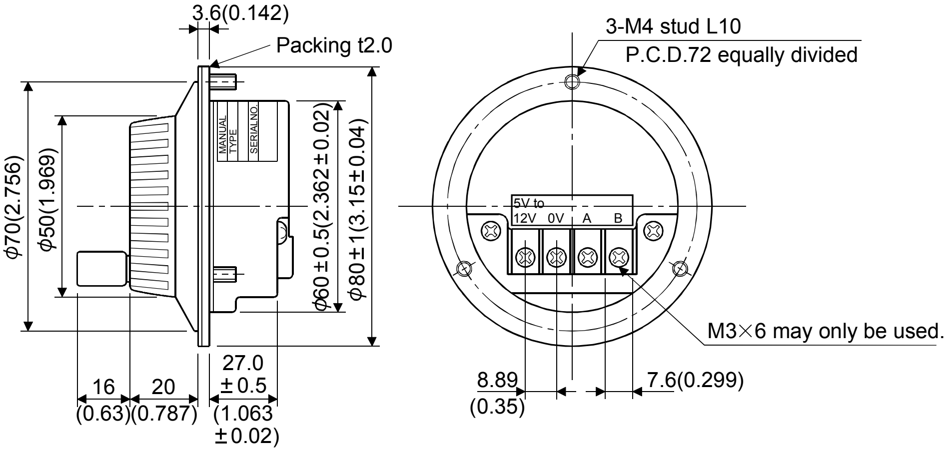
(4) Mounting

[Unit: mm(in)]



(5) Outline dimension drawing

[Unit: mm(in)]

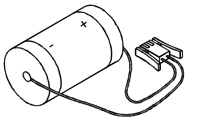


14.1.9 Battery (MR-BAT, A6BAT)

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 September, 2007).

Use the battery to build an absolute position detection system.



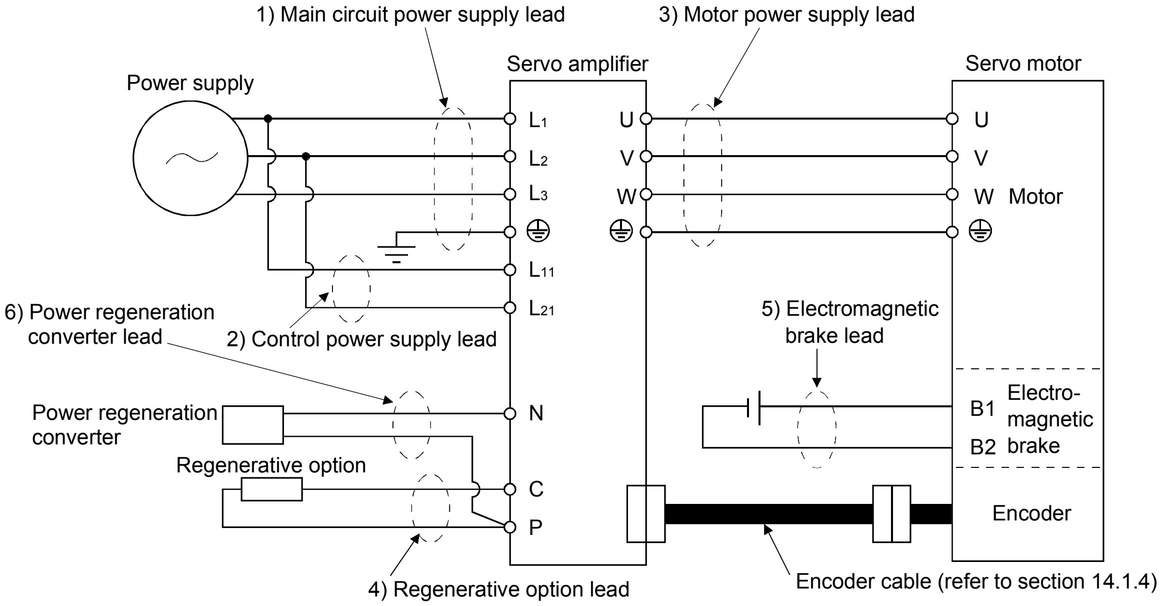
14.2 Auxiliary equipment

Always use the devices indicated in this section or equivalent. To comply with the EN Standard or UL/C-UL (CSA) Standard, use the products which conform to the corresponding standard.

14.2.1 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.



The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m(98.4ft) max. If the wiring distance is over 30m(98.4ft), choose the wire size in consideration of voltage drop.

The alphabets (a, b, c) in the table correspond to the crimping terminals (Table 14.2) used to wire the servo amplifier. For connection with the terminal block TE2 of the MR-J2S-100CP or less, refer to section 3.11.

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to section 3.8.

To comply with the UL/C-UL (CSA) Standard, use UL-recognized copper wires rated at 60 (140) or more for wiring.

Table 14.1 Recommended wires

Servo amplifier	(Note 1) Wires [mm^2]				
	1) L_1 ・ L_2 ・ L_3	2) L_{11} ・ L_{21}	3) U ・ V ・ W ・ ⏚	4) P ・ C	5) B1 ・ B2
MR-J2S-10CP(1)	2 (AWG14) : a	1.25 (AWG16)	1.25 (AWG16) : a	2 (AWG14) : a	1.25 (AWG16)
MR-J2S-20CP(1)					
MR-J2S-40CP(1)					
MR-J2S-60CP					
MR-J2S-70CP					
MR-J2S-100CP			2 (AWG14) : a		
MR-J2S-200CP	3.5 (AWG12) : b		3.5 (AWG12) : b		
MR-J2S-350CP	5.5 (AWG10) : b		(Note 2) 5.5 (AWG10) : b		
MR-J2S-500CP			5.5 (AWG10) : b		
MR-J2S-700CP	8 (AWG8) : c		8 (AWG8) : c	3.5(AW12) : c	

Note 1. For the crimping terminals and applicable tools, refer to table 14.2.

2. 3.5mm^2 for use of the HC-RFS203 servo motor.

Use wires 6) of the following sizes with the power regeneration converter (FR-RC).

Model	Wires[mm^2]
FR-RC-15K	14(AWG6)

Table 14.2 Recommended crimping terminals

Symbol	Servo amplifier side crimping terminals		
	Crimping terminal	Applicable tool	Manufacturer
a	32959	47387	Tyco Electronics
b	EVD5.5-4	YNT-1210S	
c	FVD8-5	Body YF-1・E-4 Head YNE-38 Die DH-111・DH-121	Japan Solderless Terminal

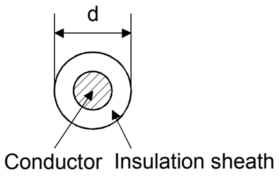
(2) Wires for cables

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 [mm^2]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance[Ω/mm]	Insulation coating ODd[mm] (Note 1)		
Encoder cable	MR-JCCBL□M-L	2 to 10 (6.56 to 32.8)	0.08	12 (6 pairs)	7/0.127	222	0.38	5.6	UL20276 AWG#28 6pair (BLACK)
		20・30 (65.6・98.4)	0.3	12 (6 pairs)	12/0.18	62	1.2	8.2	UL20276 AWG#22 6pair (BLACK)
	MR-JCCBL□M-H	2・5 (6.56・16.4)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
		10 to 50 (32.8 to 164)	0.2	14 (7 pairs)	40/0.08	105	0.88	8.0	(Note 2) A14B0238 7P
	MR-JHSCBL□M-L	2・5 (6.56・16.4)	0.08	8 (4 pairs)	7/0.127	222	0.38	4.7	UL20276 AWG#28 4pair (BLACK)
		10 to 30 (32.8 to 98.4)	0.3	12 (6 pairs)	12/0.18	62	1.2	8.2	UL20276 AWG#22 6pair (BLACK)
	MR-JHSCBL□M-H	2・5 (6.56・16.4)	0.2	8 (4 pairs)	40/0.08	105	0.88	6.5	(Note 2) A14B2339 4P
		10 to 50 (32.8 to 164)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
	MR-ENCBL□M-H	2・5 (6.56・16.4)	0.2	8 (4 pairs)	40/0.08	105	0.88	6.5	(Note 2) A14B2339 4P
		10 to 50 (32.8 to 164)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
Communication cable	MR-CPCATCBL3M	3 (9.84)	0.08	6 (3 pairs)	7/0.127	222	0.38	4.6	UL20276 AWG#28 3pair (BLACK)
Bus cable	MR-J2HBUS□M	0.5 to 5 (1.64 to 16.4)	0.08	20 (10 pairs)	7/0.127	222	0.38	6.1	UL20276 AWG#28 10pair (CREAM)

Note 1. d is as shown below.



2. Purchased from Toa Electric Industry
3. Standard OD. Max. OD is about 10% greater.

14.2.2 Circuit breakers, fuses, magnetic contactors

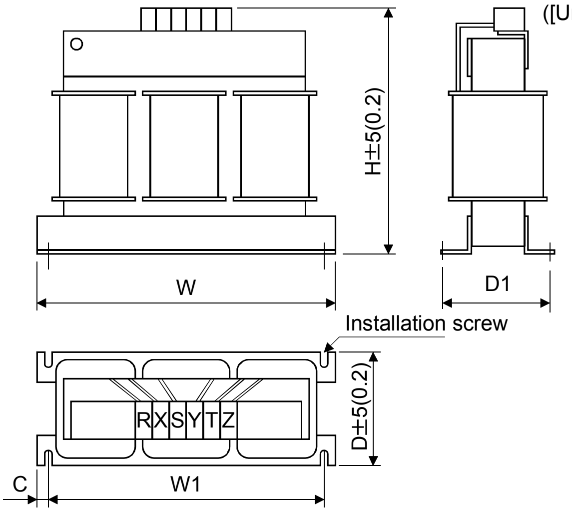
Always use one circuit breaker and one magnetic contactor with one servo amplifier. When using a fuse instead of the circuit breaker, use the one having the specifications given in this section.

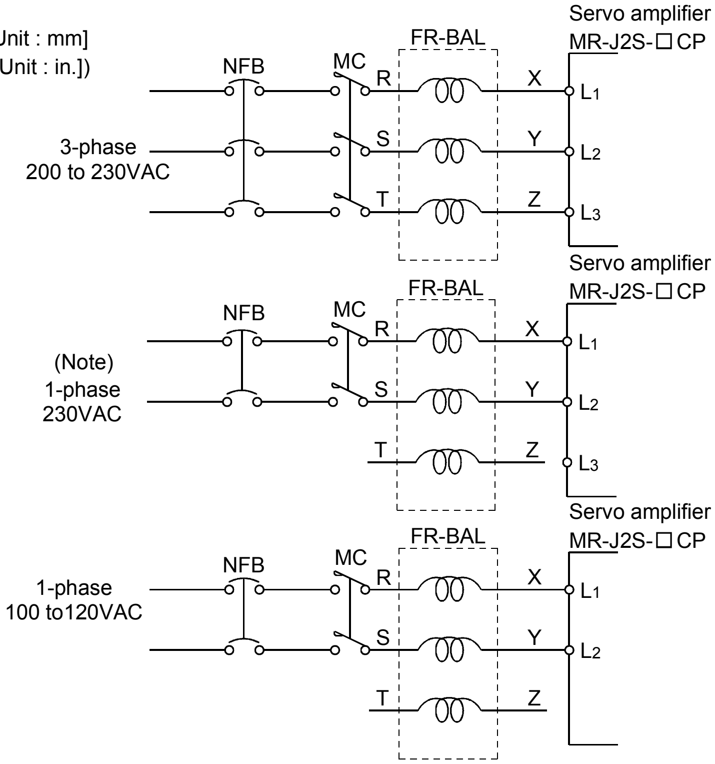
Servo amplifier	Circuit breaker	Fuse			Magnetic contactor
		Class	Current [A]	Voltage [V]	
MR-J2S-10CP(1)	30 frame 5A	K5	10	250AC	S-N10
MR-J2S-20CP	30 frame 5A	K5	10		
MR-J2S-40CP・20CP1	30 frame 10A	K5	15		
MR-J2S-60CP・40CP1	30 frame 15A	K5	20		
MR-J2S-70CP	30 frame 15A	K5	20		
MR-J2S-100CP	30 frame 15A	K5	25		
MR-J2S-200CP	30 frame 20A	K5	40		S-N18
MR-J2S-350CP	30 frame 30A	K5	70		S-N20
MR-J2S-500CP	50 frame 50A	K5	125		S-N35
MR-J2S-700CP	100 frame 75A	K5	150		S-N50

14.2.3 Power factor improving reactors

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%.

[Unit : mm]
([Unit : in.])





Note. Connect a 1-phase 230VAC power supply to L_1/L_2 and keep L_3 open.

Servo amplifier	Model	Dimensions [mm (in)]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
		W	W1	H	D	D1	C			
MR-J2S-10CP(1)/20CP	FR-BAL-0.4K	135 (5.31)	120 (4.72)	115 (4.53)	59 (2.32)	$45^{0}_{-2.5}$ ($1.77^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	2.0 (4.4)
MR-J2S-40CP/20CP1	FR-BAL-0.75K	135 (5.31)	120 (4.72)	115 (4.53)	69 (2.72)	$57^{0}_{-2.5}$ ($2.24^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	2.8 (6.17)
MR-J2S-60CP/ 70CP/ 40CP1	FR-BAL-1.5K	160 (6.30)	145 (5.71)	140 (5.51)	71 (2.79)	$55^{0}_{-2.5}$ ($2.17^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	3.7 (8.16)
MR-J2S-100CP	FR-BAL-2.2K	160 (6.30)	145 (5.71)	140 (5.51)	91 (3.58)	$75^{0}_{-2.5}$ ($2.95^{0}_{-0.098}$)	7.5 (0.29)	M4	M3.5	5.6 (12.35)
MR-J2S-200CP	FR-BAL-3.7K	220 (8.66)	200 (7.87)	192 (7.56)	90 (3.54)	$70^{0}_{-2.5}$ ($2.76^{0}_{-0.098}$)	10 (0.39)	M5	M4	8.5 (18.74)
MR-J2S-350CP	FR-BAL-7.5K	220 (8.66)	200 (7.87)	194 (7.64)	120 (4.72)	$100^{0}_{-2.5}$ ($3.94^{0}_{-0.098}$)	10 (0.39)	M5	M5	14.5 (32.0)
MR-J2S-500CP	FR-BAL-11K	280 (11.02)	255 (10.04)	220 (8.66)	135 (5.31)	$100^{0}_{-2.5}$ ($3.94^{0}_{-0.098}$)	12.5 (0.49)	M6	M6	19 (41.9)
MR-J2S-700CP	FR-BAL-15K	295 (11.61)	270 (10.62)	275 (10.83)	133 (5.24)	$110^{0}_{-2.5}$ ($4.33^{0}_{-0.098}$)	12.5 (0.49)	M6	M6	27 (59.5)

14.2.4 Relays

The following relays should be used with the interfaces.

Interface	Selection example
Relay used for input signals (interface DI-1) signals	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

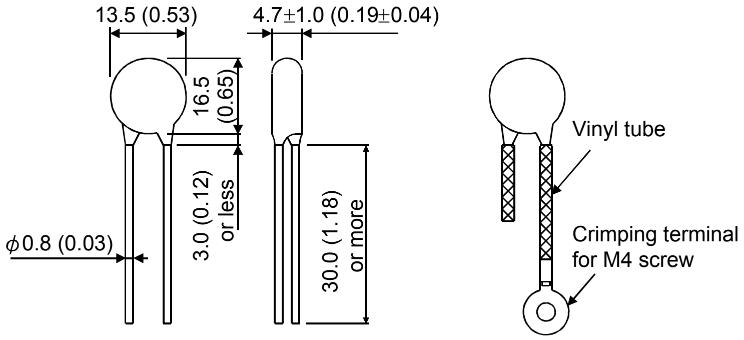
14.2.5 Surge absorbers

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. Insulate the wiring as shown in the diagram.

Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC[Vma]	DC[V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198 to 242)

Note. 1 time = 8 × 20μs

(Example) ERZV10D221 (Matsushita Electric Industry)
TNR-10V221K (Nippon chemi-con)
Outline drawing [mm] ([in]) (ERZ-C10DK221)



14.2.6 Noise reduction techniques

Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral devices to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required.

Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

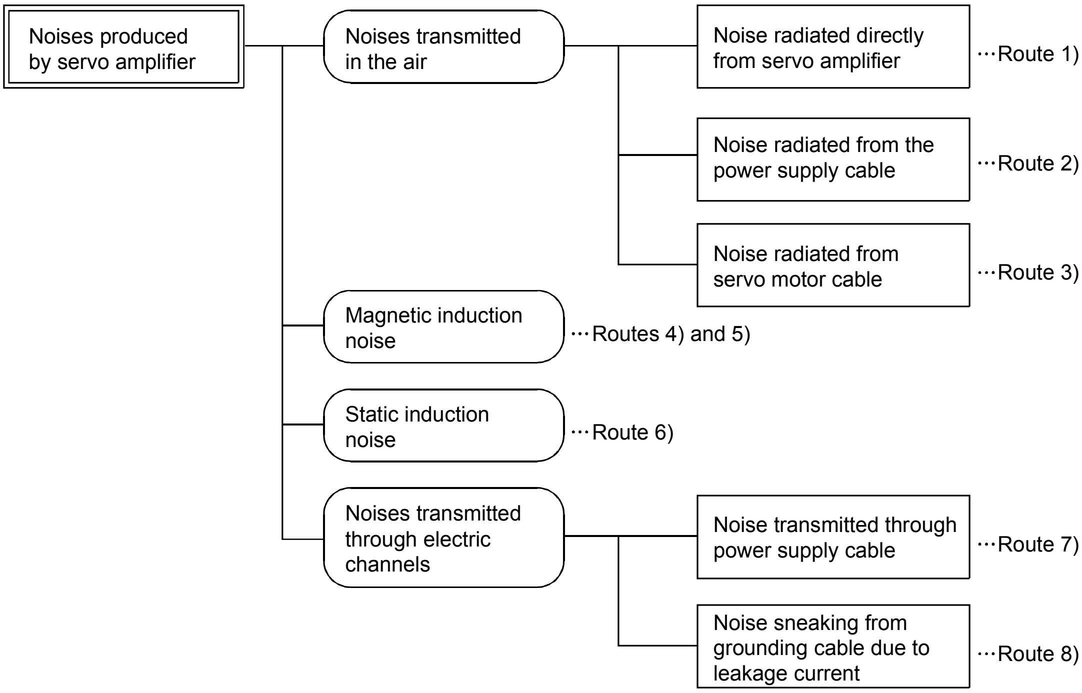
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point (refer to section 3.10).

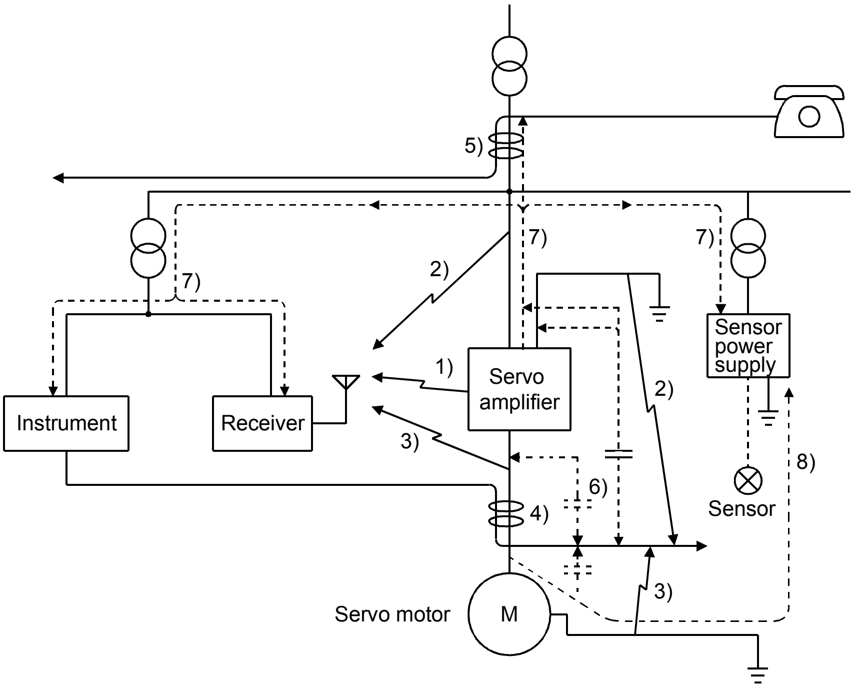
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

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

- Provide surge absorbers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the servo amplifier, to protect the servo amplifier and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the servo amplifier that cause peripheral devices to malfunction
Noises produced by the servo amplifier are classified into those radiated from the cables connected to the servo amplifier and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral devices located near the main circuit cables, and those transmitted through the power supply cables.





Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a control box together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid laying the power lines (Input cables of the servo amplifier) and signal cables side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the servo amplifier. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. 3. Avoid laying the power lines (Input 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

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

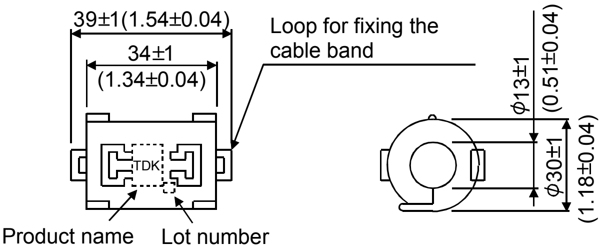
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC Tokin make are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

This impedances are reference values and not guaranteed values.

Impedance[Ω]	
10 to 100MHz	100 to 500MHz
80	150

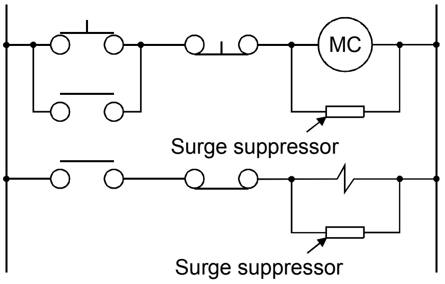
[Unit: mm]([Unit: in.])

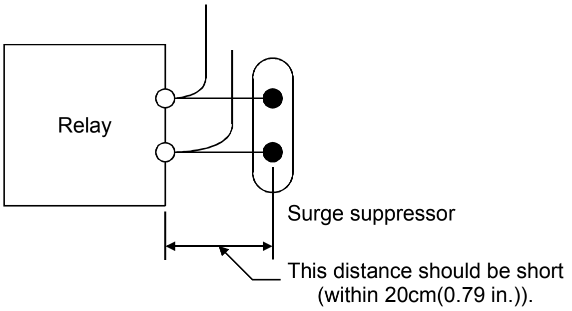


Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

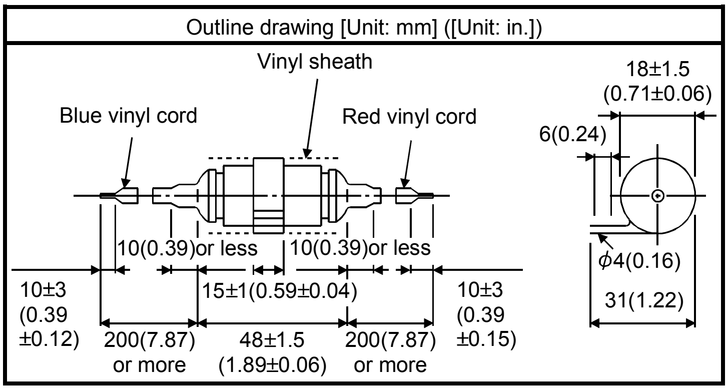
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the servo amplifier is shown below. Use this product or equivalent.





(Ex.) 972A.2003 50411
(Matsuo Electric Co., Ltd.−200VAC rating)

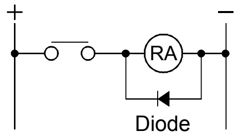
Rated voltage AC[V]	C [µF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)


Outline drawing [Unit: mm] ([Unit: in.])

Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

Maximum current: Not less than twice the drive current of the relay or the like

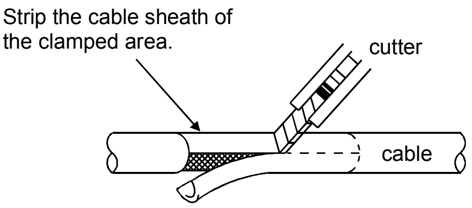


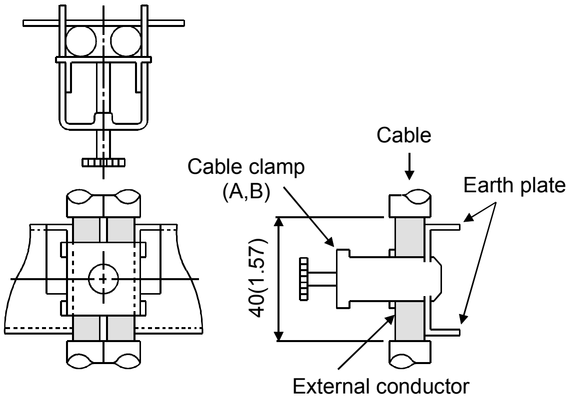
(c) Cable clamp fitting (AERSBAN-□SET)

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below.

Install the earth plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



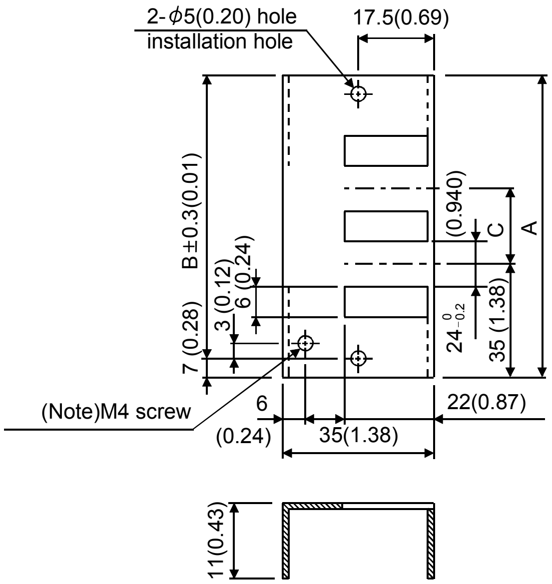


Clamp section diagram

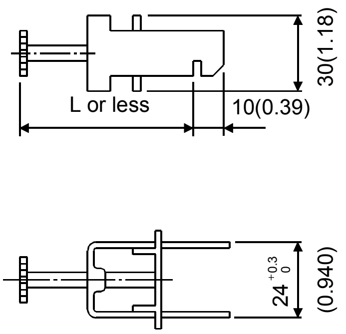
- Outline drawing

[Unit: mm]
([Unit: in.])

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 (3.94)	86 (3.39)	30 (1.18)	clamp A: 2pcs.
AERSBAN-ESET	70 (2.76)	56 (2.20)		clamp B: 1pc.

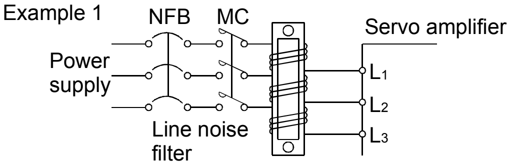
Clamp fitting	L
A	70 (2.76)
B	45 (1.77)

(d) Line noise filter (FR-BLF, FR-BSF01)

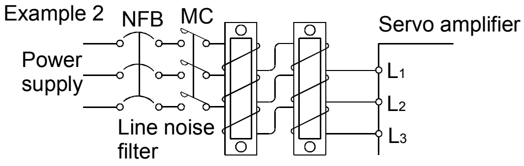
This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

<table>
<tr><th>Connection diagram</th><th>Outline drawing [Unit: mm] ([Unit: in.])</th></tr>
<tr><td rowspan="2">

Use the line noise filters for wires of the main power supply (L_1 · L_2 · L_3) and of the motor power supply (U · V · W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the servo amplifier as possible for their best performance.



(Number of turns: 4)



Two filters are used
(Total number of turns: 4)

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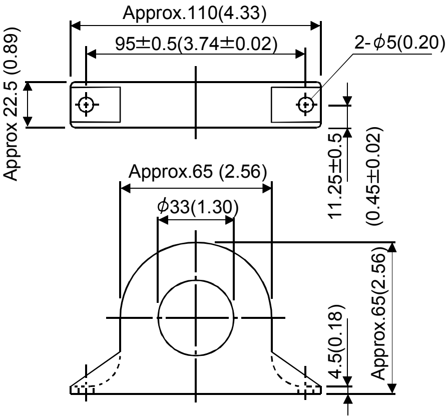
FR-BSF01(for MR-J2S-200CP or less)



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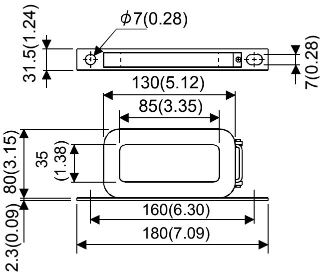
<tr><td>

FR-BLF (MR-J2S-350CP or more)



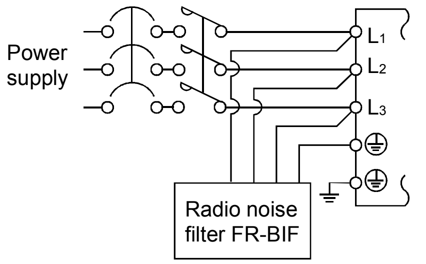
</td></tr>
</table>

(e) Radio noise filter (FR-BIF)...for the input side only

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.

<table>
<tr><th>Connection diagram</th><th>Outline drawing (Unit: mm) ([Unit: in.])</th></tr>
<tr><td>

Make the connection cables as short as possible.
Grounding is always required.
When using the FR-BIF with a single-phase wire, always insulate the wires that are not used for wiring.



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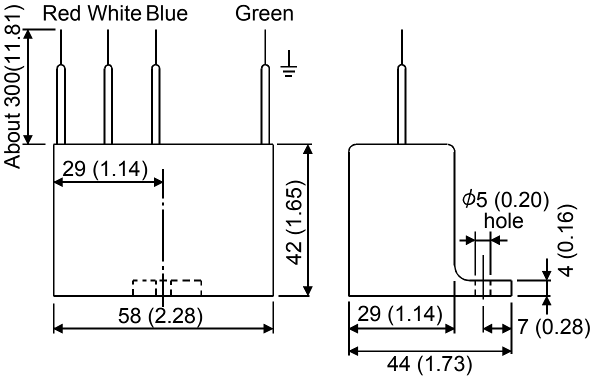
Leakage current: 4mA



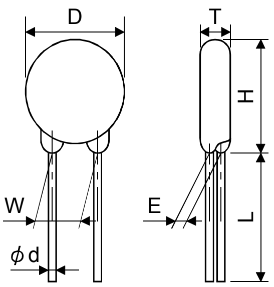
</td></tr>
</table>

(f) Varistors for input power supply (Recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the servo amplifier. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K and TND20V-471K, manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
	Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power				
	AC[V_{rms}]	DC[V]	8/20μs[A]	2ms[J]	[W]	[A]	[V]	[pF]	[V]
TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430(387 to 473)
TND20V-471K	300	385	7000/2 time	215			775	1200	470(423 to 517)

[Unit: mm]



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

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

14.2.7 Leakage current breaker

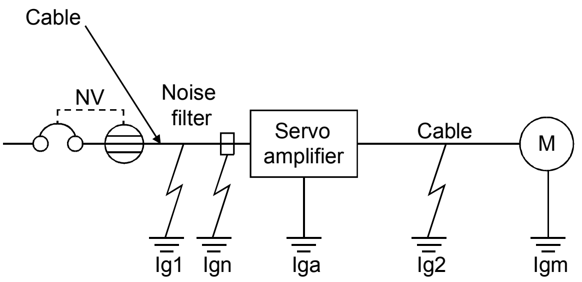
(1) Selection method

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 (11.8 in)) to minimize leakage currents.

Rated sensitivity current $\geq 10 \cdot \{Ig1+Ign+Iga+K \cdot (Ig2+Igm)\}$ [mA] ....(14.1)



K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	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.)

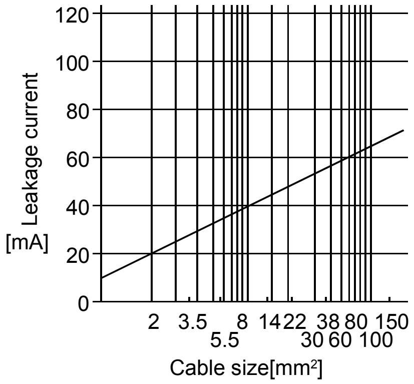


Fig. 14.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 14.4 Servo motor's leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 0.5	0.1
0.6 to 1.0	0.1
1.2 to 2.2	0.2
3 to 3.5	0.3
5	0.5
7	0.7

Table 14.5 Servo amplifier's leakage current example (Iga)

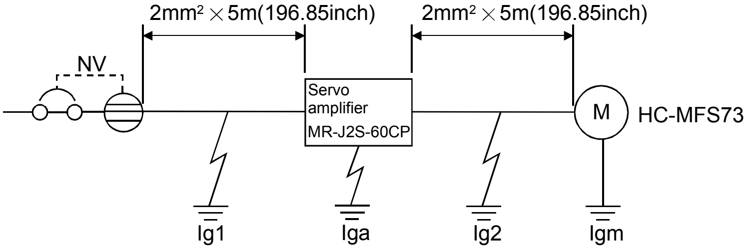
Servo amplifier capacity [kW]	Leakage current [mA]
0.1 to 0.6	0.1
0.7 to 3.5	0.15
5・7	2

Table 14.6 Leakage circuit breaker selection example

Servo amplifier	Rated sensitivity current of leakage circuit breaker [mA]
MR-J2S-10CP to MR-J2S-350CP MR-J2S-10CP1 to MR-J2S-40CP1	15
MR-J2S-500CP	30
MR-J2S-700CP	50

(2) Selection example

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



Use a leakage current breaker designed for suppressing harmonics/surges.
Find the terms of Equation (14.1) 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 (14.1).

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

$$\geq 4\ [mA]$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 4[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-SP/CP/ SW/CW/HW series.

14.2.8 EMC filter

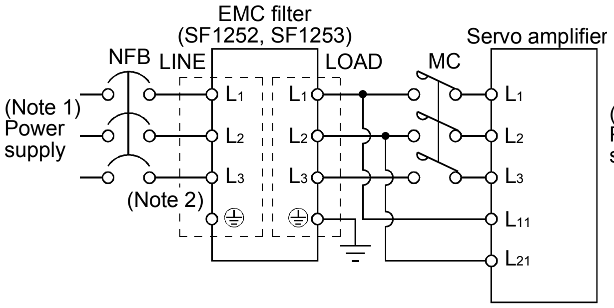
For compliance with the EMC Directive of the EN Standard, it is recommended to use the following filter. Some EMC filters are large in leakage current.

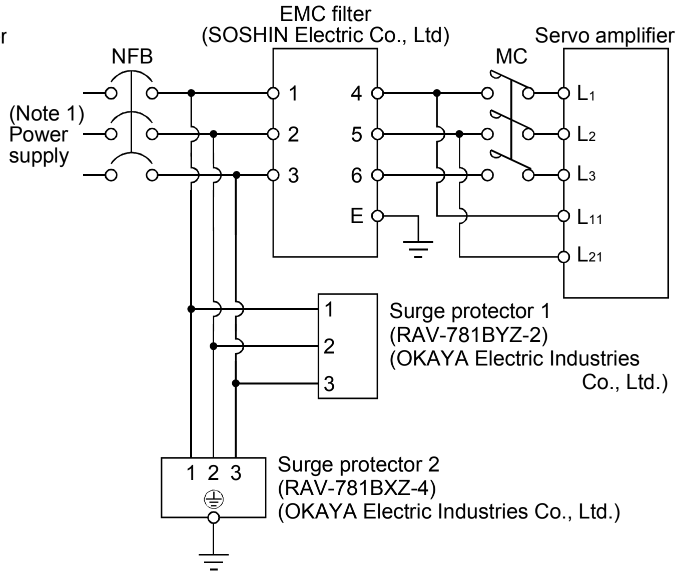
(1) Combination with the servo amplifier

Servo amplifier	Recommended filter		Mass [kg]([lb])
	Model	Leakage current [mA]	
MR-J2S-10CP to MR-J2S-100CP MR-J2S-10CP1 to MR-J2S-40CP1	SF1252	38	0.75 (1.65)
MR-J2S-200CP · MR-J2S-350CP	SF1253	57	1.37 (1.65)
MR-J2S-500CP	(Note) HF-3040A-TM	1.5	5.5 (12.13)
MR-J2S-700CP	(Note) HF-3050A-TM	1.5	6.7 (14.77)

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





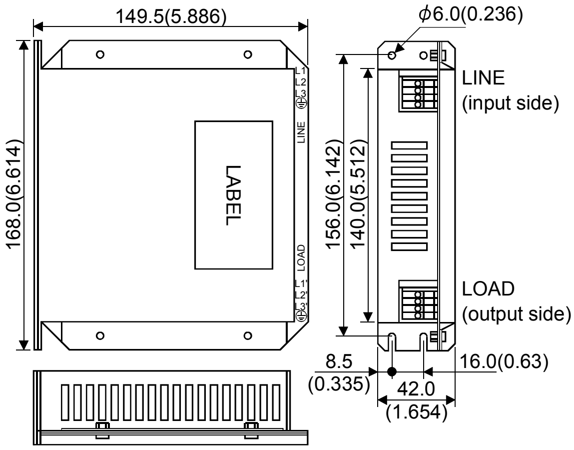
Note 1. For 1-phase 230VAC power supply, connect the power supply to L_1,L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.
2. Connect when the power supply has earth.

(3) Outline drawing

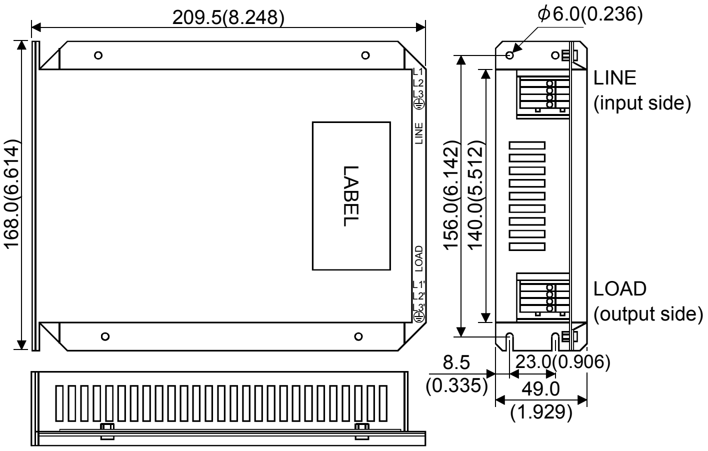
(a) EMC filter

[Unit: mm(in)]

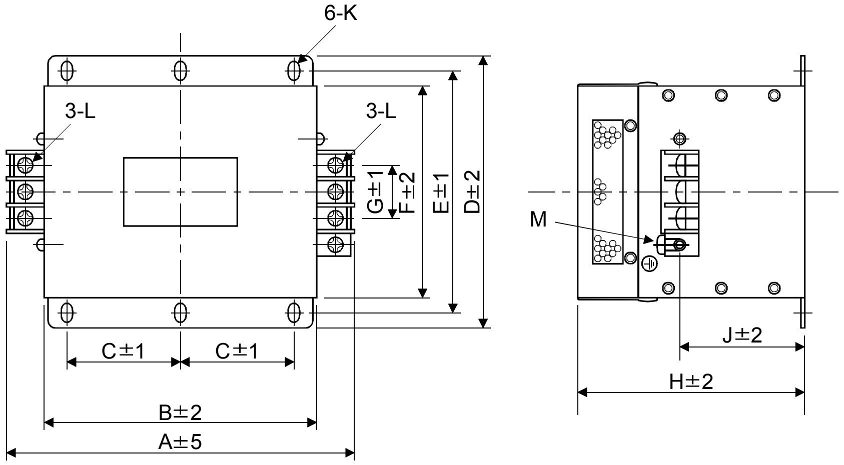
SF1252



SF1253



HF3040-TM・HF-3050A-TM

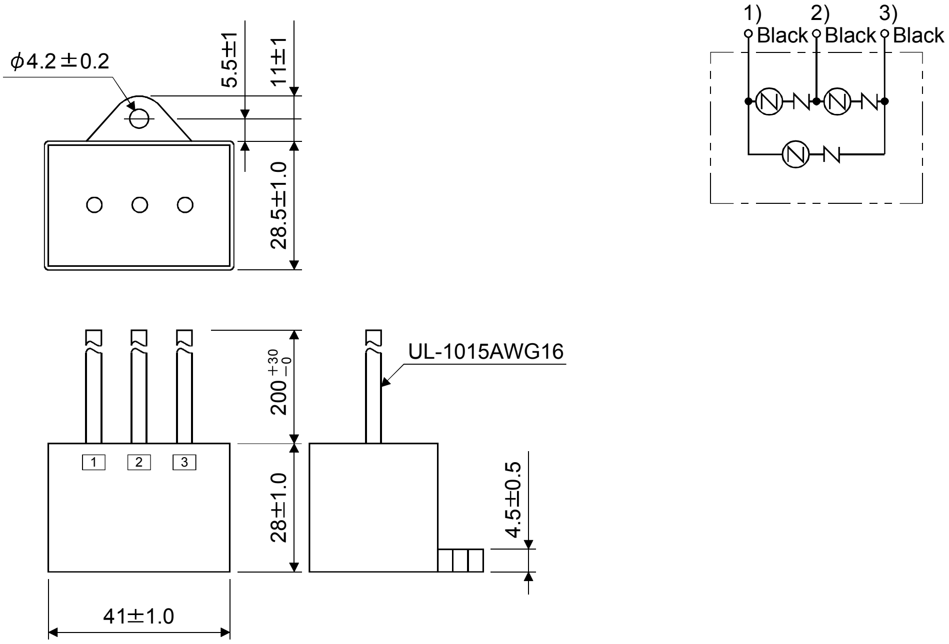


Model	Dimensions [mm(in)]											
	A	B	C	D	E	F	G	H	J	K	L	M
HF3040A-TM	260 (10.23)	210 (8.27)	85 (3.35)	155 (6.10)	140 (5.51)	125 (4.92)	44 (1.73)	140 (5.51)	70 (2.76)	R3.25, length 8	M5	M4
HF3050A-TM	290 (11.42)	240 (9.45)	100 (3.94)	190 (7.48)	175 (6.89)	160 (6.30)	44 (1.73)	170 (5.51)	100 (3.94)		M6	M4

(b) Surge protector

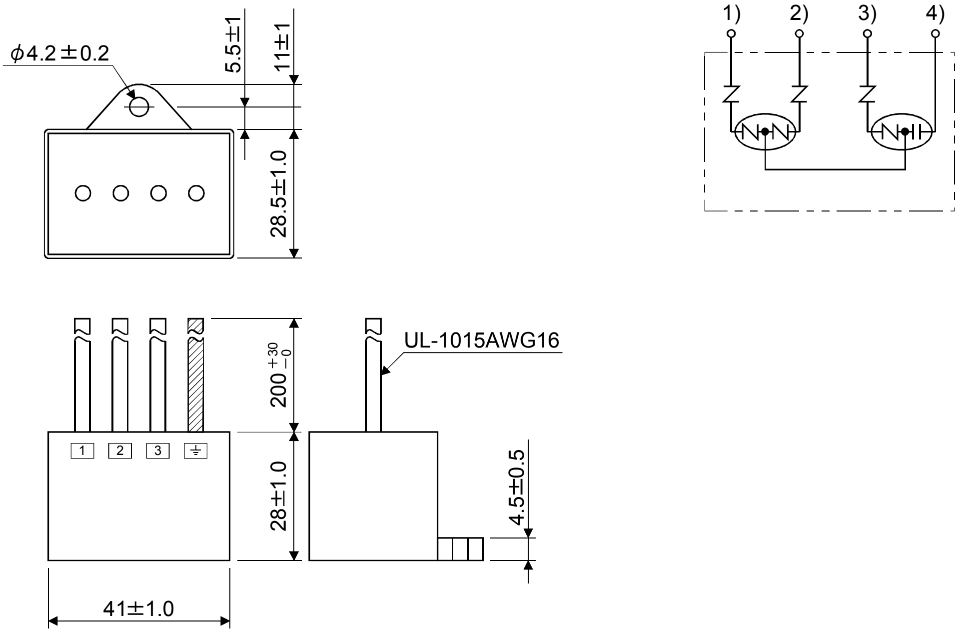
RAV-781BYZ-2

[Unit: mm]



RAV-781BXZ-4

[Unit: mm]



14.2.9 Setting potentiometers for analog inputs

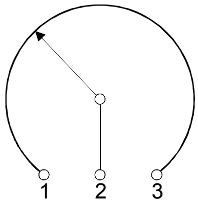
The following variable resistors are available for use with analog inputs.

(1) Single-revolution type

WA2WYA2SEBK2KΩ (Japan Resistor make)

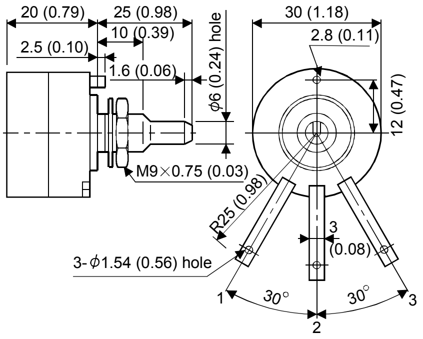
Rated power	Resistance	Resistance tolerance	Dielectric strength (for 1 minute)	Insulation resistance	Mechanical rotary angle	Rotary torque
2W	2kΩ	±10%	700V A.C	100MΩor more	300° ±5°	10 to 100g-cm or less

Connection diagram



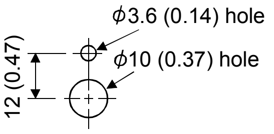
Outline dimension drawing

[Unit: mm (in)]



Panel hole machining diagram

[Unit: mm (in)]



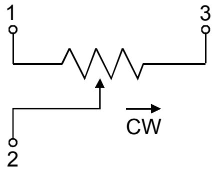
(2) Multi-revolution type

Position meter: RRS10M202 (Japan Resistor make)

Analog dial: 23M (Japan Resistor make)

Rated power	Resistance	Resistance tolerance	Dielectric strength (for 1 minute)	Insulation resistance	Mechanical rotary angle	Rotary torque
1W	2kΩ	±10%	700V A.C	1000MΩor more	$3600^\circ\ {}^{+10^\circ}_{-0^\circ}$	100g-cm or less

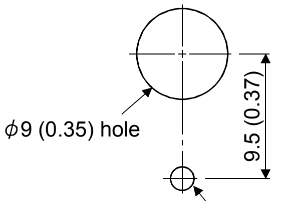
Connection diagram



Panel hole machining diagram

[Unit: mm (in)]

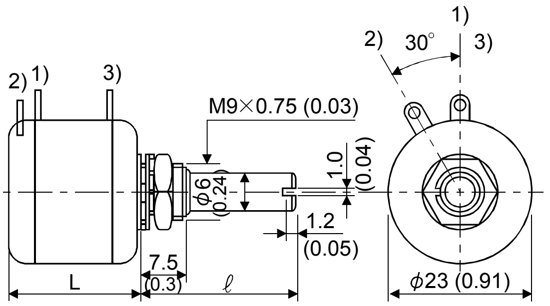
Panel thickness: 2 to 6 (0.08 to 0.24)



Outline dimension drawing

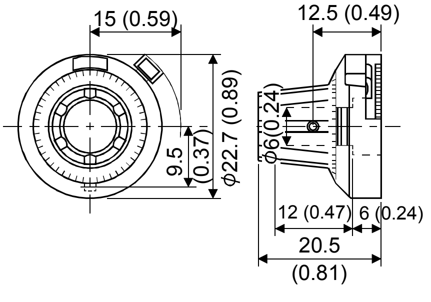
RRS10M202

[Unit: mm (in)]



23M

[Unit: mm (in)]



15. COMMUNICATION FUNCTIONS

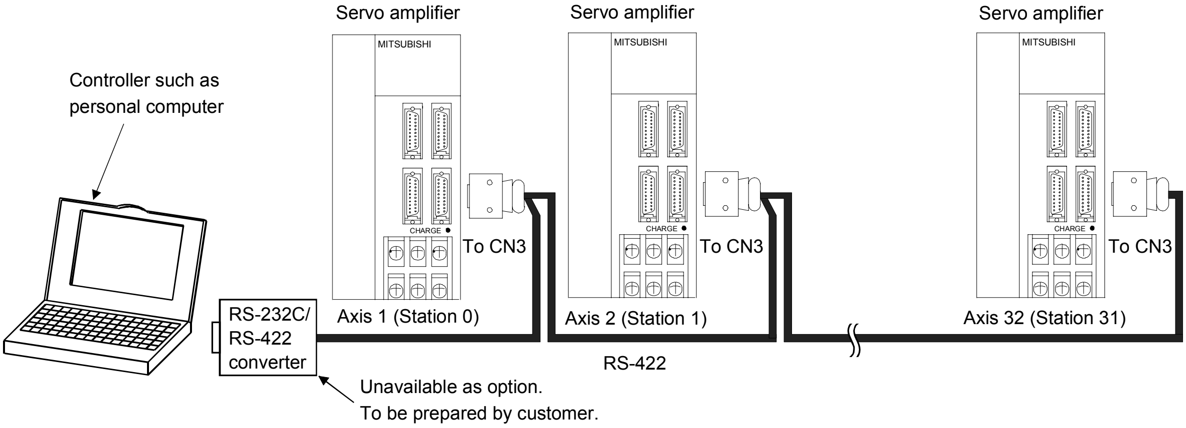
This servo amplifier has the RS-422 and RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.
However, the RS-422 and RS-232C communication functions cannot be used together. Select between RS-422 and RS-232C with parameter No.16. (Refer to section 15.2.2.)

15.1 Configuration

15.1.1 RS-422 configuration

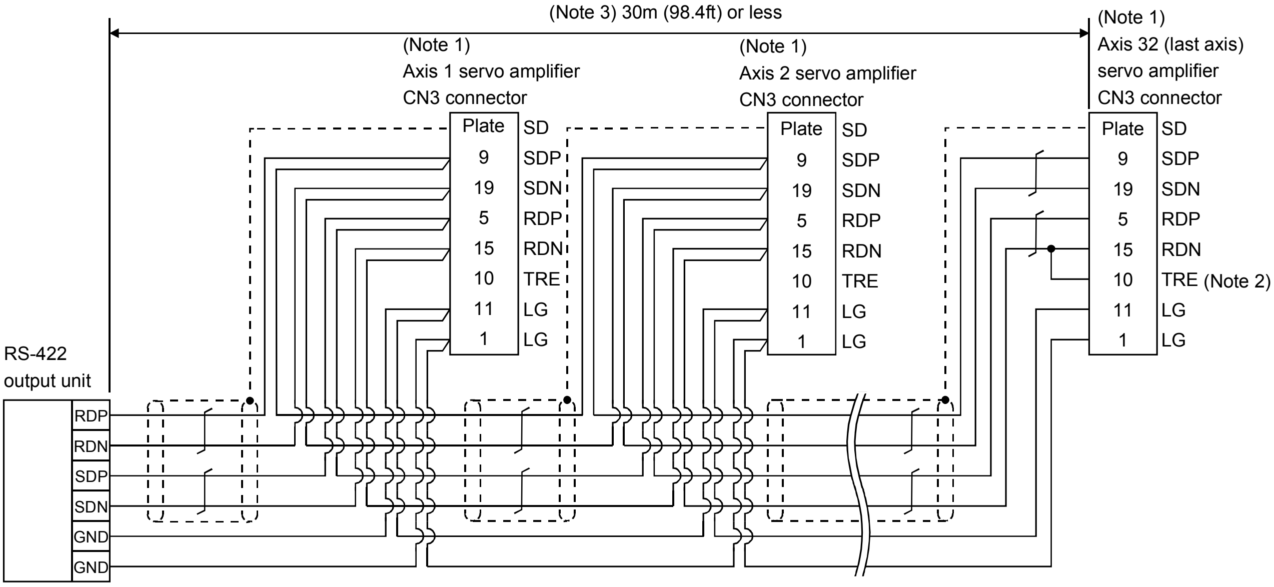
(1) Outline

Up to 32 axes of servo amplifiers from stations 0 to 31 can be operated on the same bus.



(2) Cable connection diagram

Wire as shown below.

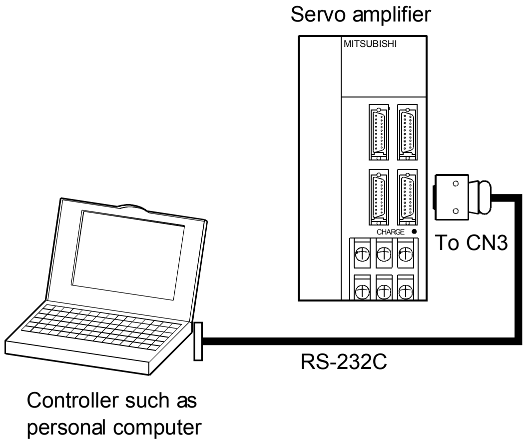


Note 1. Connector set MR-J2CN1 (3M)
Connector: 10120-3000PE
Shell kit: 10320-52F0-008
2. In the last axis, connect TRE and RDN.
3. 30m (98.4ft) or less in environment of little noise.

15.1.2 RS-232C configuration

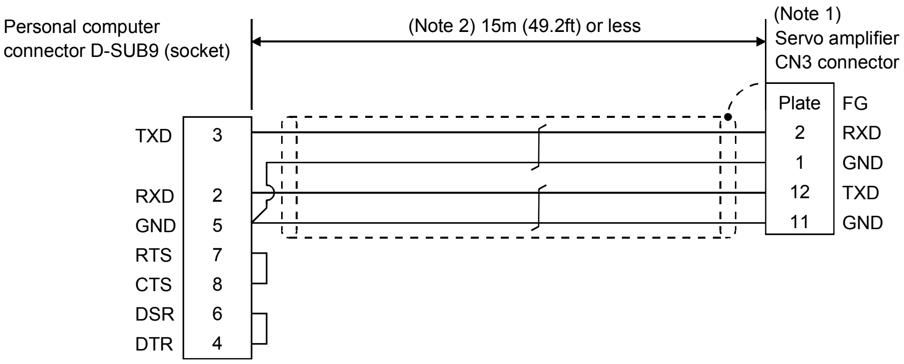
(1) Outline

A single axis of servo amplifier is operated.



(2) Cable connection diagram

Wire as shown below. The communication cable for connection with the personal computer (MR-CPCATCBL3M) is available. (Refer to section 14.1.4.)



Note 1. Connector set MR-J2CN1 (3M)

Connector: 10120-6000EL

Shell kit: 10320-3210-000

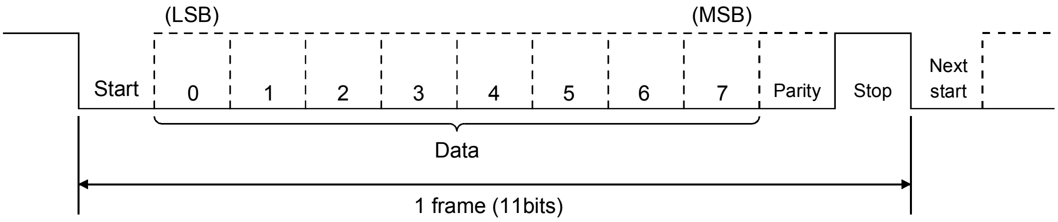
2. 15m (49.2ft) or less in environment of little noise. However, this distance should be 3m (9.84ft) or less for use at 38400bps or more baud rate.

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 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



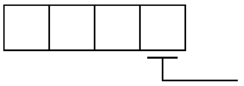
15.2.2 Parameter setting

When the RS-422/RS-232C 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. 16

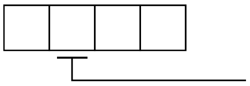


Communication baud rate
0: 9600[bps]
1: 19200[bps]
2: 38400[bps]
3: 57600[bps]

(2) Serial communication selection

Select the RS-422 or RS-232C communication standard. RS-422 and RS-232C cannot be used together.

Parameter No. 16

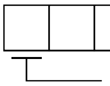


Serial communication standard selection
0: RS-232C used
1: RS-422 used

(3) Serial 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. 16



Serial communication response delay time
0: Invalid
1: Valid, reply sent in 800μs or more

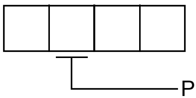
(4) Station number setting

Set the station number of the servo amplifier in parameter No. 15. The setting range is stations 0 to 31.

(5) Protocol station number selection

When communication is made without setting station numbers to servo amplifiers, choose "no station numbers" in parameter No. 57. The communication protocol will be free of station numbers.

Parameter No. 57



Protocol station number selection
0: With station numbers
1: No station numbers

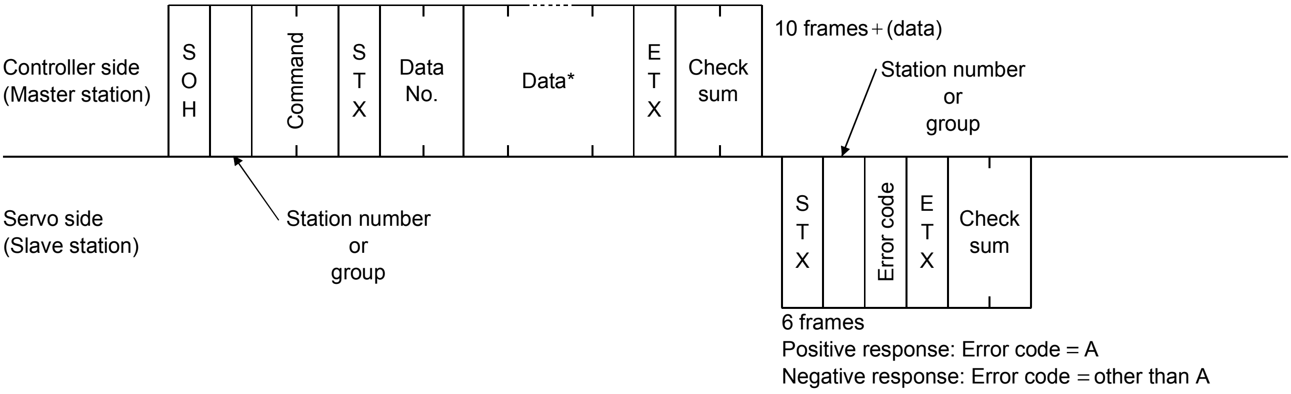
15.3 Protocol

POINT

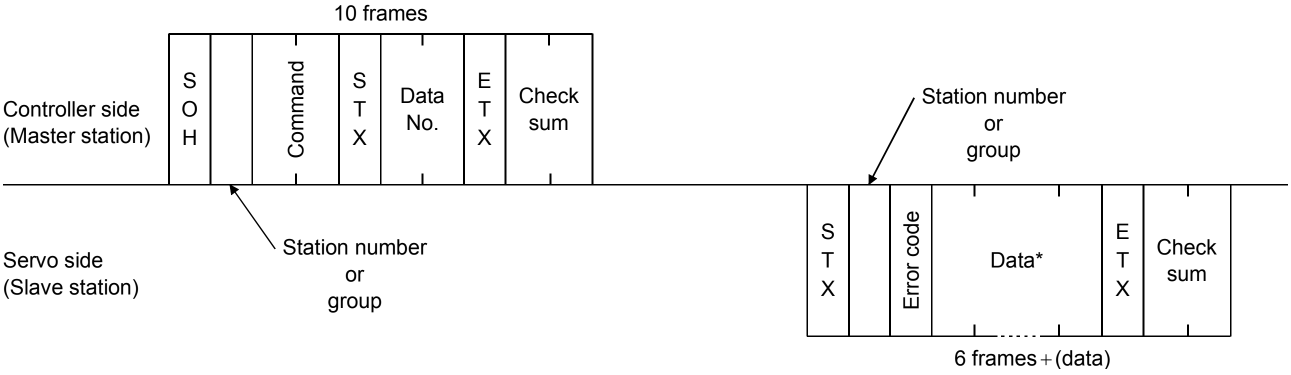
- Whether station number setting will be made or not must be selected if the RS-232C communication function is used. Note that choosing "no station numbers" in parameter No. 57 will make the communication protocol free of station numbers.

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.

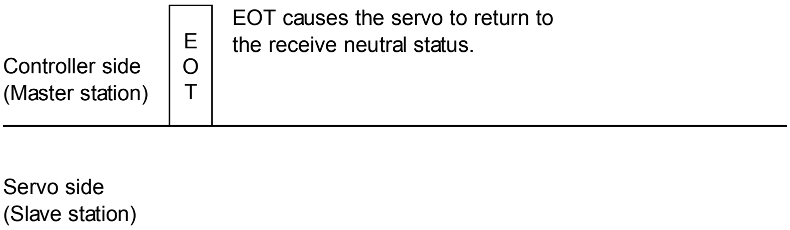
(1) Transmission of data from the controller to the servo



(2) Transmission of data request from the controller to the servo

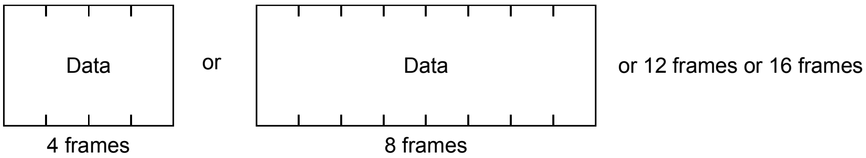


(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



15.4 Character codes

(1) Control codes

Code name	Hexadecimal (ASCII code)	Description	Personal computer terminal key operation (General)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

ASCII codes are used.

b_8	0	0	0	0	0	0	0	0
b_7	0	0	0	0	1	1	1	1
b_6	0	0	1	1	0	0	1	1
b_5	0	1	0	1	0	1	0	1

b_8 to b_5	b_4	b_3	b_2	b_1
	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
	1	0	0	1
	1	0	1	0
	1	0	1	1
	1	1	0	0
	1	1	0	1
	1	1	1	0
	1	1	1	1

C R	0	1	2	3	4	5	6	7
0	NUL	DLE	Space	0	@	P	`	p
1	SOH	DC$_1$	!	1	A	Q	a	q
2	STX	DC$_2$	“	2	B	R	b	r
3	ETX	DC$_3$	#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			‘	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
10			*	:	J	Z	j	z
11			+	;	K	[	k	{
12			,	<	L	¥	l	|
13			−	=	M	]	m	}
14			.	>	N	^	n	‾
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.

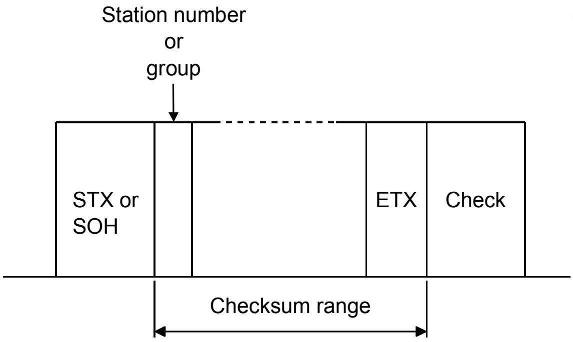
15.5 Error codes

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.

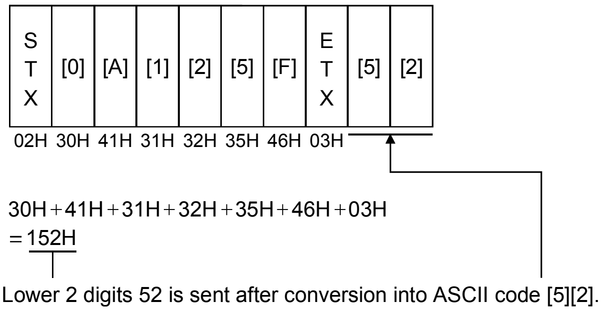
Error code		Error name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted 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.	

15.6 Checksum

The checksum is a ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or SOH).

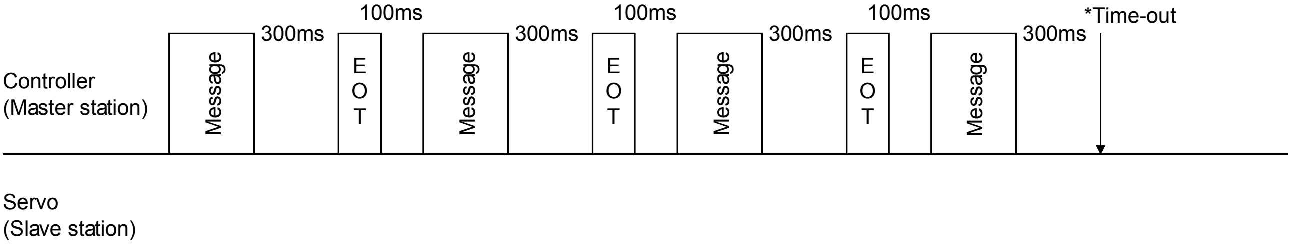


(Example)



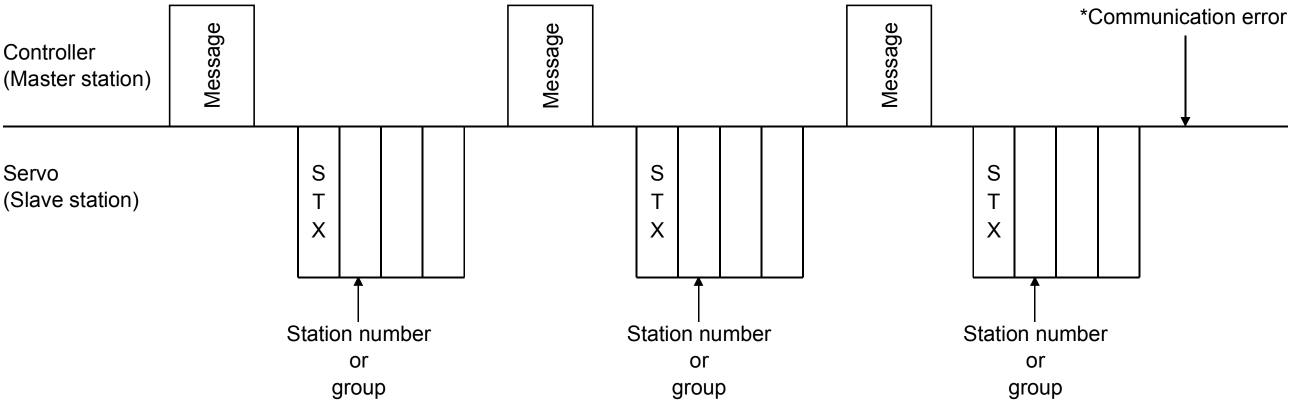
15.7 Time-out operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300[ms] after the master station has ended communication operation. 100[ms] after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above operation three times. (Communication error)



15.8 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.

15.9 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.

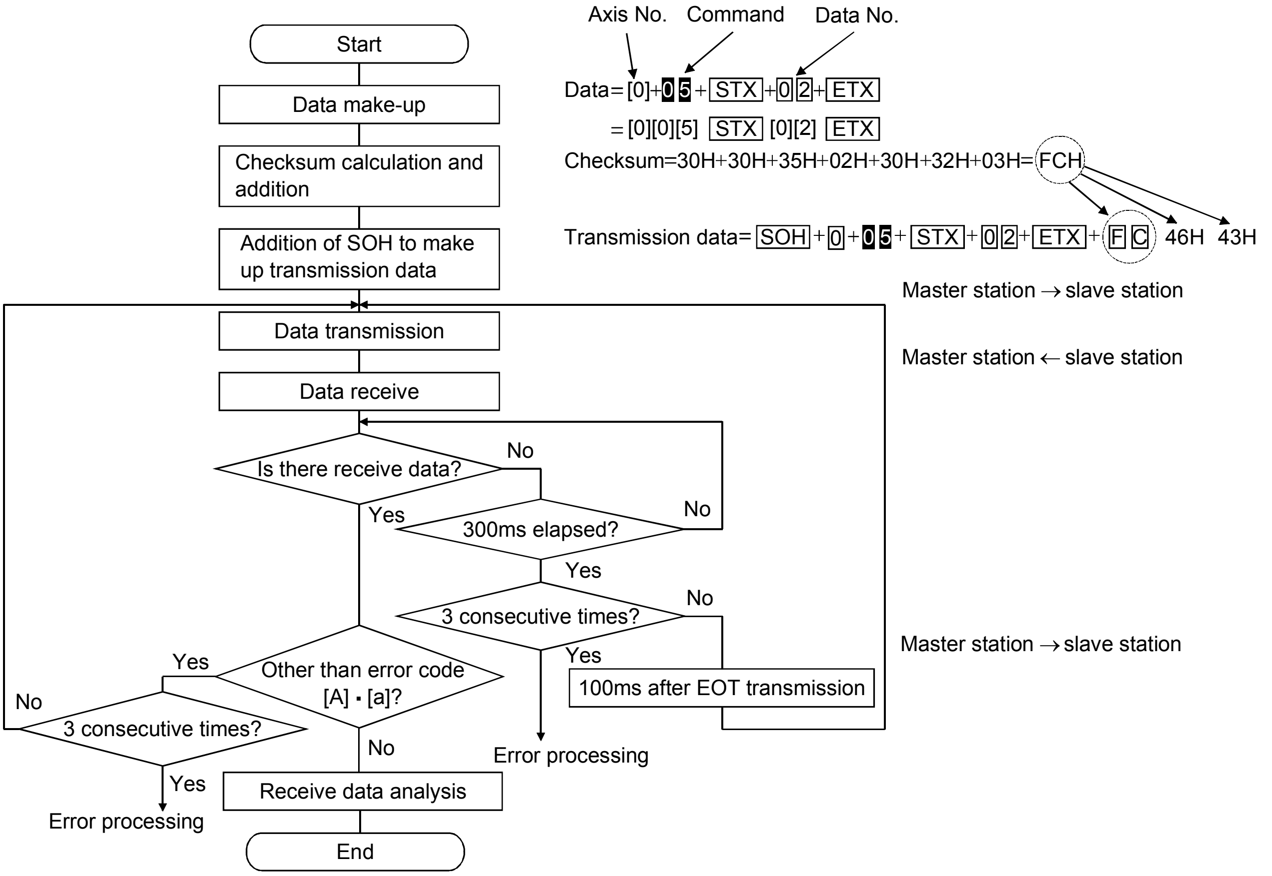
(1) 1s or more time has elapsed after the slave station is switched on; and

(2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

15.10 Communication procedure example

The following example reads the set value of parameter No.2 "function selection 1" from the servo amplifier of station 0.

Data item	Value	Description
Station number	0	Servo amplifier station 0
Command	05	Read command
Data No.	02	Parameter No.2



15.11 Command and data No. list

POINT

- If the command/data No. is the same, its data may be different from the interface and drive units and other servo amplifiers.

15.11.1 Read commands

(1) Status display (Command [0][1])

Command	Data No.	Description	Display item	Frame length
[0][1]	[8][0]	Status display data value and processing information	Current position	12
[0][1]	[8][1]		Command position	12
[0][1]	[8][2]		Command remaining distance	12
[0][1]	[8][3]		Point table No.	12
[0][1]	[8][4]		Cumulative feedback pulses	12
[0][1]	[8][5]		Servo motor speed	12
[0][1]	[8][6]		Droop pulses	12
[0][1]	[8][7]		Override	12
[0][1]	[8][8]		Torque limit voltage	12
[0][1]	[8][9]		Regenerative load ratio	12
[0][1]	[8][A]		Effective load ratio	12
[0][1]	[8][B]		Peak load ratio	12
[0][1]	[8][C]		Instantaneous torque	12
[0][1]	[8][D]		Within one-revolution position	12
[0][1]	[8][E]		ABS counter	12
[0][1]	[8][F]		Load inertia moment ratio	12
[0][1]	[9][0]		Bus voltage	12

(2) Parameter (Command [0][5])

Command	Data No.	Description	Frame length
[0][5]	[0][0] to [5][A]	Current value of each parameter The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8

(3) External I/O signals (Command [1][2])

Command	Data No.	Description	Frame length
[1][2]	[0][0]	Input device statuses	8
[1][2]	[4][0]	External input pin statuses	8
[1][2]	[6][0]	Statuses of input devices switched on through communication	8
[1][2]	[8][0]	Output device statuses	8
[1][2]	[C][0]	External output pin statuses	8

(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
[3][3]	[1][1]		First alarm in past	4
[3][3]	[1][2]		Second alarm in past	4
[3][3]	[1][3]		Third alarm in past	4
[3][3]	[1][4]		Fourth alarm in past	4
[3][3]	[1][5]		Fifth alarm in past	4
[3][3]	[2][0]	Alarm occurrence time in alarm history	Most recent alarm	8
[3][3]	[2][1]		First alarm in past	8
[3][3]	[2][2]		Second alarm in past	8
[3][3]	[2][3]		Third alarm in past	8
[3][3]	[2][4]		Fourth alarm in past	8
[3][3]	[2][5]		Fifth alarm in past	8

(5) Current alarm (Command [0][2] ・ [3][5])

Command	Data No.	Description	Frame length
[0][2]	[0][0]	Current alarm number	4

Command	Data No.	Description	Status display item	Frame length
[3][5]	[8][0]	Status display data value and processing information at alarm occurrence	Current position	12
[3][5]	[8][1]		Command position	12
[3][5]	[8][2]		Command remaining distance	12
[3][5]	[8][3]		Point table No.	12
[3][5]	[8][4]		Cumulative feedback pulses	12
[3][5]	[8][5]		Servo motor speed	12
[3][5]	[8][6]		Droop pulses	12
[3][5]	[8][7]		Override	12
[3][5]	[8][8]		Torque limit voltage	12
[3][5]	[8][9]		Regenerative load ratio	12
[3][5]	[8][A]		Effective load ratio	12
[3][5]	[8][B]		Peak load ratio	12
[3][5]	[8][C]		Instantaneous torque	12
[3][5]	[8][D]		Within one-revolution position	12
[3][5]	[8][E]		ABS counter	12
[3][5]	[8][F]		Load inertia moment ratio	12
[3][5]	[9][0]		Bus voltage	12

(6) Point table/position data (Command [4][0])

Command	Data No.	Description	Frame length
[4][0]	[0][1] to [1][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 [1][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 [1][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 [1][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 [1][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 [1][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) Software version (Command [0][2])

Command	Data No.	Description	Frame length
[0][2]	[7][0]	Software version	16

15.11.2 Write commands

(1) Status display (Command [8][1])

Command	Data No.	Description	Setting range	Frame length
[8][1]	[0][0]	Status display data clear	1EA5	4

(2) Parameter (Command [8][4])

Command	Data No.	Description	Setting range	Frame length
[8][4]	[0][0] to [5][A]	Each parameter write The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	Depends on the parameter.	8

(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 15.12.5	8

(4) Alarm history (Command [8][2])

Command	Data No.	Description	Setting range	Frame length
[8][2]	[2][0]	Alarm history clear	1EA5	4

(5) Current alarm (Command [8][2])

Command	Data No.	Description	Setting range	Frame length
[8][2]	[0][0]	Alarm reset	1EA5	4

(6) Point table/position data (Command [C][0])

Command	Data No.	Description	Setting range	Frame length
[C][0]	[0][1] to [1][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 [1][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 [1][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 [1][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 [1][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 [1][F]	Auxiliary function write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0, 1	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]	Disables all output devices (DO).	1EA5	4
[9][0]	[1][0]	Enables the disabled input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][3]	Enables the disabled output devices (DO).	1EA5	4

(13) Operation mode selection (Command [8][B])

Command	Data No.	Description	Setting range	Frame length
[8][B]	[0][0]	Operation mode changing 0000: Exit from test operation mode 0001: Jog operation 0002: Positioning operation 0003: Motor-less operation 0004: Output signal (DO) forced output	0000 to 0004	4

(14) Data for test operation mode (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 15.12.7	8
[9][2]	[A][0]	Forced output from signal pin	Refer to section 15.12.9	8

Command	Data No.	Description	Setting range	Frame length
[A][0]	[1][0]	Writes the speed of the test operation mode (jog operation, positioning operation).	0000 to 7FFF	4
[A][0]	[1][1]	Writes the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	00000000 to 7FFFFFFF	8
[A][0]	[1][2]	Clears the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	1EA5	4
[A][0]	[1][3]	Writes the moving distance (in pulses) of the test operation mode (jog operation, positioning operation).	80000000 to 7FFFFFFF	8
[A][0]	[1][5]	Temporary stop command of the test operation mode (jog operation, positioning operation)	1EA5	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

15.12 Detailed explanations of commands

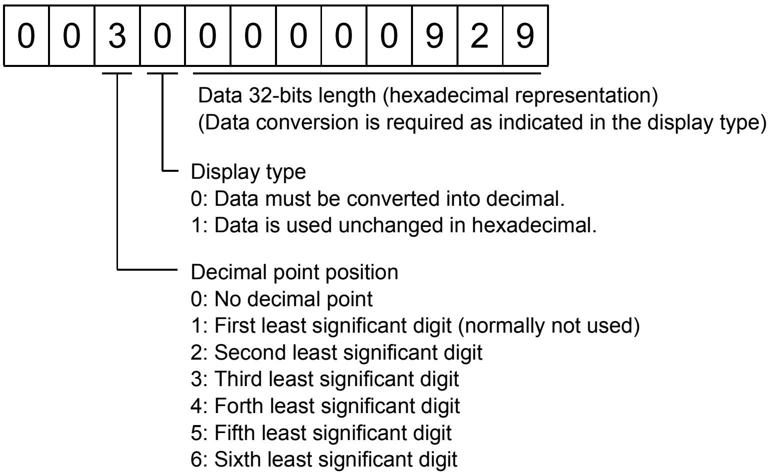
15.12.1 Data processing

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.



Data 32-bits length (hexadecimal representation)
(Data conversion is required as indicated in the display type)

Display type
0: Data must be converted into decimal.
1: Data is used unchanged in hexadecimal.

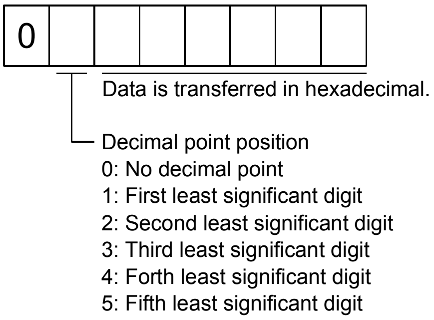
Decimal point position
0: No decimal point
1: First least significant digit (normally not used)
2: Second least significant digit
3: Third least significant digit
4: Forth least significant digit
5: Fifth least significant digit
6: Sixth least significant digit

Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
00000929H→2345
As the decimal point position is "3", a decimal point is placed in the third least significant digit.
Hence, "23.45" is displayed.

(2) Writing the processed data

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

The data to be sent is the following value.



By way of example, here is described how to process the set data when a value of "15.5" is sent. Since the decimal point position is the second digit, the decimal point position data is "2". As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

15.12.2 Status display

(1) Status display data read

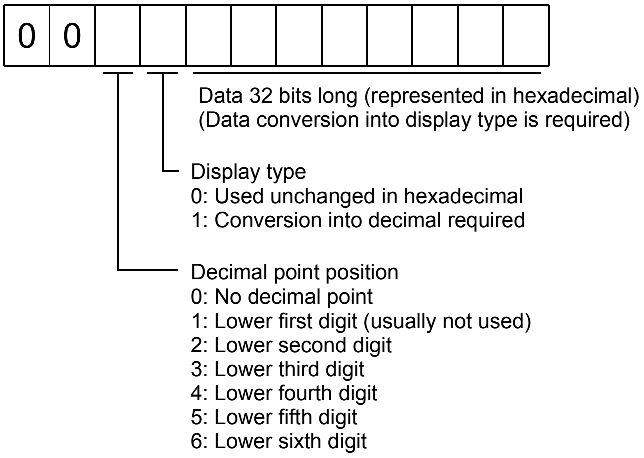
When the master station transmits the data No. to the slave station, the slave station sends back the data value and data processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. Refer to section 15.11.1.

(b) Reply

The slave station sends back the status display data requested.



(2) 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]	1EA5

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

15.12.3 Parameter

(1) Parameter read

Read the parameter setting.

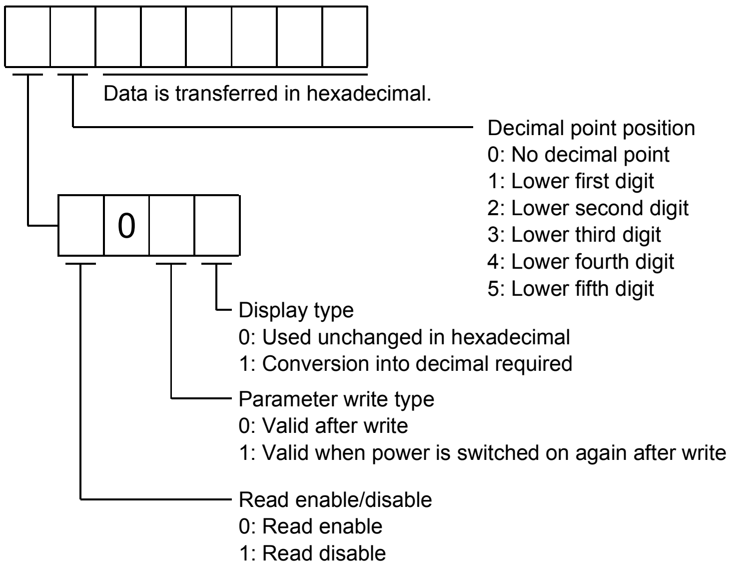
(a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No.

Command	Data No.	Data No. definition
[0][5]	[0][0] to [5][A]	Corresponds to the parameter No.

(b) Reply

The slave station sends back the data and processing information of the requested parameter No.



Enable/disable information changes according to the setting of parameter No.19 "parameter write inhibit". When the enable/disable setting is read disable, ignore the parameter data part and process it as unreadable.

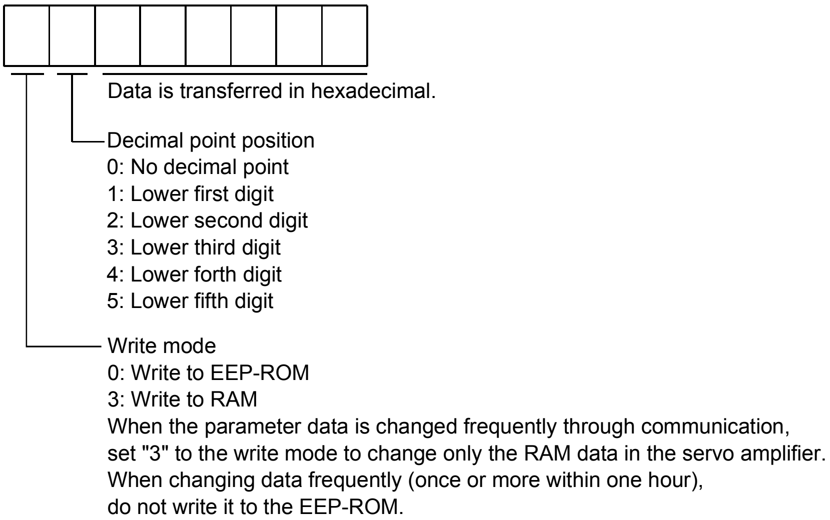
(2) Parameter write

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.
Write the value within the setting range. Refer to section 5.1 for the setting range.
Transmit command [8][4], the data No., and the set data.
The data number is represented in hexadecimal. The decimal value converted from the data number value corresponds to the parameter number. Refer to (1) (a) of this section.
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 given in section 5.1.2. 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][0] to [5][A]	See below.



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.

15.12.4 External I/O signal statuses

(1) Reading of input device statuses

Read the statuses of the input devices.

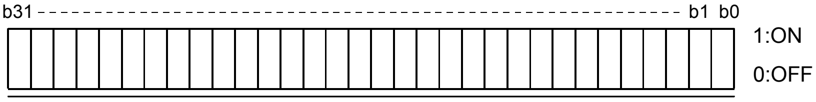
(a) Transmission

Transmit command [1][2] and data No. [0][0].

Command	Data No.
[1][2]	[0][0]

(b) Reply

The slave station sends back the statuses of the input pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Signal name
0	Servo-on (SON)
1	Forward rotation stroke limit (LSP)
2	Reverse rotation stroke limit (LSN)
3	External torque limit selection (TL)
4	Internal torque limit selection (TL2)
5	Proportion control selection (PC)
6	Reset (RES)
7	
8	
9	
10	
11	Forward rotation start (ST1)

bit	Signal name
12	Reverse rotation start (ST2)
13	
14	
15	
16	Forced stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table No. selection 1 (DI0)
20	Point table No. selection 2 (DI1)
21	Point table No. selection 3 (DI2)
22	Point table No. selection 4 (DI3)
23	Override selection (OVR)

bit	Signal name
24	Temporary stop/restart (STP)
25	Manual pulse generator multiplication 1 (TP0)
26	Manual pulse generator multiplication 2 (TP1)
27	Gain switch (CDP)
28	
29	Point table No. selection 5 (DI4)
30	Teach (TCH)
31	

(2) External input pin status read

Read the ON/OFF statuses of the external output pins.

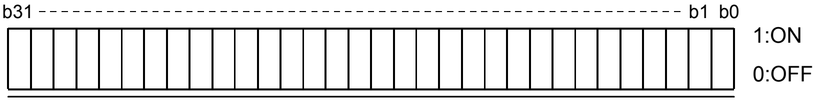
(a) Transmission

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.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	External input pin
0	CN1B-16
1	CN1B-17
2	CN1B-15
3	CN1B-5
4	CN1B-14

bit	External input pin
5	CN1A-8
6	CN1B-7
7	CN1B-8
8	CN1B-9
9	CN1A-19

(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.

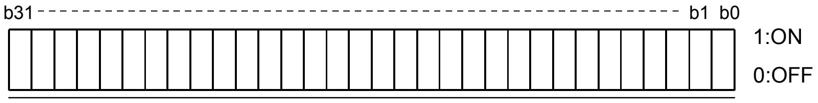
(a) Transmission

Transmit command [1][2] and data No. [6][0].

Command	Data No.
[1][2]	[6][0]

(b) Reply

The slave station sends back the statuses of the input pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Signal name
0	Servo-on (SON)
1	Forward rotation stroke limit (LSP)
2	Reverse rotation stroke limit (LSN)
3	External torque limit selection (TL)
4	Internal torque limit selection (TL2)
5	Proportion control selection (PC)
6	Reset (RES)
7	
8	
9	
10	
11	Forward rotation start (ST1)
12	Reverse rotation start (ST2)
13	
14	
15	
16	Forced stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table No. selection 1 (DI0)
20	Point table No. selection 2 (DI1)
21	Point table No. selection 3 (DI2)
22	Point table No. selection 4 (DI3)
23	Override selection (OVR)
24	Temporary stop/restart (STP)
25	Manual pulse generator multiplication 1 (TP0)
26	Manual pulse generator multiplication 2 (TP1)
27	Gain switch (CDP)
28	
29	Point table No. selection 5 (DI4)
30	Teach (TCH)
31	

(4) External output pin status read

Read the ON/OFF statuses of the external output pins.

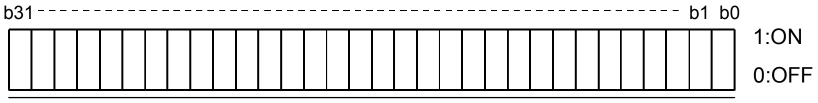
(a) Transmission

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.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	External output pin
0	CN1A-19
1	CN1A-18
2	CN1B-19
3	CN1B-6
4	CN1B-4
5	CN1B-18
6	CN1A-14

(5) Read of the statuses of output devices

Read the ON/OFF statuses of the output devices.

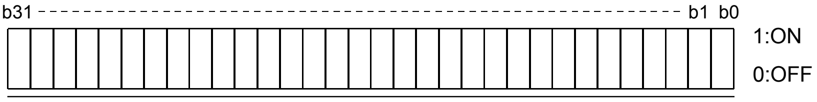
(a) Transmission

Transmit command [1][2] and data No. [8][0].

Command	Data No.
[1][2]	[8][0]

(b) Reply

The slave station sends back the statuses of the output devices.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Signal name
0	Ready (RD)
1	
2	
3	Limiting torque (TLC)
4	
5	In position (INP)
6	
7	Warning (WNG)
8	Trouble (ALM)
9	

bit	Signal name
10	Electromagnetic brake (MBR)
11	Dynamic brake interlock (DBR)
12	
13	
14	
15	Battery warning (BWNG)
16	Rough match (CPO)
17	Home position return completion (ZP)
18	Position range (POT)

bit	Signal name
19	Temporary stop (PUS)
20	Point No. output 1 (PT0)
21	Point No. output 2 (PT1)
22	Point No. output 3 (PT 2)
23	Point No. output 4 (PT 3)
24	Point No. output 5 (PT 4)

15.12.5 Input devices ON/OFF

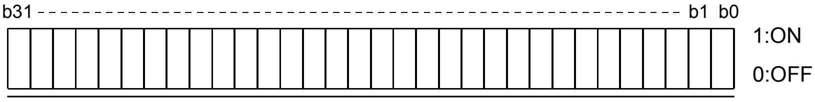
POINT

- 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. [6][0] and data.

Command	Data No.	Set data
[9][2]	[6][0]	See below.



Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Signal name
0	Servo-on (SON)
1	Forward rotation stroke limit (LSP)
2	Reverse rotation stroke limit (LSN)
3	External torque limit selection (TL)
4	Internal torque limit selection (TL2)
5	Proportion control selection (PC)
6	Reset (RES)
7	
8	
9	
10	
11	Forward rotation start (ST1)

bit	Signal name
12	Reverse rotation start (ST2)
13	
14	
15	
16	Forced stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table No. selection 1 (DI0)
20	Point table No. selection 2 (DI1)
21	Point table No. selection 3 (DI2)
22	Point table No. selection 4 (DI3)
23	Override selection (OVR)

bit	Signal name
24	Temporary stop/restart (STP)
25	Manual pulse generator multiplication 1 (TP0)
26	Manual pulse generator multiplication 2 (TP1)
27	Gain switch (CDP)
28	
29	Point table No. selection 5 (DI4)
30	Teach (TCH)
31	

15.12.6 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
External analog input signals	0V
Pulse train inputs	None

(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

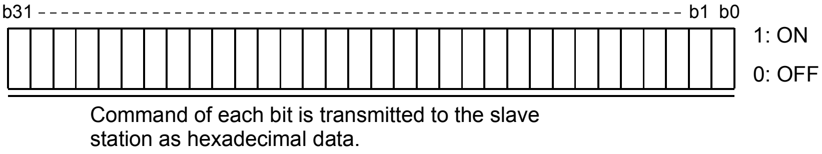
(b) Enable

Command	Data No.	Data
[9][0]	[1][3]	1EA5

15.12.7 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. [0] [0] and data.

Command	Data No.	Set data
[9][2]	[0][0]	See below



bit	Signal name
0	Servo-on (SON)
1	Forward rotation stroke limit (LSP)
2	Reverse rotation stroke limit (LSN)
3	External torque limit selection (TL)
4	Internal torque limit selection (TL2)
5	Proportion control selection (PC)
6	Reset (RES)
7	
8	
9	
10	
11	Forward rotation start (ST1)

bit	Signal name
12	Reverse rotation start (ST2)
13	
14	
15	
16	Forced stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table No. selection 1 (DI0)
20	Point table No. selection 2 (DI1)
21	Point table No. selection 3 (DI2)
22	Point table No. selection 4 (DI3)
23	Override selection (OVR)

bit	Signal name
24	Temporary stop/restart (STP)
25	Manual pulse generator multiplication 1 (TP0)
26	Manual pulse generator multiplication 2 (TP1)
27	Gain switch (CDP)
28	
29	Point table No. selection 5 (DI4)
30	Teach (TCH)
31	

15.12.8 Test operation mode

(1) Instructions for test operation mode

The test operation mode must be executed in the following procedure. If communication is interrupted for longer than 0.5s during test operation, the servo amplifier causes the motor to be decelerated to a stop and servo-locked. To prevent this, continue communication without a break, e.g. monitor the status display.

(a) Execution of test operation

1) Turn off all input devices.

2) Disable the input devices.

Command	Data No.	Data
[9][0]	[0][0]	1EA5

3) Choose the test operation mode.

Command	Data No.	Transmission data	Selection of test operation mode
[8][B]	[0][0]	0000	Test operation mode cancel
[8][B]	[0][0]	0001	Jog operation
[8][B]	[0][0]	0002	Positioning operation
[8][B]	[0][0]	0003	Motor-less operation
[8][B]	[0][0]	0004	DO forced output

4) Set the data needed for test operation.

5) Start.

6) Continue communication using the status display or other command.

(b) Termination of test operation

To terminate the test operation mode, complete the corresponding operation and.

1) Clear the test operation acceleration/deceleration time constant.

Command	Data No.	Data
[A][0]	[1][2]	1EA5

2) Cancel the test operation mode.

Command	Data No.	Data
[8][B]	[0][0]	0000

3) Enable the disabled input devices.

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Jog operation

Transmit the following communication commands.

(a) Setting of jog operation data

Item	Command	Data No.	Data
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.
Acceleration/deceleration time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.

(b) Start

Turn on the input devices SON・LSP・LSN and ST1/ST2 by using command [9][2] + data No. [0][0].

Item	Command	Data No.	Data
Forward rotation start	[9][2]	[0][0]	00000807: Turns on SON・LSP・LSN and ST1.
Reverse rotation start	[9][2]	[0][0]	00001007: Turns on SON・LSP・LSN and ST2.
Stop	[9][2]	[0][0]	00000007: Turns on SON・LSP and LSN.

(3) Positioning operation

Transmit the following communication commands.

(a) Setting of positioning operation data

Item	Command	Data No.	Data
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.
Acceleration/deceleration time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.
Moving distance	[A][0]	[1][3]	Write the moving distance [pulse] in hexadecimal.

(b) Input of servo-on・stroke end

Turn on the input devices SON・LSP and LSN by using command [9][2] + data No. [0][0].

Item	Command	Data No.	Data
Servo-on	[9][2]	[0][0]	00000001: Turns on SON.
Servo OFF Stroke end ON	[9][2]	[0][0]	00000006: Turns off SON and turns on LSP ・ LSN.
Servo-on Stroke end OFF	[9][2]	[0][0]	Turns on SON・LSP・LSN.

(c) Start of positioning operation

Transmit the speed and acceleration/deceleration time constant, turn on the servo-on (SON) and forward/reverse rotation stroke end (LSP・LSN), and then send the moving distance to start positioning operation. After that, positioning operation will start every time the moving distance is transmitted. To start opposite rotation, send the moving distance of a negative value.

When the servo-on (SON) and forward/reverse rotation stroke end (LSP・LSN) are off, the transmission of the moving distance is invalid. Therefore, positioning operation will not start if the servo-on (SON) and forward/reverse rotation stroke end (LSP・LSN) are turned on after the setting of the moving distance.

(d) Temporary stop

A temporary stop can be made during positioning operation.

Command	Data No.	Data
[A][0]	[1][5]	1EA5

Retransmit the same communication commands as at the start time to resume operation.

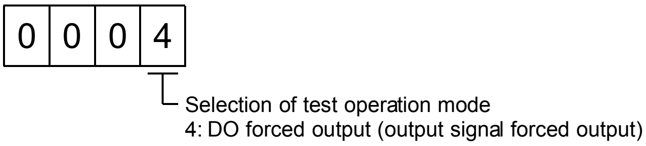
To stop positioning operation after a temporary stop, retransmit the temporary stop communication command. The remaining moving distance is then cleared.

15.12.9 Output signal pin ON/OFF output signal (DO) forced output

In the test operation mode, the output signal pins can be turned on/off independently of the servo status. Using command [9][0], disable the output signals in advance.

(1) Choosing DO forced output in test operation mode

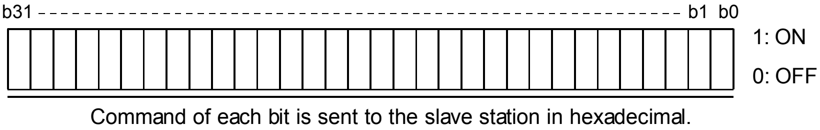
Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.



(2) External output signal ON/OFF

Transmit the following communication commands.

Command	Data No.	Setting data
[9][2]	[A][0]	See below.



bit	External output pin
0	CN1A-19
1	CN1A-18
2	CN1B-19
3	CN1B-6
4	CN1B-4
5	CN1B-18
6	CN1A-14
7	

bit	External output pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	External output pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	External output pin
24	
25	
26	
27	
28	
29	
30	
31	

15.12.10 Alarm history

(1) Alarm No. read

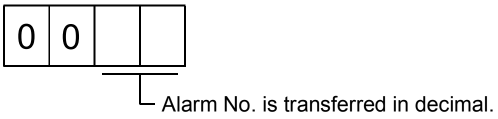
Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No.0 (last alarm) to No.5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to section 15.11.1.

(b) Reply

The alarm No. corresponding to the data No. is provided.



For example, "0032" means AL.32 and "00FF" AL._ (no alarm).

(2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

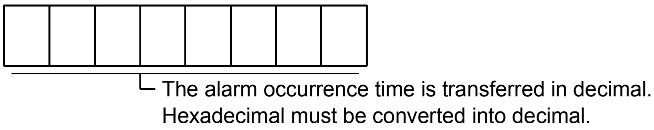
The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][5].

Refer to section 15.11.1.

(b) Reply



For example, data [0][1][F][5] indicates that the alarm occurred 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

15.12.11 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

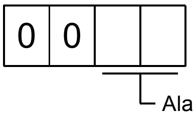
(a) Transmission

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.



Alarm No. is transferred in decimal.

For example, "0032" means AL.32 and "00FF" AL._ (no alarm).

(2) Read of the status display at alarm occurrence

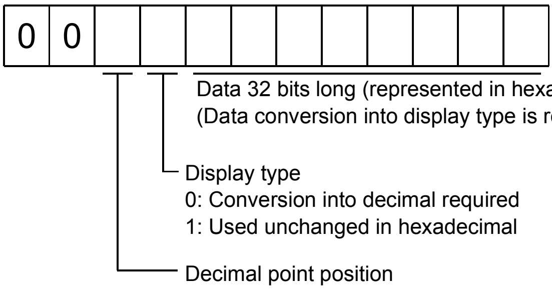
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(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 15.11.1.

(b) Reply

The slave station sends back the requested status display data at alarm occurrence.



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 entry of the Reset (RES), 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.

(a) Transmission

Command	Data No.	Data
[8][2]	[0][0]	1EA5

15.12.12 Point table

(1) Data read

(a) Position data

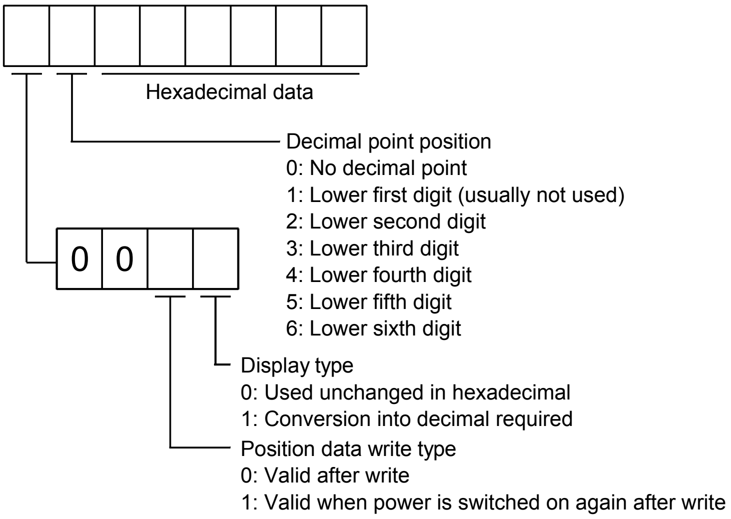
Read the position data of the point table.

1) Transmission

Transmit command [4][0] and any of data No. [0][1] to [1][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the position data of the requested point table.



(b) Speed data

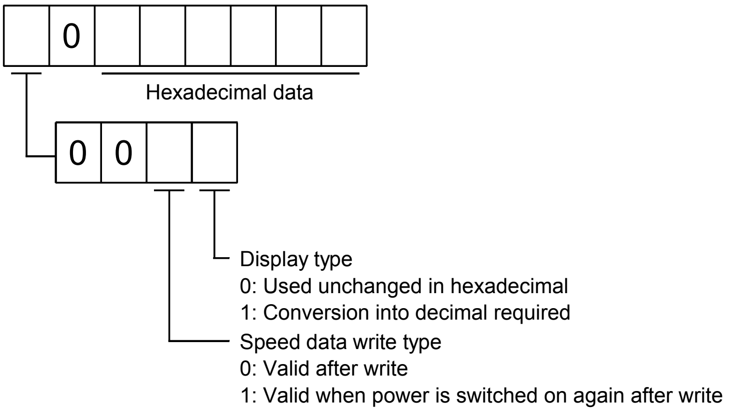
Read the speed data of the point table.

1) Transmission

Transmit command [5][0] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the speed data of the requested point table.



(c) Acceleration time constant

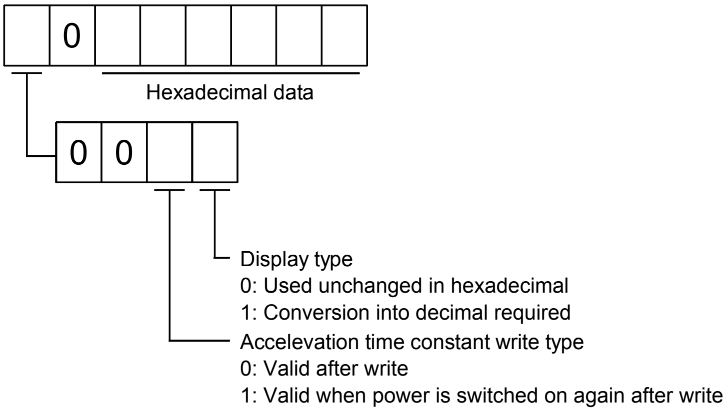
Read the acceleration time constant of the point table.

1) Transmission

Transmit command [5][4] and any of data No. [0][1] to [1][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the acceleration time constant of the requested point table.



(d) Deceleration time constant

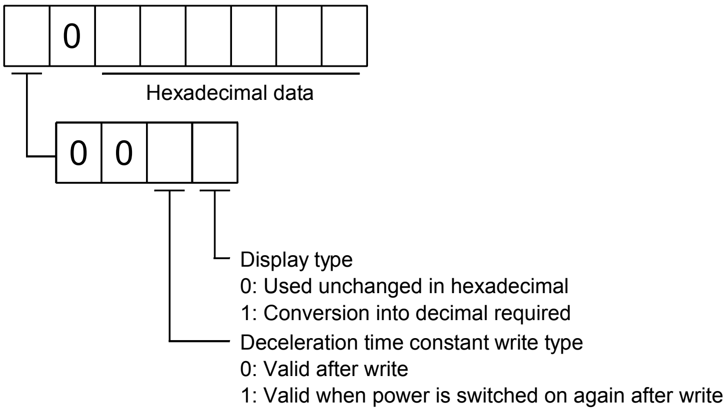
Read the deceleration time constant of the point table.

1) Transmission

Transmit command [5][8] and any of data No. [0][1] to [1][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the deceleration time constant of the requested point table.



(e) Dwell

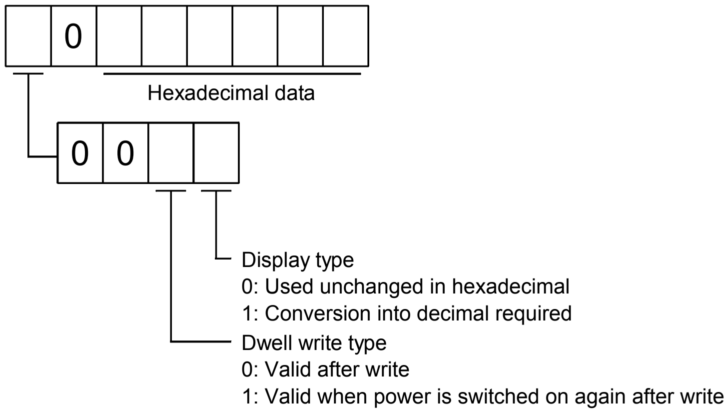
Read the dwell of the point table.

1) Transmission

Transmit command [6][0] and any of data No. [0][1] to [1][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the dwell of the requested point table.



(f) Auxiliary function

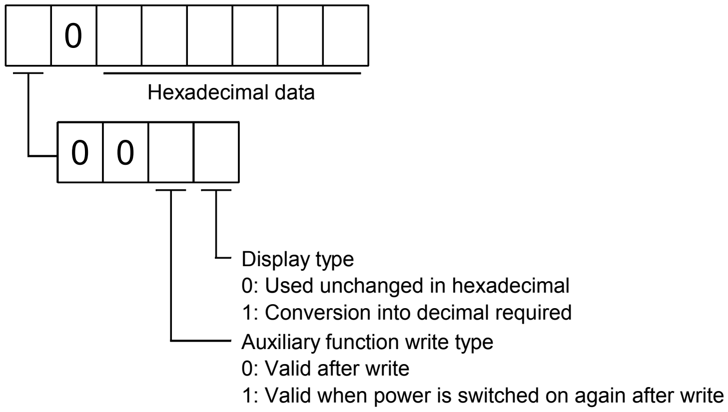
Read the auxiliary function of the point table.

1) Transmission

Transmit command [6][4] and any of data No. [0][1] to [1][F] corresponding to the point table to be read. Refer to section 15.11.1.

2) Reply

The slave station sends back the auxiliary function of the requested point table.



(2) Data write

POINT

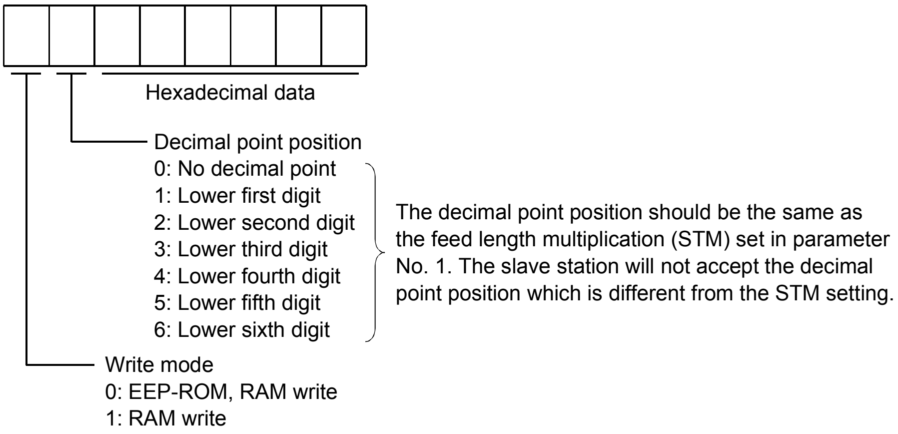
- If setting values need to be changed with a high frequency (i.e. one time or more per one hour), write the setting values to the RAM, not the EEP-ROM. The EEP-ROM has a limitation in the number of write times and exceeding this limitation causes the servo amplifier to malfunction. Note that the number of write times to the EEP-ROM is limited to approximately 100, 000.

(a) Position data

Write the position data of the point table.

Transmit command [C][0], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][0]	[0][1] to [0][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

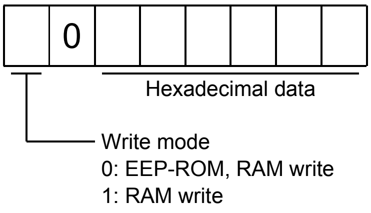
When the position data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(b) Speed data

Write the speed data of the point table.

Transmit command [C][6], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][6]	[0][1] to [0][F]	See below.



Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

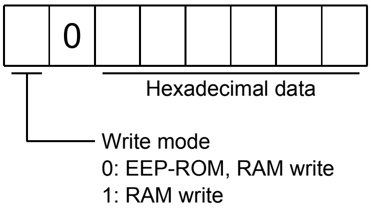
When the speed data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(c) Acceleration time constant

Write the acceleration time constant of the point table.

Transmit command [C][7], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][7]	[0][1] to [0][F]	See below.



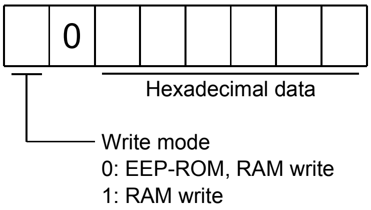
When the acceleration time constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(d) Deceleration time constant

Write the deceleration time constant of the point table.

Transmit command [C][8], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][8]	[0][1] to [0][F]	See below.



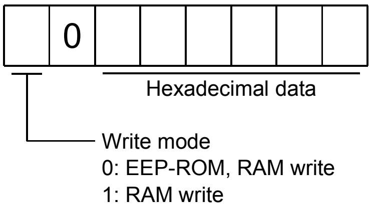
When the deceleration time is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(e) Dwell

Write the dwell of the point table.

Transmit command [C][A], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][A]	[0][1] to [0][F]	See below.



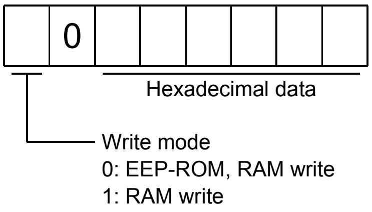
When the dwell constant is changed frequently through communication,
set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

(f) Auxiliary function

Write the auxiliary function of the point table.

Transmit command [C][B], any of data No. [0][1] to [1][F] corresponding to the point table to be written to, and the data. Refer to section 15.11.2.

Command	Data No.	Data
[C][B]	[0][1] to [0][F]	See below.



When the auxiliary function constant is changed frequently through communication,
set "1" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

15.12.13 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 through RS-422 communication.

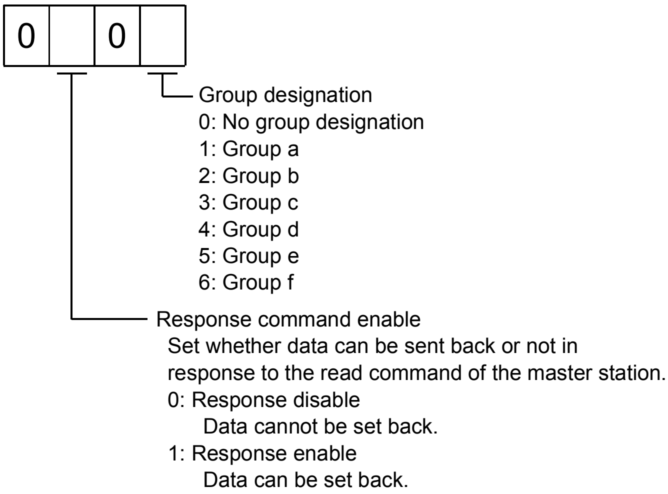
(1) Group setting write

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.



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.

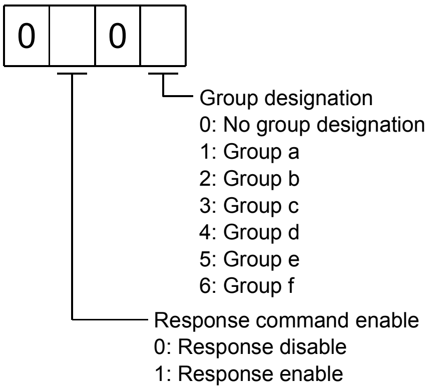
(a) Transmission

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.



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

15.12.14 Software version

Reads the software version of the servo amplifier.

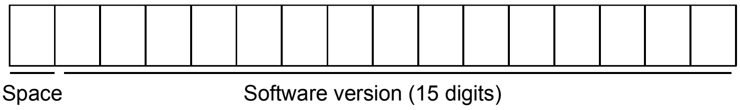
(a) Transmission

Send command [0] [2] and data No. [7] [0].

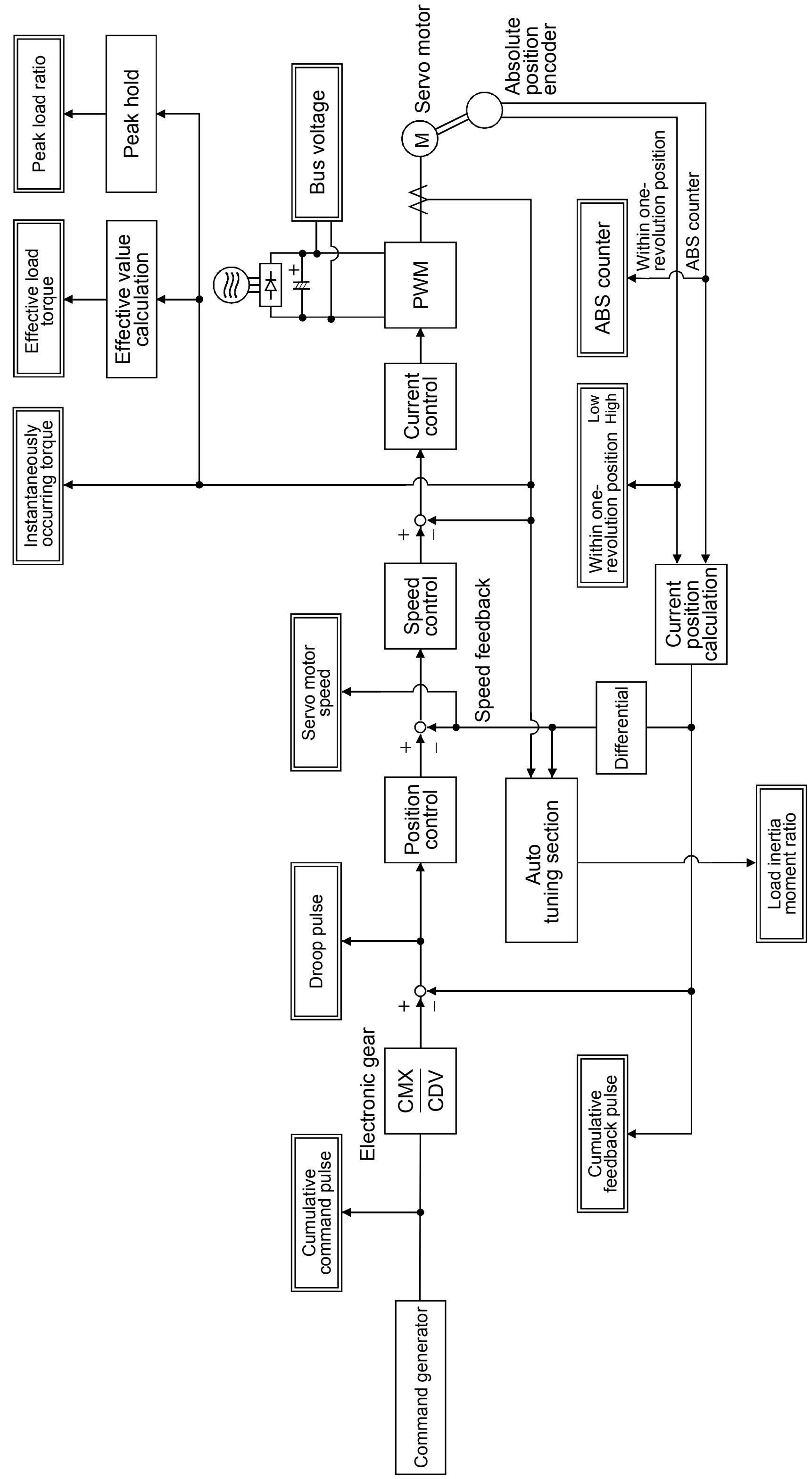
Command	Data No.
[0][2]	[7][0]

(b) Reply

The slave station returns the software version requested.

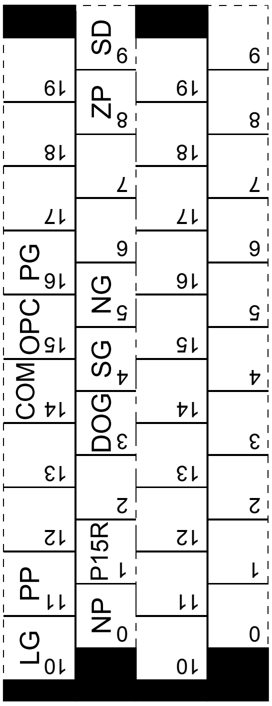


App 1. Status indication block diagram

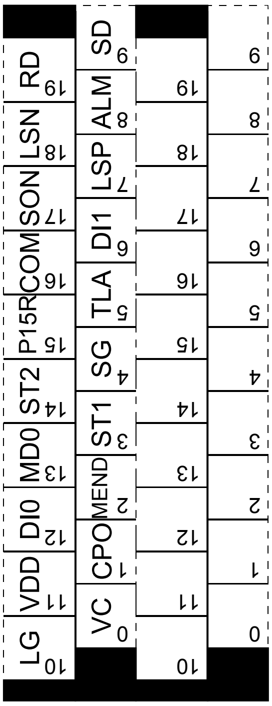


App 2. Junction terminal block (MR-TB20) terminal block labels

For CN1A



For CN1B



App 3. 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)
HC-KFS053	MR-J2S-10CP MR-J2S-10CP1
HC-KFS13	MR-J2S-10CP MR-J2S-10CP1
HC-KFS23	MR-J2S-20CP MR-J2S-20CP1
HC-KFS43	MR-J2S-40CP MR-J2S-40CP1
HC-KFS73	MR-J2S-70CP
HC-MFS053	MR-J2S-10CP MR-J2S-10CP1
HC-MFS13	MR-J2S-10CP MR-J2S-10CP1
HC-MFS23	MR-J2S-20CP MR-J2S-20CP1
HC-MFS43	MR-J2S-40CP MR-J2S-40CP1
HC-MFS73	MR-J2S-70CP
HC-SFS81	MR-J2S-100CP
HC-SFS121	MR-J2S-200CP
HC-SFS201	MR-J2S-200CP
HC-SFS301	MR-J2S-350CP
HC-SFS52	MR-J2S-60CP
HC-SFS102	MR-J2S-100CP
HC-SFS152	MR-J2S-200CP
HC-SFS202	MR-J2S-200CP
HC-SFS352	MR-J2S-350CP
HC-SFS502	MR-J2S-500CP
HC-SFS702	MR-J2S-700CP
HC-SFS53	MR-J2S-60CP
HC-SFS103	MR-J2S-100CP
HC-SFS153	MR-J2S-200CP
HC-SFS203	MR-J2S-200CP
HC-SFS353	MR-J2S-350CP

Servo motor	Servo amplifier (Software version)
HC-RFS103	MR-J2S-200CP
HC-RFS153	MR-J2S-200CP
HC-RFS203	MR-J2S-350CP
HC-RFS353	MR-J2S-500CP
HC-RFS503	MR-J2S-500CP
HC-UFS72	MR-J2S-70CP
HC-UFS152	MR-J2S-200CP
HC-UFS202	MR-J2S-350CP
HC-UFS352	MR-J2S-500CP
HC-UFS502	MR-J2S-500CP
HC-UFS13	MR-J2S-10CP MR-J2S-10CP1
HC-UFS23	MR-J2S-20CP MR-J2S-20CP1
HC-UFS43	MR-J2S-40CP MR-J2S-40CP1
HC-UFS73	MR-J2S-70CP
HC-LFS52	MR-J2S-60CP (Version A2 or later)
HC-LFS102	MR-J2S-100CP (Version A2 or later)
HC-LFS152	MR-J2S-200CP (Version A2 or later)
HC-LFS202	MR-J2S-350CP (Version A2 or later)
HC-LFS302	MR-J2S-500CP (Version A2 or later)
HA-LFS502	MR-J2S-500CP
HA-LFS702	MR-J2S-700CP

App 4. Change of connector sets to the RoHS compatible products

Connector sets (options) in the following table are changed to the RoHS compatible products after September, 2006 shipment.
Please accept that the current products might be mixed with RoHS compatible products based on availability.

Model	Current Product	RoHS Compatible Product
MR-J2CNM MR-J2CN1	Amplifier connector (3M or equivalent) 10120-3000VE (connector)	Amplifier connector (3M or equivalent) 10120-3000PE (connector)
MR-J2CNS	Amplifier connector (3M or equivalent) 10120-3000VE (connector) Encoder connector (DDK) MS3057-12A (Cable clump) MS3106B20-29S (Straight plug)	Amplifier connector (3M or equivalent) 10120-3000PE (connector) Encoder connector (DDK) D/MS3057-12A (Cable clump) D/MS3106B20-29S (Straight plug)
MR-ENCNS	Amplifier connector (3M or equivalent) 10120-3000VE (connector) MS3106A20-29S (D190) (Plug, DDK) CE3057-12A-3 (D265) (Cable clump, DDK) CE02-20BS-S (Back shell, DDK)	Amplifier connector (3M or equivalent) 10120-3000PE (connector) D/MS3106A20-29S (D190) (Plug, DDK) CE3057-12A-3-D (Cable clump, DDK) CE02-20BS-S-D (Back shell, DDK)
MR-PWCNS1	Power supply connector (DDK) CE05-6A22-23SD-B-BSS (Connector and back shell) CE3057-12A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A22-23SD-D-BSS (Connector and back shell) CE3057-12A-2-D (Cable clump)
MR-PWCNS2	Power supply connector (DDK) CE05-6A24-24SD-B-BSS (Connector and back shell) CE3057-16A-2 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A24-10SD-B-BSS (Connector and back shell) CE3057-16A-2-D (Cable clump)
MR-PWCNS3	Power supply connector (DDK) CE05-6A32-17SD-B-BSS (Connector and back shell) CE3057-20A-1 (D265) (Cable clump)	Power supply connector (DDK) CE05-6A32-17SD-D-BSS (Connector and back shell) CE3057-20A-1-D (Cable clump)
MR-BKCN	Electromagnetic brake connector MS3106A10SL-4S (D190) (Plug, DDK)	Electromagnetic brake connector D/MS3106A10SL-4S (D190) (Plug, DDK)

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision
Jan., 2002	SH(NA)030017-A	First edition
Oct., 2002	SH(NA)030017-B	Addition of Note to the environment conditions in Safety Instructions 4 (1) Addition of "About processing of waste" Addition of "EEP-ROM life" COMPLIANCE WITH EC DIRECTIVES 1. (1): Sentence change (1): HA-LFS□, HC-LFS□ addition (6) (a): Deletion (7) (c): Sentence change CONFORMANCE WITH UL/C-UL STANDARD (1): HA-LFS□, HC-LFS□ addition (7): Addition Section 1.5: HA-LFS□, HC-LFS□ addition Section 2.4 (2): Sentence change Section 3.3.2 (1) (c): Sentence change to "Position range (POT)" Section 3.5: Addition of Note into Figure Section 3.8.1: POINT addition Section 3.8.3 (1) Lead wire color deletion Section 4.1.1 (1) (b): Sentence change Section 4.2.6 (2) (a) 1): Figure change 2): Figure change (b): Figure change (c) 1): Figure change 2): Figure change (3): Figure change Section 5.2.1 (2): Addition of sentence to parameters No. 50, 51 Change of No. 55 setting Section 6.2 (1): Change to display contents Section 7.1: Change to initial screen of point table Section 7.2.2: POINT addition Section 7.5.1: Figure change Section 7.5.3 (1): Figure change, Note addition (2): Figure change, Note addition Section 7.6.2 (2): Signed 5-digit parameter addition Section 8.2.2: POINT addition Section 11.2.1: Addition of Note to AL.30 Addition of AL.61 home operation alarm Section 11.2.2: Deletion of Cause 4 from AL.16 Addition of Causes 3 - 6 to AL.37 Addition of AL.61 home operation alarm Section 13.1: Note addition Section 13.2: Change of "zero torque" representation to "servo off" Section 14.1.1 (1): Note described for MR-RB50, MR-RB51 (4): Note addition, cooling fan mounting diagram addition Section 14.1.4 (2) (a): POINT addition Fabricating connection diagram change Section 14.2.6 (2) (b): Figure change Section 14.2.8: Sentence addition Section 14.2.9: Figure change

Print data	*Manual number	Revision
Oct., 2002	SH(NA)030017-B	Section 15.10: Figure change Section 15.12.3 (2): POINT addition
Mar., 2004	SH(NA)030017-C	Safety Instructions: Overall reexamination Section 1.1.1: Partial figure reexamination Section 1.5: Note addition Section 1.7 (3): Note addition Section 1.7 (4): Note addition Section 3.1: Partial figure reexamination/Addition of Note 13 Section 3.6.1: Partial figure reexamination Section 3.8.2: Figure reexamination Section 3.8.3: Overall reexamination Section 3.9: Figure reexamination of CAUTION Section 4.1.2: Partial addition of CAUTION sentence Section 4.1.2 (f): Partial table change Section 4.2.2 (3): Partial table addition Section 4.2.3 (3): Partial table addition Section 4.2.4: Overall reexamination Section 4.3.2: Partial table deletion Section 4.4.2 (3): Partial changing of text/Partial figure addition Section 4.4.3: Partial changing of figure, table and text Section 4.4.4: Partial changing of figure, table and text Section 4.4.5: Partial changing of figure, table and text Section 4.4.6: Partial changing of figure, table and text Section 4.4.7 (2): Partial changing of table and text/Partial figure addition Section 4.4.8 (2): Partial changing of table and text/Partial figure addition Section 4.4.9 (2): Partial changing of table and text/Partial figure addition Section 4.4.11: Partial figure addition Section 5.1.2 (2): Partial addition of parameter No.0/change Setting range of parameter No.35 to No.37, Partial text addition of parameter No.63 Section 5.2.3: Partial text change Chapter 6: Title reexamination Section 6.2 (1): Table change Section 6.7.2: Partial addition of POINT sentence Section 6.7.5: POINT addition Section 6.4 (2): Change Section 11.2: Partial text change Section 11.2.2: Changing of alarm 12 to 15/addition of alarm 37 cause 7/Partial text change of alarm 51・52 Section 12.1: Overall reexamination Section 13.2: Table reexamination Section 13.3: Partial addition of text Section 13.5: Addition Section 14.1.1 (3): Partial figure change Section 14.1.1 (4): Partial text change Section 14.1.1 (5): Partial reexamination Section 14.1.2: Partial addition of text Section 14.1.2 (2): Changing of Note 2 Section 14.1.3: Partial addition of text Section 14.1.3 (2): Partial figure reexamination/Addition of Note 2 Section 14.1.7: Partial addition of text

Print data	*Manual number	Revision
Mar., 2004	SH(NA)030017-C	Section 14.1.9: POINT addition Section 14.2.8 (3): Partial figure reexamination Section 14.2.6 (2) (d): Partial figure change Section 14.2.6 (2) (e): Partial figure change Section 14.2.8: Partial figure change Appendix: Addition
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