MITSUBISHI ELECTRIC

General-Purpose AC Servo

MELSERVO-J2-Jr Series

Built-in Positioning Function

MODEL

MR-J2-03C5

SERVO AMPLIFIER
INSTRUCTION MANUAL

B

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ WARNING

- Before wiring or inspection, switch power off and wait for more than 15 minutes. Then, confirm the voltage is safe with voltage tester. Otherwise, you may get an electric shock.
- Connect the servo amplifier and servo motor to ground.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.

2. To prevent fire, note the following:

⚠ CAUTION

- Do not install the servo amplifier, servo motor and regenerative brake resistor on or near combustibles. Otherwise a fire may cause.
- When the servo amplifier has become faulty, switch off the main servo amplifier power side. Continuous flow of a large current may cause a fire.

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.
- During power-on or for some time after power-off, do not touch or close a parts (cable etc.) to the servo motor. Their temperatures may be high and you may get burnt or a parts may damaged.

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 motor by the cables, shaft or encoder.
- Do not hold the front cover to transport the controller. The controller 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 controller 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	Operation	[℃]	0 to +55 (non-freezing)	0 to +40 (non-freezing)	
		[℉]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
	Storage	[℃]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)	
		[℉]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)	
Ambient humidity	Operation		90%RH or less (non-condensing)	80%RH or less (non-condensing)	
	Storage		90%RH or less (non-condensing)		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt		
Altitude			Max. 1000m (3280 ft) above sea level		
Vibration	[m/s^2]		5.9 or less	HC-AQ Series	X ▪ Y: 19.6
	[ft/s^2]		19.4 or less	HC-AQ Series	X ▪ Y: 64

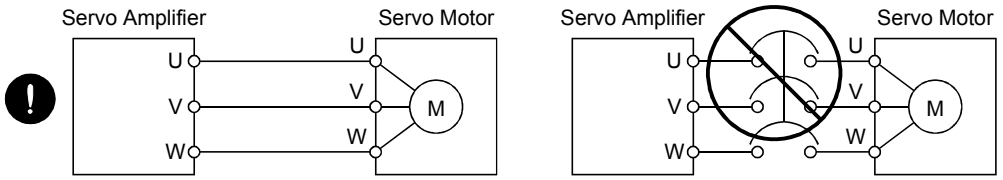
⚠ CAUTION

- 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.
- For safety of personnel, always cover rotating and moving parts.
- 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.

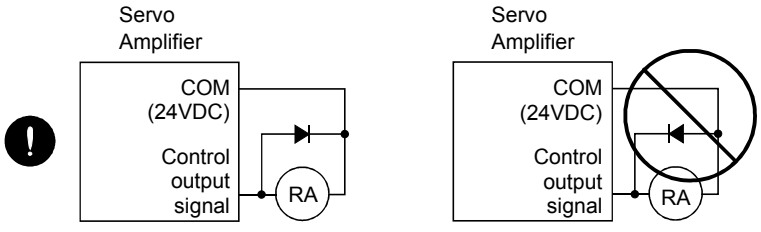
(2) Wiring

⚠ 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 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 must be wired in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



(3) Test run adjustment

⚠ CAUTION

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

(4) Usage

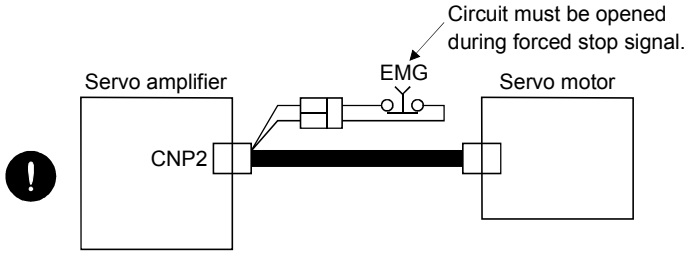
⚠ CAUTION

- Provide a forced 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 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 a forced stop signal.



⚠ CAUTION
・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 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.

(7) Disposal

⚠ CAUTION
・Dispose of the product as general industrial waste.

(8) General instruction

・To illustrate details, the equipment in the diagrams of this 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 Instruction Manual.

● About processing of waste ●

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

⚠ FOR MAXIMUM SAFETY

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

⚠ EEP-ROM life

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

- Write to the EEP-ROM due to parameter setting changes
- 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. For specific EMC directive conforming methods, refer to the EMC Installation Guidelines (IB (NA) 67310).

This servo has been confirmed to be compliant with the EMC Directives in the compliance method given in the EMC Installation Guidelines.

(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.

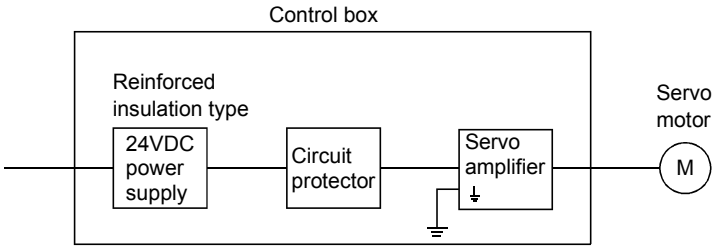
(3) Machine directive

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

2. PRECAUTIONS FOR COMPLIANCE

The standard models of the servo amplifier and servo motor comply with the EN standard.
In addition to the precautions for compliance with the EN standard provided in this manual, strictly follow the items given below. Where there is no specific explanation of EN standard compliance, the specifications are the same as those of the standard models.

(1) Configuration



(2) Environment

Operate the servo amplifier at or above the contamination level 2 set forth in IEC664. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(3) Power supply

Use a 24VDC power supply which has been insulation-reinforced in I/O.

(4) Grounding

To prevent an electric shock, always connect the protective earth terminal (E) to the servo amplifier and always connect it to the earth (E) of the control box.

(5) Auxiliary equipment and options

(a) The circuit protector 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) [℃ (℉)]
- Sheath: PVC (polyvinyl chloride)
- Installed on wall surface or open table tray

(6) 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

The standard models of the servo amplifier and servo motor comply with the UL/C-UL Standard.
Unless otherwise specified, the handling, performance, specifications, etc. of the UL/C-UL Standard-compliant models are the same as those of the standard models.
When using 24VDC power supply, options and auxiliary equipment, use those which conform to the UL/C-UL Standard.

<<About the manuals>>

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use the General-Purpose AC servo MR-J2-03C5 for the first time. Always purchase them and use the MR-J2-03C5 safely.
Also read the manual of the servo system controller.
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.

Relevant manuals

Manual name	Manual No.
MELSERVO-J2-Jr Series To Use the AC Servo Safely (Packed with the servo amplifier)	IB(NA)67426
MELSERVO Servo Motor Instruction Manual	SH(NA)3181
EMC Installation Guidelines	IB(NA)67310

CONTENTS

MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The MELSERVO-J2-Jr series general-purpose AC servo has been developed as an ultracompact, small capacity servo system compatible with the MELSERVO-J2 series 24VDC power supply. It can be used in a wide range of fields from semiconductor equipment to small robots, etc.
As the standard models comply with the EN Standard ・UL/C-UL Standard, they can be used satisfactorily in various countries.
The MR-J2-03C5 servo amplifier can be easily installed to a control box with a DIN rail.
The power supply/electromagnetic brake and encoder of the servo motor can be wired easily with a single cable.
Using a personal computer where the Servo Configuration software has been installed, you can make parameter setting, status display, etc.
Also, you can use the RS-422 communication function to set up to 32 axes of servo amplifiers.
The compatible servo motors have achieved the smallest 28mm (1.10 in)-bore flange size in this class and are further equipped with encoders of 8192 pulses/rev (incremental) resolution.

1.1.1 System configuration

This section describes operations using the MR-J2-03C5.
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 1.1.2 and 3.3.3.) The Set-up 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]
Motor speed	0 to max. speed	[r/min]
Acceleration time constant	0 to 20000	[ms]
Deceleration time constant	0 to 20000	[ms]
Dwell time	0 to 20000	[ms]
Auxiliary function	0 ▪ 1	0: 1-point automatic operation 1: Automatic continuous operation

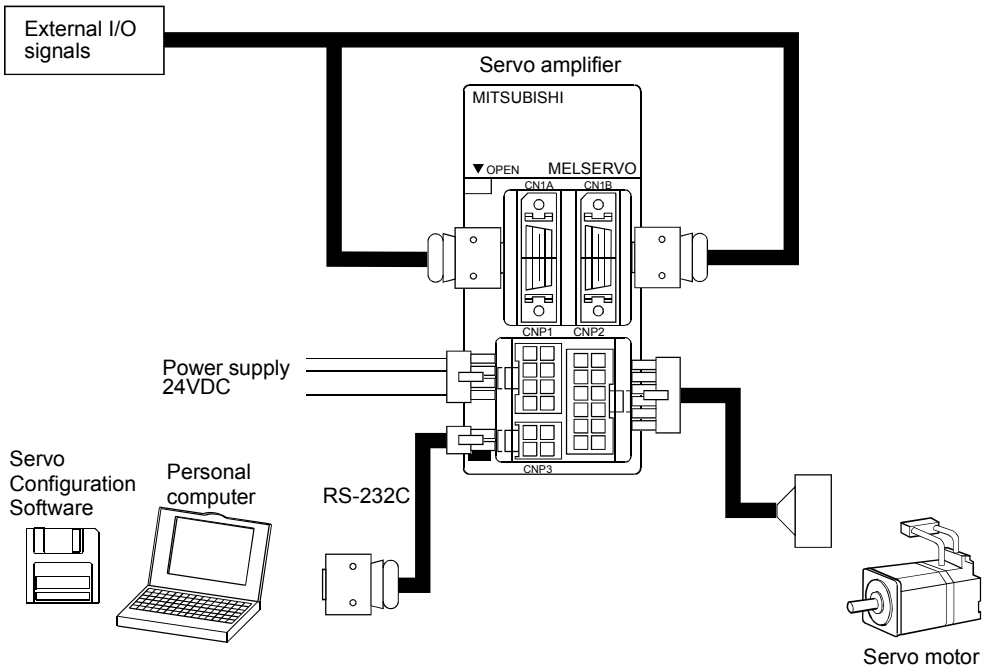
(1) Operation using external input signals

(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 the Set-up Software to set, change and monitor the parameters and point tables.



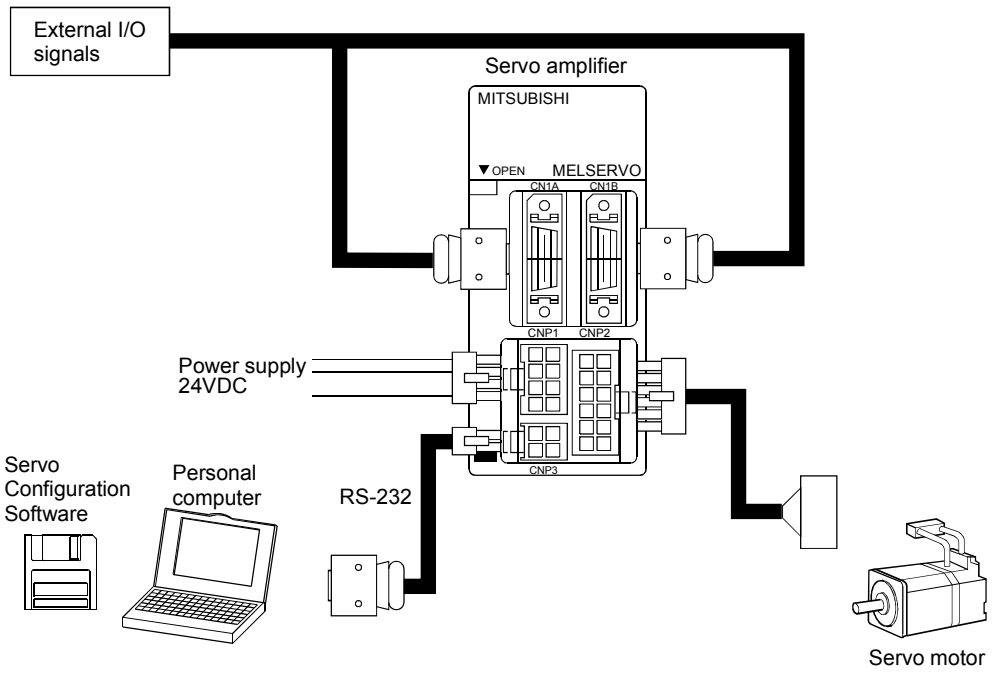
(2) Operation using external input signals and communication

(a) Description

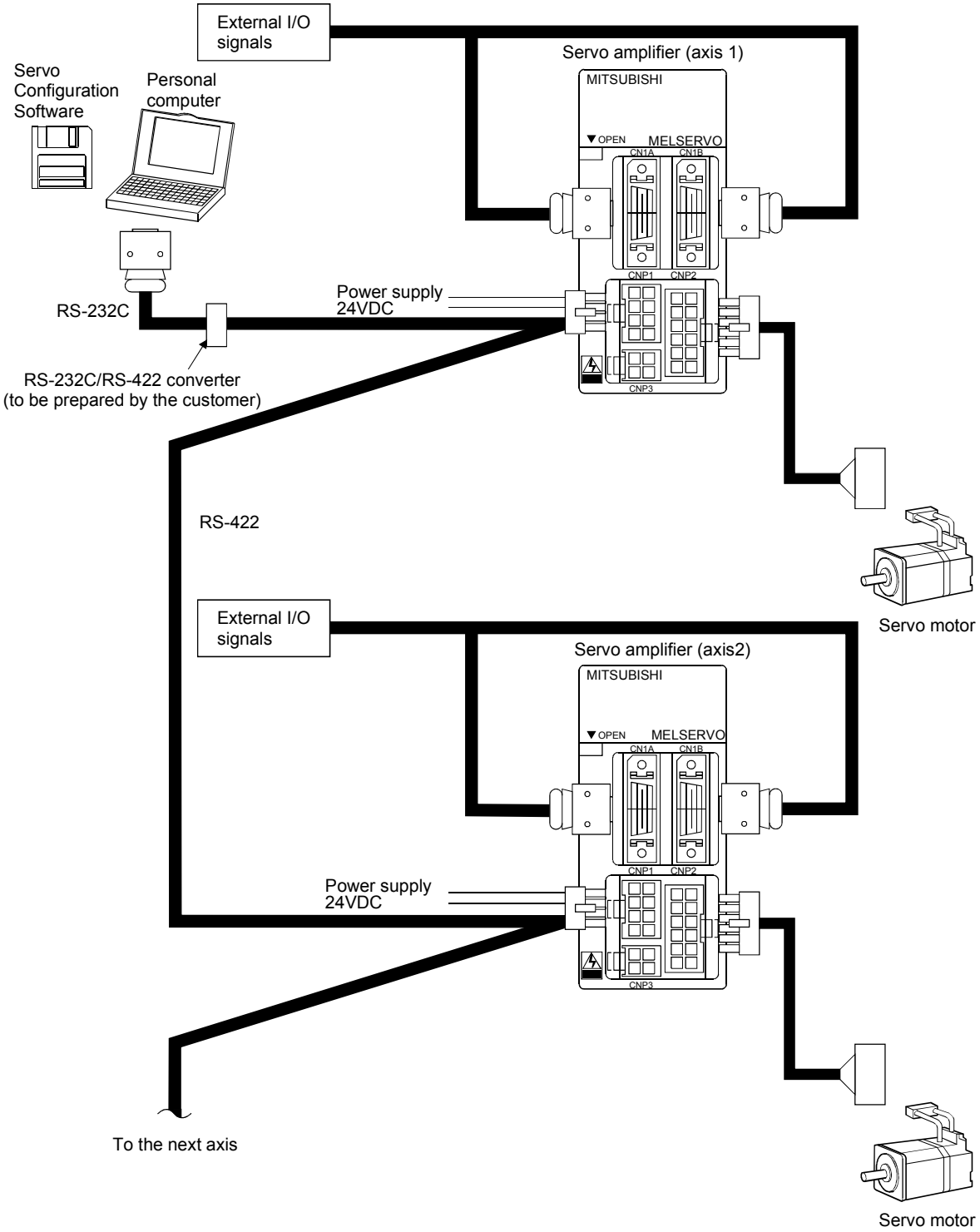
Communication can be used to change the point table data, choose the point table, change parameter values, and confirm monitor data, for example. Enter the start signal through the external I/O. Use this system when position data/speed setting or the host personal computer or the like is used to change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



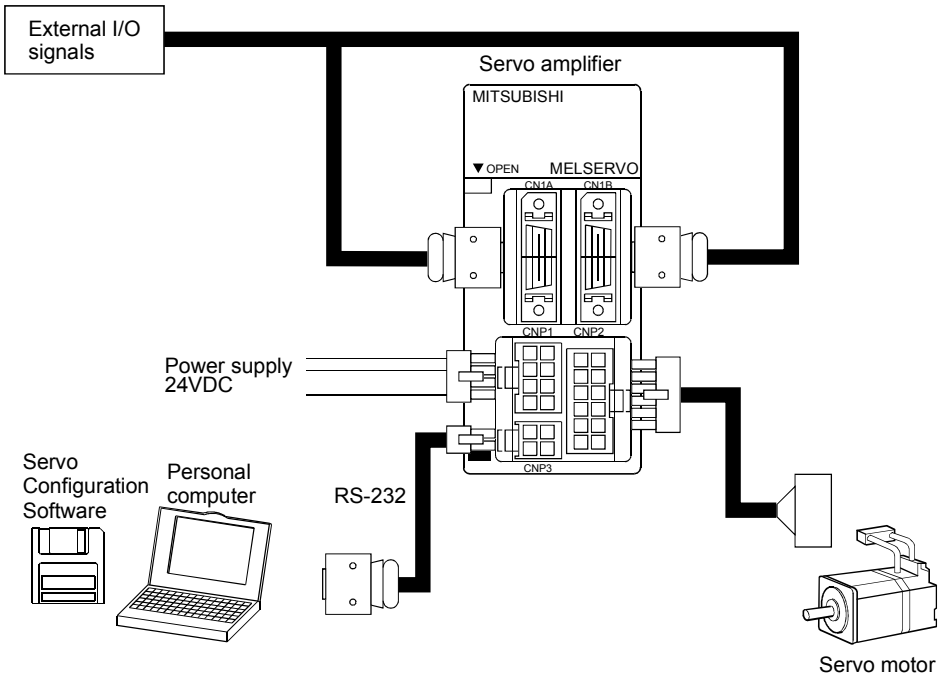
(3) Operation using communication

(a) Description

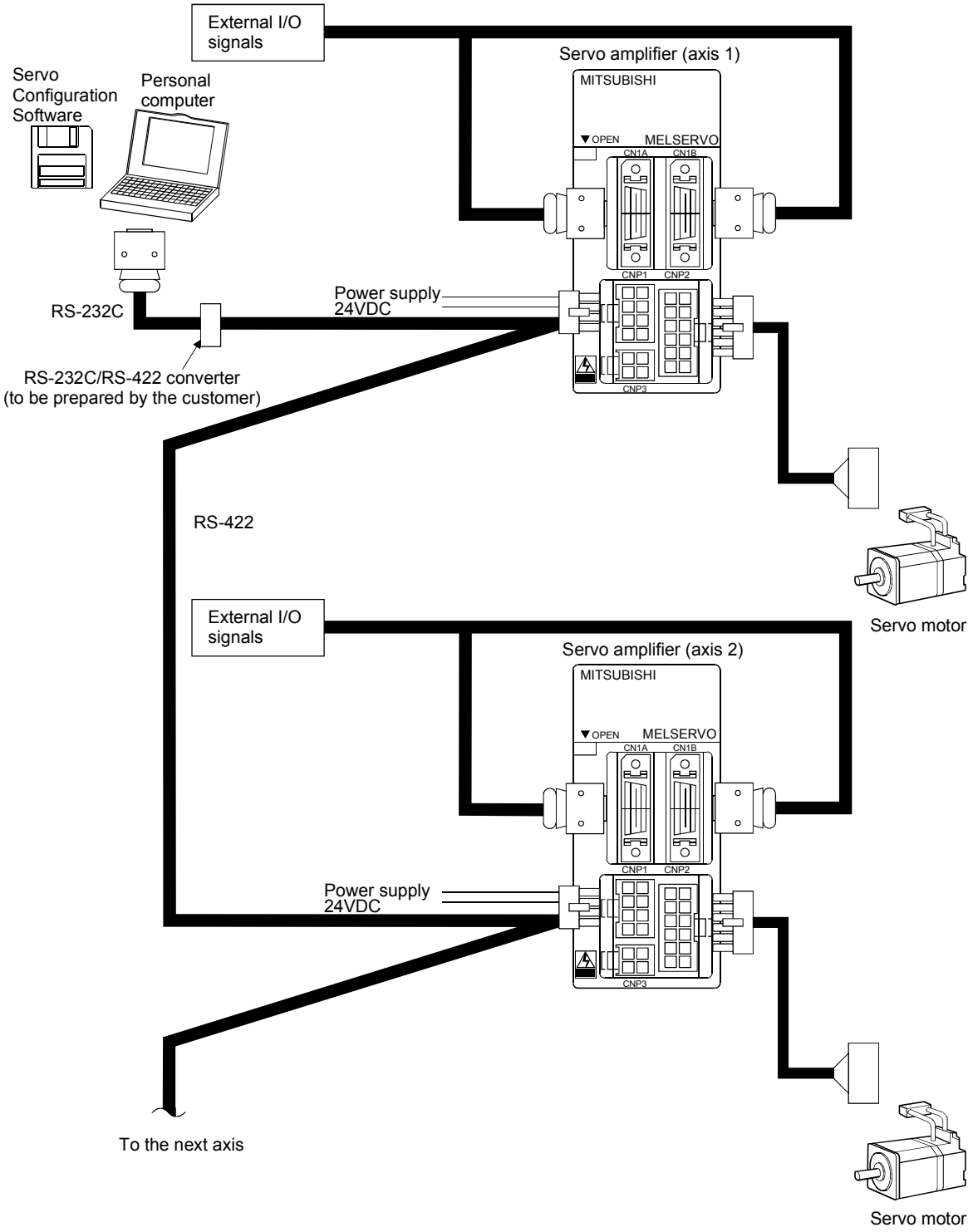
Analog input, emergency stop signal and other signals are controlled by external I/O signals and the other devices controlled through communication. Also, you can set each point table, choose the point table, and change or set parameter values, for example. Up to 32 axes may be controlled.

(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.



1.1.2 I/O devices

The MR-J2-03C5 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 3.3.3.

(1) Input devices

Device	Symbol	Description	Factory-Allocated Pin
Proximity dog	DOG	Proximity dog input device for manual home position return	CN1A-8
Servo on	SON	Operation-ready input device	CN1B-15
Forward rotation stroke end	LSP	Forward rotation stroke end input device	CN1B-16
Reverse rotation stroke end	LSN	Reserve rotation stroke end input device	CN1B-17
Forward rotation start	ST1	Forward rotation start input device	CN1B-8
Reverse rotation start	ST2	Reserve rotation start input device	CN1B-9
Automatic/manual selection	MD0	Automatic/manual mode selection input device	CN1B-7
Point table No. selection 1	DI0	Point table No. selection input device	CN1B-5
Point table No. selection 2	DI1	Point table No. selection input device	CN1B-14
Point table No. selection 3	DI2	Point table No. selection input device	
Point table No. selection 4	DI3	Point table No. selection input device	
Emergency stop	EMG	Emergency stop input device	
Alarm reset	RES	Alarm reset signal input device	
Override selection	OVR	Override selection input device	
External torque limit selection	TL0	External torque limit selection input device	
Internal torque limit selection	TL1	Internal torque limit selection input device	
Proportion control	PC	Proportion control input device	
Temporary stop/restart	STP	Temporary stop/restart input device	
Manual pulse generator multiplication	TP0 TP1	Manual pulse generator multiplication input device	

(2) Output devices

Device	Symbol	Description	Factory-Allocated Pin
Home position return completion	ZP	Home position return completion output device	CN1A-18
Rough match	CPO	Rough match signal output device	CN1B-4
In position	INP	In-position output device	CN1B-6
Trouble	ALM	Trouble output device	CN1B-18
Ready	RD	Ready output device	CN1B-19
Electromagnetic brake interlock	MBR	Electromagnetic brake interlock output device	
Position range output	POT	Position range output device	
Warning output	WNG	Warning output device	
Limiting torque	TLC	Torque limiting device	
Temporary stop	PUS	Temporary stop output device	
Dynamic brake interlock	DBR	Dynamic brake interlock output device	

1.2 Servo amplifier standard specifications

Item \ Servo amplifier				MR-J2-03C5
Circuit power supply (Note)	Voltage			21.6 to 30VDC (instantaneous permissible voltage 34V)
	Power supply capacity		HC-AQ0135D	Continuous 0.8A, max. 2.4A
			HC-AQ0235D	Continuous 1.6A, max. 4.8A
			HC-AQ0335D	Continuous 2.4A, max. 7.2A
Control circuit power supply (Note)				24VDC±10% 200mA (400mA when using the servo motor equipped with electromagnetic brake)
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 fault protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection
Speed frequency response				250Hz or more
Command system	Point table number input		Operational specifications	Positioning by specifying the point table No. (15 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, incremental value command
	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, incremental value command
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 15 speeds), automatic continuous positioning operation (2 to 15 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 (rear end detection)	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 (front end detection)	Home position return is made by counting encoder pulses after contact with proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function
			Data setting type	Home position return is made without dog. Home position may be set at any position by manual operation, etc. Home position address may be set.
			Stopper type	Home position return is made by pressing machine part against stroke end. Home position address may be set. Home position return direction may be set.
			Home position ignorance (SON position as home position)	Position where SON signal is switched on is defined as home position. Home position address may be set.

Item \ Servo amplifier				MR-J2-03B5
Other functions				Backlash function Overtravel prevention using external limit switch Software stroke limit, override using external analog signal
Structure				Open (IP00)
Environment	Ambient temperature	Operation	[°C]	0 to +55 (non-freezing)
			[°F]	32 to +131 (non-freezing)
		Storage	[°C]	−20 to +65 (non-freezing)
			[°F]	−4 to +149 (non-freezing)
	Ambient humidity	Operation		90%RH or less (non-condensing)
		Storage		
	Ambient			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
	Altitude			Max. 1000m (3280ft) above sea level
	Vibration		[m/s²]	5.9 or less
			[ft/s²]	19.4 or less
Weight			[kg]	0.2
			[lb]	0.44

Note: To comply with the low voltage directive, use a reinforced insulation stabilizing power supply.

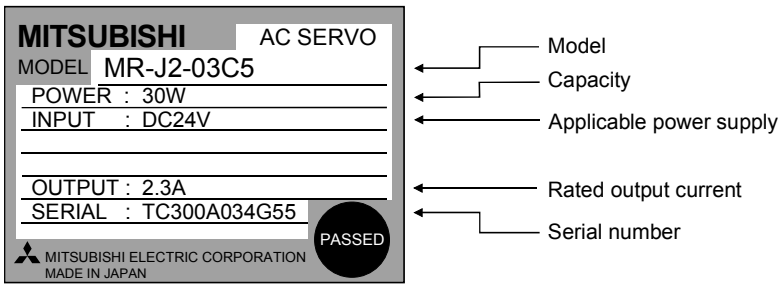
1.3 Function list

The following table lists the functions of this servo. For details of the functions, refer to the corresponding chapters and sections.

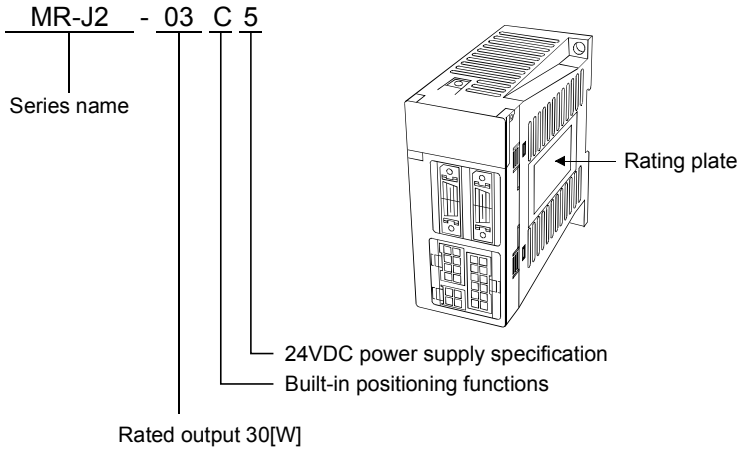
Function	Description	Refer To
Positioning by automatic operation	Select the required ones from among 15 preset point tables (moving distance, speed, acceleration time constant, deceleration time constant, auxiliary function) and perform operation in accordance with the set values. Use the external DI 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: 15 speeds)	Section 4.2.5 (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 4.2.5 (3)
Manual home position return	Dog type, count type, data setting type, stopper type, home position return ignorance	Section 4.4
Multidrop communication	Up to 32 axes of MR-J2-03C5 are controllable simultaneously by RS-422 communication.	Section 4.5.3 Chapter 8
Slight vibration suppression control	Vibration of ±1 pulse at servo motor stop is suppressed.	Section 9.5
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
Real-time auto tuning	The servo gain is automatically adjusted to the optimum value at each start/stop.	Section 9.3
Manual gain adjustment	The gain is manually adjustable if the gain could not be adjusted to the ideal value by real-time auto tuning.	Section 9.4
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Section 5.2.3
Alarm history	By using the Set-up 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 Set-up Software, any devices can be assigned to 9 input and 6 output pins.	Section 6.6
Torque limit	Servo motor-generated 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. The servo amplifier display can show up to 7 types or 15 types when the Set-up Software is used.	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) signal/reverse rotation stroke end (LSN) signal.	Section 5.2.4
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 software.	Section 5.2.7

1.4 Model code definition

(1) Rating plate



(2) Model

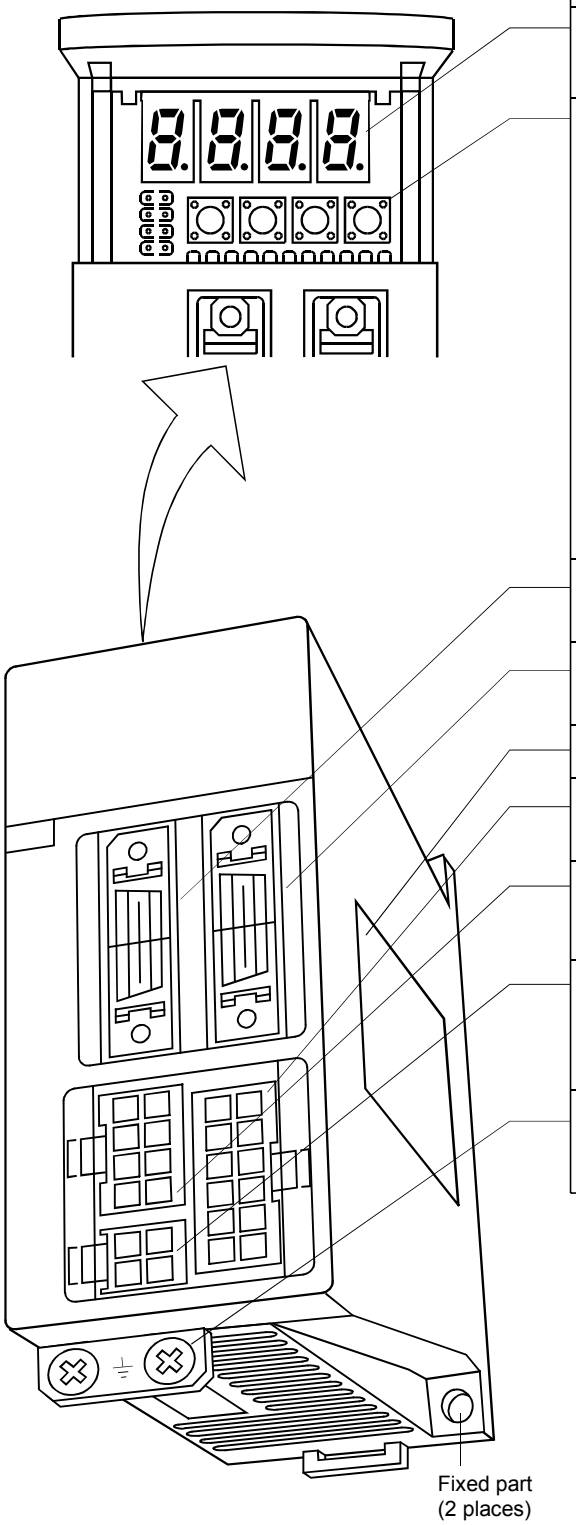


1.5 Combination with servo motor

The HC-AQ series servo motors can be used. The same combinations apply to the servo motors provided with electromagnetic brakes and reduction gears.

Servo amplifier	Servo motor
MR-J2-03C5	HC-AQ0135D
	HC-AQ0235D
	HC-AQ0335D

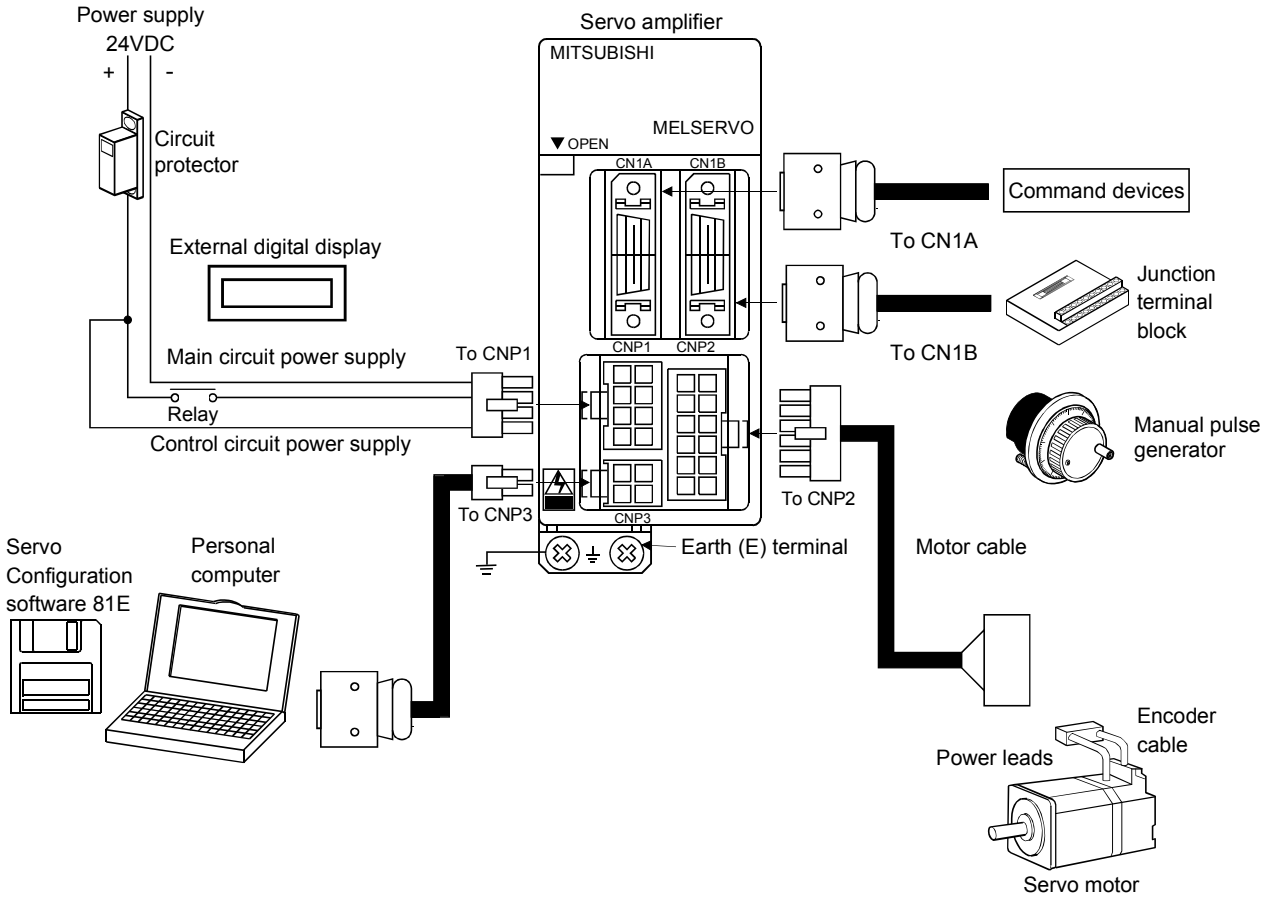
1.6 Parts identification



Name/Application	Refer To
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm and 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
Name plate	Section1.4
Servo motor connector (CNP2) Used to connect the servo motor.	Section3.3 Section12.1 Section14.1.1
Power input connector (CNP1) Used to connect the input power supply/control circuit power supply/RS-422.	Section3.3 Section3.7
Communication connector (CNP3) Used for connection with a personal computer (RS-232C).	Section3.3 Chapter 6 Chapter 8 Section14.1.1
Earth (E) terminal (⏚) To conform to the EN Standard, fit the supplied earth terminal for grounding.	Section3.9

1.7 Servo system with auxiliary equipment

⚠ WARNING	· To prevent an electric shock, fit the supplied earth terminal (E) to the servo amplifier (refer to (2), Section 3.7) and always connect it to the earth (E) of the control box.



MEMO

2. INSTALLATION

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

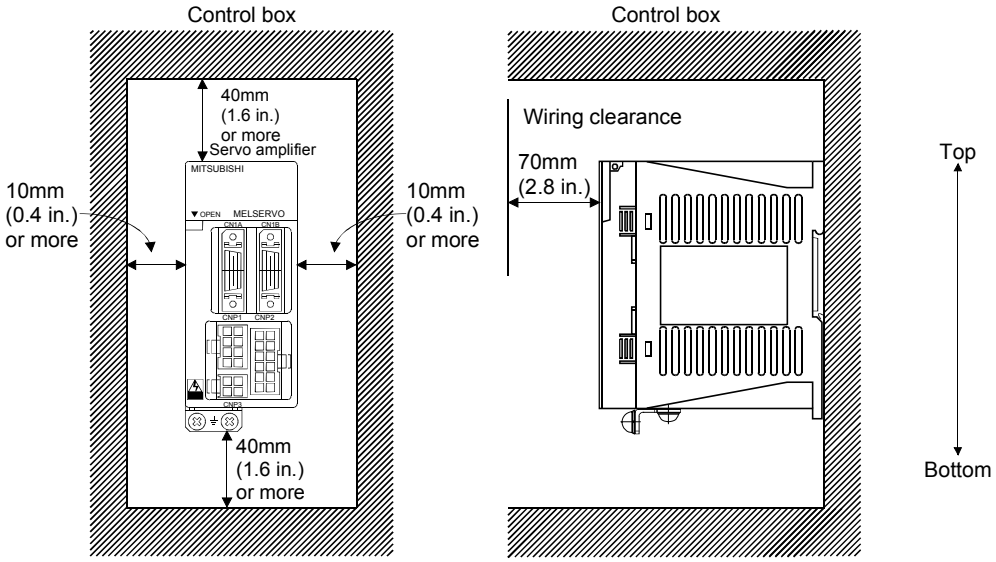
2.1 Environmental conditions

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

2.2 Installation direction and clearances

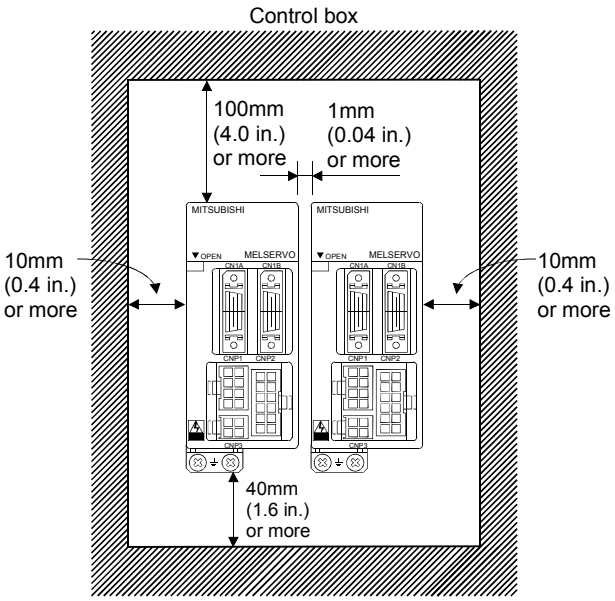
⚠ CAUTION	・The equipment must be installed in the specified direction. Otherwise, a fault may occur. ・Leave specified clearances between the servo amplifier and control box inside walls or other equipment.

(1) 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 fan to prevent the internal temperature of the control box from exceeding the environmental conditions.



(3) Others

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 fan installed on the ceiling.
(3) When installing the control box in a place where there are toxic gas, dirt and dust, provide positive pressure in the control box by forcing in clean air to prevent such materials from entering the control box.

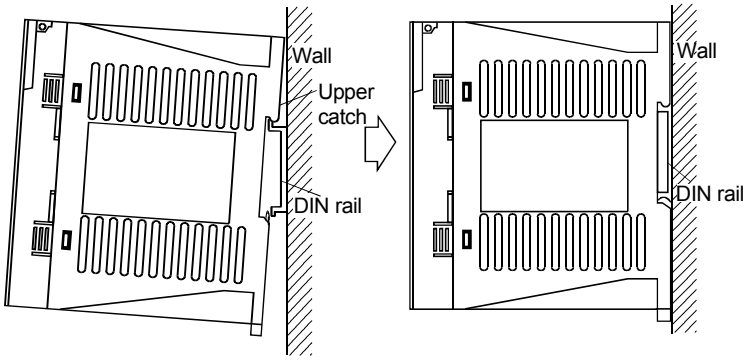
2.4 Cable stress

(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) In any application where the servo motor moves, the cables should be free from excessive stress. For use in any application where the servo motor moves, run the cables so that their flexing portions fall within the optional motor cable range. Fix the motor cable and power lead of the servo motor.
(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.
(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 13.3 for the flexing life.

2.5 Using the DIN rail for installation

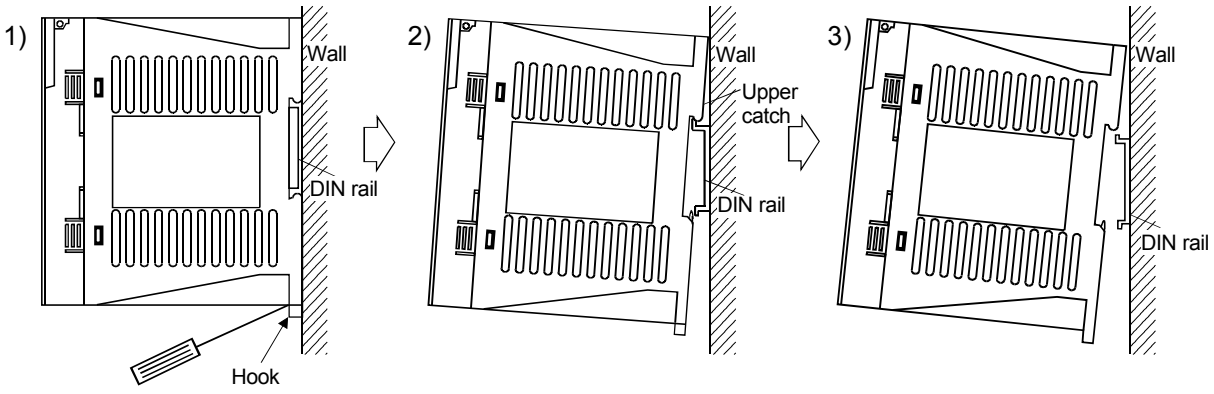
(1) Fitting into the DIN rail

Put the upper catch on the DIN rail and push the unit until it clicks.



(2) Removal from DIN rail

1) Pull down the hook.
2) Pull it toward you.
3) Lift and remove the unit.



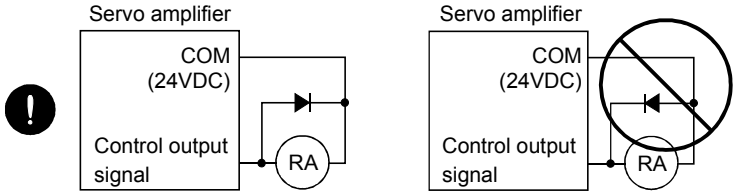
3. SIGNALS AND WIRING

⚠ WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before starting wiring, make sure that the voltage is safe in the tester more than 15 minutes after power-off. Otherwise, you may get an electric shock.
- Ground the servo amplifier and the servo motor securely.
- Do not attempt to wire the servo amplifier and servo motor until they have been Installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠ 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 emergency stop 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 with the power line of the servo motor.
- Do not modify the equipment.
- During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

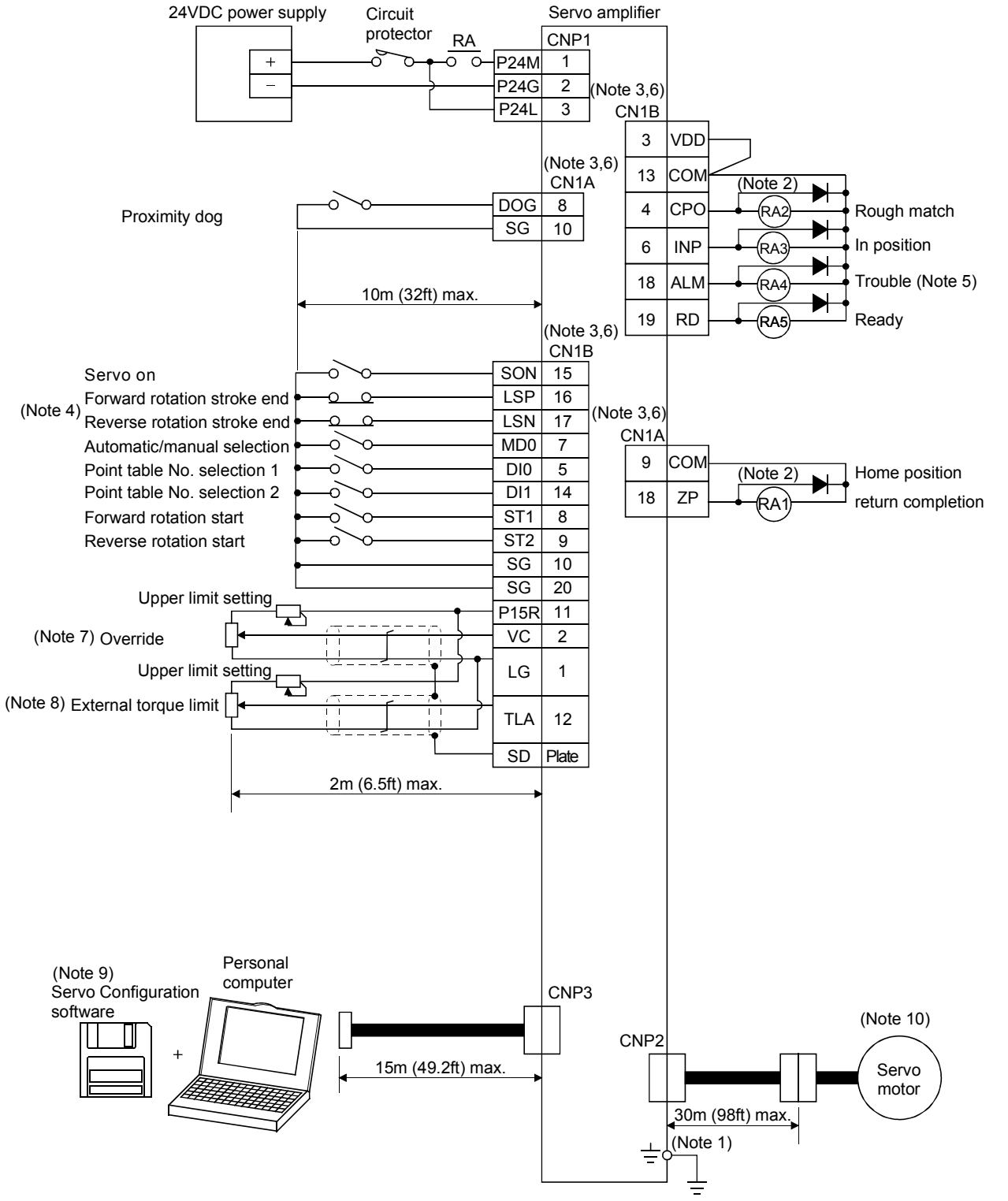
POINT

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

3.1 Standard connection example

POINT

- For the connection of the power supply system, refer to Section 3.7.1.



Note: 1. To prevent an electric shock, fit the supplied earth terminal (E) to the servo amplifier and always connect it to the earth (E) of the control box. (Refer to section 3.9.)

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 and CN1B have the same shape. Wrong connection of the connectors will lead to a fault.

4. When starting operation, always connect the forward/reverse rotation stroke end signal (LSN/LSP) with SG. (Normally closed contacts)

5. Trouble (ALM) is connected with COM in normal alarm-free condition.

6. The pins with the same signal name are connected in the servo amplifier.

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

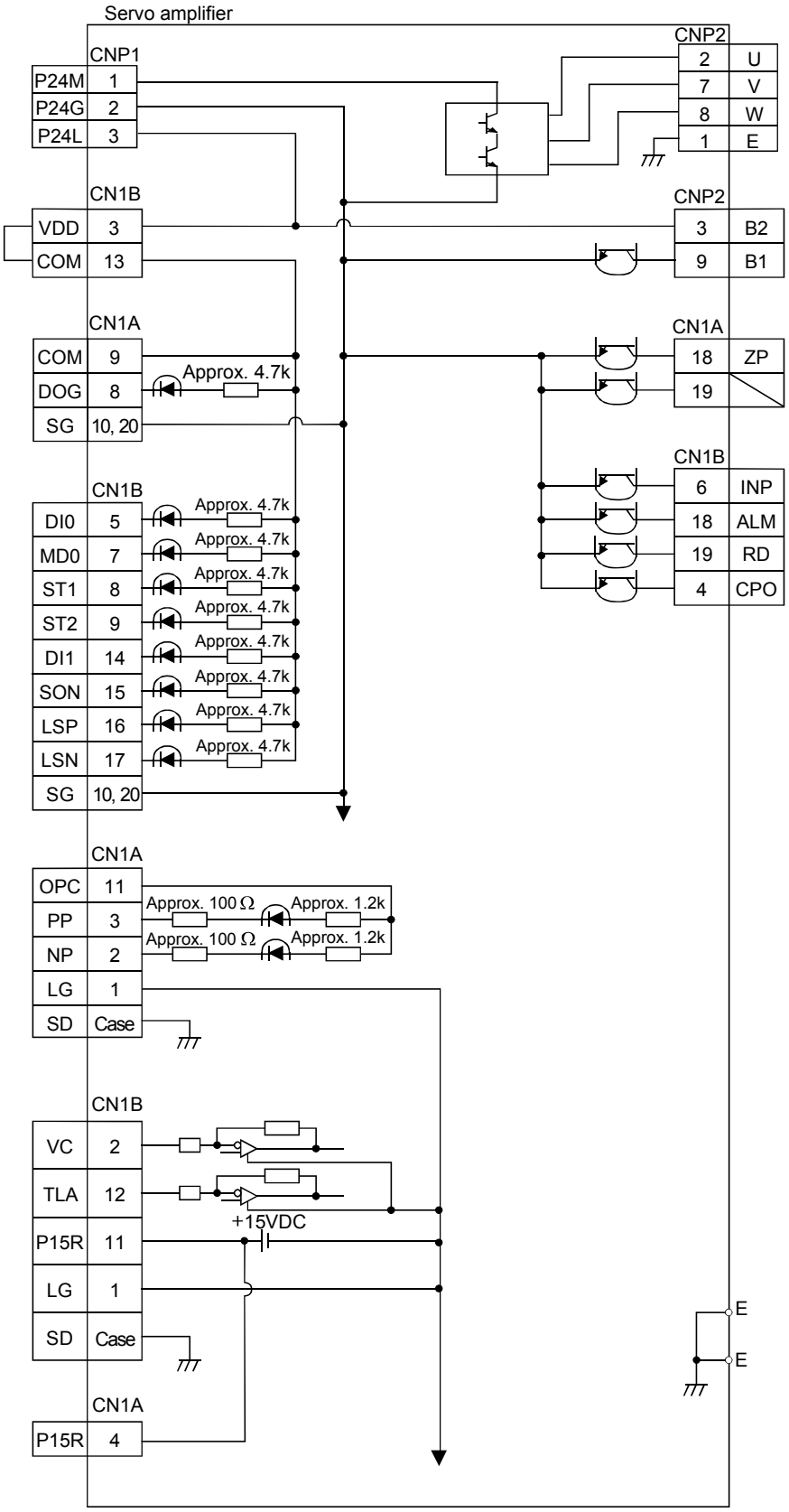
8. When using torque limit (TLA), make the external torque limit selection (TL) devices available.

9. Use MRZJW3-SETUP81E.

10. When using the servo motor provided with electromagnetic brake, refer to Section 3.8.

3.2 Internal connection diagram of servo amplifier

The following is the internal connection diagram in initial device assignment.

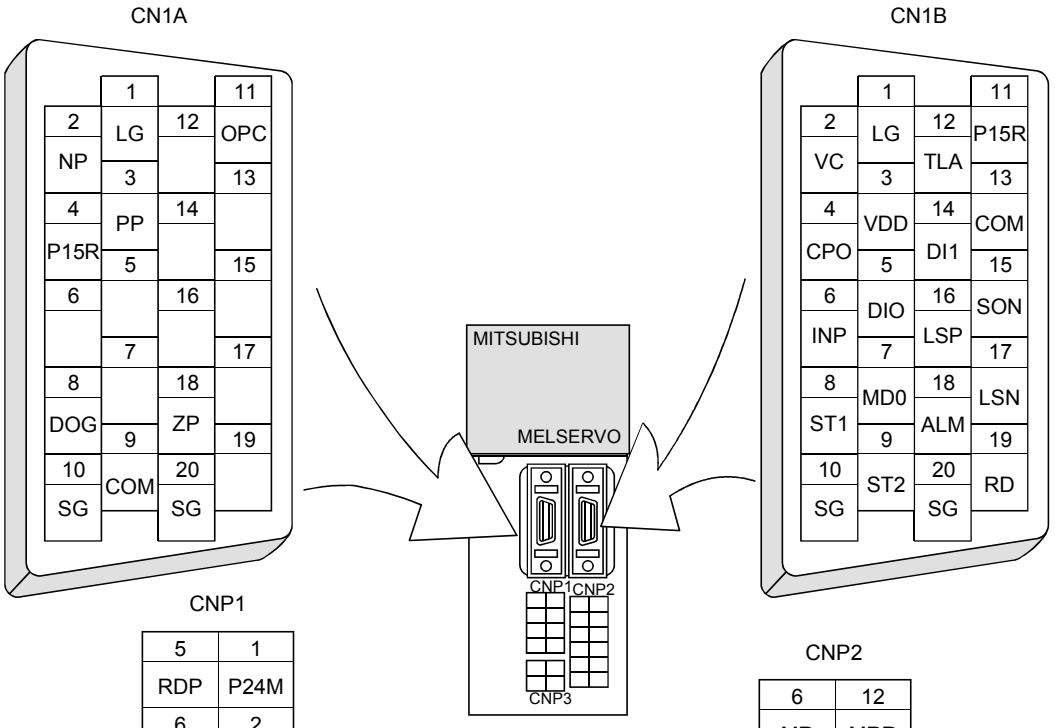


3.3 I/O signals

3.3.1 Connectors and signal arrangements

POINT

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



CN1A			
1			11
2	LG	12	OPC
NP			
3			13
4	PP	14	
P15R			
5			15
6		16	
7			17
8		18	
DOG	ZP		
9			19
10	COM	20	
SG		SG	

CN1B			
1			11
2	LG	12	P15R
VC		TLA	
3			13
4	VDD	14	COM
CPO		DI1	
5			15
6	DIO	16	SON
INP		LSP	
7			17
8	MD0	18	LSN
ST1		ALM	
9			19
10	ST2	20	RD
SG		SG	

CNP1

5	1
RDP	P24M
6	2
RDN	P24G
7	3
SDP	P24L
8	4
SDN	TRE

CNP2

6	12
MR	MRR
5	11
P5	LG
4	10
SD	
3	9
B2	B1
2	8
U	W
1	7
E	V

CNP3

3	1
SD	LG
4	2
TXD	RXD

3.3.2 Signal explanations

1) CN1A

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Digital I/F power supply input</td><td>COM</td><td>9</td><td>Used to input 24VDC±10% for input interface.
Driver power input terminal for digital interface.
COM of each connector is connected in the servo amplifier.</td><td></td></tr>
<tr><td>Open collector power input</td><td>OPC</td><td>11</td><td>When using a manual pulse generator, supply 24VDC to this terminal.</td><td></td></tr>
<tr><td>Digital I/F common</td><td>SG</td><td>10, 20</td><td>Common terminal for VDD and COM. Connected with LG in the servo amplifier.</td><td></td></tr>
<tr><td>15VDC power supply</td><td>P15R</td><td>4</td><td>Used to output 15VDC. Power supply terminal for VC and TLA.</td><td></td></tr>
<tr><td>Control common</td><td>LG</td><td>1</td><td>Common terminal for VC, TLA and P15R.</td><td></td></tr>
<tr><td rowspan="2">Manual pulse generator</td><td>PP</td><td>3</td><td rowspan="2">Used to connect the manual pulse generator (MR-HDP01).
For details, refer to Section 14.1.4.</td><td rowspan="2"></td></tr>
<tr><td>NP</td><td>2</td></tr>
<tr><td>Proximity dog</td><td>DOG</td><td>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□□</td><td>DOG-SG are opened.</td></tr>
<tr><td>□1□□(initial value)</td><td>DOG-SG are shorted.</td></tr>
</table></td><td>DI-1</td></tr>
<tr><td>Home position return completion</td><td>ZP</td><td>18</td><td>ZP-SG are connected on completion of home position return.</td><td>DO-1</td></tr>
<tr><td></td><td></td><td>19</td><td>Empty</td><td></td></tr>
<tr><td>Shield</td><td>SD</td><td>Plate</td><td>Connect one end of the shielded cable.</td><td></td></tr>
</table>

2) CN1B

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>I/F Internal power supply</td><td>VDD</td><td>3</td><td>Used to output +24V±10% to across VDD-COM.
Connected with P24L in the servo amplifier.</td><td></td></tr>
<tr><td>Digital I/F power supply input</td><td>COM</td><td>13</td><td>Used to input 24VDC±10% for input interface.
Driver power input terminal for digital interface.
COM of each connector is connected in the servo amplifier.</td><td></td></tr>
<tr><td>15VDC power supply</td><td>P15R</td><td>11</td><td>Used to output +15VDC to across P15R-LG. Used for VC/TLA power supply.</td><td></td></tr>
<tr><td>Digital I/F Common</td><td>SG</td><td>10, 20</td><td>+24VDC common terminal for VDD, COM, etc. Connected with LG in the servo amplifier.</td><td></td></tr>
<tr><td>Control common</td><td>LG</td><td>1</td><td>Common terminal for VC, TLA and P15R.</td><td></td></tr>
<tr><td>Servo on</td><td>SON</td><td>15</td><td>When SON-SG are shorted, the base circuit is switched on and the servo amplifier is ready to operate.
When they are opened, the base circuit is shut off and the servo motor coasts.</td><td>DI-1</td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>16</td><td rowspan="2">To start operation, short LSP-SG or LSN-SG. When they are opened, the servo motor is stopped suddenly and servo-locked.
<table><tr><th colspan="2">(Note) Input signals</th><th colspan="2">Operation</th></tr><tr><th>LSP</th><th>LSN</th><th>CCW direction</th><th>CW direction</th></tr><tr><td>1</td><td>1</td><td>○</td><td>○</td></tr><tr><td>0</td><td>1</td><td></td><td>○</td></tr><tr><td>1</td><td>0</td><td>○</td><td></td></tr><tr><td>0</td><td>0</td><td></td><td></td></tr></table>Note. 0: LSG-SG open
1: LSG-SG shorted</td><td>DI-1</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>17</td><td>DI-1</td></tr>
<tr><td>Forward rotation start</td><td>ST1</td><td>8</td><td>This signal serves as a forward rotation start signal for the incremental value command system.
In automatic operation mode, the servo motor rotates in the forward rotation direction as soon as ST1-SG are shorted.
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.

This signal serves as a start signal for the absolute value command system. In automatic operation mode, operation starts as soon as ST1-SG are shorted.
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.</td><td>DI-1</td></tr>
<tr><td>Reverse rotation start</td><td>ST2</td><td>9</td><td>In automatic operation mode, the servo motor rotates in the reverse rotation direction as soon as ST2-SG are shorted. (Incremental value command only)
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.</td><td>DI-1</td></tr>
</table>

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Automatic/manual selection</td><td>MD0</td><td>7</td><td>Short MD0-SG to choose the automatic operation mode, or open them to choose the manual operation mode.</td><td>DI-1</td></tr>
<tr><td>Point table No. selection</td><td>DI0
DI1</td><td>5
14</td><td>The following table lists the point table numbers which may be chosen by the combinations of DI0 and DI1:
<table>
<tr><th colspan="2">(Note) Input signals</th><th rowspan="2">Selected Point Table No.</th></tr>
<tr><th>DI1</th><th>DI0</th></tr>
<tr><td>0</td><td>0</td><td>Manual home position return</td></tr>
<tr><td>0</td><td>1</td><td>Point table No.1</td></tr>
<tr><td>1</td><td>0</td><td>Point table No.2</td></tr>
<tr><td>1</td><td>1</td><td>Point table No.3</td></tr>
</table>
Note: 0: DI1/DI0-SG open
1: DI1/DI0-SG shorted</td><td>DI-1</td></tr>
<tr><td>Rough match</td><td>CPO</td><td>4</td><td>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 switched off.</td><td>DO-1</td></tr>
<tr><td>In position</td><td>INP</td><td>6</td><td>INP-SG are connected when the droop pulses fall within the parameter-set in-position range.
This signal is not output while the base circuit is switched off.</td><td>DO-1</td></tr>
<tr><td>Trouble</td><td>ALM</td><td>18</td><td>ALM-SG are disconnected when the protective circuit is activated to shut off the base circuit at power off.
They are connected in normal condition at power off.</td><td>DO-1</td></tr>
<tr><td>Ready</td><td>RD</td><td>19</td><td>RS-SG are connected when the servo amplifier is ready to operate without failure after servo-on.</td><td>DO-1</td></tr>
<tr><td>Override</td><td>VC</td><td>2</td><td>−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[%].</td><td>Analog input</td></tr>
<tr><td>External torque limit</td><td>TLA</td><td>12</td><td>0 to +10V is applied to across TLA-LG to limit the servo motor-generated torque.
Apply 0[V] for 0 torque or 10[V] for max. torque.</td><td>Analog input</td></tr>
<tr><td>Shield</td><td>SD</td><td>Plate</td><td>Connect one end of the shielded cable.</td><td></td></tr>
</table>

3) CNP1

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td rowspan="5">RS-422 I/F</td><td>SDP</td><td>7</td><td rowspan="5">RS-422 communication terminal
RS-422 and RS-232C functions cannot be used together.
Short "6" and "4" at the last axis.</td><td rowspan="5"></td></tr>
<tr><td>SDN</td><td>8</td></tr>
<tr><td>RDP</td><td>5</td></tr>
<tr><td>RDN</td><td>6</td></tr>
<tr><td>TRE</td><td>4</td></tr>
</table>

4) CNP3

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td rowspan="2">RS-232C I/F</td><td>TXD</td><td>4</td><td rowspan="2">RS-232C communication terminal
Use parameter No.16 for selection.</td><td rowspan="2"></td></tr>
<tr><td>RXD</td><td>2</td></tr>
<tr><td>Ground</td><td>SD</td><td>Plate</td><td>Connect one end of the shielded cable.</td><td></td></tr>
</table>

5) CNP21

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td rowspan="2">Electromagnetic brake contact</td><td>B1A</td><td>1</td><td rowspan="2">Opening B1A-B1B enables the electromagnetic brake.
Configure up a circuit that switches off main circuit power and enables the electromagnetic brake as soon as EMG-SG are opened at a forced stop.</td><td rowspan="2"></td></tr>
<tr><td>B1B</td><td>2</td></tr>
</table>

3.3.3 Additional function devices

By using the Set-up Software, you can assign the signals given in this section to the pins of connectors CN1A and CN1B, in addition to the signals in Section 3.3.2.

(1) Pins which accept different signals

Pin Type	Connector Pin No.	Device in Initial Status	Device Symbol
Input-only pins	CN1B-5	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
Output-only pins	CN1B-4	Rough match	CPO
	CN1B-6	In position	INP
	CN1B-18	Trouble	ALM
	CN1B-19	Ready	RD
	CN1A-18	Home position return completion	ZP
	CN1A-19	Empty	

(2) Assignable devices

1) Input devices

Device Name	Symbol	Description	I/O Division
No assigned function		No function is assigned.	
Emergency stop	EMG	When EMG-SG are opened, the servo amplifier is placed in the emergency 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 emergency stop status to cancel the emergency stop status.	DI-1
Override selection	OVR	Short OVR-SG to make override (VC) valid.	DI-1
External torque limit selection	TL	Short TL-SG to make external analog torque limit valid. For more information, refer to Section 3.2.5.	DI-1
Internal torque limit selection	TL2	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.	DI-1
Proportion control	PC	Short PC-SG to switch the speed amplifier from proportional integral type to proportional type.	DI-1

<table>
<tr><th>Device Name</th><th>Symbol</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Alarm reset</td><td>RES</td><td>Short RES-SG to deactivate the alarm.
If RES-SG are shorted in no alarm status, the base circuit is not shut off. Set □□1□ in parameter No. 22 to shut off the base circuit.
Some alarms cannot be deactivated by the reset signal. Refer to Section 11.2.1.
Since this device is not designed for stopping, do not switch it on during operation.</td><td>DI-1</td></tr>
<tr><td>Point table No. selection</td><td>DI0
DI1
DI2
DI3</td><td>Valid in the automatic mode.
The following table lists the point table numbers that may be chosen by the combinations of DI0, DI1, DI2 and DI3:
<table>
<tr><th colspan="4">(Note) Device</th><th rowspan="2">Selected Point Table No.</th></tr>
<tr><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>Manual home position return</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Point table No.1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Point table No.2</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>Point table No.3</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Point table No.4</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Point table No.5</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>Point table No.6</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Point table No.7</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Point table No.8</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Point table No.9</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Point table No.10</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>Point table No.11</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Point table No.12</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Point table No.13</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Point table No.14</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Point table No.15</td></tr>
</table>
Note:0: DI3/DI2/DI1/DI0-SG open
1: DI3/DI2/DI1/DI0-SG shorted</td><td>DI-1</td></tr>
</table>

<table>
<tr><th>Device Name</th><th>Symbol</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Temporary stop/Restart</td><td>STP</td><td>Short STP-SG during automatic operation to make a temporary stop.
Short STP-SG again to make a restart.
Shorting the forward/reverse rotation start signal during a temporary stop is ignored.
Switching from automatic mode to manual 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 4.2.5, (4).</td><td>DI-1</td></tr>
<tr><td>Manual pulse generator multiplication</td><td>TP0
TP1</td><td>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) Device</th><th rowspan="2">Manual Pulse Generator Multiplication Factor</th></tr>
<tr><th>TP1</th><th>TP0</th></tr>
<tr><td>0</td><td>0</td><td>Parameter No.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><td></td></tr>
</table>

2) Output devices

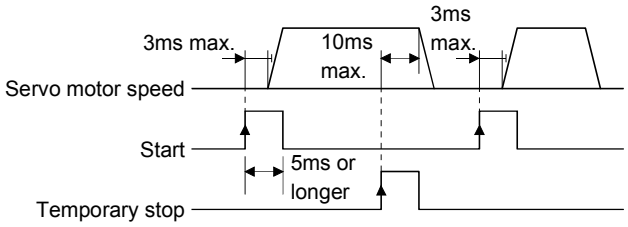
Device Name	Symbol	Description	I/O Division
No assigned function		No function is assigned.	
Electromagnetic brake interlock	MBR	Used to output the interlock signal for electromagnetic brake. MBR-SG are disconnected at servo-off or alarm occurrence.	DO-1
Position range	POT	POT-SG are connected when the actual current position is within the parameter-set range. The output is open when home position return is incomplete or the base circuit is switched off.	DO-1
Warning	WNG	WNG-SG are connected when warning occurs. Open in normal condition.	DO-1
Limiting torque	TLC	TLC-SG are connected when the internally or externally set torque limit value is reached.	DO-1
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.	DO-1

3.4 Detailed description of the signals

3.4.1 Start and stop signals

(1) Make up a sequence so that the start signal is switched on after the main circuit has been established. The start signal is 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.

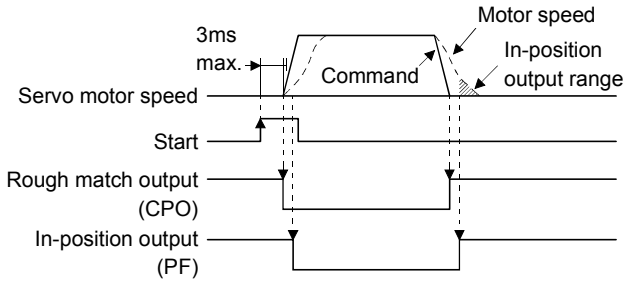


(3) When a programmable controller is used, the ON time of the start/stop signal should be 5ms or longer to prevent a malfunction.

(4) During operation, the start signal (ST1, ST2) is not accepted. The next operation should always be started after the rough match signal is output with the rough match output range set to 0 or after the in-position signal is output.

3.4.2 Rough match, in-position

The following chart shows the output timings of the rough match and in-position signals:



3.4.3 Override

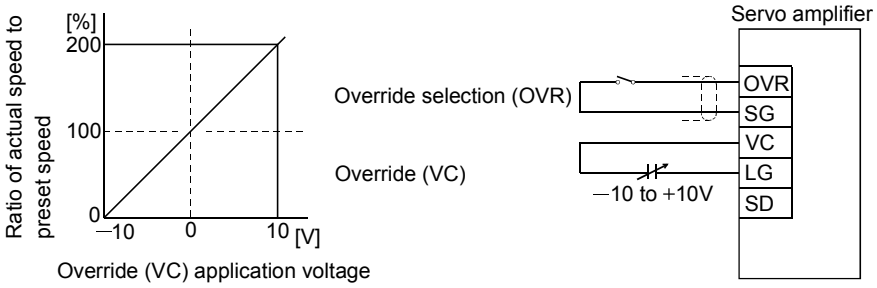
POINT
▪ When using the override, make the override selection (OVR) device available.

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)	Servo Configuration Software setting required.
Contact input signal	Override selection (OVR)	
Parameter	No.25 override offset	−999 to 999mV

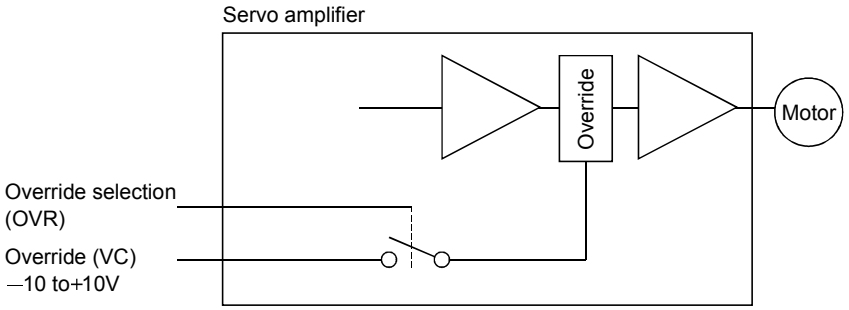
(1) Override (VC)

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:

External Input Signal OVR	Speed Change Value
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) device and internal torque limit selection (TL2) device available.

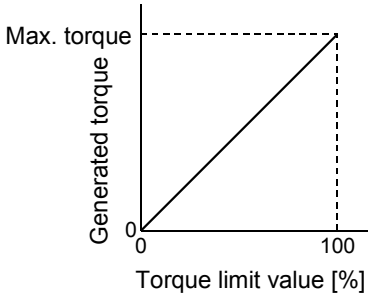
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLA)	Servo Configuration Software setting required.
Contact input signals	External torque limit selection (TL)	
	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.20 selection function 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 external torque limit using analog input signal. This function limits generated 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 generated torque relative to the setting.

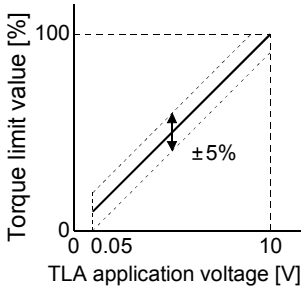


(2) External torque limit (TLA)

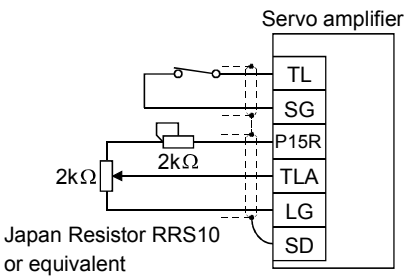
By applying a voltage (0 to 10V) to the external torque limit (TLA) terminal, limit values can be set from outside consecutively. The following graph shows the relationship between input voltage and limit value.

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 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/TL1-SG off (open)
1: TL/TL1-SG on (short)

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

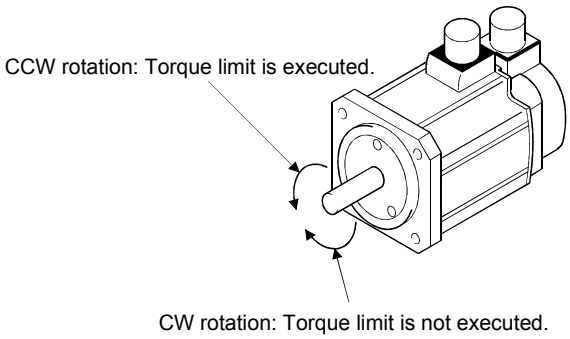
Using parameter No.26, the offset voltage can be set relative to the input voltage of the external torque limit (TLA). The setting is between −999 to 999mV.

(5) Selection of rotation direction for torque limit execution (parameter No.20)

Using parameter No.20, the rotation direction for torque limit execution can be selected.

Parameter No.20 Setting	Rotation Direction for Torque Limit Execution	
	CCW direction	CW direction
□□□0 (initial value)	○	○
□□□1	○	
□□□2		○

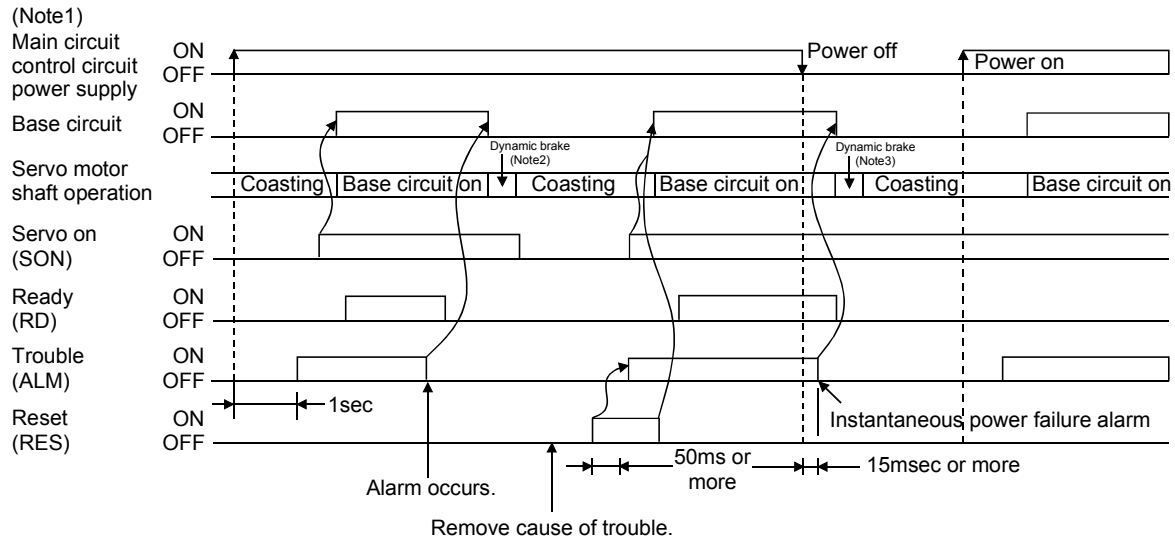
For example, when □□□ 1 is set in parameter No.20, torque limit is executed in the CCW direction but not in CW direction.



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 off, then on.
However, the alarm cannot be reset unless its cause of occurrence is removed.



Note 1. Shut off the main circuit power as soon as an alarm occurs.
2. At overcurrent (32) alarm occurrence, the dynamic brake does not operate. The servo motor coasts to a stop.
3. When control circuit power switches off, the dynamic brake does not operate. The servo motor coasts to a stop.

Precautions for alarm occurrence

1) Overcurrent, overload 1 or overload 2
If operation is repeated by switching control circuit power off, then on to reset the overcurrent (A.32), overload 1 (A.50) or overload 2 (A.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.

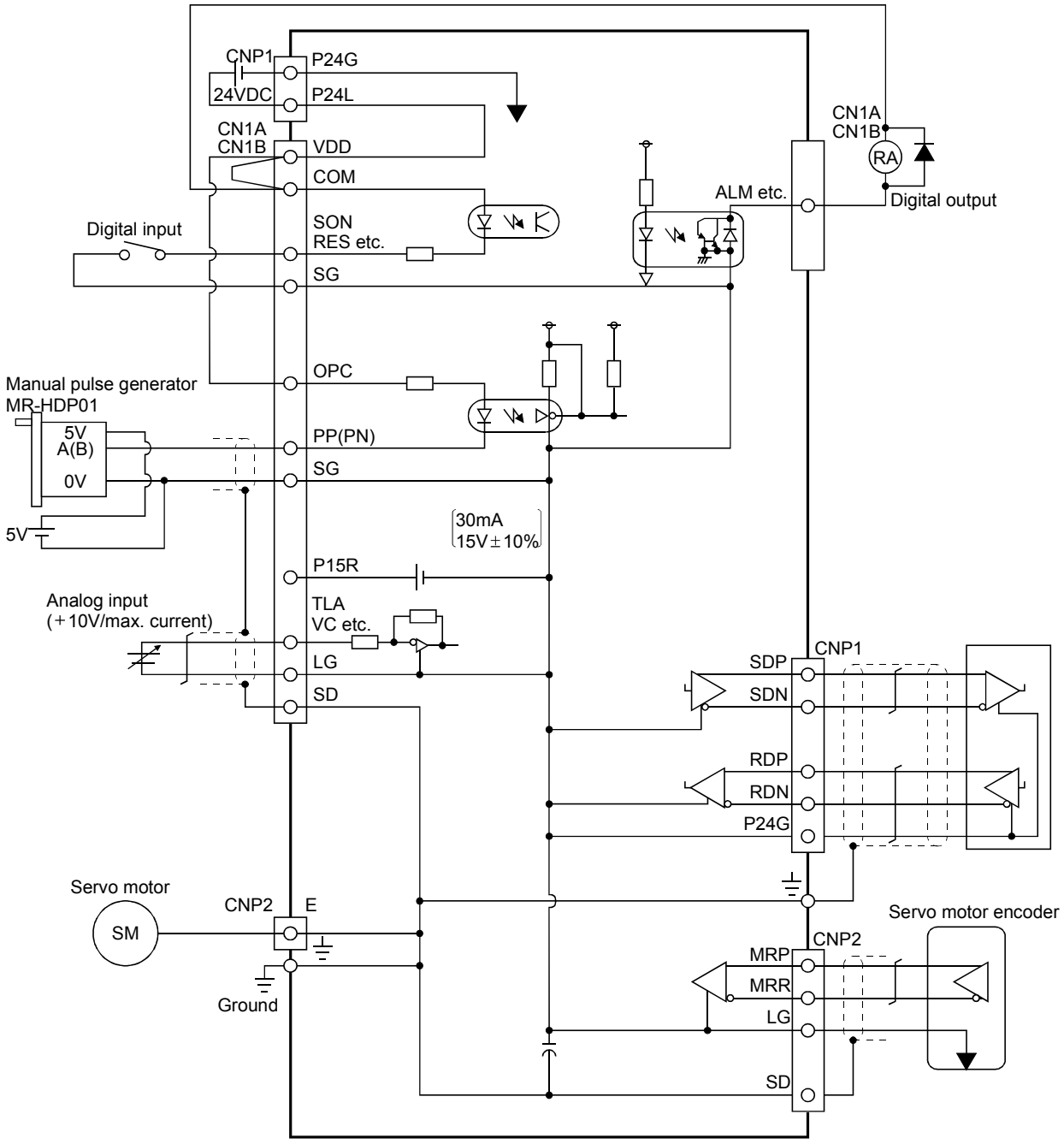
2) Instantaneous power failure
Undervoltage (AL.10) occurs when the input power is in either of the following statuses.
・A power failure of the control circuit power supply continues for 40ms or longer and the control circuit is not completely off.
・The bus voltage dropped to 15VDC or less.

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

3.6 Interfaces

3.6.1 Common line

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

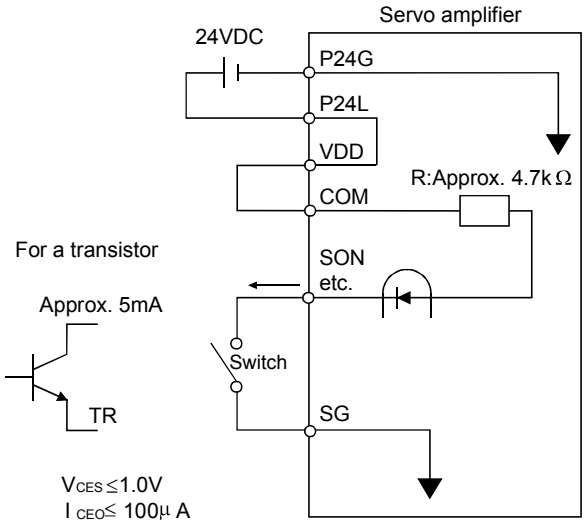


3.6.2 Detailed description of the interfaces

This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in Section 3.3.2, 3.3.3.
Refer to this section and connect the interfaces with the external equipment.

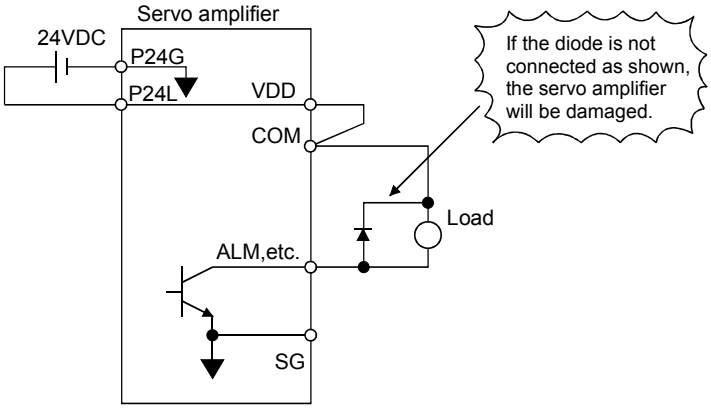
(1) Digital input interface DI-1

Give a signal with a relay or open collector transistor.

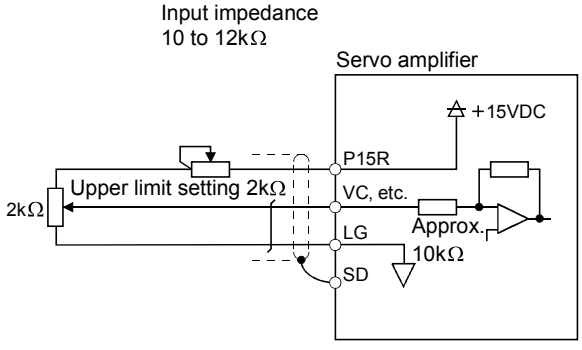


(2) Digital output interface DO-1

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)



(3) Analog input



3.7 Input power supply circuit

CAUTION

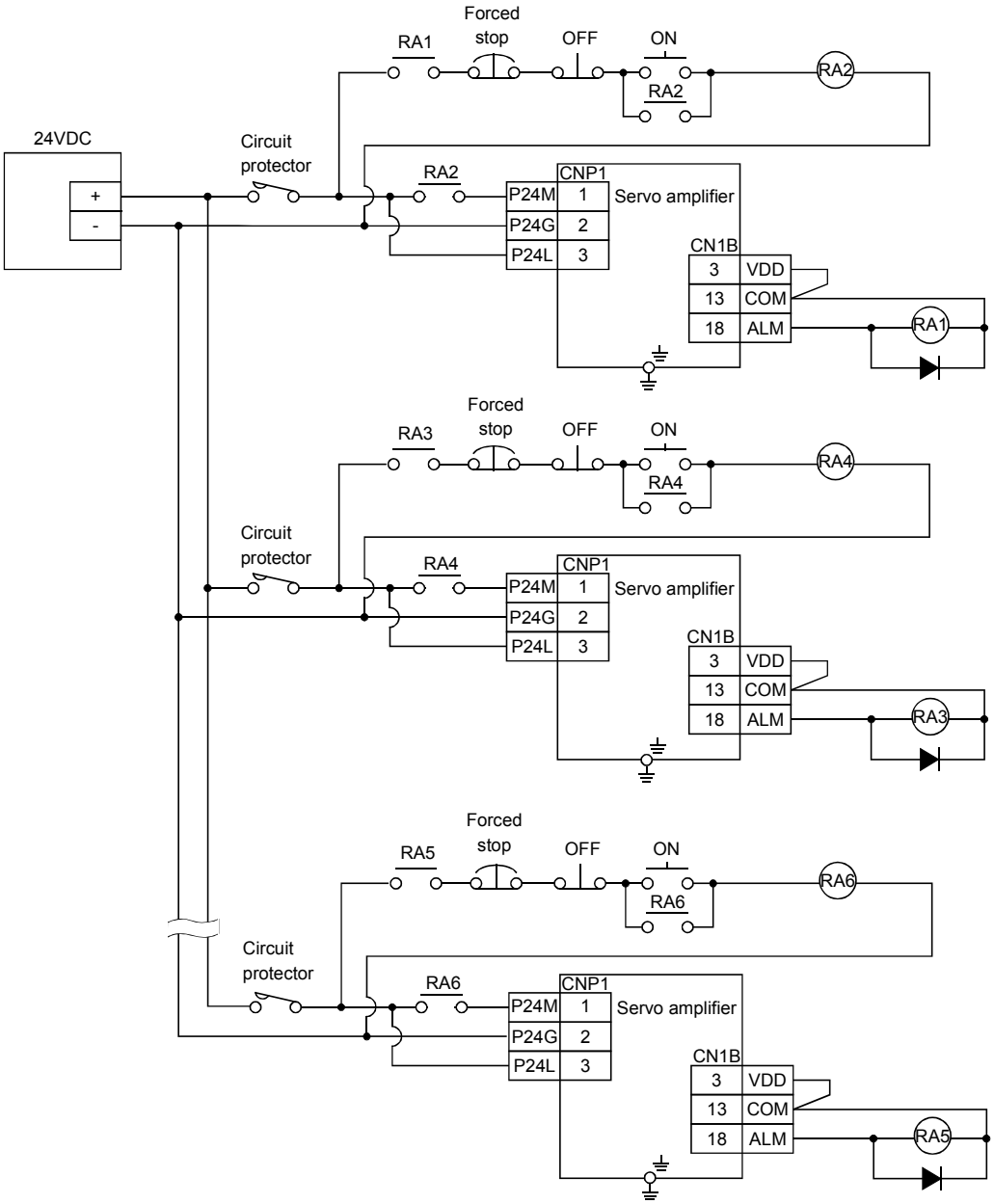
- When the servo amplifier has become faulty, switch power off on the servo amplifier power side. Continuous flow of a large current may cause a fire.

POINT

- If the equipment does not comply with the EN Standard, use the insulated 24VDC power supply.

3.7.1 Connection example

Wire the power supply and main circuits as shown below so that the servo-on signal also turns off as soon as power is switched off at detection of alarm occurrence.
When using an electromagnetic brake, determine the power supply by taking the rated current value of the electromagnetic brake into consideration.



3.7.2 Explanation of signals

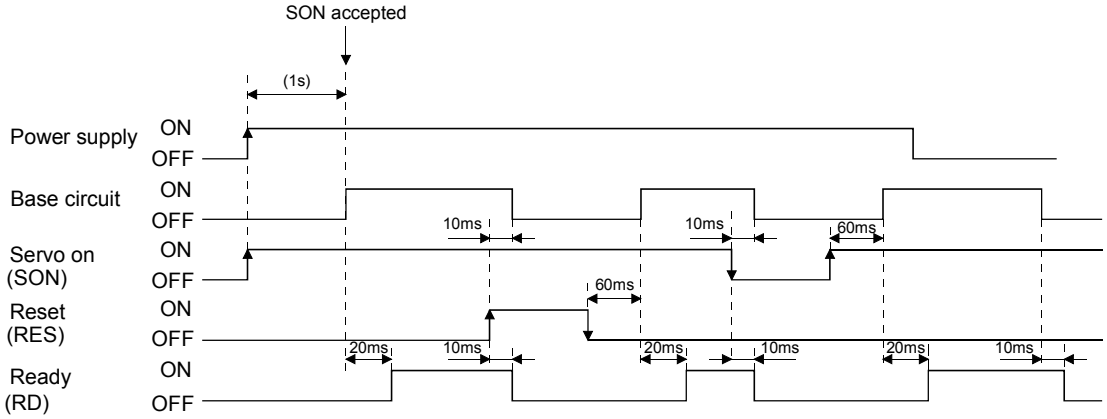
Abbreviation	Signal Name	Description
P24M	Main circuit power input	Power supply for main circuit
P24G	Power ground	Main circuit power supply and control circuit power supply. Connected to SG and LG inside the unit.
P24L	Control circuit power input	Control circuit power supply and digital I/O power supply. Always use a stabilizing power supply.
⏚	Ground	Grounding terminal Connect to the earth of the control box for grounding.

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 relay with the main circuit power supply. Configure up an external sequence to switch off the relay as soon as an alarm occurs.
2) Switch on the control circuit power supply P24L, P24G 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 signal (SON) about 1 second after the main circuit power supply is switched on. Therefore, when SON is switched on simultaneously with the 24V power supply, the base circuit will switch on in about 1 second, and the ready signal (RD) will switch on in further about 20ms, making the servo amplifier ready to operate. (Refer to (2) in this section.)

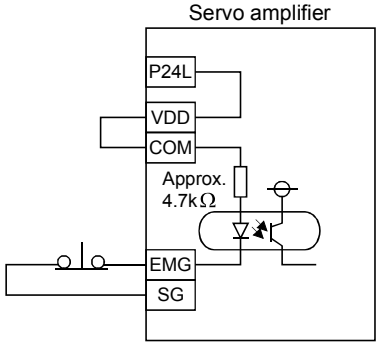
(2) Timing chart



(3) Forced stop

> ⚠ CAUTION ▪ To stop operation and switch power off immediately, provide a forced stop circuit.

Emergency stop (EMG) can be used by making device setting on the 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 a 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 (A. E6).
During ordinary operation, do not use the forced stop signal to alternate stop and run.
Also, if the start signal is on during an emergency stop, the servo motor will rotate as soon as the warning is reset. During a forced stop, always shut off the run command.



(4) CNP1 connector wiring

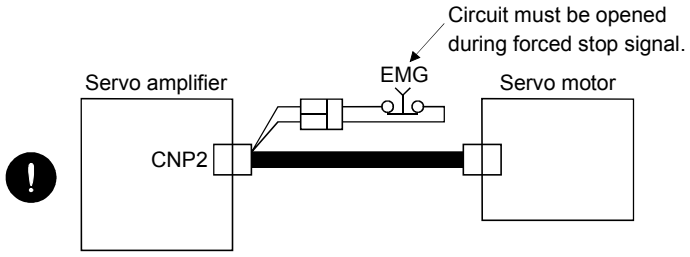
The servo amplifier is packed with the following parts for wiring the CNP1.
For connection of the terminals and cables, use the crimping tool 57026-5000 (for UL1007) or 57027-5000 (for UL1015).

Part	Model	Maker
Connector	5557-08R	molex
Terminal	5556	

3.8 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 emergency stop signal.



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

POINT

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

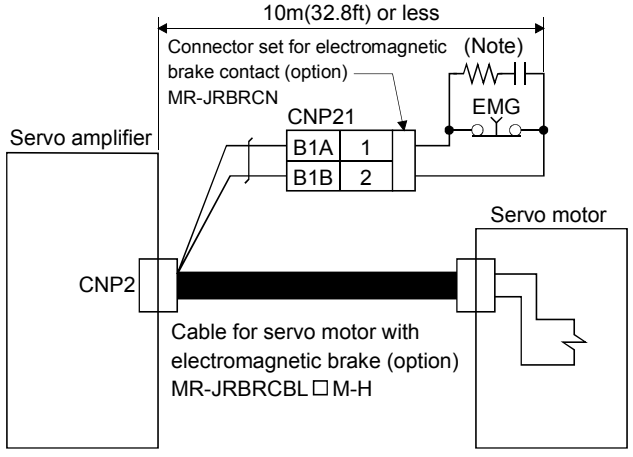
Note the following when the servo motor equipped with electromagnetic brake is used for applications requiring a brake to hold the motor shaft (vertical lift applications):

1) The brake will operate when the forced stop switch on.
2) While the reset signal is on, the base circuit is shut off. When using the servo motor with a vertical shaft, use the electromagnetic brake interlock signal (MBR).
3) Switch off the servo-on command after the servo motor has stopped.

(1) Connection diagram

Configure up a circuit which switches off main circuit power and makes the electromagnetic brake effective as soon as EMG-SG are disconnected at a forced stop.

For connection, use the optional MR-JRBRCBL□M-H electromagnetic braked servo motor cable and MR-JRBRCN electromagnetic brake contact connector set.



Note. Fit a snubber circuit to the forced stop contact. (Refer to Section 14.2.6)

(2) Setting

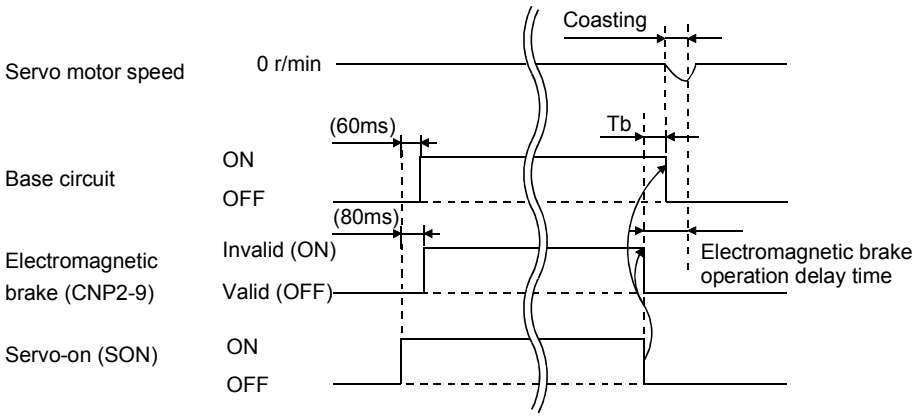
(a) In the device setting of the Servo Configuration Software, make the electromagnetic brake interlock signal (MBR) available.

(b) In parameter No.33 (electromagnetic brake sequence output), set the time delay (Tb) from electromagnetic brake operation to base circuit shut-off at a servo off time as in the timing chart in (2) in this section.

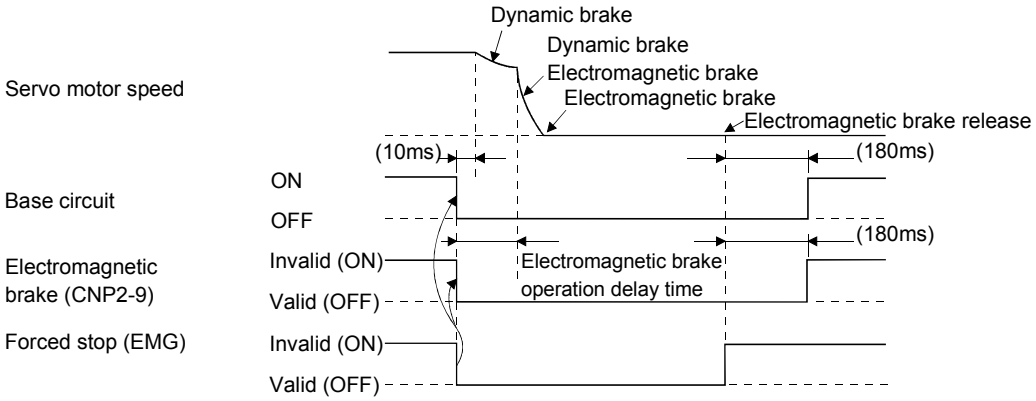
(3) Operation timings

(a) Servo-on signal command (SON) ON/OFF

Tb [ms](parameter No.33) after the servo-on signal (SON) is switched off, the servo lock is released and the servo motor coasts. If the electromagnetic brake is made valid in the servo lock status, the brake life may be shorter. Therefore, when using the electromagnetic brake in a vertical lift application or the like, set Tb to about the same as the electromagnetic brake operation delay time to prevent a drop.



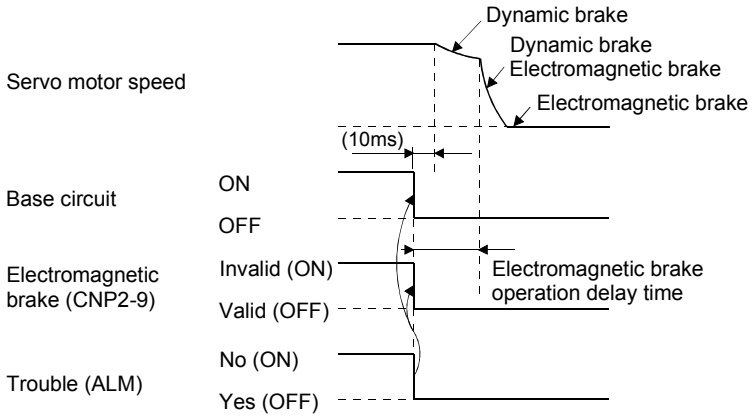
(b) Emergency stop signal (EMG) ON/OFF



(c) Alarm occurrence

POINT

▪ When the overcurrent(A.32) alarm occurs, the dynamic brake cannot be operated.



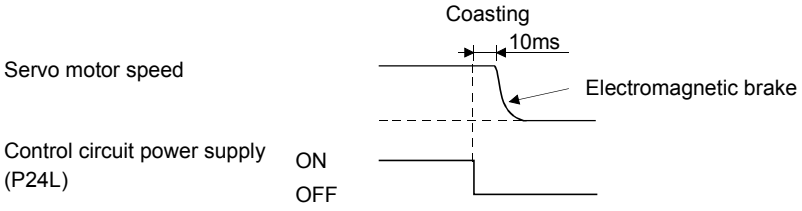
(d) Main circuit power off

When main circuit power switches off, the undervoltage alarm (A.10) occurs and the operation timing is as shown in (c) of this section.

(e) Control circuit power off

POINT

▪ When the control circuit power supply is turned off, the dynamic brake cannot be operated.



(4) Release of electromagnetic brake

To release the electromagnetic brake with main circuit power off, switch on electromagnetic brake power B1 (CNP2-9) in the DO forced output mode of Servo Configuration Software.

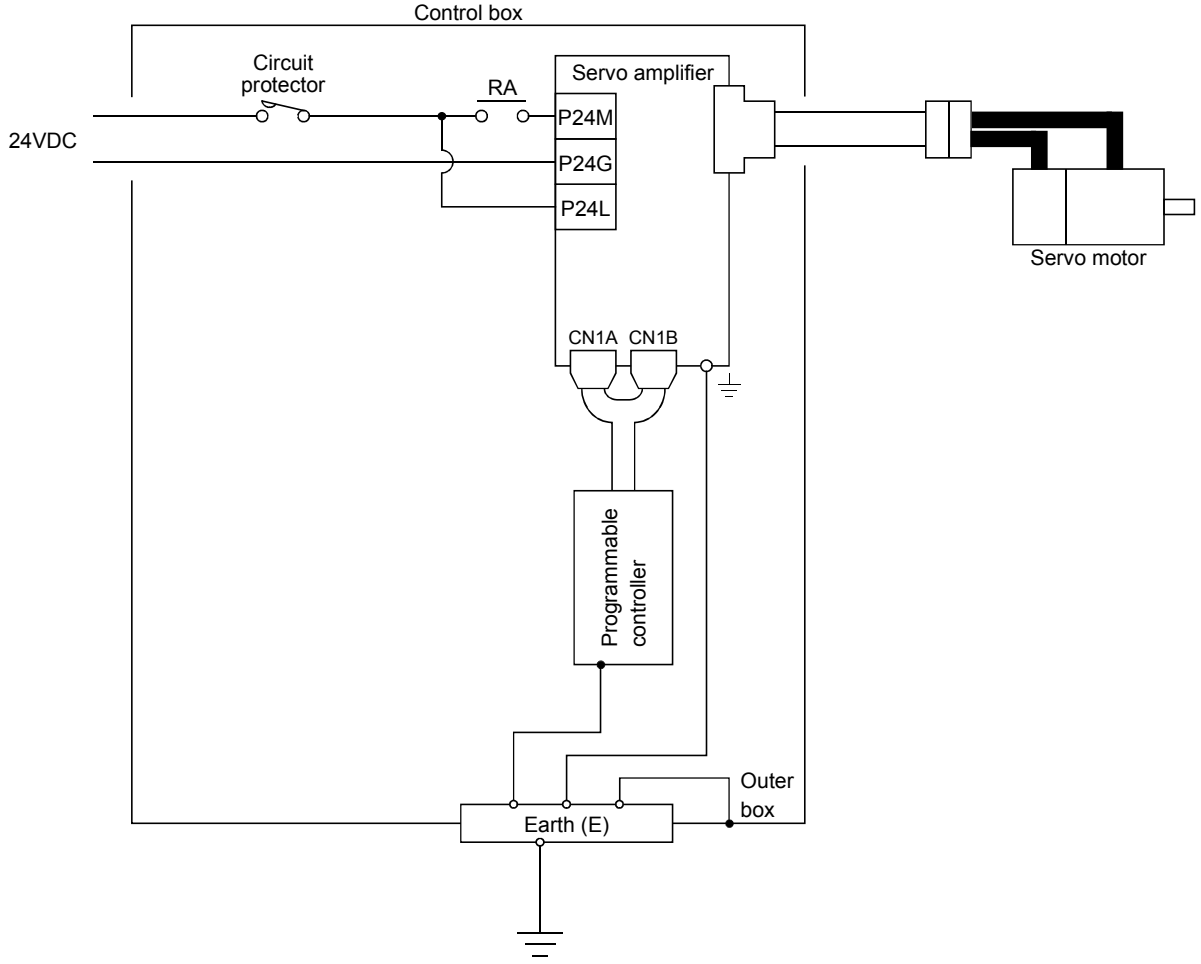
3.9 Grounding

> **⚠ WARNING**
>
> - Ground the servo amplifier and servo motor securely.
> - To prevent an electric shock, always connect the earth terminal (E) of the servo amplifier to the earth (E) of the control box (refer to (2) of this section for the fitting method of the earth terminal).

(1) Connection diagram

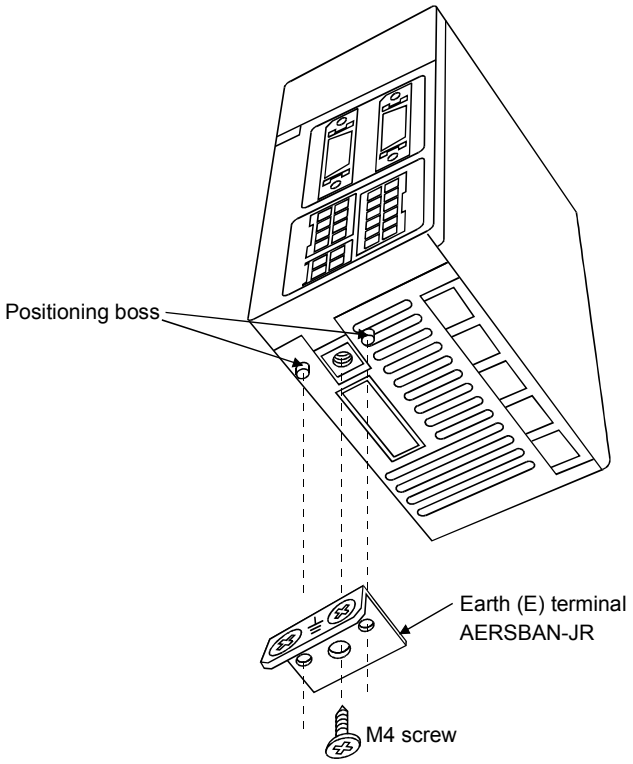
The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cablerouting, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.

To conform to the EMC Directive, refer to the EMC INSTALLATION GUIDELINES (IB (NA) 67310).



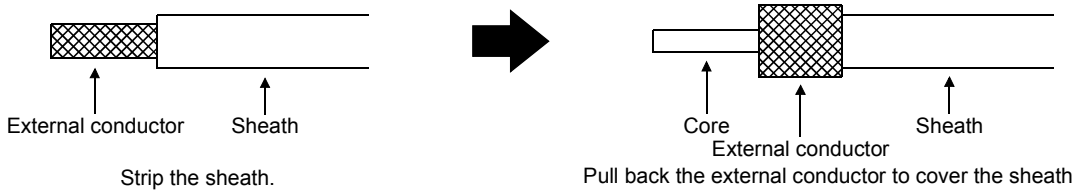
(2) Fitting of earth (E) terminal (AERSBAN-JR)

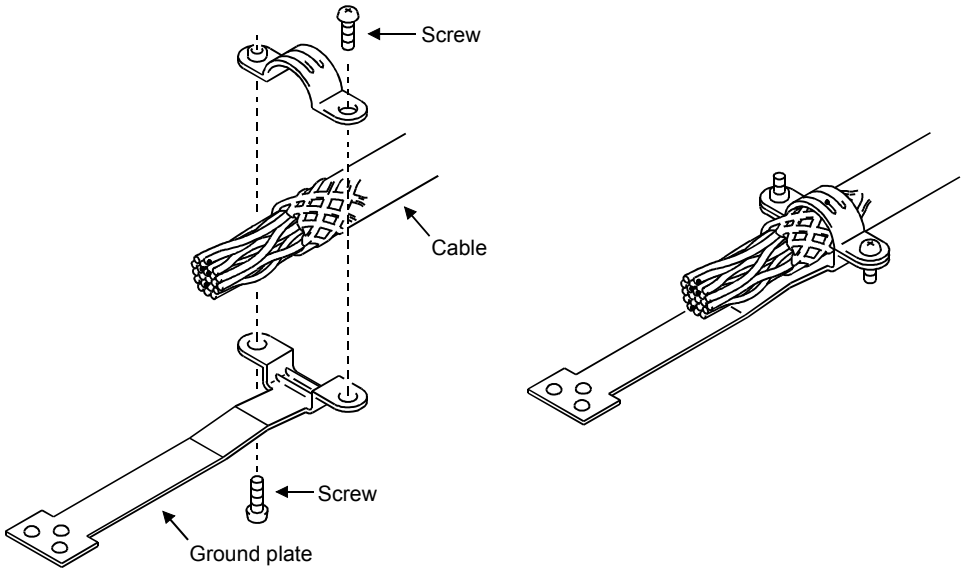
As shown below, fit the earth (E) terminal to the bottom or top of the servo amplifier.



3.10 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.





4. OPERATION

4.1 When switching power on for the first time

4.1.1 Pre-operation check items

Before starting operation, check the following:

(1) Wiring

(a) A correct power supply is connected to the power input terminals (P24M・P24G・P24L) 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 (P24M・P24L).

(d) The servo amplifier and servo motor are grounded securely.

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

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

(g) SD and SG of connectors CN1A and CN1B is not shorted.

(h) 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.

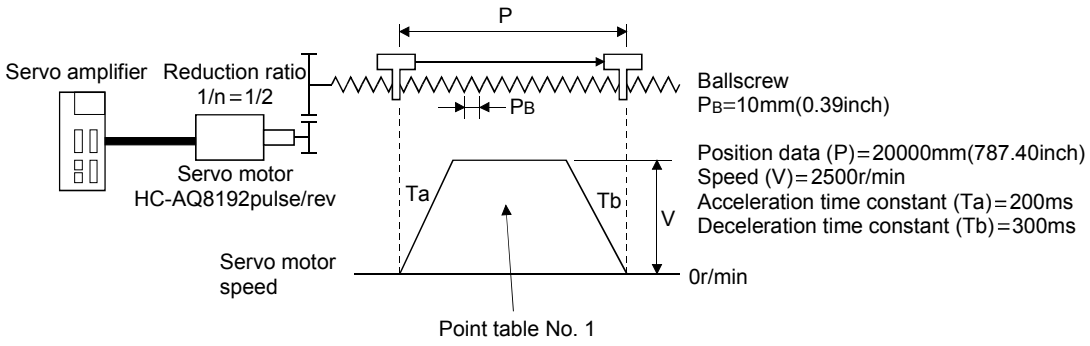
4.1.2 Startup

⚠ 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 brake 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) Command resolution: 10μm
2) Command system: Absolute value command system
3) Electronic gear calculation

$$\frac{CMX(pulse)}{CDV(\mu m)} = \frac{8192}{\frac{1}{n} \cdot P_B \cdot 1000} = \frac{8192}{\frac{1}{2} \cdot 10 \cdot 1000} = \frac{8192}{5000} \quad \cdots\cdots (4.1)$$

CMX=8192
CDV=5000

4) 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.
5) Point table No.1 is used to execute automatic operation once.

(2) Startup procedure

(a) Power on

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

2) When main circuit power/control circuit power is switched on, "r" (motor speed) appears on the servo amplifier display.

(b) Test operation

Using jog operation in the test operation mode of the Servo Configuration Software, operate at the speed as low as possible, and check whether the servo motor operates correctly. (Refer to Section 6.7.1.)

(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
0	Command system selection	□□0□	Absolute value command system.
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.
4	Electronic gear numerator (CMX)	8192	From calculation result of formula (4.1)
5	Electronic gear denominator (CDV)	5000	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 [$\times 10^{STM}\mu m$]	Servo Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms]	Auxiliary Function
20000	2500	200	300	0	0

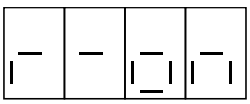
(e) Servo on

Switch the servo on in the following procedure:

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

2) Switch on the servo on signal (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

Always perform home position return before starting positioning operation. 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
8	Home position return type	□000 Dog type home position return is selected. Home position return is started in address incremented direction. Proximity dog signal is valid when DOG-SG are opened.	
9	Home position return speed	1000	Motion is made up to proximity dog at 1000r/min.
10	Creep speed	10	Motion is made up to home position at 10r/min.
11	Home position shift distance	0	No home position shift
42	Home position return position data		Home position address is entered automatically after home position return.
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	
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	Forward rotation side limit switch is turned on.
Reverse rotation stroke end	LSN	ON	Reverse 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 3.8 (3). Note that forward/reverse rotation stroke end (LSP/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) Emergency stop (EMG) OFF

The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. Alarm A.E6 (Servo emergency stop warning) 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

> **POINT**
>
> ▪ The servo motor will not operate if the forced stop, forward rotation stroke end and reverse rotation stroke end devices are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn off across these signals and SG. (Refer to Section 6.6.)

4.2.1 What is automatic operation mode?

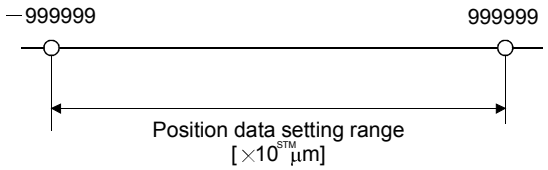
(1) Command system

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) signal. Automatic operation has the absolute value command system and incremental value command system.

(a) Absolute value command system

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

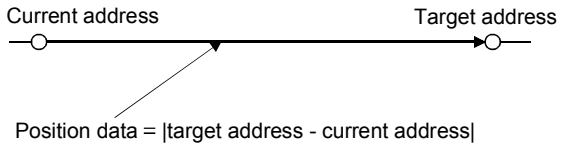
Setting range: −999999 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.1)



(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)



(2) Point table

(a) Point table setting

Up to 15 point tables may be set. To use point table No.4 to 15, however, the point table No. selection 3 signal (DI2) and/or point table No. selection 4 signal (DI3) should be made valid in "I/O Devices" on the Servo Configuration Software.

Set the point tables using the Servo Configuration Software or the servo amplifier operation section.

The following table lists what to set:

Name	Setting Range	Unit	Description
Position data	Absolute value command system: −999999 to 999999 Incremental value command system: 0 to 999999	[$\times 10^{STM}\mu m$]	In the absolute value command system, motion is made to the set address. In the incremental value command system, motion is made over the set distance. Use the parameter to select the incremental value command or absolute value command. A negative value cannot be set to the incremental value command.
Motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the 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 time	0 to 20000	ms	Set the dwell time. Set "0" in the auxiliary function to make the dwell time invalid. Set "1" in the auxiliary function and 0 in the dwell time to perform continuous operation. When the dwell time is set, the position command of the selected point table is completed, and after the set dwell time has elapsed, the position command of the next point table is started.
Auxiliary function	0 ▪ 1		Set the auxiliary function. Set "1" to execute point tables consecutively without a stop. 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.15 results in an error. For full information, refer to Section 4.2.5.

(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 15, the point table No. selection 3 input signal (DI2) and/or point table No. selection 4 input signal (DI3) should be made valid in I/O Devices (Refer to Chapter 6) on the Servo Configuration.

When the communication function is used to select the point tables, refer to Chapter 8 for details of the command transmission method, etc.

(Note 2) Input Signals				Selected Point Table No.
(Note 1) DI3	(Note 1) DI2	DI1	DI0	
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Note: 1. Make signals valid in I/O Devices on the Servo Configuration Software.
2.1: DI3/DI2/DI1-DI-SG open.
0: DI3/DI2/DI1-DI0-SG shorted.

(3) Parameter setting

Set the following parameters to perform automatic operation:

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

Select the absolute value command system or incremental value command system.

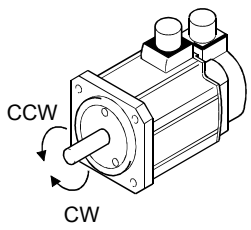
Parameter No. 0 Setting	Positioning System
□□0□	Absolute value command
□□1□	Incremental value command

(b) Operation 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.

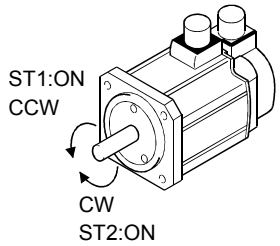
1) Absolute value command

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

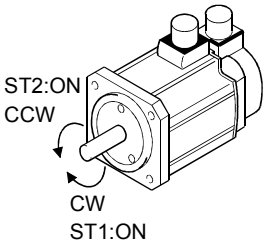


2) Incremental value command system

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. The actual moving distance is the result of multiplying the entered position data by the unit multiplication factor.

1) Absolute value command

Parameter No.1 Setting	Feed Length Multiplication STM [Times]	Position Data Input Range [mm]
□□0□	Position data × 1	−999.999 to +999.999
□□1□	Position data × 10	−9999.99 to +9999.99
□□2□	Position data × 100	−99999.9 to +99999.9
□□3□	Position data × 1000	−999999 to +999999

2) Incremental value command system

Parameter No.1 Setting	Feed Length Multiplication STM [Times]	Position Data Input Range [mm]
□□0□	Position data × 1	0 to 999.999
□□1□	Position data × 10	0 to 9999.99
□□2□	Position data × 100	0 to 99999.9
□□3□	Position data × 1000	0 to 999999

4.2.2 Absolute value command system

(1) Setting

(a) Signal, parameters

Set the input signal and parameters as follows according to the purpose of use:

Item	Setting Method	Description
Automatic operation mode selection	Automatic/manual selection signal (MD0)	Short MD0-SG (ON).
Absolute value command system selection	Parameter No.0	Setting: □□0□
Servo motor rotation direction	Parameter No.1	Refer to Section 4.2.1, (3).
Feed length multiplication	Parameter No.1	Refer to Section 4.2.1, (3).

(b) Point table

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

Point Table No.	Position Data [$\times 10^{STM}$μm]	Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms]	Auxiliary Function
1	2000	3000	200	150	0	0
2	−100	1500	250	200	0	0
3	500	200	150	250	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
14	15000	1800	200	250	0	0
15	12000	2500	200	250	0	0

(2) Operation

Choose the point table using DI0 to DI3 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 signal (MD0)	Short MD0-SG (ON).
Point table selection	Point table No. selection 1 signal (DI0) Point table No. selection 2 signal (DI1) Point table No. selection 3 signal (DI2) Point table No. selection 4 signal (DI3)	Refer to Section 4.2.1, (2).
Start	Forward rotation start signal (ST1)	Short ST1-SG (ON) to start.

4.2.3 Incremental value command system

(1) Setting

(a) Signal, parameters

Set the input signal and parameters as follows according to the purpose of use:

Item	Setting Method	Description
Automatic operation mode selection	Automatic/manual selection signal (MD0)	Short MD0-SG (ON)
Incremental value command system selection	Parameter No.0	Setting: □□1□
Servo motor rotation direction	Parameter No.1	Refer to Section 4.2.1, (3).
Feed length multiplication	Parameter No.1	Refer to Section 4.2.1, (3).

(b) Point table

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

Point Table No.	Position Data [$\times 10^{STM}$μm]	Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms]	Auxiliary Function
1	2000	3000	200	150	0	0
2	100	1500	250	200	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮
14	15000	1800	200	250	0	0
15	12000	2500	200	250	0	0

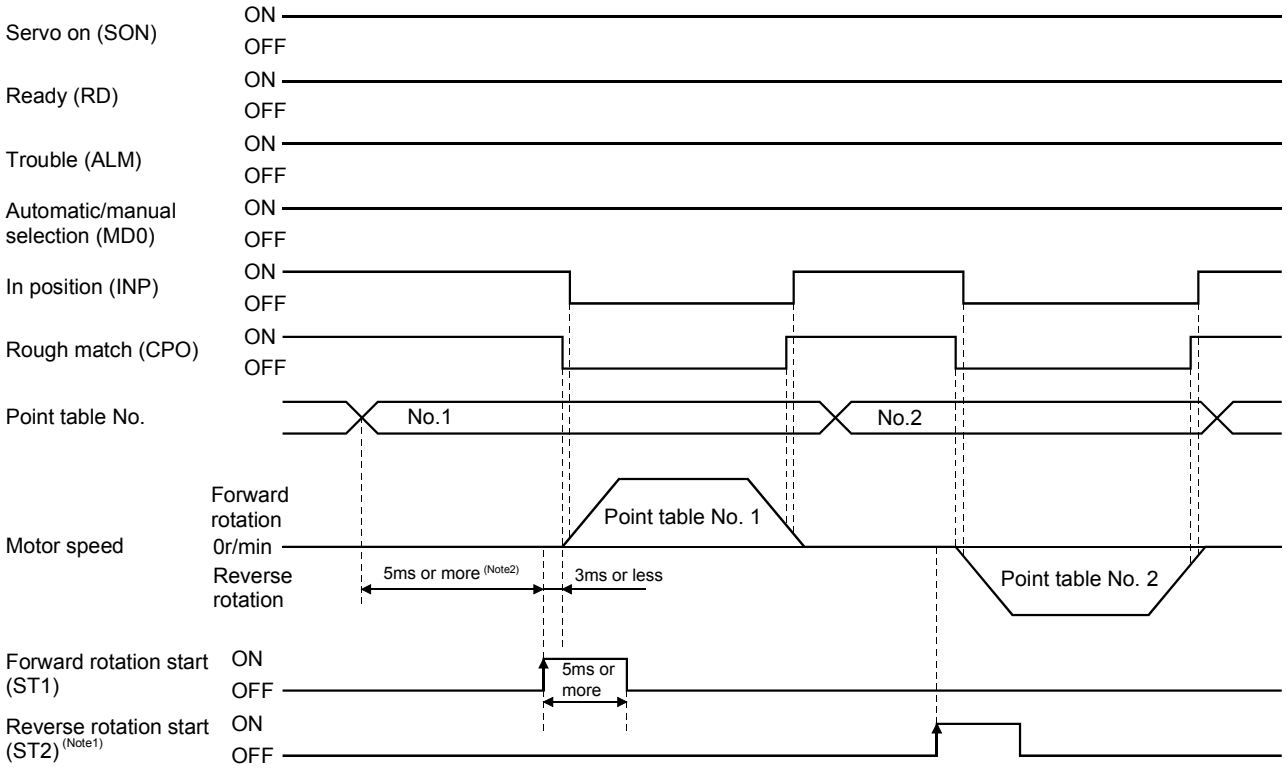
(2) Operation

Choose the point table using DI0 to DI3 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 signal (MD0)	Short MD0-SG (ON)
Point table selection	Point table No. selection 1 signal (DI0) Point table No. selection 2 signal (DI1) Point table No. selection 3 signal (DI2) Point table No. selection 4 signal (DI3)	Refer to Section 4.2.1, (2).
Start	Forward rotation start signal (ST1)	Short ST1-SG (ON) to start motion in forward rotation direction.
	Reverse rotation start signal (ST2)	Short ST2-SG (ON) to start motion in reverse rotation direction.

4.2.4 Automatic operation timing chart

The following is the timing chart.



Note1: Reverse rotation start (ST2) is invalid for absolute value command system.

2: A delay of the input filter setting time set in parameter No. 2 will occur in detection of the external signal.
Make up a sequence that will change the point table selection earlier by the time into which the fluctuation of the signal variation caused by the sequence of the output signal from the servo system controller and by the hardware has been considered.

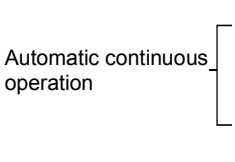
4.2.5 Automatic continuous operation

(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:



Point Table Setting	
Dwell time	Auxiliary function
0	1
1 or more	1

(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 position data and 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.14, operation can be performed at a maximum of 15 speeds. Set "0" to the auxiliary function of the last point table.

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

The following table gives a setting example:

Point Table No.	Dwell Time [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".

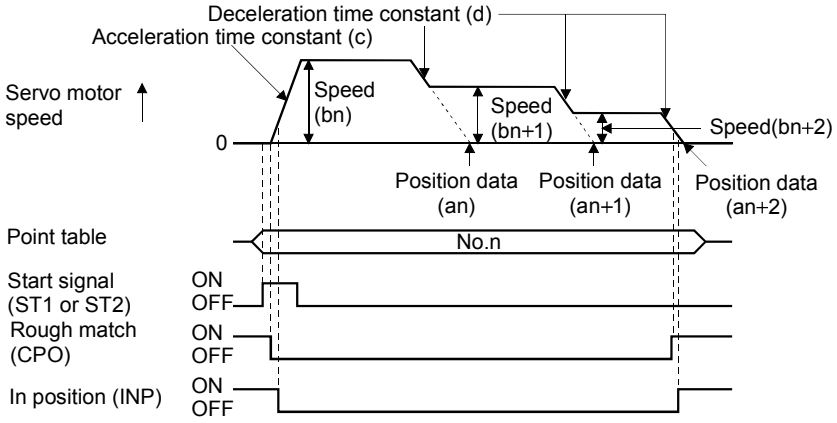
2. Always set "0" to the auxiliary function of the last point table among the consecutive point tables.

In the absolute value command system, 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.

In the incremental value command system, the position data is the total of the position data of the consecutive point tables.

(a) Absolute value command system

1) Positioning in the same direction

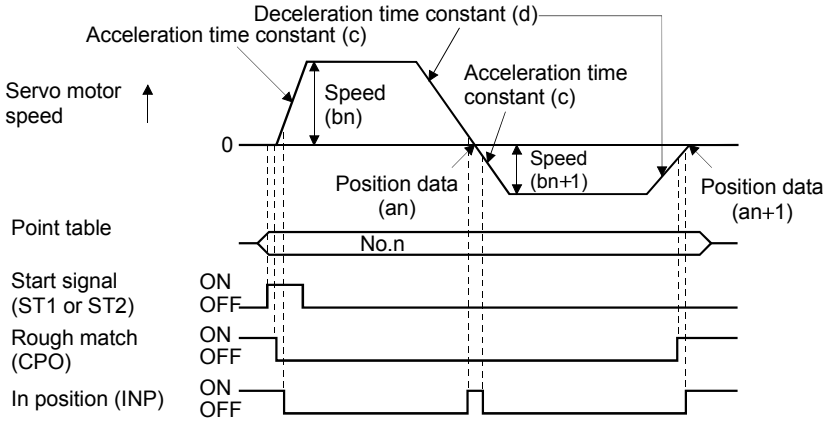


Point Table No.	Position Data [$\times 10^{STM}$ μm]	Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms] (Note 1)	Auxiliary Function
n	an	bn	c	d	0	1
n + 1	an + 1	bn + 1	Invalid	Invalid	0	1
n + 2	an + 2	bn + 2	Invalid	Invalid	0	0 (Note 2)

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 changed in direction midway

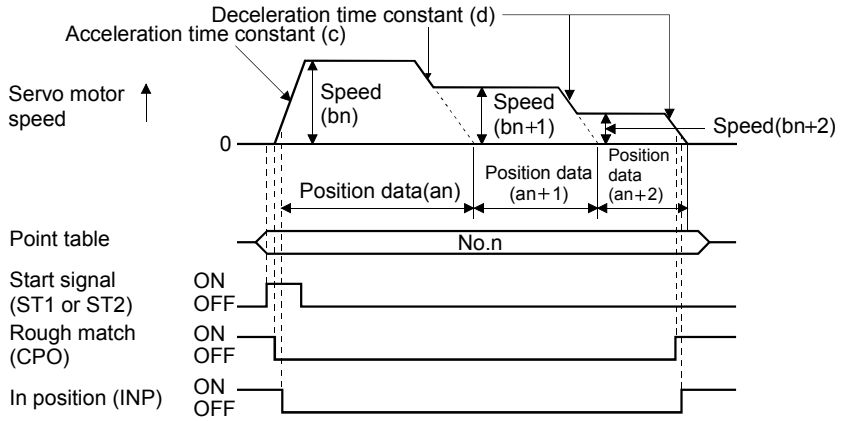


Point Table No.	Position Data [$\times 10^{STM}$ μm]	Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms] (Note 1)	Auxiliary Function
n	an	bn	c	d	0	1
n + 1	an + 1	bn + 1	Invalid	Invalid	0	0 (Note 2)

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



Point Table No.	Position Data [$\times 10^{STM}$ μm]	Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]	Dwell Time [ms] (Note 1)	Auxiliary Function
n	an	bn	c	d	0	1
n + 1	an + 1	bn + 1	Invalid	Invalid	0	1
n + 2	an + 2	bn + 2	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.

(3) Automatic continuous positioning operation

By merely choosing one point table and performing operation, operation can be performed in accordance with consecutive point tables. Set the period from a stop to the next start in the dwell time of the point table.

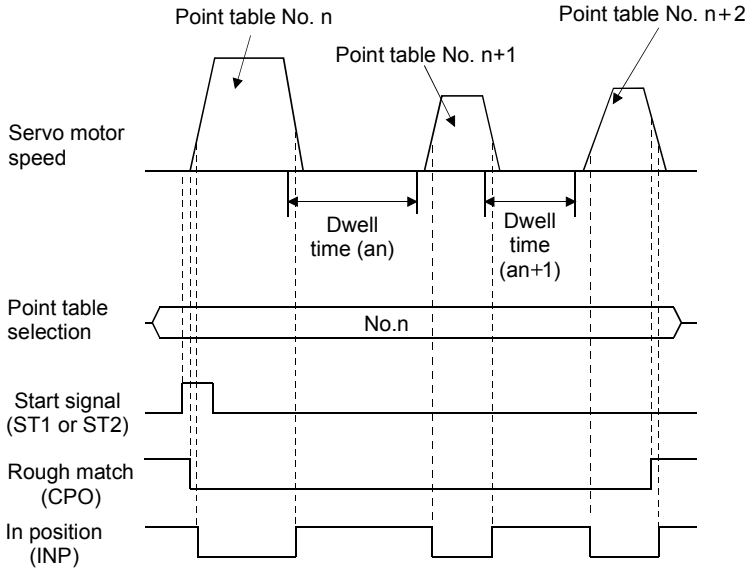
By setting "1" to the auxiliary function of up to point table No.14, automatic continuous positioning operation can be performed in accordance with a maximum of 15 point tables.

Always set "0" to the auxiliary function of the last point table. Note that if "0" is set to the dwell time, varied speed operation will be performed.

The following table gives a setting example:

Point Table No.	Dwell Time [ms] (Note 1)	Auxiliary Function	Variable Speed Operation
1	3000	1	Consecutive point table data
2	1000	1	
3		0 (Note 2)	
4	5000	1	Consecutive point table data
5	1000	1	
6	1000	1	
7		0 (Note 2)	

Note: 1. Always set "1" or more.
2. Always set "0" to the auxiliary function of the last point table among the consecutive point tables.



Point Table No.	Dwell Time [ms] (Note 1)	Auxiliary Function
n	an	1
n + 1	an + 1	1
n + 2	Invalid	0 (Note 2)

Note: 1. Always set "1" or more.

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

(4) Temporary stop/restart

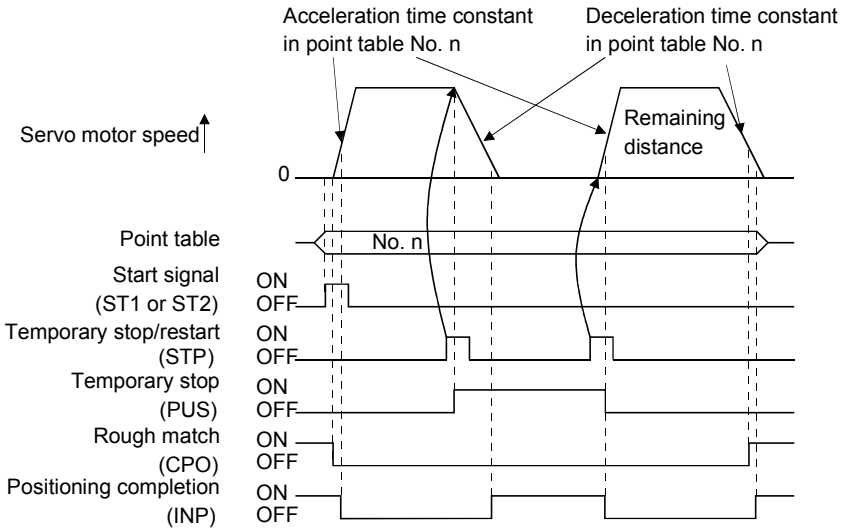
When STP-SG are connected during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When STP-SG are connected again, the remaining distance is executed.

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

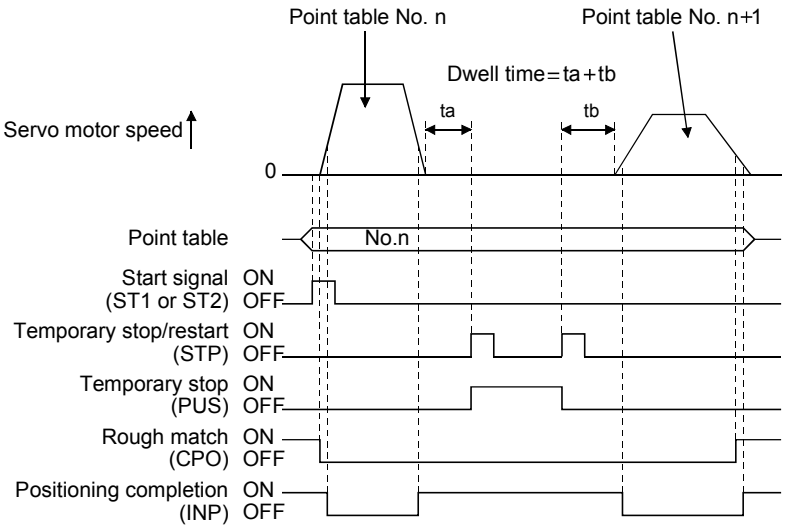
The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

The temporary stop/restart input is ignored during home position return and jog operation.

(a) When the servo motor is rotating



(b) During dwell time



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

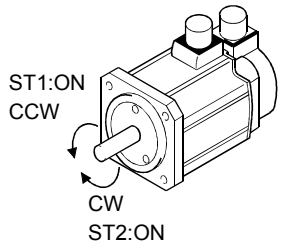
(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 4 signals (DI0 to DI3) are invalid:

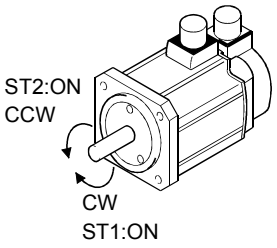
Item	Setting Method	Description
Manual operation mode selection	Automatic/manual selection signal (MD0)	Open MD0-SG (OFF).
Servo motor rotation direction	Parameter No.1	Refer to (2) in this section.
Jog speed	Parameter No.13	Set the speed of the servo motor.
Acceleration/deceleration time constant	Point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

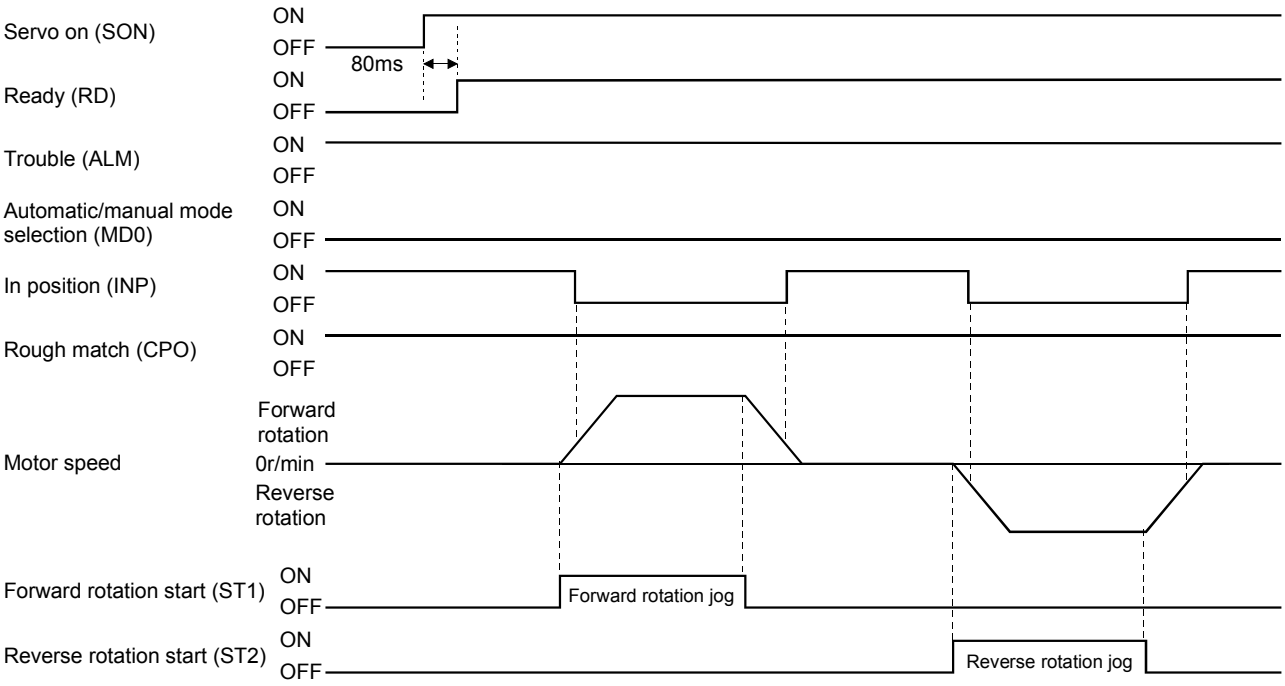


Parameter No. 1 □□□1

(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) in this section. By shorting ST2-SG, the servo motor rotates in the reverse direction to ST1.

(4) Timing chart



4.3.2 Manual pulse generator operation

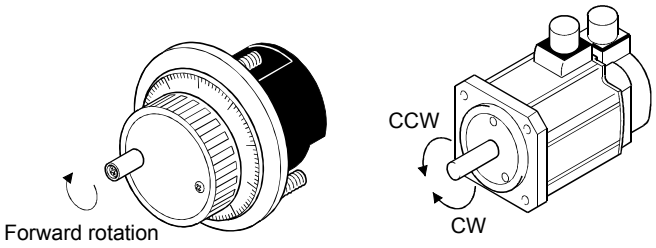
(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 4 signals (DI0 to DI3) are invalid:

Item	Setting Method	Description
Manual operation mode selection	Automatic/manual selection signal (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) in this section.
Servo motor rotation direction	Parameter No.1	Refer to (2) in 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 Servo Configuration Software (refer to Chapter 6).

Pulse Generator Multiplication 2 (across TP1)	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, refer to (2) in 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. Home position return is required every time input power is switched on.
The MR-J2-03C5 has the home position return methods given in this section. Choose the most appropriate method for your machine structure and application.
The MR-J2-03C5 has the automatic home position 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

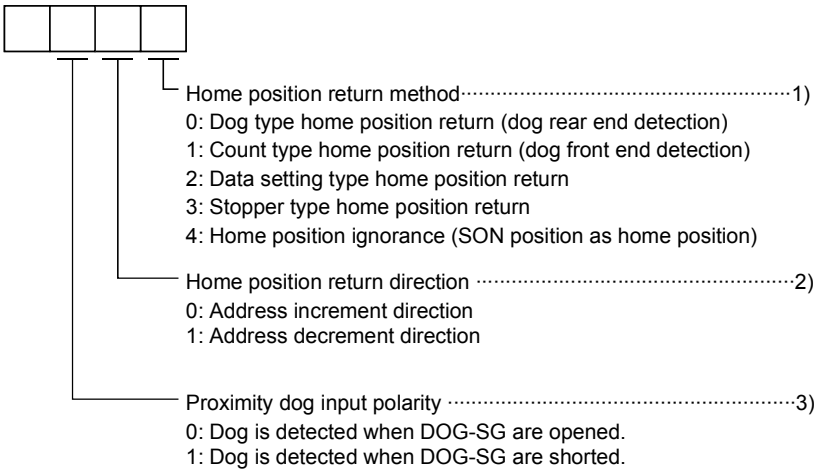
Five manual home position return types are available. Choose the optimum home position return according to the machine type, etc.

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 and 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 stopper, home position return speed must be set to a fully low value and the machine and stopper strength must be fully considered.
Home position ignorance (Servo-on position as home position)	The position where servo is switched on 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:



1) Choose the home position method.
2) Choose the starting direction of home position. Set "0" to start home position in the direction in which the address is incremented from the current position, or "1" to start home position 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, always make sure that the limit switch operates.
2) Confirm the home position 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 signal (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 (3) in this section and choose home position return direction.
Dog input polarity	Parameter No.8	Refer to (3) in this section 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	Address reached by home position return is stored automatically.

(2) Length of proximity dog

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

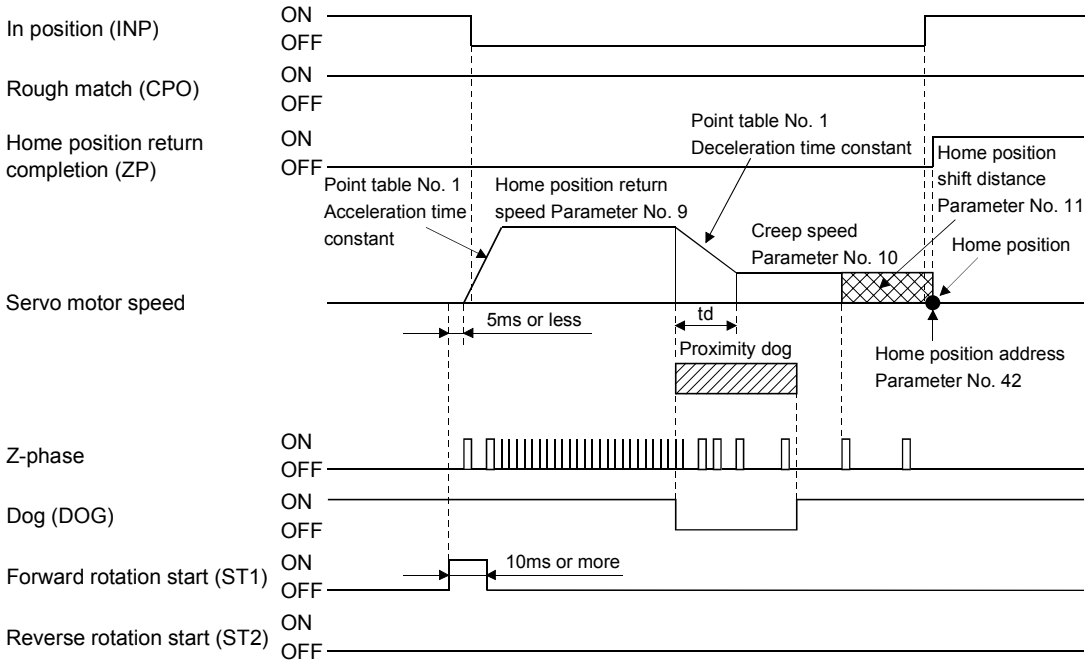
$$L_1 \geq \frac{V}{60} \bullet \frac{td}{2} \quad \text{..... (4.2)}$$

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

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

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

(3) Timing chart



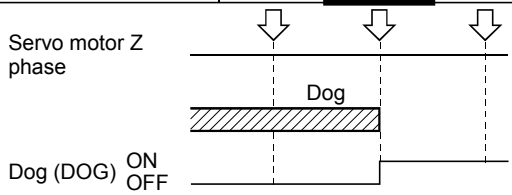
The address on completion of home position return is the value automatically set in parameter No.42 (home position return position data).

(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 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".

Servo motor	Within one-revolution position		
HC-AQ	0	8192	0



4.4.3 Count type home position return

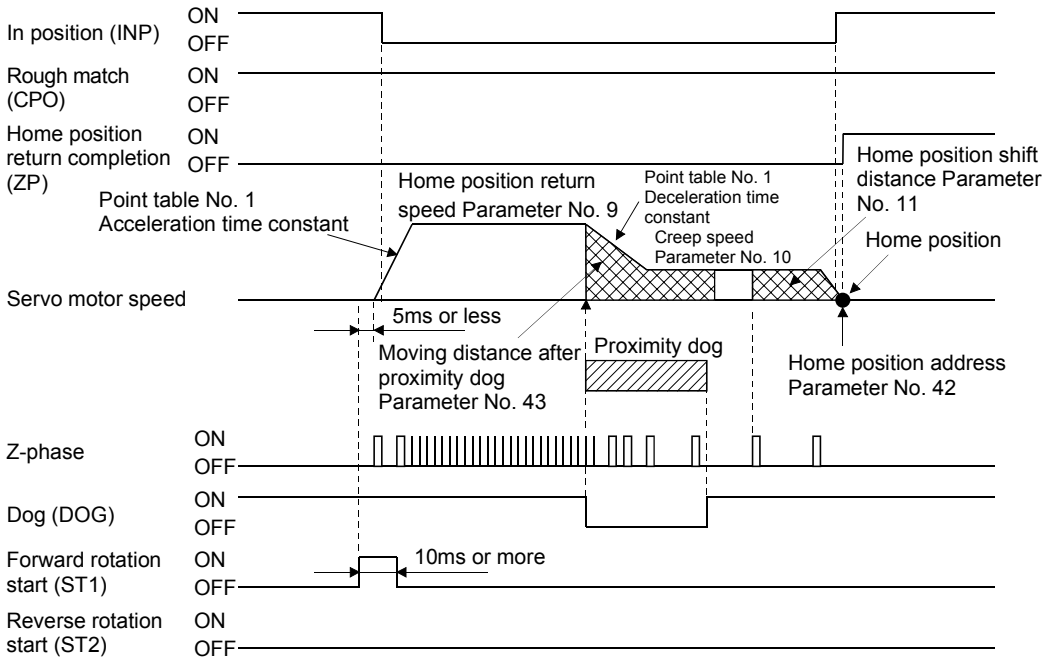
In count type home position return, a motion is made over the distance set in parameter No.43 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the dog signal (DOG) 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 dog signal 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 signal (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 (3) and choose home position return direction.
Dog input polarity	Parameter No.8	Refer to Section 4.4.1 (3) 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	Parameter No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.42	Set the current position at home position return completion.

(2) Timing chart



The address on completion of home position return is the value automatically set in parameter No.42 (home position return position data).

4.4.4 Data setting type home position return

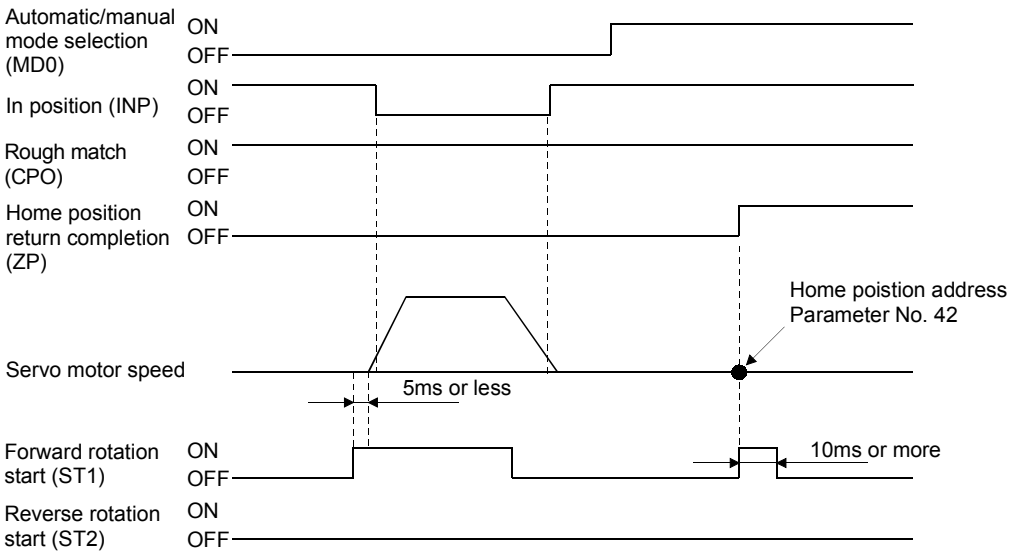
In data setting type home position return, a motion is made to any position by jog operation, manual pulse generator operation or the like to make a home position return, and the position reached is defined as a home position.

(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 signal (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	Set the current position at home position return completion.

(2) Timing chart



The address on completion of home position return is the value automatically set in parameter No.42 (home position return position data).

4.4.5 Stopper type home position return

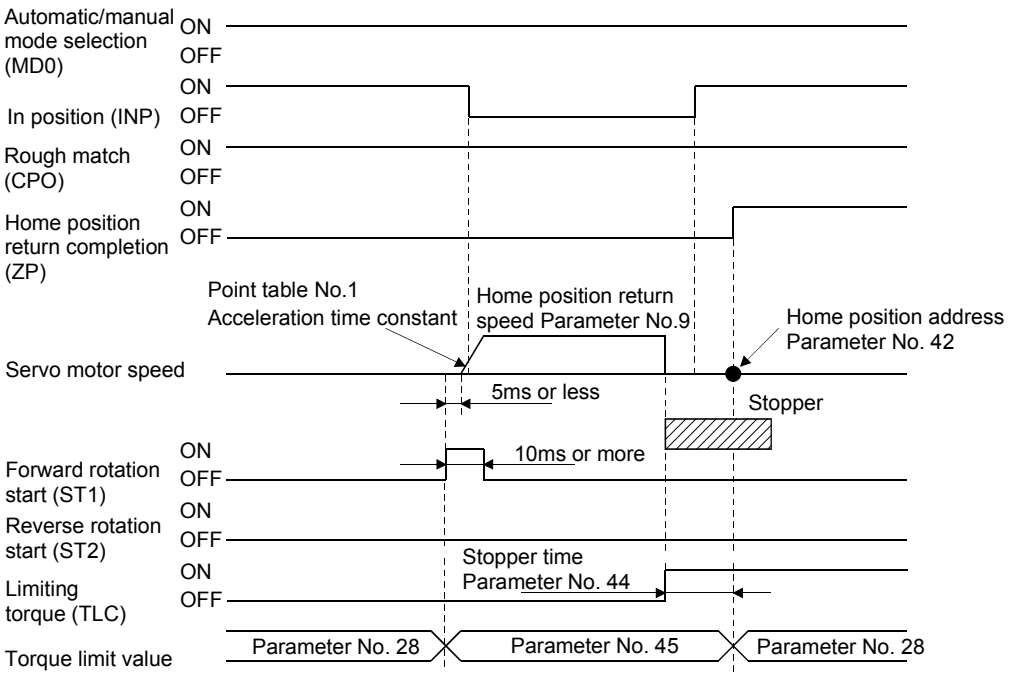
In stopper type home position return, a machine part is pressed against a stopper or the like by jog operation, manual pulse generator operation or the like to make a home position return and that position is defined as a home position.

(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 signal (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	Set the current position at home position return completion.

(2) Timing chart



The address on completion of home position return is the value automatically set in parameter No.42 (home position return position data).

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

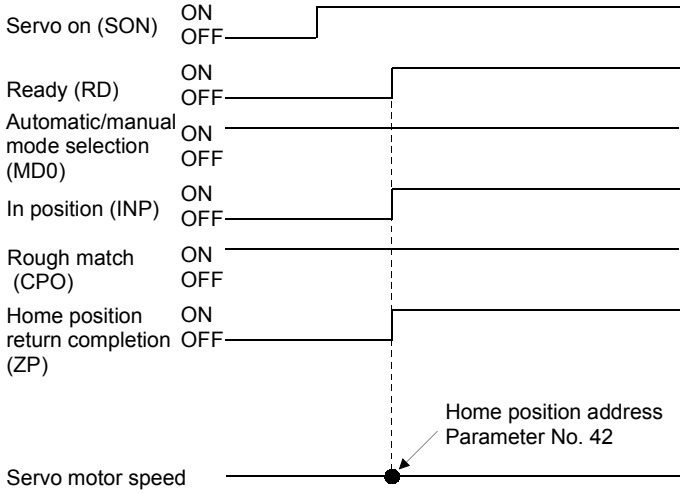
The position where servo is switched on is defined as a home position as soon as servo is switched on.

(1) Signals, parameter

Set the input signals and parameter as follows:

Item	Device/Parameter Used	Description
Manual home position mode selection	Automatic/manual selection signal (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 ignorance	Parameter No.8	□□□4: Home position ignorance is selected.
Home position return position data	Parameter No.42	Set the current position at home position return completion.

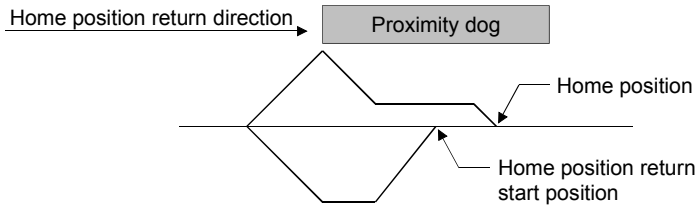
(2) Timing chart



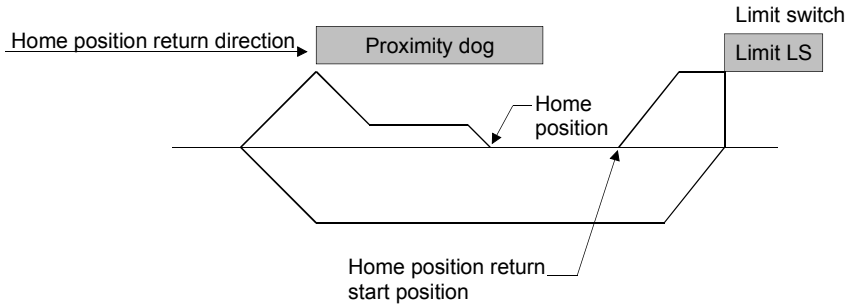
The address on completion of home position is the value automatically set in parameter No.42 (home position return position data).

4.4.7 Automatic home position return function

If the current position is at or beyond the proximity dog in dog or count type home position return, you need not make a start after making a return by jog operation or the like.
When the current position is at the proximity dog, an automatic return is made before home position return.



At a start, a motion is made in the home position return direction and an automatic return is made on detection of the limit switch. 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 limit switch and A. 90 occurs.



Software limit cannot be used with these functions.

4.5 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 8 for full information on the connection and transferred data between the controller and servo amplifier.

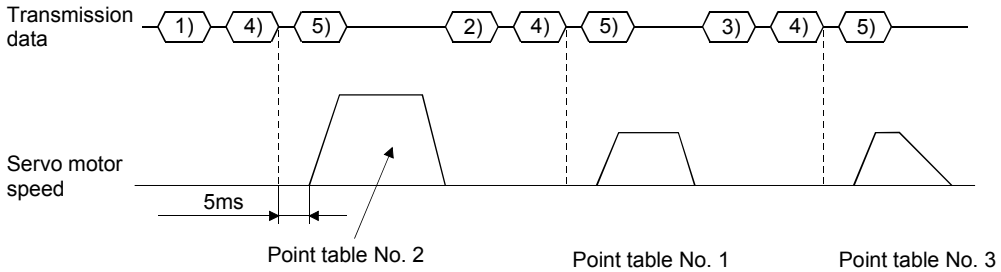
4.5.1 Positioning operation in accordance with point tables

By selecting the point table No. and switching on the start signal (ST1, 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 15.

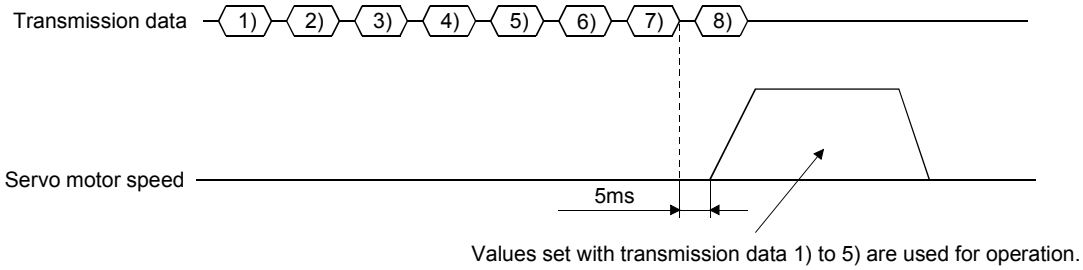
(2) Timing chart



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]

4.5.2 Positioning operation

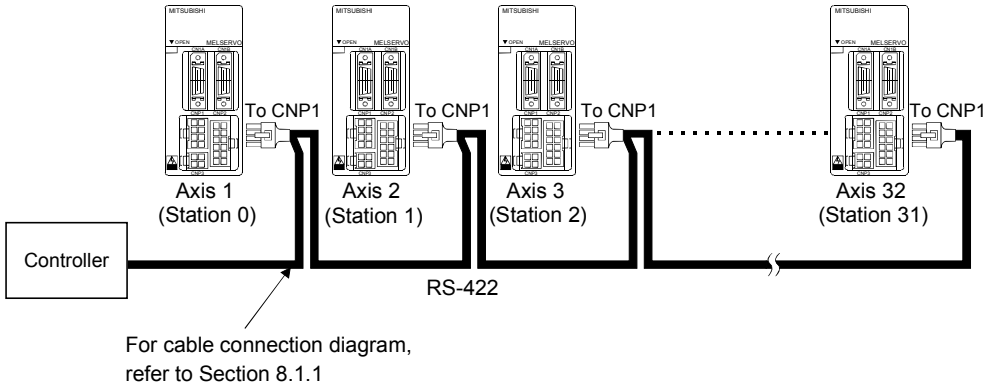
Positioning operation can be performed by changing the point table settings and making a start. For example, positioning operation can be performed by writing the data of point table No.1, then specifying point table No.1, and making a start.
For transmission data details, refer to Chapter 8.



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]

4.5.3 Multidrop system

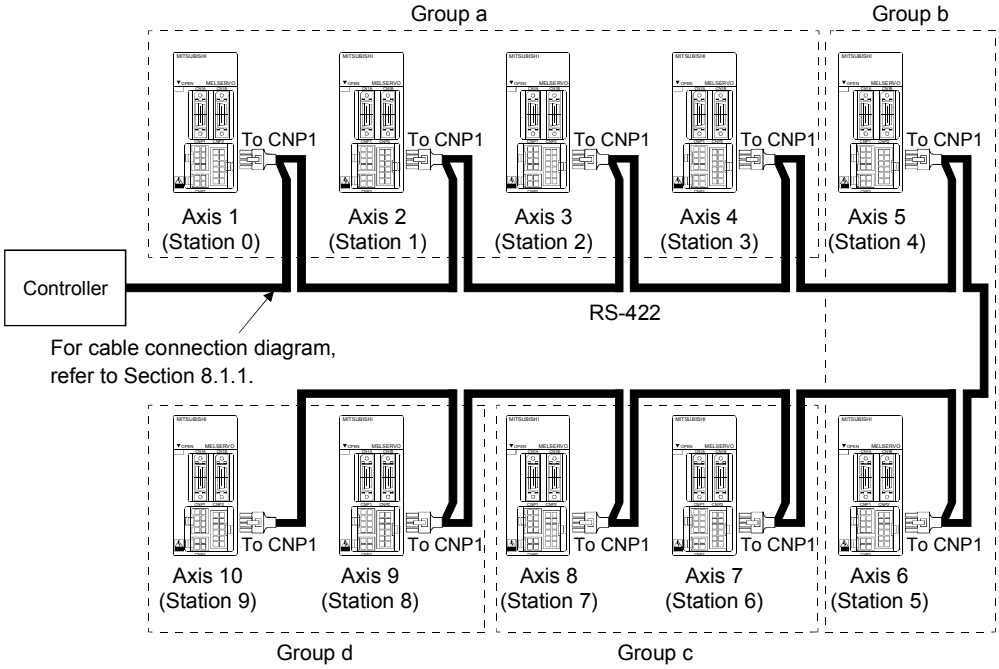
The RS-422 communication function can be used to operate several servo amplifiers on the same bus. In this case, set the station numbers to the servo amplifiers to determine the destination servo amplifier of the currently transmitted data. Use parameter No.15 to set the station numbers.
Always set one 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.



4.5.4 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.

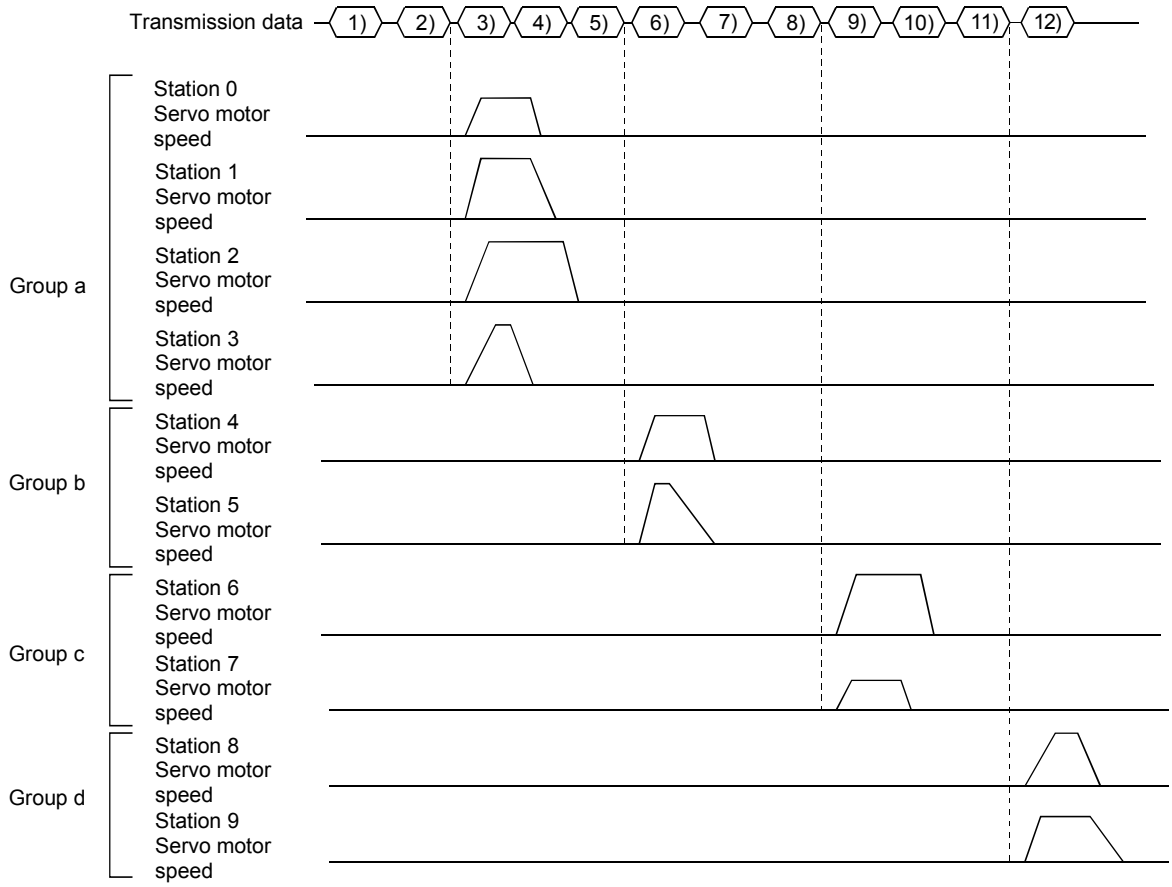
(1) Group setting example



Servo Amplifier Station No.	Group Setting
0	a
1	
2	
3	
4	b
5	
6	c
7	
8	d
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.

POINT
・In the maker setting parameters, do not set values other than the initial values.

5.1 Parameter list

5.1.1 Parameter write inhibit

POINT
・Set "000E" when using the 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 MR-J2-03C5 servo amplifier, its parameters are classified into the basic parameters (No.0 to 19) and expansion parameters (No.20 to 66) 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 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 No.20 to No.53	Expansion Parameters No.54 to No.66
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 Lists

POINT

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

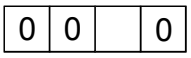
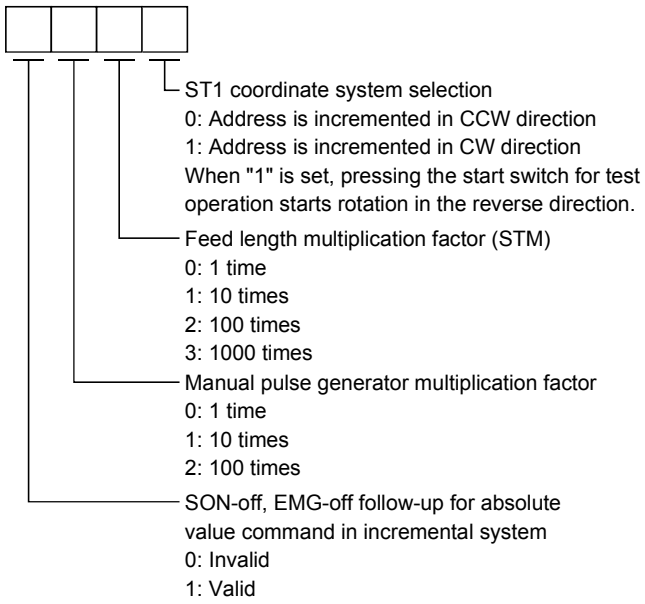
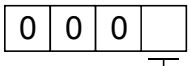
For details of the parameters, refer to the corresponding items.

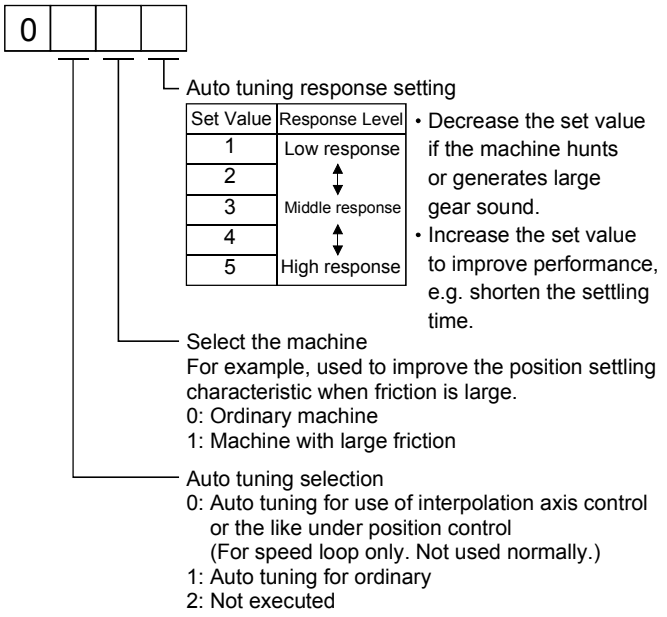
(1) Item list

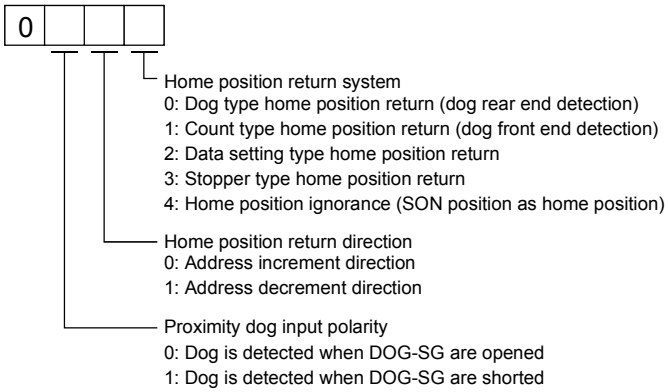
Class	No.	Symbol	Name and Function	Initial Value	Unit	Customer Setting
Basic parameters	0	*STY	Command system selection	0000		
	1	*FTY	Feeding function selection	0000		
	2	*OP1	Function selection 1	0002		
	3	AUT	Auto tuning	0104		
	4	*CMX	Electronic gear numerator	1		
	5	*CDV	Electronic gear denominator	1		
	6	INP	In-position range	100	pulse	
	7	PG1	Position loop gain 1	145	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	$\times 10^{STM}$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 baudrate	0100		
	17		For manufacture setting	0		
	18	*DMD	Status display selection, alarm history clear	0000		
	19	*BLK	Parameter write inhibit	0000		

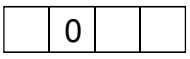
Class	No.	Symbol	Name and Function	Initial Value	Unit	Customer Setting
Expansion parameters	20	＊OP2	Function selection 2	0000		
	21	＊OP3	For manufacturer setting	0002		
	22	＊OP4	Function selection 4	0000		
	23	SIC	Serial communications time-out selection	0		
	24	FFC	Feed forward gain	0	%	
	25	VCO	Override offset	0	mV	
	26	TLO	Torque limit offset	0	mV	
	27		For manufacturer setting	0		
	28	TL1	Internal torque limit 1	100	%	
	29	TL2	Internal torque limit 2	100	%	
	30	＊BKC	Backlash compensation	0	pulse	
	31		For manufacturer setting	0000	mV	
	32			0	mV	
	33	MBR	Electromagnetic brake sequence output	0	ms	
	34	DG2	Ratio of load inertia moment to motor inertia moment	3.0	0.1 times	
	35	PG2	Position loop gain 2	97	rad/s	
	36	VG1	Speed loop gain 1	873	rad/s	
	37	VG2	Speed loop gain 2	1144	rad/s	
	38	VIC	Speed integral compensation	20	ms	
	39	VDC	Speed differential compensation	980		
	40		For manufacturer setting	0		
	41		For manufacturer setting	0		
	42	＊ZPS	Home position return position data	0	$\times 10^{STM}\mu m$	
	43	DCT	Moving distance after proximity dog	1000	$\times 10^{STM}\mu m$	
	44	ZTM	Stopper type home position return stopper time	100	ms	
	45	ZTT	Stopper type home position return torque limit value	15	%	
	46 47	＊LMP	Software limit +	0	$\times 10^{STM}\mu m$	
	48 49	＊LMN	Software limit －	0	$\times 10^{STM}\mu m$	
	50 51	＊LPP	Position range output address +	0	$\times 10^{STM}\mu m$	
	52 53	＊LNP	Position range output address －	0	$\times 10^{STM}\mu m$	
	54 to 66		For manufacturer setting			

(2) Detail list

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Basic parameters	0	*STY	Command system selection Used to select the command system.  	0000		Refer to Name and function column.	Section 4.2
	1	*FTY	Feeding function selection Used to set the feed length multiplication factor and manual pulse generator multiplication factor.  	0000		Refer to Name and function column.	Section 4.2.1 Section 4.2.1 Section 4.3.2
	2	*OP1	Function selection 1 Used to select the input filter and absolute position detection system.  	0002		Refer to Name and function column.	

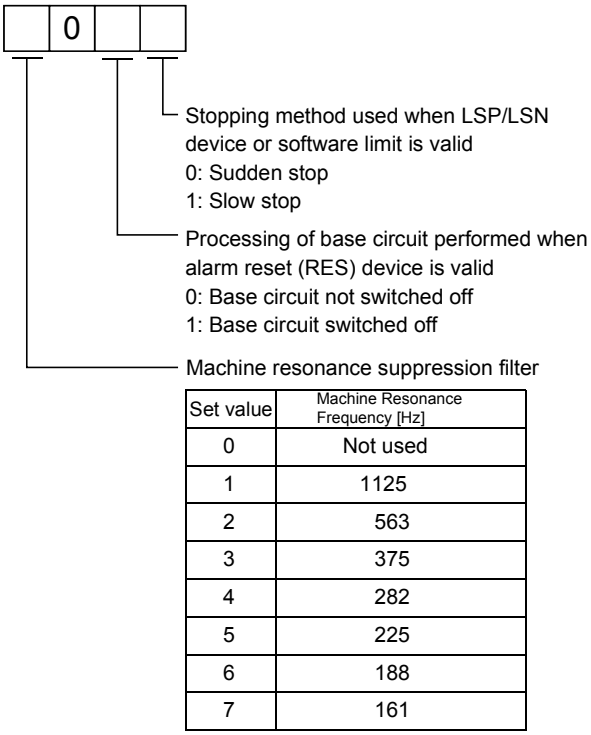
Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Basic parameters	3	AUT	Auto tuning Used to set the response level, etc. for execution of auto tuning.  	0104		Refer to Name and function column.	Chapter 9
	4	*CMX	Electronic gear numerator Set the value of electronic gear numerator. Refer to Section 5.2.1 for setting.	1		1 to 32767	Section 5.2.1
	5	*CDV	Electronic gear denominator Set the value of electronic gear denominator. Refer to Section 5.2.1 for setting.	1		1 to 32767	Section 5.2.1
	6	INP	In-position range Used to set the droop pulse range when the in-position (INP) signal is output.	100	pulse	0 to 10000	

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Basic parameters	7	PG1	Position loop gain 1 Used to set the gain of position loop 1. Increase the gain to improve tracking performance in response to the position command.	146	rad/s	4 to 1000	Chapter 9
	8	*ZTY	Home position return type Used to set the home position return system, home position return direction and proximity dog input polarity.  	0010		Refer to Name and function column.	Section 4.4
	9	ZRF	Home position return speed Used to set the motor speed for home position return.	500	r/min	0 to permissible speed	Section 4.4
	10	CRF	Creep speed Used to set the creep speed after proximity dog detection.	10	r/min	0 to permissible speed	Section 4.4
	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	Section 4.4
	12	CRP	Rough match output range Used to set the command remaining distance range where the rough match (CPO) signal is output.	0	$\times 10^{STM}$ μm	0 to 65535	Section 5.2.6
	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 an S-pattern time constant into the acceleration/deceleration time constant of the point table. This time constant is invalid for home position return.	0	ms	0 to 100	Section 5.2.3
	15	*SNO	Station number setting Used to specify the station number for multidrop communication. Always set one station to one axis of servo amplifier. If one station number is set to two or more stations, normal communication cannot be made.	0	Station	0 to 31	

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Basic parameters	16	＊BPS	Communication baudrate Used to select the RS-422/RS-232C communication baudrate and choose various conditions for communication.  RS-422/RS-232C baudrate selection 0: 9600[bps] 1: 19200[bps] 2: 4800[bps] Protocol checksum selection 0: Yes (checksum added) 1: No (checksum not added) RS-422/RS-232C communication standard selection 0: RS-422 used 1: RS-232C used Communication response delay time 0: Invalid, reply sent in less than 400ms 1: Valid, reply sent in 400μs or more	0100		Refer to Name and function column.	Section 8.2.2
	17		For manufacturer setting Must not be changed.	0			
	18	＊DMD	Status display selection, alarm history clear Used to select the status display shown at power-on and choose alarm history clear.  Status display on servo amplifier display at power-on 0: Motor speed (initial value) 1: Regenerative load ratio 2: Effective load ratio 3: Peak load ratio 4: Within one-revolution position 5: ABS count 6: Load inertia moment Status display of MR-DP60 0: Current position (initial value) 1: Command position 2: Command remaining distance 3: Point table No. 4: Cumulative feedback pulses 5: Motor speed 6: Droop pulses 7: Override 8: Torque limit voltage 9: Regenerative load ratio A: Effective load ratio B: Peak load ratio C: Within one-revolution position D: ABS counter E: Load inertia moment Alarm history clear 0: Invalid (not cleared) 1: Valid (cleared) 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).	0000		Refer to Name and function column.	Section 7.2 Section 7.2 Section 5.2.5

<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><th>Refer To</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 No.20 to 53</th><th>Expansion Parameters No.54 to 66</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 Servo Configuration Software.</td><td>0000</td><td></td><td>Refer to Name and function column.</td><td>Section 5.1.1</td></tr>
<tr><td>Expansion parameters</td><td>20</td><td>＊OP2</td><td>Function selection 2
Used to select slight vibration suppression control.
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>
Slight vibration suppression control selection
0: Invalid
1: Valid</td><td>0000</td><td></td><td>Refer to Name and function column.</td><td>Section 3.4.4

Section 9.5</td></tr>
<tr><td></td><td>21</td><td></td><td>For manufacturer setting
Must not be change</td><td>0002</td><td></td><td></td><td></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><th>Refer To</th></tr>
<tr><td rowspan="10">Expansion parameters</td><td>22</td><td>＊OP4</td><td>Function selection 4
Used to select stop processing at LSP/LSN signal off and choose the machine resonance suppression filter.
 

<table><tr><th>Set value</th><th>Machine Resonance Frequency [Hz]</th></tr><tr><td>0</td><td>Not used</td></tr><tr><td>1</td><td>1125</td></tr><tr><td>2</td><td>563</td></tr><tr><td>3</td><td>375</td></tr><tr><td>4</td><td>282</td></tr><tr><td>5</td><td>225</td></tr><tr><td>6</td><td>188</td></tr><tr><td>7</td><td>161</td></tr></table></td><td>0000</td><td></td><td>Refer to Name and function column.</td><td>Section 5.2.5

Chapter 9</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><td></td></tr>
<tr><td>24</td><td>FFC</td><td>Feed forward gain
Used to set the feed forward gain.
When it is set to 100%, droop pulses will be almost zeroed in constant-speed operation. Note that sudden acceleration/ deceleration will increase overshoot. As a guideline, specify 1s or more as the acceleration/deceleration time constant to the rated speed when you set the feed forward gain to 100%. When setting this parameter, always set auto tuning (parameter No. 3) to "No".</td><td>0</td><td>%</td><td>0 to 100</td><td></td></tr>
<tr><td>25</td><td>VCO</td><td>Override offset
Used to set the offset voltage to analog override.</td><td>0</td><td>mV</td><td>－999 to 999</td><td>Section 3.4.3</td></tr>
<tr><td>26</td><td>TL0</td><td>Torque limit offset
Used to set the offset voltage to analog torque limit.</td><td>0</td><td>mV</td><td>－999 to 999</td><td>Section 3.4.4</td></tr>
<tr><td>27</td><td></td><td>For manufacture setting
Must not be change</td><td>0</td><td></td><td></td><td></td></tr>
<tr><td>28</td><td>TL1</td><td>Internal torque limit 1
Used to limit servo motor-generated torque on the assumption that the maximum torque is 100%. When 0 is set, torque is not produced.</td><td>100</td><td>%</td><td>0 to 100</td><td>Section 3.4.4</td></tr>
<tr><td>29</td><td>TL2</td><td>Internal torque limit 2
Used to limit servo motor-generated 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 signal.</td><td>100</td><td>%</td><td>0 to 100</td><td>Section 3.4.4</td></tr>
</table>

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	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.	0	pulse	0 to 1000	
	31		For manufacturer setting Must be not change.	0000			
	32			0			
	33	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake switches off and when the base circuit is shut off.	0	ms	0 to 1000	Section 3.8
	34	GD2	Ratio of load inertia moment to motor inertia moment: Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning is selected, the result of auto tuning is automatically set.	3.0	×0.1 times	0 to 1000	Chapter 9
	35	PG2	Position loop gain 2 Used to set the gain of the position loop. 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.	97	rad/s	1 to 500	Chapter 9
	36	VG1	Speed loop 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. When auto tuning is selected, the result of auto tuning is automatically set.	873	rad/s	20 to 5000	Chapter 9
	37	VG2	Speed loop 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. When auto tuning is selected, the result of auto tuning is automatically set.	1144	rad/s	20 to 8000	Chapter 9
	38	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. When auto tuning is selected, the result of auto tuning is automatically set.	20	ms	1 to 1000	Chapter 9
	39	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control signal is switched on.	980		0 to 1000	Chapter 9
	40		For manufacture setting Must not change.	0			
	41			0			
	42	＊ZPS	Home position return position data Used to set the current position on completion of home position return.	0	×10^{STM} μm	−32768 to 32767	Section 4.4
	43	DCT	Moving distance after proximity dog Used to set the moving distance after proximity dog in count type home position return.	1000	×10^{STM} μm	0 to 65535	Section 4.4.3

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	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 (ZTT) is reached to when the home position is set.	100	ms	5 to 1000	Section 4.4.5
	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.	15	%	1 to 100	Section 4.4.5
	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 − (parameter No.48・No.49). Set the same sign to parameters No.46 and 47. Setting of different signs will result in a parameter error. Set address:□□□□□□ Upper 3 digits / Lower 3 digits Parameter No. 47 Parameter No. 46	0	×10^{STM} μm	−999999 to 999999	Section 5.2.7
	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 + (parameter No.46・No.47). Set the same sign to parameters No.48 and 49. Setting of different signs will result in a parameter error. Set address:□□□□□□ Upper 3 digits / Lower 3 digits Parameter No. 49 Parameter No. 48	0	×10^{STM} μm	−999999 to 999999	Section 5.2.7
	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. Set address:□□□□□□ Upper 3 digits / Lower 3 digits Parameter No. 51 Parameter No. 50	0	×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:□□□□□□ Upper 3 digits / Lower 3 digits Parameter No. 53 Parameter No. 52	0	×10^{STM} μm	−999999 to 999999	
	54 to 66		For manufacturer setting Must not be changed.				

5.2 Detailed explanation

5.2.1 Electronic gear

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

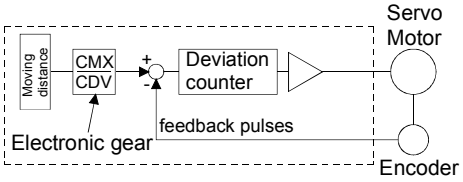
POINT

・ The range of the electronic gear setting is $\frac{1}{20} < \frac{CMX}{CDV} < 20$. If you set any value outside this range, a parameter error (A.37) occurs.
・ Always make electronic gear setting in the servo off status to prevent runaway due to false setting.

(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.

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



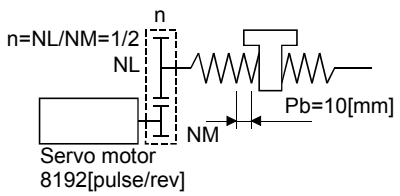
The following examples are used to explain how to calculate the electronic gear value:

POINT

・ The following specification symbols are needed for electronic gear calculation:
P_b : Ballscrew lead [mm]
n : Reduction ratio
P_t : Servo motor resolution [pulse/rev]
ΔS : Travel per servo motor revolution [mm/rev]

(a) Ballscrew setting example

Machine specifications



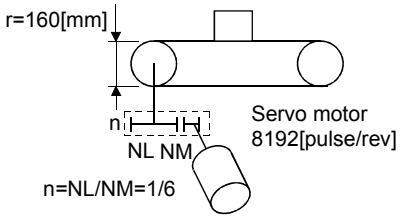
Ballscrew lead: $P_b = 10$ [mm]
Reduction ratio: n = 1/2
Servo motor resolution: $P_t = 8192$ [pulse/rev]

$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot p_b \cdot 1000} = \frac{8192}{1/2 \cdot 10 \cdot 1000} = \frac{8192}{5000} = \frac{1024}{625}$$

Hence, set 1024 to CMX and 625 to CDV.

(b) Conveyor setting example

Machine specifications



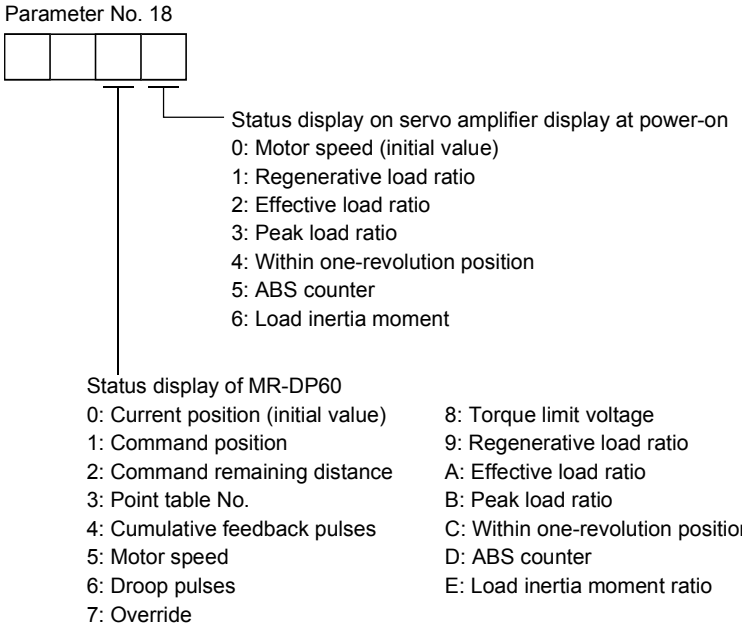
Pulley diameter: r = 160 [mm]
Reduction ratio: n = 1/6
Servo motor resolution: $P_t = 8192$ [pulse/rev]

$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{8192}{1/6 \cdot 160 \cdot \pi \cdot 1000} = \frac{8192}{83775.804} \fallingdotseq \frac{2048}{20939}$$

Reduce CMX and CDV to the setting range or less, and round off the first decimal place.
Hence, set 2048 to CMX and 20939 to CDV.

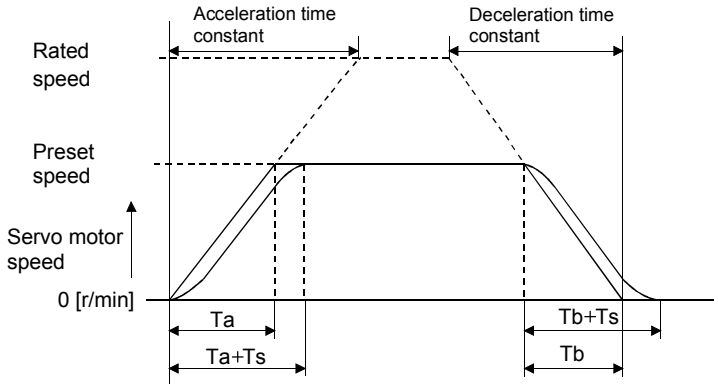
5.2.2 Changing the status display screen

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 settings. In the initial condition, the servo amplifier display shows the motor speed and the MR-DP60 shows the current position.
For display details, refer to Section 7.2.



5.2.3 S-pattern acceleration/deceleration

In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern 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. Note that the time equivalent to the S-pattern time constant setting increases until positioning is complete.



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

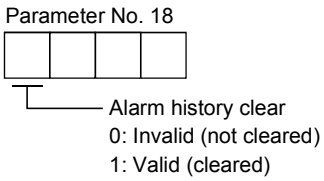
5.2.4 Changing the stop pattern using a limit switch

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)

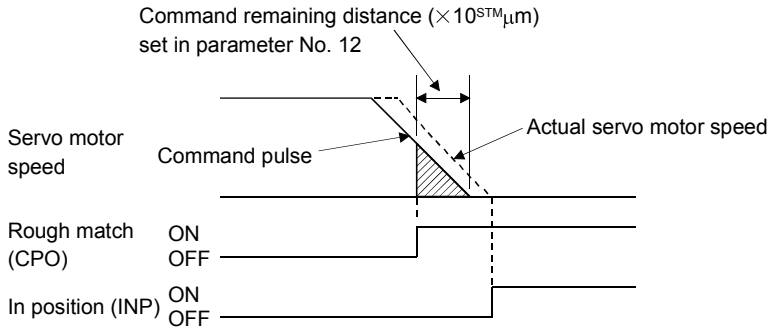
5.2.5 Alarm history clear

The alarm history can be confirmed by using the 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.18 before starting operation. Clearing the alarm history automatically returns to 0□□□. This parameter is made valid by switching power off, then on after setting.



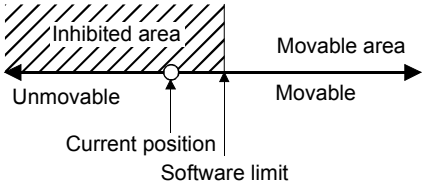
5.2.6 Rough match output

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



5.2.7 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.



MEMO

6. SERVO CONFIGURATION SOFTWARE

The Servo Configuration software 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.
Baudrate	19200bps, 9600bps
Monitor	Batch display, high-speed display, graph display
Alarm	Alarm display, alarm history, data display at alarm occurrence
Diagnostic	External I/O signal display, function device display, cumulative power-on time display, software number display, motor information display, tuning data display
Parameters	Data setting, list display, change list display, detailed information display, I/O Devices
Test operation	Jog operation, positioning operation, motor-less operation, output signal (D0) forced output, single-step feed
Position-Data	Point Tables setting
File operation	Data read, save, print
Others	Station setting, help display

6.2 System configuration

(1) Components

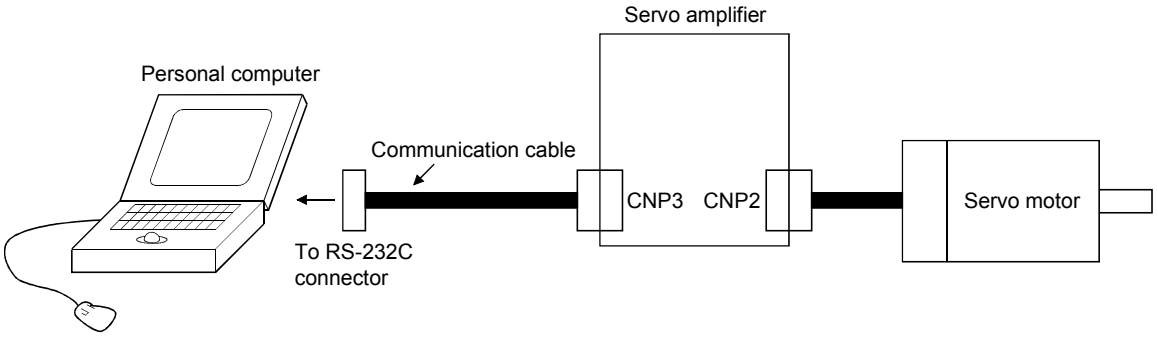
To use this software, the following components are required in addition to the servo amplifier and servo motor:

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: 30MB 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	Which can be connected to the personal computer.
Mouse	Which can be used with Windows 3.1 • 95 (English). Note that a serial mouse is not used.
Printer	Which can be used with Windows 3.1 • 95 (English).
Communication cable	MR-JRPC98CBL3M • MR-JRPCATCBL3M When these cannot be used, refer to Section 14.1.1 and fabricate.
RS-232C/RS-422 converter	Needed to use the RS-422 multidrop communication function of the servo amplifier.

Note: 1. Windows is a trade mark of Microsoft Corporation.
2. On some personal computers, this software may not run properly.

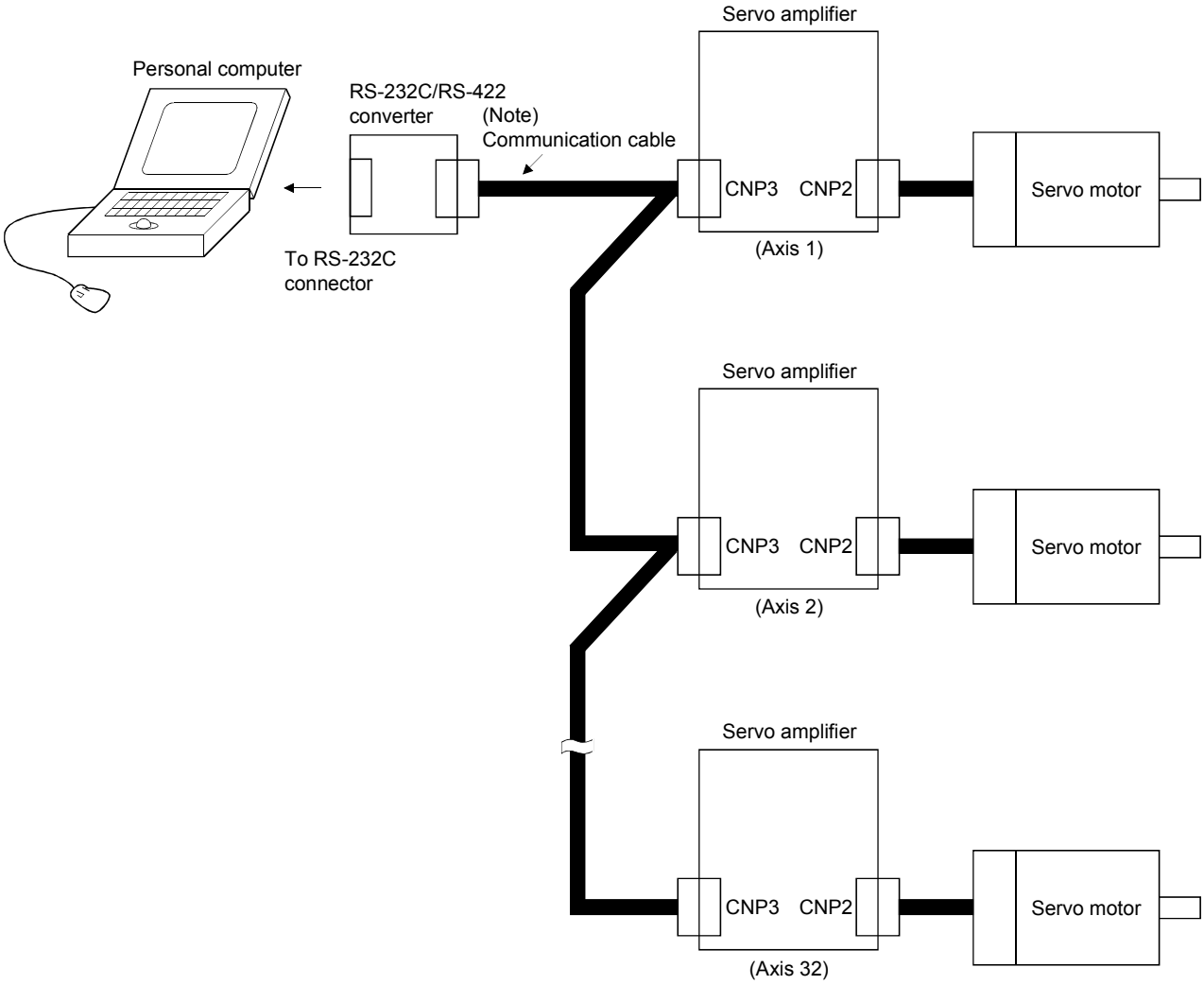
(2) Configuration diagram

(a) When using RS-232C



(b) When using RS-422

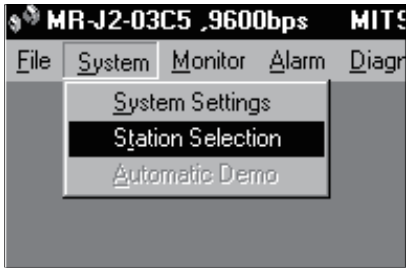
You can make multidrop connection of up to 32 axes.



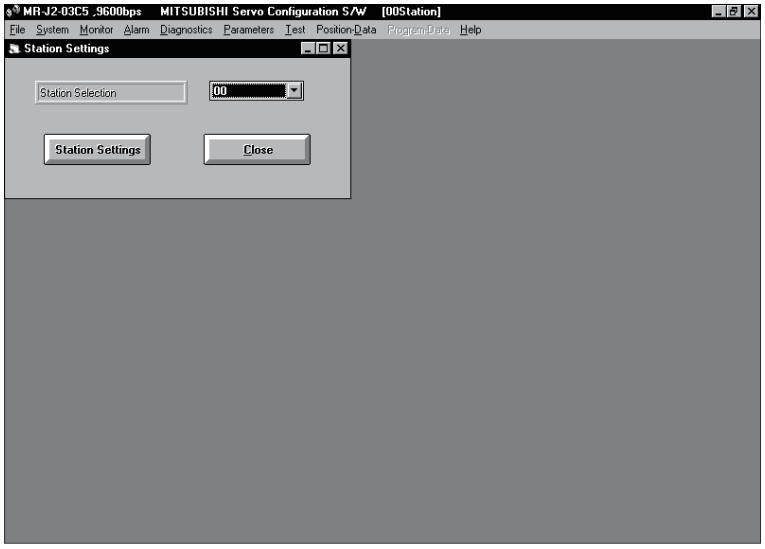
Note: For cable connection, refer to section 8.1.1.

6.3 Station setting

Choose System on the menu bar and choose Station Selection on the menu.



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



(1) Station number setting

Choose the station number in the combo box and press the Station Settings button to set the station number.

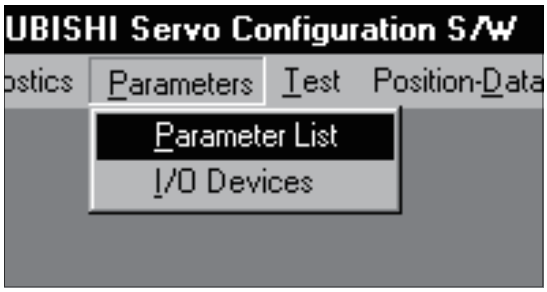
POINT
▪ This setting should be the same as the station number which has been set in the parameter in the servo amplifier used for communication.

(2) Closing of the station setting window

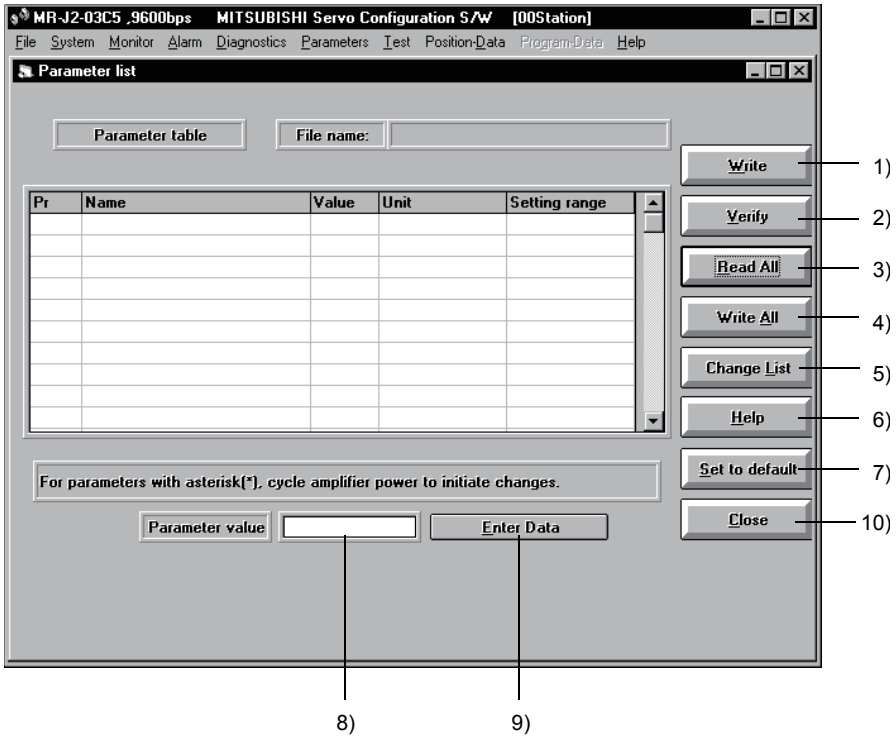
Press the Close button to close the window.

6.4 Parameters

Choose Parameters on the menu bar and choose Parameter List on the menu.



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



(1) Parameter value write (1))

Choose 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 (2))

Press the Verify button to verify all parameter values being displayed and the parameter values of the servo amplifier.

(3) Parameter value batch-read (3))

Press the Read All button to read and display all parameter values from the servo amplifier.

(4) Parameter value batch-write (4))

Press the Write All button to write all parameter values to the servo amplifier.

(5) Parameter change list display (5))

Press 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 (6))

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

(7) Parameter default value indication (7))

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

(8) Parameter value change (8) ,9))

Choose the parameter to be changed, enter a new value into the Parameter value input field, and press the return 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

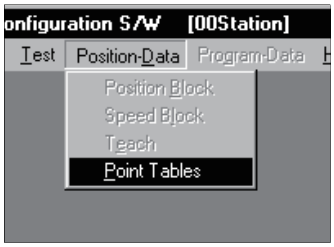
Used to print all parameter values being displayed on the window. Use the File menu on the menu bar to print.

(12) Parameter list window closing (10))

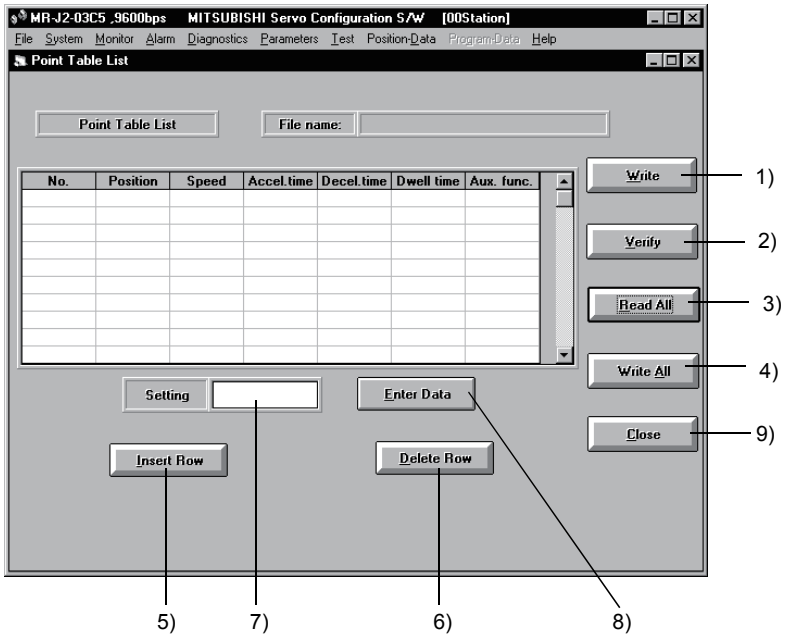
Press the Close button to close the window. If the Close button is pressed without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

6.5 Point table

Choose Position-Data on the menu bar and choose Point Tables on the menu.



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



(1) Point table data write (1))

Choose 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 (2))

Press the Verify button to verify all data being displayed and the data of the servo amplifier.

(3) Point table data batch-read (3))

Press the Read All button to read and display all point table data from the servo amplifier.

(4) Point table data batch-write (4))

Press the Write All button to write all point table data to the servo amplifier.

(5) Point table data insertion (5))

Press 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 (6))

Press 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 (7) ,8))

Choose the data to be changed, enter a new value into the Setting input field, and press the return 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

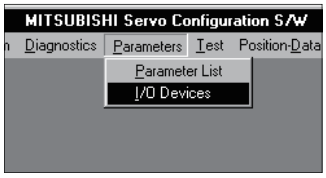
Used to print all point table data being displayed on the window. Use the File menu on the menu bar to print.

(11) Point table data list window closing (9))

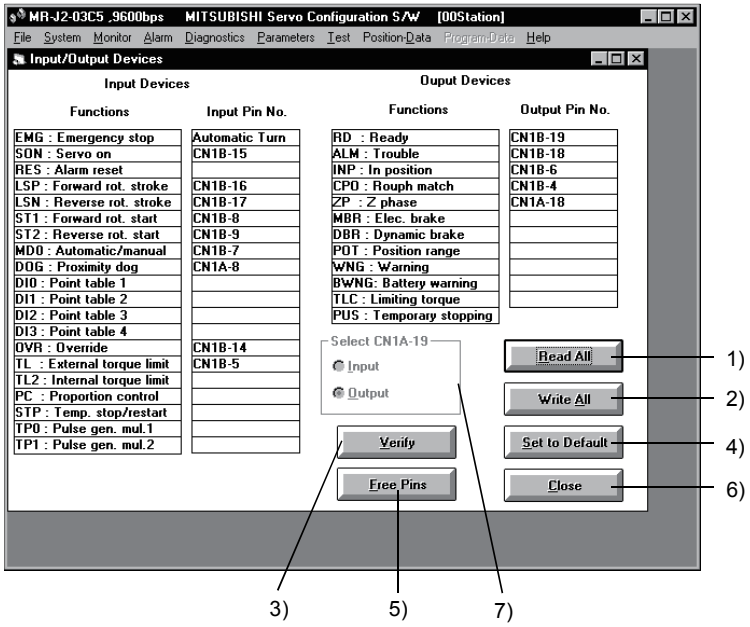
Press the Close button to close the window.

6.6 Device setting

When using the device setting, preset "000E" in parameter No.19.
Choose Parameters on the menu bar and choose I/O Devices on the menu.



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



(1) Function assignment batch-read (1))

Press the Read All button to read and display from the servo amplifier the pins which have been assigned functions.

(2) Function assignment batch-write (2))

Press the Write All button to write to the servo amplifier the pins which have been assigned functions.

(3) Function assignment verify (3))

Press the Verify button to verify the function assignment being displayed and the function assignment in the servo amplifier.

(4) Function assignment default value indication (4))

Press the Set to default button to show the initial values of function assignment.

(5) Function assignment changing

(a) Function assignment changing

Drag the pin number whose function assignment is to be changed and drop it in the new function to change the setting. Automatic on setting cannot be dragged.

(b) Automatic on setting

Double-click the pin number field to set the function assignment to the automatic on mode. Double-click it again to cancel the automatic on mode.

When the pin number has already been assigned a function and the setting is changed to automatic on, that pin becomes empty.

(c) Automatic assignment of empty pin

Double-click the function name field to assign the function to the currently empty pin automatically.

Double-click it again to cancel the assignment.

When there is no empty pin, no assignment is made.

(6) CN1A-19 selection (7))

In the MR-J2-03C5, it is defined as an empty output pin.

(7) Indication of the pins to which functions are currently not assigned (5))

Press the Free Pins button to show the currently empty pin numbers.

(8) Closing of I/O device setting window (6))

Press the Close button to close the window.

When (1) function assignment batch-write is not made, pressing the Close button makes the function assignment change invalid.

6.7 Test operation

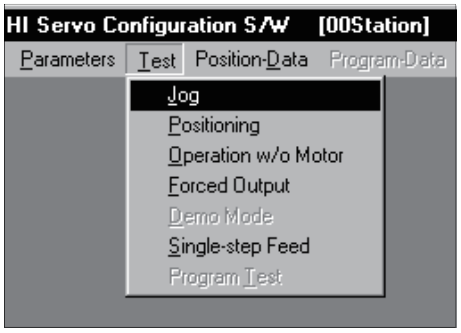
6.7.1 Jog operation

POINT

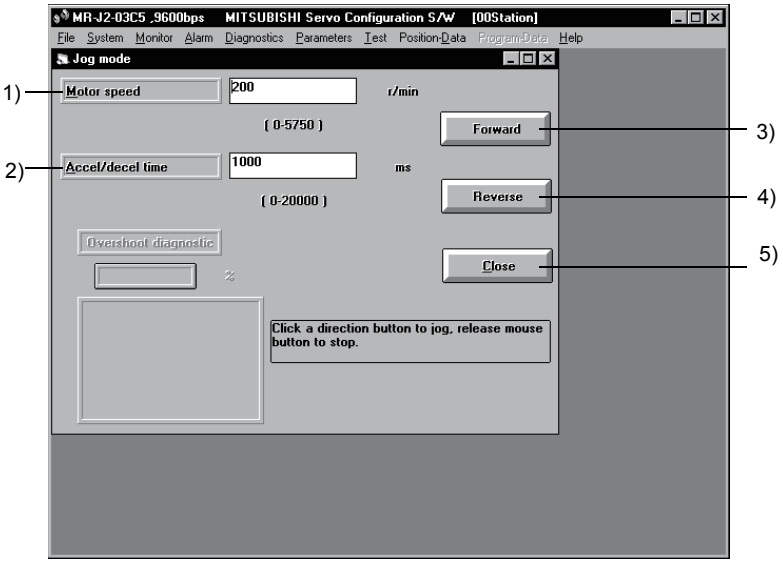
- In the jog operation mode, do not rewrite data from the point table list screen or the servo amplifier's front panel. Otherwise, the set values are made invalid.
- The servo motor will not operate if the forced stop, forward rotation stroke end and reverse rotation stroke end devices are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn off across these signals and SG. (Refer to Section 6.6.)

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

Choose Test on the menu bar and choose Jog on the menu.



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



(1) Servo motor speed setting (1))

Enter a new value into the Motor speed input field and press the return key.

(2) Acceleration/deceleration time constant setting (2))

Enter a new value into the Accel/decel time input field and press the return key.

(3) Servo motor start (3), 4))

Hold down the Forward button to rotate the servo motor in the forward rotation direction.
Hold down the Reverse button to rotate the servo motor in the reverse rotation direction.

(4) Servo motor stop

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

(5) Jog operation window closing (5))

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

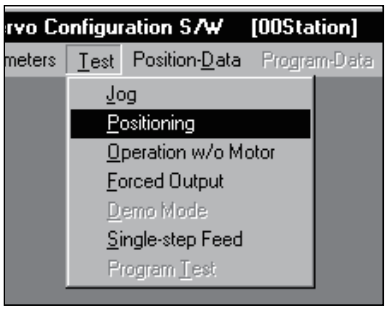
6.7.2 Positioning operation

POINT

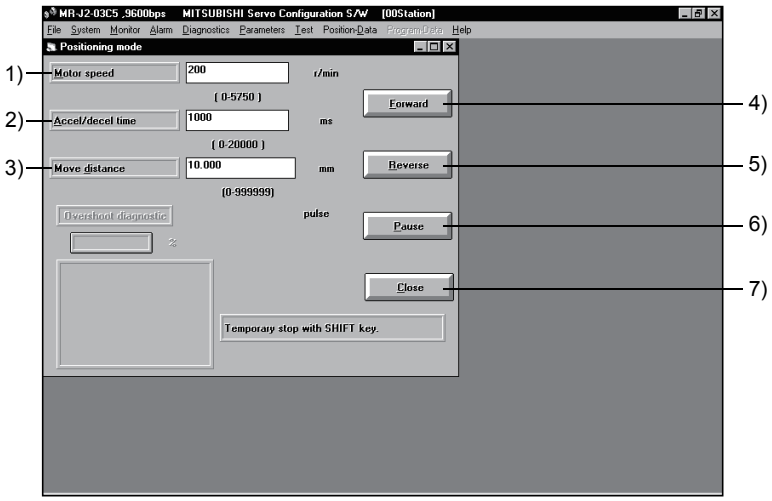
- In the positioning operation mode, do not rewrite data from the point table list screen or the servo amplifier's front panel. Otherwise, the set values are made invalid.
- The servo motor will not operate if the forced stop, forward rotation stroke end and reverse rotation stroke end devices are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn off across these signals and SG. (Refer to Section 6.6.)

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

Choose Test on the menu bar and choose Positioning on the menu.



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



(1) Servo motor speed setting (1))

Enter a new value into the Motor speed input field and press the return key.

(2) Acceleration/deceleration time constant setting (2))

Enter a new value into the Accel/decel time input field and press the return key.

(3) Moving distance setting (3))

Enter a new value into the Move distance input field and press the return key.

(4) Servo motor start (4), 5))

Press the Forward button to rotate the servo motor in the forward rotation direction.
Press the Reverse button to rotate the servo motor in the reverse rotation direction.

(5) Temporary stop of servo motor (6))

Press the Pause button to stop the servo motor temporarily.
Press the Forward and Reverse buttons to resume rotation.

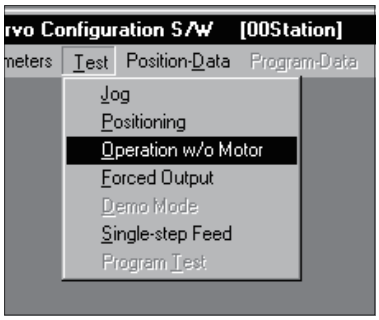
(6) Positioning operation window closing (7))

Press the Close button to cancel the positioning operation mode and close the window.

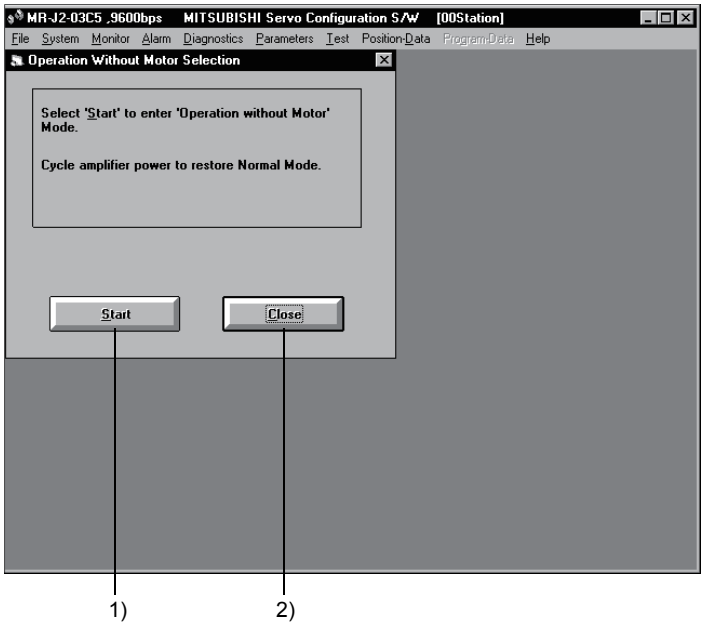
6.7.3 Motor-less operation

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

Choose Test on the menu bar and choose Operation w/o Motor on the menu.



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



(1) Execution of motor-less operation 1)

Press Start to perform motor-less operation.

(2) Termination of motor-less operation 2)

Press Close to close the window.

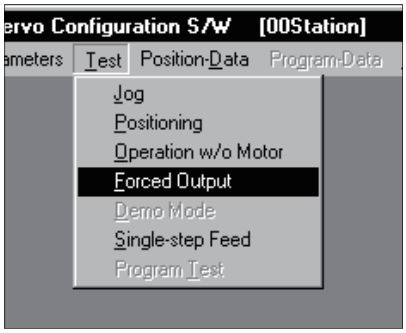
(3) Cancel of motor-less operation

To cancel motor-less operation, switch off the power of the servo amplifier.

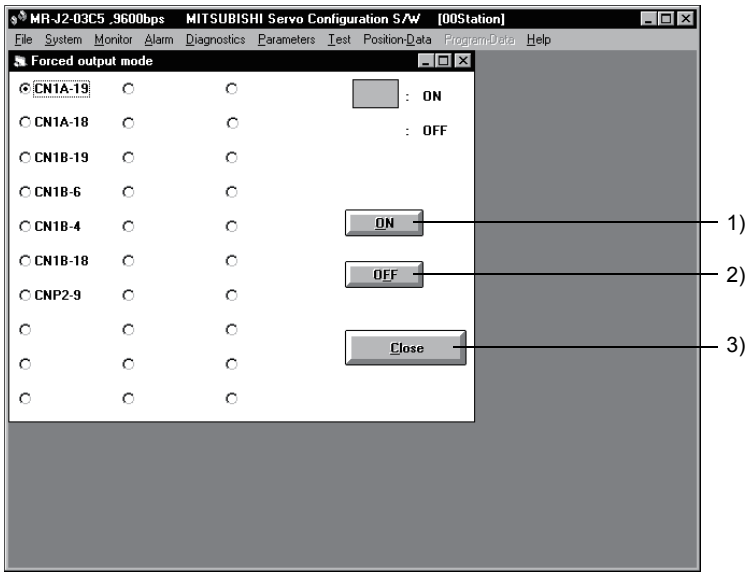
6.7.4 Output signal (DO) forced output

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

Choose Test on the menu bar and choose Forced Output on the menu.



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



(1) Signal ON/OFF setting (1), 2))

Choose the signal name or pin number and press the ON or OFF button to write the corresponding signal status to the servo amplifier.

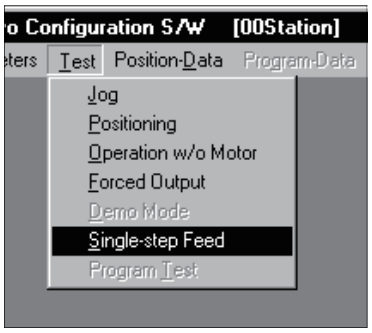
(2) DO forced output window closing (3))

Press the Close button to cancel the output signal (DO) forced output mode and close the window.

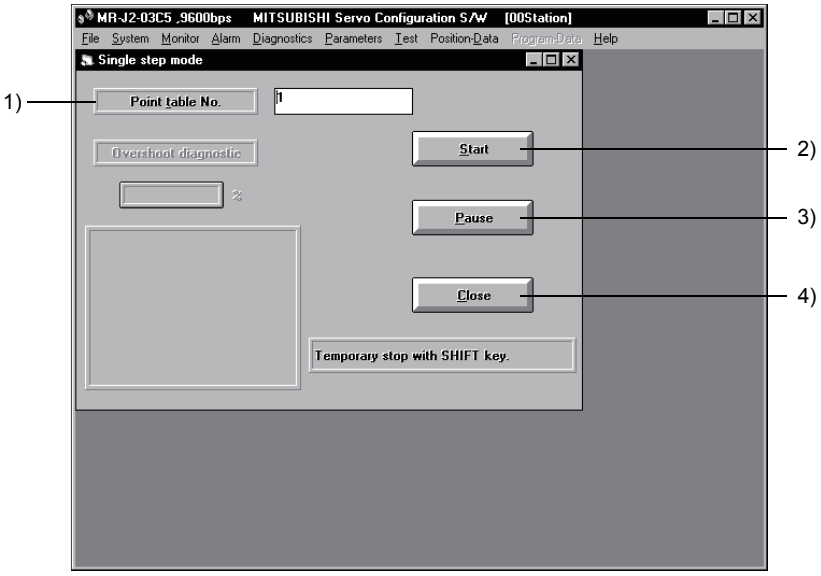
6.7.5 Single-step feed

> **POINT**
>
> ▪ The servo motor will not operate if the forced stop, forward rotation stroke end and reverse rotation stroke end devices are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn off across these signals and SG. (Refer to Section 6.6.)

Operation is performed in accordance with the preset point table No.
Choose Test on the menu bar and choose Single-step Feed on the menu.



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



(1) Point table No. setting (1))

Enter the point table No. into the "Point table No." input field and press the return key.

(2) Servo motor start (2))

Press the Start button to rotate the servo motor.

(3) Temporary stop of servo motor (3))

Press the Pause button to stop the servo motor temporarily.
Press the Start button to resume rotation.

(4) Servo motor stop (3))

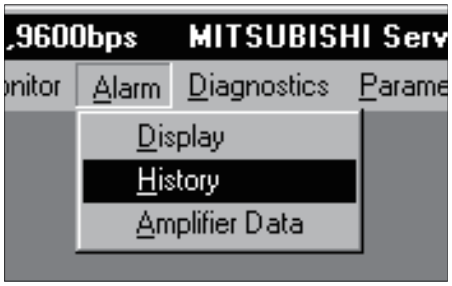
Press the Pause button again during a temporary stop of the servo motor to clear the remaining moving distance.

(5) Single-step feed window closing (4))

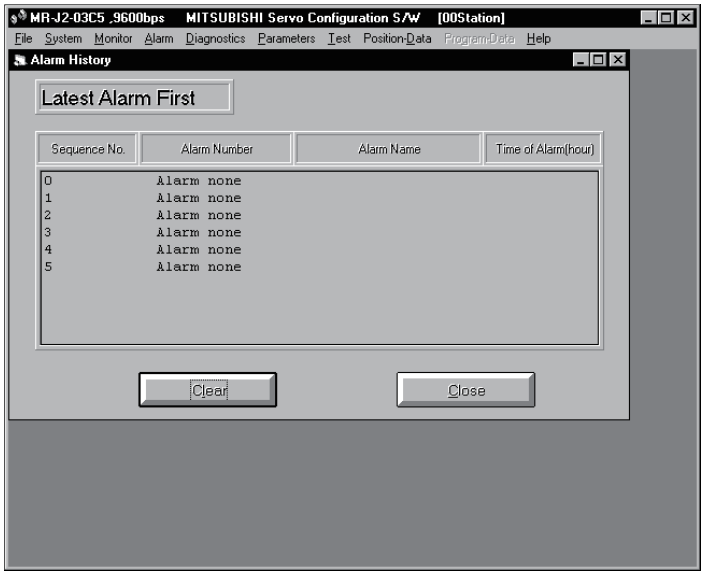
Press the Close button to cancel the single-step feed mode and close the window.

6.8 Alarm history

Choose Alarms on the menu bar and choose History on the menu.



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



(1) Alarm history display

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

(2) Alarm history clear

Press the Clear button to clear the alarm history stored in the servo amplifier.

(3) Closing of alarm history window

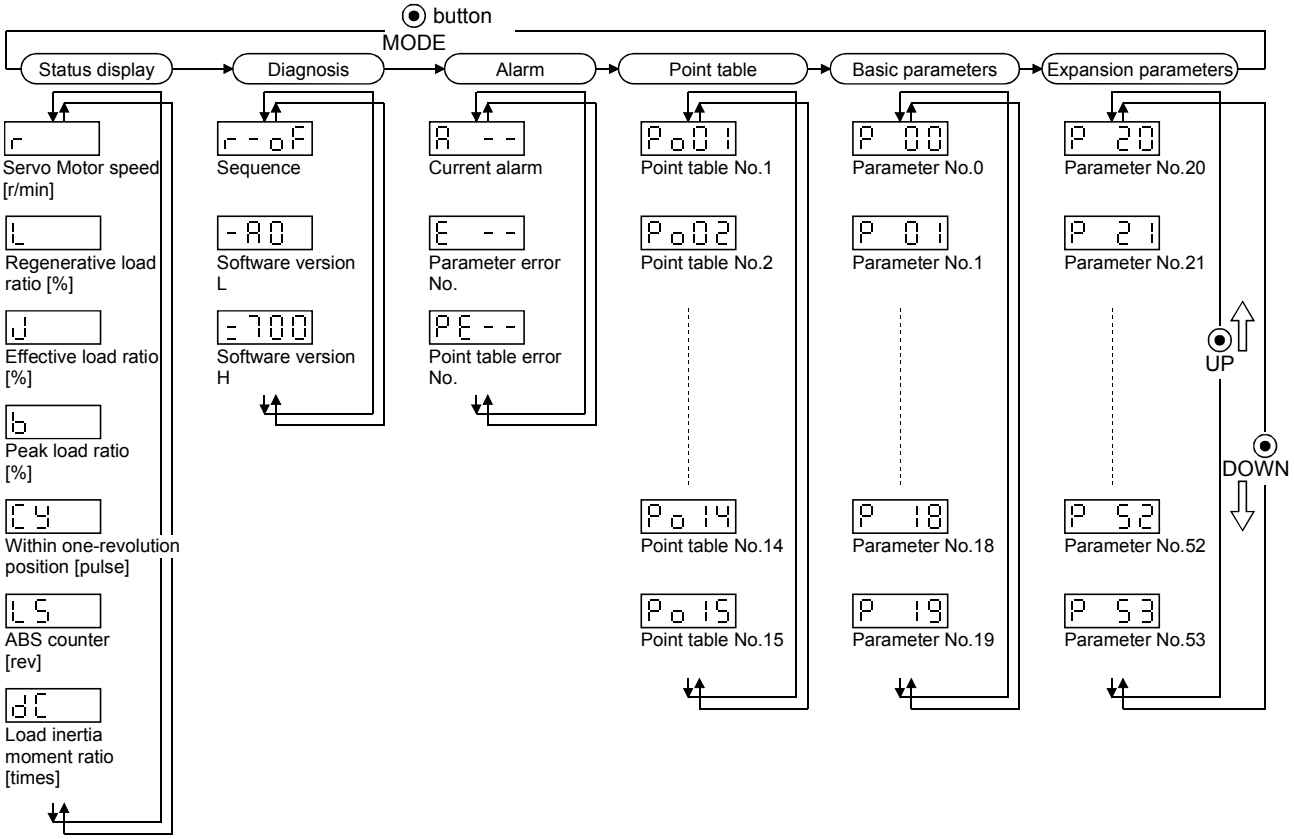
Press the Close button to close the window.

MEMO

7. DISPLAY AND OPERATION

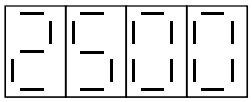
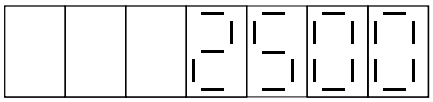
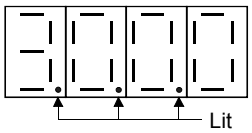
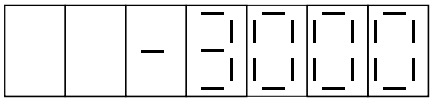
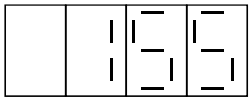
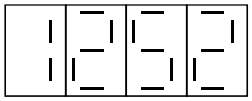
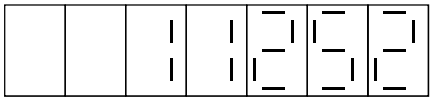
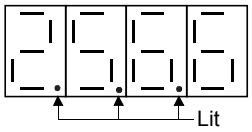
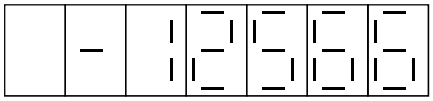
7.1 Display flowchart

Use the display (4-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.
To refer to or set the expansion parameters, make them valid with parameter No.19 (parameter write disable).



7.2 Status display

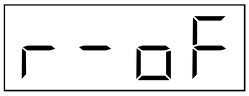
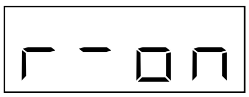
The servo status during operation is shown on the 4-digit, 7-segment LED display. Press the "UP or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol appears. Press the "SET" button to display its data.
The servo amplifier display shows the lower four digits of seven data items such as the motor speed.
In addition, use of the optional external digital display (MR-DP60) allows the statuses of 15 items to be shown in up to six digits. For the usage and parameter setting method, refer to Section 5.2.2.
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 the lit decimal points in the upper three dights.	
Load inertia moment	15.5 times	 Value of ×0.1 times is shown.	
ABS counter	11252pulse		
	−12566pulse	 Negative value is indicated by the lit decimal points in the upper three dights.	

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

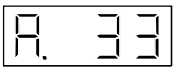
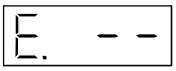
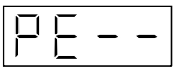
Status Display	Symbol	Unit	Description	Display Range	
				Servo amplifier display	MR-DP60
Current position		mm	The current position from the machine home position of 0 is displayed.	Cannot be displayed.	−999999 to 999999
Command position		mm	The position data in the point table or the preset command position is displayed.	Cannot be displayed.	−999999 to 999999
Command remaining distance		mm	During operation, the remaining distance from the current position to the command position is displayed. During a stop, the next feed distance is displayed.	Cannot be displayed.	−999999 to 999999
Point table No.			The point table No. being executed is displayed.	Cannot be displayed.	0 to 15
Cumulative feedback pulses		pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the value exceeds ±9999999, it returns to zero. Press the Clear button to reset the display value to zero.	Cannot be displayed.	−9999999 to 9999999
Servo motor speed	r	r/min	The servo motor speed is displayed. "−" is added to the speed of the servo motor rotating in the reverse direction	−5400 to 5400	−5400 to 5400
Droop pulses		pulse	The number of droop pulses in the deviation counter is displayed. "−" is added to the droop pulses in the reverse direction. The displayed number of pulses is not yet multiplied by the electronic gear value.	Cannot be displayed.	−9999999 to 9999999
Override		%	The override setting is displayed. 100% is displayed when override is invalid.	Cannot be displayed.	0 to 200
Torque limit voltage		V	The voltage of the torque limit command (TLA) is displayed.	Cannot be displayed.	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 current of 100%.	0 to 300	0 to 300
Peak load ratio	b	%	The peak torque is displayed. Rated torque is defined as 100% and the highest value for the past 15 seconds is displayed.	0 to 300	0 to 300
Within one-revolution position	Cy	pulse	Position within one revolution is displayed in terms of encoder pulses. When the value exceeds the maximum number of pulses, it returns to 0. The servo amplifier display shows the 4 lower digits of the actual within one-revolution position. It is incremented by CCW rotation.	0 to 8191	0 to 8191
ABS counter	LS	rev	Moving distance from the home position in the absolute position detection system is displayed in terms of the absolute position detector's counter value. Because of 4-digit indication, the servo amplifier display shows the 4 lower digits of the actual ABS counter value.	−9999 to 9999	−32768 to 32767
Load inertia moment ratio	dC	0.1 Times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0 to 1000	0 to 1000

7.3 Diagnostic mode

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.
Software version Low		Indicates the version of the software.
Software version High		Indicates the system number of the software.

7.4 Alarm mode

The current alarm, past 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.

Name	Display	Description
Current alarm		Indicates no occurrence of an alarm.
		Indicates the occurrence of overvoltage (A.33). Flickers at occurrence of the alarm.
Parameter error		Indicates no occurrence of parameter error (A.37).
		Indicates that the data of parameter No.1 is faulty.
Point table error		Indicates no occurrence of point table error (A.37).
		Indicates that the data of parameter No.1 is faulty.

Function at occurrence of an alarm

(1) Any mode screen display the current alarm.

(2) The other screen is visible during occurrence of an alarm. At this time, the decimal point in the fourth digit flickers.

(3) To clear any alarm, remove its cause and use any of the following methods:

(a) Switch power off, then on.

(b) Press the "SET" button on the present alarm screen. (Refer to Section 11.2.1 for alarms that may be cleared.)

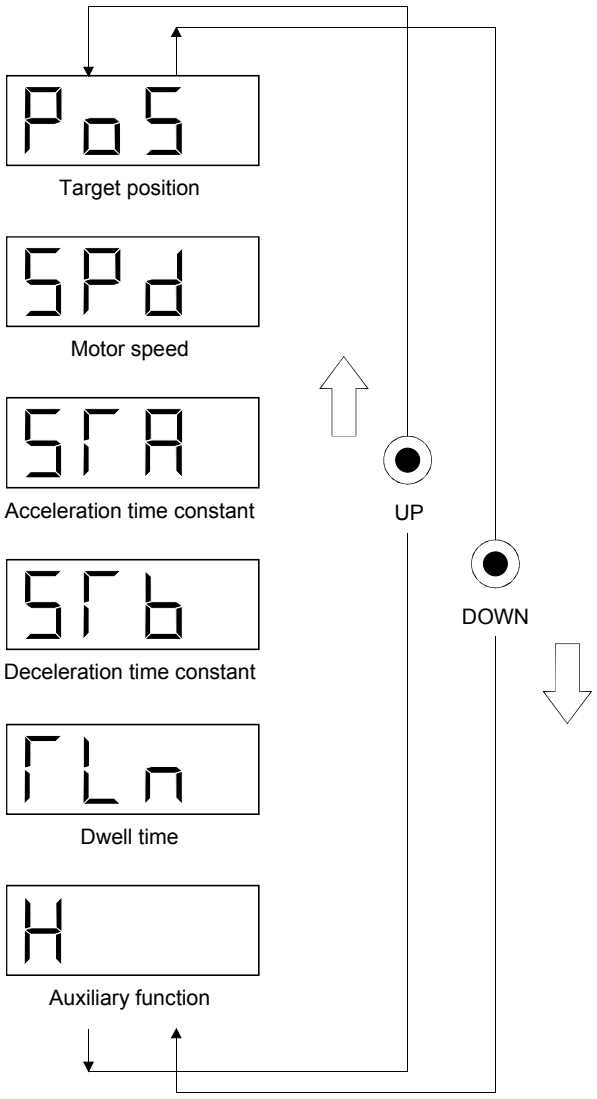
(c) Turn on the alarm reset (RES) signal. (Refer to Section 11.2.1 for alarms that may be cleared.)

7.5 Point table mode

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

(1) Point table mode setting screen sequence

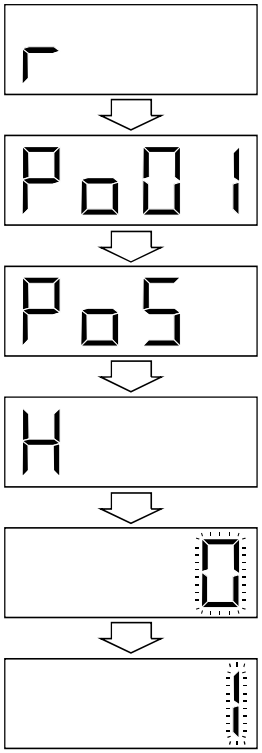
Press "SET" in the point table mode. The following screen appears.
Press "UP" or "DOWN" to move to the next screen.



(2) Operation method

(a) Setting of 4 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:



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.

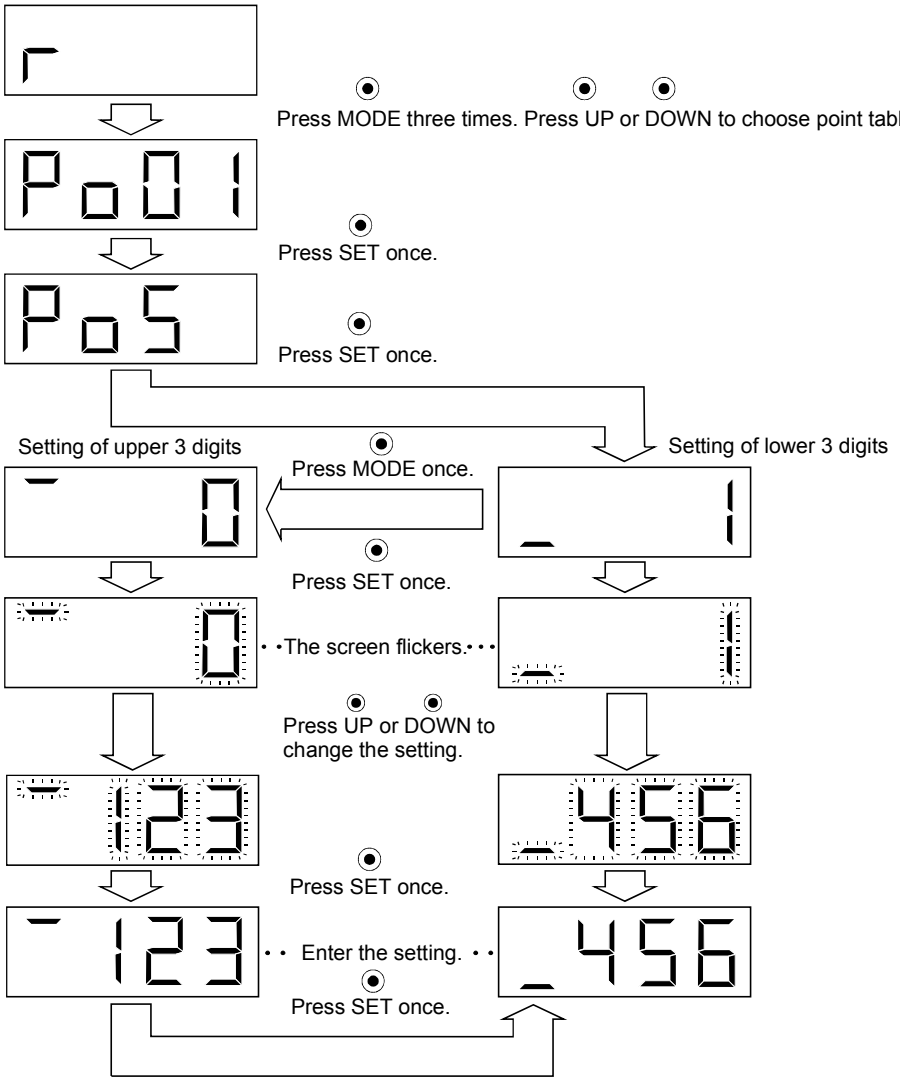
Use UP or DOWN to change the setting.

Press SET to enter the value.

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.

(b) Setting of 5 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":



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

Change the parameter settings when:

・The number of pulse per servo motor revolution is changed

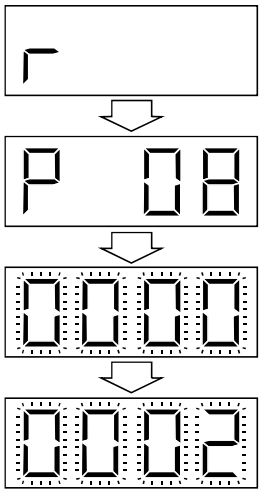
・The machine mounted with the servo motor hunts or operational performance is further improved.

The parameter whose abbreviation is marked ∗ in Section 5.1.2 is made valid by switching power off, then on after changing its setting.

(1) Operation example

1) 4-digit parameter

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 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.

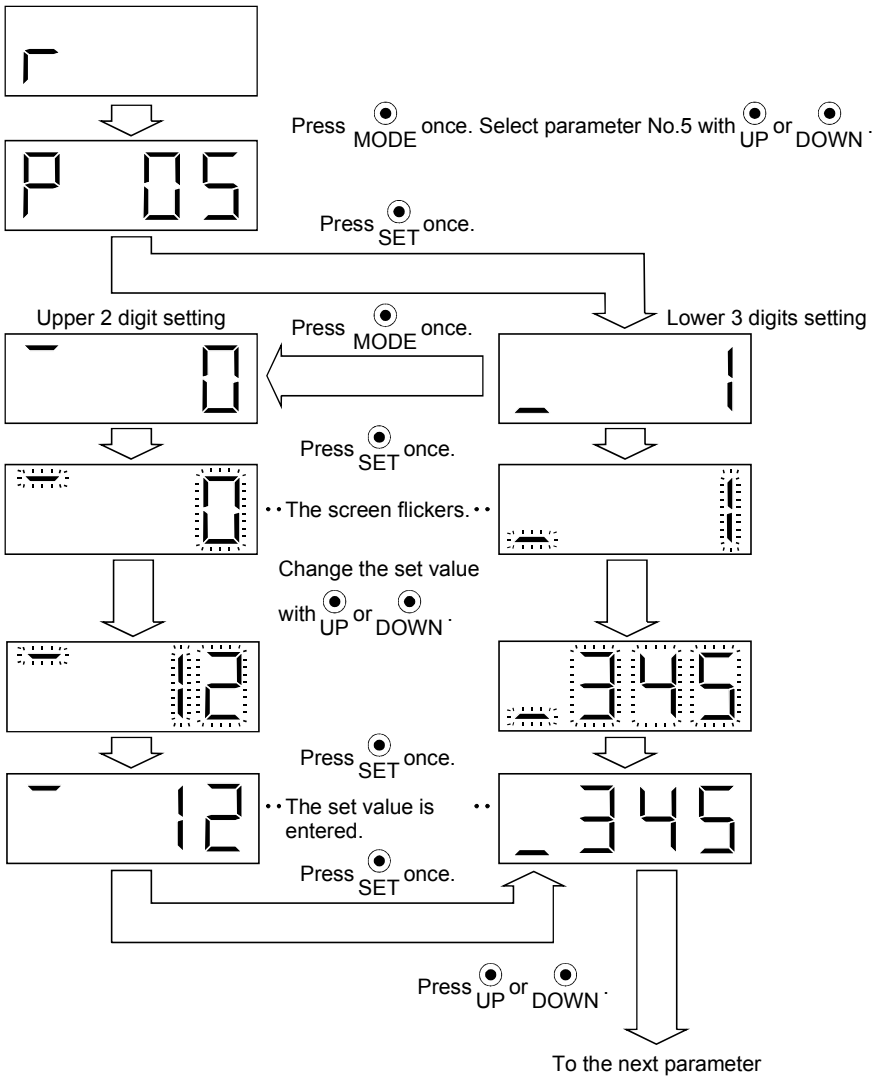
To shift to the next parameter, press the "UP" or "DOWN" button.

When changing the parameter No.8 setting, change its set value, then switch power off once and switch it on again to make the new value valid.

2) 5-digit parameter

The following example shows the operation procedure performed to change the electronic gear denominator (parameter No.5) into "12345":

Call the display screen shown after power-on.



When changing the parameter No.5 setting, change its set value, then switch power off once and switch it on again to make the new value valid.

(2) Expansion parameters

To use the expansion parameters, change the setting of parameter No.19 (parameter write disable). Refer to Section 5.1.1.

MEMO

8. COMMUNICATION FUNCTIONS

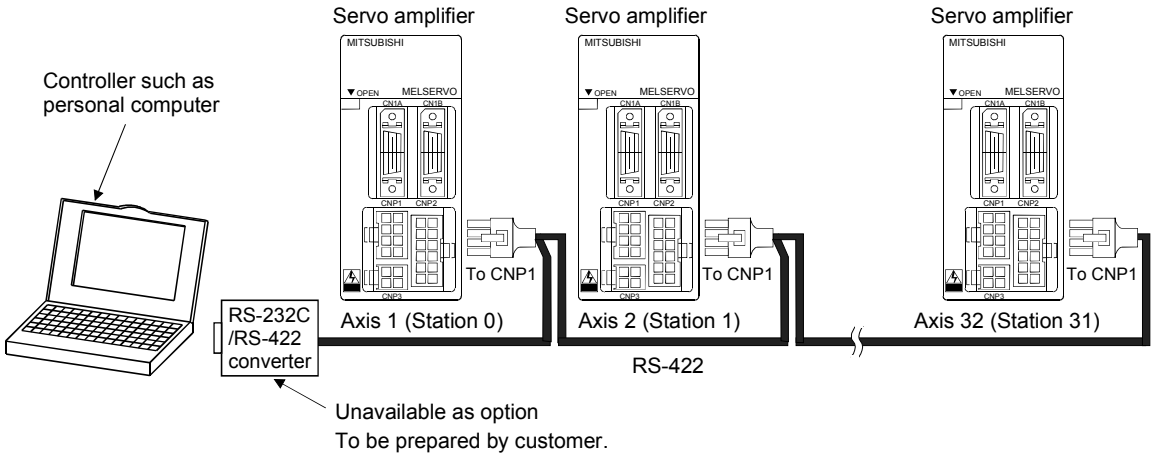
The Servo amplifier has the RS-422 and RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.
However, the RS-422 and RS-232C communication functions cannot be used together. Select between RS-422 and RS-232C with parameter No.16. (Refer to Section 8.2.2(3).)

8.1 Configuration

8.1.1 RS-422 configuration

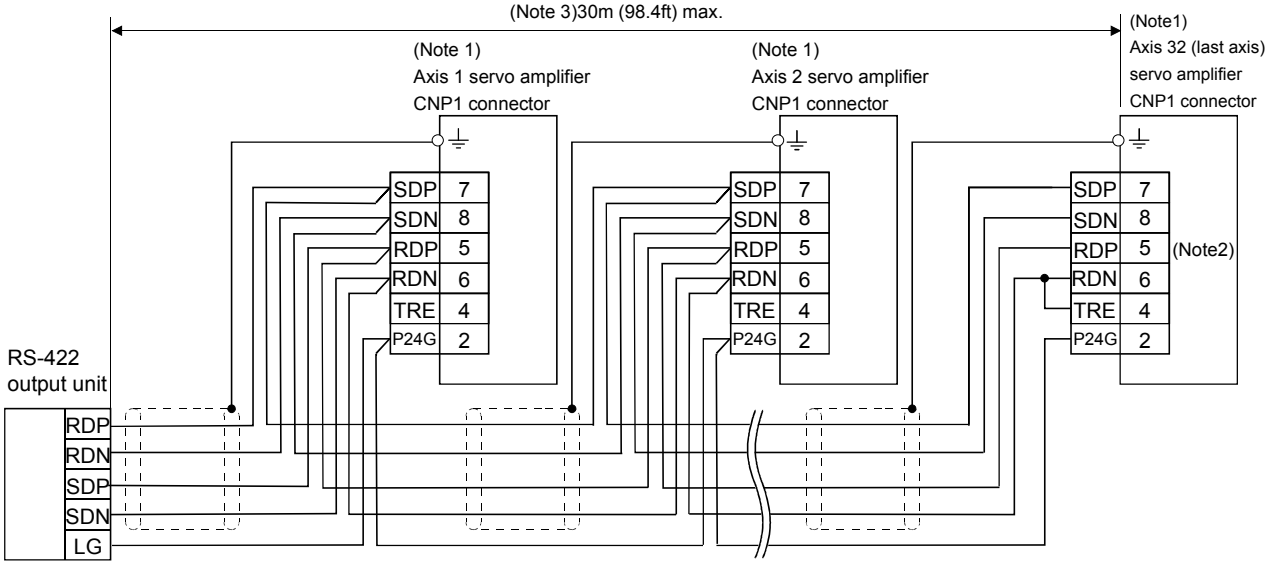
(1) Outline

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:

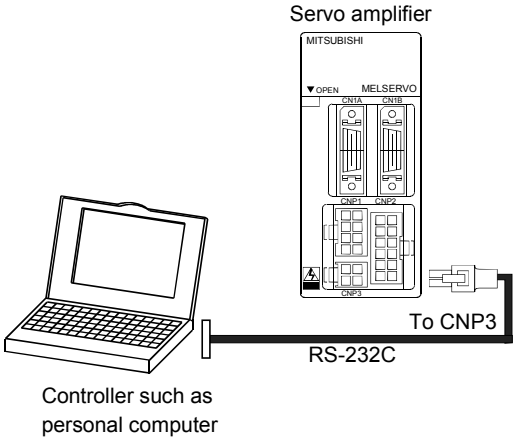


Note: 1. molex's CNP1 connector
Connector: 5557-08R
2. In the last axis, connect TRE and RDN.
3. Overall distance is 30m (98.4ft) max. in the environment where there is a little noise.

8.1.2 RS-232C configuration

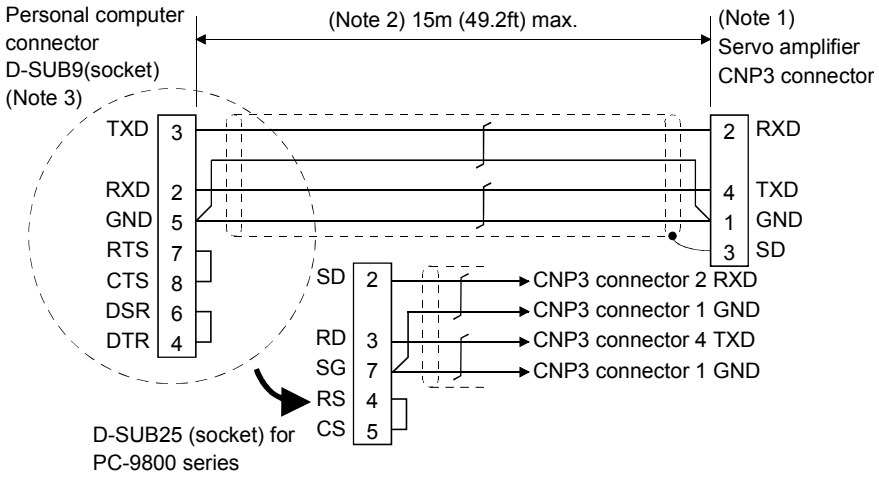
(1) Outline

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 ・ MR-CPC98CBL3M) is available. (Refer to Section 14.1.1.)



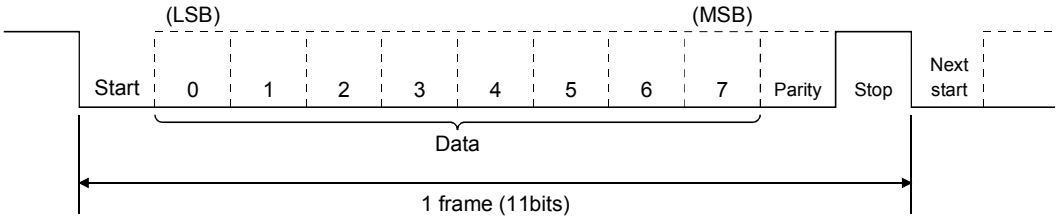
Note:1. molex's CNP3 connector
Connector: 5557-04R-210
Terminal: 5556
2. 15m (49.2ft) max. in environment of little noise.
3. For PC-AT compatible controller series.

8.2 Communication specifications

8.2.1 Communication overview

The 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
Baudrate	4800/9600/19200 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



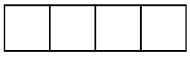
8.2.2 Parameter setting

When the RS-422/RS-232C communication function is used to operate the servo, set the communication specifications.

(1) Communication baudrate

Choose the communication speed. Match this value to the communication speed of the sending end (master station).

Parameter No. 16

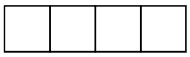


Communication baudrate
0: 9600[bps]
1:19200[bps]
2: 4800[bps]

(2) Checksum

The checksum added to data can be deleted. When the checksum is not needed for the communication specifications of the master station, delete the checksum with this parameter.

Parameter No. 16

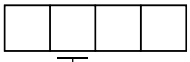


Checksum
0: Yes (checksum added)
1: No (checksum not added)

(3) RS-422/RS-232C serial interface selection

Select the RS-422 or RS-232C communication standard. RS-422 and RS-232C cannot be used together.

Parameter No. 16

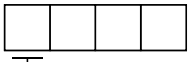


RS-422/RS-232C communication standard selection
0: RS-232C used
1: RS-422 used

(4) Communication 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 400μs or "1" to send back data in 400μs or more.

Parameter No. 16



Communication delay time
0: Invalid, reply sent in less than 400μs
1: Valid, reply sent in 400μs or more

(5) Serial communication time-out

No communication for a given period of time between the master and slave stations may be judged as a communication cable or master station fault to stop the servo motor.

Setting	Description
0	No time-out check
1 to 60	Time-out check period setting Check period = setting (S)

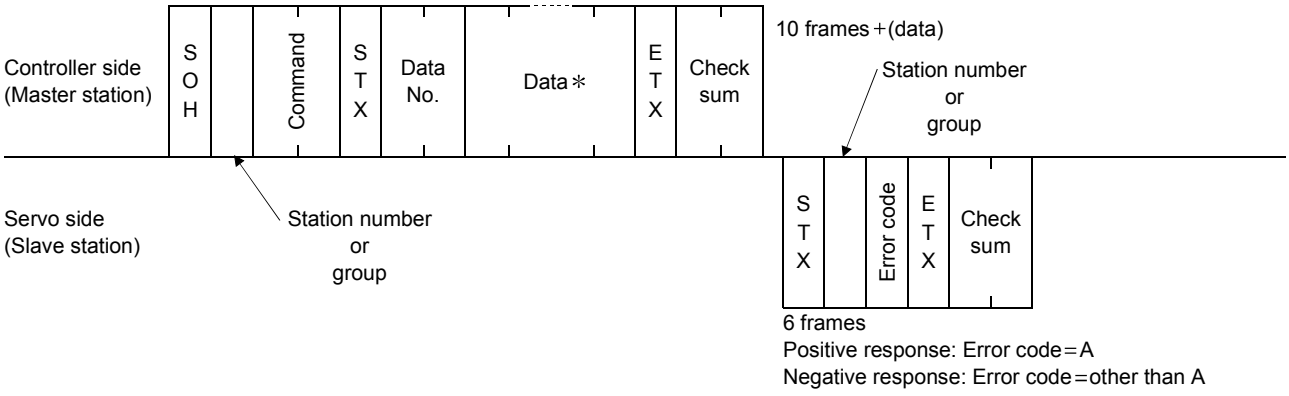
(6) Station number setting

Set the station number of the servo amplifier in parameter No. 15. The setting range is stations 0 to 31.

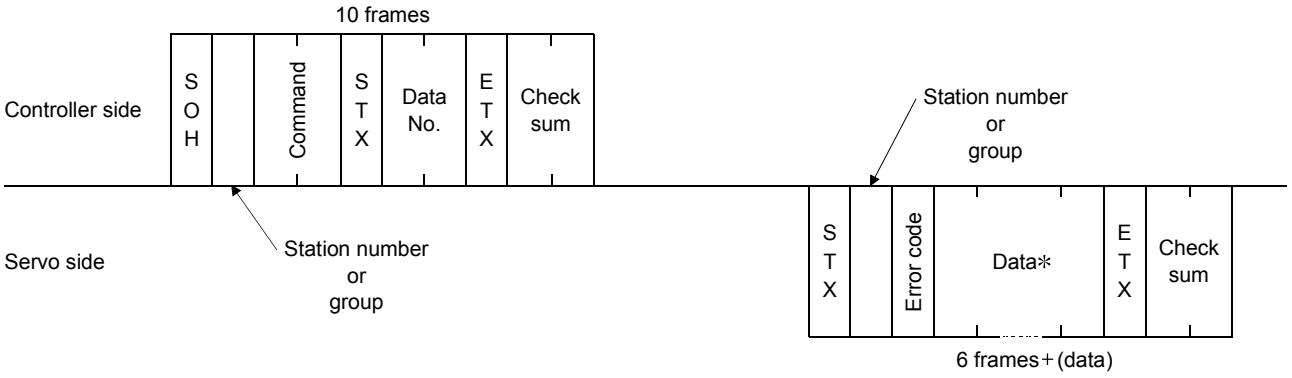
8.3 Protocol

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.

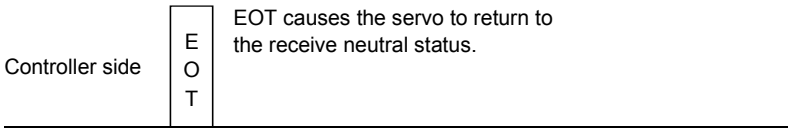
(1) Transmission of data from the controller to the servo



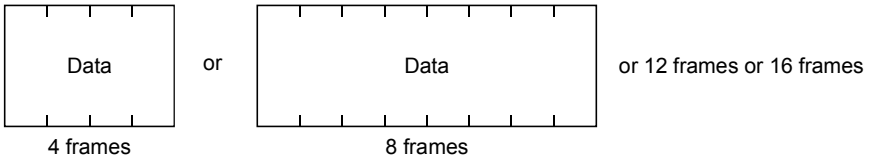
(2) Transmission of data request from the controller to the servo



(3) Recovery of communication status by time-out



* Data: Choose the data length from among 4, 8, 12 and 16 frames (data length depends on the command).



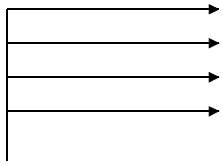
8.4 Character codes

(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	C / R	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	Space	0	@	P	`	p
	0	0	0	1	1	SOH	DC_1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC_2	"	2	B	R	b	r
	0	0	1	1	3	ETX	DC_3	#	3	C	S	c	s
	0	1	0	0	4			$	4	D	T	d	t
	0	1	0	1	5			%	5	E	U	e	u
	0	1	1	0	6			&	6	F	V	f	v
	0	1	1	1	7			'	7	G	W	g	w
	1	0	0	0	8			(	8	H	X	h	x
	1	0	0	1	9			)	9	I	Y	i	y
	1	0	1	0	10			*	:	J	Z	j	z
	1	0	1	1	11			+	;	K	[	k	{
	1	1	0	0	12			,	<	L	¥	l	|
	1	1	0	1	13			-	=	M	]	m	}
	1	1	1	0	14			.	>	N	^	n	¯
	1	1	1	1	15			/	?	O	_	o	DEL

(3) Station numbers

You may set 32 station numbers from station 0 to station 31 and the ASCII 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 when the station number is "0" (first axis).

(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.

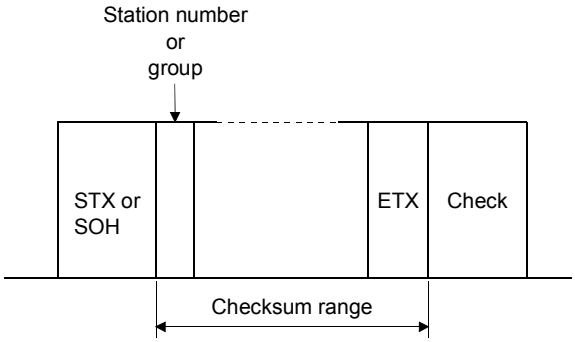
8.5 Error codes

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 code transmitted in uppercase indicates that the servo is normal and the one in lowercase indicates that an alarm has occurred.

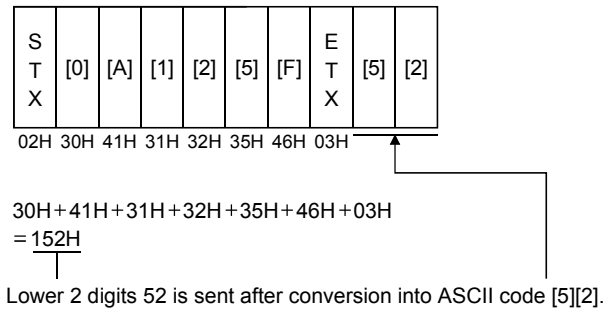
Error Code		Error Name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted 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.	

8.6 Checksum

Checksum range

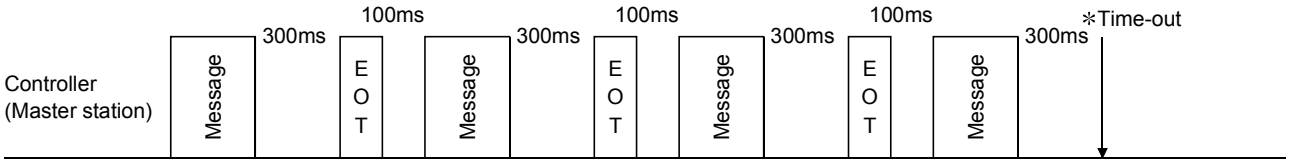


The checksum is sent as an ASCII-coded hexadecimal code representing the lower two digits of the sum of ASCII-coded hexadecimal values up to ETX, with the exception of the first control code (STX or SOH).



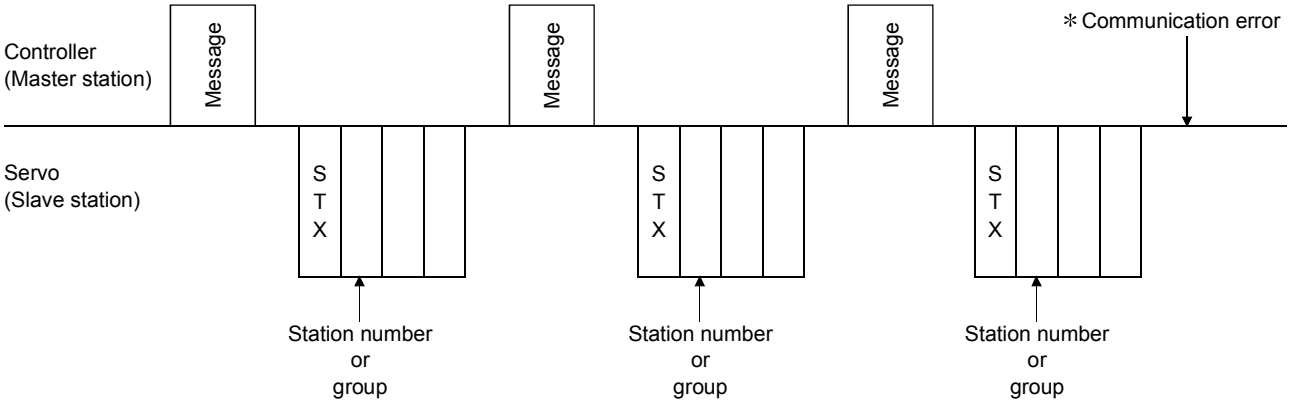
8.7 Time-out operation

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)



8.8 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.

8.9 Initialization

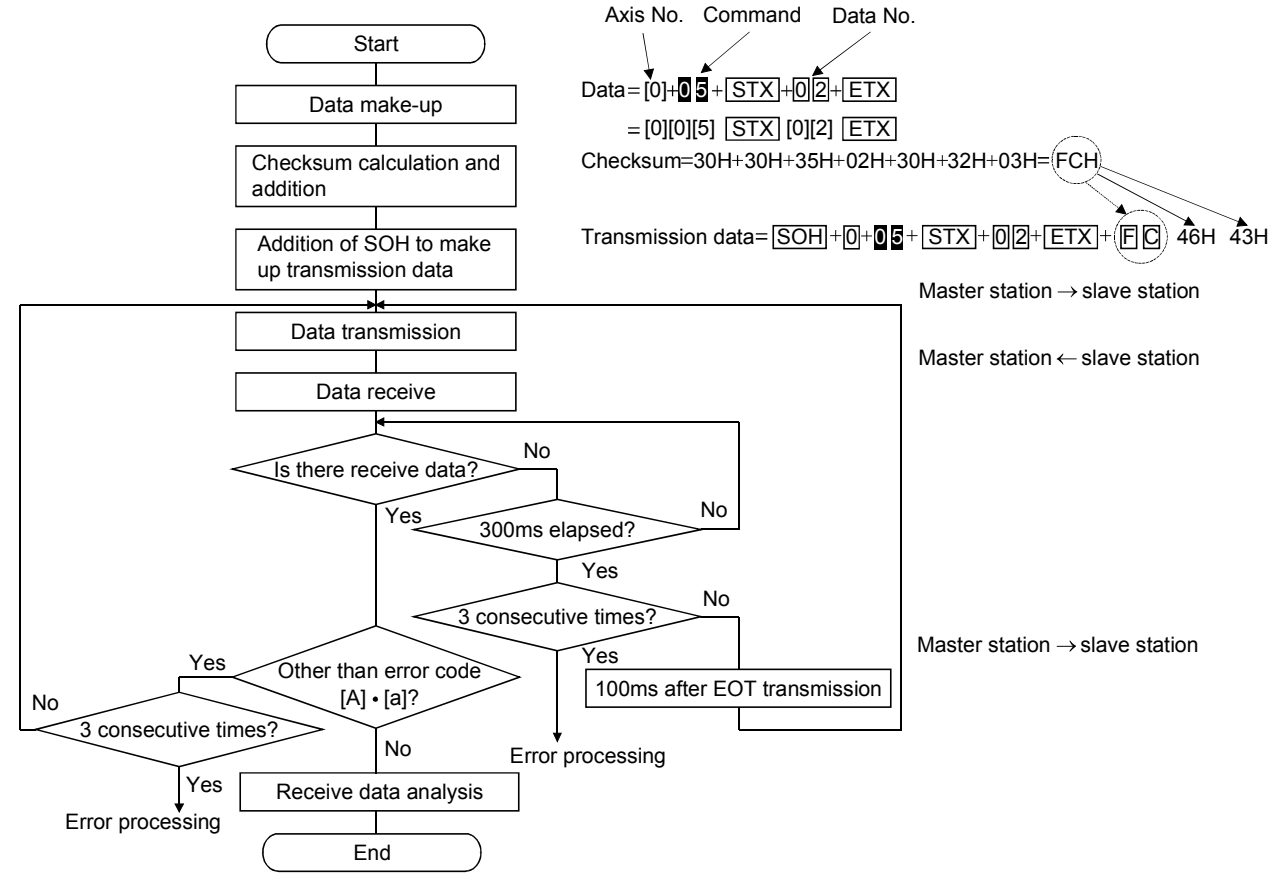
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

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.

8.10 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



8.11 Command and data No. list

8.11.1 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]		Within one-revolution position	12
[0][1]	[8][D]		ABS counter	12
[0][1]	[8][E]		Load inertia moment ratio	12

(2) Parameter (Command [0][5])

Command	Data No.	Description	Frame Length
[0][5]	[0][0] to [3][5]	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]		Within one-revolution position	12
[3][5]	[8][D]		ABS counter	12
[3][5]	[8][E]		Load inertia moment ratio	12

(6) Point table/position data (Command [4][0])

Command	Data No.	Description	Point table No.	Frame Length
[4][0]	[0][1]	Position data read	1	8
[4][0]	[0][2]		2	8
[4][0]	[0][3]		3	8
[4][0]	[0][4]		4	8
[4][0]	[0][5]		5	8
[4][0]	[0][6]		6	8
[4][0]	[0][7]		7	8
[4][0]	[0][8]		8	8
[4][0]	[0][9]		9	8
[4][0]	[0][A]		10	8
[4][0]	[0][B]		11	8
[4][0]	[0][C]		12	8
[4][0]	[0][D]		13	8
[4][0]	[0][E]		14	8
[4][0]	[0][F]		15	8

(7) Point table/speed data (Command [5][0])

Command	Data No.	Description	Point table No.	Frame Length
[5][0]	[0][1]	Speed data read	1	8
[5][0]	[0][2]		2	8
[5][0]	[0][3]		3	8
[5][0]	[0][4]		4	8
[5][0]	[0][5]		5	8
[5][0]	[0][6]		6	8
[5][0]	[0][7]		7	8
[5][0]	[0][8]		8	8
[5][0]	[0][9]		9	8
[5][0]	[0][A]		10	8
[5][0]	[0][B]		11	8
[5][0]	[0][C]		12	8
[5][0]	[0][D]		13	8
[5][0]	[0][E]		14	8
[5][0]	[0][F]		15	8

(8) Point table/acceleration time constant (Command [5][4])

Command	Data No.	Description	Point table No.	Frame Length
[5][4]	[0][1]	Acceleration time constant read	1	8
[5][4]	[0][2]		2	8
[5][4]	[0][3]		3	8
[5][4]	[0][4]		4	8
[5][4]	[0][5]		5	8
[5][4]	[0][6]		6	8
[5][4]	[0][7]		7	8
[5][4]	[0][8]		8	8
[5][4]	[0][9]		9	8
[5][4]	[0][A]		10	8
[5][4]	[0][B]		11	8
[5][4]	[0][C]		12	8
[5][4]	[0][D]		13	8
[5][4]	[0][E]		14	8
[5][4]	[0][F]		15	8

(9) Point table/deceleration time constant (Command [5][8])

Command	Data No.	Description	Point table No.	Frame Length
[5][8]	[0][1]	Deceleration time constant read	1	8
[5][8]	[0][2]		2	8
[5][8]	[0][3]		3	8
[5][8]	[0][4]		4	8
[5][8]	[0][5]		5	8
[5][8]	[0][6]		6	8
[5][8]	[0][7]		7	8
[5][8]	[0][8]		8	8
[5][8]	[0][9]		9	8
[5][8]	[0][A]		10	8
[5][8]	[0][B]		11	8
[5][8]	[0][C]		12	8
[5][8]	[0][D]		13	8
[5][8]	[0][E]		14	8
[5][8]	[0][F]		15	8

(10) Point table/dwell time (Command [6][0])

Command	Data No.	Description	Point table No.	Frame Length
[6][0]	[0][1]	Dwell time read	1	8
[6][0]	[0][2]		2	8
[6][0]	[0][3]		3	8
[6][0]	[0][4]		4	8
[6][0]	[0][5]		5	8
[6][0]	[0][6]		6	8
[6][0]	[0][7]		7	8
[6][0]	[0][8]		8	8
[6][0]	[0][9]		9	8
[6][0]	[0][A]		10	8
[6][0]	[0][B]		11	8
[6][0]	[0][C]		12	8
[6][0]	[0][D]		13	8
[6][0]	[0][E]		14	8
[6][0]	[0][F]		15	8

(11) Point table/auxiliary function (Command [6][4])

Command	Data No.	Description	Point table No.	Frame Length
[6][4]	[0][1]	Auxiliary function read	1	8
[6][4]	[0][2]		2	8
[6][4]	[0][3]		3	8
[6][4]	[0][4]		4	8
[6][4]	[0][5]		5	8
[6][4]	[0][6]		6	8
[6][4]	[0][7]		7	8
[6][4]	[0][8]		8	8
[6][4]	[0][9]		9	8
[6][4]	[0][A]		10	8
[6][4]	[0][B]		11	8
[6][4]	[0][C]		12	8
[6][4]	[0][D]		13	8
[6][4]	[0][E]		14	8
[6][4]	[0][F]		15	8

(12) Group setting (Command [1][F])

Command	Data No.	Description	Frame Length
[1][F]	[0][0]	Reading of group setting value	4

(13) Others

Command	Data No.	Description	Frame Length
[0][2]	[9][0]	Servo motor end pulse unit absolute position	8
[0][2]	[9][1]	Command unit absolute position	8
[0][2]	[7][0]	Software version	16

8.11.2 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 [3][5]	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		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	Point table No.	Setting Range	Frame Length
[C][0]	[0][1]	Position data write	1		8
[C][0]	[0][2]		2		8
[C][0]	[0][3]		3		8
[C][0]	[0][4]		4		8
[C][0]	[0][5]		5		8
[C][0]	[0][6]		6		8
[C][0]	[0][7]		7		8
[C][0]	[0][8]		8		8
[C][0]	[0][9]		9		8
[C][0]	[0][A]		10		8
[C][0]	[0][B]		11		8
[C][0]	[0][C]		12		8
[C][0]	[0][D]		13		8
[C][0]	[0][E]		14		8
[C][0]	[0][F]		15		8

(7) Point table/speed data (Command [C][6])

Command	Data No.	Description	Point table No.	Setting Range	Frame Length
[C][6]	[0][1]	Speed data write	1		8
[C][6]	[0][2]		2		8
[C][6]	[0][3]		3		8
[C][6]	[0][4]		4		8
[C][6]	[0][5]		5		8
[C][6]	[0][6]		6		8
[C][6]	[0][7]		7		8
[C][6]	[0][8]		8		8
[C][6]	[0][9]		9		8
[C][6]	[0][A]		10		8
[C][6]	[0][B]		11		8
[C][6]	[0][C]		12		8
[C][6]	[0][D]		13		8
[C][6]	[0][E]		14		8
[C][6]	[0][F]		15		8

(8) Point table/acceleration time constant (Command [C][7])

Command	Data No.	Description	Point table No.	Setting Range	Frame Length
[C][7]	[0][1]	Acceleration time constant write	1		8
[C][7]	[0][2]		2		8
[C][7]	[0][3]		3		8
[C][7]	[0][4]		4		8
[C][7]	[0][5]		5		8
[C][7]	[0][6]		6		8
[C][7]	[0][7]		7		8
[C][7]	[0][8]		8		8
[C][7]	[0][9]		9		8
[C][7]	[0][A]		10		8
[C][7]	[0][B]		11		8
[C][7]	[0][C]		12		8
[C][7]	[0][D]		13		8
[C][7]	[0][E]		14		8
[C][7]	[0][F]		15		8

(9) Point table/deceleration time constant (Command [C][8])

Command	Data No.	Description	Point table No.	Setting Range	Frame Length
[C][8]	[0][1]	Deceleration time constant write	1		8
[C][8]	[0][2]		2		8
[C][8]	[0][3]		3		8
[C][8]	[0][4]		4		8
[C][8]	[0][5]		5		8
[C][8]	[0][6]		6		8
[C][8]	[0][7]		7		8
[C][8]	[0][8]		8		8
[C][8]	[0][9]		9		8
[C][8]	[0][A]		10		8
[C][8]	[0][B]		11		8
[C][8]	[0][C]		12		8
[C][8]	[0][D]		13		8
[C][8]	[0][E]		14		8
[C][8]	[0][F]		15		8

(10) Point table/dwell time (Command [C][A])

Command	Data No.	Description	Point table No.	Setting Range	Frame Length
[C][A]	[0][1]	Dwell time write	1		8
[C][A]	[0][2]		2		8
[C][A]	[0][3]		3		8
[C][A]	[0][4]		4		8
[C][A]	[0][5]		5		8
[C][A]	[0][6]		6		8
[C][A]	[0][7]		7		8
[C][A]	[0][8]		8		8
[C][A]	[0][9]		9		8
[C][A]	[0][A]		10		8
[C][A]	[0][B]		11		8
[C][A]	[0][C]		12		8
[C][A]	[0][D]		13		8
[C][A]	[0][E]		14		8
[C][A]	[0][F]		15		8

(11) Point table/auxiliary function (Command [C][B])

Command	Data No.	Description	Point table No.	Setting Range	Frame Length
[C][B]	[0][1]	Auxiliary function write	1		8
[C][B]	[0][2]		2		8
[C][B]	[0][3]		3		8
[C][B]	[0][4]		4		8
[C][B]	[0][5]		5		8
[C][B]	[0][6]		6		8
[C][B]	[0][7]		7		8
[C][B]	[0][8]		8		8
[C][B]	[0][9]		9		8
[C][B]	[0][A]		10		8
[C][B]	[0][B]		11		8
[C][B]	[0][C]		12		8
[C][B]	[0][D]		13		8
[C][B]	[0][E]		14		8
[C][B]	[0][F]		15		8

(12) Group setting (Command [9][F])

Command	Data No.	Description	Setting Range	Frame Length
[9][F]	[0][0]	Group setting		4

8.12 Detailed explanations of commands

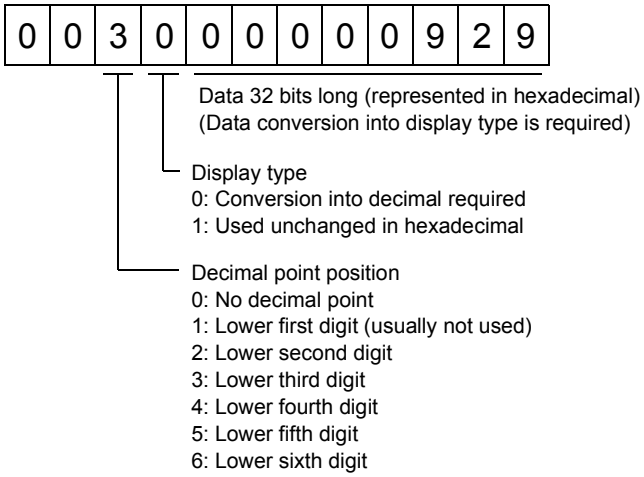
8.12.1 Data processing

When the command + data number or the command + data number + data are sent from the master station to a slave station, a reply or data is returned from the servo amplifier according to the purpose.
In these send data and receive data, numerical values are represented in decimal, hexadecimal, etc.
Hence, data must be processed to meet their purposes.
Follow the corresponding explanation since whether data must be processed or not and how to process them changes with monitoring, parameters, etc.
How to process send/receive data when reading and writing data will be described below.

(1) Processing read data

For the display type of 0, eight-character data is converted from a hexadecimal number to a decimal number and a decimal point is provided from the decimal point information.
For the display type of 1, eight-character data is used as-is.

How to process receive data "003000000929" to show the status is explained here by way of example.
Receive data is as follows:

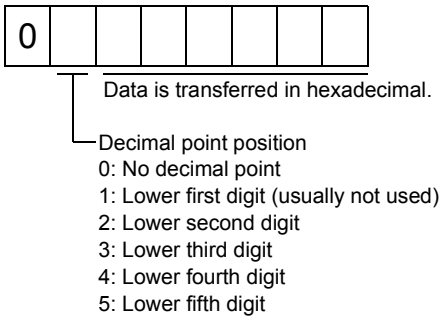


As the display type is "0" in this case, the hexadecimal data is converted into a decimal number.
00000929H→2345
Since the decimal point position is "3", the decimal point is put in the third lower digit.
Hence, "23.45" appears.

(2) Writing processed data

When written data is handled as a decimal number, the decimal point position must be specified. If it is not specified, data cannot be written. When data is handled as a hexadecimal number, specify "0" for the decimal point position.

The data to be sent is as follows:



How to process set data to the value of "15.5" is explained here by way of example.

Since the decimal point position is the second digit, the decimal point data is "2".

As the data to be transmitted is a hexadecimal number, the decimal data is converted into a hexadecimal number.

115→9B

Hence, "0200009B" is sent.

8.12.2 Status display

(1) Status display data read

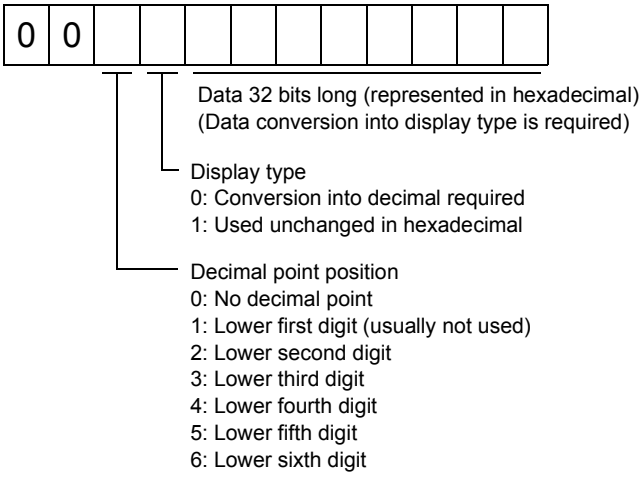
When the master station transmits the data No. to the slave station, the slave station sends back the data value and data processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. Refer to Section 8.11.1.

(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.

8.12.3 Parameter

(1) Parameter read

Read the parameter setting.

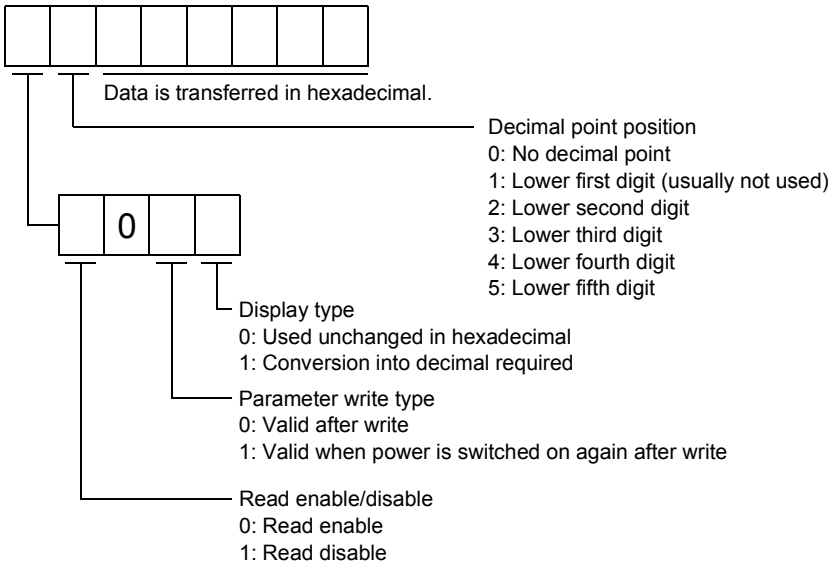
1) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No.

Command	Data No.
[0][5]	[0][0] to [3][5]

2) 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

Write the parameter setting.

Write the value within the setting range. Refer to Section 5.1 for the setting range.

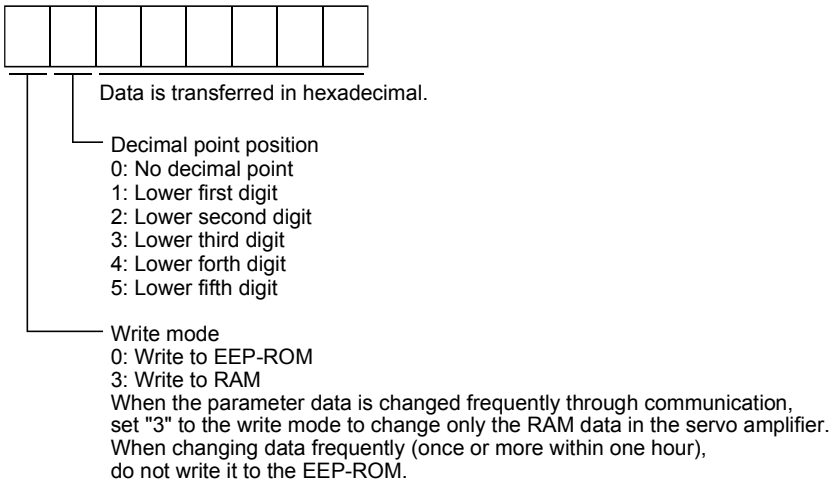
Transmit command [8][4], the data No., and the set data.

The data number is represented in hexadecimal. The decimal value converted from the data number value corresponds to the parameter number.

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 [3][5]	See below.



8.12.4 External I/O signal statuses

(1) Reading of input device statuses

Read the statuses of the input devices.

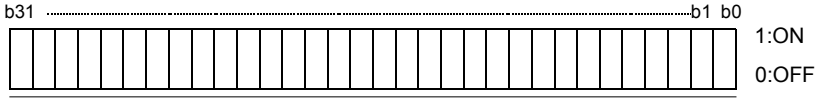
(a) Transmission

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	Alarm reset (RES)
7	
8	
9	

bit	Signal Name
10	
11	Forward rotation start (ST1)
12	Reverse rotation start (ST2)
13	
14	
15	
16	Emergency stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table selection 1 (DI0)

bit	Signal Name
20	Point table selection 2 (DI1)
21	Point table selection 3 (DI2)
22	Point table 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	
28	
29	

(2) External input pin status read

Read the ON/OFF statuses of the external output pins.

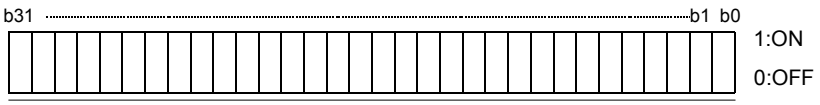
(a) Transmission

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	

(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.

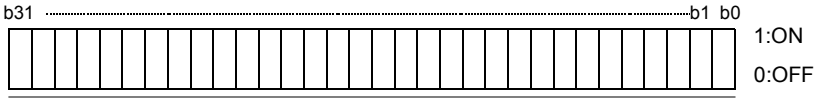
(a) Transmission

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	Alarm reset (RES)
7	
8	
9	

bit	Signal Name
10	
11	Forward rotation start (ST1)
12	Reverse rotation start (ST2)
13	
14	
15	
16	Emergency stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table selection 1 (DI0)

bit	Signal Name
20	Point table selection 2 (DI1)
21	Point table selection 3 (DI2)
22	Point table 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	
28	
29	

(4) External output pin status read

Read the ON/OFF statuses of the external output pins.

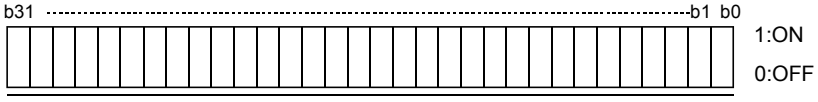
(a) Transmission

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

bit	External output Pin
5	CN1B-18
6	CNP2-9

(5) Read of the statuses of output devices

Read the ON/OFF statuses of the output devices.

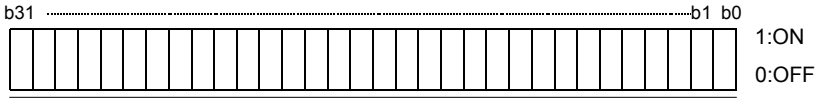
(a) Transmission

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)

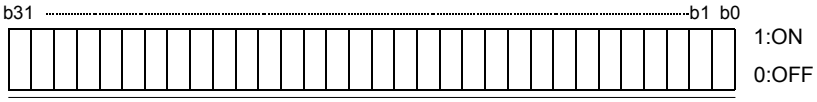
bit	Signal Name
8	Trouble (ALM)
9	
10	Electromagnetic brake (MBR)
11	Dynamic brake (DBR)
12	
13	
14	
15	

bit	Signal Name
16	Rough match (CPO)
17	Home position return completion (ZP)
18	Position range output (POT)
19	Temporary stop (PUS)
20	
21	
22	
23	

8.12.5 Device ON/OFF

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	Alarm reset (RES)
7	
8	
9	

bit	Signal Name
10	
11	Forward rotation start (ST1)
12	Reverse rotation start (ST2)
13	
14	
15	
16	Emergency stop (EMG)
17	Automatic/manual selection (MD0)
18	Proximity dog (DOG)
19	Point table selection 1 (DI0)

bit	Signal Name
20	Point table selection 2 (DI1)
21	Point table selection 3 (DI2)
22	Point table 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	
28	
29	

8.12.6 Alarm history

(1) Alarm No. read

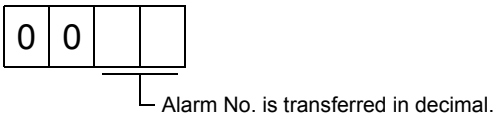
Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No.0 (last alarm) to No.5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to Section 8.11.1.

(b) Reply

The alarm No. corresponding to the data No. is provided.



For example, "0032" means A.32 and "00FF" A._ (no alarm).

(2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

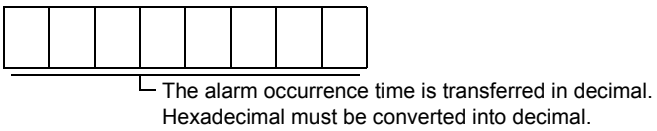
The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][5].

Refer to Section 8.11.1.

(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

8.12.7 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

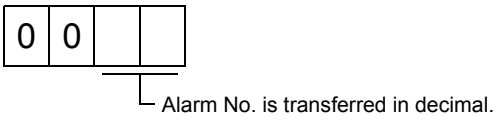
(a) Transmission

Send command [0][2] and data No. [0][0].

Command	Data No.
[0][2]	[0][0]

(b) Reply

The slave station sends back the alarm currently occurring.



For example, "0032" means A.32 and "00FF" A._ (no alarm).

(2) Read of the status display at alarm occurrence

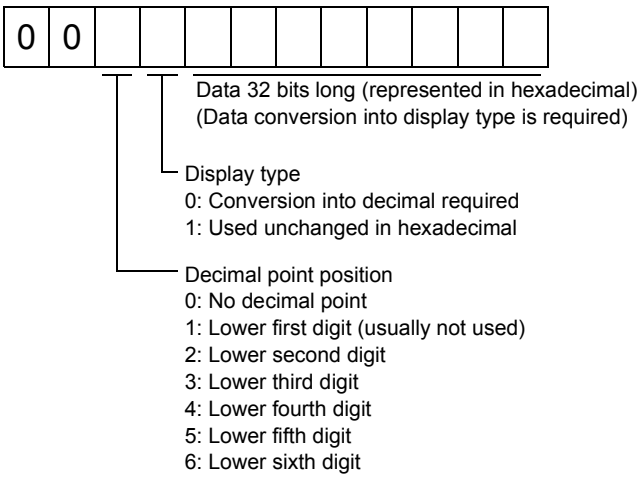
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][E] corresponding to the status display item to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the requested status display data at alarm occurrence.



(3) Current alarm clear

As by the entry of the RES signal, 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. Transmission

Command	Data No.	Data
[8][2]	[0][0]	1EA5

8.12.8 Point table

(1) Position data read

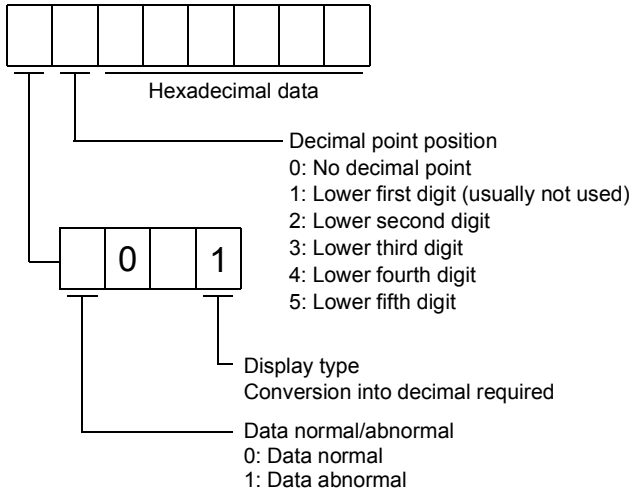
Read the position data of the point table.

(a) Transmission

Transmit command [4][0] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the position data of the requested point table.



(2) Speed data read

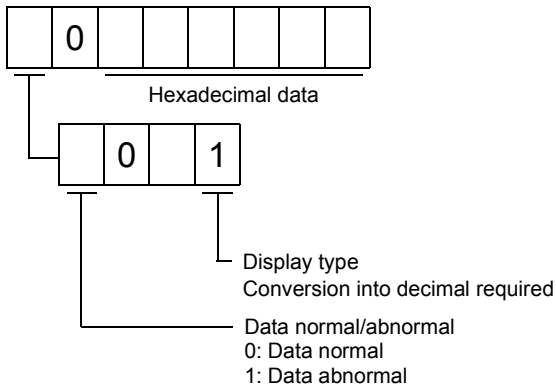
Read the speed data of the point table.

(a) 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 8.11.1.

(b) Reply

The slave station sends back the speed data of the requested point table.



(3) Acceleration time constant read

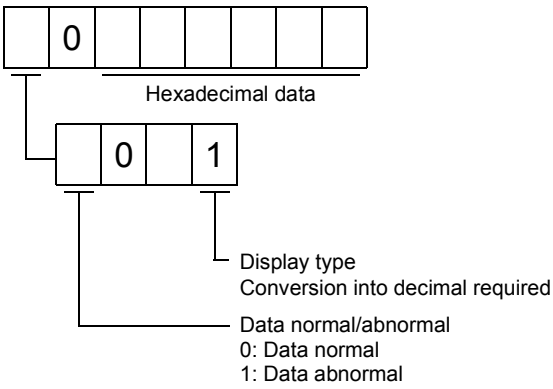
Read the acceleration time constant of the point table.

(a) Transmission

Transmit command [5][4] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the acceleration time constant of the requested point table.



(4) Deceleration time constant read

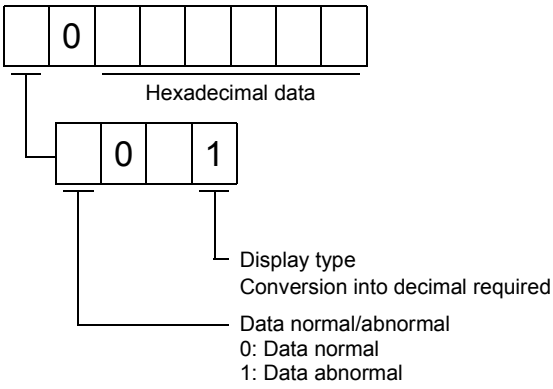
Read the deceleration time constant of the point table.

(a) Transmission

Transmit command [5][8] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the deceleration time constant of the requested point table.



(5) Dwell time read

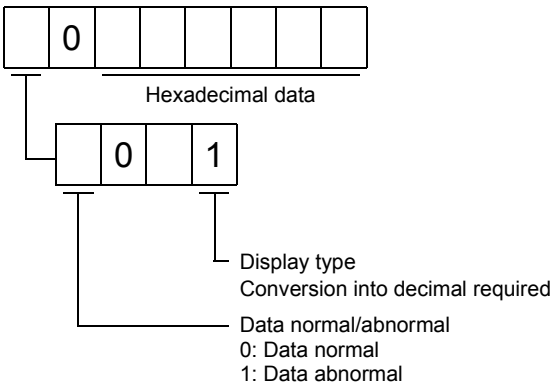
Read the dwell time of the point table.

(a) Transmission

Transmit command [6][0] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the dwell time of the requested point table.



(6) Auxiliary function read

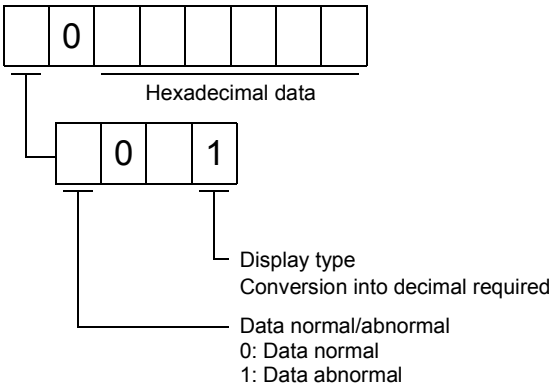
Read the auxiliary function of the point table.

(a) Transmission

Transmit command [6][4] and any of data No. [0][1] to [0][F] corresponding to the point table to be read. Refer to Section 8.11.1.

(b) Reply

The slave station sends back the auxiliary function of the requested point table.

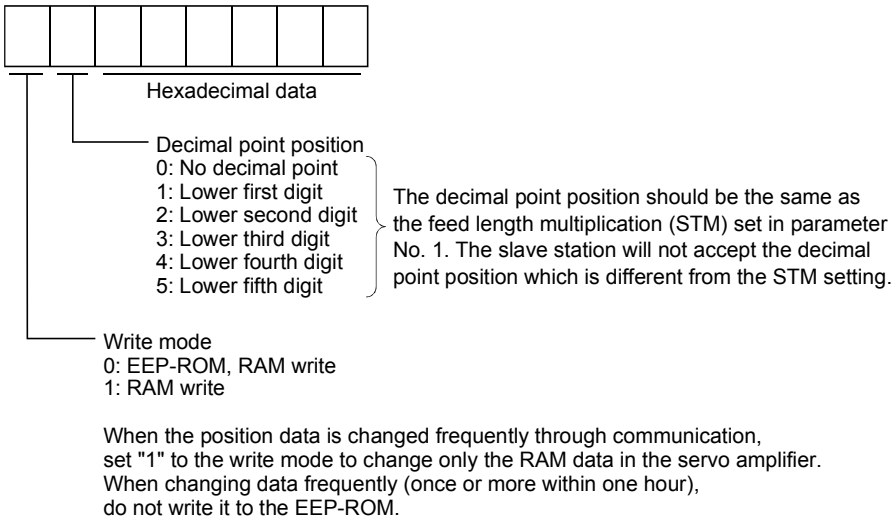


(7) Position data write

Write the position data of the point table.

Transmit command [C][0], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

Command	Data No.	Data
[C][0]	[0][1] to [0][F]	See below.



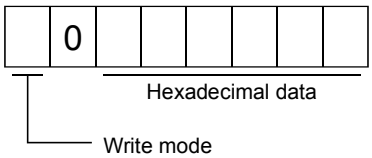
When the position data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(8) Speed data write

Write the speed data of the point table.

Transmit command [C][6], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

Command	Data No.	Data
[C][6]	[0][1] to [0][F]	See below.



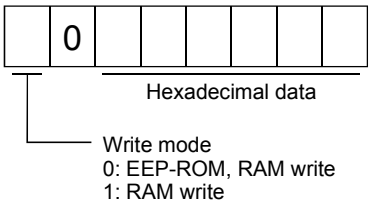
When the speed data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(9) Acceleration time constant write

Write the acceleration time constant of the point table.

Transmit command [C][7], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

Command	Data No.	Data
[C][7]	[0][1] to [0][F]	See below.



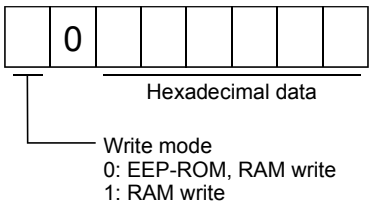
When the acceleration time constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(10) Deceleration time constant write

Write the deceleration time constant of the point table.

Transmit command [C][8], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

Command	Data No.	Data
[C][8]	[0][1] to [0][F]	See below.



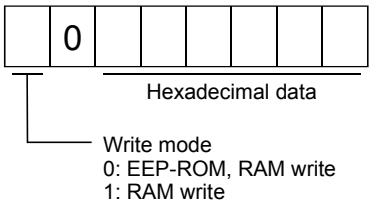
When the deceleration time is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(11) Dwell time write

Write the dwell time of the point table.

Transmit command [C][A], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

Command	Data No.	Data
[C][A]	[0][1] to [0][F]	See below.



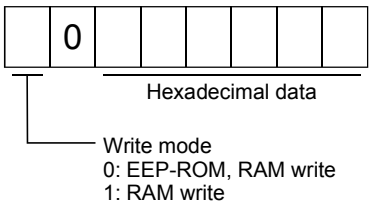
When the dwell time constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the servo amplifier. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(12) Auxiliary function write

Write the auxiliary function of the point table.

Transmit command [C][B], any of data No. [0][1] to [0][F] corresponding to the point table to be written to, and the data. Refer to Section 8.11.2.

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.

8.12.9 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.

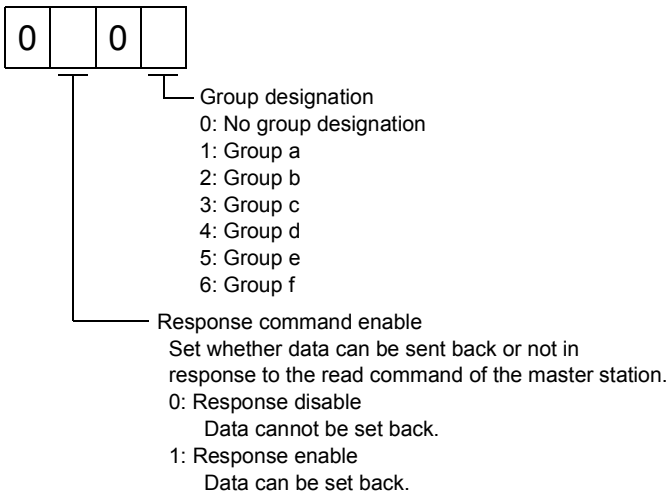
(1) Group setting write

Write the group designation value to the slave station.

Transmission

Transmit command [9][F], data No. [0][0] and data.

Command	Data No.	Data
[9][F]	[0][0]	See below.



(2) Group setting read

Read the set group designation value from the slave station.

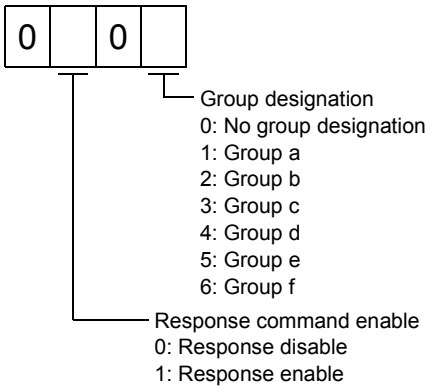
(a) Transmission

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.



8.12.10 Other commands

(1) Servo motor end pulse unit absolute position

Read the absolute position in the servo motor end pulse unit.

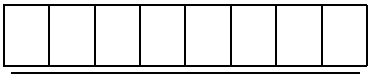
(a) Transmission

Send command [0][2] and data No. [9][0].

Command	Data No.
[0][2]	[9][0]

(b) Reply

The slave station sends back the requested servo motor end pulses.



Absolute value is sent back in hexadecimal in the servo motor end pulse unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the motor end pulse unit.

(2) Command unit absolute position

Read the absolute position in the command unit.

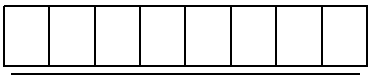
(a) Transmission

Send command [0][2] and data No. [9][1].

Command	Data No.
[0][2]	[9][1]

(b) Reply

The slave station sends back the requested command pulses.



Absolute value is sent back in hexadecimal in the command unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the command unit.

(3) Software version

Reads the software version of the servo amplifier.

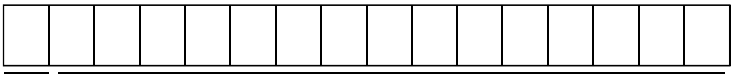
(a) Transmission

Send command [0] [2] and data No.[7] [0].

Command	Data No.
[0][2]	[7][0]

(b) Reply

The slave station returns the software version requested.



Space Software version (15 digits)

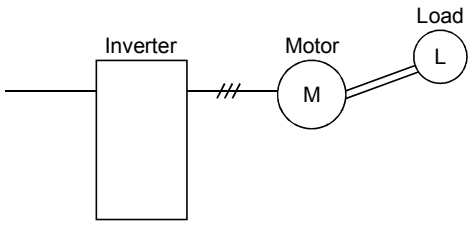
MEMO

9. ADJUSTMENT

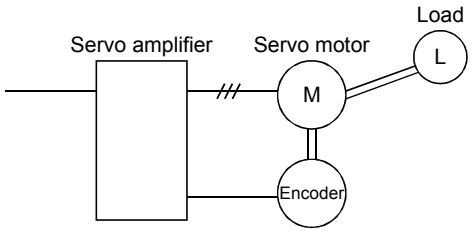
9.1 What is gain adjustment?

9.1.1 Difference between servo amplifier and other drives

Besides the servo amplifier, there are other motor drives such as an inverter and stepping driver. Among these drives, the servo amplifier requires gain adjustment.
The inverter and stepping driver are in an open loop (actual motor speed and position are not detected on the driver side).

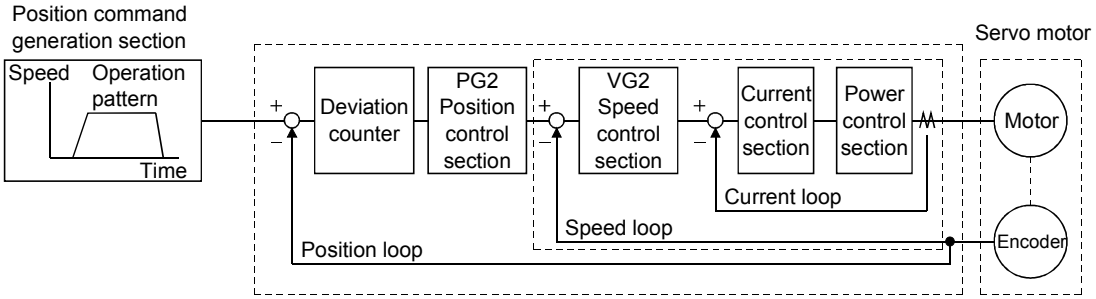


On the other hand, the servo amplifier always detects the positions and speeds of the motor and machine using the servo motor encoder, and exercises control to match the position and speed commands with the actual motor (machine) position and speed. In the servo system, adjustment is needed because:



(1) Response changes according to the inertia moment of the machine;
(2) Vibration occurs due to the resonance point, etc. peculiar to the machine; and
(3) Operation delay and accuracy specification differ between machines and response should satisfy this specification.

9.1.2 Basics of the servo system



A general servo system configuration is shown above. The servo control system consists of three loops: current loop, speed loop and position loop. Among these three loops, the response of the inside loop must be increased 4 to 6 times higher. If this condition is not satisfied, vibration will be generated. If the condition further worsens, hunting will occur.

(1) Current loop

For the servo amplifier, the response level of the current loop is factory-set to a high value and need not be adjusted. If the motor is installed to the machine, the response of the current loop will hardly vary.

(2) Speed loop

Response will vary according to the inertia moment of the machine. When the load inertia moment increases, the response of the speed loop will reduce. Use the speed loop gain (VG2) to compensate for the reduction of the response level.

$$\text{Speed loop response fv[rad/s]} = \frac{\text{Amplifier gain setting VG2[rad/s]}}{1 + m}$$

m : Loop inertia moment ratio $\left(= \frac{J_L}{J_M} \right)$

J_L = load inertia moment

J_M = servo motor shaft inertia moment

(3) Position loop

The response level will not vary according to machine conditions.

Position loop response fp[rad/s] = amplifier gain setting PG2[rad/s]

When the motor is installed to the machine, the gain must be adjusted to satisfy fv = 4 to 6fp according to the load inertia moment ratio m.

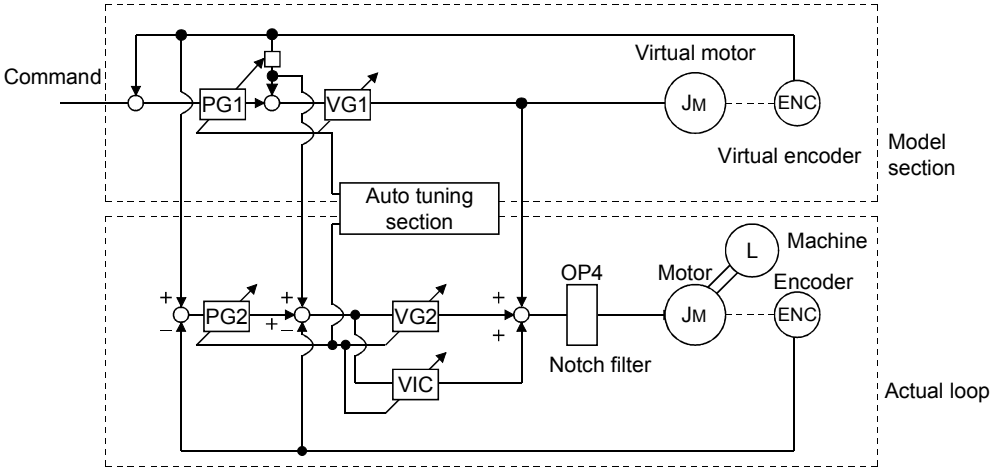
9.2 Gain adjustment

9.2.1 Parameters required for gain adjustment

Parameter No.	Symbol	Name
3	ATU	Auto tuning
7	PG1	Position loop gain 1
22	* OP4	Function selection 4 (machine resonance filter)
34	GD2	Ratio of load inertia moment to motor inertia moment
35	PG2	Position loop gain 2
36	VG1	Speed loop gain 1
37	VG2	Speed loop gain 2
38	VIC	Speed integral compensation

9.2.2 Block diagram

The block diagram of the servo amplifier servo control section is shown above. (The current loop is omitted.)



(1) Actual loop section

A control loop designed to control the actual motor and acts to control the servo system stably in response to the load torque of the machine.

(2) Model section

Acts to provide the ideal operation values to the current loop in response to the command.

(3) Auto tuning section

Judges the load inertia moment of the machine fitted with the actual motor from the operation error of the motor to change each control gain in real time.

The gains changed by auto tuning are PG1, VG1, PG2, VG2 and VIC.

9.2.3 What is auto tuning?

The angular speed (ω) and torque (T) are estimated in accordance with the equation of motion (9.1) used for motor acceleration/deceleration. In actuality, the acceleration/deceleration characteristics of the model and those of the actual motor are compared to estimate the inertia moment of the load in real time.

$$J\frac{d\omega}{dt} = T \quad \text{.....(9.1)}$$

J : Inertia moment
ω : Angular speed
T : Torque

Real-time auto tuning is performed in the following procedure:

(1) When the motor makes acceleration/deceleration, load inertia moment JL is estimated in the above method to calculate the load inertia moment ratio (GD2).
(2) Each gain (PG1, VG1, PG2, VG2, VIC) to the calculated load inertia moment ratio (GD2) is changed according to the response level set in parameter No.3. Note that these gains have been patterned beforehand to satisfy the aforementioned stabilization condition.

9.3 Gain adjustment by auto tuning

9.3.1 Adjustment method

In the factory setting of the servo amplifier, auto tuning is valid and the response setting is "2" (parameter No.3 : 0104).
The initial settings provide sufficient tuning for general machines. Higher-level tuning can be provided by adjusting the response setting (parameter No.3) according to machine rigidity.
The following table lists guidelines for response setting to drive systems. Choose slow response when using a reduction gear having backlash:

Main Drive System		Fast Response	Middle Response	Slow Response
Ballscrew	Direct coupling	←	→	
	With reduction gear	←	→	
Rack & pinion	Direct coupling		←	→
	With reduction gear		←	→
Timing belt	Direct coupling		←	→
	With reduction gear		←	→
Chain	Direct coupling		←	→
	With reduction gear		←	→

The following is how to adjust the response setting to machine phenomena:

Actual Machine Operation	Ideal Machine Operation	Parameter No.3 Setting
Settling time is long (Note)	Reduce settling time.	Increase response setting.
Large overshoot at stop	Reduce overshoot.	Decrease response setting. Set machine selection setting to "large friction".
Gear sound generated from machine	Reduce gear sound.	Decrease response setting.

Note: Settling time indicates time from zero command pulse to servo motor stop.

9.3.2 Valid conditions

POINT

- If the acceleration/deceleration time is long or the motor speed used is only low speed, the valid conditions of auto tuning are not satisfied. Therefore, it may result in false tuning.
  In this case, after performing operation which satisfies the auto tuning conditions, set auto tuning selection to "Not executed" (parameter No.3: □ 2 □ □).

This section provides constraints on the operation pattern to enable excellent auto tuning. If the conditions in this section cannot be satisfied, normal auto tuning may not be performed. In this case, after executing auto tuning in operation which satisfies the conditions given in this section, make auto tuning invalid to disallow the gain setting from being changed.

(1) Set the acceleration time (time until the preset speed is reached) to 5s or less and the acceleration/deceleration current to 50% or more.
(2) Perform operation several times until the cumulative acceleration/deceleration time is 1s or more.
(3) Set the servo motor speed to 500r/min or more.

9.4 Manual gain adjustment

On some machines, gain adjustment may not be made by auto tuning or excellent gain setting may not be made if gain adjustment is performed by auto tuning. In this case, adjust the gains manually. Use any of the methods given in this section to adjust the gains.

9.4.1 When machine rigidity is low

(1) Machine condition

Because of low machine rigidity, the response setting of auto tuning is set to slow response and it takes too much time to reach the target position.

When the machine or motor shaft is moved lightly at a stop, it moves easily.

(2) Adjustment procedure

(a) Adjustment 1

1) Execute auto tuning with the response setting of the level at which machine will not vibrate. Set "0101" in parameter No.3.
2) Set "Not executed" (parameter No.3: □ 2 □ □) by the auto tuning selection.
3) Gradually decrease the speed integral compensation VIC (parameter No.38) setting.

(b) Adjustment 2

1) Perform auto tuning with the response setting of slow response.
Set "0101" in parameter No.3.
2) Set 563Hz or 375Hz to the machine resonance filter (Parameter No.22).
3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) If the machine condition does not become excellent after the above adjustment, reduce the setting of speed integral compensation (parameter No.38) as in Adjustment 1.

9.4.2 When the machine vibrates due to machine resonance frequency

(1) Machine condition

The servo motor shaft is oscillating at high frequency (100Hz or more).

The servo motor shaft motion cannot be confirmed visually. However, if the machine generates large noise and vibrates, make Adjustment 1.

If higher "response setting" of auto tuning increases vibration, make Adjustment 2.

(2) Adjustment procedure

(a) Adjustment 1

1) Perform auto tuning with the response setting of slow response.
   Set "0101" in parameter No.3.
2) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.22).
3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) Decrease the machine resonance suppression filter gradually and repeat step 3).
   The optimum value is provided at the point where vibration is minimum.
5) To further shorten the settling time, gradually increase the response selection (parameter No.3) and repeat steps 1) to 4).

(b) Adjustment 2

1) Choose the response setting of slow response.
   Set "0101" in parameter No.3.
2) Set the load inertia moment ratio (parameter No.34).
   If an exact machine inertia moment ratio is unknown, enter an approximate value.
   When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the load inertia moment ratio (parameter No.34) value.

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

3) Set "not executed" (parameter No.3: □ 2 □ □) by the auto tuning selection.
4) Decrease the speed loop gain 2 (parameter No. 37) to a value about 100 to 200 smaller than the automatically set value.
5) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.22).
6) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
7) Decrease the machine resonance suppression filter gradually and repeat step 6).
   The optimum value is provided at the point where vibration is minimum.
8) When there is no machine resonance, check the operating status and gradually increase the speed loop gain 2 (parameter No.37) and repeat steps 5) to 7) in (b) Adjustment 2.
   Set the value about 50 to 100 smaller than the value at which gear sound begins to be generated.
   Make this gain a little smaller if there is variation in the machine because a timing belt or the like is used.
9) To further shorten the settling time, gradually increase the response setting (parameter No.3) and repeat steps 1) to 8).

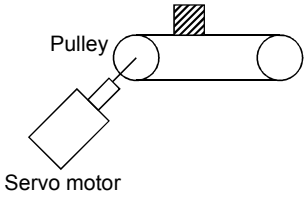
9.4.3 Load inertia moment is 20 or more times

(1) Machine condition

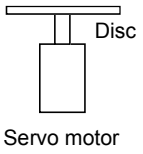
The machine inertia moment is 20 times or more and the servo motor oscillates at low frequency (5Hz or more). At this time, servo motor shaft vibration can be confirmed visually.

This adjustment method is valid for the following machines:

(a) Machine in which a timing belt is driven without reduction gear



(b) Machine in which a disc is rotated without reduction gear



(c) Machine of which ballscrew lead is long

(2) Adjustment procedure

1) Choose the response setting of slow response.
   Set "0101" in parameter No.3.
2) Set the load inertia moment ratio (parameter No.34).
   If an exact machine inertia moment ratio is unknown, enter an approximate value.
   When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the load inertia moment ratio (parameter No.34) value.

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

3) Set "not executed" (parameter No.3: □ 2 □□) by the auto tuning selection.
4) Alternate a start and a stop several times and check whether the machine does not vibrate.
5) If vibration still persists, repeat steps 1) and 4).
6) If vibration still persists, make (a) Adjustment 1 and (b) Adjustment 2 in paragraph (2) of Section 9.4.2.
7) If you want to further raise the response, set parameter No. 3 to "auto tuning executed" (third digit) with operation stopped, and increase the response setting (first digit). After that, set that parameter to "auto tuning not executed" (third digit). For example, set parameter No. 3 to "0102" and then change it to "0202".
8) Reducing the speed loop's integral time constant (parameter No.38) may improve the performance. However, making it too small may generate vibration.

9.4.4 When shortening the settling time

(1) Machine condition

The settling time will be increased by the gains provided by auto tuning.

(2) Adjustment procedure

1) Choose the response setting of slow response.
   Set 0101 in parameter No.3.
2) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
3) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.34).
   If an exact machine inertia moment ratio is unknown, enter an approximate value.
   When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the load inertia moment ratio (parameter No.34) value.

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

4) Set "not executed" (parameter No.3: □ 2 □□) by the auto tuning selection.
   Make the parameter No.7, 35 to 38 settings manually adjustable.
5) Check the operating status and adjust the following parameter values:

Parameter No.	Symbol	Name	Description
7	PG1	Position loop gain 1	Higher setting shortens the settling time but is liable to cause overshooting.
35	PG2	Position loop gain 2	
36	VG1	Speed loop gain 1	Higher setting improves the servo response level but is liable to cause vibration.
37	VG2	Speed loop gain 2	
38	VIC	Speed integral compensation	Lower setting keeps the speed constant to load disturbance and increases holding force at a stop (servo rigidity) but is liable to cause overshooting.

Make adjustment by gradually increasing the parameter No.7, 35 to 37 settings at the same ratio and reducing the speed integral compensation (parameter No.38). The optimum value is provided at the point just before vibration increases. Use of the machine resonance suppression filter (parameter No.22) may increase the limit point. Note that since the maximum value of the speed loop gain is "2000", do not set a value greater than that.

9.4.5 When the same gain is used for two or more axes

(1) Machine condition

To perform interpolation operation with two or more axes of servo amplifiers, the position loop gains of the axes are set to the same value.

(2) Adjustment procedure

1) To adjust the gains of each axis, adjust the gains of all axes in the adjustment procedures in Sections 9.4.1 to 9.4.5.
2) Set "□0□□" or "□2□□" in parameter No.3.

□2□□ : Interpolation control..... The following parameter values change at the next start/stop.

Parameter No.	Symbol	Name
35	PG2	Position loop gain 2
37	VG2	Speed loop gain 2
38	VIC	Speed integral compensation

□2□□ : No auto tuning .....Make auto tuning invalid and set each gain manually.

3) Match position loop gain 1 to the minimum value of each axis to make the gains of all axes equal.

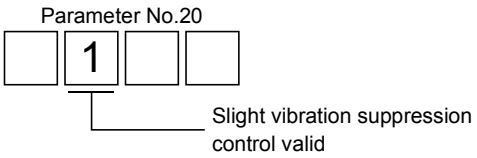
9.5 Slight vibration suppression control

The slight vibration suppression control mode is used to reduce servo-specific ±1 pulse vibration at the time of a stop. This mode produces an effect especially when the ratio of load inertia moment to servo motor inertia moment is small (2 to 5 times). Note that when vibration is attributable to looseness (such as gear backlash) or machine resonance, use the machine resonance suppression filter (parameter No.22). The slight vibration suppression control mode should be used after real-time auto tuning or manual gain adjustment.

Usage

First, perform real-time auto tuning or manual gain adjustment so that vibration falls within ±2 to 3 pulses.

Set "□1□□" in parameter No.20 to enter the slight vibration suppression mode at the time of a stop.



10. INSPECTION

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

POINT

・Do not test the servo amplifier with a megger (measure insulation resistance), or it may become faulty.

・Do not disassemble and/or repair the equipment on customer side.

(1) Inspection

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.

Part Name	Life Guideline
Smoothing capacitor	10 years
Relay	Number of power-on and number of emergency stop time: 100,000 times

(a) Smoothing capacitor

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

(b) Relays

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

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.

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	Refer To
1	Power on	・LED is not lit. ・LED flickers.	Not improved if connectors CN1A, CN1B and CNP2 are disconnected.	1. Power supply voltage fault 2. Servo amplifier is faulty. 3. Poor connection of CNP1	
			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.	
		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).	Check the display to see if the servo amplifier is ready to operate.	1. Servo on signal is not input. (Wiring mistake) 2. 24VDC power is not supplied to COM.	Section 7.3
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure: 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	Make gain adjustment in the following procedure: If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Communication command error, machine slip, etc.	

11.2 When alarm or warning has occurred

POINT

- If an alarm has occurred, detect the trouble (ALM) and turn off the servo on (SON).

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.
If an alarm occurs, ALM-SG are opened.
Any of the alarms marked ○ in the Alarm Deactivation field can be deactivated by performing the corresponding operation.

	Display	Name	Alarm Deactivation		
			Power OFF → ON	Press "SET" on present alarm screen	Alarm Reset (RES) signal
Alarms	A.10	Undervoltage	○	○	○
	A.11	Board error 1	○		
	A.12	Memory error 1	○		
	A.13	Clock error	○		
	A.15	Memory error 2	○		
	A.16	Encoder error 1	○		
	A.17	Board error 2	○		
	A.18	Board error 3	○		
	A.20	Encoder error 2	○		
	A.24	Motor output ground fault	○		
	A.31	Overspeed	○	○	○
	A.32	Overcurrent	○	○	○
	A.33	Overvoltage	○		
	A.35	Command pulse frequency error	○	○	○
	A.37	Parameter error	○		
	A.50	Overload 1	(Note) ○	(Note) ○	(Note) ○
	A.51	Overload 2	(Note) ○	(Note) ○	(Note) ○
	A.52	Error excessive	○	○	○
	A.61	Operation alarm	○	○	○
	A.8A	Serial communication time-out	○	○	○
	A.8E	Serial communication error	○	○	○
	8888	Watchdog	○		
Warnings	A.90	Home position return incomplete	Removing the cause of occurrence deactivates the alarm automatically.		
	A.96	Home position setting error			
	A.98	Software limit warning			
	A.E1	Overload warning			
	A.E6	Servo emergency stop warning			
	A.E9	Main circuit off warning			

Note: After removing the cause of occurrence, allow about 15 minutes for cooling before resuming operation.

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.

> **POINT**
> - When any of the following alarms has occurred, always remove its cause and allow about 15 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.
> - Overload 1 (A.50)
> - Overload 2 (A.51)
> - Deactivate the alarm by switching power off, then on.
> - When alarm reset (RES) is made valid in "I/O Devices" on the Servo Configuration Software, alarm reset (RES) may be used to deactivate the alarm. Refer to Section 11.2.1 for details.

When an alarm occurs, the trouble signal (ALM) switches off and the servo motor is stopped by the dynamic brake. At this time, the display shows the corresponding alarm number.
Remove the cause of the alarm in accordance with this section. The optional Servo Configuration Software may be used to refer to the cause.

Display	Name	Definition	Cause	Action
A.10	Undervoltage	Power supply voltage dropped 20V to or less	1. Power supply voltage is low.	Review the power supply.
			2. Power failed instantaneously for 15ms or longer.	
			3. Shortage of control circuit power supply capacity caused the power supply voltage to drop at start, etc.	
			4. Power was restored after bus voltage had dropped to 15VDC. (Main circuit power was switched on within 5s after it had been switched off.)	
			5. Faulty parts in the servo amplifier Checking method Alarm (10) occurs if power is switched on after CN1A・CN1B・CNP2 and CNP3 connectors are disconnected.	Change the servo amplifier.
A.11	Board error 1	Printed board faulty	Faulty parts in the servo amplifier Checking method Alarm (any of 11 to 13 and 15) occurs if power is switched on after CN1A・CN1B・CNP2 and CNP3 connectors are disconnected.	Change the servo amplifier.
A.12	Memory error 1	RAM, ROM memory fault		
A.13	Clock error	Printed board fault		
A.15	Memory error 2	EEP-ROM fault		
A.16	Encoder error 1	Communication error occurred between encoder and servo amplifier.	1. CNP2 connector disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Motor cable faulty (Wire breakage or short)	Repair or change cable.

Display	Name	Definition	Cause	Action
A.17	Board error 2	CPU/parts fault	1. Faulty parts in the servo amplifier. Checking method Alarm (AL.17) occurs if power is switched on after connectors have been disconnected.	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.
A.18	Board error 3	Printed board fault	Faulty parts in the servo amplifier. Checking method Alarm (AL.18) occurs if power is switched on after connectors have been disconnected.	Change the servo amplifier.
A.20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. CNP2 connector disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Motor cable faulty (Encoder wiring broken or shorted)	Repair or change cable.
A.24	Motor output ground fault	Ground fault occurred at the servo motor outputs (U, V and W phases) of the servo amplifier.	1. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			2. Main circuit of servo amplifier failed. Checking method Alarm (A.24) occurs if the power is switched on after CNP2 connector are disconnected.	Change the servo amplifier.
A.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. Encoder faulty.	Change the servo motor.

Display	Name	Definition	Cause	Action
A.32	Overcurrent	Current that flew is higher than the permissible current of the servo amplifier.	1. Short occurred in servo amplifier output phases U, V and W.	Correct the wiring.
			2. Transistor of the servo amplifier faulty. Checking method Alarm (A.32) occurs if power is switched on after CNP2 connector 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.
A.33	Overvoltage	Input value of converter bus voltage 35V or more.	Power supply voltage is outside the permissible voltage range.	Change battery.
A.35	Command pulse frequency error	Input pulse frequency of the manual pulse generator 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.
A.37	Parameter error	Parameter or point table setting is abnormal.	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
			2. Point table data is in error.	Set the point table data correctly.
A.50	Overload 1	Load exceeded overload protection characteristic of servo amplifier. Load ratio 200%: 85s or more	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
A.51	Overload 2	Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked: 1s or more	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Servo amplifier's output U, V, W do not match servo motor's input 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.
A.52	Error excessive	Droop pulse value of the deviation counter exceeded 80k pulses.	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Torque limit value (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.

Display	Name	Definition	Cause	Action
A52	Error excessive	Droop pulse value of the deviation counter exceeded 80k pulses.	7. Encoder faulty	Change the servo motor.
			8. Wrong connection of servo motor. Servo amplifier's output U, V, W do not match servo motor's input U, V, W.	Connect correctly.
A.61	Operation alarm	"1" is set in auxiliary function of point table No.15.	Setting error of auxiliary function of point table No.15	Set "0" in auxiliary function of point table No.15.
A.8A	Serial communication time-out	Valid command has not been transmitted from communication device (e.g. personal computer) to servo amplifier within time-out period.	1. Communication connector disconnected.	Connect correctly.
			2. Communication cable fault	Repair or change the cable.
			3. Valid command has not been transmitted from communication device (e.g. personal computer) within time-out period.	Transmit valid command from communication device (e.g. personal computer) within time-out period.
A.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).
8888	Watchdog	CPU, parts faulty	Fault of parts in servo amplifier Checking method Alarm (8888) occurs if power is switched on after CN1A・CN1B・CNP2 and CNP3 connectors are disconnected.	Change servo amplifier.

11.2.3 Remedies for warnings

POINT

- When any of the following alarms has occurred, do not resume operation by switching power of the servo amplifier OFF/ON repeatedly. The servo amplifier and servo motor may become faulty. If the power of the servo amplifier is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
  - Overload warning 1 (A.E1)

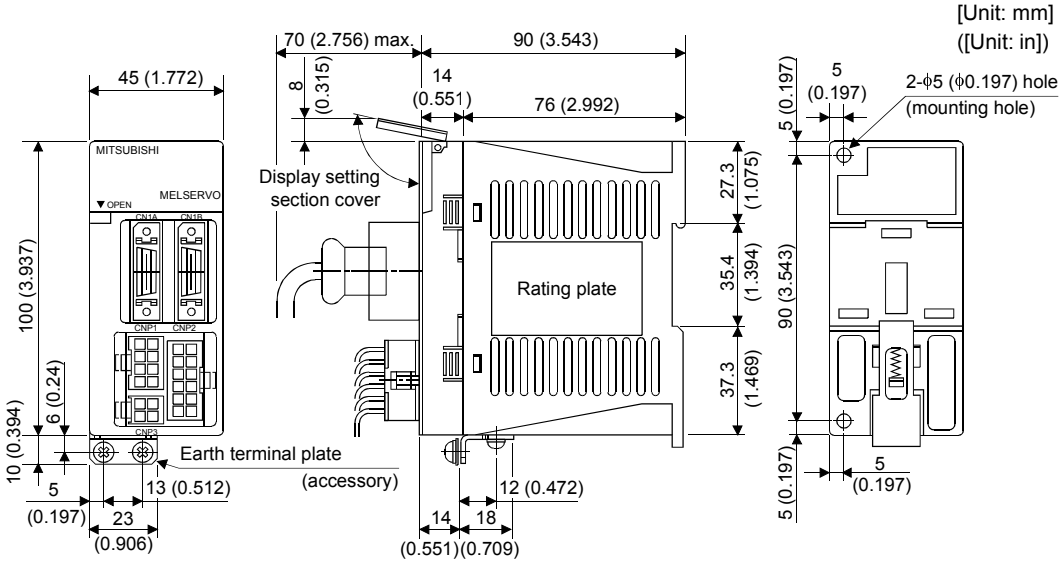
If E6, E7 or E9 occurs, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed. Eliminate the cause of the warning according to this section. Use the optional Servo Configuration software to refer to the cause of warning.

Display	Name	Definition	Cause	Action
A.90	Home position return incomplete	1. Positioning operation was performed without home position return. 2. Home position return ended abnormally.	1. Positioning operation was performed without home position return. 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.	1. Perform home position return. 2. Review home position return speed/creep speed/moving distance after proximity dog.
A.96	Home position setting error	1. Home position could not be made.	Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
A.98	Software limit warning	Command position exceeded software limit.		1. Review the operation pattern. 2. Review the software limit setting.
AE1	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 A.50,51.	Refer to A. 50, A. 51.
AE6	Servo emergency stop warning	EMG-SG are open.	External emergency stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate emergency stop.
AE9	Main circuit off warning	Servo was switched on with main circuit power off.		Switch on main circuit power.

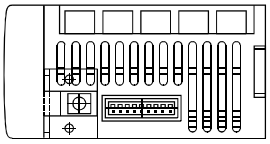
12. OUTLINE DIMENSION DRAWINGS

12.1 Servo amplifiers

[Unit: mm]
([Unit: in])



Servo Amplifier Model	Weight [kg] ([lb])
MR-J2-03C5	0.2 (0.44)



(Note)

CNP1

5	1
RDP	P24M
6	2
RDN	P24G
7	3
SDP	P24L
8	4
SDN	EM1

CNP2

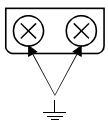
6	12
MR	MRR
5	11
P5	LG
4	10
SD	
3	9
B2	B1
2	8
U	W
1	7
E	V

CNP3

3	1
SD	LG
4	2
TXD	RXD

Note: One connector (5557-08R) and 10 terminals (5556) for CNP1 wiring are included in the package.

Earth terminal



Terminal screw: M4
Tightening torque: 1.24 [N・m] (11.0 [lb・in])

12.2 Connectors

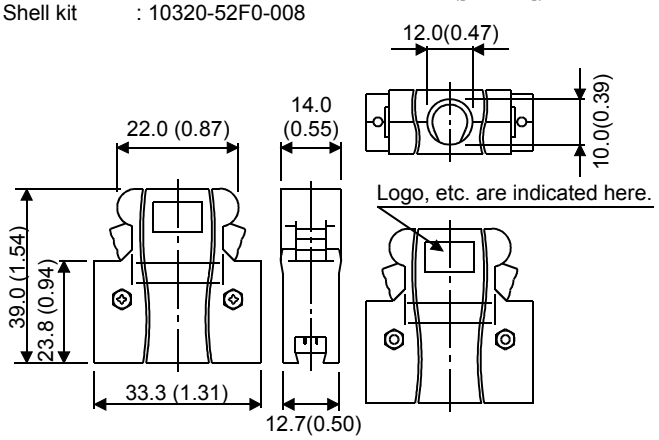
(1) Servo amplifier side

< 3M >

(a) Soldered type

Model
Connector : 10120-3000VE
Shell kit : 10320-52F0-008

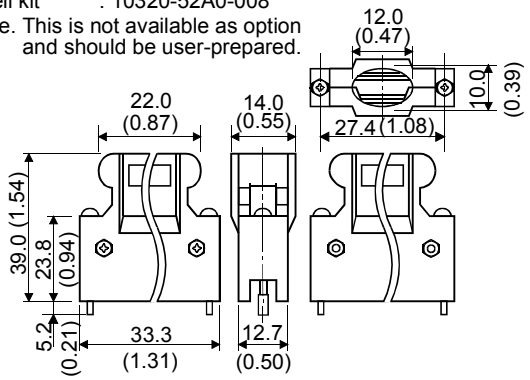
[Unit: mm]
([Unit: in])



(b) Threaded type

Model
Connector : 10120-3000VE
Shell kit : 10320-52A0-008
Note. This is not available as option and should be user-prepared.

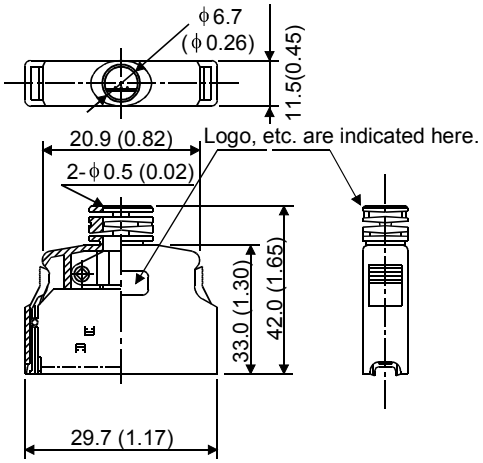
[Unit: mm]
([Unit: in])



(c) Insulation displacement type

Model
Connector : 10120-6000EL
Shell kit : 10320-3210-000

[Unit: mm]
([Unit: in])

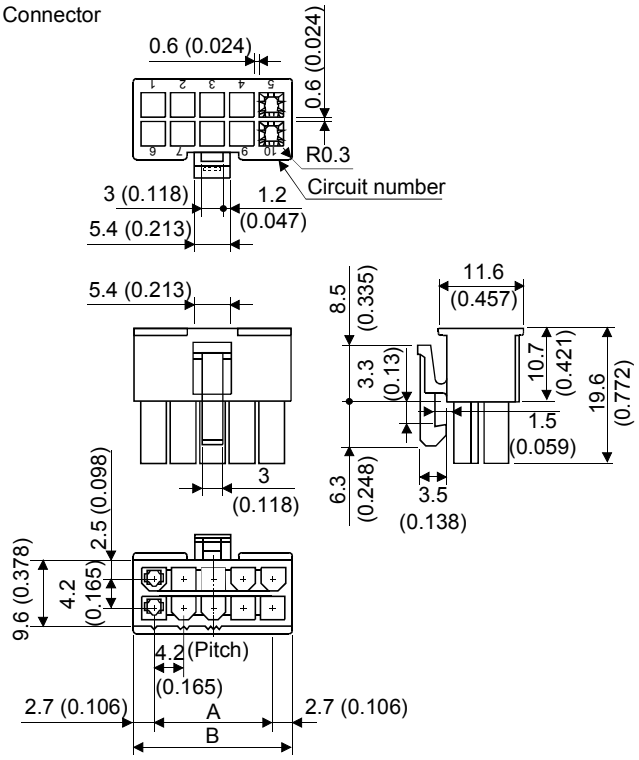


(2) Connectors for CNP1/CNP2/CNP3

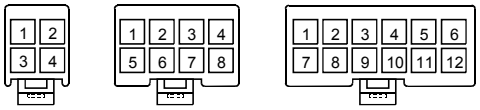
<molex>

Connector

[Unit: mm]
([Unit: in])



Layout diagrams classified by the number of poles

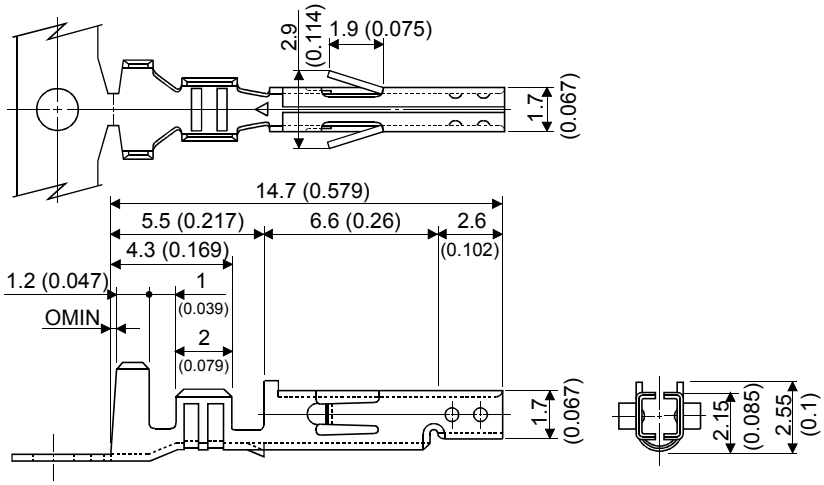


4 poles 8 poles 12 poles

Model	Variable Dimensions	
	A	B
5557-04R	4.2 (0.165)	9.6 (0.378)
5557-08R	12.6 (0.496)	18.0 (0.709)
5557-12R	21.0 (0.827)	26.4 (1.039)

Terminal
Model: 5556

[Unit: mm]
([Unit: in])



Applicable wire
- Core size : AWG#18 to #24 (5556-PBTL)
  AWG28 (5556-PBT2L)
- Sheath OD: ϕ3.1mm (ϕ0.122 in) max.
- Strip length: 3.0 to 3.5 [mm]
  (0.118 to 0.138 [in])

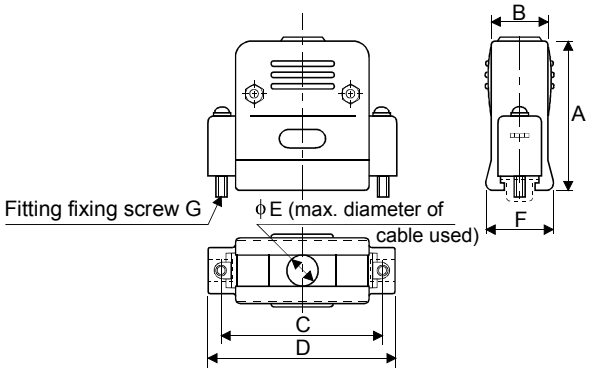
Exclusive tools

Terminal	Wire specifications		Tool number
	Core size	Sheath OD [mm(inch)]	
5556-PBL	AWG18 to AWG24	1.5 to 2.2 (0.06 to 0.09)	57026-5000
		2.3 to 3.1 (0.06 to 0.12)	57027-5000
5556-PBT2L	AWG28		57064-5000
5556-PBT3L	AWG16		57022-5300

(3) Communication cable connector

<Japan Aviation Electronics Industry >

[Unit: mm]
([Unit: in])

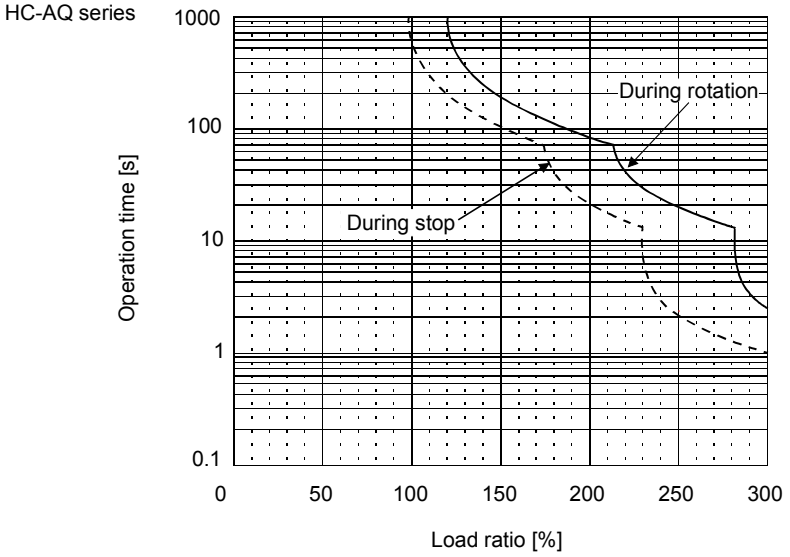


Type	A ±1	B ±1	C ±0.25	D ±1	ϕE	F Reference	G
DE-C1-J6-S6	34.5(1.36)	19(0.75)	24.99(0.98)	33(1.30)	6(0.24)	18(0.71)	#4-40

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. The operation characteristics of the electronic thermal relay are shown below. Overload 1 alarm (A.50) occurs if overload operation performed is above the electronic thermal relay protection curve shown below. Overload 2 alarm (A.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.



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 Dynamic brake characteristics

Fig. 13.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 13.1 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to Fig. 13.3)

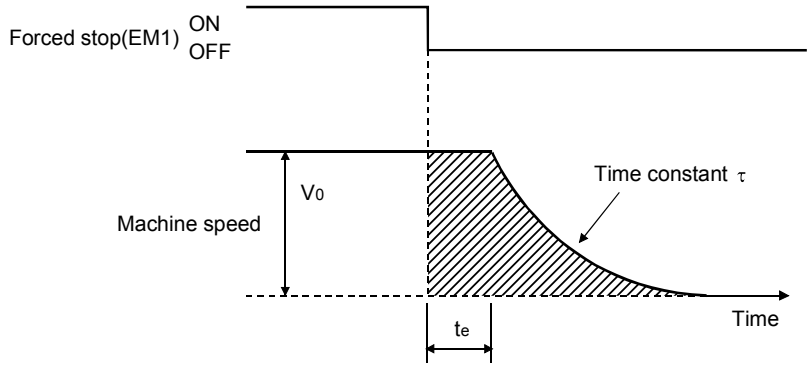


Fig. 13.2 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad (13.1)$$

L_{max} : Maximum coasting distance [mm][in]
V_0 : Machine rapid feedrate [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 (Fig. 10.3) [s]
t_e : Delay time of control section (Fig. 10.2) [s]
(There is processing delay time of about 3.5ms.)

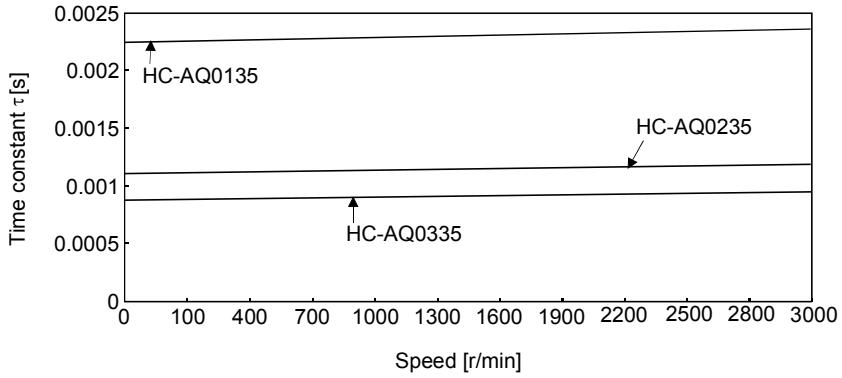


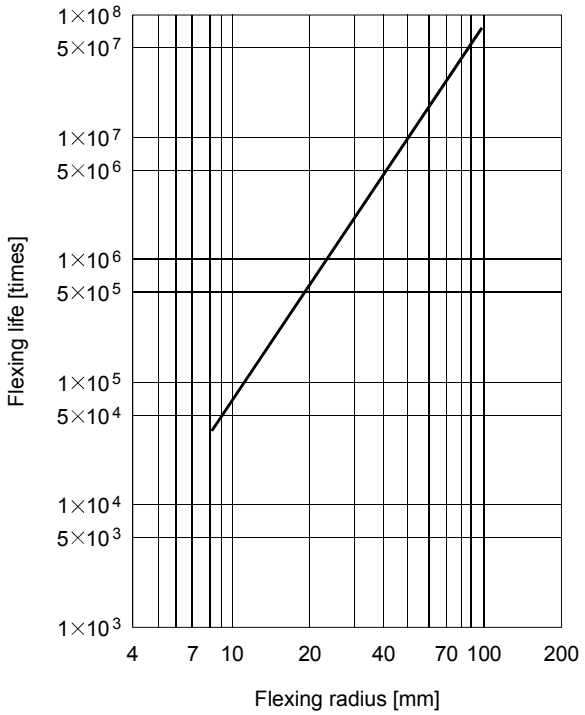
Fig. 13.3 Dynamic brake time constant

Use the dynamic brake at the load inertia moment indicated in the following table. If the load inertia moment is higher than this value, the servo amplifier 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-J2-03C5	100

13.3 Motor cable flexing life

The flexing life of the MR-JRCBL□M-H cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



MEMO

14. OPTIONS AND AUXILIARY EQUIPMENT

⚠ WARNING	・Before connecting any option or auxiliary equipment, switch power off, and after more than 15 minutes have elapsed, confirm the voltage with a tester or the like. Otherwise, you may get an electric shock.

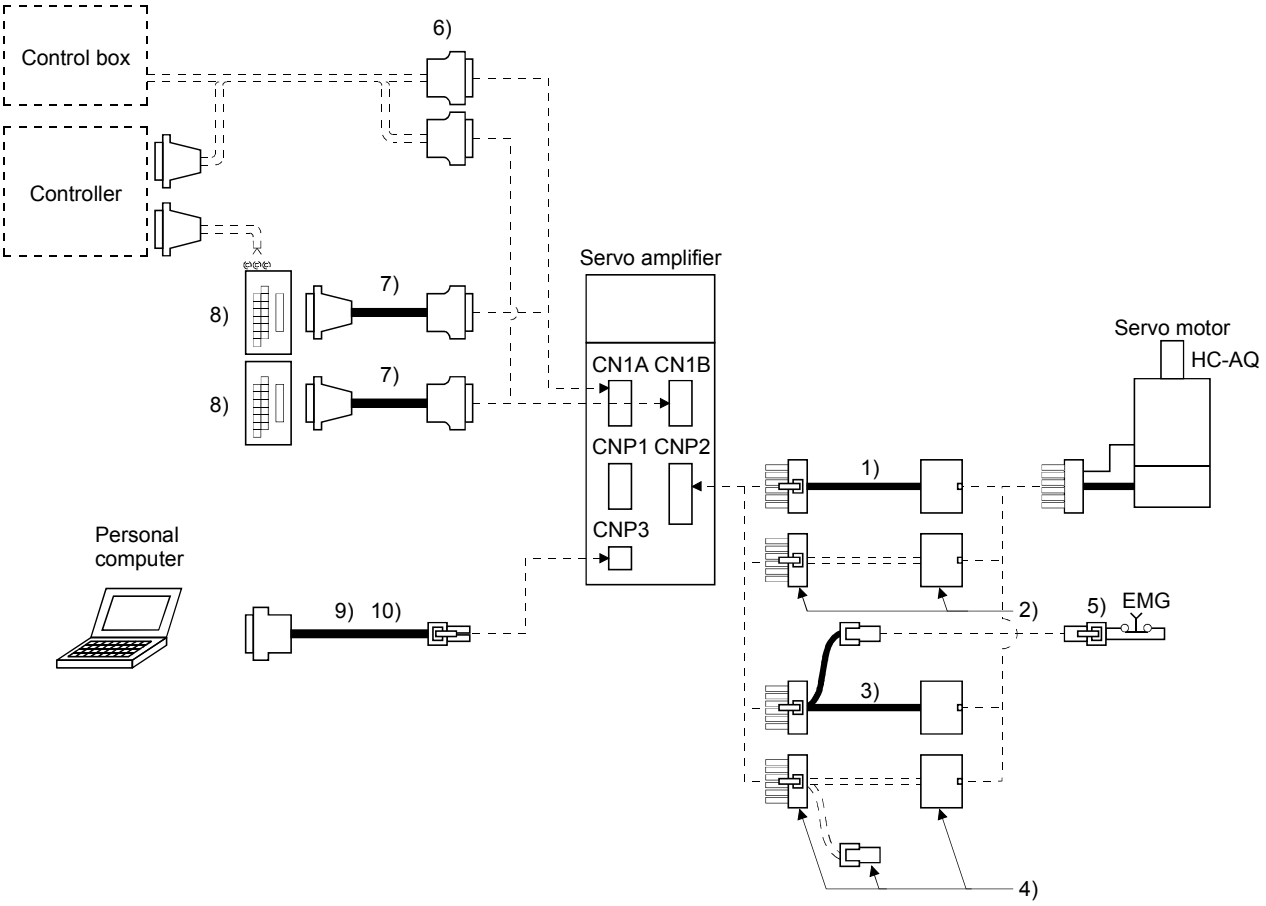
⚠ CAUTION	・Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

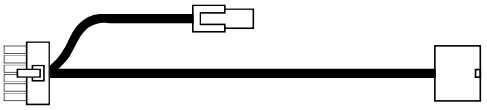
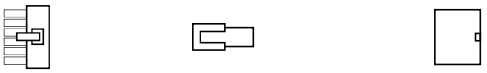
14.1 Options

14.1.1 Cables and connectors

(1) Cable make-up

The following cables are used for connection with the servo motor and other models.
The broken line areas in the diagram are not options.



No.	Product	Model	Description	Application
1)	Motor cable	MR-JRCBL □ M-H Refer to (2) in this section	Connector: 5557-12R-210 Terminal: 5556 (molex) Connector: 5559-12P-210 Terminal: 5558 (molex) 	IP20 compliant
2)	Motor cable connector set	MR-JRCNM	Connector: 5557-12R-210 Terminal: 5556 (molex) Connector: 5559-12P-210 Terminal: 5558 (molex) 	IP20 compliant
3)	Motor cable for servo motor with electromagnetic brake	MR-JRBRCBL □ -H Refer to (2) in this section.	Connector: 5557-12R-210 Terminal: 5556 (molex) Connector: 5559-02P-210 Terminal: 5558 (molex) Connector: 5559-12P-210 Terminal: 5558 (molex) 	IP20
4)	Motor cable connector set for servo motor with electromagnetic brake	MR-JRBRCNM	Connector: 5557-12R-210 Terminal: 5556 (molex) Connector: 5559-02P-210 Terminal: 5558 (molex) Connector: 5559-12P-210 Terminal: 5558 (molex) 	IP20
5)	Connector set for electromagnetic brake contact	MR-JRBRCN	Connector:5557-02R-210 Qty: 1 Terminal: 5556 Qty: 4 (molex) 	
6)	Control signal connector set	MR-J2CN1	Connector: 1020-3000VE Shell kit: 10320-52F0-008 (3M or equivalent)  Qty: 2 each	
7)	Junction terminal block cable	MR-J2TBL □ M Refer to section 14.1.2.	Connector: HIF3BA-20D-2.54R (Hirose Electric) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	For junction terminal block connection
8)	Junction terminal block	MR-TB20	Refer to Section 14.1.2.	
9)	Communication cable	MR-JRPC98CBL3M Refer to (3) in this section.	Connector: 5557-04R-210 Terminal: 5556 (molex) Connector: DE-25PF-N Case: DB-C2-J9 (Japan Aviation Electronics) 	For connection with PC-98 personal computer
10)	Communication cable	MR-JRPC98CBL3M Refer to (3) in this section.	Connector: 5557-04R-210 Terminal: 5556 (molex) Connector: DE-9SF-N Case: DE-C1-J6-S6 (Japan Aviation Electronics) 	For connection with PC-AT-compatible personal computer

(2) Motor cable

⚠ CAUTION	・If you have fabricated the encoder cable, connect it correctly. Otherwise, misoperation or explosion may occur. ・Use the MR-JRBRCBL□M-H when using the servo motor provided with electromagnetic brake.

POINT
・The encoder cable is not oil resistant. ・Refer to Section 13.3 for the flexing life of the encoder cable.

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.

Servo Motor	Motor Cable			Connector Set
	(Note 1) Model	Use for EN/UL Standard	(Note 2) Long flexing life	
HC-AQ0135D to HC-AQ0335D	MR-JRCBL□M-H	○	○	MR-JRCNM

Note: 1. □ indicates the cable length: 2, 5, 10, 20, 30 (m).
2. The standard cable has a long flexing life.

(a) MR-JRCBL□M-H

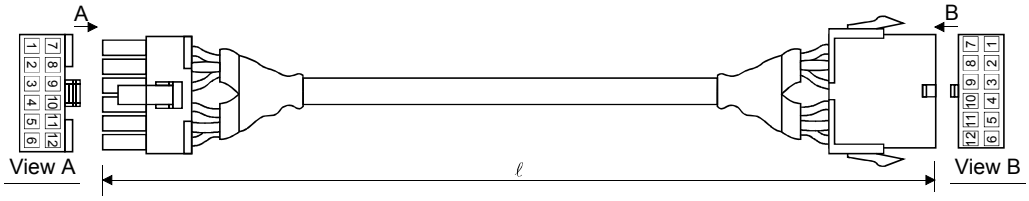
1) Model explanation

Model: MR-JRCBL□M-H

Long flexing life

Symbol	Cable Length [m]([ft])
2	2(6.5)
5	5(16.4)
10	10(32.8)
20	20(65.6)
30	30(98.4)

2) Outline drawing

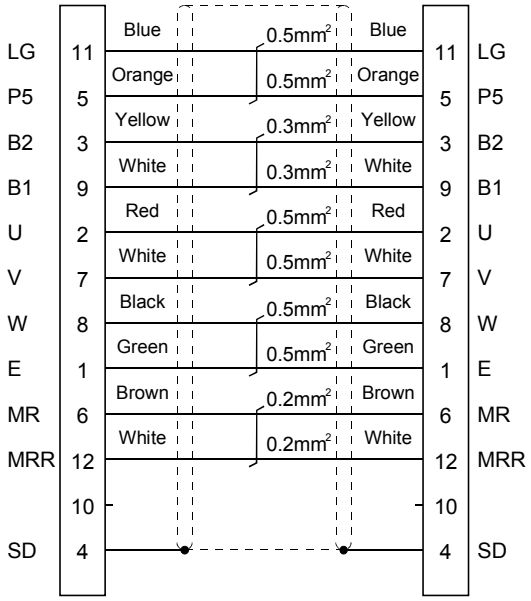


3) Connection diagram

When fabricating the cable, use the recommended wire (J14B1180) given in Section 14.2.1 and follow the connection diagram shown below. A cable of up to 30m(98.4ft) may be fabricated for this connection.

Servo amplifier side
Connector: 5557-12R-210
Terminal :5556

Servo motor side
Connector: 5559-12P-210
Terminal :5558



(b) MR-JRBRCBL□M-H

Use this cable when using the servo motor provided with electromagnetic brake.

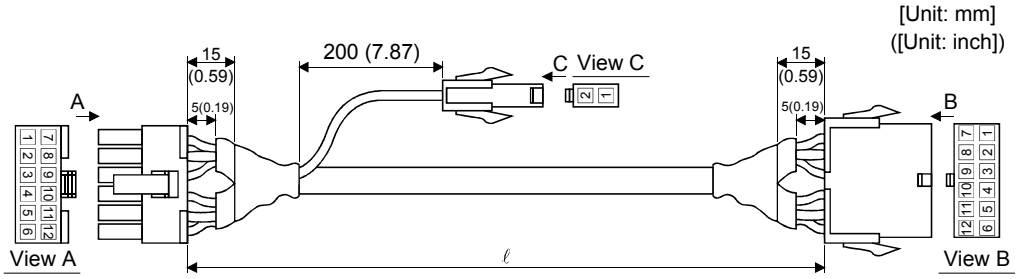
1) Model explanation

Model: MR-JRBRCBL□M-H

Long flexing life

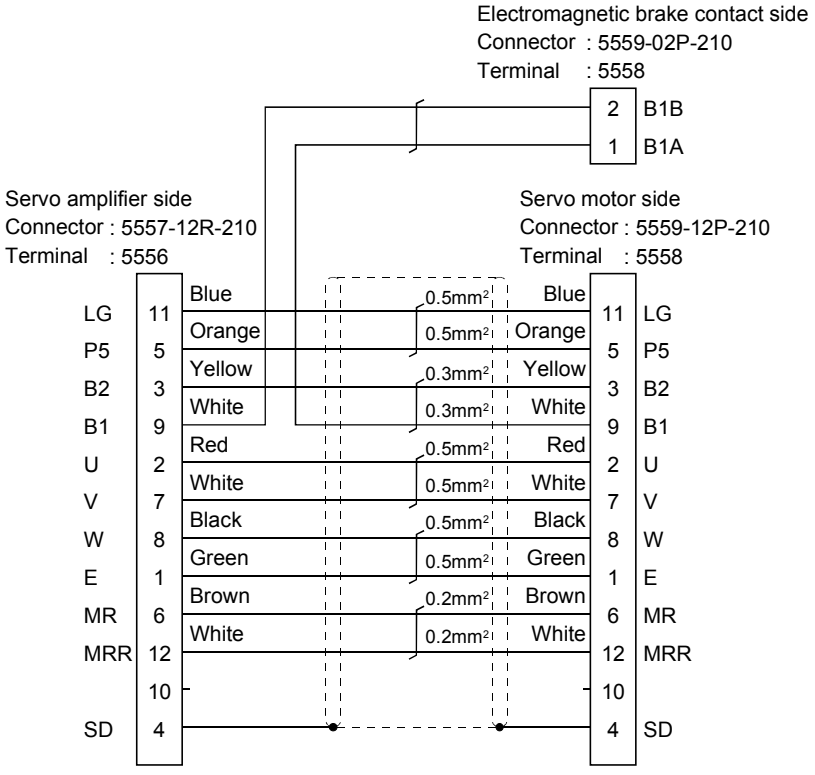
Symbol	Cable Length [m]([ft])
2	2(6.5)
5	5(16.4)
10	10(32.8)
20	20(65.6)
30	30(98.4)

2) Outline drawing



3) Connection diagram

When fabricating the cable, use the recommended wire (J14B1180) given in Section 14.2.1 and follow the connection diagram shown below. A cable of up to 30m(98.4ft) may be fabricated for this connection. The electromagnetic brake contact cable length is up to 10m(32.8ft).



(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.

Select the communication cable according to the shape of the RS-232C connector of the personal computer used. When fabricating the cable, refer to the connection diagram in this section.

(a) Fabricating instructions

The following must be observed in fabrication:

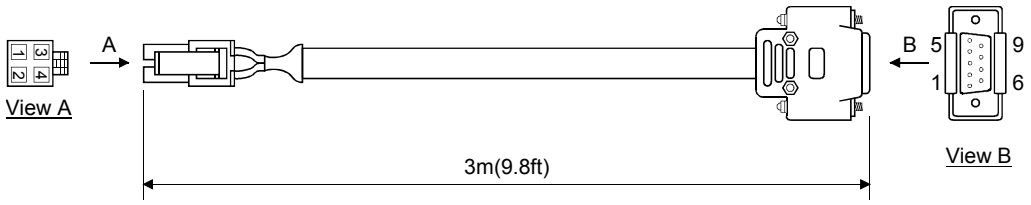
1) Always use a shielded, multi-core cable and connect the shield with SD securely.

2) The optional communication cable is 3m (9.8ft) long. When the cable is fabricated, its maximum length is 15m (49.2ft) in offices of good environment with minimal noise.

(b) Outline drawing

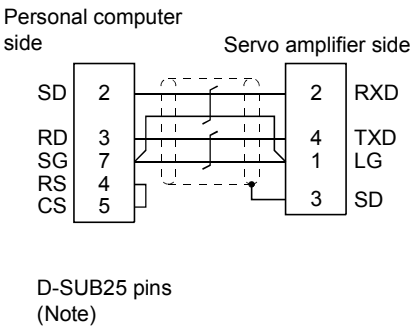
・MR-JRPC98CBL3M

・MR-JRPCATCBL3M

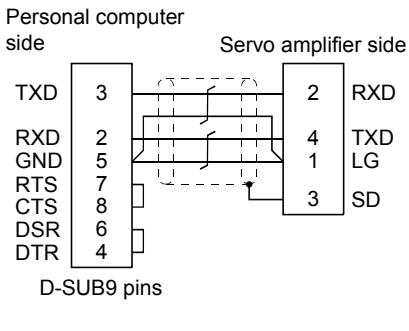


(c) Connection diagram

・MR-JRPC98CBL3M



・MR-JRPCATCBL3M



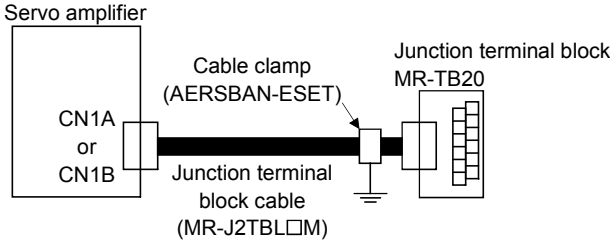
Note: The PC98 Notes having the connector of half-pitch 14 pins are also available. Confirm the shape of the RS-232C connector of the personal computer used.

14.1.2 Junction terminal block (MR-TB20)

> **POINT**
>
> ▪ When the junction terminal block is used, "SG" of CN1A-20 and CN1B-20 cannot be used. 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 (2) (C), Section 14.2.4

(2) Terminal labels

Among the terminal block labels for the junction terminal block, use the two for the MR-J2-C. When changing the input signals on the Servo Configuration Software, refer to this Section (4) and Section 3.3 and apply the accessory signal seals to the labels.

1) For CN1A

LG	PP			COM	OPC	PG			
10	11	12	13	14	15	16	17	18	19

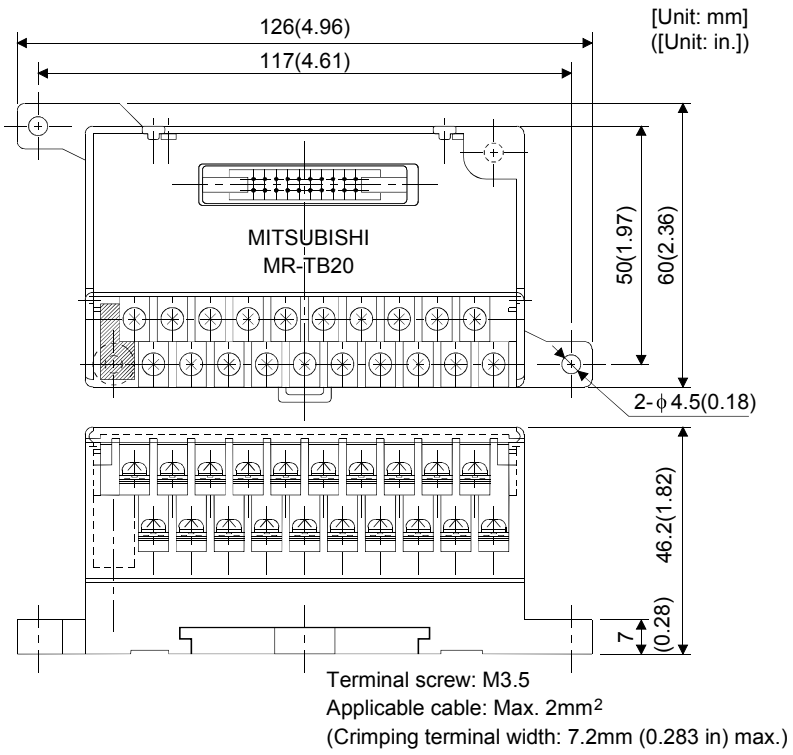
	NP	P15R		DOG	SG	NG			ZP	SD
	0	1	2	3	4	5	6	7	8	9

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	INP	ST1	SG	TLA	DI1	LSP	ALM	SD
	0	1	2	3	4	5	6	7	8	9

(3) Outline drawing



(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)
HIF38A-20D-2.54R (connector)

Servo amplifier side (CN1A CN1B) connector (3M)
1020-6000EL (connector)
10320-3210-000 (shell kit)

(Note) Terminal Block Labels		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	0PC	1	A2	4
	DI0	12	B3	5
	INP	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
LAR	LSP	7	A8	16
	LSN	18	B9	17
ZP	ALM	8	A9	18
	RD	19	B10	19
SD	SD	9	A10	20
				Plate

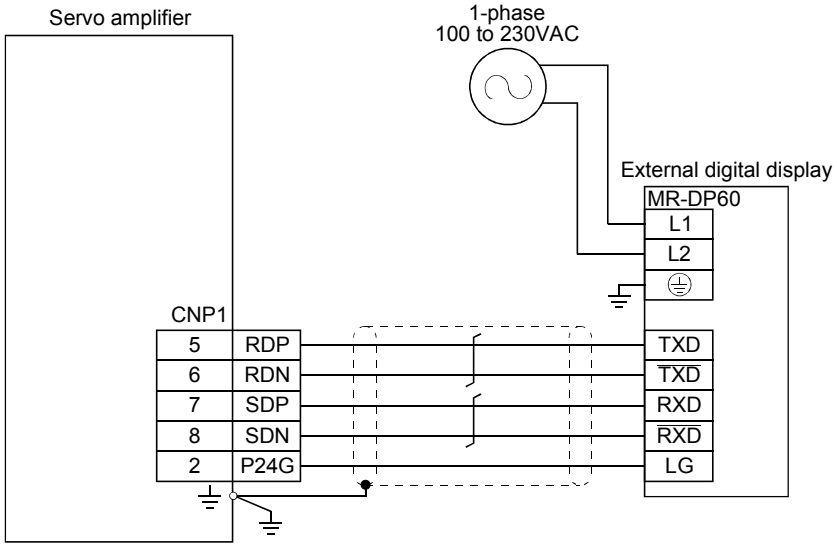
14.1.3 External digital display (MR-DP60)

The data equivalent to the servo amplifier status display can be displayed on the MR-DP60. When using the MR-DP60, set "□0□2" in parameter No. 16. The items that appear at the time of power-on can be selected in parameter No.18.

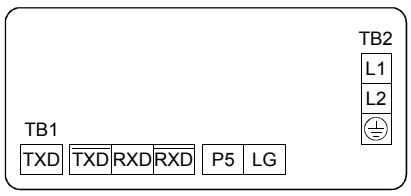
(1) Specifications

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-422A.
	Baudrate		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
Ambient temperature	Operation	[°C]	0 to +55 (non-freezing)
		[°F]	32 to 131 (non-freezing)
	Storage	[°C]	−20 to +65 (non-freezing)
		[°F]	−4 to 149 (non-freezing)
Ambient humidity	Operation		90%RH or less (non-condensing)
	Storage		

(2) Connection example



(3) Terminal arrangement

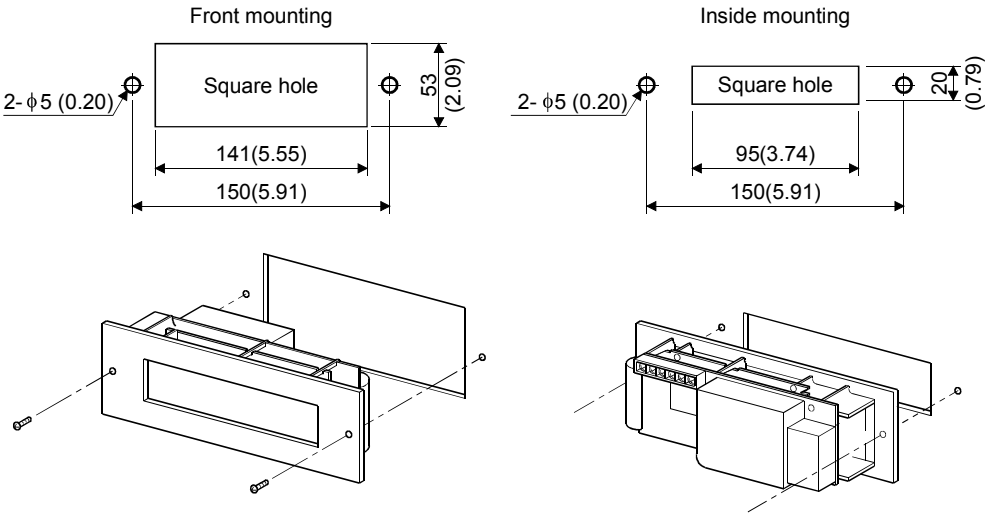


Signal	Description
L1	100 to 230VAC power input
L2	
⏚	Ground
RXD	Receive signal input
$\overline{\text{RXD}}$	Inverse receive signal input
$\overline{\text{TXD}}$	Inverse transmission signal output
TXD	Transmission signal output
P5	5VDC output (Note)
LG	Control common

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.

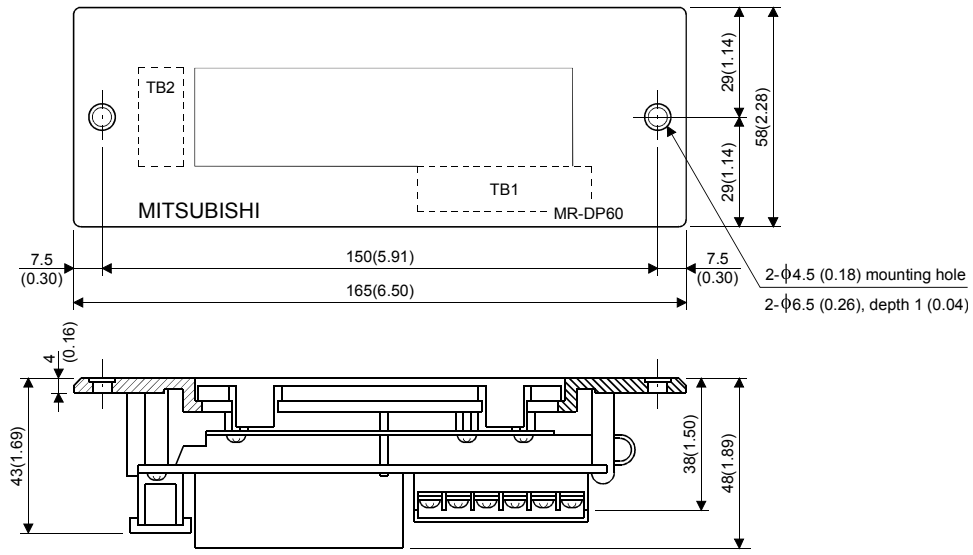
(4) Mounting

[Unit: mm (in)]



(5) Outline dimension drawing

[Unit: mm (in)]



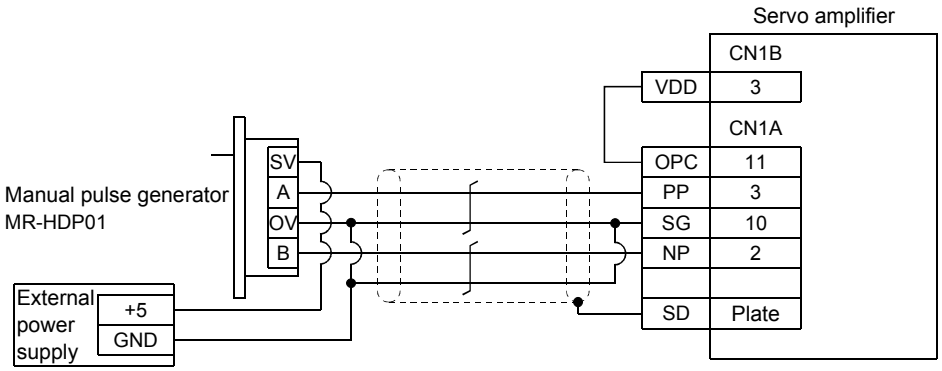
14.1.4 Manual pulse generator (MR-HDP01)

(1) Specifications

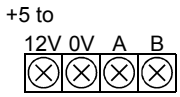
Item			Specifications
Power supply	Voltage		4.5 to 13.2VDC
	Current consumption		60mA max.
Interface			Output current max. 20mA for open collector output
Pulse signal form			2 A-phase and B-phase signals with 90° phase difference
Pulse resolution			100p / rev
Max. speed			Instantaneous max. 600r/min, ordinary 200r/min
Ambient temperature	Operation	[°C]	−10 to +60
		[°F]	−50 to 140
	Storage	[°C]	−30 to +80
		[°F]	−86 to 176

(2) Connection example

Use an external power supply to supply power to the manual pulse generator.



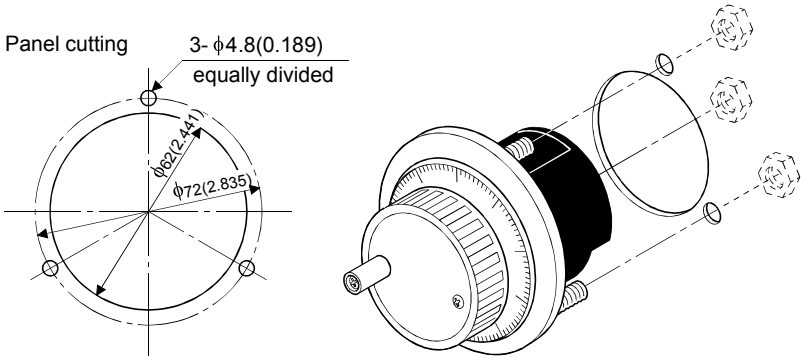
(3) Terminal arrangement



Signal Name	Description
+5 to 12V	Power input
0V	Power and signal common
A	A-phase pulse output
B	B-phase pulse output

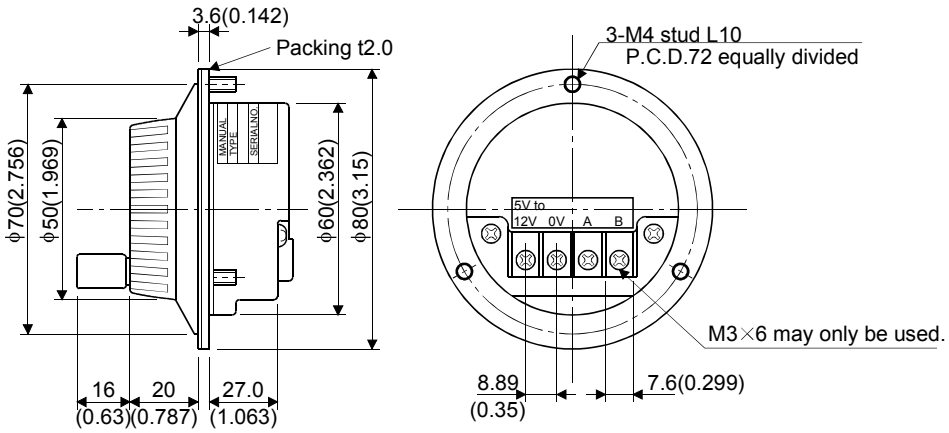
(4) Mounting

[Unit: mm(in)]



(5) Outline dimension drawing

[Unit: mm(in)]



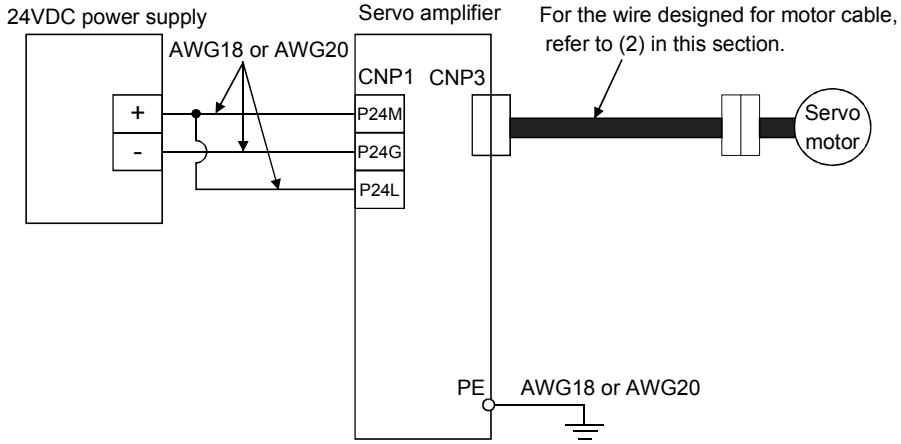
14.2 Auxiliary Equipment

Always use the devices indicated in this section or equivalent. To comply with the EN Standard or UL/C-UL 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 wires used assume that they are 600V vinyl wires and the wiring distance is 30m max. If the wiring distance is over 30m, choose the wire size in consideration of voltage drop.

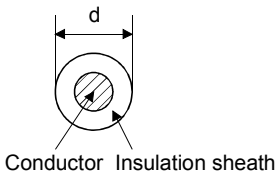
To comply with the UL/C-UL Standard, use UL-recognized copper wires rated at 60℃ (140℉) or more for wiring.

(2) Wires for cables

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

Type	Model	Length [mm^2(ft)]	Core size [mm^2]	Number of Cores	Characteristics of one core			(Note 2) Finishing OD [mm]	(Note 3)Wire model
					Structure [Wires/mm]	Conductor resistance [Ω /mm]	Insulation coating OD d[mm] (Note 1)		
Motor cable	MR-JRCBL□M-H	2 to 30	0.2	2(1 pair)	40/0.08	(Note 3) 105 or less	0.88	10.5	J14B1180
Motor cable	MR-JRBRCBL□M-H	2 to 30	0.3	2(1 pair)	3/20/0.08	(Note 3) 71.9 or less	1.3	10.5	J14B1180 (Between servo amplifier and servo motor)
Motor cable	MR-JRBRCBL□M-H	0.2	0.5	6(3 pairs)	3/33/0.08	(Note 3) 43.5 or less	1.53	10.5	UL1015 AWG20 (Between servo amplifier and electromagnetic brake contact)
Communi-cation cable	MR-JRPC98CBL3M	3	0.2	4(2 pairs)	7/0.18	119 or less	0.54	5.9	TKVVBS(P) 0.2mm^2 × 2P
Communi-cation cable	MR-JRPCATCBL3M	3	0.2	4(2 pairs)	7/0.18	119 or less	0.54	5.9	TKVVBS(P) 0.2mm^2 × 2P

Note 1: d is as shown below:



2: Standard OD. Max. OD is about 10% greater.
3: Measurement condition 20[℃] (68[℉])

14.2.2 Circuit protector

Servo amplifier	Circuit protector
MR-J2-03C5	CP-30BA 1P 1-M5A

Note: Use the operation characteristic of "mid-speed type".

14.2.3 Relays

The following relays should be used with the interfaces:

Interface	Selection Example
Relay used especially for switching on-off input command (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

14.2.4 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 3.9).

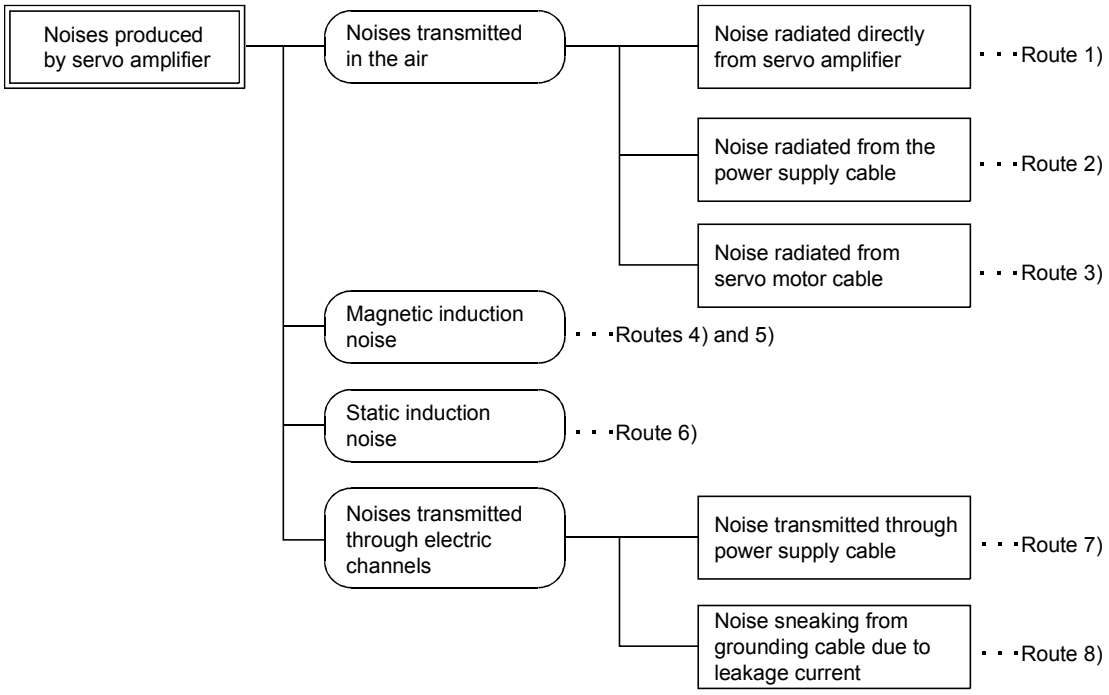
(b) Reduction techniques for external noises that cause the servo amplifier to malfunction

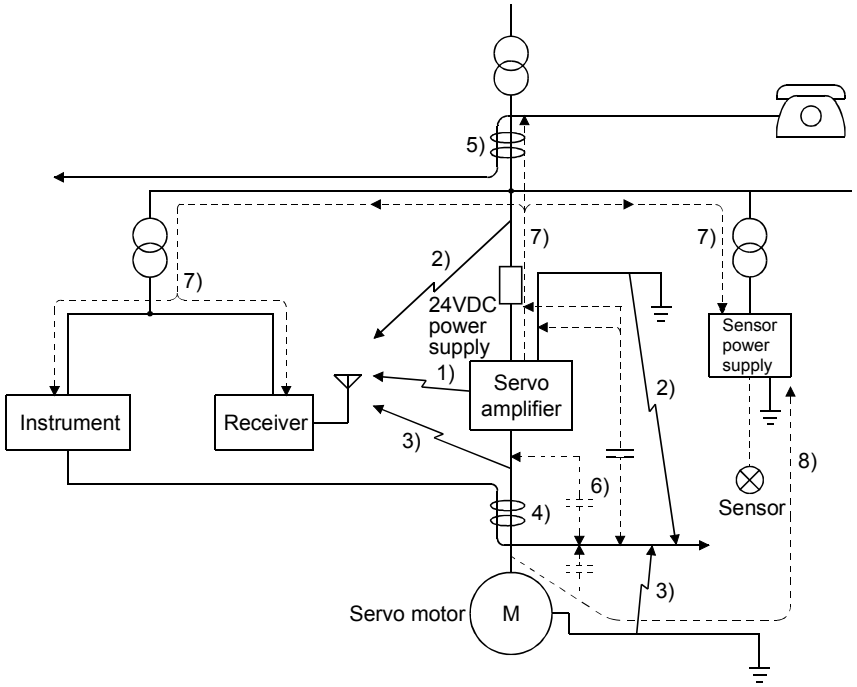
If there are noise sources (such as a magnetic contractor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- Provide surge absorbers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.

(c) Techniques for noises radiated by the servo amplifier that cause peripheral devices to malfunction

Noises produced by the servo amplifier are classified into those radiated from the cables connected to the servo amplifier and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral devices located near the main circuit cables, and those transmitted through the power supply cables.





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 (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. (4) Insert a line noise filter to the I/O cables or a radio noise filter on the input line. (5) Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. (1) Provide maximum clearance between easily affected devices and the servo amplifier. (2) Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. (3) Avoid laying the power lines (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. (4) Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. (1) Insert the radio noise filter (FR-BIF) on the power cables (input cables) of the servo amplifier. (2) Insert the line noise filter 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.

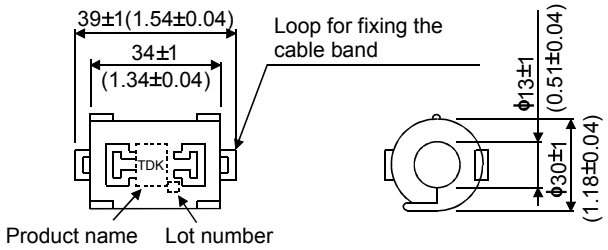
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC Tokin are available as data line filters.

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.])

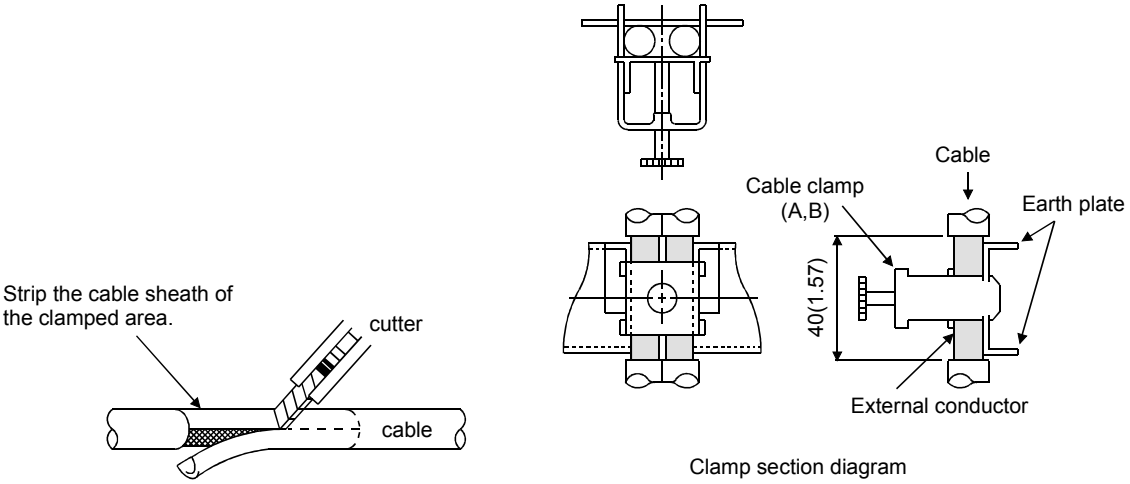


Outline drawing (ZCAT3035-1330)

(b) Cable clamp fitting (AERSBAN-□SET)

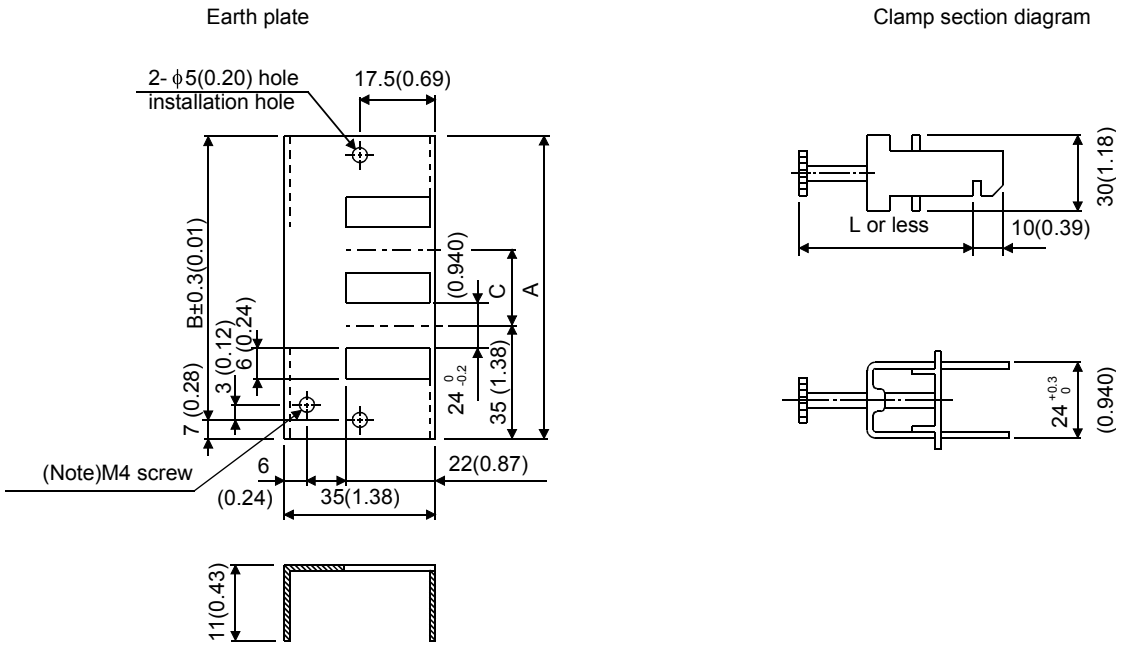
Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth plate near the servo amplifier for the encoder cable. Peel part of the cable sheath 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.



・ Outline drawing

[Unit: mm]
([Unit: in.])



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)

14.2.5 Setting potentiometers for analog inputs

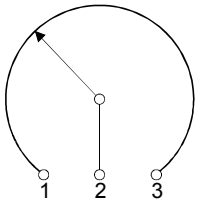
The following variable resistors are available for use with analog inputs for override etc.

(1) Single-revolution type

WA2WYA2SEBK2KΩ (Japan Resistor)

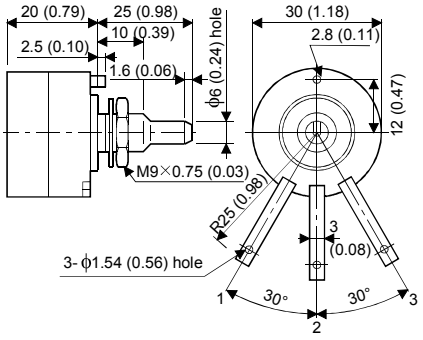
Rated Power	Resistance	Resistance Tolerance	Dielectric Strength (for 1 minute)	Insulation Resistance	Mechanical Rotary Angle	Rotary Torque
2W	2kΩ	±10%	700V A.C	100MΩor more	300° ±5°	10 to 100g-cm or less

Connection diagram



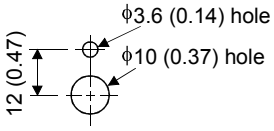
Outline dimension drawing

[Unit: mm (in)]



Panel hole machining diagram

[Unit: mm (in)]

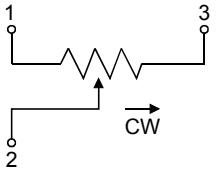


(2) Multi-revolution type

RRS10 (M) 2KΩ (Japan Resistor)

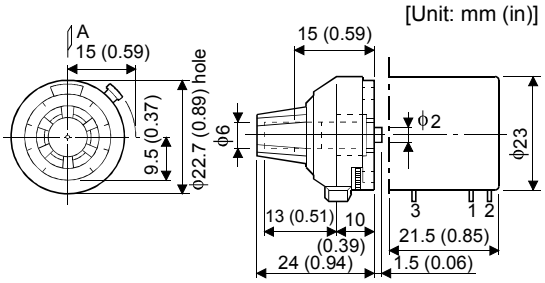
Rated Power	Resistance	Resistance Tolerance	Dielectric Strength (for 1 minute)	Insulation Resistance	Mechanical Rotary Angle	Rotary Torque
1W	2kΩ	±10%	700V A.C	1000MΩor more	3600° $^{+10^\circ}_{-0^\circ}$	100g-cm or less

Connection diagram



Outline dimension drawing

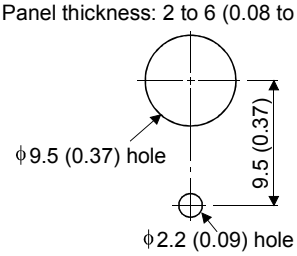
[Unit: mm (in)]



Panel hole machining diagram

[Unit: mm (in)]

Panel thickness: 2 to 6 (0.08 to 0.24)

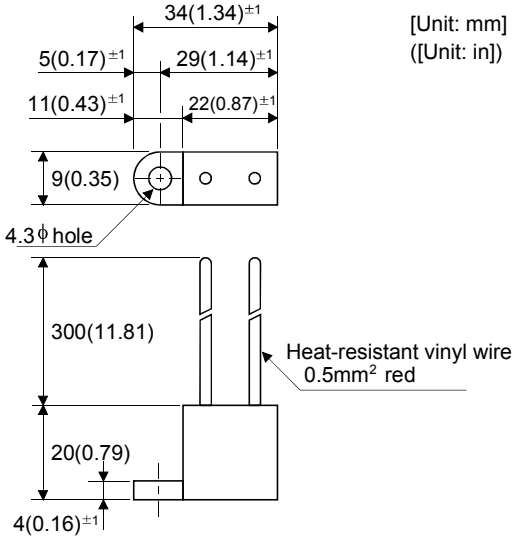


14.2.6 Snubber unit

This section provides the recommended snubber circuit unit which is installed to the forced stop contact for servo motor with electromagnetic brake. Refer to Section 3.8 (1) for the connection method.

Spark quencher for control equipment
Model: SQ13150BF (Nisshin Seigyo Kiko)

Operating Voltage ACV	Electrostatic Capacitance μF±20%	Resistance Value Ω±20%	Resistor Rated Power W
150	0.3	150	0.5



MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Data	*Manual Number	Revision
Aug., 2001	SH(NA)3209-A	First edition
June, 2006	SH(NA)3209-B	Safety Instructions: 1.To prevent electrical shock Sentence is partially modified. 4(2)Wiring Caution is added. 4(4)Usage Caution is added. FOR MAXIMUM SAFETY: Sentence is modified. Chapter 2: Caution is added. Chapter 3: Caution is added. Section 3.5: Caution is added. Section 3.5(2): Sentence is modified. Section 3.7.1: Relay contacts in the connection diagram are modified. Section 3.8: Caution is added. Section 4.1.2(2) (b): Sentence is partially modified. Section 4.4.2(3): Reverse rotation start (ST2) in the drawing is added. Section 4.4.3(2): Reverse rotation start (ST2) in the drawing is added. Section 4.4.5(2): Drawing is modified. Section 5.2.1: “POINT” is partially modified. Section 6.7.2: Sentence is modified. Section 8.12.3(2): Drawing is modified. Chapter 10: “WARNING” is partially modified. Section 11.2: “POINT” is partially modified. Section 11.2.2: Description in AL.17 is partially added. Section 11.2.3: “POINT” is added. Section 12.2(2): Dimensions are modified. Section 13.1: Note is added. Chapter 14: “WARNING” is partially modified. Section 14.1.3(2): Connection diagram for the MR-DP60 is modified.

MODEL	
MODEL CODE	

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE:TOKYO BLDG MARUNOUCHI TOKYO 100-8310

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Specifications subject to change without notice.