MITSUBISHI

Single Axis Programmable Servo

MELSERVO-J2-C-S100

Specifications and Instruction Manual

PRELIMINARY

MITSUBISHI ELECTRIC

● 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 10 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.
- When a regenerative brake resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative brake transistor fault or the like may overheat the regenerative brake resistor, causing a fire.

3. To prevent injury, note the follow

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal,, Otherwise,, a burst,, damage,, etc. may occur.
- Connect the terminals correctly to prevent a burst,, damage,, etc.
- Ensure that polarity (+, –) is correct. Otherwise, a burst, damage, etc. may occur.
- During power-on or for some time after power-off, do not touch the servo amplifier fins, regenerative brake resistor, servo motor, etc. Their temperatures may be high and you may get burnt.

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 acordng 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 matter from entering the servo amplifier.
- Do not drop or strike servo amplifier or servo motor. Isolate from all impact loads.
- Use the servo amplifier and servo motor under the following environmental conditions:

<table>
<tr><th colspan="2" rowspan="2">Environmen</th><th colspan="3">Conditions</th></tr>
<tr><th>Servo Amplifier</th><th colspan="2">Servo Motor</th></tr>
<tr><td rowspan="2">Ambient temperature</td><td>[°C]</td><td>0 to +55 (non-freezing)</td><td colspan="2">0 to +40 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>32 to 131 (non-freezing)</td><td colspan="2">32 to 104 (non-freezing)</td></tr>
<tr><td colspan="2">Ambient humidity</td><td>90%RH or less (non-condensing)</td><td colspan="2">80%RH or less (non-condensing)</td></tr>
<tr><td rowspan="2">Storage temperature</td><td>[°C]</td><td>–20 to +65 (non-freezing)</td><td colspan="2">–15 to +70 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>–4 to 149 (non-freezing)</td><td colspan="2">5 to 158 (non-freezing)</td></tr>
<tr><td colspan="2">Storage humidity</td><td colspan="3">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">Ambience</td><td colspan="3">Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="2">Altitude</td><td colspan="3">Max. 1000m (3280 ft) above sea level</td></tr>
<tr><td rowspan="8">Vibration</td><td rowspan="4">[m/s²]</td><td rowspan="4">5.9 {0.6G} or less</td><td>HC-MF Series
HA-FF Series
HC-UF 13 to 73</td><td>X · Y : 19.6 {2G}</td></tr>
<tr><td>HC-SF81
HC-SF52 to 152
HC-SF53 to 153
HC-UF 72 · 152</td><td>X : 9.8 {1G}
Y : 24.5 {2.5G}</td></tr>
<tr><td>HC-SF121 · 201
HC-SF202 · 352
HC-SF203 · 353
HC-UF202</td><td>X : 19.6 {2G}
Y : 49 {5G}</td></tr>
<tr><td>HC-SF301</td><td>X : 11.7 {1.2G}
Y : 29.4 {3G}</td></tr>
<tr><td rowspan="4">[ft/s²]</td><td rowspan="4">19.4 or less</td><td>HC-MF Series
HA-FF Series
HC-UF 13 to 73</td><td>X · Y : 64</td></tr>
<tr><td>HC-SF81
HC-SF52 to 152
HC-SF53 to 153
HC-UF 72 · 152</td><td>X : 32
Y : 80</td></tr>
<tr><td>HC-SF121 · 201
HC-SF202 · 352
HC-SF203 · 353
HC-UF202</td><td>X : 64
Y : 161</td></tr>
<tr><td>HC-SF301</td><td>X : 38
Y : 96</td></tr>
</table>

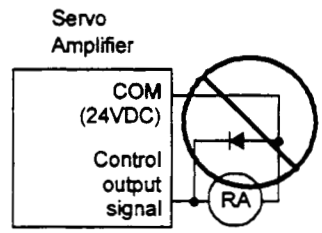
⚠ CAUTION

- 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 (FR-BIF option) between the servo motor and servo amplifier.
- Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.
- 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 instable.

(4) Usage

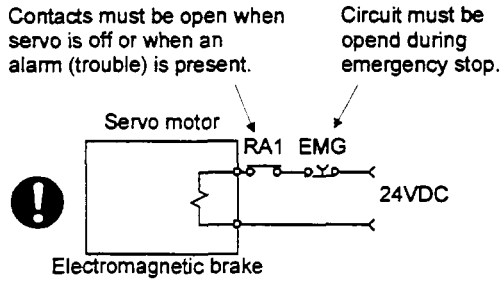
⚠ CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched 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.
- Use the servo amplifier with the specified servo motor.
- The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- For such reasons as service life and mechanical structure (e.g. where a ballscrew and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

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



- 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. Please consult our sales representative.

(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.

COMPLIANCE WITH EC DIRECTIVES

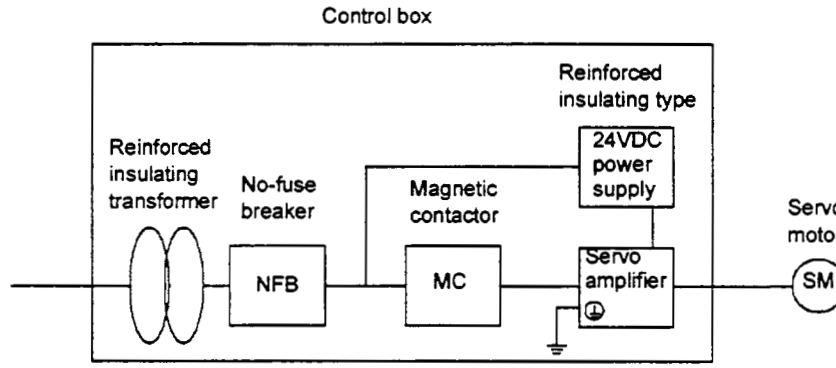
1. WHAT ARE EC DIRECTIVES?

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.
The servo amplifiers do not function independently but are designed for use with machines and equipment. Therefore, the CE marking does not apply to the servo amplifiers but applies to the machines and equipment into which the servo amplifiers are installed.
This servo amplifier conforms to the standards related to the Low Voltage Directive to facilitate CE marking on machines and equipment into which the servo amplifiers will be installed. To ensure ease of compliance with the EMC Directive, Mitsubishi Electric prepared the "EMC INSTALLATION GUIDELINES" (IB(NA)67310) which provides servo amplifier installation, control box making and other procedures. Please contact your sales representative.

2. PRECAUTIONS FOR COMPLIANCE

Use the standard model of servo amplifier (expected to be compliant soon) and the EN Standard-compliant model of HC-MF/HA-FF/HC-UF or the standard model of HC-SF/HC-RF. In addition to the instructions provided in this Instruction Manual, also follow the instructions below. If the model is not specifically described to comply with the EN Standard in this Instruction Manual, it has the same specifications as those of the standard models:

(1) Structure



(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

(a) Operate the servo amplifier to meet the requirements of the overvoltage category II set forth in IEC664. For this purpose, a reinforced insulating transformer conforming to the IEC or EN Standard should be used in the power input section.

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

(4) Grounding

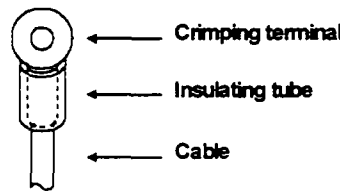
(a) To prevent an electric shock, always connect the protective earth (PE) terminals (marked ⏚) of the servo amplifier to the protective earth (PE) of the control box.

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

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

(5) Wiring

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



(b) Use a fixed terminal block to connect the power supply lead of the HC-MF/HA-FF HC-UF 3000 r/min series servo motor to the servo amplifier. Do not connect cables directly.

(6) Auxiliary equipment and options

(a) The no-fuse breaker and magnetic contactor used should be the EN or IEC Standard-compliant products of the models described in Section 14.2.2.

(b) The sizes of the cables described in Section 14.2.2 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204.

- Ambient temperature: 40 (104) [°C (°F)]
- Sheath: PVC (polyvinyl chloride)
- Installed on wall surface or open table tray

(c) Use the EMC filter for noise reduction. The radio noise filter (FR-BIF) is not required.

(7) Miscellaneous

For the other EMC Directive guidelines on the servo amplifier, refer to the "EMC INSTALLATION GUIDELINES".

CONFORMANCE WITH UL/C-UL STANDARD

Use the standard model of servo amplifier (will be listed soon) and the UL/C-UL Standard-compliant model of servo motor.
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 the options and auxiliary equipment, use those which confrom to the UL/C-UL Standard.
To comply with the UL/C-UL Standard, strictly observe the following:

(1) Installation

Install a fan of 100CFM air flow 10.16 cm (4 in) above the servo amplifier or provide cooling of at least equivalent capability.

(2) Power supply capacity

The power supply capacity of the servo amplifier is 5000A maximum.

(2) Capacitor discharge time

The capacitor discharge time is as listed below. To ensure safety, do not touch the charging section for 10 minutes after power-off.

Servo Amplifier	Discharge Time [min]
MR-J2-10C · 20C-S100	1
MR-J2-40C · 60C-S100	2
MR-J2-70C to 350C-S100	3

CONTENTS

Optional Servo Motor Instruction Manual CONTENTS

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

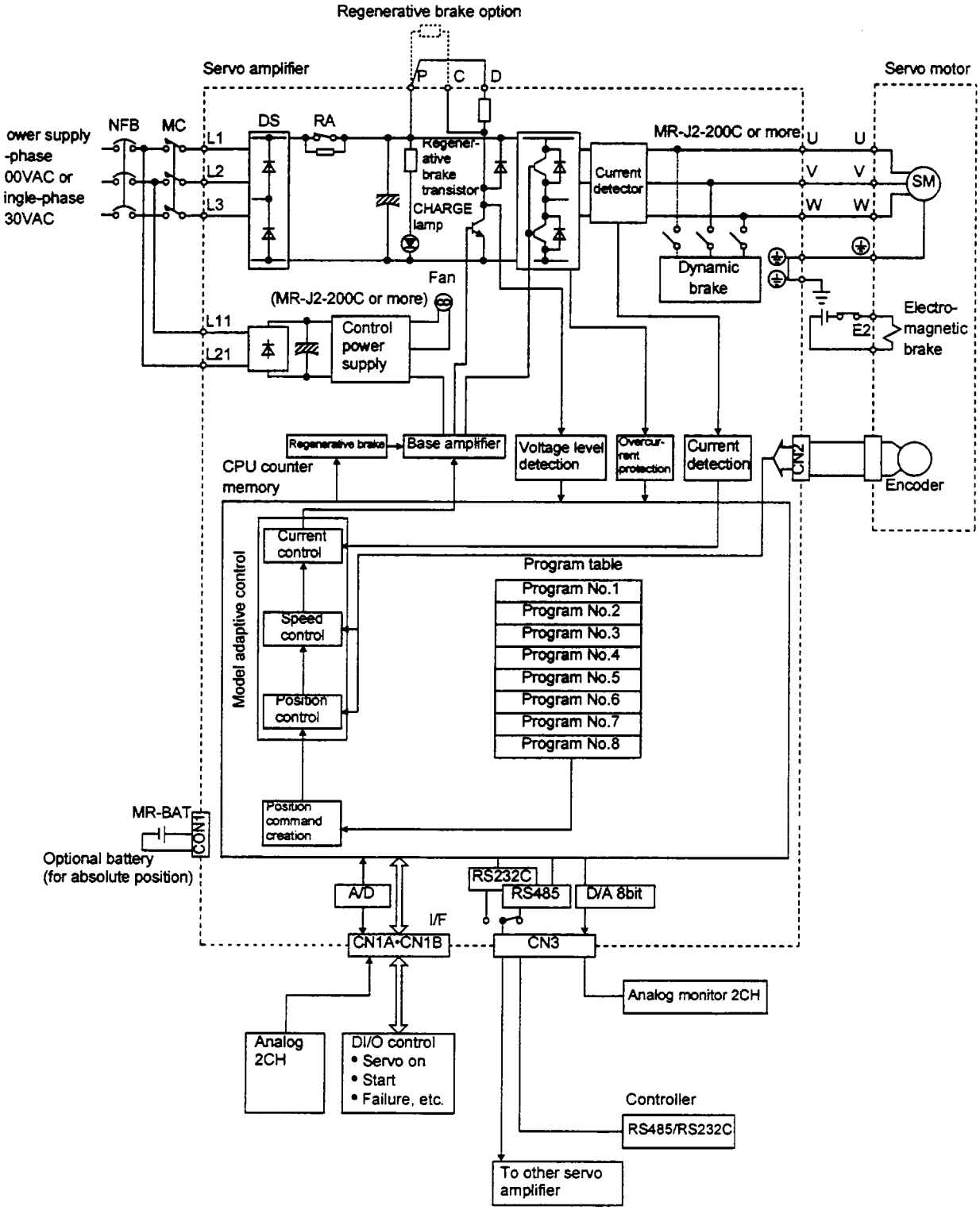
1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The MR-J2-C-S100 AC servo amplifier with built-in positioning functions is the MR-J2-A general-purpose AC amplifier which incorporate single-axis positioning functions.
These functions perform positioning operation by merely setting the position data (target positions), motor speeds, acceleration and deceleration time constants, etc to programming by Windows™ based Software (Configuration Software). The servo amplifier is the most appropriate to configure a simple positioning system or to simplify a system, for example. You can choose a configuration suitable for your purpose, e.g. simple positioning system using external I/O signals (DI/O), operation using DI/O and RS-232C or RS-485 serial communication. or multi drop operation using RS-485 serial communication.
All servo motors are equipped with an absolute position encoder as standard. An absolute position detection system can configured by merely adding a battery to the servo amplifier. Once the home position has been set, zeroing is not required at power on, alarm occurrence, etc.

1.1.1 Function block diagram

The function block diagram of the MELSERVO-J2-C-S100 is shown below.



1.1.2 System configuration

This section describes operations using the MELSERVO-J2-C-S100.
You can arrange any configurations from a single-axis to max. 32-axis systems. Further, the connector pins in interface section allow you to assign the optimum signals to respective systems. (Refer to Sections 1.1.3 and 3.2.3.)
The Configuration Software (refer to Chapter 6) and personal computer are required to change or assign devices.

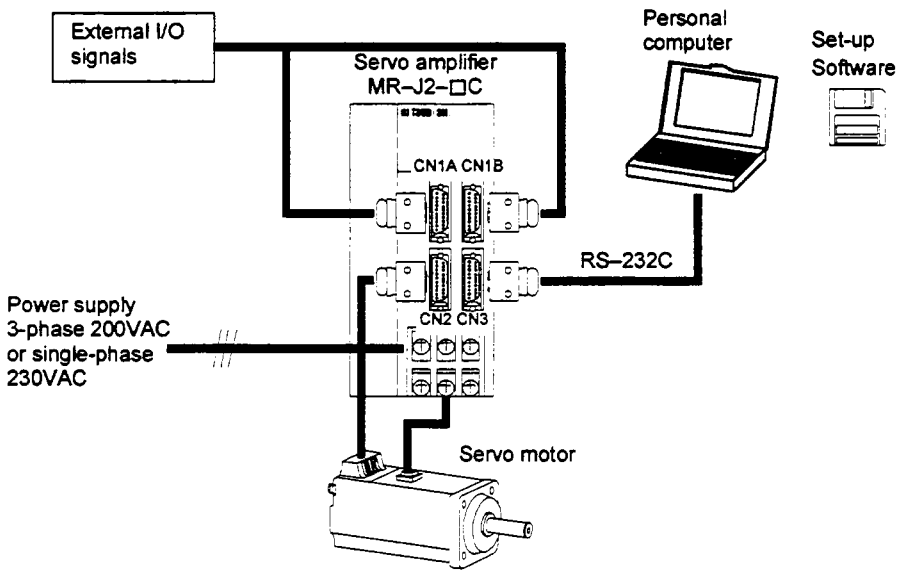
(1) Operation using external input signals

(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 Configuration Software to set, change and monitor the parameters and the motion programming.



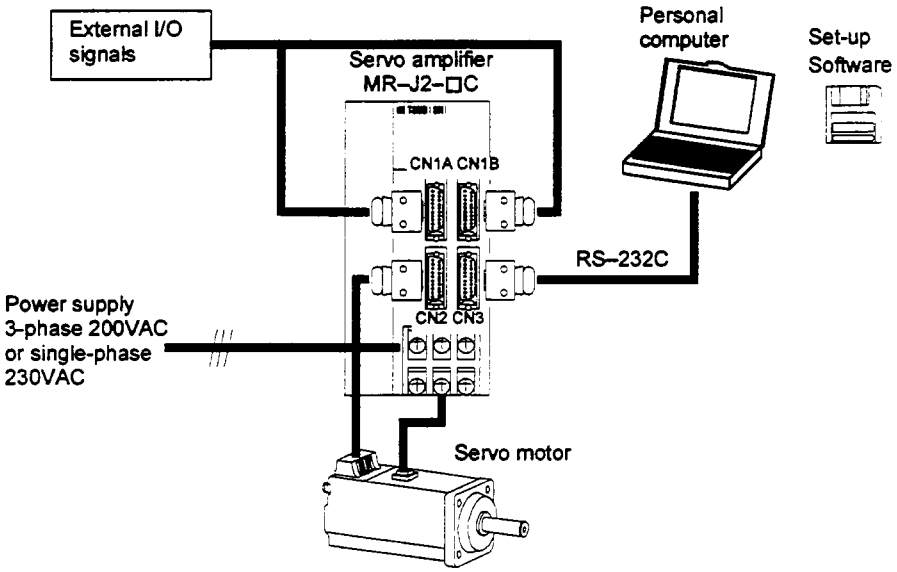
(2) Operation using external input signals and communication

(a) Description

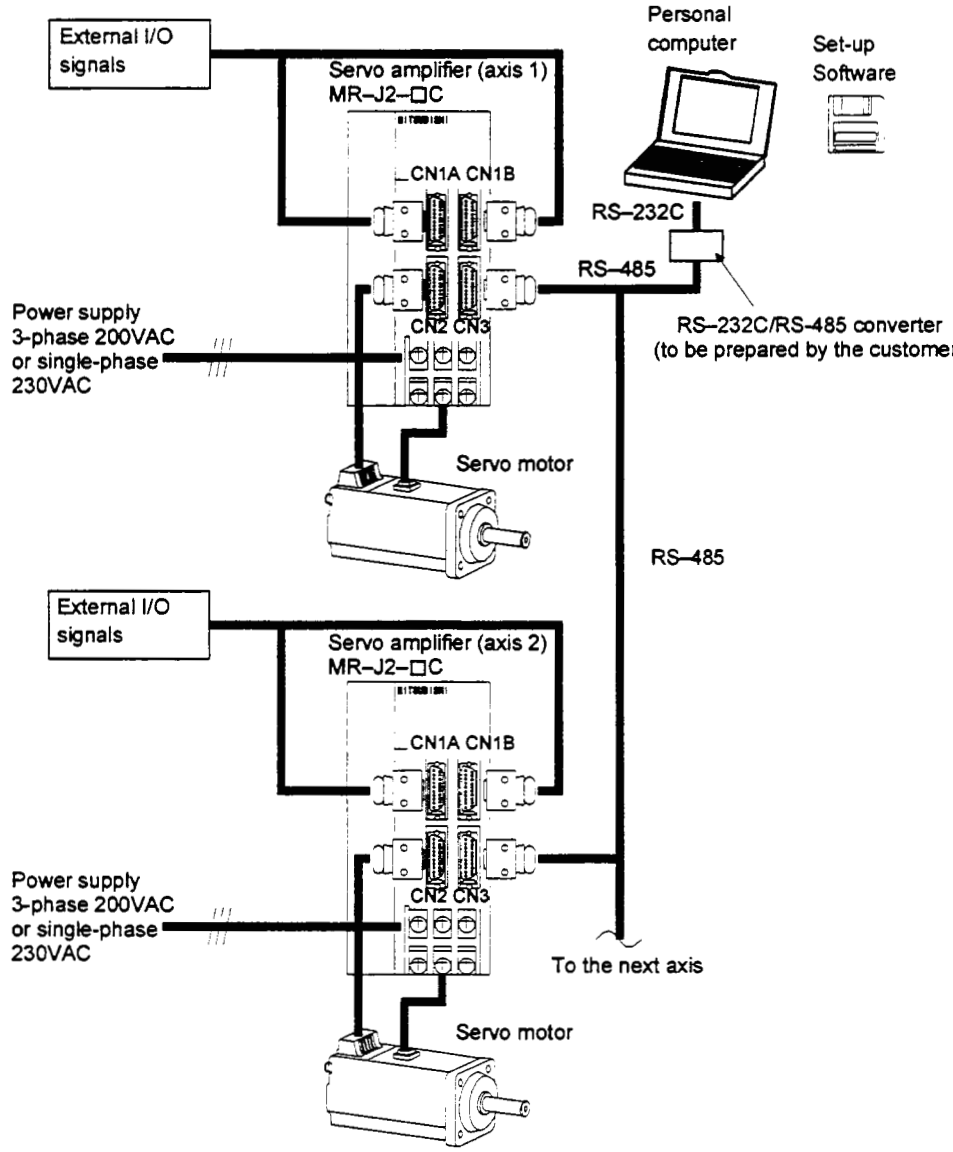
Communication can be used to change parameter values, and confirm monitor data, for example. Enter the start signal through the external I/O.

(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-485. Use parameter No. 16 to change the communication system.



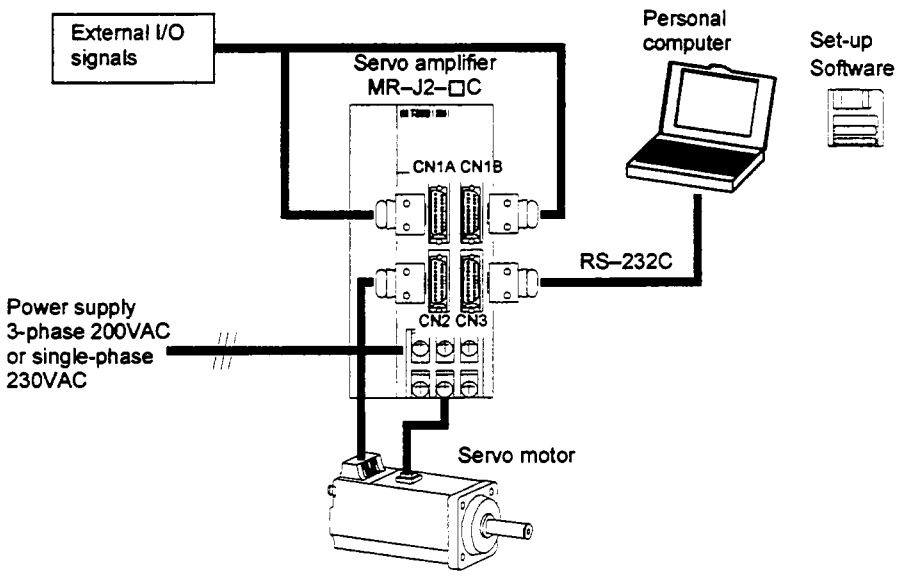
(3) Operation using communication

(a) Description

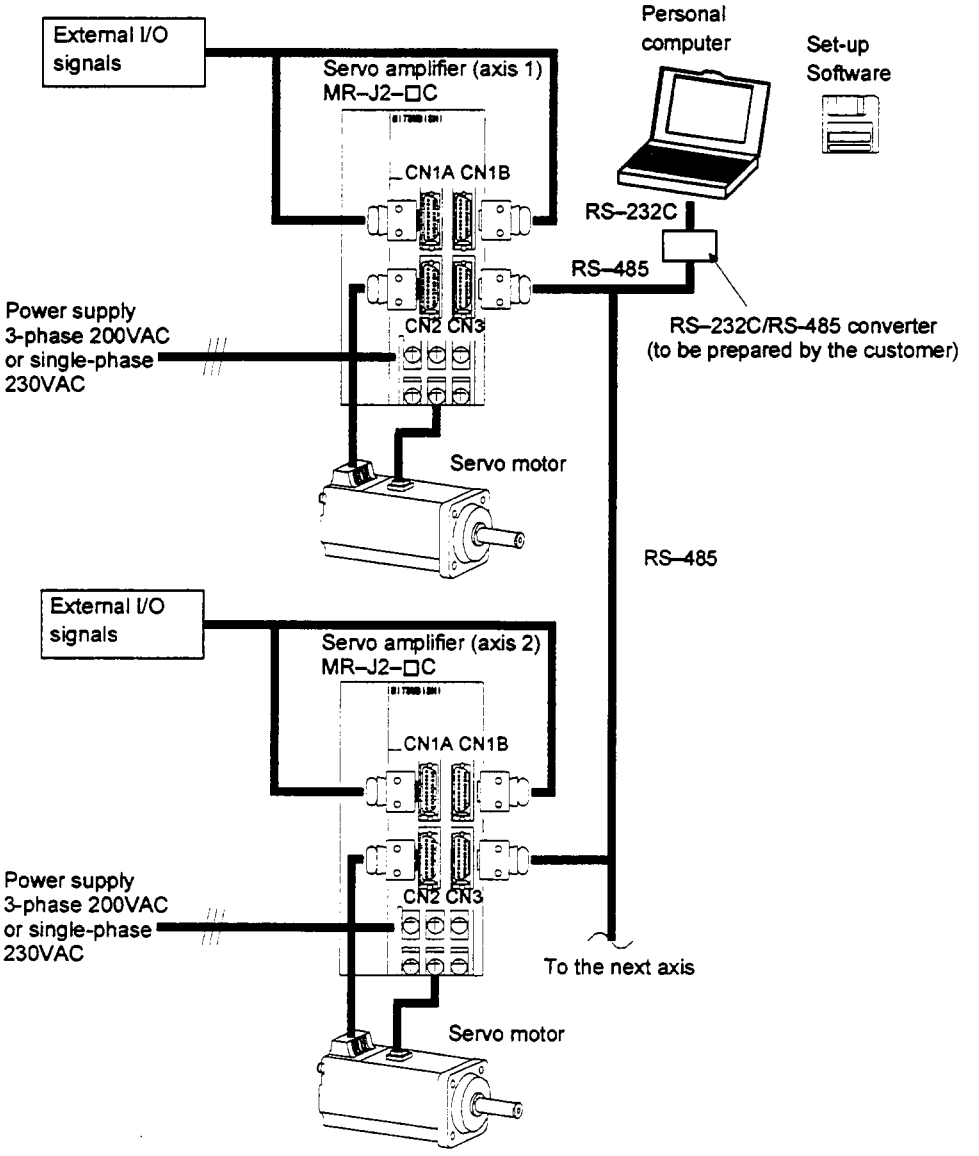
Analog input, emergency stop signal and other signals are controlled by external I/O signals and the other controlled through communication. Also, you can set change or set parameter values, for example.
Up to 32 axes may be controlled.

(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-485.
Use parameter No. 16 to change the communication system.



1.1.3 I/O devices

The MELSERVO-J2-C-S100 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 3.2.

(1) Input devices

Device	Symbol	Description	Factory-Allocated Pin
Proximity dog	DOG	Proximity dog signal input device for manual zeroing	CN1A-8
Servo on	SON	Operation-ready signal input device	CN1A-19
Forward rotation stroke end	LSP	Forward rotation stroke end signal input device	CN1B-16
Reverse rotation stroke end	LSN	Reserve rotation stroke end signal input device	CN1B-17
Forward rotation start	ST1	Forward rotation start signal input device	CN1B-7
Reverse rotation start	ST2	Reserve rotation start signal input device	—
Automatic/manual selection	MDO	Automatic/manual mode selection signal input device	—
Program No. selection 1	PS1	Program No. selection signal input device	CN1B-5
Program No. selection 2	PS2	Program No. selection signal input device	CN1B-14
Program No. selection 3	PS3	Program No. selection signal input device	—
Emergency stop	EMG	Emergency stop input device	—
Alarm reset	RES	Alarm reset signal input device	CN1B-15
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	Pulse multiplication input device	—
Program input 1	PI1	Program input device terminal	CN1B-8
Program input 2	PI2	Program input device terminal	CN1B-9
Program input 3	PI3	Program input device terminal	—

(2) Output devices

Device	Symbol	Description	Factory-Allocated Pin
Zeroing completion	ZP	Zeroing completion output device	CN1A-18
Movement complete	PED	Movement complete synchronous output device	CN1B-6
Trouble	ALM	Trouble signal 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	—
Battery warning output	BWNG	Battery 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	—
Program output 1	OUT1	Program output device	CN1B-4
Program output 2	OUT2	Program output device	—
Program output 3	OUT3	Program output device	—
SYNC synchronous output	SOUT	SYNC synchronous output device	—

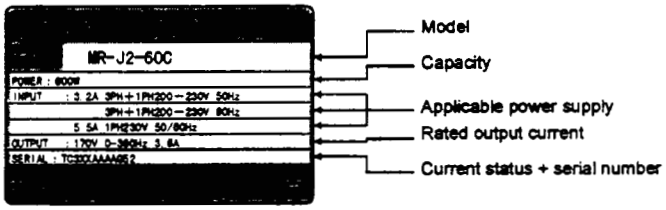
1.2 Function List

The following table lists the functions of the MELSERVO-J2-C-S100. For details of the functions, refer corresponding chapters and sections.

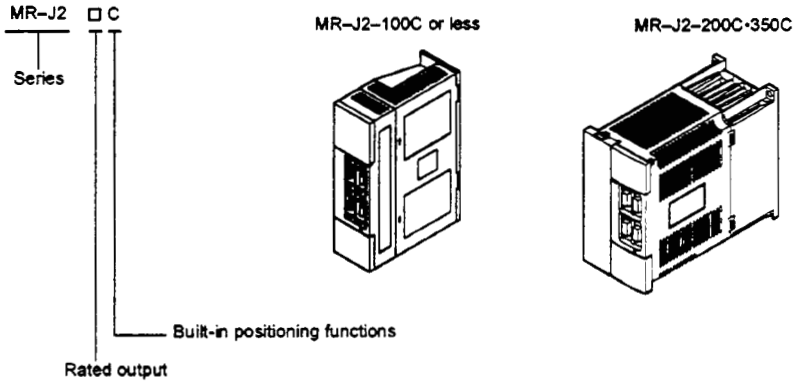
Function	Description	Refer To
Manual zeroing	Dog type, count type, data setting type, stopper type, zero ignorance	Section 4.4
Multidrop communication	Up to 32 axes of MR-J2-C-S100 are controllable simultaneously by RS485 communication.	Section 4.6 Chapter 8
Absolute position detection system	By merely setting the home position once, zeroing need not at each power on.	Section 4.5
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 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 9.2
Manual gain adjustment	The gain is manually adjustable if the gain could not be adjusted ideal value by real-time auto tuning.	Section 9.2
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Section 5.2.3
Analog monitor output	The servo status is output in terms of voltage in real time.	Section 5.2.4
Alarm history	By using the Set-up Software, the current alarm and five past 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, 5 output and 1 I/O pins.	Section 6.6
Torque limit	Servo motor-generated torque is limited. Parameter × 2 limit value Analog input × 1 limit value	Section 3.2.5
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 3.2.4
Status display	The servo status is displayed. The servo amplifier display can show up 7 types or 15 types when the Configuration Software is used.	Section 7.2
Test operation mode	Jog operation, motor-less operation, DO forced output.	Section 6.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP) signal/reverse rotation end (LSN) signal.	Section 5.2.5
Software limit	The travel region is limited using parameters in terms of address. The function similar to that of a limit switch is limited by software.	Section 5.2.8

1.3Model Name Make-Up

(1) Name plate



(2) Model



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

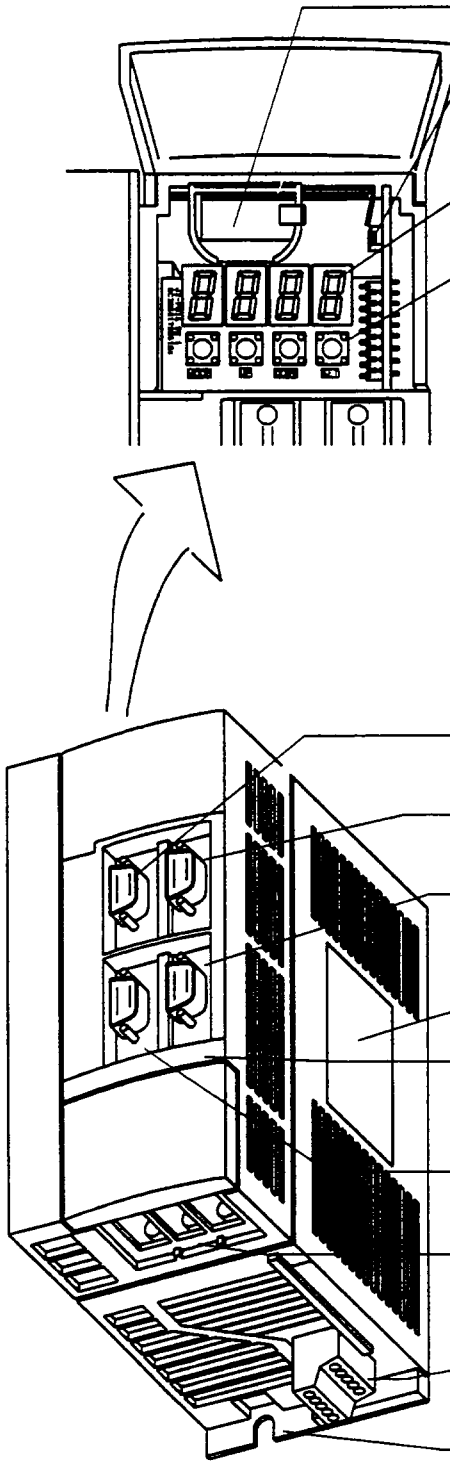
1.4 Combination with Servo Motor

The following table lists combinations of servo amplifiers and servo motors.
The same combinations apply to the models with electromagnetic brakes, the models with reduction gears, the EN Stan dard-compliant models and the UL/C-UL Standard-compliant models.

Servo Amplifier	Servo Motors				
	HC-MF□	HA-FF□	HC-SF□	HC-RF□	HC-UF□
MR-J2-10C-S100	053 · 13	053 · 13	×	×	13
MR-J2-20C-S100	23	23	×	×	23
MR-J2-40C-S100	43	33 · 43	×	×	43
MR-J2-60C-S100	×	63	52 · 53	×	×
MR-J2-70C-S100	73	×	×	×	72
MR-J2-100C-S100	×	×	81 102 · 103	×	×
MR-J2-200C-S100	×	×	121 to 301 152 · 202 153 · 203	103 · 153	152
MR-J2-350C-S100	×	×	352 · 353	203	202

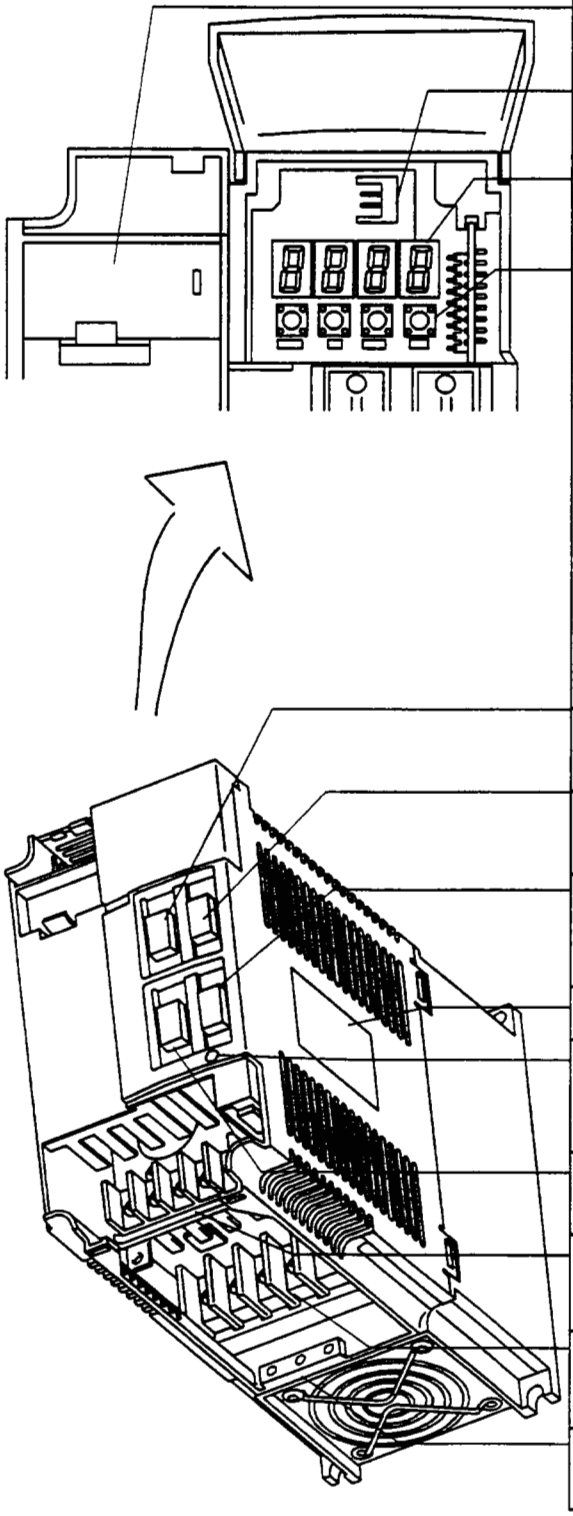
1.5 Parts Identification

(1) MR-J2-100C-S100 or less



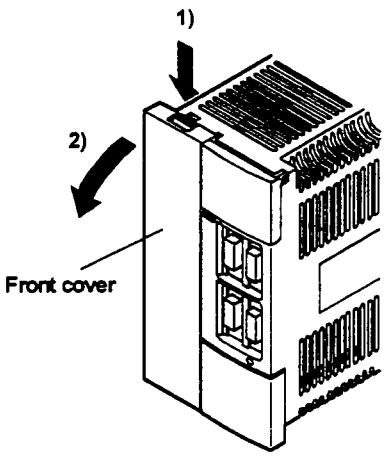
Name/Application	Refer To
Battery holder Contains the battery for absolute position data backup.	Section4.5
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm and parameter setting operations. MODE UP DOWN SET Used to set data. Used to change the display or data in each mode. Used to change the mode.	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.2
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.2
Communication connector (CN3) Used to connect a command device (RS-485/RS-232C) and output analog monitor data.	Chapter6 Chapter8 Section14.1.2
Name plate	Section1.3
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	———
Encoder connector (CN2) Connector for connection of the servo motor encoder.	Section3.3 Section14.1.2
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section3.2.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative brake option.	Section3.2.1 Section14.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.6

(2) MR-J2-200C-S100 or more



Name/Application	Refer To
Battery holder Contains the battery for absolute position data backup.	Section4.5
Battery connector (CON1) Used to connect the battery for absolute position data backup.	Section4.5
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Chapter7
Operation section Used to perform status display, diagnostic, alarm and parameter setting operations. MODE UP DOWN SET Used to set data. Used to change the display or data in each mode. Used to change the mode.	Chapter7
I/O signal connector (CN1A) Used to connect digital I/O signals.	Section3.2
I/O signal connector (CN1B) Used to connect digital I/O signals.	Section3.2
Communication connector (CN3) Used to connect a command device (RS-485/RS232C) and output analog monitor data.	Chapter6 Chapter8 Section14.1.2
Name plate	Section1.3
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	———
Encoder connector (CN2) Connector for connection of the servo motor encoder.	Section3.3 Section14.1.2
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section3.2.1
Control circuit terminal block (TE2) Used to connect the control circuit power supply and regenerative brake option.	Section3.2.1 Section14.1.1
Protective earth (PE) terminal (⏚) Ground terminal.	Section3.6

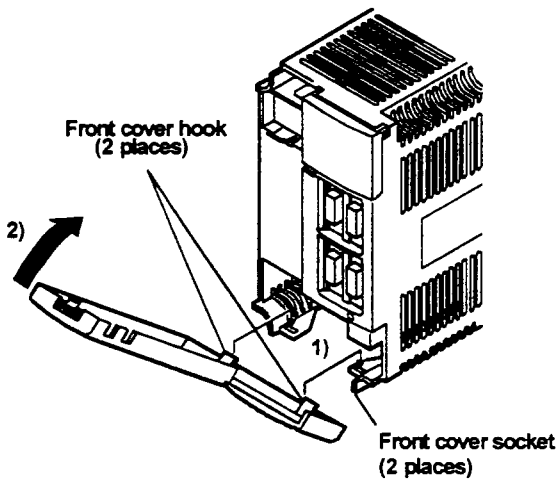
Removal of the front cover



1) Hold down the removing knob.

2) Pull the front cover toward you.

Reinstallation of the front cover



1) Insert the front cover hooks into the front cover sockets of the s ervo amplifier.

2) Press the front cover against the servo amplifier until the removing knob clicks.

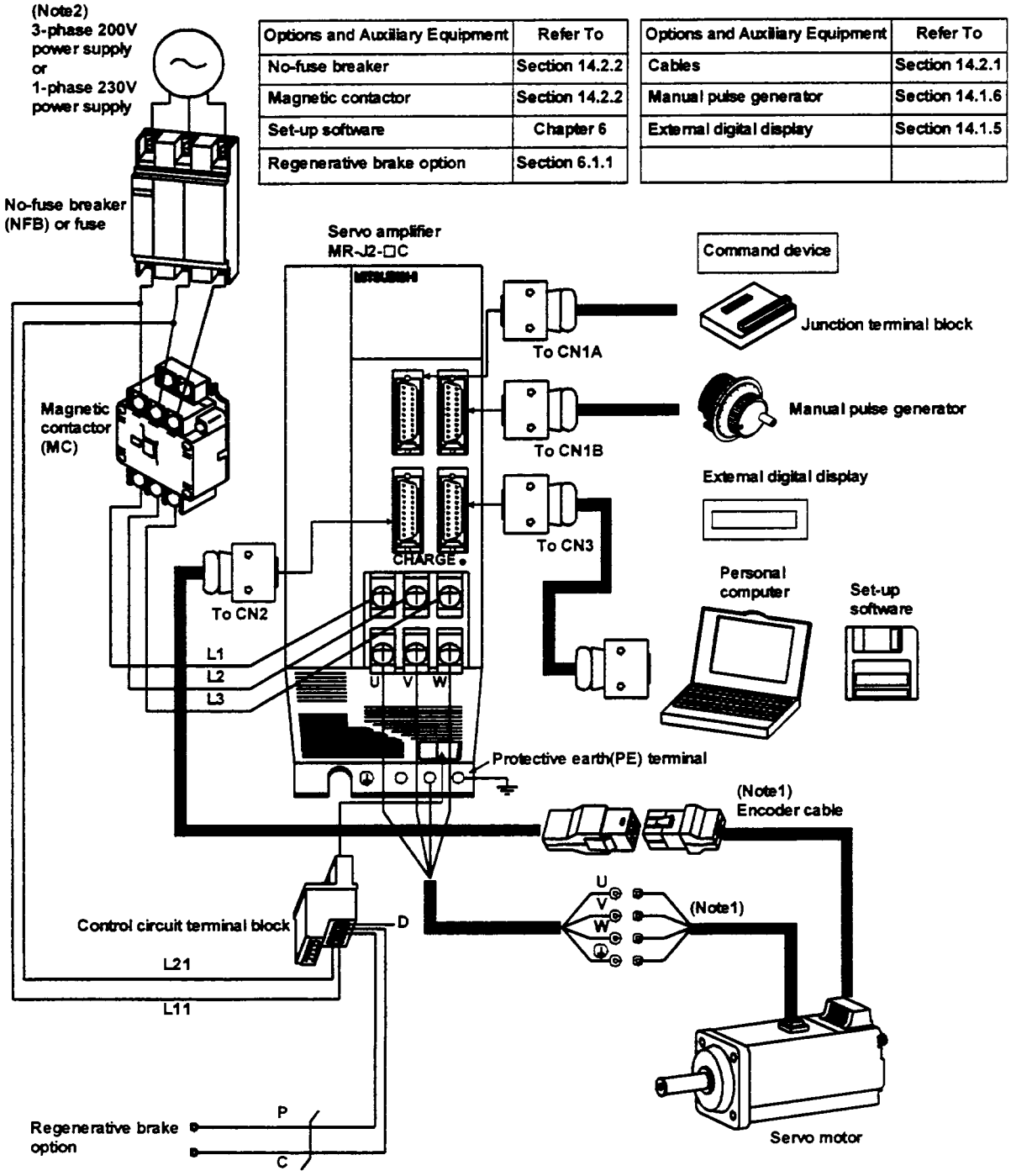
1.6 Servo System with Auxiliary Equipment

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

(1) MR-J2-100C-S100 or less

Options and Auxiliary Equipment	Refer To
No-fuse breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
Set-up software	Chapter 6
Regenerative brake option	Section 6.1.1

Options and Auxiliary Equipment	Refer To
Cables	Section 14.2.1
Manual pulse generator	Section 14.1.6
External digital display	Section 14.1.5

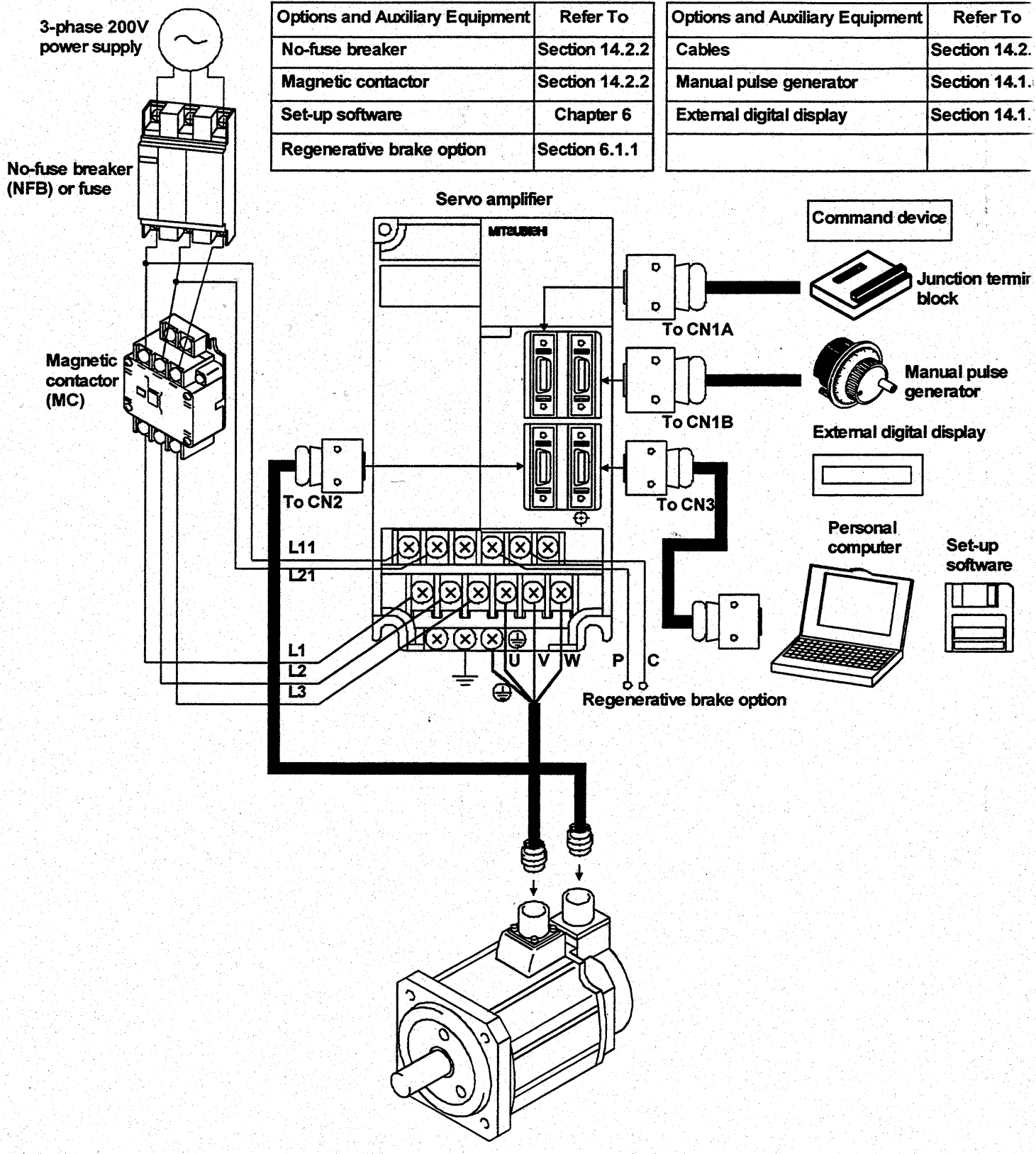


Note: 1. The HA-FF-UE, HC-SF, HC-RF series have Cannon connectors.
2. A single-phase 230V power supply may be used with the servo amplifier of MR-J2-70C or less. Connect the power supply to L1 and L2 terminals and leave L3 open. Note that this power supply cannot be used for a combination with the HC-SF52·53 servo motor.

(2) MR-J2-200C or more

Options and Auxiliary Equipment	Refer To
No-fuse breaker	Section 14.2.2
Magnetic contactor	Section 14.2.2
Set-up software	Chapter 6
Regenerative brake option	Section 6.1.1

Options and Auxiliary Equipment	Refer To
Cables	Section 14.2.
Manual pulse generator	Section 14.1.
External digital display	Section 14.1.



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.
- 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.

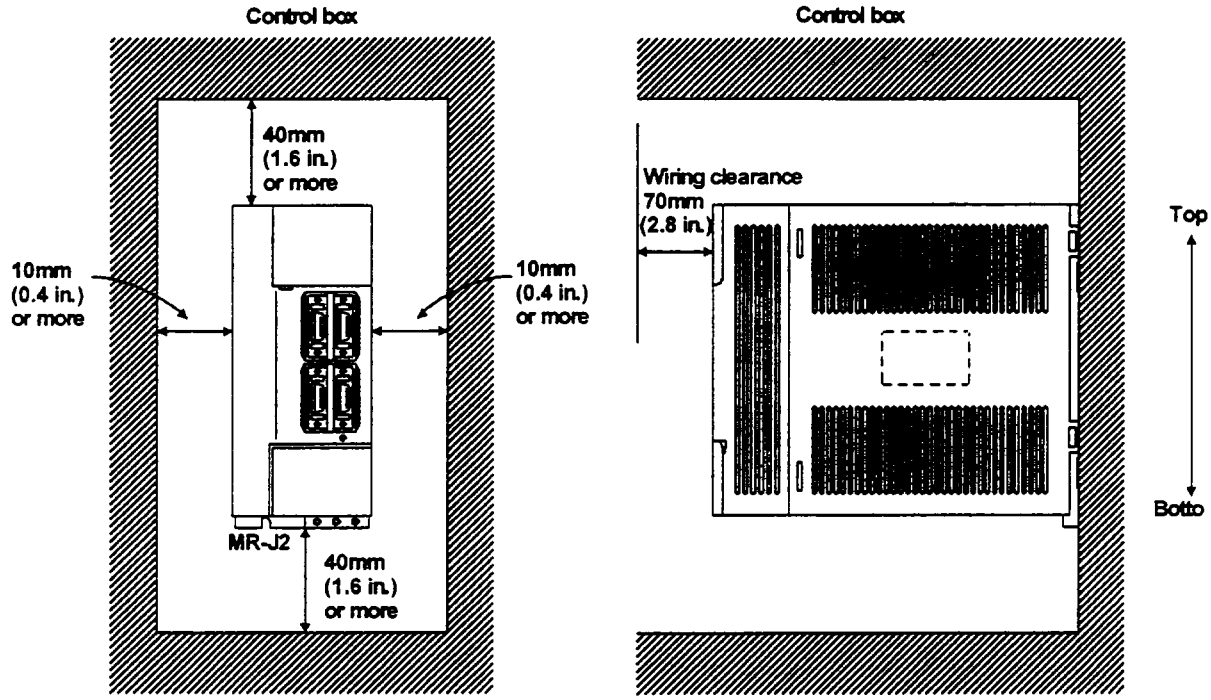
2.1 Environmental conditions

Environment	Conditions
Ambient temperature	0 to +55 [°C] (non-freezing)
	32 to +131 [°F] (non-freezing)
Ambient humidity	90%RH or less (non-condensing)
storage temperature	-20 to +65 [°C] (non-freezing)
	-4 to +149 [°F] (non-freezing)
storage humidity	90%RH or less (non-condensing)
Ambient	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
Altitud	Max. 1000m (3280 ft) above sea level
Vibration	5.9 [m/s^2] {0.6G} or less
	19.4 [ft/s^2] or less

2.2 Installation direction and clearances

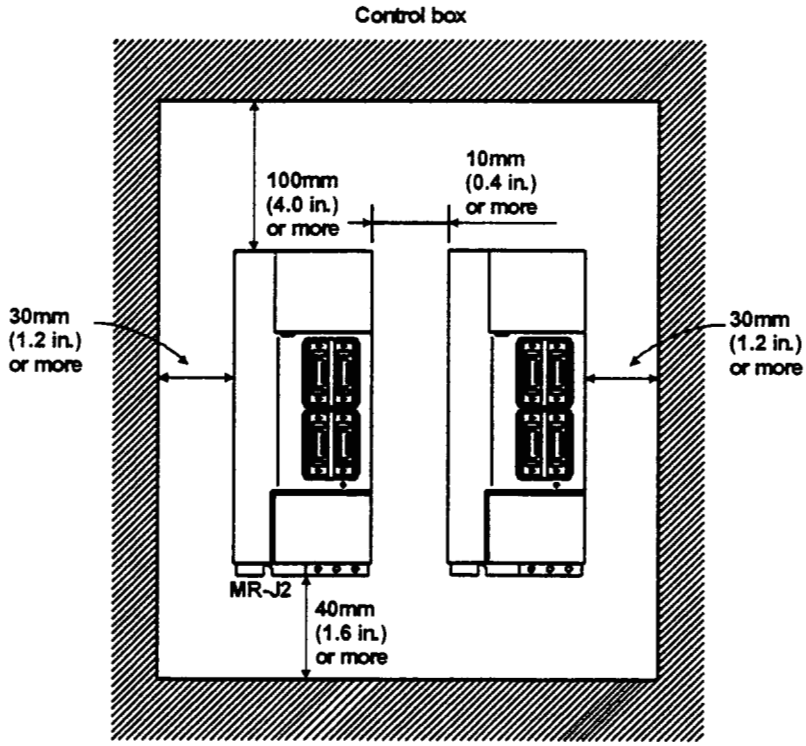
⚠ CAUTION	• The equipment must be installed in the specified direction. Otherwise, a fault may occur. • Leave specified clearances between the servo amplifier and control box inside walls or other equipment.

(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

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

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

2.3 Keep out foreign materials

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

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

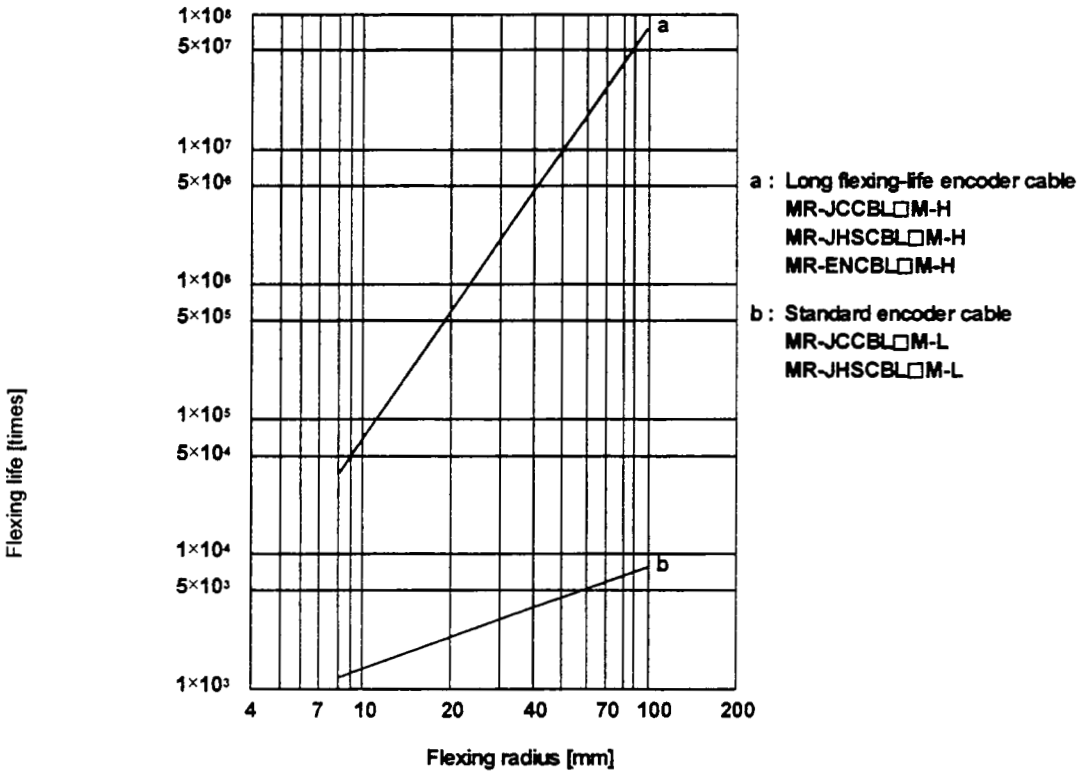
(1) The way of clamping the cable must be fully examined so that flexing stress and cable's own weight stress are not applied to the cable connection.

(2) In any application where the servo motor moves, the cables should be free from excessive stress. When the servo motor moves, e.g. the encoder cable and servo motor wiring are contained in a cable bearer, run the cables so that their flexing portions fall within the optional encoder cable range.

Fix the encoder cable and power cable 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) The flexing lives of the cables are shown below. In actuality, provide a little allowance for these values. For install ation on a machine where the servo motor will move, the flexing radius should be made as large as possible.



Note: This graph gives calculated values which are not guaranteed.

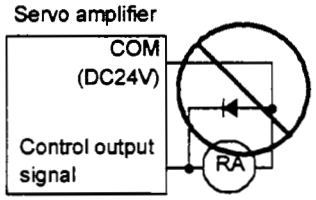
3 SIGNALS AND WIRING

⚠ 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 10 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.



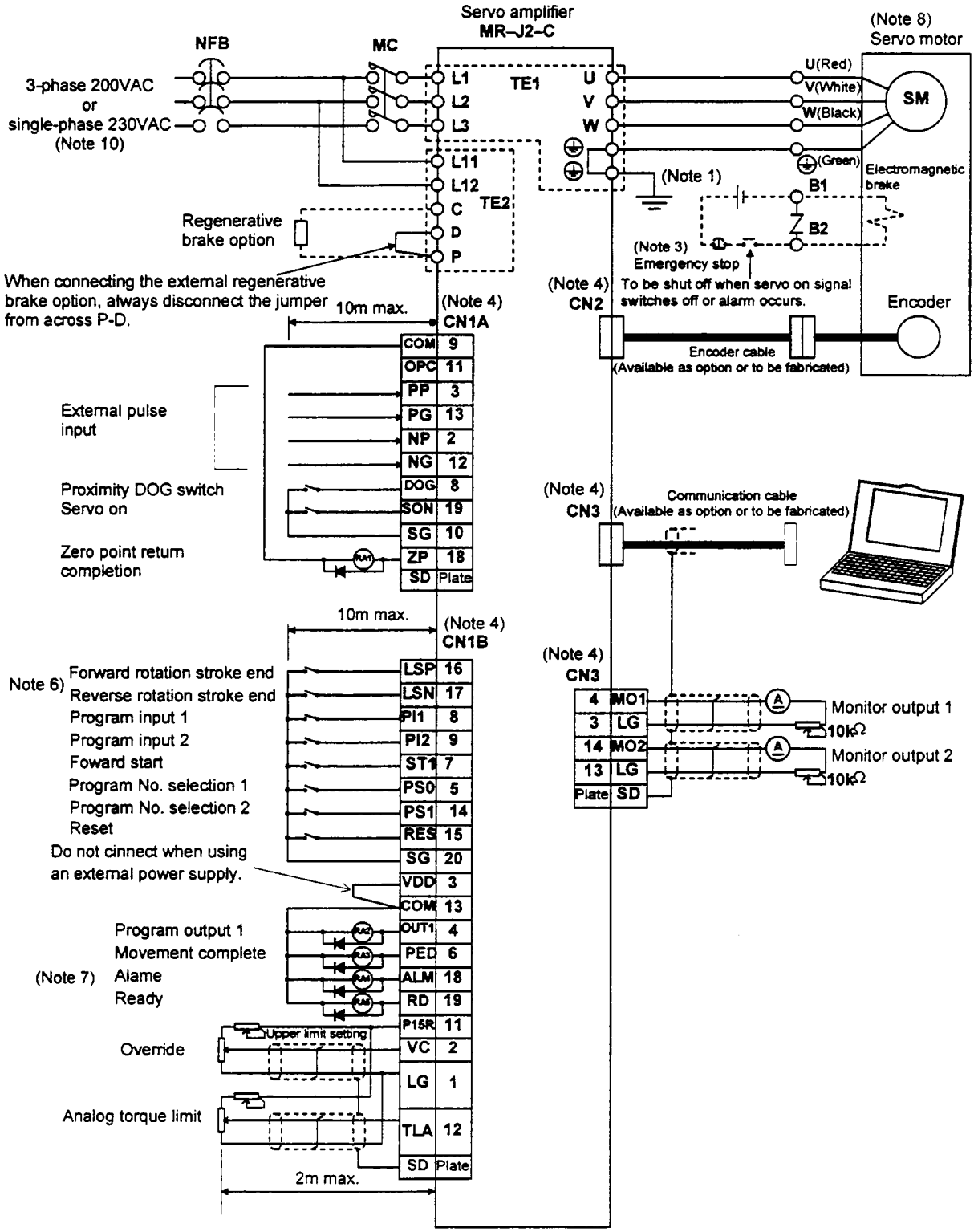
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo motor.
- When using the regenerative brake resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative brake resistor, causing a fire.
- Do not modify the equipment.

POINT

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

3.1 Connection Diagram

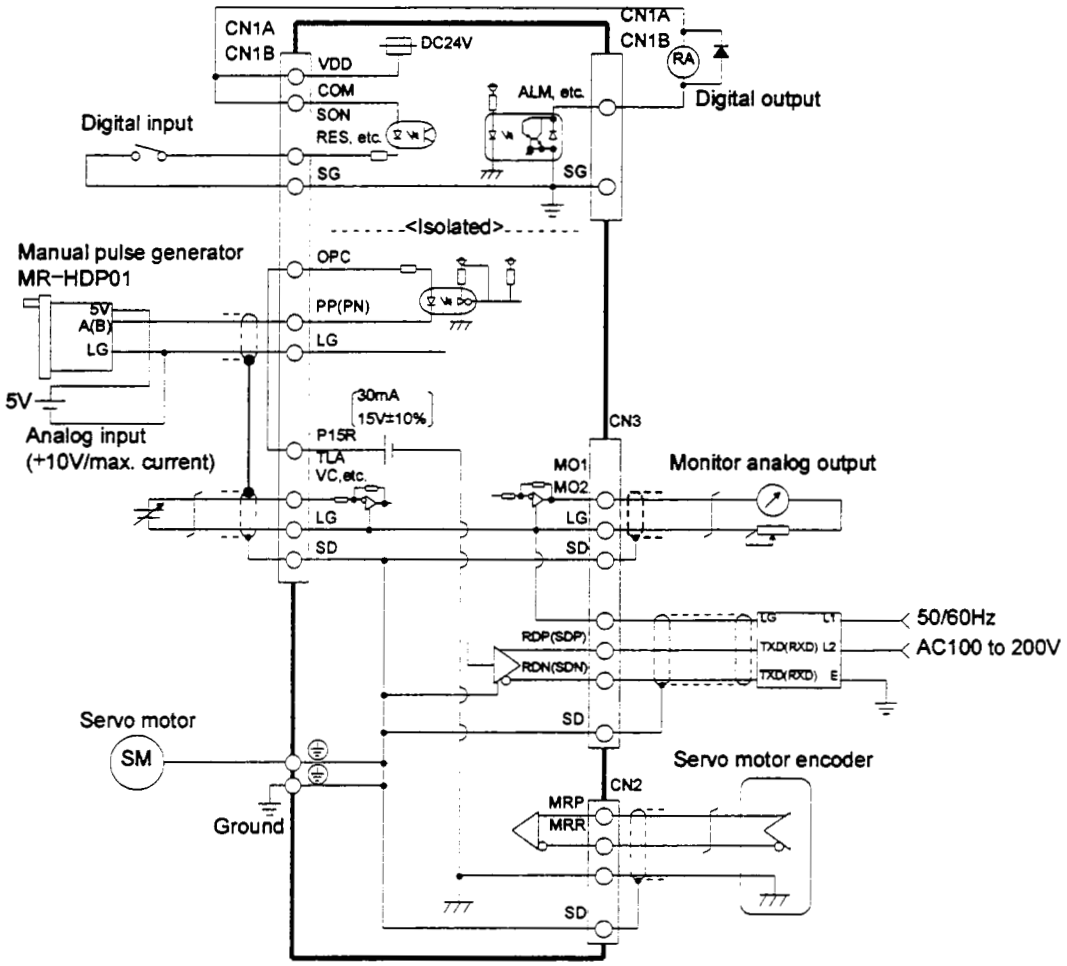
3.1.1 Standard connection example



Note:
1. To prevent an electric shock, always connect the protective earth (PE) terminal of the servo amplifier to the protective earth (PE) of the control box.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the emergency stop and other protective circuits.
3. The emergency stop switch must be installed.
4. CN1A, CN1B, CN2 and CN3 have the same shape. Wrong connection of the connectors will lead to a fault.
5. The sum of currents that flow in the external relays should be 80mA max. If it exceeds 80mA, supply interface power from external.
6. When starting operation, always connect the forward/reverse rotation stroke end signal (LSN/LSP) with SG. (Normally closed contacts)
7. Trouble (ALM) is connected with COM in normal alarm-free condition.
8. The connection method changes with the servo motor series.Refer to Section 3.3.
9. The pins with the same signal name are connected in the servo amplifier.
10. A single-phase 230V power supply may be used with the servo amplifier of MR-J2-70C-S100 or less. However, it cannot be used when the servo amplifier is combined with the HC-SF52/53 servo motor. Connect the power supply to L_1 and L_2 terminals and leave L_3 open.
11. When using override (VC), make the override selection (OVR) device available.
12. When using torque limit (TLA), make the external torque limit selection (TL) devices available.

3.1.2 Common line

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



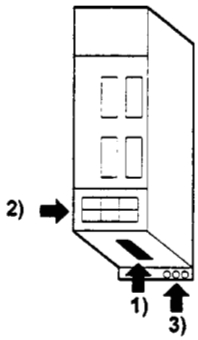
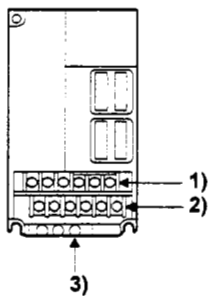
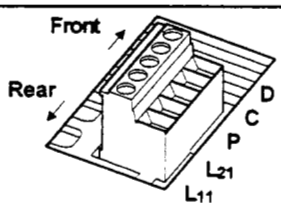
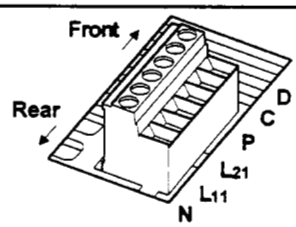
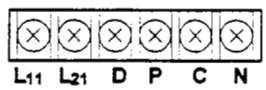
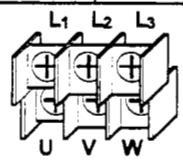
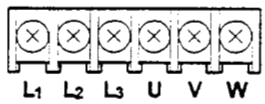
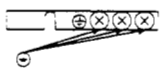
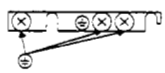
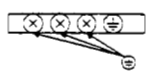
3.2 Servo Amplifier

> ⚠ CAUTION Only the specified voltage should be applied to each terminal. Otherwise, a burst, damage, etc. may occur.

3.2.1 Terminal blocks (Power supply system)

(1) Signal arrangement

Terminal block signals are as listed below:

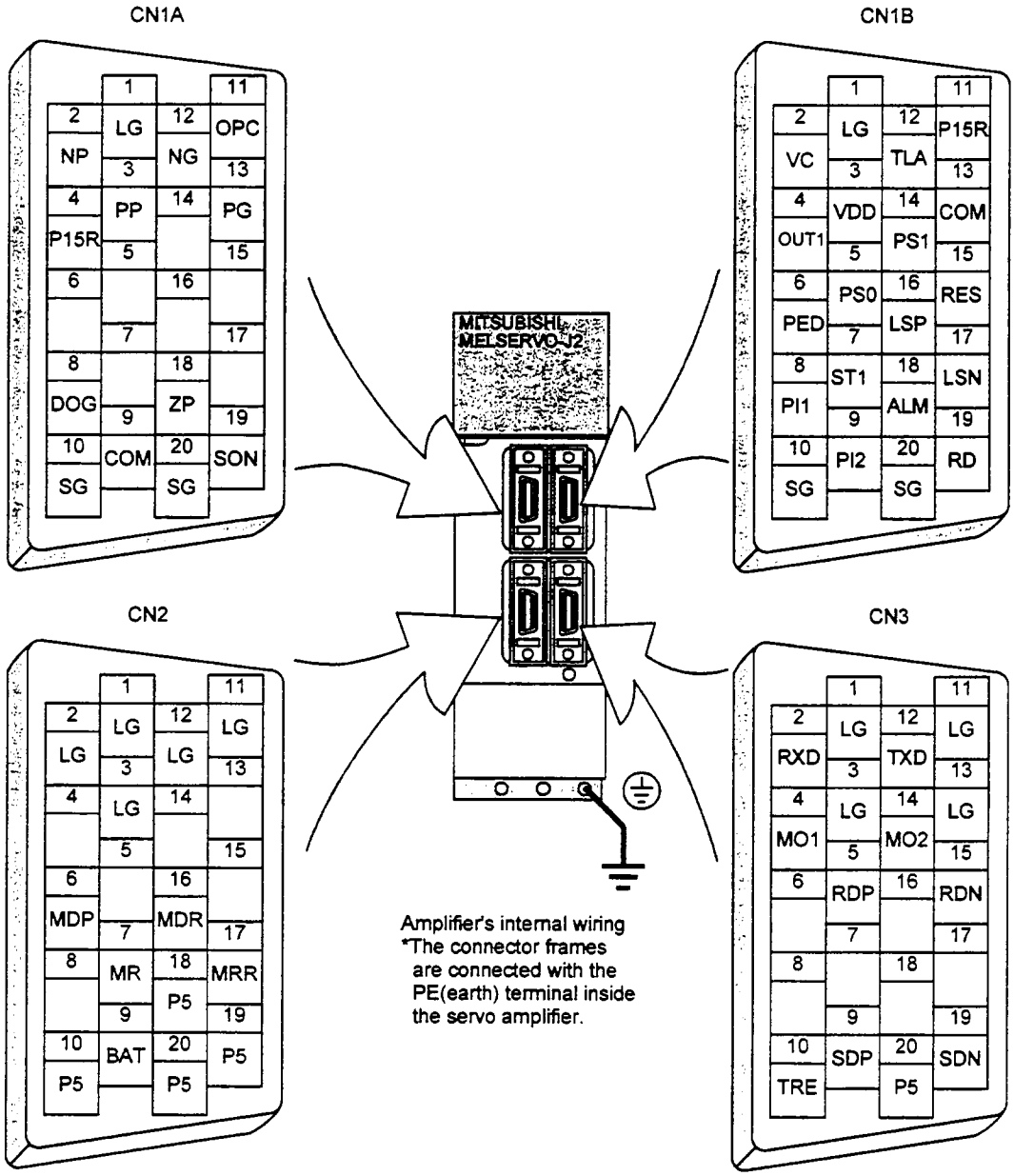
Servo Amplifiers / Terminals			MR-J2-10C-S100 to MR-J2-60C-S100	MR-J2-70C-S100 MR-J2-100C-S100	MR-J2-200C-S100 MR-J2-350C-S100
Terminal positions					
Terminal signals	1)	Control circuit terminal block (TE2)	 (Phoenix Contact make)	 (Phoenix Contact make)	
	2)	Main circuit terminal block (TE1)			
	3)	Protective earth (PE) terminals			

(2) Signals

<table>
<tr><th>Symbol</th><th>Signal</th><th>Description</th></tr>
<tr><td>L_1, L_2, L_3</td><td>Main circuit power supply</td><td>Main circuit power input terminals
Supply L_1, L_2 and L_3 with the following power:
<table>
<tr><th>Servo amplifier / Power supply</th><th>MR-J2-10C to MR-J2- 70C-S100</th><th>MR-J2-100C-100 to MR-J2-350C-S100</th></tr>
<tr><td>3-phase 200 to 230VAC, 50/60Hz</td><td colspan="2">$L_1 \cdot L_2 \cdot L_3$</td></tr>
<tr><td>(Note) Single-phase 230VAC, 50/60Hz</td><td>$L_1 \cdot L_2$</td><td>×</td></tr>
</table>
Note: Cannot be used for combination with the servo motor HC-SF52 · 53.</td></tr>
<tr><td>U, V, W</td><td>Servo motor output</td><td>Servo motor power output terminals
Connect to the servo motor power supply terminals (U, V, W).</td></tr>
<tr><td>L_{11}, L_{21}</td><td>Control circuit power supply</td><td>Control circuit power input terminals
Supply L_{11} and L_{21} with single-phase 200-230VAC, 50/60Hz power.
L_{11} and L_{21} should be in phase with L_1 and L_2, respectively.</td></tr>
<tr><td>P, C, D</td><td>Regenerative brake option</td><td>Regenerative brake option connection terminals
C and D are factory-connected.
When using the regenerative brake option,always remove wiring from across P-D and connect the regenerative brake option across P-C.</td></tr>
<tr><td>N</td><td>———</td><td>Do not connect.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Ground terminal
Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.</td></tr>
</table>

3.2.2 Connectors (I/O Signals)

(1) Signal arrangement



(2) Signal explanations

1) CN1A

Signal Name	Symbol	Pin No.	Description	I/O Division
Digital I/F power supply input	COM	9	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. When using an external power supply, connect a power supply of 24VDC, 200mA or more to this terminal.	
Open collector power inp ut	OPC	11	When using a pulse train in the open collector, supply 24VDC to this terminal.	
Digital I/F common	SG	10, 20	Common terminal for VDD and COM and isolated from LG.	
DC15V power supply	P15R	4	Used to output 15VDC. Power supply terminal for VC and TLA.	
Control common	LG	1	Common terminal for VC, TLA, MO1, MO2 and P15R.	
Manual pulse generator	PP	3	Used to enter a 2-phase pulse train. 1)In the open collector system (max. input frequency 200kpps) A phase pulse train across PP-SG, B phase pulse train across NP-SG. 2)In the differential receiver system (max. input frequency 400kpps A phase pulse train across PG-PP, B phase pulse train across NG-NP	
	PG	13		
	NP	2		
	NG	12		
Proximity dog	DOG	8	Proximity dog signal input terminal for manual zeroing. When terminals DOG-SG are opened, the proximity dog signal is detected. The polarity of dog detection input can be changed with the parameter.	DI-1

Parameter No.8	Polarity of Proximity Dog Detection Input
□0□□ (initial value)	DOG-SG are opened.
□1□□	DOG-SG are shorted.

Zeroing completion	ZP	18	ZP-SG are connected on completion of zeroing. In the absolute position system, ZP-SG are connected when the servo amplifier is ready to operate but are disconnected if: 1) SON-SG are opened; 2) EMG-SG are opened; 3) RES-SG are shorted; 4) Alarm occurs; 5) Limit switch opens; 6) Zeroing has not been made after the purchase of the product; 7) Zeroing has not been made after the occurrence of absolute position erasure (A. 25) or absolute position counter warning (A. E3); 8) Zeroing has not been made after the changing of the electronic gear value; 9) Zeroing has not been made after the absolute position system was made valid; ords 10) The ST1 coordinate system (000□ in parameter No.1) has been changed.	DO-1
Servo on	SON	19	Operation-ready signal input terminal. 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.	DI-1
Shield	SD	Plate	Connect one end of the shielded cable.	

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.
When using this power supply for digital interface, connect it with COM.
Permissible current: 80mA</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.
When using an external power supply, connect a power supply of 24VDC, 200mA or more to this terminal.</td><td></td></tr>
<tr><td>DC15V 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. and isolated from LG.</td><td></td></tr>
<tr><td>Control common</td><td>LG</td><td>1</td><td>Common terminal for VC, TLA, MO1, MO2 and P15R.</td><td></td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>16</td><td>Forward/reverse rotation stroke end signal input terminals.
To start operation, short LSP-SG or LSN-SG. When they are opened, the servo motor is stopped suddenly and servo-locked.</td><td>DI-1</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>17</td><td>
<table>
<tr><th>Across LS P-SG</th><th>Across LS N-SG</th><th colspan="2">Operation</th></tr>
<tr><th></th><th></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:Open,1:Short
</td><td>DI-1</td></tr>
<tr><td>Program input 1</td><td>PI1</td><td>8</td><td>Program input device terminal 1
During to running program, signal to commanded SYNC(1).</td><td>DI-1</td></tr>
<tr><td>Program input 2</td><td>PI2</td><td>9</td><td>Program input device terminal 2
During to running program, signal to commanded SYNC(2)</td><td>DI-1</td></tr>
<tr><td>Start
/ Forward rotation start</td><td>ST1</td><td>7</td><td>Start signal input terminal.
In automatic operation mode, operation starts as soon as ST1-SG are shorted.
In zeroing mode, zeroing 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.
Note: Forward rotation denotes the direction in which the address is incremented.</td><td>DI-1</td></tr>
<tr><td>Program No. selection</td><td>PS0
PS1</td><td>5
14</td><td>Program number selection input terminal.
PS0 and PS1 relationship between signal status and operation are as follows.
<table>
<tr><th>PS2</th><th>PS1</th><th>PS0</th><th>Selected program No</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Program No.1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Program No.2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Program No.3</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Program No.4</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Program No.5</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Program No.6</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Program No.7</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Program No.8</td></tr>
</table>
PS2 is not the factory default.
It is necessary to allocate by parameter No.59 to 63.
0:Open 1:Short</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>Program output 1</td><td>OUT1</td><td>4</td><td>Program output 1 device
OUT1 is device signal when commanded OUTON(1)/OUT OF(1) in the program.
It is possible turn on time by Parameter No.54</td><td>DO-1</td></tr>
<tr><td>Movement completion</td><td>PED</td><td>6</td><td>Movement completion synchronous output device.
After the command remaining distance and smoothing reach zero,this signal is output (PED-SG are connected) within the droop pulses set in Parameter No.12</td><td>DO-1</td></tr>
<tr><td>Trouble</td><td>ALM</td><td>18</td><td>Trouble signal output terminal.
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>Ready output terminal.
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>Alarm reset</td><td>RES</td><td>15</td><td>Alarm reset signal input device.
Short RES-SG to deactivate the alarm.
When □□1□ is set in parameter No.22, the base circuit is shut off while RES-SG are shorted.
The following alarms cannot be deactivated:
<table>
<tr><th>Indication</th><th>Name</th><th>Indication</th><th>Name</th></tr>
<tr><td>A. 11</td><td>Board error 1</td><td>A. 20</td><td>Encoder error 2</td></tr>
<tr><td>A. 12</td><td>Memory error 1</td><td>A. 24</td><td>Motor output ground fault</td></tr>
<tr><td>A. 13</td><td>Clock error</td><td>A. 25</td><td>Absolute position erase</td></tr>
<tr><td>A. 15</td><td>Memory error 2</td><td>A. 30</td><td>Regenerative error</td></tr>
<tr><td>A. 16</td><td>Encoder error 1</td><td>A. 37</td><td>Parameter error</td></tr>
<tr><td>A. 17</td><td>Board error 2</td><td>A. 50</td><td>Overload 1</td></tr>
<tr><td>A. 18</td><td>Board error 3</td><td>A. 51</td><td>Overload 2</td></tr>
</table></td><td>DI-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) CN3

Signal Name	Symbol	Pin No.	Description	I/O Division
Analog monitor 1	MO1	4	Used to output the data set in parameter No.17 to across MO1-LG in terms of voltage. Resolution 8 bits	Analog output
Analog monitor 2	MO2	14	Used to output the data set in parameter No.17 to across MO2-LG in terms of voltage. Resolution 8 bits	Analog output
RS-485 I/F	SDP	9	RS-485 communication terminal RS-485 and RS-232C functions cannot be used together. Short "15" and "10" at the last axis.	
	SDN	19		
	RDP	5		
	RDN	15		
	TRE	10		
RS-232C I/F	TXD	2	RS-232C communication terminal Use parameter No.16 for selection.	
	RXD	12		
Monitor common	LG	1, 3, 11, 13	Monitoring common for control common	
Ground	SD	Plate	Connect one end of the shielded cable.	

3.2.3 Additional function devices

By using the Windows™ based Software or parameter, you can assign the signals given in this section to the pins of connectors CN1A and CN1B, in addition to the signals in Section 3.2.2.

(1) Pins which accept different signals

Pin Type	Connector Pin No.	Device in Initial Status	Device Symbol	Parameter No.
Input-only pins	CN1B-5	Program No. selection 0	PS0	60
	CN1B-14	Program No. selection 1	PS1	62
	CN1A-8	Proximity dog	DOG	59
	CN1B-15	Alarm reset	RES	62
	CN1B-16	Forward rotation stroke end	LSP	63
	CN1B-17	Reverse rotation stroke end	LSN	63
	CN1B-7	Start/Forward rotation start	ST1	60
	CN1B-8	Program input 1	PI1	61
	CN1B-9	Program input 2	PI2	61
I/O pin	CN1A-19	Servo on	SON	59 or 66
Output-only pins	CN1B-4	Program output 1	OUT1	62
	CN1B-6	Movement completion	PED	67
	CN1B-18	Trouble	ALM	68
	CN1B-19	Ready	RD	68
	CN1A-18	Zeroing completion	ZP	66

Note: Terminal CN1A-19 can be set as either INPUT or OUTPUT by Parameter No.58.

(2) Assignable devices

1) Input devices

Device Name	Symbol	Description	I/O Division
No assigned function	—	No function is assigned.	DI-1
Emergency stop	EMG	Emergency stop input device. 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	Override selection input device. Short OVR-SG to make override (VC) valid.	DI-1
External torque limit selection	TL0	External torque limit selection input device. Short TL0-SG to make external analog torque limit valid. For more information, refer to Section 3.2.5.	DI-1
Internal torque limit selection	TL1	Internal torque limit selection input device. Open TL1-SG to make the torque limit value set in parameter No.28 (TL0) valid, or short them to make the value set in parameter No.29 (TL1) valid. For more information, refer to Section 3.2.5.	DI-1
Proportion control	PC	Proportion control input device. Short PC-SG to switch the speed amplifier from proportional integral type to proportional type.	DI-1
Program input 3	PI3	Program input device terminal. During to running program.PI3 is device signal when commanded SYNC(3)	DI-1
Reverse rotation start	ST2	Reverse JOG start signal input device. In jog operation mode, the servo motor rotates in the reverse rotation direction while ST2-SG are shorted. Note: Reverse rotation denotes the direction in which the address is decremented.	DI-1
Automatic/Manual selection	MDO	Automatic/manual mode selection signal input terminal. Short MDO-SG to choose the automatic operation mode, or open them to choose the manual operation mode.	DI-1

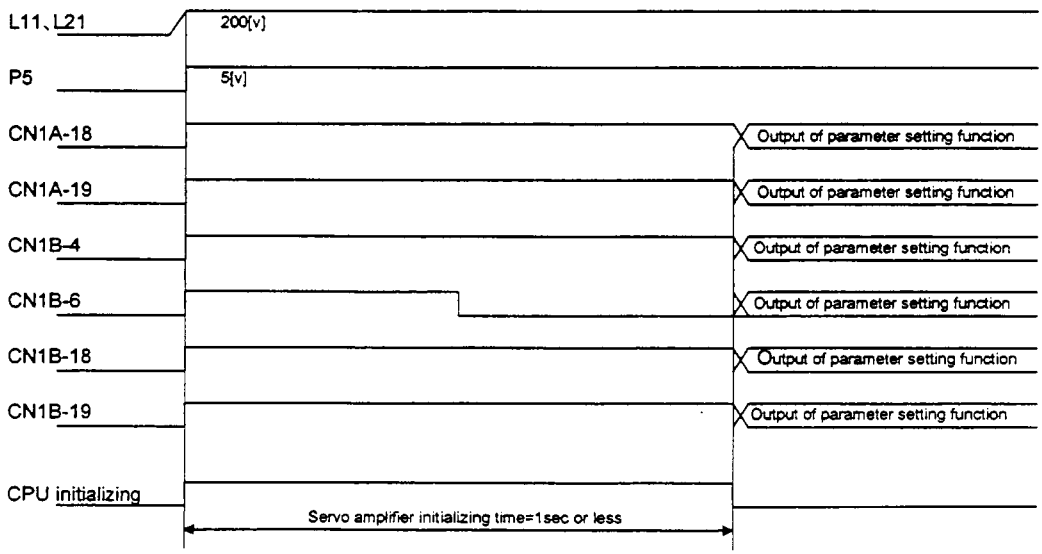
<table>
<tr><th>Device Name</th><th>Symbol</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Program No. selection 2</td><td>PS2</td><td>Program number selection signal input device.
During the program operation mode, it is selected when ST1 signal up-edge.
PS0,PS1 and PS2 relationship between the select signal and program number are as follows.
<table>
<tr><th>PS2</th><th>PS1</th><th>PS0</th><th>Selected program No.</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Program No.1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Program No.2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Program No.3</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Program No.4</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Program No.5</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Program No.6</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>Program No.7</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>Program No.8</td></tr>
</table>
Note: 0:Open, 1:Shot</td><td>DI-1</td></tr>
<tr><td>Temporary stop/restart</td><td>STP</td><td>Temporary stop/restart input device.
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 zeroing and jog operation, the temporary stop/restart input is ignored.
Refer to Section 4.2.2, (4).</td><td>DI-1</td></tr>
<tr><td>Input pulse magnification selection</td><td>TP0
TP1</td><td>Input pulse magnification selection input device.
<table>
<tr><th>TP1</th><th>TP0</th><th>Input pulse magnification</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	Electromagnetic brake interlock output device. Used to output the interlock signal for electromagnetic brake. MBR-SG are disconnected at servo-off or alarm occurrence.	DO-1
Position range output	POT	Position range output device. POT-SG are connected when the number of actual position address is in the preset position range.	DO-1
Warning	WNG	Warning output device. WNG-SG are connected when warning occurs. Open in normal condition.	DO-1
Battery warning	BWNG	Battery warning output device. BWNG-SG are connected when the open battery cable warning (A. 92) or battery warning (A. 9F) occurs. Open in normal condition.	DO-1
Limiting torque	TLC	Torque limiting device. TLC-SG are connected when the internally or externally set torque limit value is reached.	DO-1
Temporary stop	PUS	Temporary stop device. 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
Program output	OUT2 OUT3	Program output device. OUT2 is device signal when commanded OUTON(2)/OUT OF(2) in the program. OUT3 is device signal when commanded OUTON(3)/OUT OF(3) in the program.	DO-1
SYNC synchronous output	SOUT	SYNC synchronous output device. SOUT-SG are connected when waiting for SYNC( ) command.	DO-1
Dynamic brake interlock	DBR	Dynamic brake interlock output device.	DO-1

(3) Notes of output signal

If the machine is directly driven by the output device of MR-J2-S100, you need the following attention.
MR-J2-S100 can have 6 output device (CN1A-18, CN1B-14, -6, -18,-19,and reversible device CN1A-19).
As for **CN1B-6**, during amplifier initializing period, **it differ from condition of other output device.**



3.2.4 Override

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

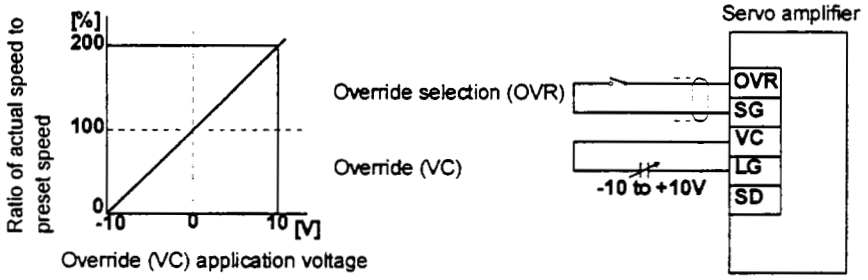
The override (VC) may be used to change the servo motor speed. The following table lists the signals and parameter related to the override:

Item	Name	Remarks
Analog input signal	Override (VC)	Set-up Software setting required.
Contact input signal	Override selection (OVR)	
Parameter	No.25 override offset	-999 to 999mV

(1) Override (VC)

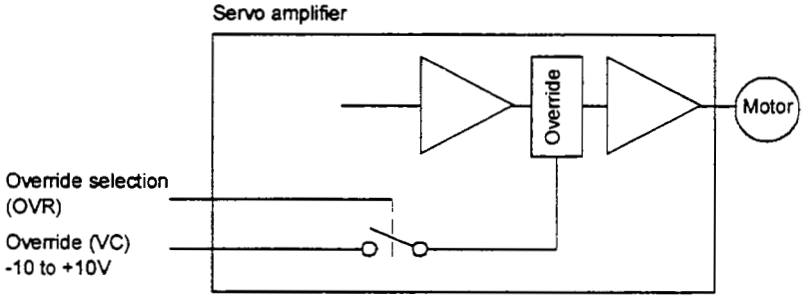
By applying a voltage (-10 to +10V) to the override (VC) terminal, change values can be set from outside consecutively. The following graph shows the relationship between the input voltage and the ratio of actual speed to preset speed.

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



(2) Override selection (OVR)

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



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

Across OVR-SG	Speed Change Value
Open	No change
Short	Override (VC) setting is made valid.

(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.

3.2.5 Torque limit

POINT
To use the torque limit, make the external torque limit selection (TL0) device and internal torque limit selection (TL1) device available.

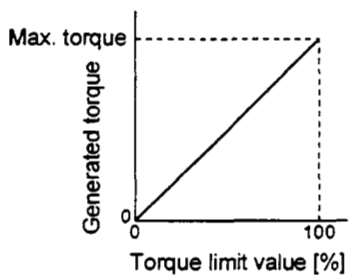
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLA)	Servo Configuration Software setting required.
Contact input signals	External torque limit selection (TL0)	
	Internal torque limit selection (TL1)	
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%.

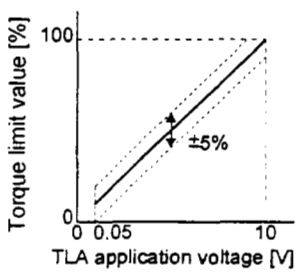
(1) Internal torque limits 1, 2

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

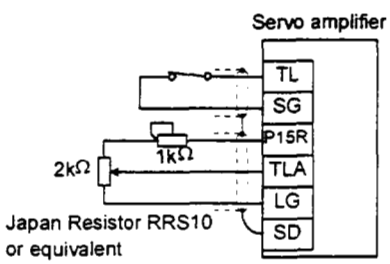


(2) External torque limit (TLA)

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

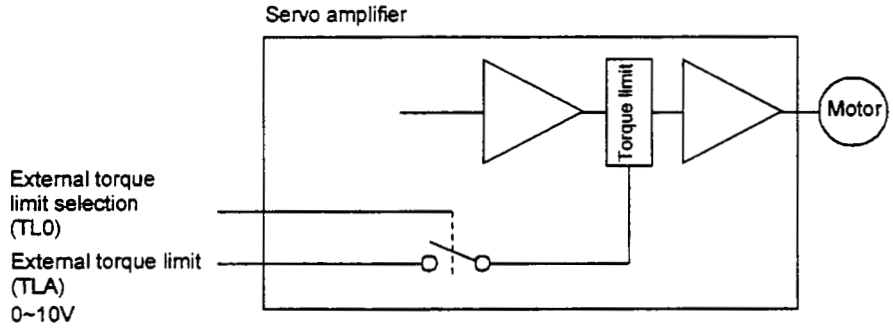
(3) External torque limit selection (TL0), internal torque limit selection (TL1)

To use the external torque limit selection (TL0) and internal torque limit selection (TL1), make them available using the Configuration Software (refer to Chapter 6).

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

(a) External torque limit selection (TL0)

Used to make the external torque limit (TLA) valid or invalid.

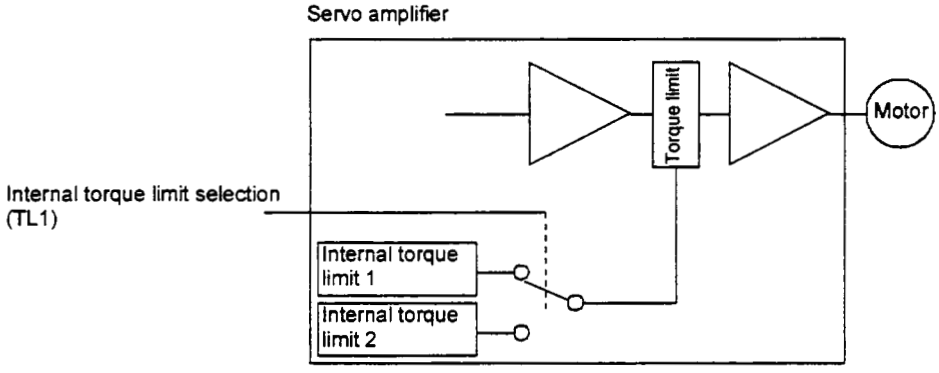


Using the external torque limit selection (TL0), choose the limit value as follows:

Across TL0-SG	Torque Limit Value
Open	No limit
Short	External torque limit (TLA) setting is made valid.

(b) Internal torque limit selection (TL1)

Used to change the internal torque limit.



Using the internal torque limit selection (TL1), choose the limit value as follows. When TL1-SG are shorted, the smaller value of the internal torque limits 1 and 2 is chosen:

Across TL1-SG	Torque Limit Value (Parameter)
Open	Internal torque limit 1
Short	Internal torque limit 1 if internal torque limit 1 < internal torque limit 2
	Internal torque limit 2 if internal torque limit 1 > internal torque limit 2

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

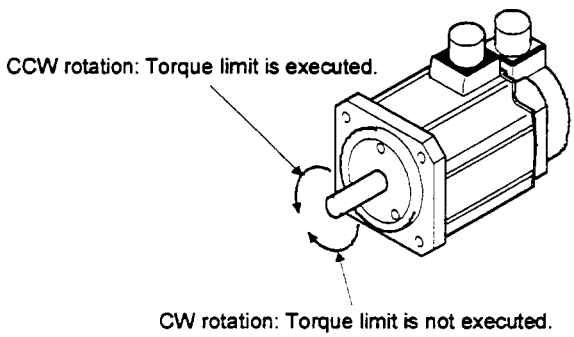
Using parameter No.26, the offset voltage can be set relative to the input voltage of the external torque limit (TLA). The setting is between -999 to 999mV.

(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	×	○

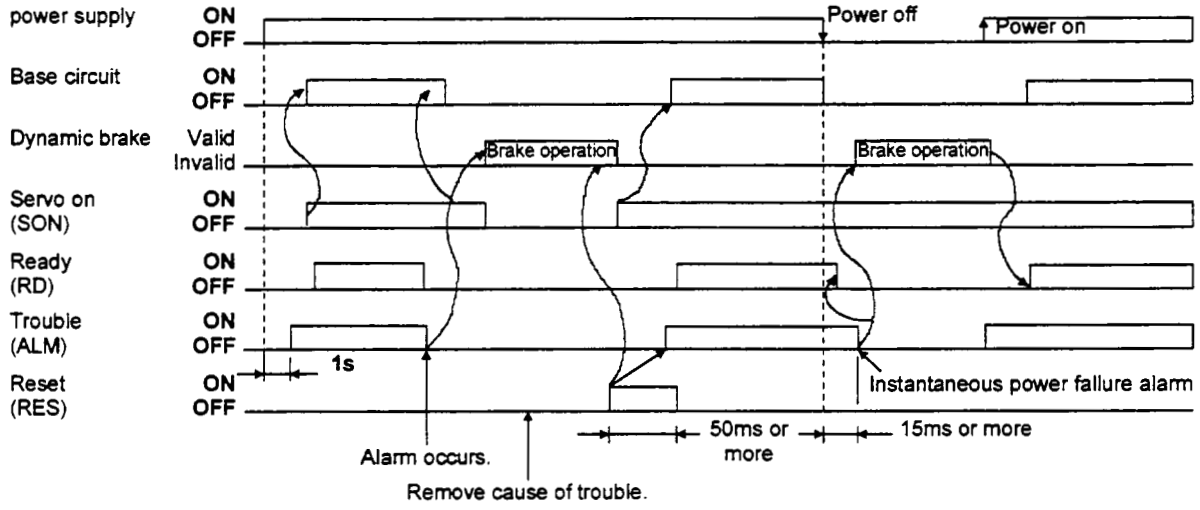
For example, when □□□1 is set in parameter No.20, torque limit is executed in the CCW direction but not in CW direction.



3.2.6 Alarm Occurrence Timing Chart

⚠ CAUTION	When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation.

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.



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) Regenerative alarm
   If operation is repeated by switching control circuit power off, then on to reset the regenerative (A. 30) alarm after its occurrence, the external regenerative brake resistor will generate heat, resulting in an accident.
3) Instantaneous power failure
   If a power failure continues 15ms or longer, the undervoltage (A. 10) alarm will occur. If the power failure still persists for 20ms or longer, the control circuit is switched off. When the power failure is reset in this state, the alarm is reset and the servo motor will start suddenly if the servo-on signal (SON) is on. To prevent hazard, make up a sequence which will switch off the servo-on signal (SON) if an alarm occurs.
4) Incremental system
   When an alarm occurs, the home position is lost. When resuming operation after deactivating the alarm, make a return to home position.

3.2.7 Interfaces

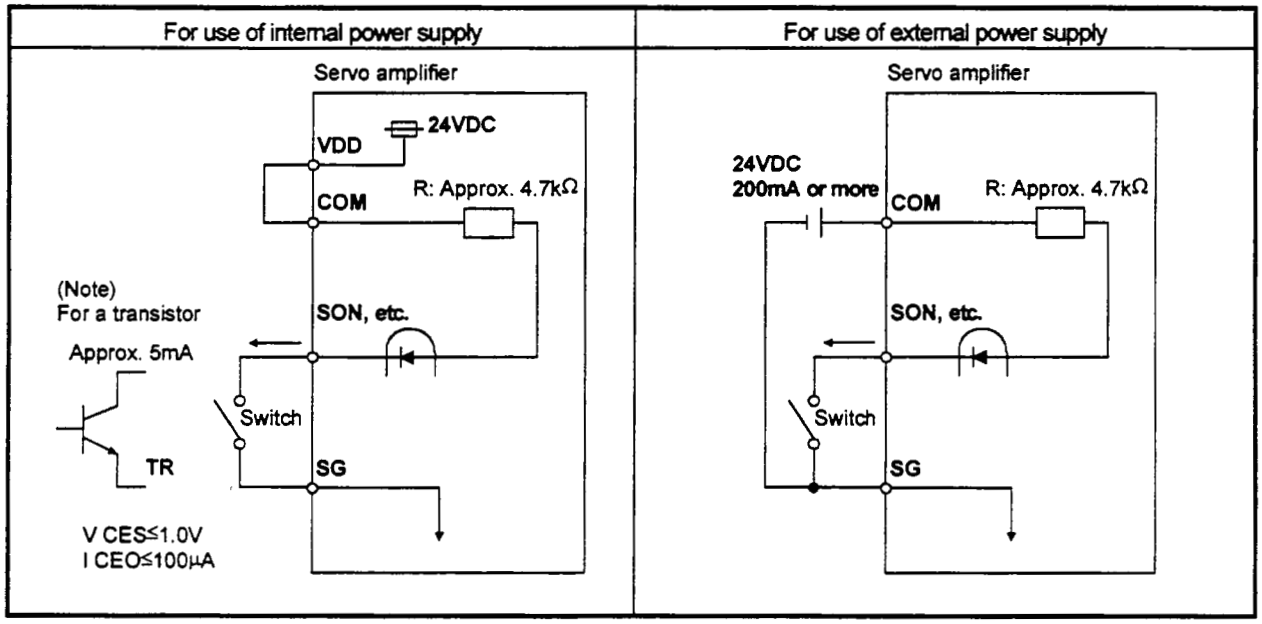
This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in Sections 3.2.2 and 3.2.3.

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.

Source input is also possible. Refer to (5) in this section.

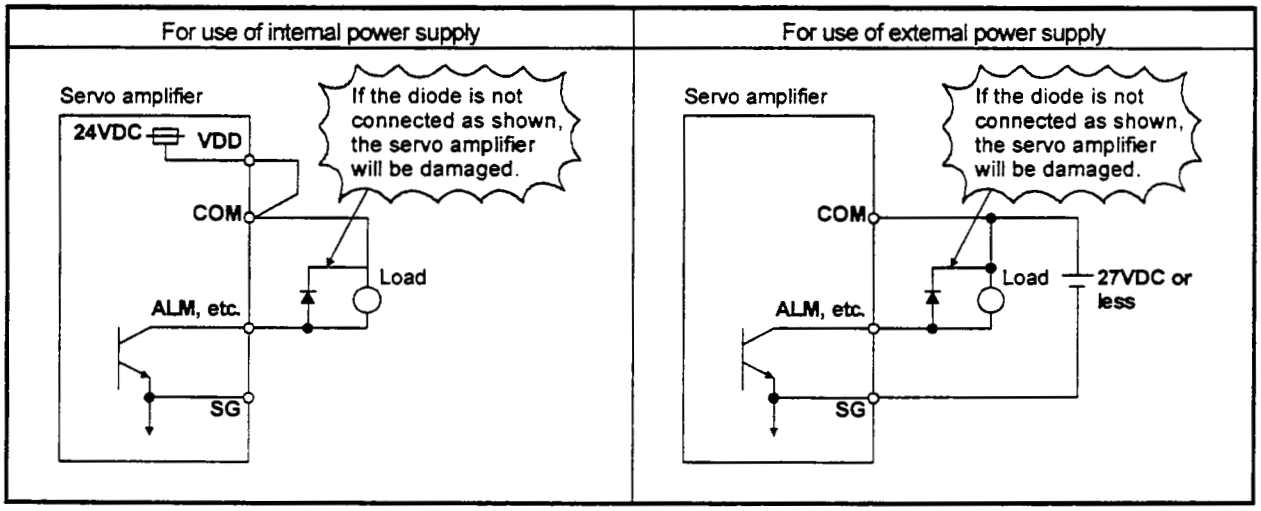


Note: This also applies to the use of the external power supply.

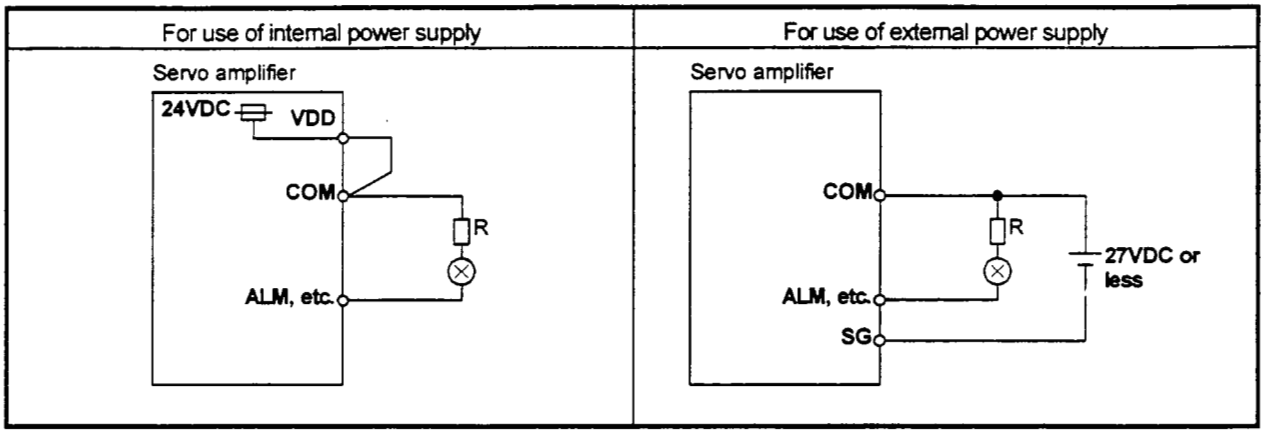
(2) Digital output interface DO-1

A lamp, relay or photocoupler can be driven. Provide a diode (D) for an inductive load, or an inrush current suppressing resister (R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less)

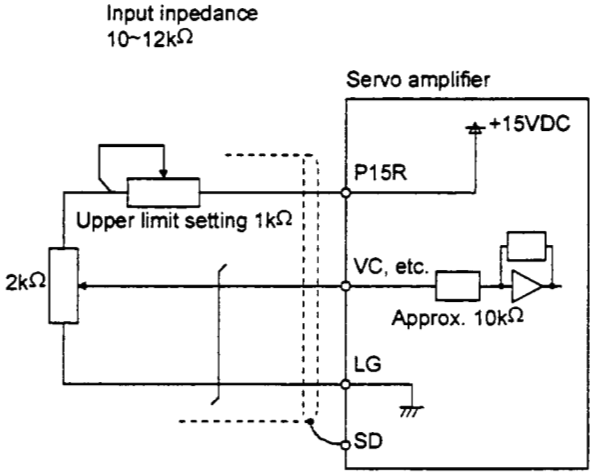
1) Inductive load



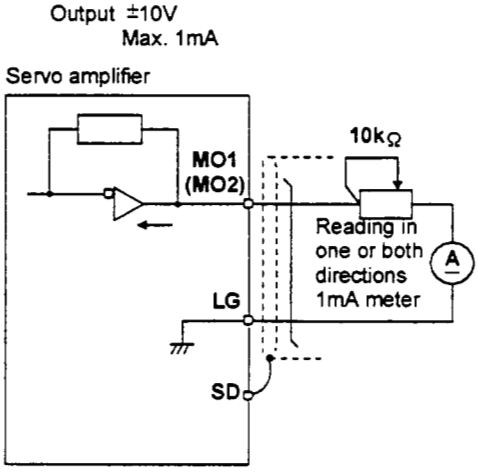
2) Lamp load



(3) Analog input

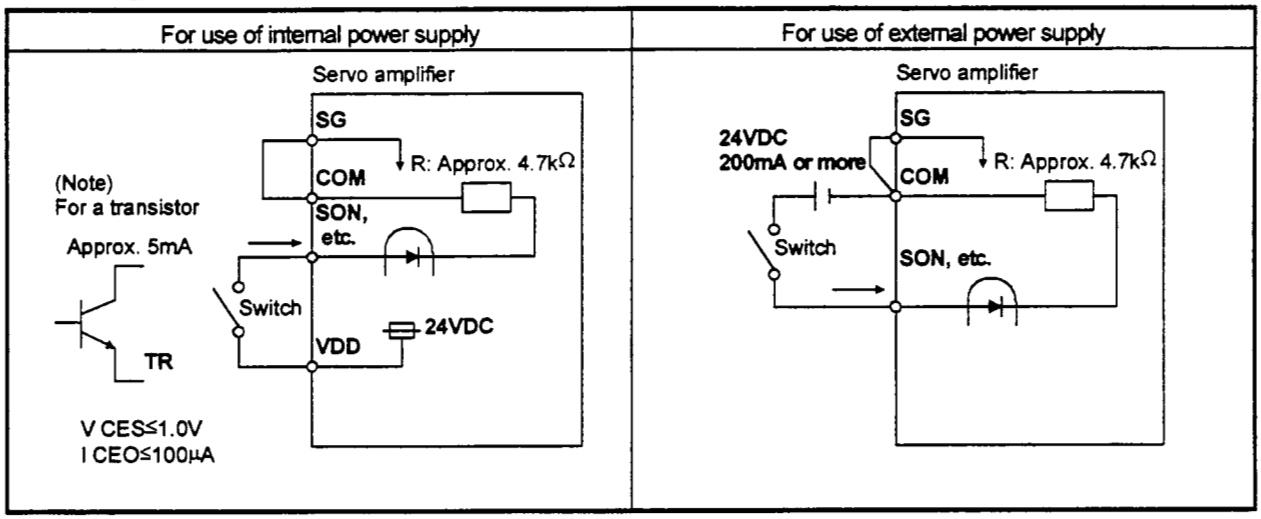


(4) Analog output



(5) Source input interface

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



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

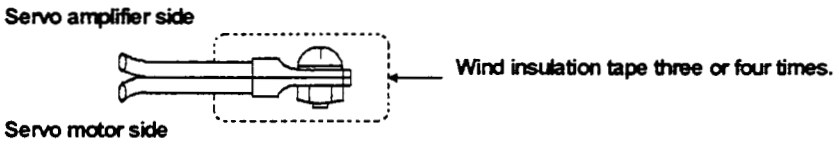
3.3 Connection of Servo Amplifier and Servo Motor

3.3.1 Connection instructions

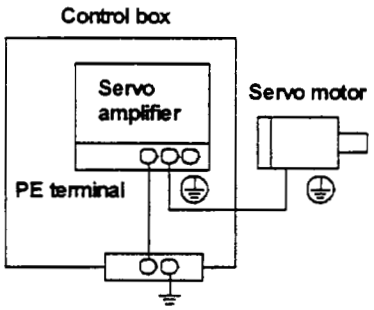
⚠ WARNING	Insulate the connections of the power supply terminals to prevent an electric shock.

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

(1) Wind an insulation tape around the connection several times. For the EN Standard-compliant model, connect via a fixed terminal block.



(2) For grounding, connect the earth cable of the servo motor to the protective earth (PE) terminal of the servo amplifier and connect the ground cable of the servo amplifier to the earth via the protective earth of the control box.



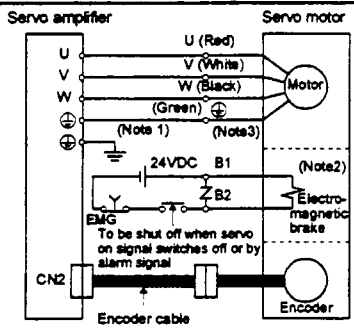
(3) Supply exclusive 24VDC power to the brake lead of the servo motor with electromagnetic brake.

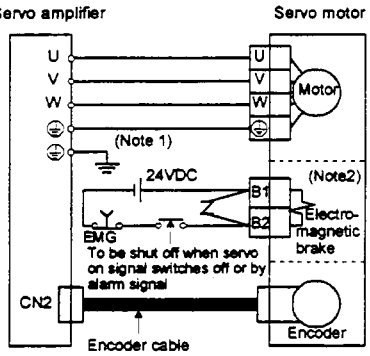
The connection method differs according to the series and capacity of the servo motor and whether or not the servo motor has the electromagnetic brake. Perform wiring in accordance with this section.

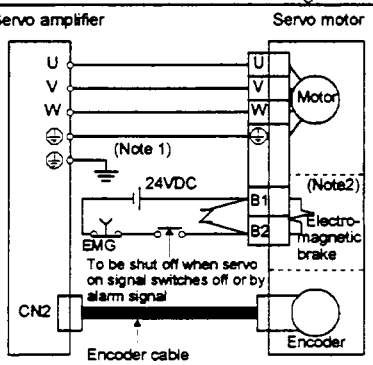
3.3.2 Connection diagram

The following table lists wiring methods according to the servo motor types. Use the connection diagram which conforms to the servo motor used. For cables required for wiring, refer to Section 14.2.1. For encoder cable connection, refer to Section 14.1.2.

For the cable side connector, refer to Chapter 3 of the servo motor technical information.

<table>
<tr><th>Servo Motor</th><th>Connection Diagram</th></tr>
<tr><td>HC-MF053 (B) to 73 (B) (-UE)
HA-FF053 (B) to 63 (B)
HC-UF13 (B) to 73 (B)</td><td> 

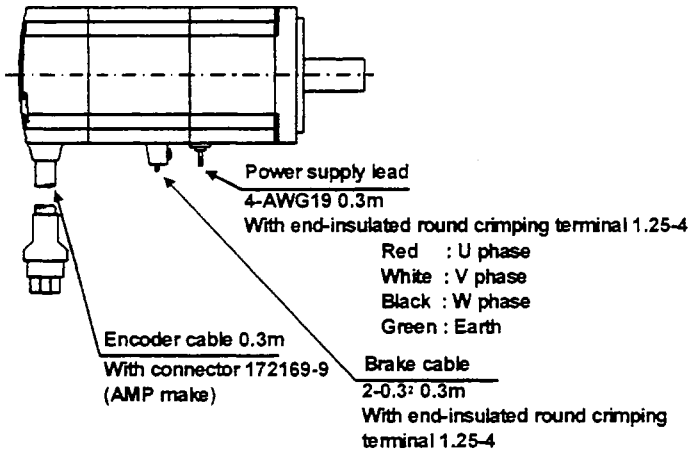
Note: 1. To prevent an electric shock, always connect the protective earth (PE) terminal servo amplifier to the protective earth (PE) of the control box.
Note: 2. This circuit applies to the servo motor with electromagnetic brake.
3. For the HA-FF series, connect the ground cable to the earth terminal of the servo motor.</td></tr>
<tr><td>HA-FF053 (B) to 63 (B)-UE
HC-SF201 (B) · 301 (B)
HC-SF202 (B) · 352 (B)
HC-SF353 (B)
HC-UF202B</td><td> 

Note: 1. To prevent an electric shock, always connect the protective earth (PE) terminal servo amplifier to the protective earth (PE) of the control box.
Note: 2. This circuit applies to the servo motor with electromagnetic brake.</td></tr>
<tr><td>HC-SF52 to 352
HC-SF52B to 152B
HC-RF103 (B) to 203 (B)
HC-UF72 to 202
HC-UF72B · 152B</td><td> 

Note: 1. To prevent an electric shock, always connect the protective earth (PE) terminal servo amplifier to the protective earth (PE) of the control box.
Note: 2. This circuit applies to the servo motor with electromagnetic brake.</td></tr>
</table>

3.3.3 I/O terminals

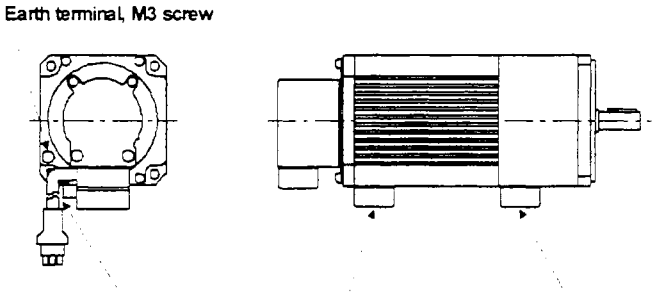
(1) HC-MF(-UE) series



Encoder connector signal arrangement

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

(2) HA-FF series



Encoder connector signal arrangement

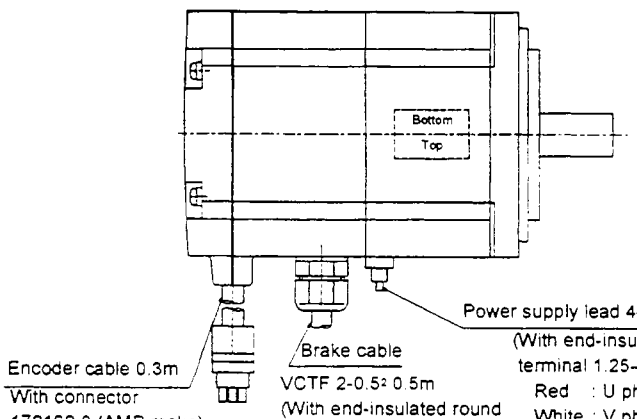
1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	
7	8	9
P5	LG	SHD

Encoder cable 0.3m
With connector 172169-9
(AMP make)

Power supply cable
VCTF3-1.25² 0.5m
With end-insulated round
crimping terminal 1.25-4
Red : U phase
White : V phase
Black : W phase

Brake cable
VCTF2-0.5² 0.5m
With end-insulated round crimping
terminal 1.25-4

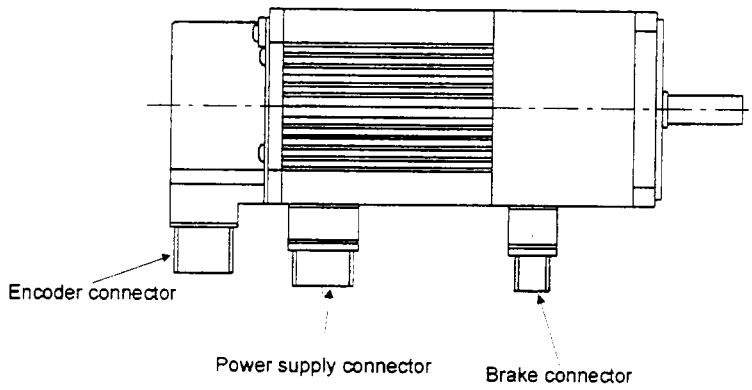
(3) HC-UF 3000r/min series



Encoder connector signal arrangement

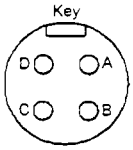
1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	
7	8	9
P5	LG	SHD

(4) HA-FF-UE series



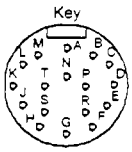
Servo Motor	Connector		
	For power supply	For encoder	For brake
HA-FF053(B)-UE to HA-FF63(B)-UE	CE05-2A14S-2PD-B	MS3102A20-29	MS3102E10SL-4P

Power supply connector signal arrangement
CE05-2A14S-2PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

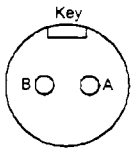
Encoder connector signal arrangement
MS3102A20-29P



Pin	Signal
A	—
B	—
C	MR
D	MRR
E	—
F	BAT
G	LG
H	—
J	—

Pin	Signal
K	—
L	—
M	—
N	SD
P	—
R	LG
S	P5
T	—

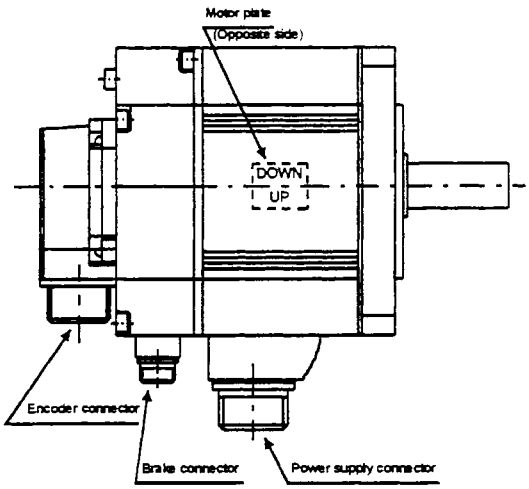
Brake connector signal arrangement
MS3102E10SL-4P



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

Note: 24VDC without polarity.

(5) HC-SF · HC-RF · HC-UF2000 r/min series

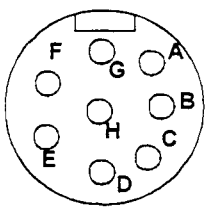


Servo Motor	Servo Motor Side Connectors		
	For power supply	For encoder	Electromagnetic Brake Connector
HC-SF81(B) HC-SF52(B) to 152(B) HC-SF53(B) to 153(B)	CE05-2A22-23PD-B	MS3102A20-29P	The connector for power is shared.
HC-SF121(B) to 301(B) HC-SF202(B) to 352(B) HC-SF203(B) 353(B)	CE05-2A24-10PD-B		MS3102A10SL-4P
HC-RF103(B) to 203 (B)	CE05-2A22-23PD-B	MS3102A20-29P	The connector for power is shared.
HC-UF72(B) 152(B)	CE05-2A22-23PD-B	MS3102A20-29P	The connector for power is shared.
HC-UF202(B)	CE05-2A24-10PD-B		MS3102A10SL-4P

Power supply connector signal arrangement

CE05-2A22-23PD-B

Key

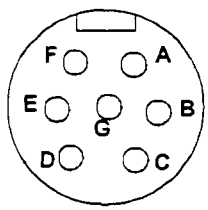


Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	—
F	—
G	(Note) B1
H	(Note) B2

Note:24VDC,without polarity

CE05-2A24-10PD-B

Key



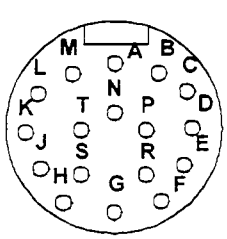
Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)
E	(Note) B1
F	(Note) B2
G	—

Note:24VDC,without polarity

Encoder connector signal arrangement

MS3102A20-29P

Key



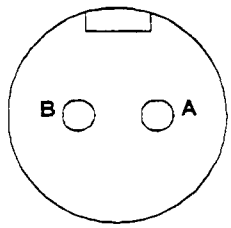
Pin	Signal
A	—
B	—
C	MR
D	MRR
E	—
F	BAT
G	LG
H	—
J	—

Pin	Signal
K	—
L	—
M	—
N	SD
P	—
R	LG
S	P5
T	—

Electromagnetic brake connector signal pin-out

MS3102E10SL-4P

Key



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

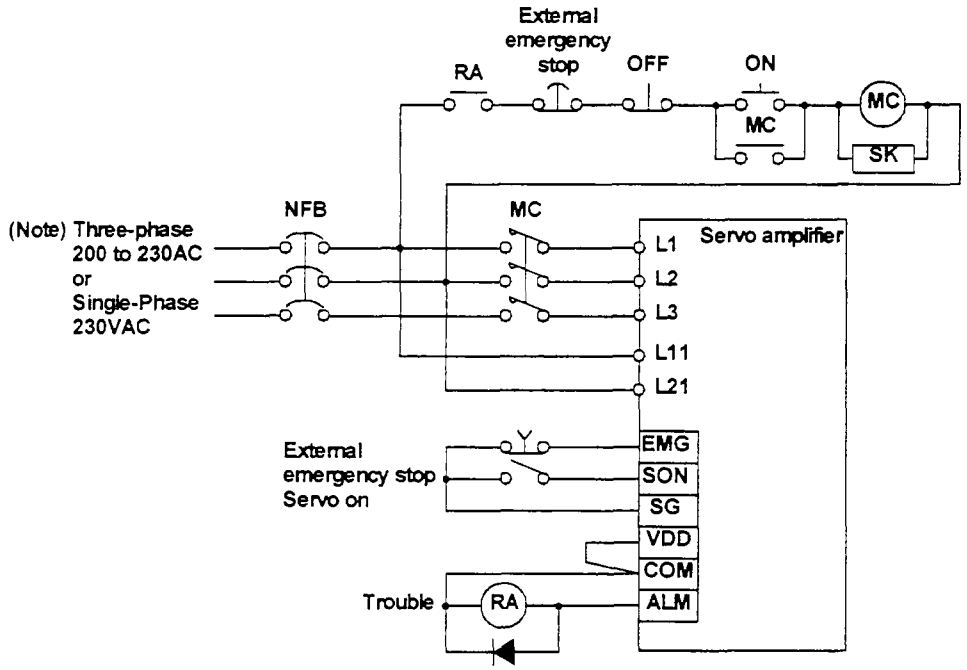
Note:24VDC without polarity

3.4 Input Power Supply Circuit

> **⚠ CAUTION**
>
> - When the servo amplifier has become faulty, switch power off on the servo amplifier power side. Continuous flow of a large current may cause a fire.
> - Use the trouble signal to switch power off. Otherwise, a regenerative brake transistor fault or the like may overheat the regenerative brake resistor, causing a fire.

(1) Connection example

Wire the power supply and main circuits as shown below. A no-fuse breaker (NFB) must be used with the input cables of the power supply.

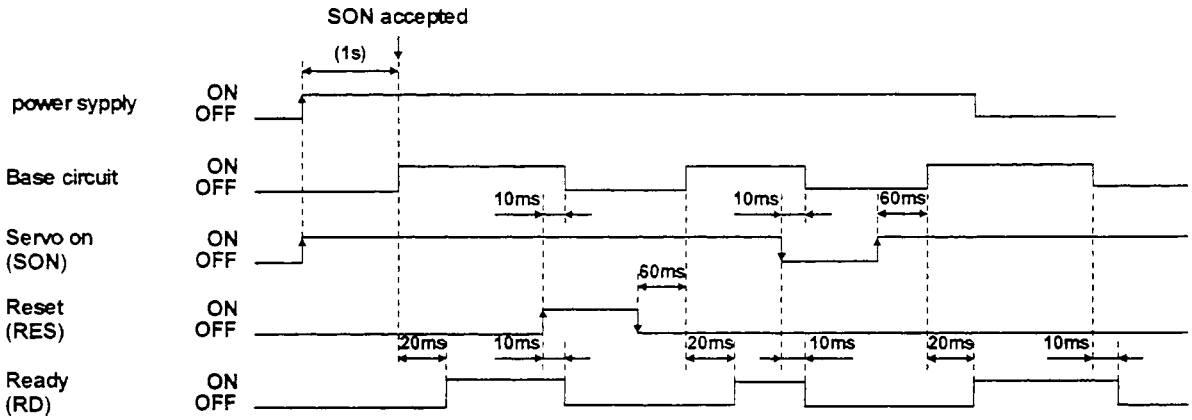


Note: L3 is not provided for single-phase 230V power supply.

(2) Power-on sequence

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

(3) Timing chart



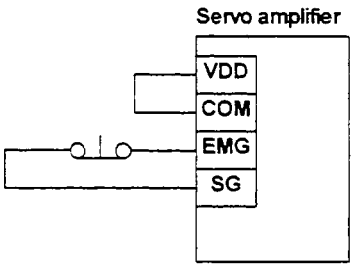
(4) Emergency stop

Emergency stop (EMG) can be used by making device setting on the Set-up Software. Make up a circuit which shuts off main circuit power as soon as EMG-SG are opened at an emergency stop.

To ensure safety, always install an external emergency 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 emergency stop warning (A. E6).

During ordinary operation, do not use the external emergency stop signal to alternate stop and run.

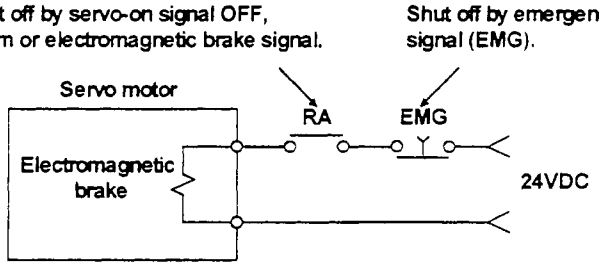
Also, if the start signal is on or a pulse train is input during an emergency stop, the servo motor will rotate as soon as the warning is reset. During an emergency stop, always shut off the run command.



3.5 Servo Motor with Electromagnetic Brake

⚠ CAUTION

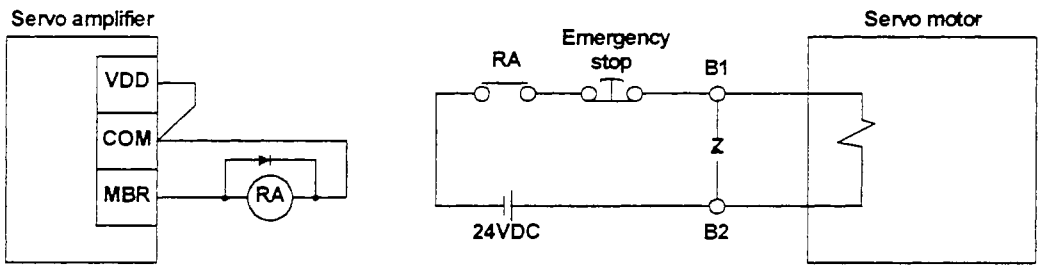
Make up the electromagnetic brake operation circuit so that it is activated not only by the servo amplifier signals but also by an external emergency stop signal.



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) In the device setting of the Set-up Software, make the electromagnetic brake interlock signal (MBR) available.
2) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.
3) The brake will operate when the power (24VDC) switches off.
4) While the reset 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).

(1) Connection diagram



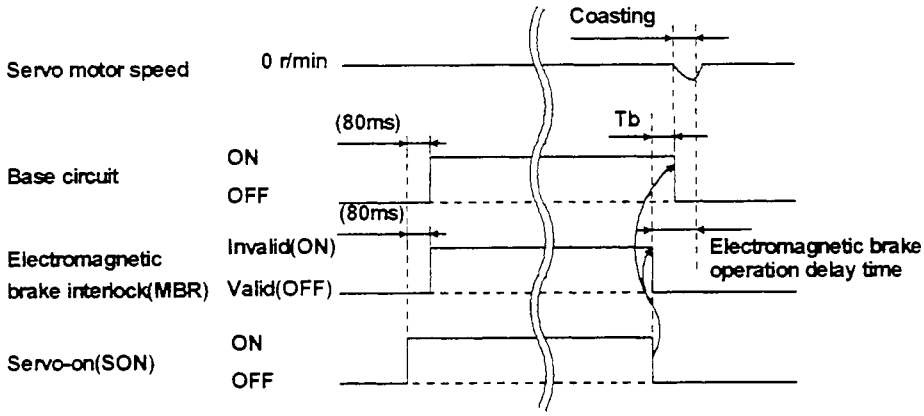
(2) Setting

1) In the device setting of the Set-up Software, make the electromagnetic brake interlock signal (MBR) available.
2) Using parameter No.33 (electromagnetic brake sequence output), set a time delay from electromagnetic brake operation to base circuit shut-off as in the timing chart shown in (3) in this section.

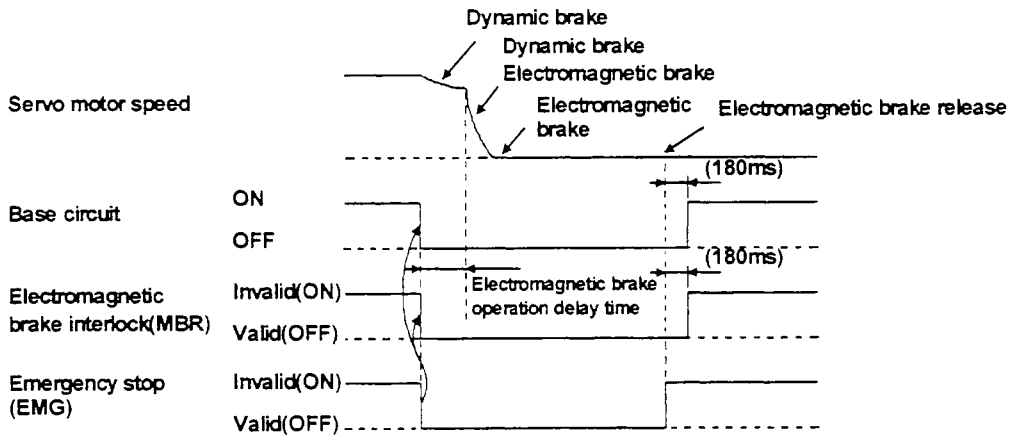
(3) Timing charts

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

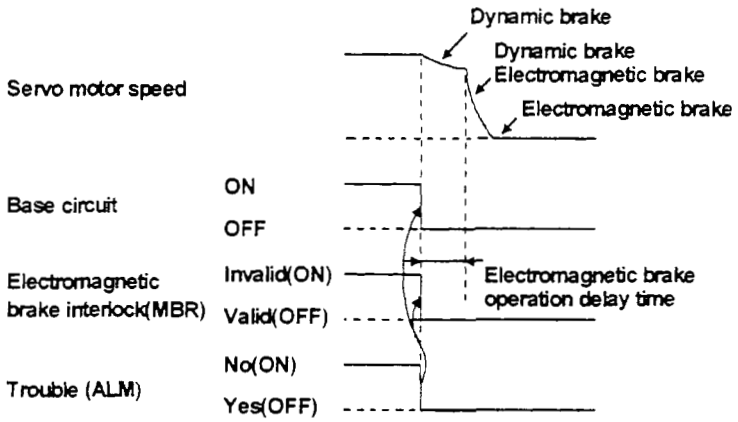
The following chart shows the way of holding the motor shaft in vertical lift applications. Adjust Tb to minimize a drop after servo-off. The servo motor starts coasting Tb after the servo switches off. When using this sequence, therefore, the servo should be switched off after the servo motor has stopped.



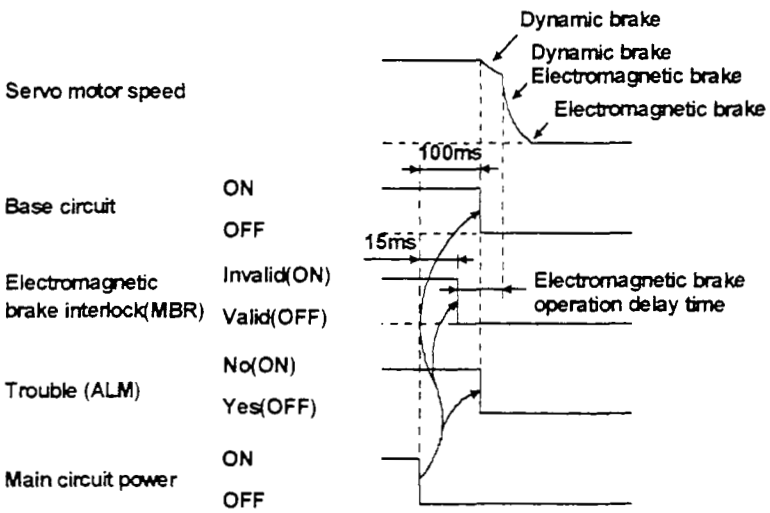
2) Emergency stop signal (EMG) ON/OFF



3) Alarm occurrence



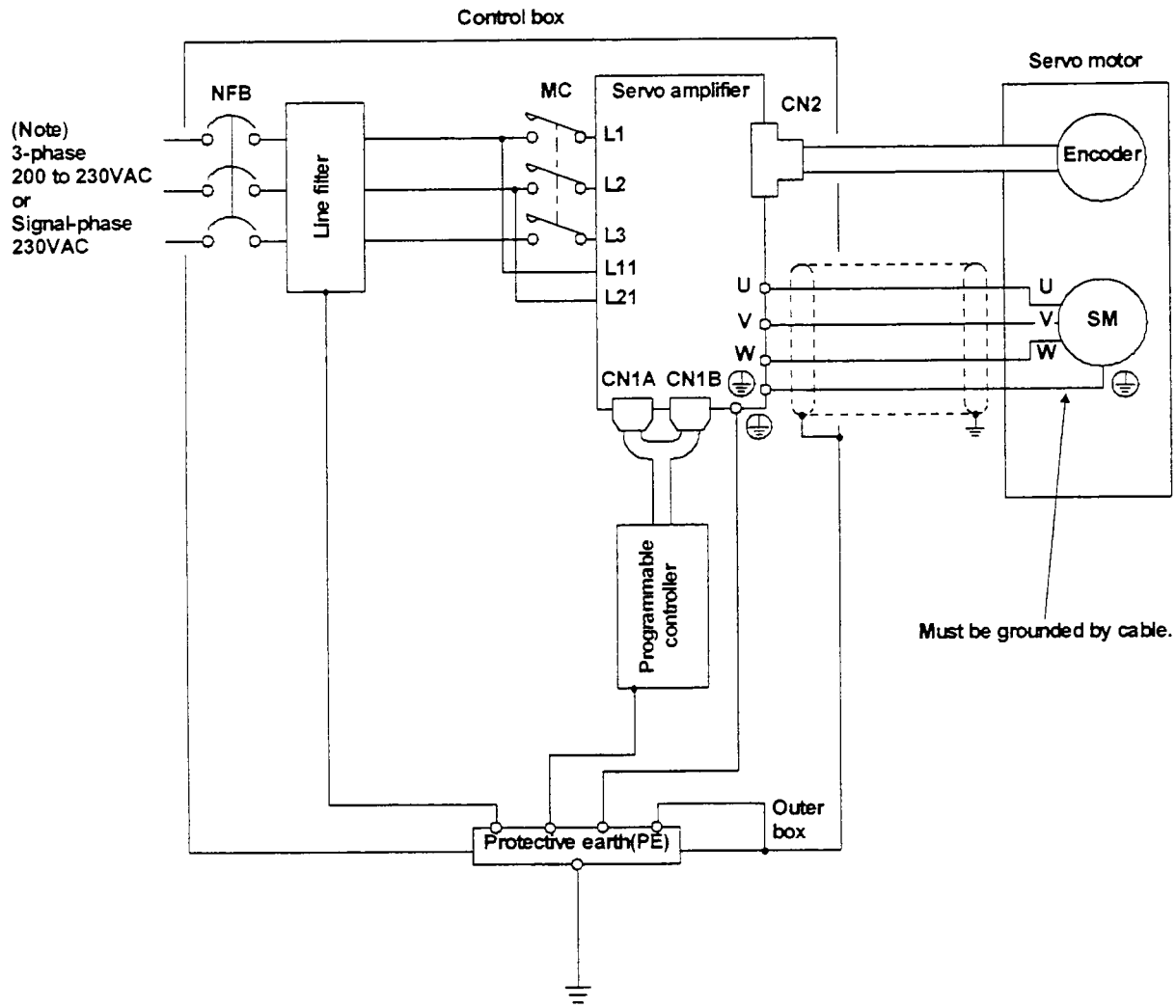
4) Main circuit power off



3.6 Grounding

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

The servo amplifier switches the power transistor on-off to supply power to the servo motor.
Depending on the wiring and ground 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 use a flat mesh copper cable, which is as large as possible (3.5mm^2 or larger is desirable), for grounding.
To conform to the EMC Directive, refer to the EMC INSTALLATION GUIDELINES (IB(NA)67310).

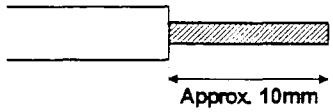


Note: L3 is not provided for single-phase 230V power supply.

3.7 Servo Amplifier Terminal Block (TE2) Wiring Method

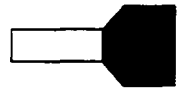
1) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is. (Cable size: 0.2 to 2.5mm^2)



Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. (Cable size: 0.2 to 2.5mm^2)Alternatively, a bar terminal may be used to put the wires together.(Phoenix Contact make)

Bar terminal for 1 cable
(Bar terminal ferrule with insulation sleeve)



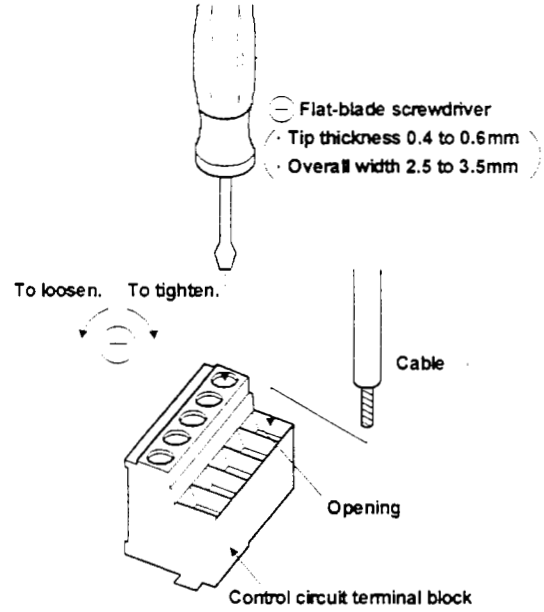
Bar terminal for 2 cable
(Twin ferrule with insulation sleeve)

Cable Size		Bar Terminal Type		Crimping Tool
[mm^2]	AWG	For 1 cable	For 2 cables	
0.25	24	AI0.25-6YE AI0.25-8YE	×	CRIMPFOX-UD6
0.5	20	AI0.5-6WH AI0.5-8WH	×	
0.75	18	AI0.75-6GY AI0.75-8GY	AI-TWIN2 × 0.75-8GY AI-TWIN2 × 0.75-10GY	
1	18	AI1-6RD AI1-8RD	AI-TWIN2 × 1-8RD AI-TWIN2 × 1-10RD	
1.5	16	AI1.5-6BK AI1.5-8BK	AI-TWIN2 × 1.5-8BK AI-TWIN2 × 1.5-12BK	
2.5	14	AI2.5-8BU AI2.5-8BU-1000	AI-TWIN2 ×2.5-10BU AI-TWIN2 × 2.5-13BU	

2) Connection

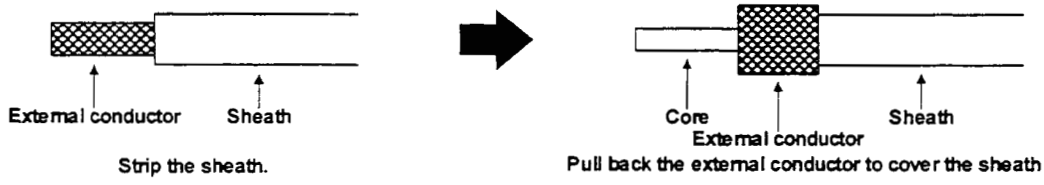
Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver so that the cable does not come off. (Tightening torque: 0.5 to 0.6N·m) Before inserting the cable into the opening, make surethat the screw of the terminal is fully loose.

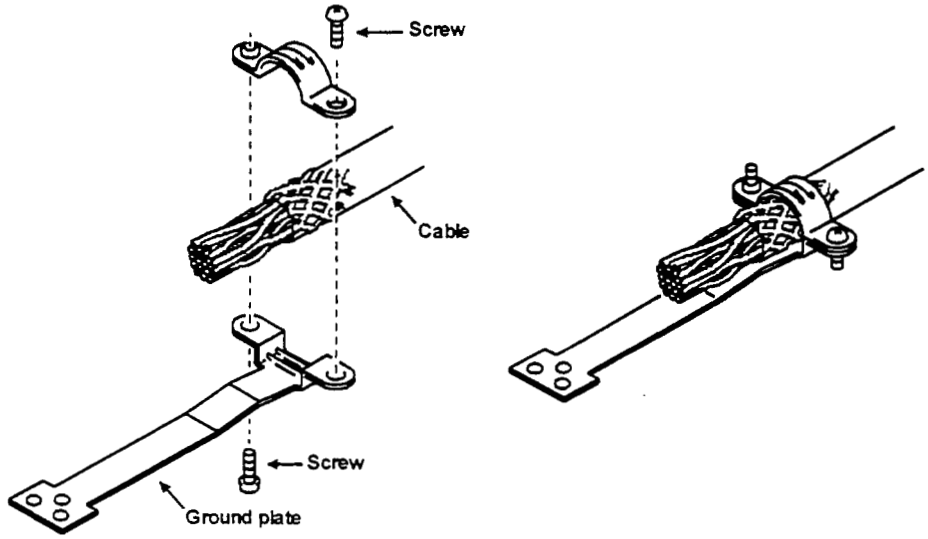
When using a cable of 1.5mm^2 or less, two cables may be inserted into one opening.



3.8 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 checks

Before starting operation, check the following:

(1) Wiring

1) A correct power supply is connected to the power input terminals (L_1, L_2, L_3) of the servo amplifier.
2) 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.
3) The servo motor power supply terminals (U, V, W) of the servo amplifier are not shorted to the power input terminals (L_1, L_2, L_3).
4) The servo amplifier and servo motor are grounded securely.
5) When the regenerative brake option is used, the lead has been removed across D-P of the control circuit terminal block. Also, twisted cables are used for its wiring.
6) When stroke end limit switches are used, the signals across LSP-SG and LSN-SG are on during operation.
7) 24VDC or higher voltages are not applied to the pins of connectors CN1A and CN1B.
8) SD and SG of connectors CN1A and CN1B are not shorted.
9) 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

1) The screws in the servo motor installation part and shaft-to-machine connection are tight.
2) The servo motor and the machine connected with the servo motor can be operated.

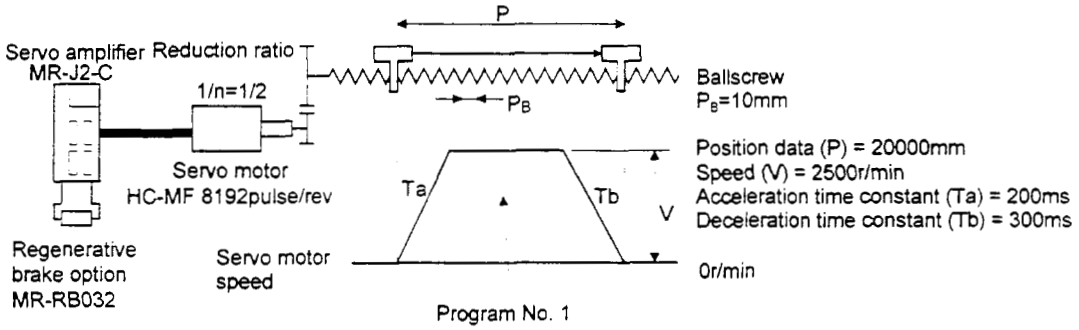
4.1.2 Startup

⚠ 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 unexpe cted operation. • During power-on or soon after power-off, do not touch the servo amplifier heat sink, regenerative brake resistor, servo motor, etc. as they may be at high temperatures. You may get burnt.

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



Program No. 1

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

5) For the device command method, external input signals are used by the point table selection, forward rotation start (ST1), servo on (SON) and other commands.
6) Program selection 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 1

Using jog operation in the "test operation mode" of the Servo Configuration Software, make sure that the servo motor operates. (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.

Setting Example

Parameter	Name	Setting	Description
No.0	Control mode,regenerative brake option selection	□20□	Second digit : Absolute value command system Third digit : MR-RB032 regenerative brake option is used
No.1	Feeding function selection	□□10	First digit : When forward rotation start(ST1) is valid, address is incremented in CCW direction. Second digit : Since command resolution is 10 times, feed length multiplication factor of 10 times is selected.
No.2	Function selection 1	1□□□	Fourth digit : Absolute position detection system
No.4	Electronic gear numerator (CMX)	8192	From calculation result of formula (4.1)
No.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) Programming

Make the programming according to the operation pattern.

Refer to Section 4.2 for the program language and to Sections 6.5 and 7.5 for the setting method.

Setting Example

SPN (2500)	Servo Motor Speed	2500[r/min]
STA (200)	Acceleration Time Constant	200[ms]
STB (300)	Deceleration Time Constant	300[ms]
MOV (20000)	Position Data	20000[×10^{STM}μm]
TIM (1)	Dwell Time	1[×10ms]
STOP	Program Stop	

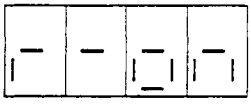
(e) Servo on

Switch the servo on in the following procedure:

1) Switch on main circuit/control power.

2) Switch on the servo on signal (SON) (short SON-SG).

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) Zeroing

Before starting positioning operation, always make home position return. Refer to Section 4.4 for zeroing types. A parameter setting example for dog type zeroing is given here.

Parameter	Name	Setting	Description
No.8	Zeroing type	□000	First digit : Dog type zeroing is selected. Second digit : Zeroing is started in address incremented direction. Third digit : Proximity dog signal is valid when DOG-SG are opened.
No.9	Zeroing speed	1000	Motion is made up to proximity dog at 1000r/min.
No.10	Creep speed	10	Motion is made up to home position at 10r/min.
No.11	Zero shift distance	0	No zero shift
No.42	Zeroing position data	0	Zero address is entered automatically after zeroing.
No.43	Moving distance after proximity dog	×	Not used in dog type zeroing.

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 start (ST1) to execute zeroing.

Device Name	Symbol	ON/OFF	Description
Automatic/manual selection	MDO	ON	Program operation mode is selected.
Program No. selection.	PS□	ON	Set the zeroing program No.
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.

Note: 1) MD0 is internal short with factory default by the parameter No.64.

2) Zeroing program example is two lines following.

ZRT

STOP

3) Zero point dose not follow up to SON, EMG-off and RES on. If you need Zero point follow up with incremental positioning system. Set the parameter No.01 (1□□□).

(g) Automatic operation

Set the input signals as listed below and switch on the start (ST1) to execute automatic operation in accordance with program No.

Device Name	Symbol	ON/OFF	Description
Automatic/manual selection	MDO	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.
Program No. selection.	PS□	ON	Set the zeroing program No.

(h) Stop

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

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 occurs.

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

The servo motor is brought to a sudden stop and servo-locked.

4.2 Automatic Operation Mode

4.2.1 What is automatic operation mode?

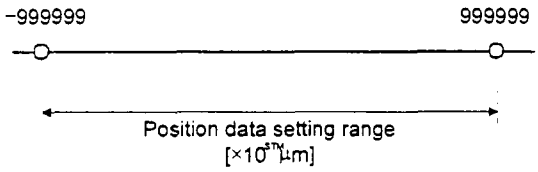
(1) Command system

After selection of preset programs using the input signals or communication, operation is started by the forward rotation start (ST1) 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.

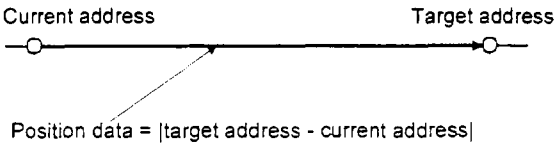
Setting range: -999999 to 999999 [$\times 10^{STM}\mu m$] (STM = feed length multiplication parameter No.1)



(b) Incremental value command system

As position data, set the moving distance from the current address to the target address.

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



(c) The difference between absolute and Incremental

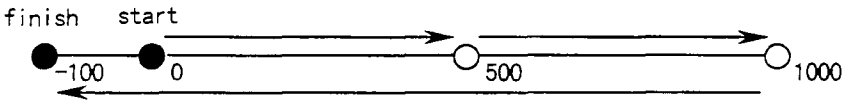
By your selection of command mode(parameter No.1),it makes all the difference.

The example is shown as follows.

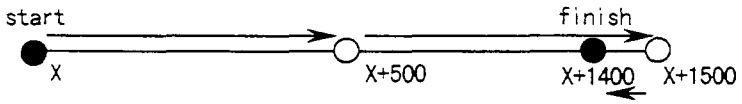
Example program

SPN(500)	Motor speed	500[r/min.]
STC(200)	Acc/Dec time	200[msec]
MOV(500)	Move command	500[$\times 10^{STM}\mu m$]
SPN(1000)	Motor speed	1000[r/min.]
MOVA(1000)	Move command	1000[$\times 10^{STM}\mu m$]
MOVA(-100)	Move command	-100[$\times 10^{STM}\mu m$]
STOP	Program end	

Choose the absolute command mode : When using the absolute value command mode,positioning is carried out to the set position data for which the zero point has been set as the reference by the MOV or MOVA command.



Choose the incremental command mode : When using the incremental value command,positioning is carried out to the set data for which the current position has been set as the reference by the MOV or MOVA command.



(2) Programming

(a) Program language specifications

1) The language used in the program operation-edit window will be described below.

2) Simple language for program operation (60 steps programming with Configuration S/W)

3) 8 program numbers within total 60 steps can be selected by external PS□ switches or communication.

Command	Name	Setting (**: Set value)	Setting Range	Unit	Description
SPN	Speed (Motor speed)	SPN(**)	0 to Max. Speed	r/min	Used to set the command speed given to the motor for positioning. The set value should be not more than the maximum speed of the motor.
STC	Acceleration/ Deceleration time	STC(**)	0 to 20000	msec	Used to set both the acceleration and deceleration time. (Time required to reach the rated speed of the corresponding servo motor) STA and STB commands can set the acceleration and deceleration time Individually. It can not be changed during command outputting.
STA	Acceleration time	STA(**)	0 to 20000	msec	Used to set the acceleration time required to reach the rated speed from Zero speed. It can not be changed during command outputting.
STB	Deceleration time	STB(**)	0 to 20000	msec	Used to set the deceleration time required to reach the rated speed from Zero speed. It can not be changed during command outputting.
MOV	Move command	MOV(**)	-999999 to 999999	$\times 10^{STM}$ μm	Movement by set values. Positioning operation is performed with the set Values of the feed rate (SPN) and acceleration /deceleration time (STC) (STA) (STB). No symbol : CCW rotation. -CW rotation. Incremental system or absolute system can select by parameter.
MOVA	Continuous move command	MOVA(**)	-999999 to 999999	$\times 10^{STM}$ μm	Continuous movement by set values. Incremental system or absolute System can select by parameter. Programming point is after MOV command , otherwise error has occurred. Incremental system or absolute system can select by parameter. MOVA command must be at after MOV command, otherwise error has occurred.
SYNC	Waiting external signal to switch on	SYNC(**)	——	——	Used to hold the next operation until the preset digital input signal (PI□) of the servo amplifier switches on. After SOUT output and On-edge signal is valid.
OUTON	External signal ON output	OUTON (**)	——	——	External output device signal turns ON (short).
OUTOF	External signal OFF output	OUTOF (**)	——	——	External output device signal turns OFF (open).
TRIP	Trip point	TRIP (**)	-999999 to 999999	$\times 10^{STM}$ μm	When the trip point is reached, the next step will be executed.
COUNT	External Pulse counter	COUNT (**)	-999999 to 999999	pulse	The next step will be executed when external pulse input counter reach set couter valu COUNT(0) is clearing of the pulse counter.
TIM	Dwell command time	TIM(**)	1 to 2000	× 10msec	Used to hold the next operation until the preset time elapses. After smoothing 0, started to count up.
ZRT	Zero point return	ZRT	——	——	Zero point return operation. Set to the Zeroing method at parameter No.8.
TIMES	Program repeat Command	TIMES(**)	0, 1 to 10000	Times	Describe TIMES (setting value) at the head of the program, And STOP at the end of the program. The program will repeat execusion number of times. This is not required when the program is to be run only once. The program will be run infinitely when 0 is set. It is not possible to repeatedly run a set part of a program.
STOP	Program end		——	——	Program stops signal, and it must be at end of the program. (Required)

Note:

1) SYNC, OUTON, OUTOF, TRIP and COUNT commands are available to be validated during command outputting.

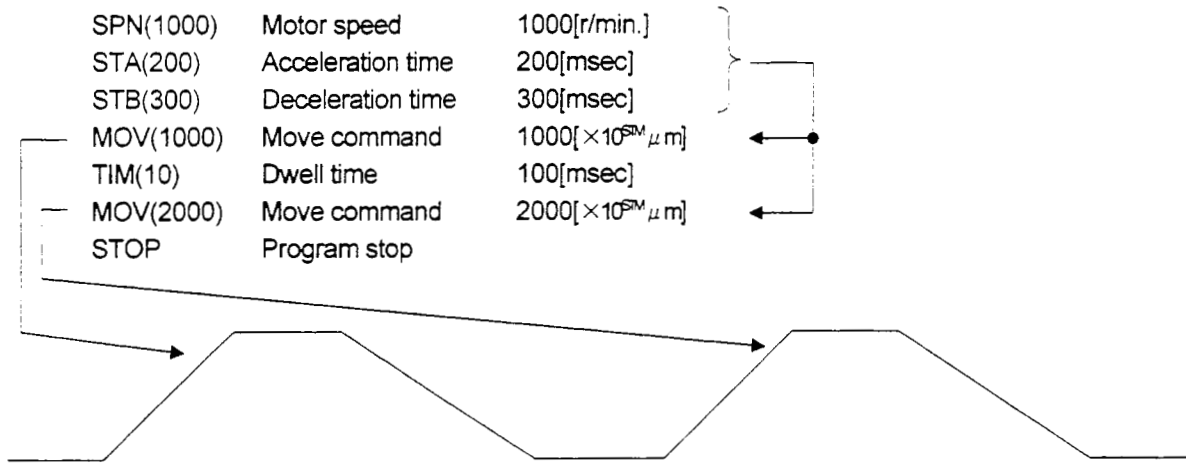
2) SPN, STA, STB and STC commands will be validated, when the MOV and MOVA command.

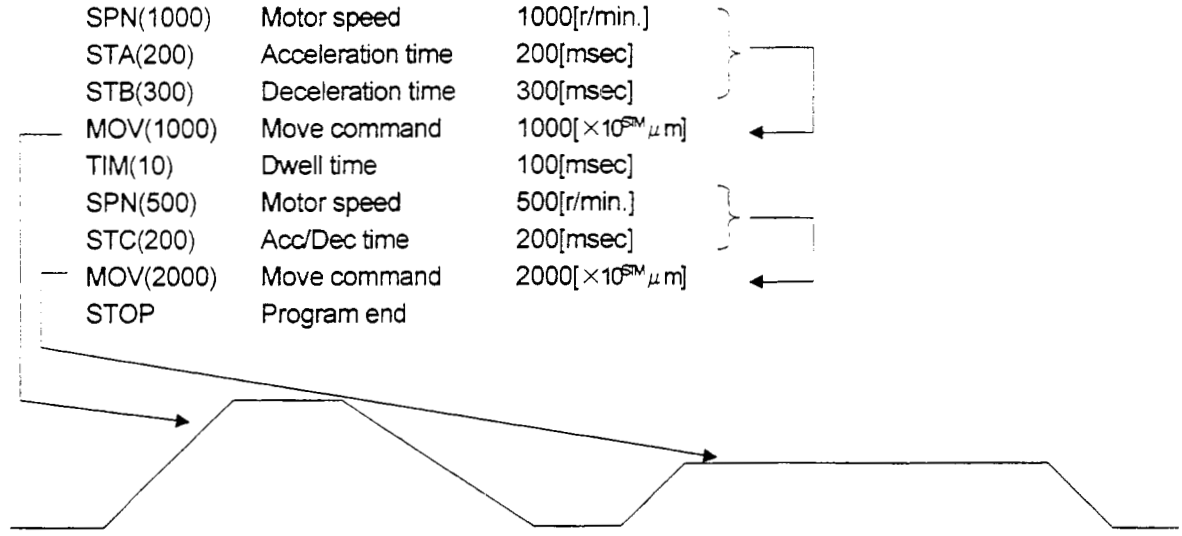
3) If you set the parameter by OUTON command. During setting time, this command does not execute following command.

(b) Details of programming languages

1) Positioning command conditions (SPN, STA, STB, STC)

SPN, STC, STA and STB commands will be validated, when the MOV and MOVA commands are executing. The setting numbers will be validated, expect resetting the numbers.



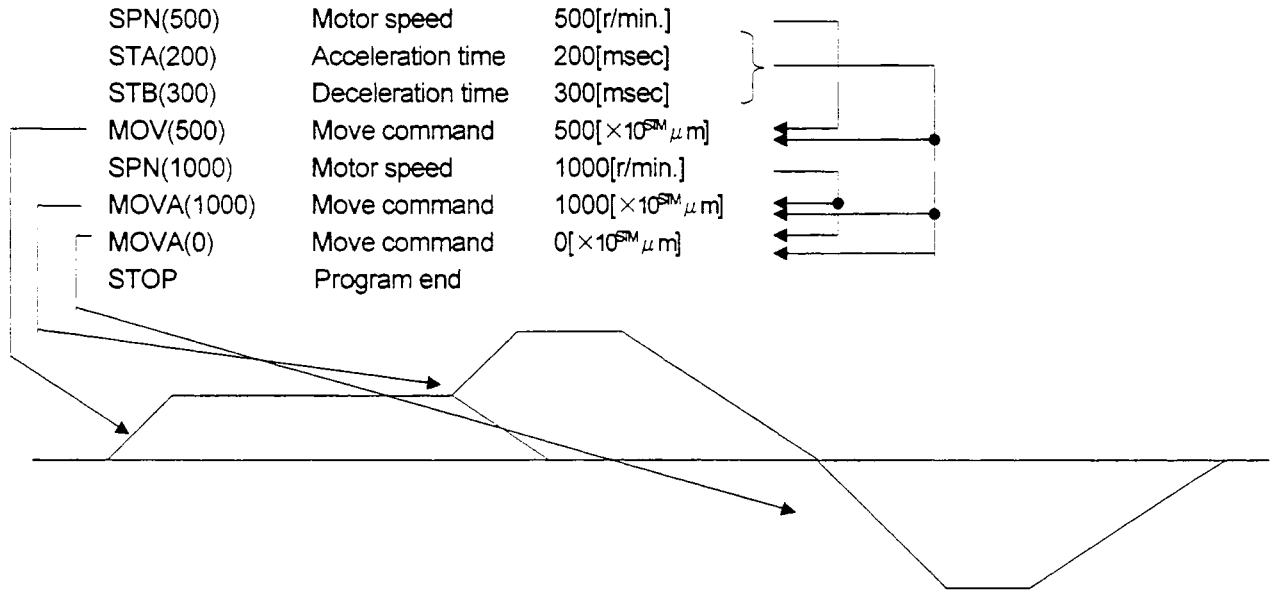


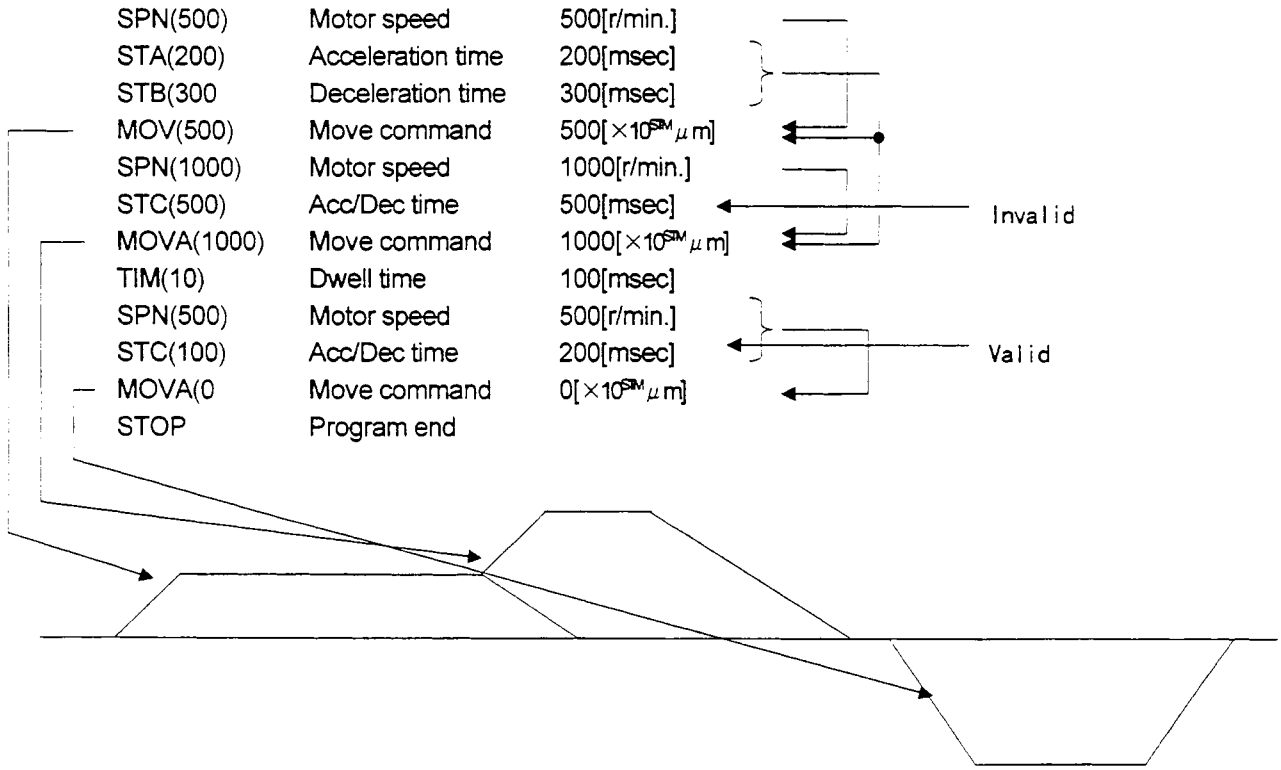
2)Move command (MOV, MOVA)

- MOVA command is continuous movement command of MOV / MOVA command.
- The change speed point of MOVA command is a deceleration begin point of the previous MOV / MOVA command when execution by along.
- The acceleration / deceleration time when continuous operation of MOVA command is execution value of previous MOV / MOVA command.

(if programming the MOVA command after the command output completed, setting number will be validated)

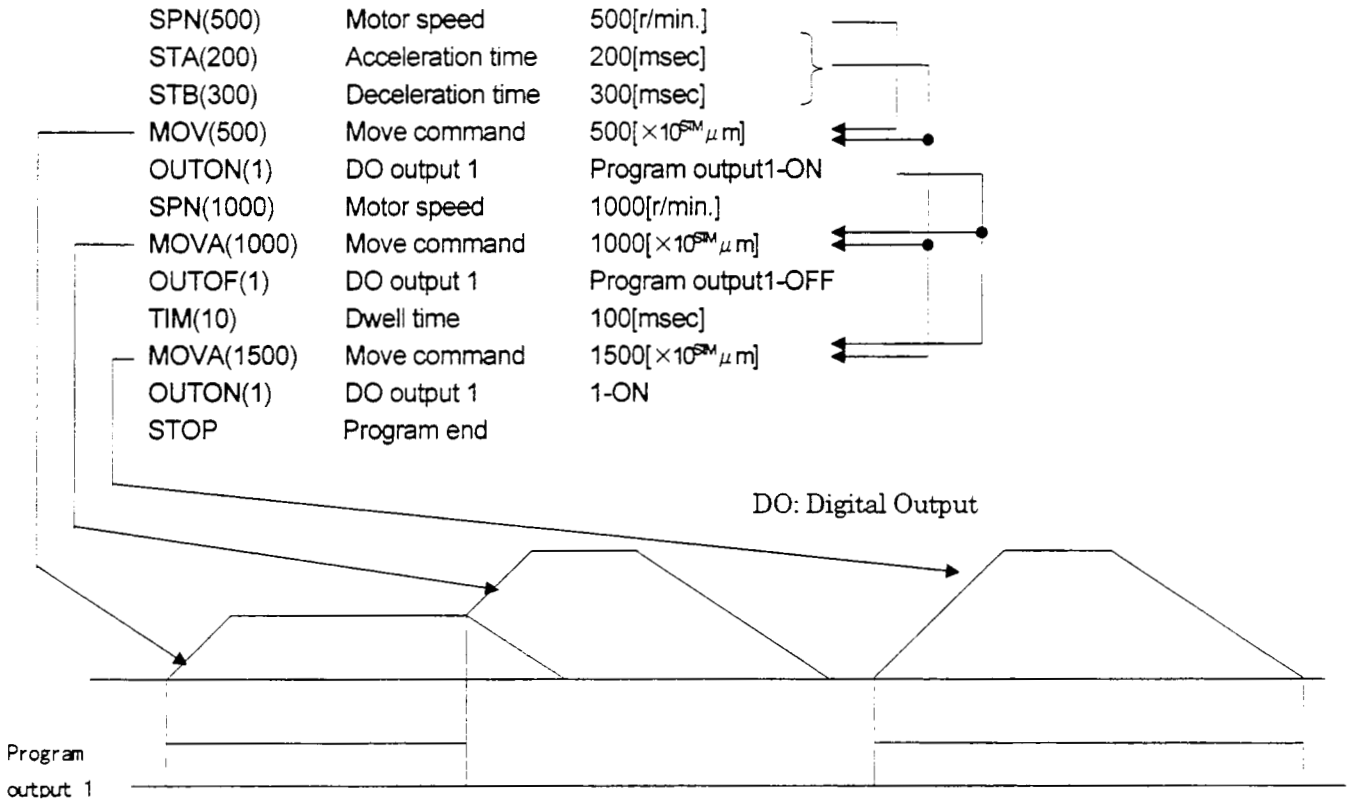
- MOVA command is available to programming to by along.





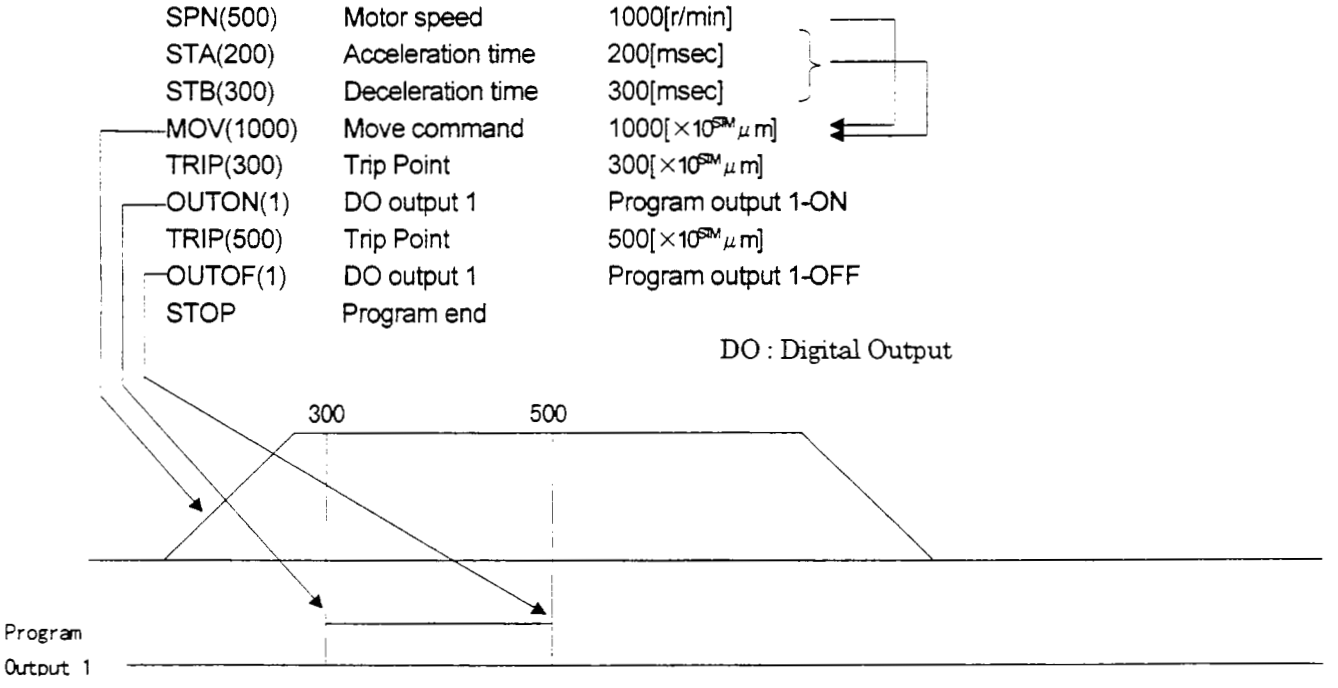
3) Input / Output command (SYNC, OUTON, OUTOF)

- SYNC, OUTON and OUTOF will not be checked the command output complete.



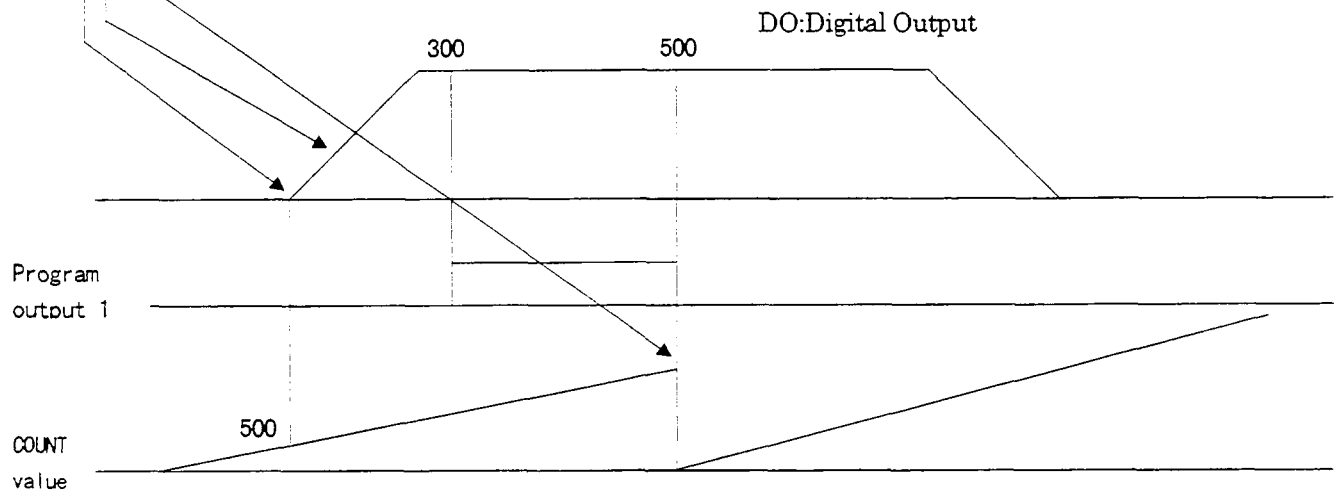
4) Trip Point instruction command (TRIP)

TRIP command will not be checked the command output complete.



5) External Pulse Count command (COUNT)
Even if the program is running,COUNT command is valid.

COUNT(500)	Counter set	1000[pulse]
SPN(500)	Motor speed	500[r/min]
STA(200)	Acceleration time	200[msec]
STB(300)	Deceleration time	300[msec]
MOV(1000)	Move command	1000[$\times 10^{SM}\mu$m]
TRIP(300)	Trip point	300[$\times 10^{SM}\mu$m]
OUTON(1)	DO output 1	Program output 1-ON
TRIP(500)	Trip point	500[$\times 10^{SM}\mu$m]
OUTOF(1)	DO output 1	Program output 1-OFF
COUNT(0)	Counter set	Counter clear
STOP	Program end	



6) Zero point return command (ZRT)
- Set to parameter the Zero point return operation.
- Programming the MOVA command after the ZRT command which will be operated after Zeropoint return complete, however it would not be continuous operation.

7) Program control (TIMES, STOP)
TIMES command must be at head of the program and STOP command must be at end of the program.
If these commands be at other lines, it will be occurred error.

(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.

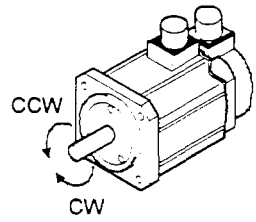
Parameter No. 0 Setting	Positioning System
□□0□	Absolute value command
□□1□	Incremental value command

(b) Operation mode selection (parameter No.1)

Choose the servo motor rotation direction at the time when the forward rotation start (ST1) 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
□□□1	CW rotation with + position data



2) Incremental value command system

Parameter No.1 Setting	Servo Motor Rotation Direction When Forward Rotation Start (ST1) ON
□□□0	CCW rotation with + position data CW rotation with – position data
□□□1	CW rotation with + position data CCW rotation with – position data

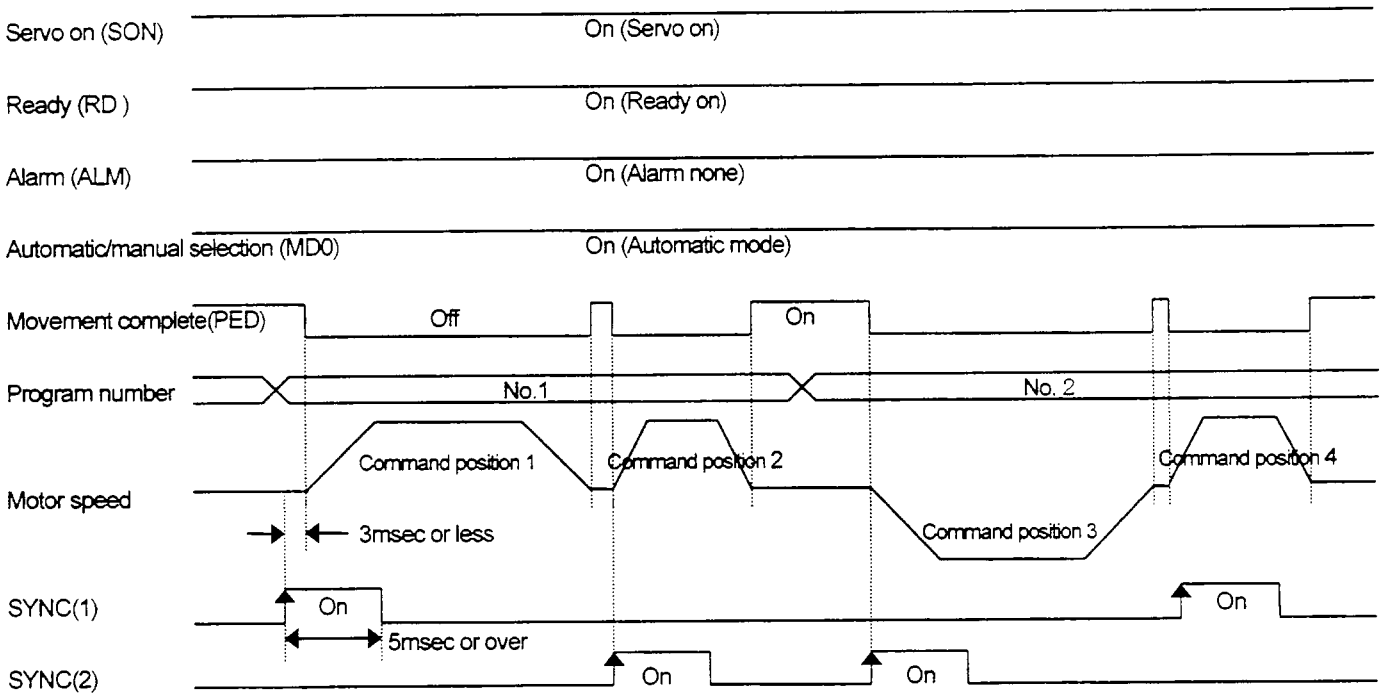
(c) Feed length multiplication selection (parameter No.1)

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

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

4.2.2 Automatic program-operation timing chart

The following is the timing chart.



Note: Start device must turn on ,whenever program change.

(4) Temporary stop/restart

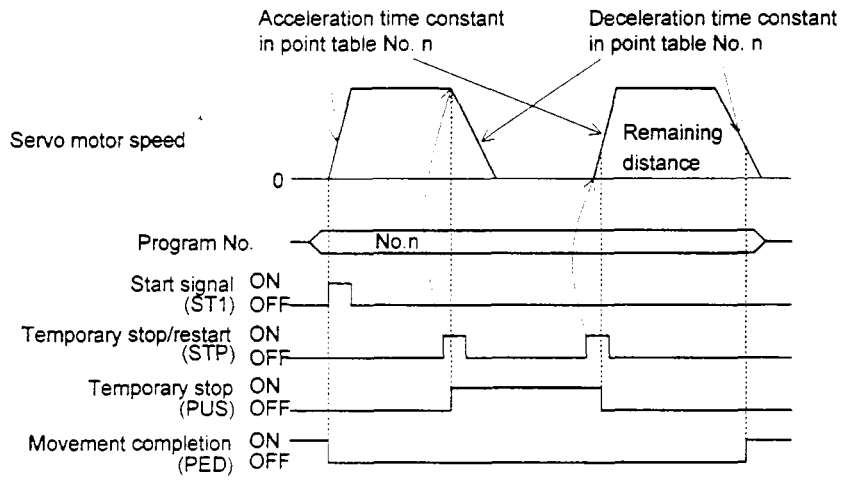
When STP-SG are connected during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When STP-SG are connected again, the remaining distance is executed.

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

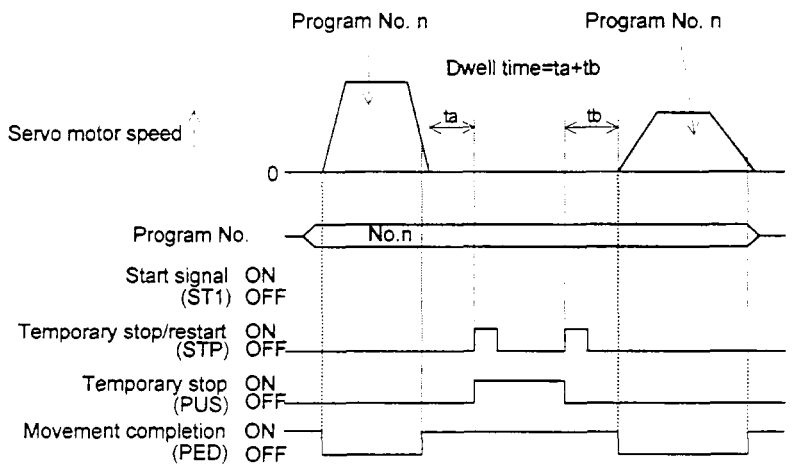
The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

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

(a) When the servo motor is rotating



(b) During dwell 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

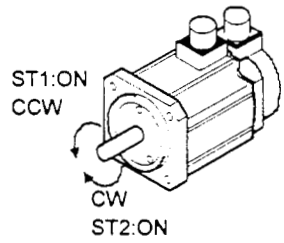
(1) Setting

Set the input signal and parameters as follows according to the purpose of use. In this case, the Program No. selection 1 to 8 signals (PS0 to PS3) are invalid:

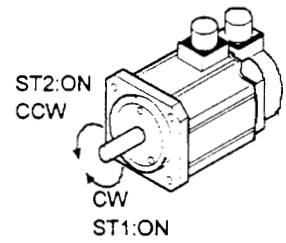
Item	Setting Method	Description
Manual operation mode selection	Automatic/manual selection signal (MDO)	Open MDO-SG (OFF).
Servo motor rotation direction	Parameter No.1	Refer to (2) in this section.
Jog speed	Parameter No.13	Set the speed of the servo motor.
Acceleration/deceleration time constant	Parameter No.40	Set the acceleration/deceleration time constants.

(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



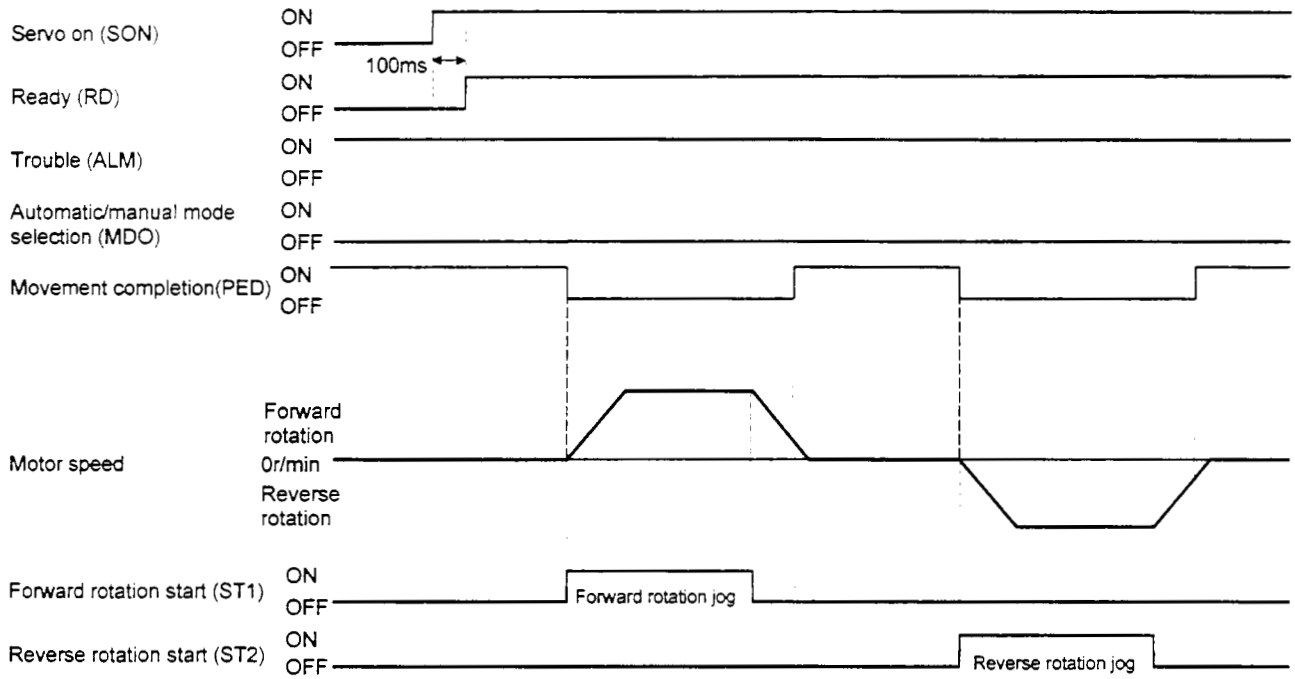
Parameter No. 1 □□□1

(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 in the parameter. For the rotation direction, refer to (2) in this section. By shorting ST2-SG, the servo motor rotates in the reverse direction to ST1.

Note: In jog operation,parameter No.14(STC) is valid.

(4) Timing chart



4.4 Manual Zeroing Mode

4.4.1 Outline of zeroing

Zeroing is performed to match the command coordinates with the machine coordinates. In the incremental system, zeroing is required every time input power is switched on. In the absolute position detection system, once zeroing is done at the time of installation, the current position is retained if power is switched off. Hence, zeroing is not required when power is switched on again.
The MR-J2-C-S100 has the zeroing methods given in this section. Choose the most appropriate method for your machine structure and application.
The MR-J2-C-S100 has the automatic zeroing return function which executes zeroing 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 zeroing types

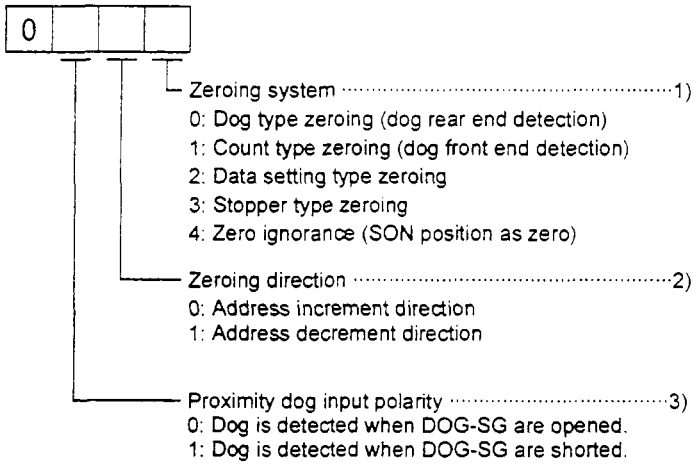
Five manual zeroing types are available. Choose the optimum zeroing according to the machine type, etc.

Type	Zeroing Method	Features
Dog type zeroing	With deceleration started at the front end a proximity dog, the position where the first Z-phase signal is given past the rear end or a motion has been made over the zero shift distance starting from the Z-phase signal is defined as a home position.	General zeroing method using a proximity dog. Repeatability of zeroing is excellent and the mach ine 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 zeroing	With deceleration started at the front end a proximity dog, the position where the first Z-phase signal is given after advancement over the preset moving distance after dog or a motion has been made over the zero shift distance starting from the Z-phase signal is defined as a home position.	Zeroing method using a proximity dog. Used when it is desired to minimize the length of the proximity dog.
Data setting type zeroing	The position reached after any automatic motion is defined as a home position.	No proximity dog required.
Stopper type zeroing	The position where the machine stops when its part is pressed against a machine stopper by jog operation, manual pulse generator or the like is defined as a ho me position.	Since the machine part collides with the machine stopper, zeroing speed must be set to a fully low value and the machine and stopper strength must be fully considered.
Zero ignorance (Servo-on position as zero)	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) Zeroing parameter

When performing zeroing, set parameter No.8 as follows:



1) Choose the zeroing method.
2) Choose the starting direction of zeroing. Set "0" to start zeroing in the direction in which the address is incremented from the current position, or "1" to start zeroing 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 zeroing, always make sure that the limit switch operates.
2) Confirm the zeroing 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 zeroing

A zeroing 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 zero 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 zeroing mode selection	Automatic/manual selection signal (MDO)	Open MDO-SG (OFF).
	Program selection No. (PS□)	Short PS□-SG (ON).
Dog type zeroing	Parameter No.8	□□□0: Dog type zeroing is selected.
Zeroing direction	Parameter No.8	Refer to (3) in this section and choose zeroing direction.
Dog input polarity	Parameter No.8	Refer to (3) in this section and choose dog input polarity.
Zeroing speed	Parameter No.9	Set speed until detection of dog.
Creep speed	Parameter No.10	Set speed after detection of dog.
Zero 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.
Zeroing acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Zeroing position data	Parameter No.42	Address reached by zeroing 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):

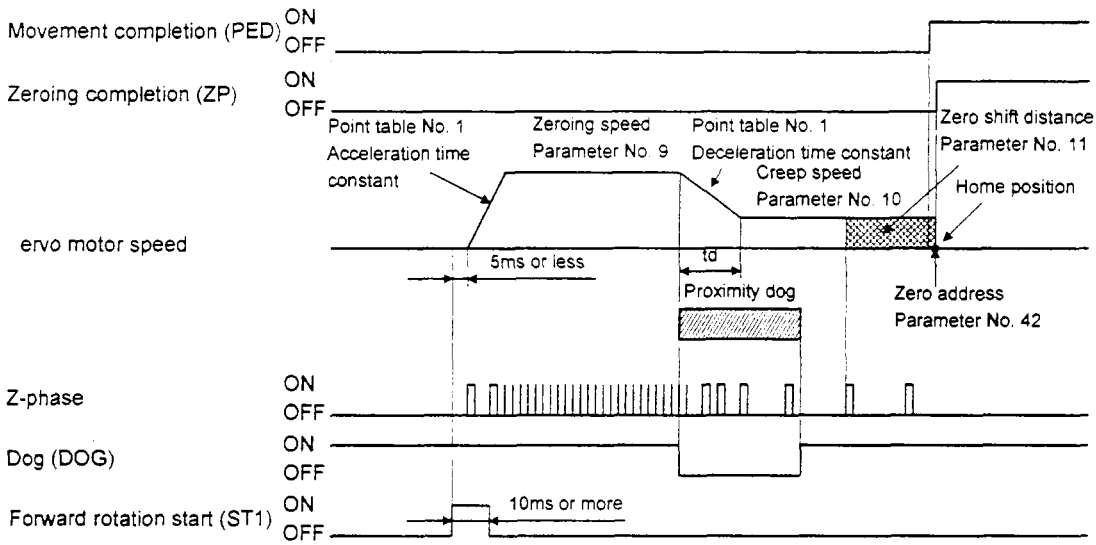
$$L1 = \frac{V}{60} \cdot \frac{td}{2} \quad \cdots\cdots (4.2)$$

L1 : Proximity dog length [mm]
V : Zeroing speed [mm/min]
td : Deceleration time [s]

$$L2 = 2 \cdot \Delta S \quad \cdots\cdots (4.3)$$

L2 : Proximity dog length [mm]
ΔS : Moving distance per servo motor revolution [mm]

(3) Timing chart



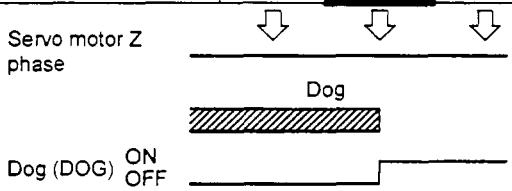
The address on completion of zeroing is the value automatically set in parameter No.42 (zeroing position data).

(4) Adjustment

In dog type zeroing, 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-MF·HA-FF·HC-UF 3000 r/min	0	4096	0
HC-SF·RF·UF 2000 r/min	0	8192	0



4.4.3 Count type zeroing

In count type zeroing, 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.

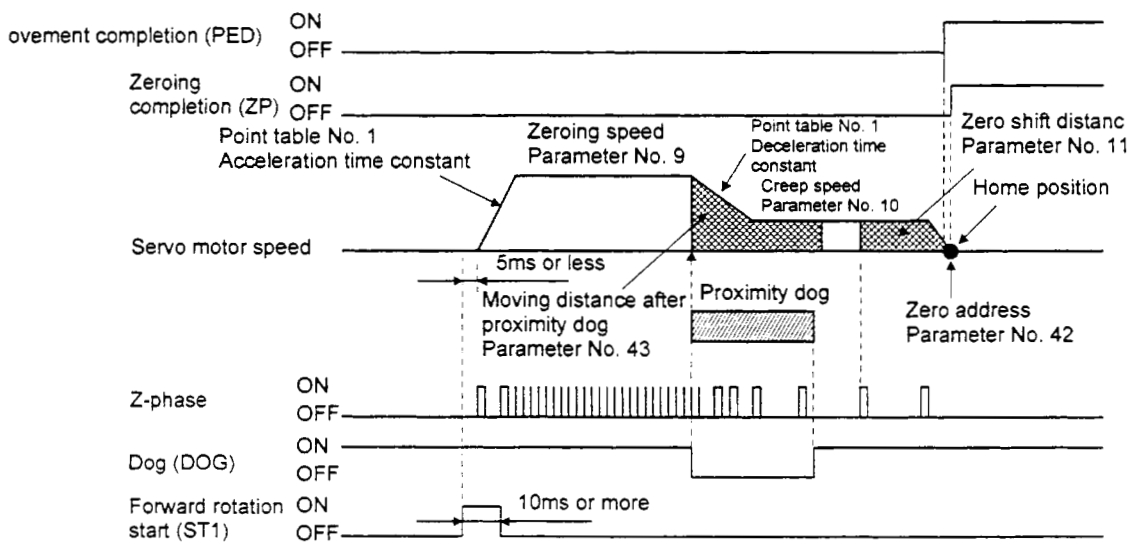
This zeroing method is used when the required proximity dog length cannot be reserved to use dog type zeroing or when the dog signal is entered electrically from a controller or the like.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (MDO)	Open MDO-SG (OFF).
	Program selection No. (PS□)	Short PS□-SG (ON).
Count type zeroing	Parameter No.8	□□□1: Count type zeroing is selected.
Zeroing direction	Parameter No.8	Refer to (3) in this section and choose zeroing direction.
Dog input polarity	Parameter No.8	Refer to (3) in this section and choose dog input polarity.
Zeroing speed	Parameter No.9	Set speed until detection of dog.
Creep speed	Parameter No.10	Set speed after detection of dog.
Zero 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.
Moving distance after proximity dog	Parameter No.43	Set the moving distance after passage of proximity dog front end.
Zeroing acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.

(2) Timing chart



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

4.4.4 Data setting type zeroing

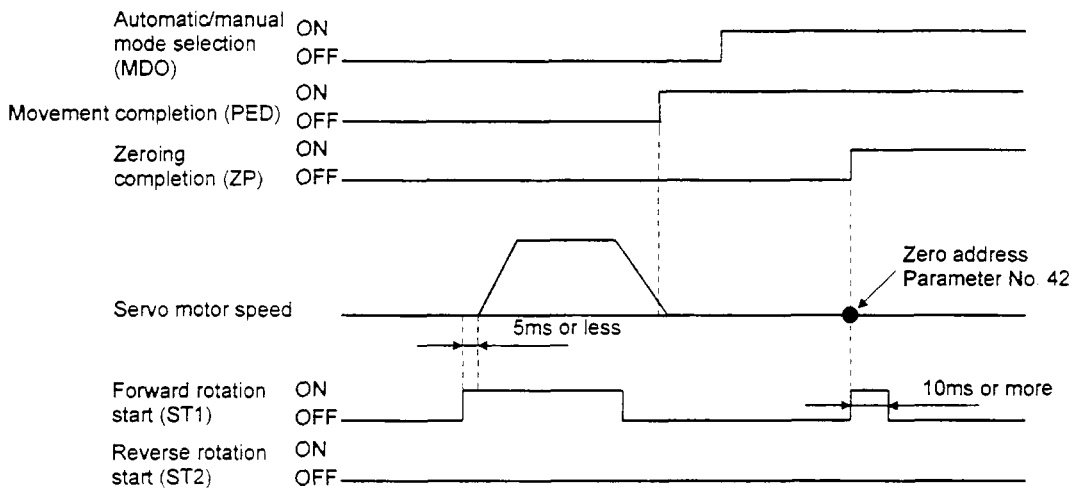
In data setting type zeroing, a motion is made to any position by jog operation, manual pulse generator operation or the like to make a home position return, and the position reached is defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (MDO)	Open MDO-SG (OFF).
	Program selection No. (PS□)	Short PS□-SG (ON).
Data setting type zeroing	Parameter No.8	□□□2: Data setting type zeroing is selected.

(2) Timing chart



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

4.4.5 Stopper type zeroing

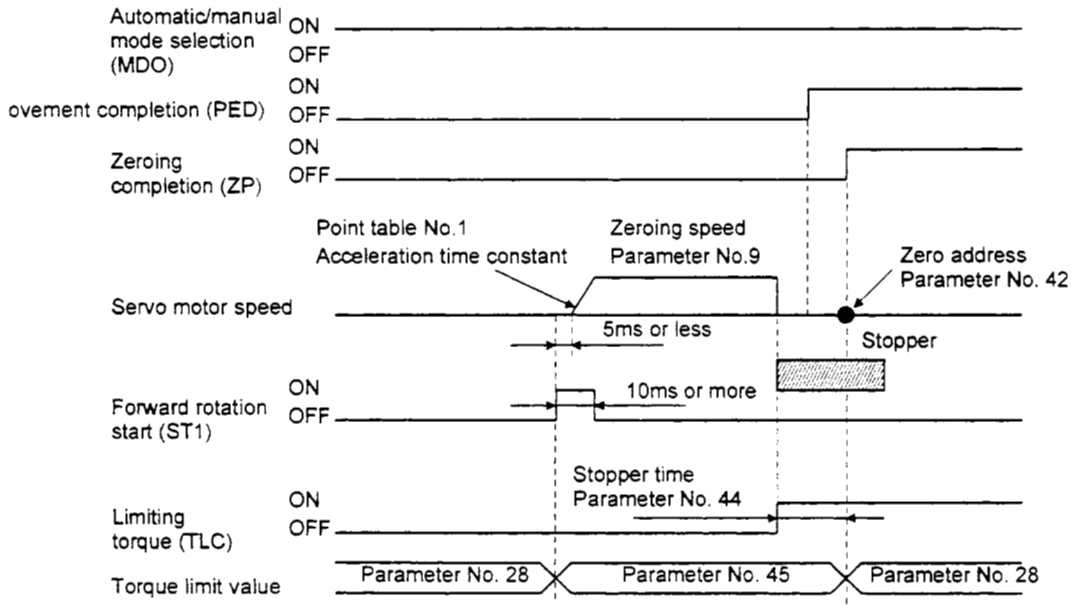
In stopper type zeroing, a machine part is pressed against a stopper or the like by jog operation, manual pulse generator operation or the like to make a home position return and that position is defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual selection	Automatic/manual selection signal (MDO)	Open MDO-SG (OFF).
	Program selection No. (PS□)	Short PS□-SG (ON).
Stopper type zeroing	Parameter No.8	□□□3: Stopper type zeroing is selected.
Stopper time	Parameter No.44	Time from when the part makes contact with stopper to when zeroing data is obtained to output zeroing completion (ZP)
Stopper type zeroing torque limit	Parameter No.45	Set the servo motor torque limit value for executi on of stopper type zeroing.
Zeroing acceleration constant	Point table No.1	Use the acceleration time constant of point No.1.

(2) Timing chart



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

4.4.6 Zero ignorance (servo-on position defined as zero)

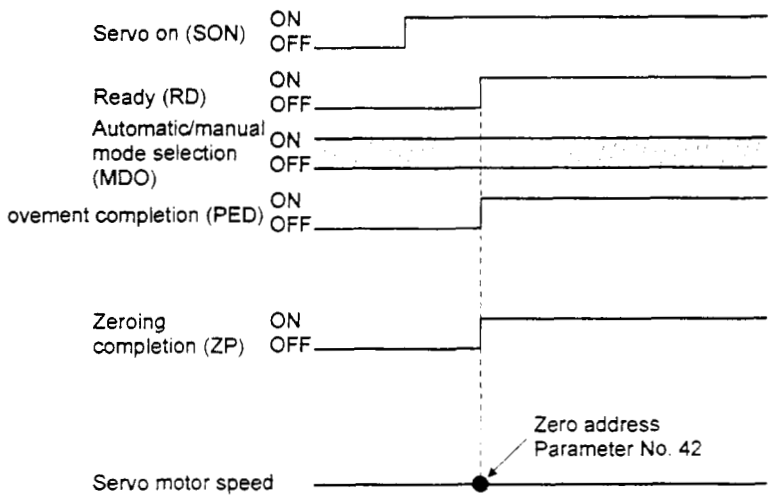
The position where servo is switched on is defined as a home position as soon as servo is switched on.

(1) Signals, parameter

Set the input signals and parameter as follows:

Item	Device/Parameter Used	Description
Zero ignorance	Parameter No.8	□□□4: Zero ignorance is selected.

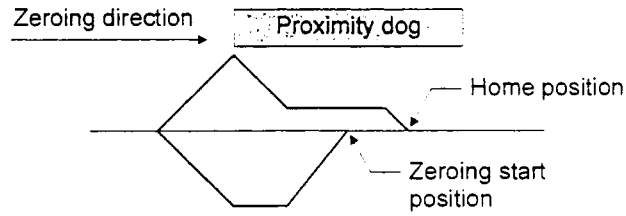
(2) Timing chart



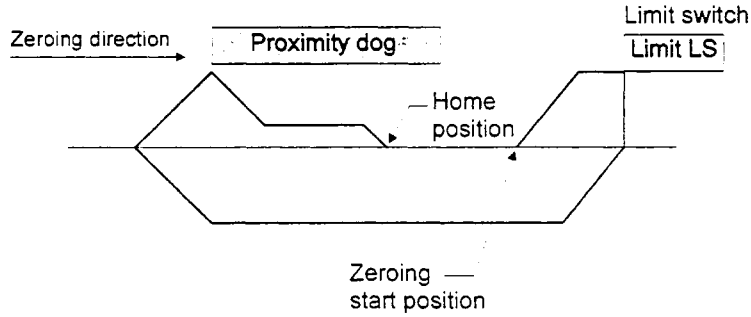
The address on completion of zeroing is the value automatically set in parameter No.42 (zeroing position data).

4.4.7 Automatic zeroing return function

If the current position is at or beyond the proximity dog in dog or count type zeroing, 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 zeroing.



At a start, a motion is made in the zeroing 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 zeroing 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 Absolute position detection system

The MR-J2-C-S100 servo amplifier contains a single-axis controller. Also, all servo motor encoders are compatible with an absolute position system. Hence, an absolute position detection system can be configured up by merely loading an absolute position data back-up battery and setting parameter values.

(1) Restrictions

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

1) Stroke-less coordinate system, e.g. rotary shaft, infinite positioning.
2) Operation performed in incremental value command type positioning system.

(2) Specifications

Item	Description
System	Electronic battery backup system
Battery	1 piece of lithium battery (primary battery, nominal + 3.6V) Type: MR-BAT or A6BAT
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	500r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
(Note 3) Data holding time during battery replacement	2 hours at delivery, 1 hour in 5 years after delivery
Battery storage period	5 years from date of manufacture

Note: 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.
2. Time to hold data by a battery with power off.
3. Period during which data can be held by the super capacitor in the encoder after power-off with the battery voltage low or the battery removed, or during which data can be held with the encoder cable disconnected.
Battery replacement should be finished within this period.

(3) Structure

Component	Description
Servo amplifier	Use standard models.
Servo motor	
Battery	MR-BAT or A6BAT
Encoder cable	Use a standard model. When fabricating, refer to (2), Section 14.1.2.

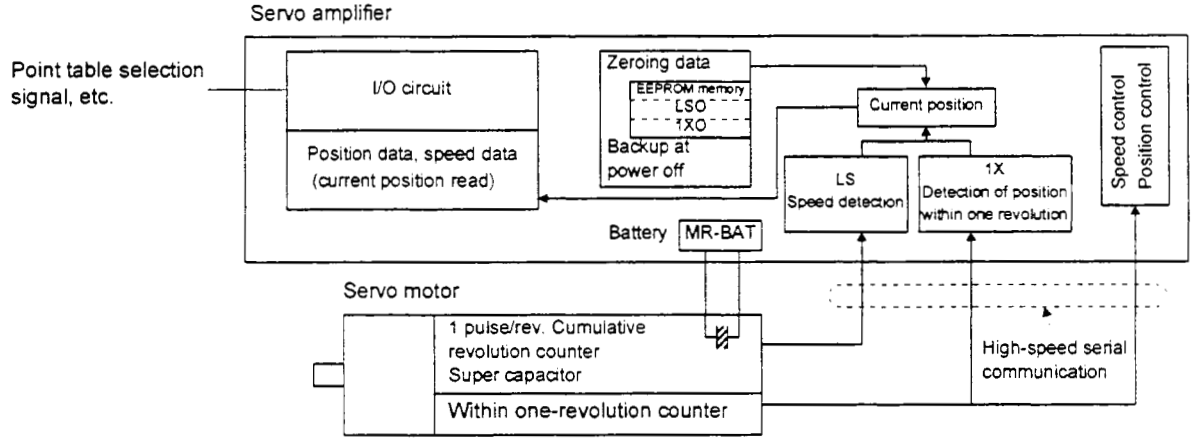
(4) Outline of absolute position detection data communication

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose programming controller power is on or off.

Therefore, once the home position is defined at the time of machine installation, zeroing is not needed when power is switched on thereafter.

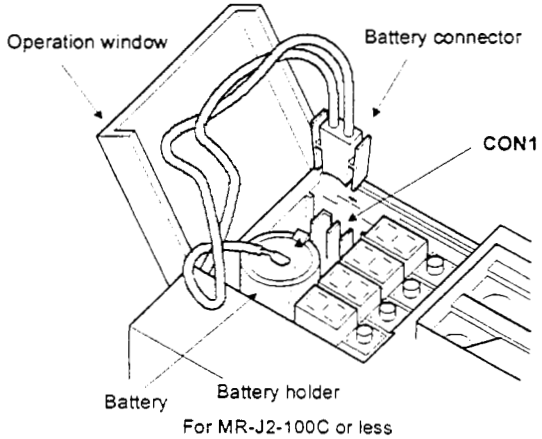
If a power failure or a fault occurs, restoration is easy.Also, the absolute position data, which is battery-backed by the super capacitor in the encoder, can be retained within the specified period (cumulative revolution counter value retaining time) if the cable is unplugged or broken.



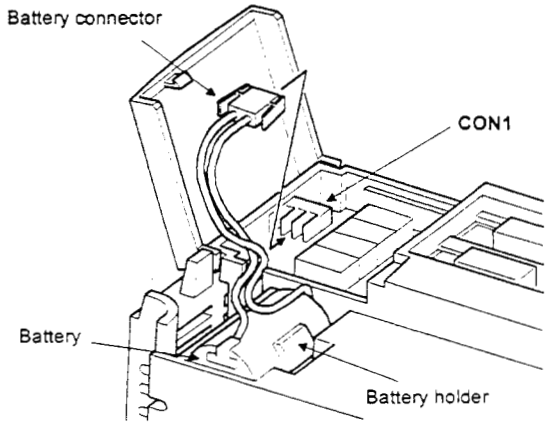
(5) Battery installation procedure

> **POINT**
>
> The internal circuits of the servo amplifier may be damaged by static electricity. Always take the following precautions:
> - Ground human body and work bench.
> - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

1) Open the operation window. (When the model used is the MR-J2-200C-S100 or more,also remove the front cover.)
2) Install the battery in the battery holder.
3) Install the battery connector into CON1 until it clicks.



For MR-J2-100C or less



For MR-J2-200C or more

(6) Parameter setting

Set parameter No.2 as indicated below to make the absolute position detection system valid:

Parameter No.2

1	–	–	–

Selection of absolute position detection system
0: Incremental system
1: Absolute position detection system

4.6 Serial Communication Operation

The RS-485 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-485 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.

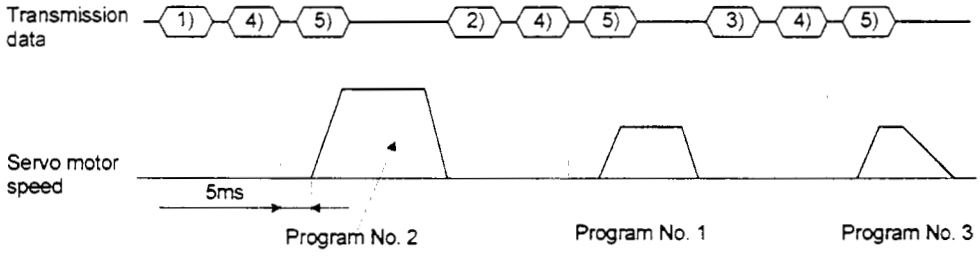
4.6.1 Positioning operation in accordance with program

By selecting the program No. and switching on the start signal (ST1) using the communication function, positioning operation in accordance with program can be started.

(1) Selection of program No.

Using the device forced output from the controller (command [9][2], data No. [2][0]),choose program from among No.1 to 8.

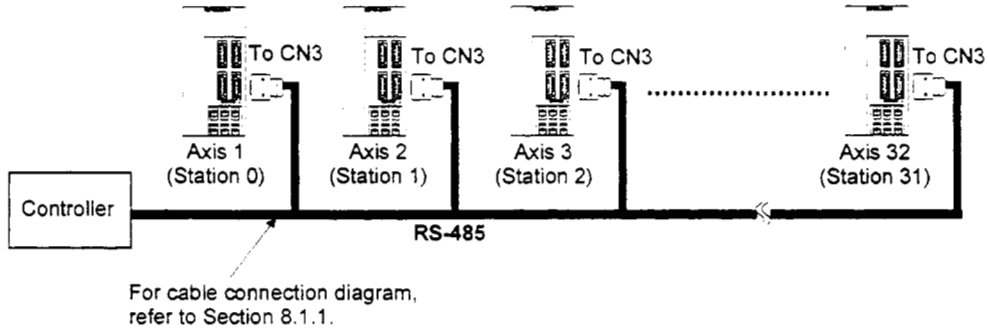
(2) Timing chart



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

4.6.2 Multidrop communication

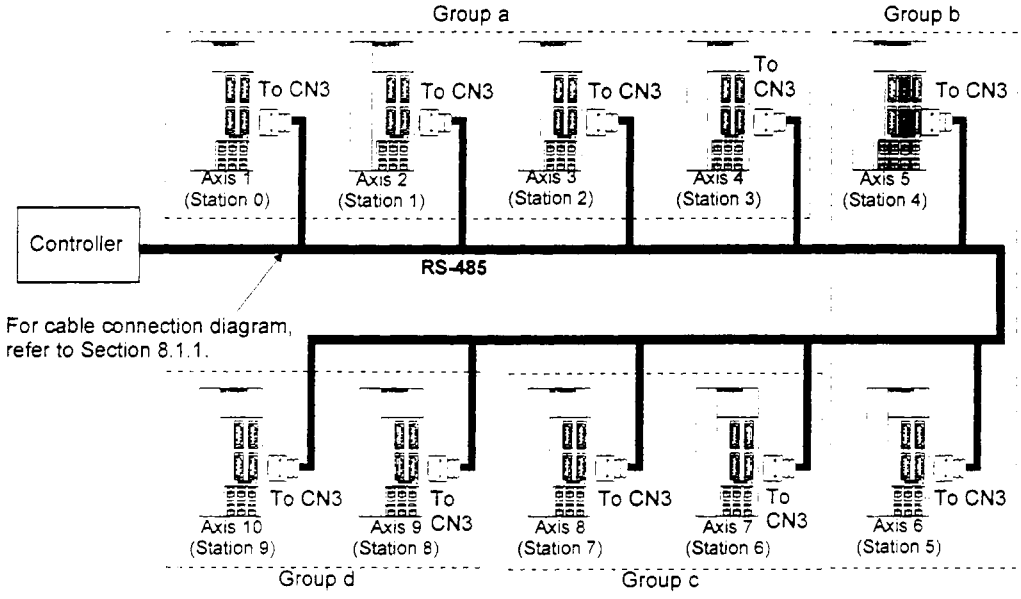
The RS-485 communication function can be used to operate several servo amplifiers on the same bus. In this case, set the station numbers to the servo amplifiers to determine the destination servo amplifier of the currently transmitted data. Use parameter No.15 to set the station numbers.
Always set one 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 4.6.3.



4.6.3 Group designation

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

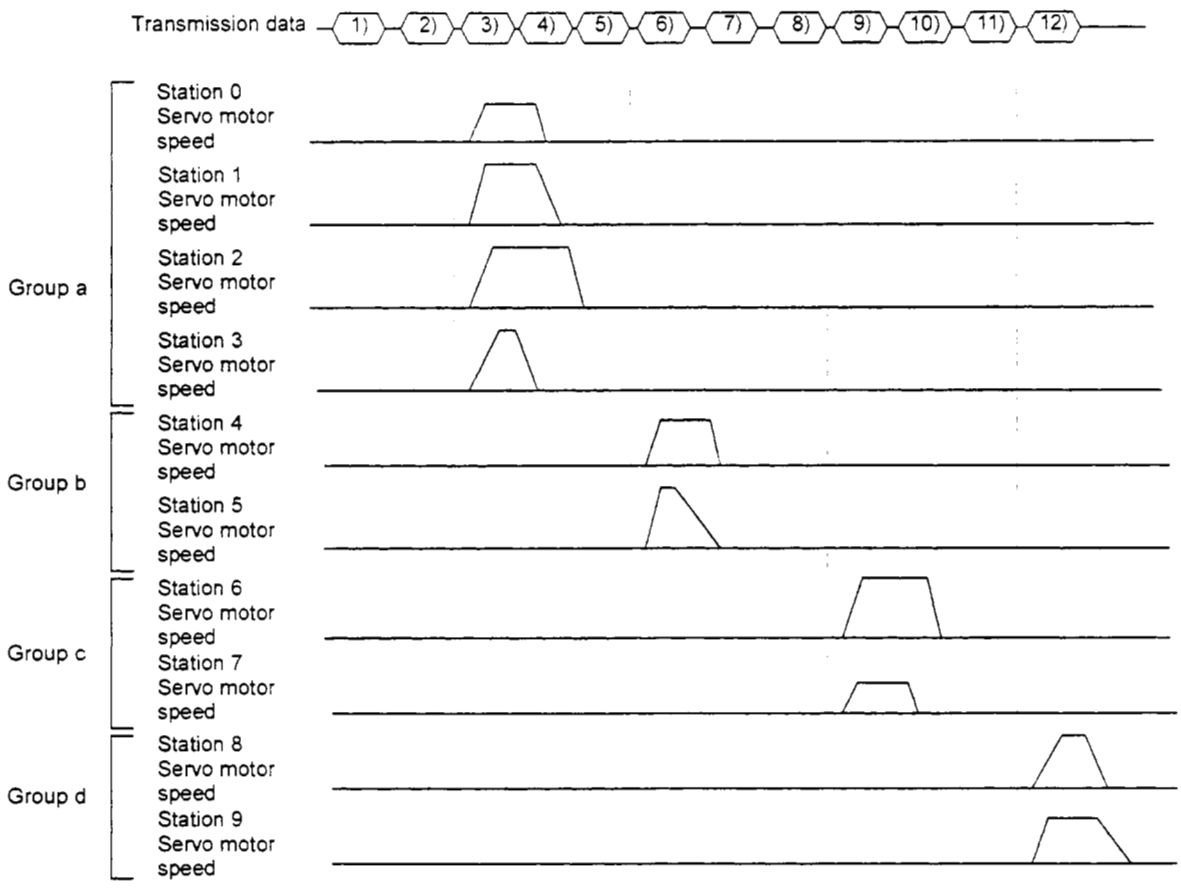
(1) Group setting example



Servo Amplifier Station No.	Group Setting
Station 0	A
Station 1	
Station 2	
Station 3	
Station 4	B
Station 5	
Station 6	C
Station 7	
Station 8	D
Station 9	

(2) Timing chart

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



No.	Transmission Data	Command	Data No.
1)	Selection of program 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 program 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 program 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 program No.1 of group d	[9] [2]	[6] [0]
11)	Forward rotation start (ST1) ON	[9] [2]	[6] [0]
12)	Forward rotation start (ST1) OFF	[9] [2]	[6] [0]

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

(3) Group setting instructions

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

5. PARAMETERS

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

5.1 Parameter List

5.1.1 Parameter write inhibit

POINT

- Set "000E" when using the 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-C-S100 servo amplifier, its parameters are classified into the basic parameters (No.0 to 19) and expansion parameters (No.20 to 68) 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.

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.68
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

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.

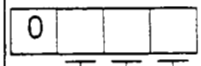
(1) Item list

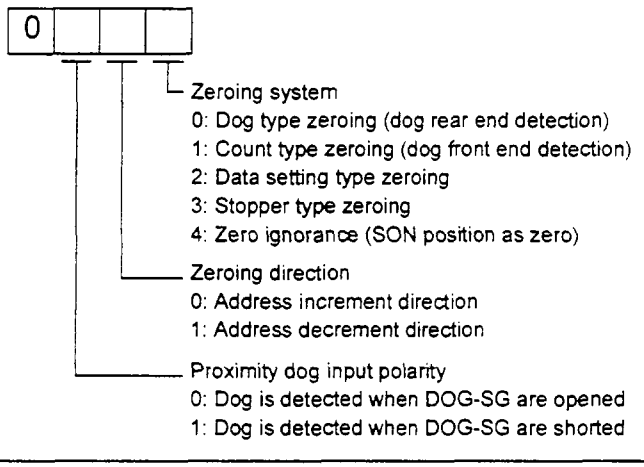
Class	No.	Symbol	Name and Function	Initial Value	Unit	Customer Setting
Basic parameters	0	*STY	Control mode, regenerative brake option selection	0000		
	1	*FTY	Feeding function selection	0000		
	2	*OP1	Function selection 1	0000		
	3	AUT	Auto tuning	0102		
	4	*CMX	Electronic gear numerator	1		
	5	*CDV	Electronic gear denominator	1		
	6	PDE	Movement completion output range	100	pulse	
	7	PG1	Position loop gain 1	36	rad/s	
	8	*ZTY	Zeroing type	0014		
	9	ZRF	Zeroing speed	500	r/min	
	10	CRF	Creep speed	10	r/min	
	11	ZST	Zero shift distance	0	μm	
	12		Spare	0		
	13	JOG	Jog speed	100	r/min	
	14	*STC	S-pattern acceleration/deceleration time constant	0	ms	
	15	*SNO	RS-485 station number setting	0	station	
	16	*BPS	Communication baudrate	0100		
	17	MOD	Analog monitor output	0100		
	18	*DMD	Status display selection, alarm history clear	0000		
	19	*BLK	Parameter block	0000		

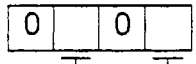
Class	No.	Symbol	Name and Function	Initial Value	Unit	Customer Setting
Expansion parameters	20	*OP2	Function selection 2	0000		
	21	*OP3	For manufacturer setting	0002		
	22	*OP4	Function selection 4	0000		
	23	SIC	Serial communications time-out selection	0		
	24	FFC	Feed forward gain	0	%	
	25	VCO	Override offset	0	mV	
	26	TLO	Torque limit offset	0	mV	
	27		Spare	0		
	28	TL1	Internal torque limit 1	100	%	
	29	TL2	Internal torque limit 2	100	%	
	30	*BKC	Backlash compensation	0	pulse	
	31	MO1	Analog monitor ch1 offset	0	mV	
	32	MO2	Analog monitor ch2 offset	0	mV	
	33	MBR	Electromagnetic brake sequence output	100	ms	
	34	DG2	Ratio of load inertia moment to motor inertia moment	70	× 0.1 times	
	35	PG2	Position loop gain 2	30	rad/s	
	36	VG1	Speed loop gain 1	216	rad/s	
	37	VG2	Speed loop gain 2	714	rad/s	
	38	VIC	Speed integral compensation	20	ms	
	39	VDC	Speed differential compensation	980		
	40	JTS	Jog operation acceleration/deceleration time constant	100	ms	
	41	ZTS	Zeroing acceleration/deceleration time constant	100	ms	
	42	*ZPS	Zeroing position data	0	× 10^{STM}μm	
	43	DCT	Moving distance after proximity dog	1000	× 10^{STM}μm	
	44	ZTM	Stopper type zeroing stopper time	100	ms	
	45	ZTT	Stopper type zeroing torque limit value	15	%	
	46 47	*LMP	Software limit +	0	× 10^{STM}μm	
	48 49	*LMN	Software limit –	0	× 10^{STM}μm	
	50 51	*LPP	Position range output address +	0	× 10^{STM}μm	
	52 53	*LNP	Position range output address –	0	× 10^{STM}μm	
	54	OUT1	OUT1 output time selection	0	× 10ms	
	55	OUT2	OUT2 output time selection	0	× 10ms	
	56	OUT3	OUT3 output time selection	0	× 10ms	
	57		Spare	0		
	58	*DI0	Input / Output device selection	0000		
	59	*DI1	Input device selection 1	0209		
	60	*DI2	Input device selection 2	060A		
	61	*DI3	Input device selection 3	1615		
	62	*DI4	Input device selection 4	030B		
	63	*DI5	Input device selection 5	0504		
	64	*DI6	Input device selection 6	0102		
	65	*DI7	Input device selection 7	0000		
	66	*DO1	Output device selection 1	0005		
	67	*DO2	Output device selection 2	110D		
	68	*DO3	Output device selection 3	0102		

(2) Detail list

Class	No	Symbol	Name and function	Initial Value	Unit	Setting Rnge	Refer To
Basic parameters	0	*STY	Control mode. Regenerative brake option selection Use to select the control mode and regenerative brake option. 0 _ _ _ Program editing 0: Valid 1: Invalid Selection of command mode 0: Use in absolute position detection system 1: Use in incremental positioning system Select the regenerative brake option 0:Not used 2:MR-RB032 3:MR-RB12 4:MR-RB32 5:MR-RB30 6:MR-RB50	0000		0000h to 0611h	Section 4.2 Section 14.1.1
	1	*FTY	Feeding system selection Used to set the feed length multiplication factor and External pulse multiplication factor. _ _ _ _ Coordinate system selection 0: CCW(address increase) 1: CW (address increase) Feed length multiplication factor (STM) 0:1 time 1:10 times 2:100 times 3:1000 times External pulse input magnification setting 0: 1 time 1: 10 times 2: 100 times SON-off,EMG-off follow up for absolute value command in incremental system 0: Invalid 1: Valid	0000		0000h to 1231h	Section 4.2.1 Section 5.2.1 Section 4.3
	2	*OP1	Function selection 1 Used to select the input filter and absolute position detection system. _ 0 _ _ Input filter If external input signal To noise, etc., input filter is used to suppress it. 0: None 1: 1.77msec 2: 3.55msec Unit of position data 0: mm 1: inch 2: pulse Absolute positioning system 0: Use in incremental 1: Use in absolute position detection system	0000		0000h to 1002h	Section 4.5

<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 rowspan="4">Basic parameters</td><td>3</td><td>AUT</td><td>Auto tuning
Used to set the response level, etc. for execution of auto tuning.
 
</td><td>0102</td><td></td><td>0000h
to
0215h</td><td>Chapter 9</td></tr>
<tr><td>4</td><td>*CMX</td><td>Electronic gear numerator
Note: Set in the range of $\frac{1}{20}<\frac{CMX}{CDV}<20$.
If $\frac{1}{100}<\frac{CMX}{CDV}<100$ is exceeded. a parameter error will occur.</td><td>1</td><td></td><td>1 to 32767</td><td>Section 5.2.1</td></tr>
<tr><td>5</td><td>*CDV</td><td>Electronic gear denominator
Setting example Roll diameter: 50mm
Reduction ratio: 3/7
Number of pulses: 16384 pulses
$\frac{\text{Number of pulses (CMX)}}{\text{Moving distance (CDV)}}=\frac{16384}{50\times\pi\times3/7\times1000}$
$=\frac{7168}{9375\pi}$
$\fallingdotseq\frac{7168}{29452}$
Hence, set 7168 to CMX and 29452 to CDV.
Note: When there is a fraction, perform a carry within the setting range and round off that fraction.</td><td>1</td><td></td><td>1 to 32767</td><td>Section 5.2.1</td></tr>
<tr><td>6</td><td>PED</td><td>Movement completion output rang
Used to set the droop pulse range when the movement completion (PED) signal is output.</td><td>100</td><td>pulse</td><td>0 to 10000</td><td></td></tr>
</table>

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Basic parameter	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.	36	rad/s	4 to 1000	Chapter 9
	8	*ZTY	Zeroing type Used to set the zeroing system, zeroing direction and proximity dog input polarity.  	0014		0000h to 0114h	Chapter 9
	9	ZRF	Zeroing speed Used to set the motor speed for zeroing.	500	r/min	0 to Maxspeed	Section 4.4
	10	CRF	Creep speed Used to set the creep speed after proximity dog detection.	10	r/min	0 to Maxspeed	Section 4.4
	11	ZST	Zero 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		Spare	0			
	13	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to Maxspeed	
	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 zeroing.	0	ms	0 to 100	Section 5.2.3
	15	*SNO	RS-485 station number setting Used to specify the station number for RS-485 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	

<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="2">Basic parameters</td><td>16</td><td>*BPS</td><td>Communication baudrate
Used to select the RS-485/RS-232C communication baudrate and choose various conditions for communication.
 
RS-485/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-485/RS-232C communication standard selection
0: RS-485 used
1: RS-232C used
Communication response delay time
0: Invalid, reply sent in less than 400μs
1: Valid, reply sent in 400μs or more</td><td>0100</td><td></td><td>0000h
to
1112h</td><td>Section 5.2.7</td></tr>
<tr><td>17</td><td>MOD</td><td>Analog monitor output
Used to set the signal provided to the analog monitor output.
 
<table><tr><th rowspan="2">Setting</th><th colspan="2">Analog Monitor Output Selection</th></tr><tr><th>ch2</th><th>ch1</th></tr><tr><td>0</td><td colspan="2">Servo motor speed (±8V/max. speed)</td></tr><tr><td>1</td><td colspan="2">Generated torque (±8V/max. torque)</td></tr><tr><td>2</td><td colspan="2">Motor speed (+8V/max. speed)</td></tr><tr><td>3</td><td colspan="2">Generated torque (+8V/max. torque)</td></tr><tr><td>4</td><td colspan="2">Current command (±8V/max. current command)</td></tr><tr><td>5</td><td colspan="2">Speed command (±8/max. speed)</td></tr><tr><td>6</td><td colspan="2">Droop pulses (±10V/128 pulses)</td></tr><tr><td>7</td><td colspan="2">Droop pulses (±10V/2048 pulses)</td></tr><tr><td>8</td><td colspan="2">Droop pulses (±10V/8192 pulses)</td></tr><tr><td>9</td><td colspan="2">Droop pulses (±10V/32768 pulses)</td></tr><tr><td>A</td><td colspan="2">Droop pulses (±10V/131072 pulses)</td></tr></table></td><td>0100</td><td></td><td>0000h
to
0A0Ah</td><td>Section 5.2.4</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="2">Basic parameters</td><td>18</td><td>*DMD</td><td>Status display selection, alarm history clear
Used to select the status display shown at power-on and choose alarm history clear.

[ ][0][ ][ ]

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

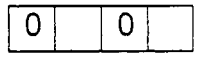
Status display of MR-DP60
0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Point table No.
4: Cumulative feedback pulses
5: Motor speed
6: Droop pulses
7: Override
8: Torque limit voltage
9: Regenerative load ratio
A: Effective load ratio
B: Peak load ratio
C: 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).</td><td>0000</td><td></td><td>0000h
to
10E6h</td><td>Section 7.2

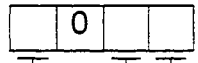
Section 7.2

Section 5.2.6</td></tr>
<tr><td>19</td><td>*BLK</td><td>Parameter block
Used to select the reference and write ranges of the parameters.

<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 68</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 he Servo Configuration Software.</td><td>0000</td><td></td><td>0000h
to
000Eh</td><td>Section 5.1.1</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="3">Expansion parameters</td><td>20</td><td>*OP2</td><td>Function selection 2
Used to select slight vibration suppression control.
 

<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>0000h
to
1102h</td><td>Section 3.2.5

Section 9.5</td></tr>
<tr><td>21</td><td>*OP3</td><td>For manufacturer setting</td><td>0002</td><td></td><td></td><td></td></tr>
<tr><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.
 

Stopping method used when LSP/LSN device or software limit is valid
0: Sudden stop
1: Slow stop
Processing of base circuit performed when alarm reset (RES) device is valid
0: Base circuit not switched off
1: Base circuit switched off
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>0000h
to
7011h</td><td>Section 5.2.5

Chapter 9</td></tr>
</table>

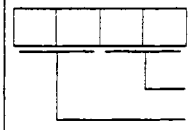
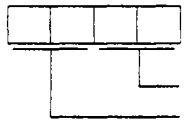
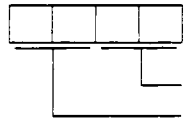
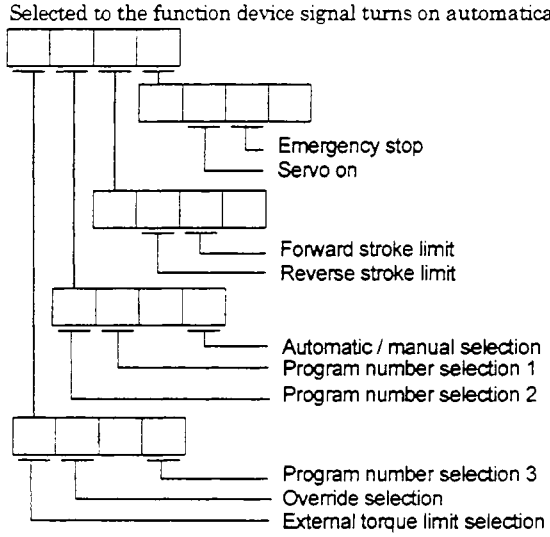
<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th><th>Refer To</th></tr>
<tr><td rowspan="11">Expansion parameters</td><td>23</td><td>*SIC</td><td>Serial communication time-out selection
Used to choose the time-out 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>s</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 not be generated in constant speed operation. Note that sudden acceleration/deceleration will increase overshoot.
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>Chapter 9</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 3.2.4</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 3.2.5</td></tr>
<tr><td>27</td><td></td><td>Spare</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 3.2.5</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 3.2.5</td></tr>
<tr><td>30</td><td>*BKC</td><td>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 zeroing direction. In the absolute position detection system, this function compensates for the backlash pulse count in the direction opposite to the operating direction at power-on.</td><td>0</td><td>pulse</td><td>0 to 1000</td><td></td></tr>
<tr><td>31</td><td>MO1</td><td>Analog monitor ch1 offset
Used to set the offset voltage of the analog monitor ch1 output (MO1).</td><td>0</td><td>mV</td><td>-999 to 999</td><td>Section 5.2.4</td></tr>
<tr><td>32</td><td>MO2</td><td>Analog monitor ch2 offset
Used to set the offset voltage of the analog monitor ch2 output (MO2).</td><td>0</td><td>mV</td><td>-999 to 999</td><td>Section 5.2.4</td></tr>
</table>

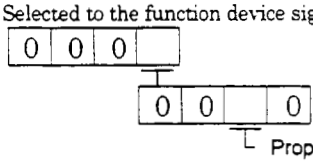
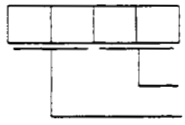
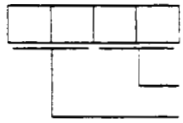
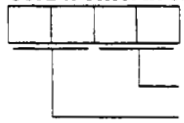
Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	33	MBR	Electromagnetic brake sequence output Used to set the delay time between when the electromagnetic brake interlock signal (MBR) switches off and when the base circuit is shut off.	100	ms	0 to 1000	Section 3.5
	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.	70	×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.	30	rad/s	1 to 500	Chapter 9
	36	VG1	Speed loop gain 1 Normally this parameter setting 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.	216	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.	714	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	JTS	Jog operation acc/dec time constant Used to set theacceleraion/deceleration time when jog operation.	100	ms	1 to 20000	
	41	ZTS	Zeroing operation acc/dec time constant Used to set the acceleration/deceleration time when zeroing operation.	100	ms	1 to 20000	
	42	*ZPS	Zeroing position data Used to set the current position on completion of zeroing.	0	$\times 10^{STM}$ 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 zeroing.	1000	$\times 10^{STM}$ 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 zeroing stopper time In stopper type zeroing, 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 zeroing torque limit Used to set the torque limit value relative to the max. torque in [%] in stopper type zeroing.	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 "softw are limit –". 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 5.2.9
	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 +". 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 5.2.9
	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. 52 ———— Parameter No. 53	0	×10^{STM} μm	-999999 to 999999	

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	54	OUT1	OUT1 output time selection This parameter turn on OUT1 during the set time. If set 0, OUT1 turn on to OUT OF(1) command.	0	10ms	0 to 2000	
	55	OUT2	OUT2 output time selection This parameter turn on OUT2 during the set time. If set 0, OUT2 turn on to OUT OF(2) command.	0	10ms	0 to 2000	
	56	OUT2	OUT3 output time selection This parameter turn on OUT3 during the set time. If set 0, OUT3 turn on to OUT OF(3) command.	0	10ms	0 to 2000	
	57		Spare	0			
	58	*DI0	Input/Output device selection Used to select the CN1A-19 pin to output device or Input device. 0 0 CN1A-19 pin 0: Input device 1: Output device External dynamic-brake selection 0: Invalid 1: Valid When selected the external dynamic-brake output at parameter No.62,63,64, it must be set "1". Note: Similar Function could be realized with configuration S/W	0000		0000h to 1001h	
	59	*DI1	Input device selection 1 Used to select the function of CN1A-8 pin and CN1A-19 pin Set to the function of CN1A-8 pin Set to the function of CN1A-19 pin Note: Similar Function could be realized with configuration S/W	0209		0000h to 1F1Fh	
	60	*DI2	Input device selection 2 Used select the function of CN1B-5 pin and CN1B-7 pin. Set to the function of CN1B-5 pin Set to the function of CN1B-7 pin Note: Similar Function could be realized with configuration S/W	060A		0000h to 1F1Fh	

Setting	Input function	Setting	Input function
00	No function	0D	Spare
01	EMG	0E	OVR
02	SON	0F	TL0
03	RES	10	TL1
04	LSP	11	PC
05	LSN	12	STP
06	ST1	13	TP0
07	ST2	14	TP1
08	MD0	15	PI1
09	DOG	16	PI2
0A	PS1	17	PI3
0B	PS2	18	Spear
0C	PS3	19	Spear

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	61	*DI3	Input device selection 3 Used select the function of CN1B-8 pin and CN1B-9 pin.  Note: Similar Function could be realized with configuration S/W	1615		0000h to 1F1Fh	
	62	*DI4	Input device selection 4 Used select the function of CN1B-14 pin and CN1B-15 pin.  Note: Similar Function could be realized with configuration S/W	030B		0000h to 1F1Fh	
	63	*DI5	Input device selection 5 Used select the function of CN1B-16 pin and CN1B-17 pin.  Note: Similar Function could be realized with configuration S/W	0504		0000h to 1F1Fh	
	64	*DI6	Input/Output device selection 6 Selected to the function device signal turns on automatically.  Note: Similar Function could be realized with configuration S/W	0102		0000h to FFFFh	

Class	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range	Refer To
Expansion parameters	65	*DI7	Input/Output device selection 7 Selected to the function device signal turns on automatically.  Note: Similar Function could be realized with configuration S/W	0000		0000h to FFFFh	
	66	*DO1	Output device selection 1 Used to select the function of CN1A-18 pin and CN1A-19 pin.  Note: Similar Function could be realized with configuration S/W	0005		0000h to 1F1Fh	
	67	*DO2	Output device selection 2 Used to select he function of CN1B-6 pin and CN1B-4 pin  Note: Similar Function could be realized with configuration S/W	110D		0000h to 1F1Fh	
	68	*DO3	Output device selection 3 Used to select he function of CN1B-18 pin and CN1B-19 pin  Note: Similar Function could be realized with configuration S/W	0102		0000h to 1F1Fh	

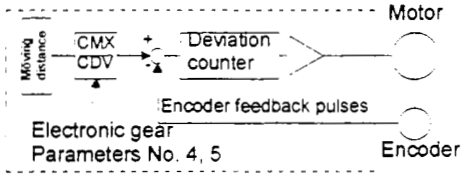
Setting	Output function	Setting	Output function
00	No function	09	WNG
01	RD	0A	BWNG
02	ALM	0B	TLC
03	Spare	0C	PUS
04	Spare	0D	OUT1
05	ZP	0E	OUT2
06	MBR	0F	OUT3
07	DBR	10	SOUT
08	POT	11	PED

5.2 Detailed Explanation

5.2.1 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 multip lication ratio to the moving distance on the servo amplifier.

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

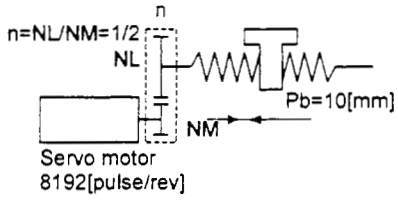


The following examples are used to explain how to calculate the electronic gear value:

(1) Ballscrew setting example

Machine specifications

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



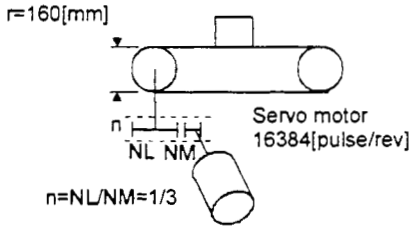
$$\frac{CMX}{CDV} = \frac{P_t}{\Delta S} = \frac{P_t}{n \cdot P_b \cdot 1000} = \frac{8192}{1/2 \cdot 10 \cdot 1000} = \frac{8192}{5000} = \frac{1024}{625}$$

Hence, set 1024 to CMX and 625 to CDV.

(2) Conveyor setting example

Machine specifications

Pulley diameter: r = 10 [mm]
Reduction ratio: n = 1/3
Servo motor resolution: $P_t = 16384$ [pulse/rev]

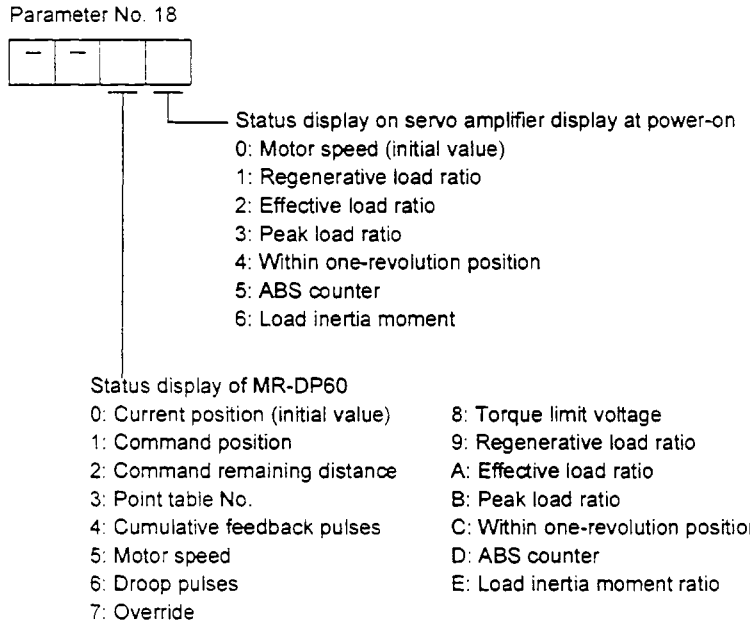


$$\frac{CMX}{CDV} = \frac{P_t}{\Delta S} = \frac{P_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{16384}{1/3 \cdot 160 \cdot \pi \cdot 1000} = \frac{16384}{167551.61} = \frac{4096}{41888} = \frac{2048}{20944}$$

Reduce CDV to 32767 or less and round off the first decimal place.
Hence, set 2048 to CMX and 20944 to CDV.

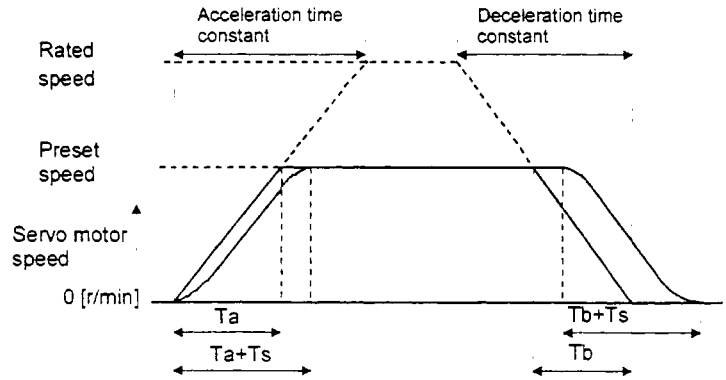
5.2.2 Changing the status display screen

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

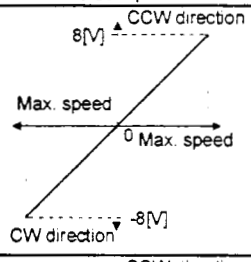
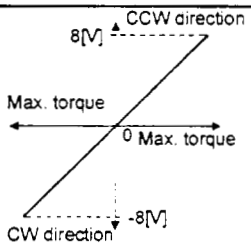
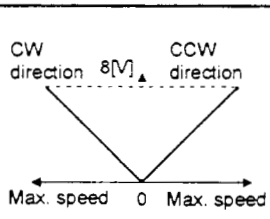
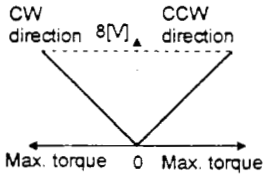
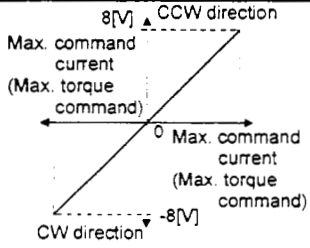
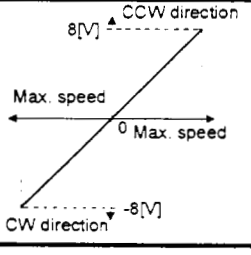
In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern time constant (parameter No.14), a smooth start/stop can be made. When the S-pattern time constant is set, smooth positioning is executed as shown below. Note that the time equivalent to the S-pattern time constant setting increases until positioning is complete.

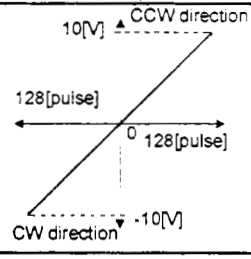
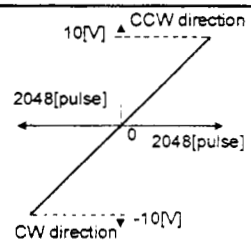
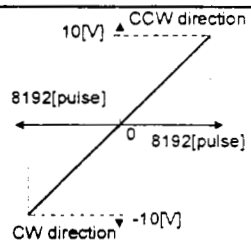
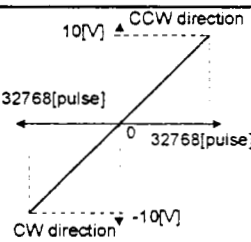
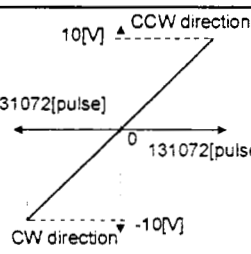


Ta: Time until preset speed is reached
Tb: Time until stop
Ts: S-pattern time constant (parameter No. 14)
Setting range 0 to 100ms

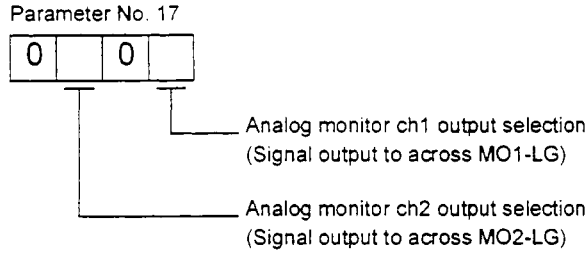
5.2.4 Analog output

The servo status can be output to two channels in terms of voltage. Use this function when using an ammeter to monitor the servo status or synchronizing the torque/speed with the other servo.
The servo amplifier is factory-set to output the motor speed to CH1 and the generated torque to CH2. The setting can be changed as listed below by changing the parameter No.17 value:

Setting	Output Item	Description
0	Motor speed	
1	Generated torque	
2	Motor speed	
3	Generated torque	
4	Current command (Torque command)	
5	Command speed	

Setting	Output Item	Description
6	Droop pulses (128pulse)	
7	Droop pulses (2048pulse)	
8	Droop pulses (8192pulse)	
9	Droop pulses (32768pulse)	
A	Droop pulses (131072pulse)	

Change the following digits of parameter No.17:



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

Parameter	Description	Setting Range [mV]
Parameter No.31	Used to set the offset voltage for the analog monitor CH1 output.	-999 to 999
Parameter No.32	Used to set the offset voltage for the analog monitor CH2 output.	

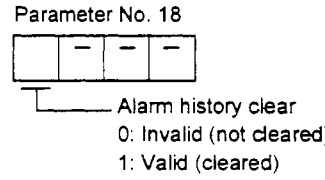
5.2.5 Changing the stop pattern using a limit switch

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

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

5.2.6 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.



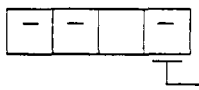
5.2.7 Selection of communication specifications

When the RS-485/RS-232C communication function is used to operate the servo, choose the communication specifications with parameter No.16.

(1) Communication baudrate

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

Parameter No. 16

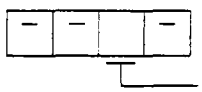


Communication baudrate
0: 9600[bps]
1:19200[bps]
2: 4800[bps]

(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

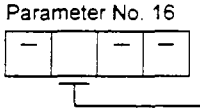


Checksum
0: Yes (checksum added)
1: No (checksum not added)

(3) RS-485/RS-232C serial interface selection

Select the RS-485 or RS-232C communication standard. RS-485 and RS-232C cannot be used together.

Parameter No. 16

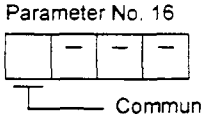


RS-485/RS-232C communication standard selection
0: RS-485 used
1: RS-232C used

(4) Communication delay time

Set the time from when the servo amplifier (slave station) receives communication data to when it data. Set "0" to send back data in less than 400 μ s or "1" to send back data in 400 μ s or more.

Parameter No. 16



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

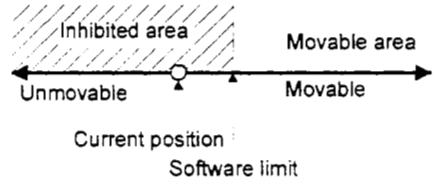
(5) Serial communication time-out

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)

5.2.8 Software limit

A limit stop using a software limit is made as in stroke end operation. When a motion goes beyond the setting range, the motor is stopped and servo-locked. This function is made valid at power-on but made invalid during zeroing. This function is made invalid when the software limit + setting is the same as the software limit - setting.



6. SERVO CONFIGURATION SOFTWARE

The Servo Configuration software uses the communication function of the servo amplifier to perform programming, parameter setting changes graph display, test operation, etc. on a personal computer.

6.1 Specifications

Item	(Note 1) Description
Communication signal	Conforms to RS-232C.
Baudrate	19200bps, 9600bps
(Note 2) Monitor	Batch display, high-speed display, graph display
Alarm	Alarm display, alarm history, data display at
Diagnostic	External I/O signal display, function device display, cumulative power-on time display, software number display, tuning data display, ABS data display
Parameters	Data setting, list display, change list display, detailed information display, I/O Devices
Test operation	Jog operation, motor-less operation, output signal forced output, program test
Program Data	Programming, editting
File operation	Data read, save, print
Others	Station setting, help display

Note: 1. On some personal computers, this software may not run properly.
2. Minimum resolution changes with the processing speed of the personal computer.

6.2 System configuration

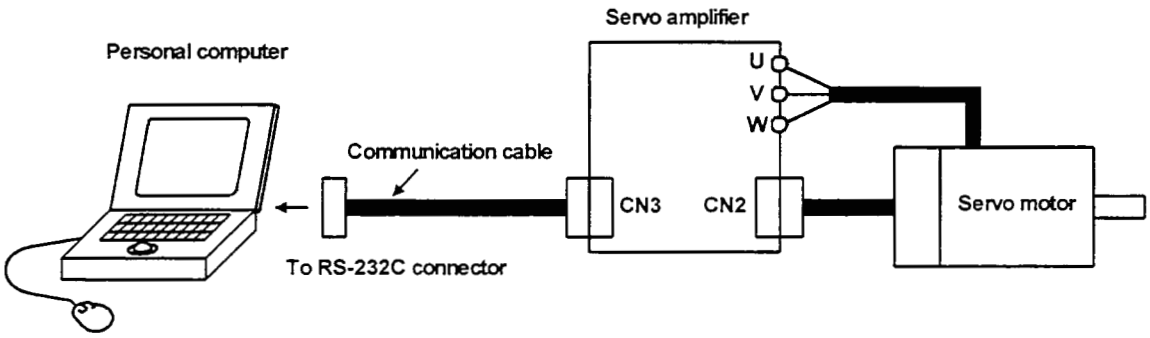
(1) Components

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

Model	Description
Personal computer	Which contains a 80386 or higher CPU and on which Windows 3.1·95 runs (80486 or higher recommended).Memory: 8MB or more, hard disk: 1MB or more, serial port used.
OS	Windows 3.1·95
Display	640×400 or more color or 16-scale monochrome display which can be used with Windows 3.1·95.
Keyboard	Which can be connected to the personal computer.
Mouse	Which can be used with Windows 3.1·95. Note that a serial mouse is not used.
Printer	Which can be used with Windows 3.1·95.
Communication cable	MR-CPC98CBL3M·MR-CPCATCBL3M When these cannot be used, refer to Section 14.1.2 and fabricate.

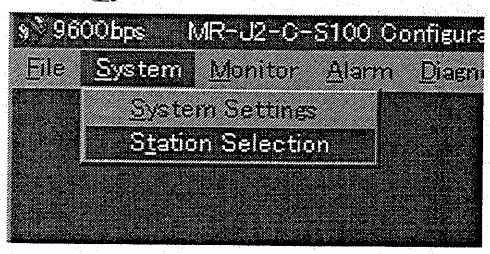
Note: Windows is a trade mark of Microsoft Corporation.

(2) Configuration diagram

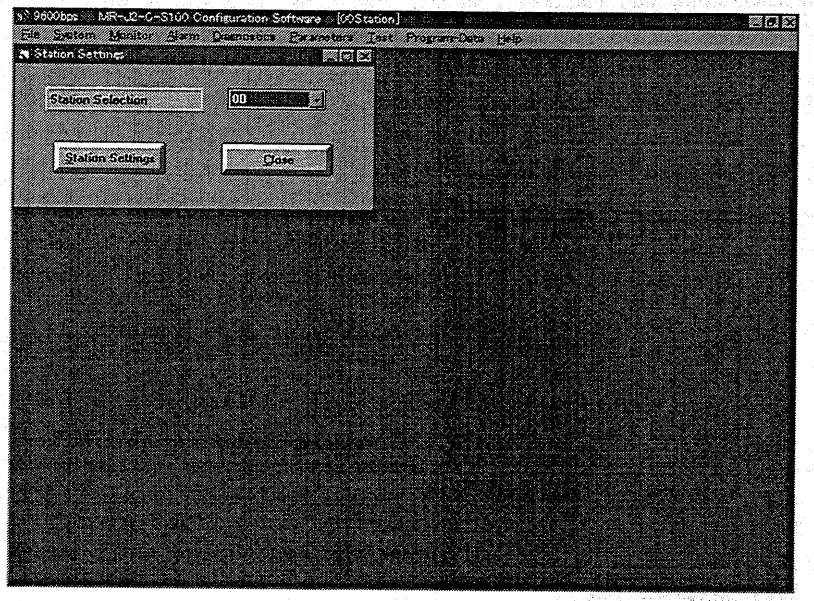


6.3 Station Setting

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.

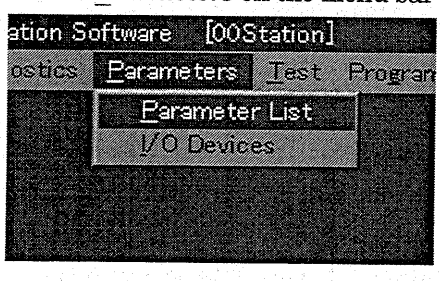
> **POINT**
>
> This setting should be the same as the station number which has been set in the parameter in the servo amplifier used for communication.

(2) Closing of the station setting window

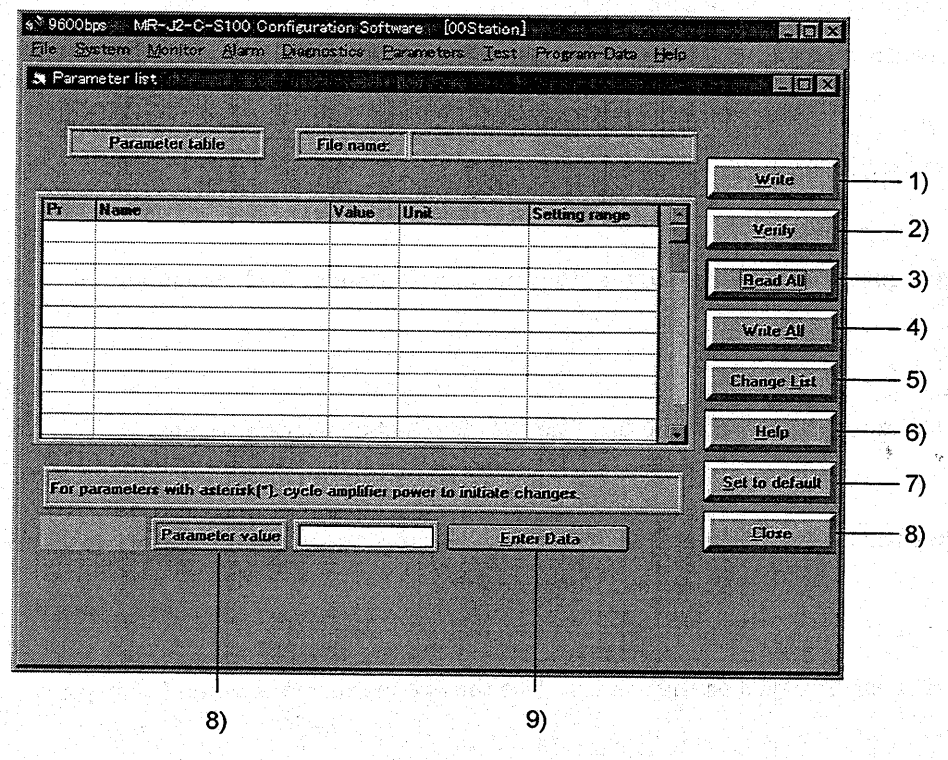
Press the **Close** button to close the window.

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 to the servo amplifier.

(2) Parameter value verify (2))

Press the **Verify** button to verify all parameter values being displayed and the parameter 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

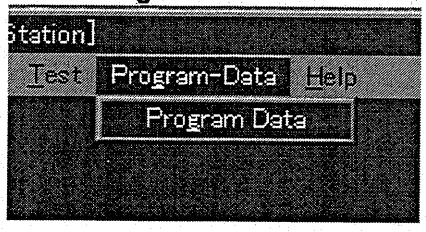
Used to print all parameter values being displayed on the window. Use the **File** menu on the menu bar to print.

(12) Parameter list window closing (10))

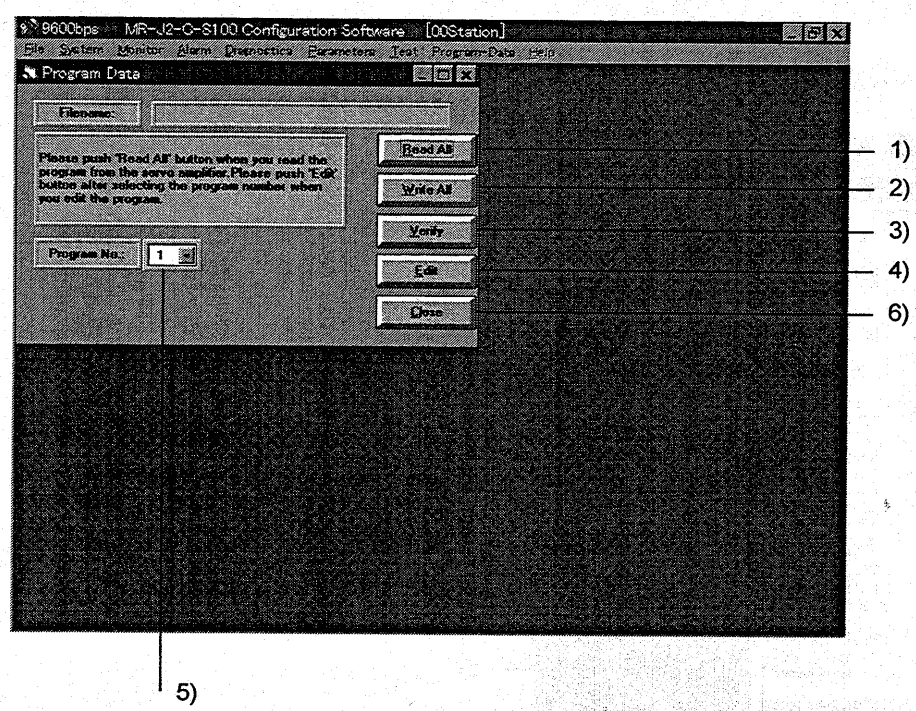
Press the **Close** button to close the window. If the **Close** button is pressed without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

6.5 Programming

Choose **Program-Data** on the menu bar and choose **Program Data** on the menu.



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



(1) Program data batch-read (1))

Press the **Read All** button to read all program data from the servo amplifier.

(2) Program data batch-write (2))

Press the **Write All** button to write all program data to the servo amplifier.

(3) Program data verify (3))

Press the **Verify** button to verify all program data being the program data of the servo amplifier.

(4) Program data edit (4))

Press the **Edit** button to edit the program data of displayed program No.

(5) Program No.(5))

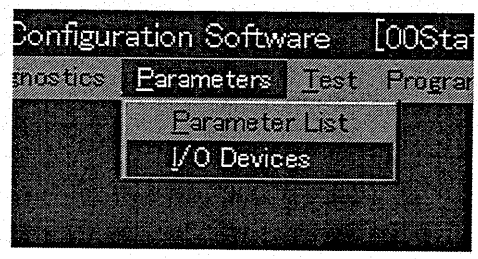
Press the arrow button to show program edit No.

(6) Program data window closing (6))

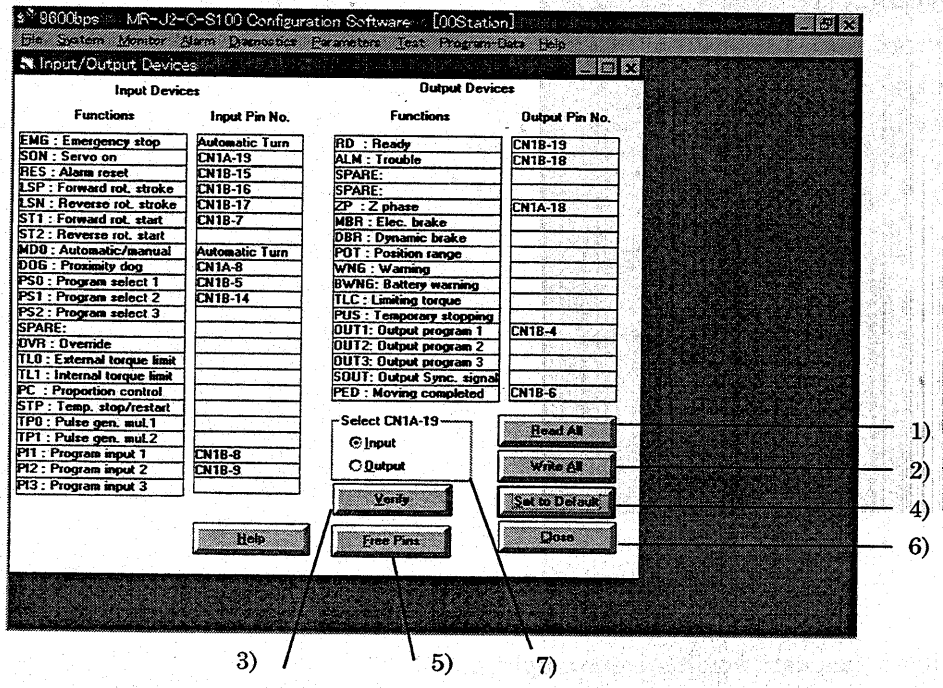
Press the **Close** button to close the window.

6.6 Device Setting

When using the device setting, preset "□□□E" 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))

Select whether the CN1A-19 pin is used as an input or output pin.

In the initial setting, it is defined as an empty output pin.

When this selection is changed, the CN1A-19 pin is set as the empty pin of the chosen one.

(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.

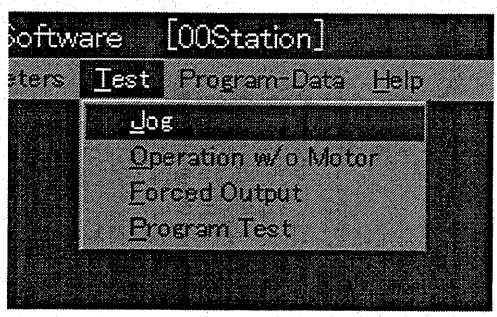
When (1) function assignment batch-write is not made, pressing the **Close** button makes the function assignment change invalid.

6.7 Test Operation

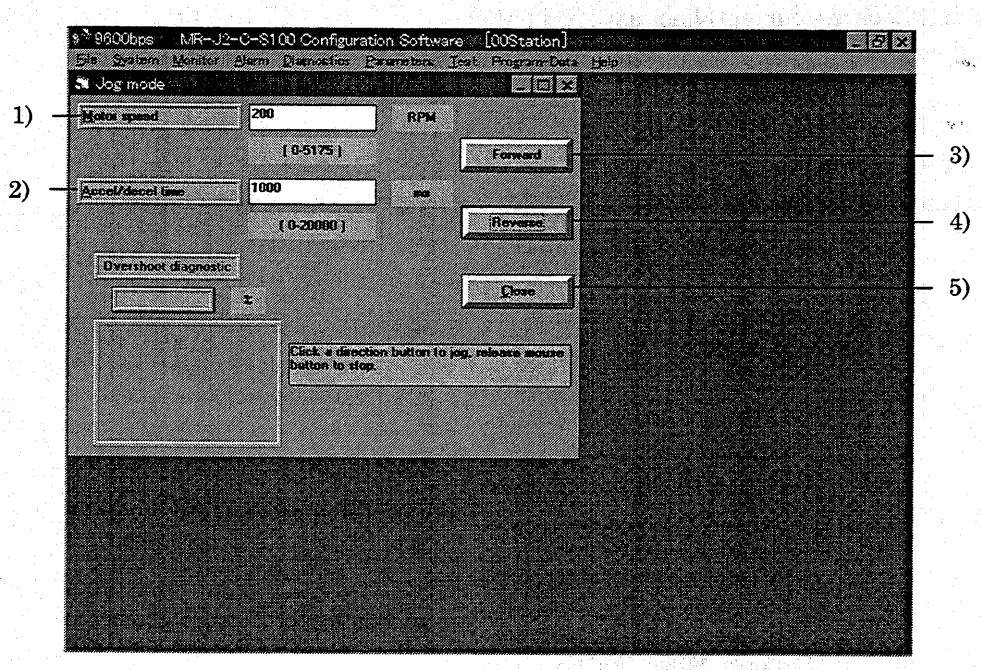
6.7.1 Jog operation

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.

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.

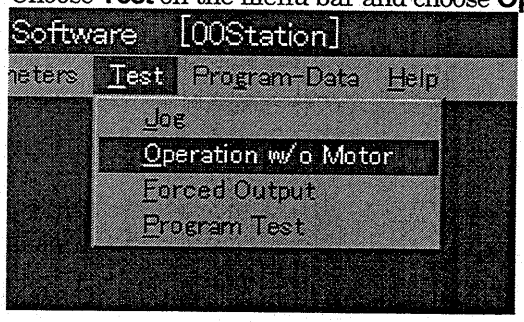
(5) Jog operation window closing (5))

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

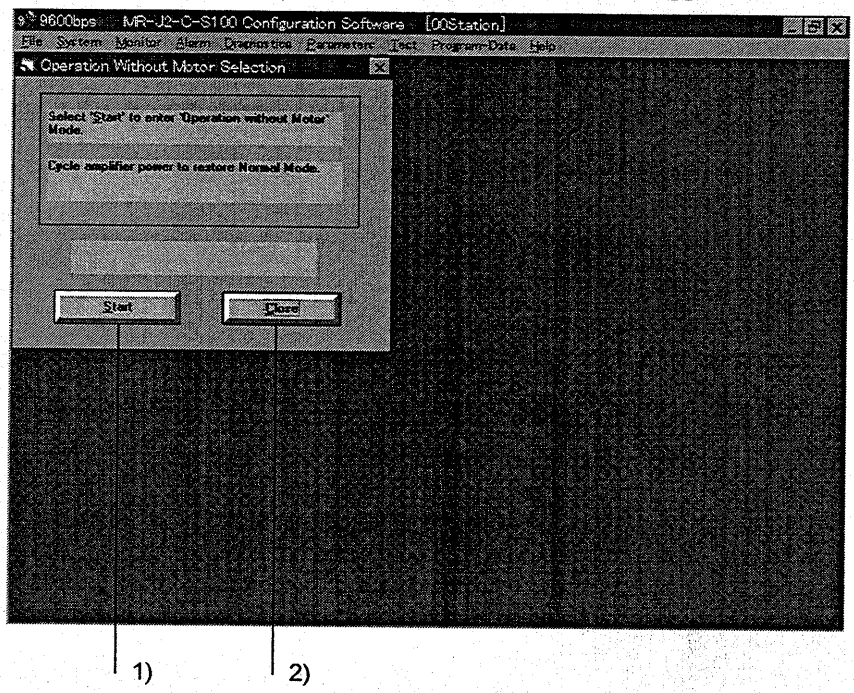
6.7.2 Motor-less operation

Without a servo motor being connected, the output signals are provided and the servo amplifier 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.

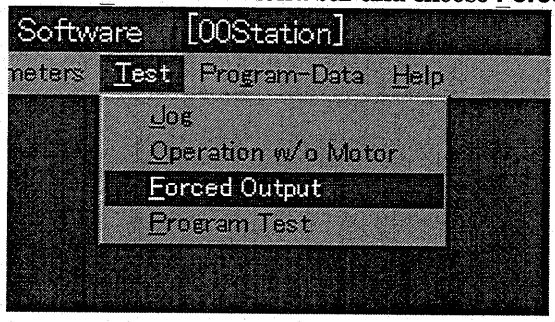
(2) Termination of motor-less operation 2)
Press **Close** to close the window.

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

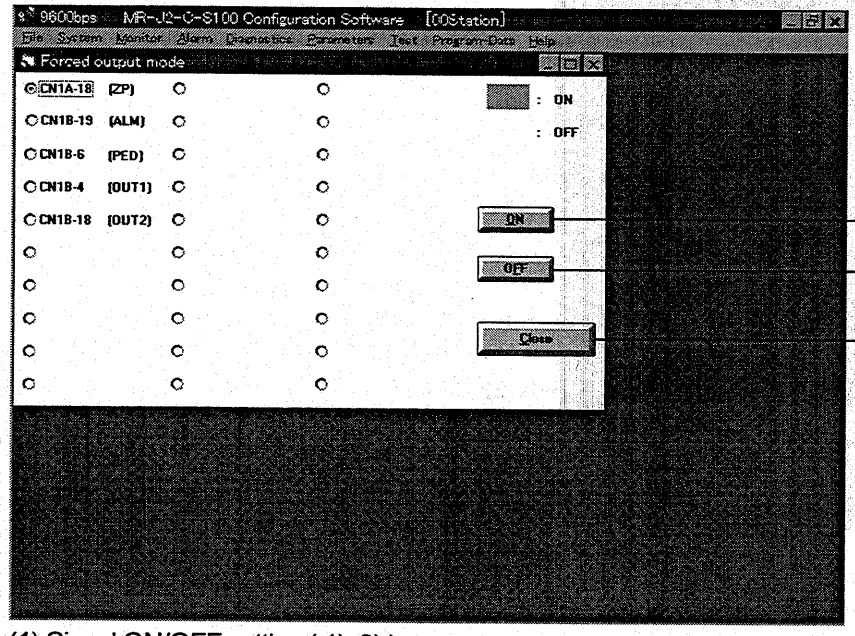
6.7.3 DO forced output

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.

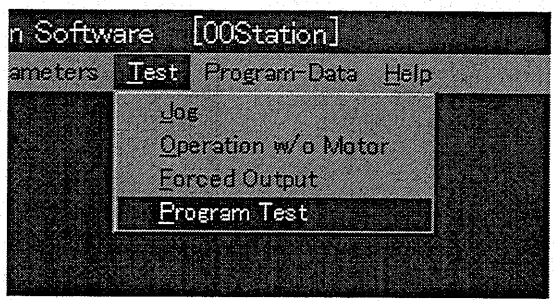
(2) DO forced output window closing (3))

Press the **Close** button to cancel the DO forced output mode and close the window.

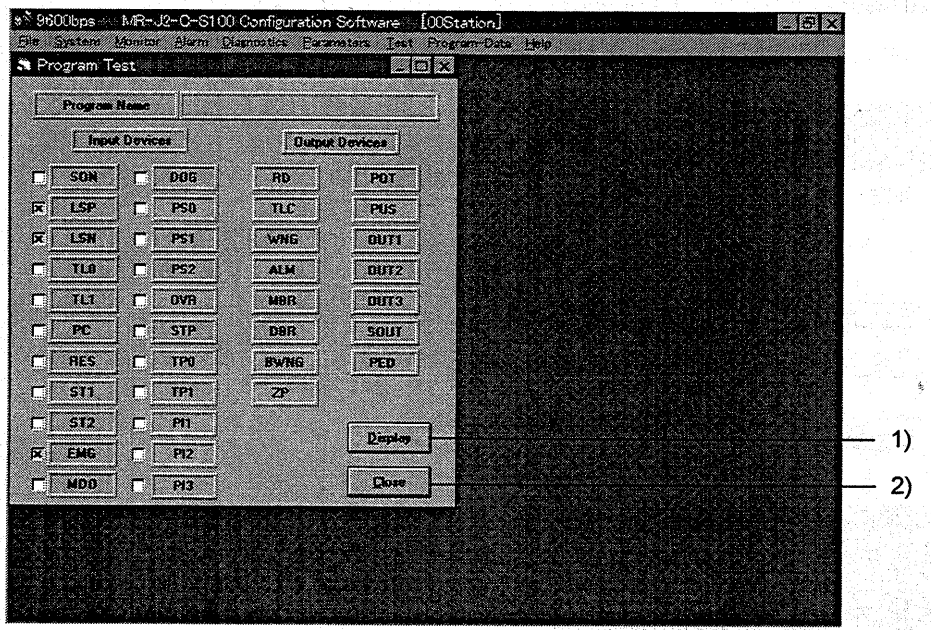
6.7.4 Program Test

Operation is performed in accordance with the preset program No.

Choose **Test** on the menu bar and choose **Program Test** on the menu.



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



(1) Display of program (1))

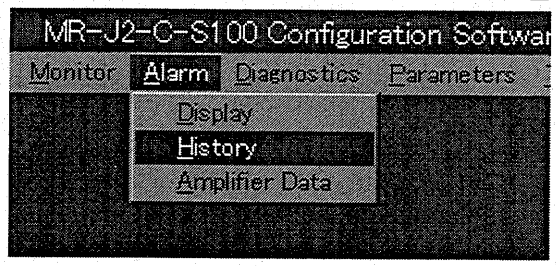
Enter the **Display** button to appear the program and program No..

(2) Program test window closing (2))

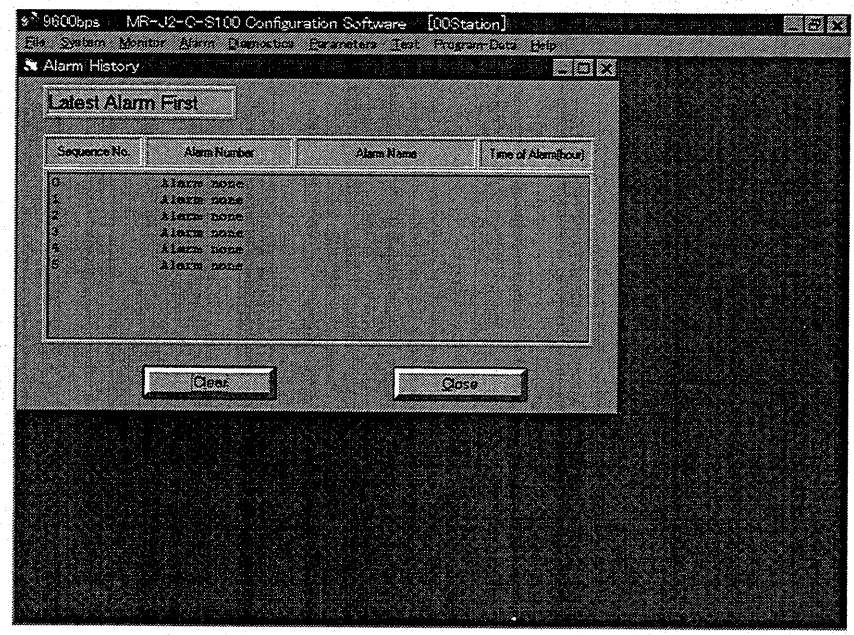
Press the **Close** button to cancel the program test and close the window.

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.

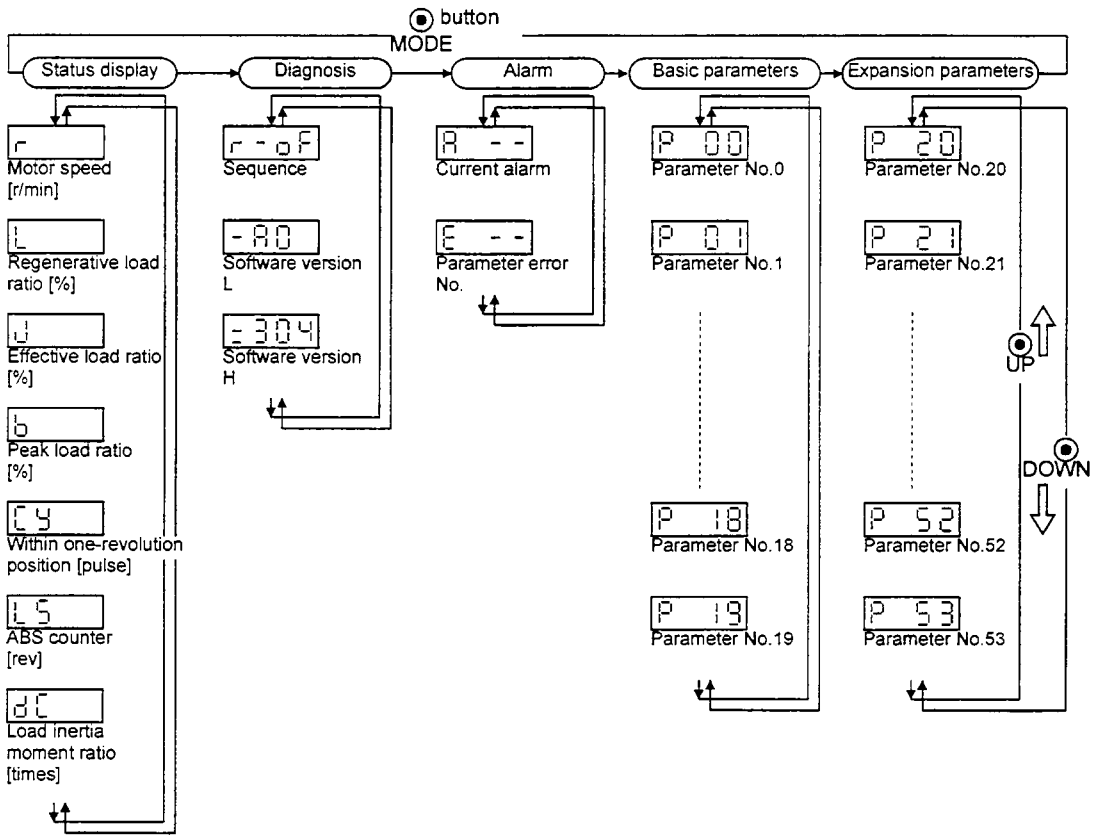
(3) Closing of alarm history window

Press the **Close** button to close the window.

7. DISPLAY AND OPERATION

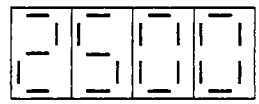
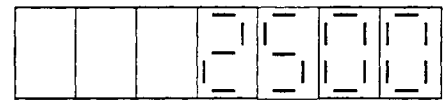
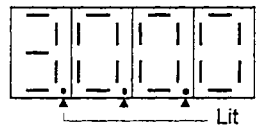
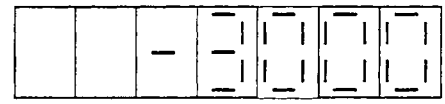
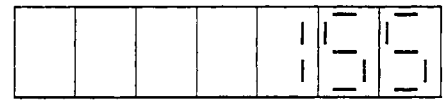
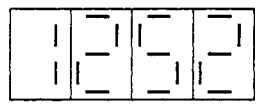
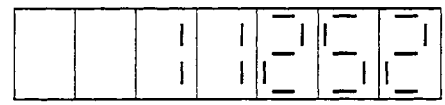
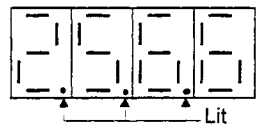
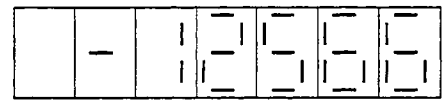
7.1 Display Flowchart

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

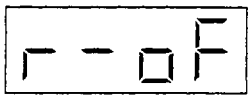
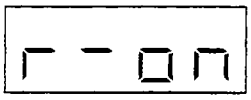
The servo status during operation is shown on the 4-digit, 7-segment LED display. Press the "UP or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol appears. Press the "SET" button to display its data.
The servo amplifier display shows the lower 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
Motor speed	Forward rotation at 3000r/min		
	Reverse rotation at 3000r/min		
Load inertia moment	15.5 times		
ABS counter	11252pulse		
	-12566pulse		

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

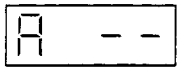
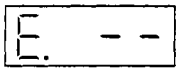
Status Display	Symbol	Unit	Description	Display Range	
				Servo amplifier Display	MR-DP60
Current position	—	mm	The current position from the machine home position of 0 is displayed.	Cannot be displayed.	-999999 to 999999
Command position	—	mm	The position data in the point table or the preset command 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
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
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.	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 po wer is displayed in %.	0 to 100	0 to 100
Effective load ratio	J	%	The continuous effective load torque is displayed. Rated torque is defined as 100% and the effective value for the past 15 seconds is displayed.	0 to 300	0 to 300
Peak load ratio	b	%	The peak torque is displayed. Rated torque is defined as 100% and the peak torque 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 encoder pulses. When the value exceeds the maximum number pulses, it returns to 0. The servo amplifier display shows the 4 lower digits of the actual within one-revolution position.	HC-MF · HA-FF · HC-UF 3000r/min: 0 to 8191 HC-SF · RF · UF2000r/min: 0 to 9999	HC-MF · HA-FF · HC-UF 3000r/min: 0 to 8191 HC-SF · RF · UF2000r/min: 0 to 16383
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.	-9999 to 9999	-32768 to 32767
Load inertia moment ratio	dc	Times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0.0 to 100.0	0.0 to 100.0

7.3 Diagnostic Mode

Name	Display	Description
Sequence		Not ready. Indicates that the servo amplifier is being initialized or an alarm has.
		Ready. Indicates that the servo was switched on after completion 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 alarm 33 (over voltage). Flickers at occurrence of the alarm.
Parameter error		Indicates no occurrence of alarm 37 (parameter error).
		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, switch power off, then on or press the "SET" button on the current alarm screen. Note that this should be done after removing the cause of the alarm.

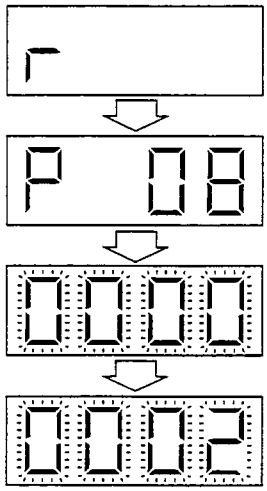
7.5 Parameter Mode

Change the parameter settings when:
- The regenerative brake option is used;
- The number of pulse per servo motor revolution is changed
  (When the number of pulse per servo motor revolution has been set to the position command unit, set number of pulses in the parameter of the position command unit unless the maximum number is restricted); or
- The machine mounted with the servo motor hunts or operational performance is further improved.

(1) Operation example

1) 4-digit parameter

The following example shows the operation procedure performed after power-on to change the zero setting system 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.

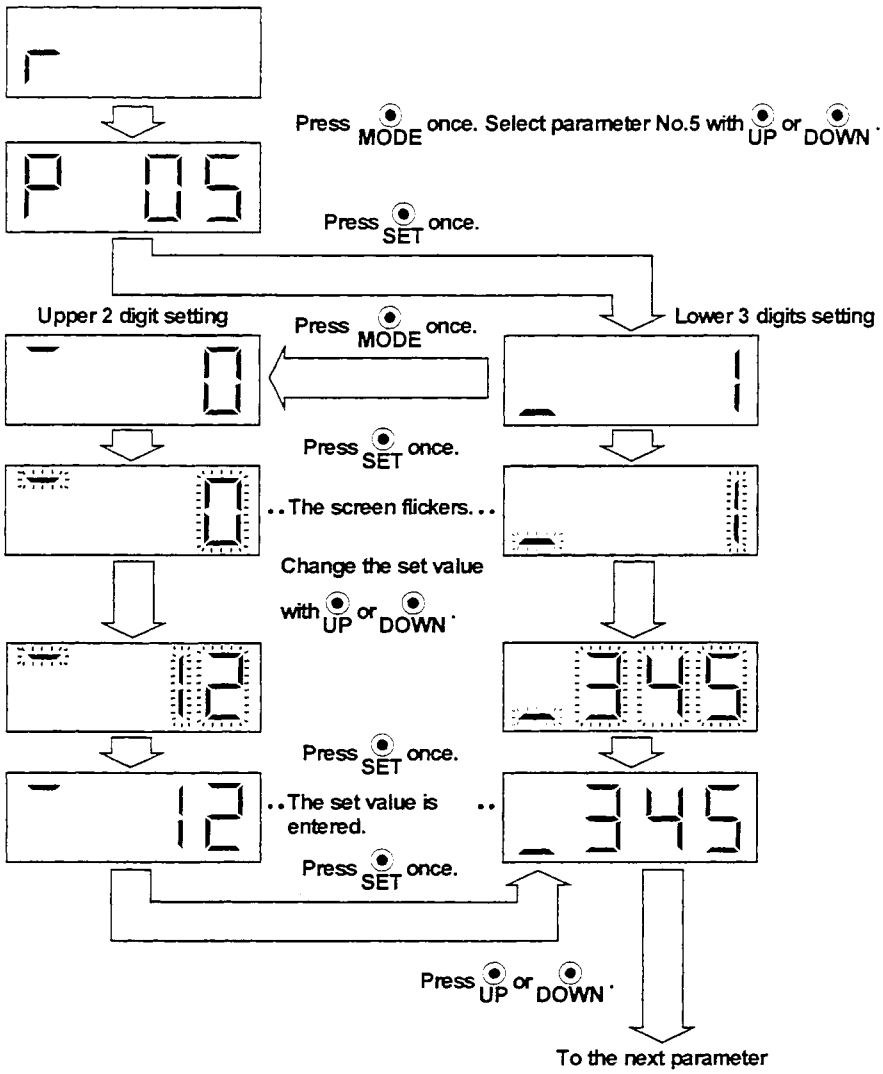
To shift to the next parameter, press the "UP" or "DOWN" button.

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).

8. COMMUNICATION FUNCTIONS

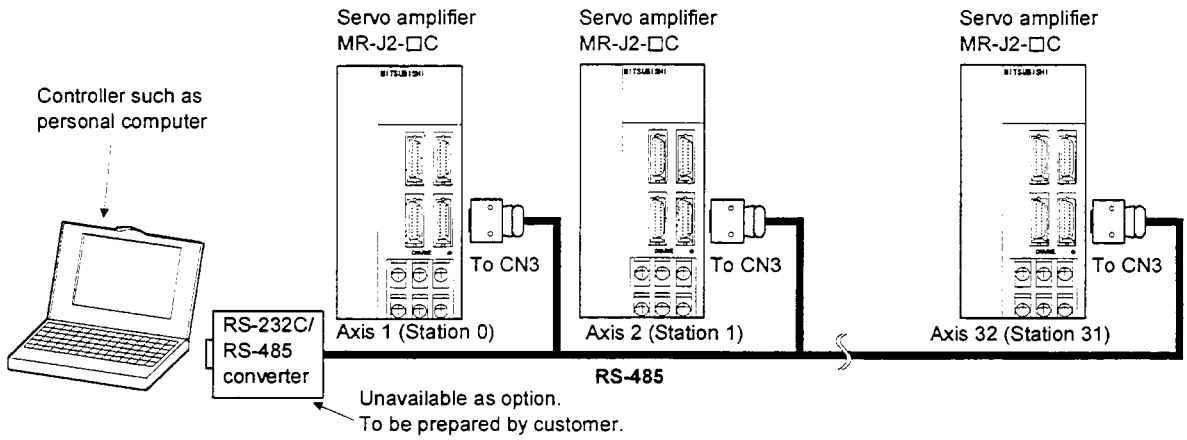
The MR-J2-C-S100 has the RS-485 and RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.
However, the RS-485 and RS-232C communication functions cannot be used together. Select between RS-485 and RS-232C with parameter No.16. (Refer to Section 5.2.7.)

8.1 Configuration

8.1.1 RS-485 configuration

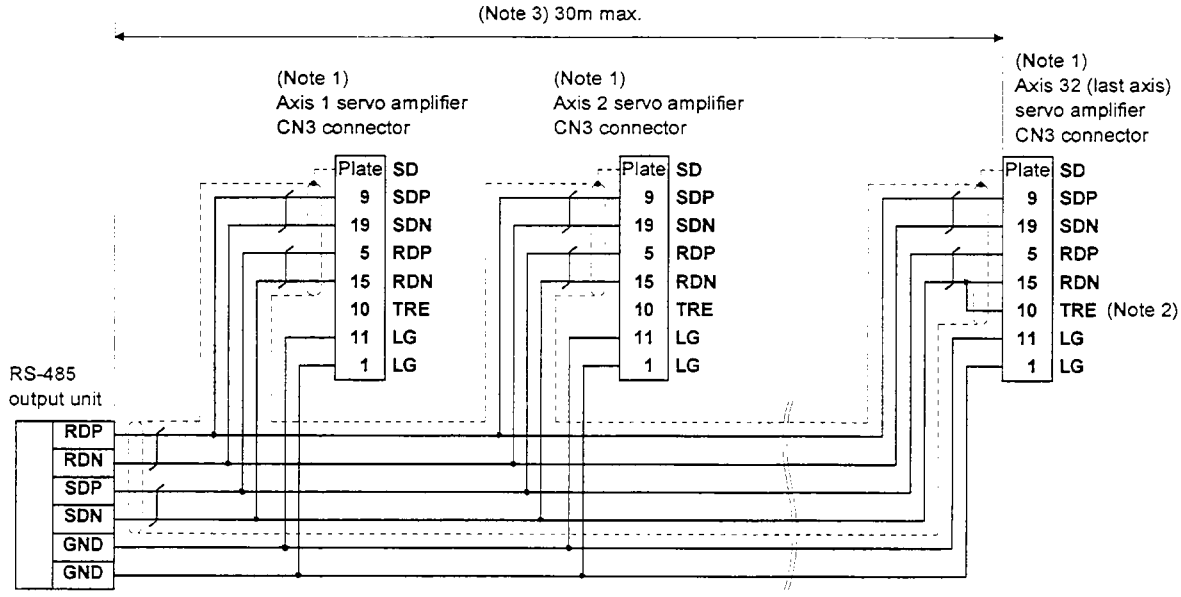
(1) Outline

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:

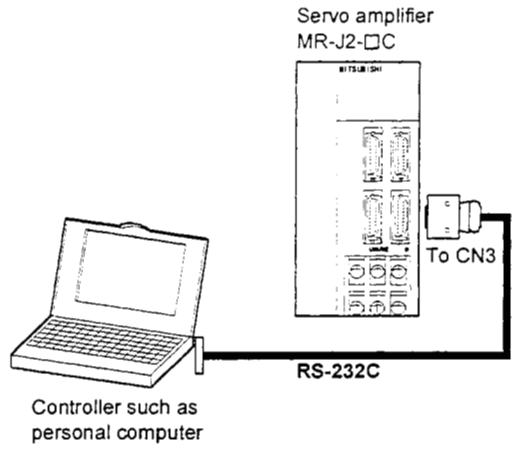


Note: 1. 3M's CN3 connector example is
Connector: 1020-3000VE
Shell kit: 10320-52F0-008
2. In the last axis, connect TRE and RDN.
3. 30m max. in environment of little noise.

8.1.2 RS-232C configuration

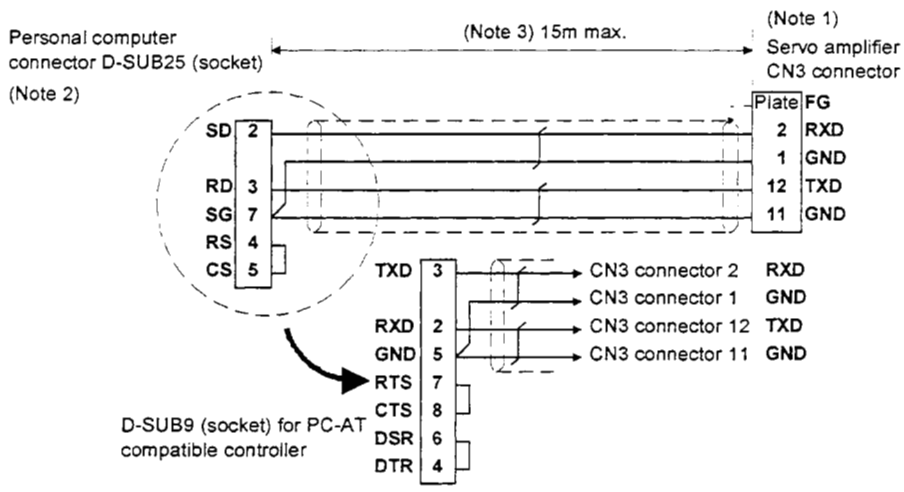
(1) Outline

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 14.1.2.)

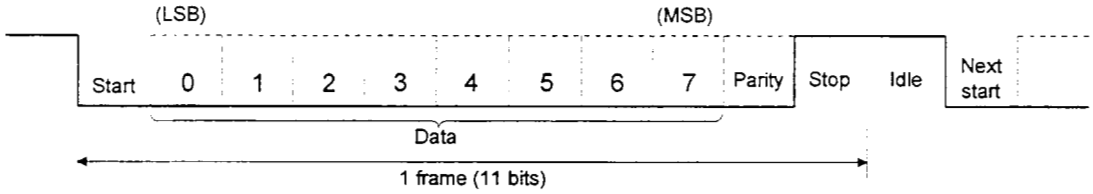


Note: 1. 3M's CN3 connector example is
Connector: 1020-3000VE
Shell kit: 10320-52F0-008
2. For the PC-98(NEC) series. The PC-98(NEC) series also has the half-pitch type.
3. 15m max. in environment of little noise.

8.2 Communication Specifications

The MELSERVO-J2 series 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 (e.g. MR-J2-C-S100 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

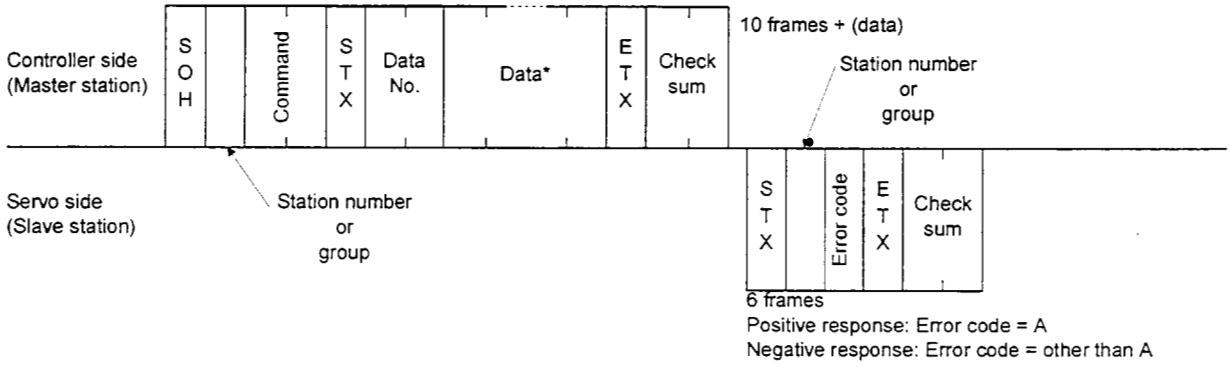


8.3 Protocol

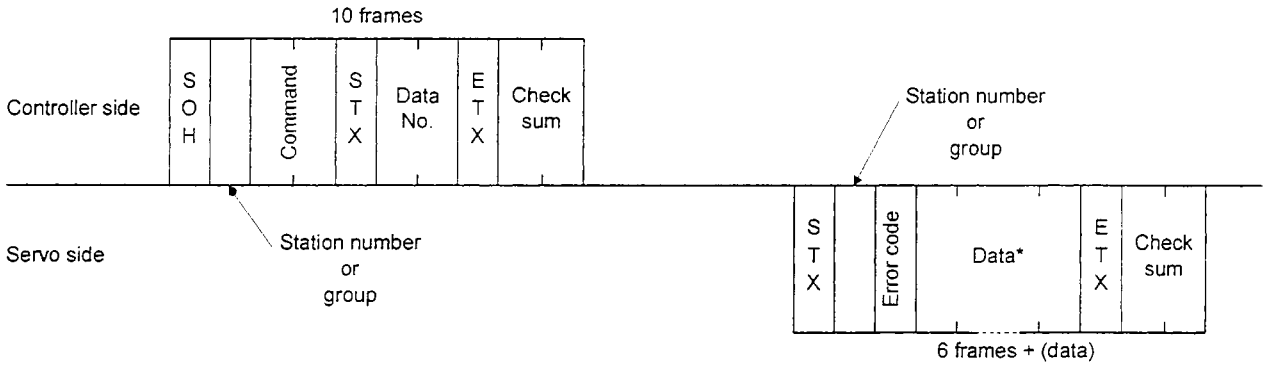
Since up to 32 axes may be connected to the bus, add a station number or group to the command, data No., etc. to determine the destination servo amplifier of data communication. Set the station number or group to each servo amplifier using the parameter. Transmission data is valid for the servo amplifier 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.

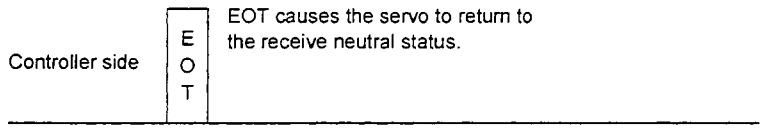
(1) Transmission of data from the controller to the servo



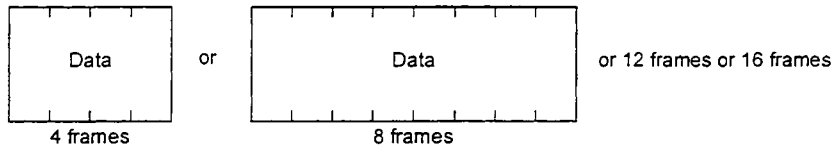
(2) Transmission of data request from the controller to the servo



(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).



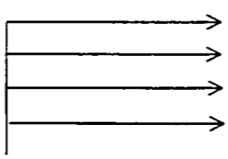
8.4 Character Codes

(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 unit 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~b_5	b_4	b_3	b_2	b_1
	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
	1	0	0	1
	1	0	1	0
	1	0	1	1
	1	1	0	0
	1	1	0	1
	1	1	1	0
	1	1	1	1

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

(3) Station numbers

You may set 32 station numbers from station 0 to station 31 and the ASCII unit codes are used 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

Example: Station number "0" (axis 1)

Transmit "30H" in hexadecimal.

(4) Group

Group	a	b	c	d	e	f	All group
ASCII code	a	b	c	d	e	f	*

Example: For group a

Transmit "61H" in hexadecimal.

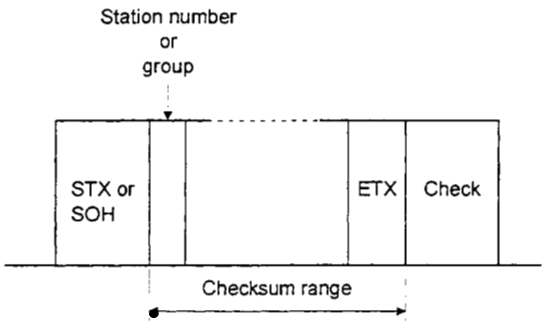
8.5 Error Codes

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.

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.	

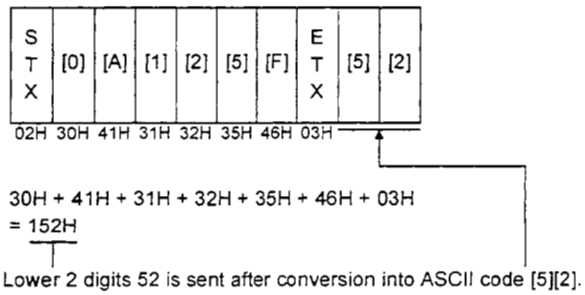
8.6 Checksum

Checksum range



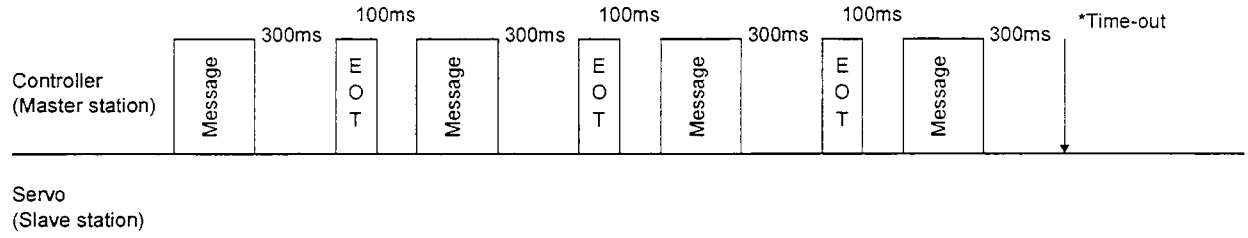
The check sum is a ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or S0H).

(Example)



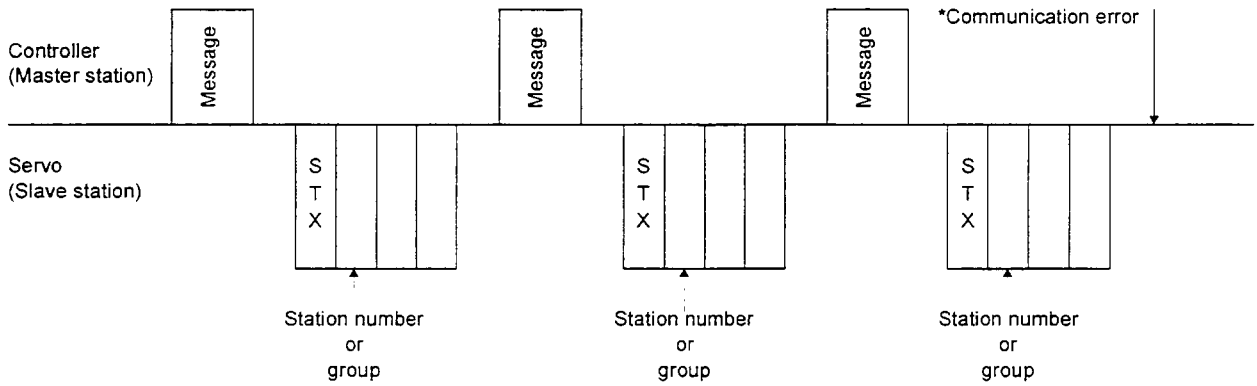
8.7 Time-Out Operation

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

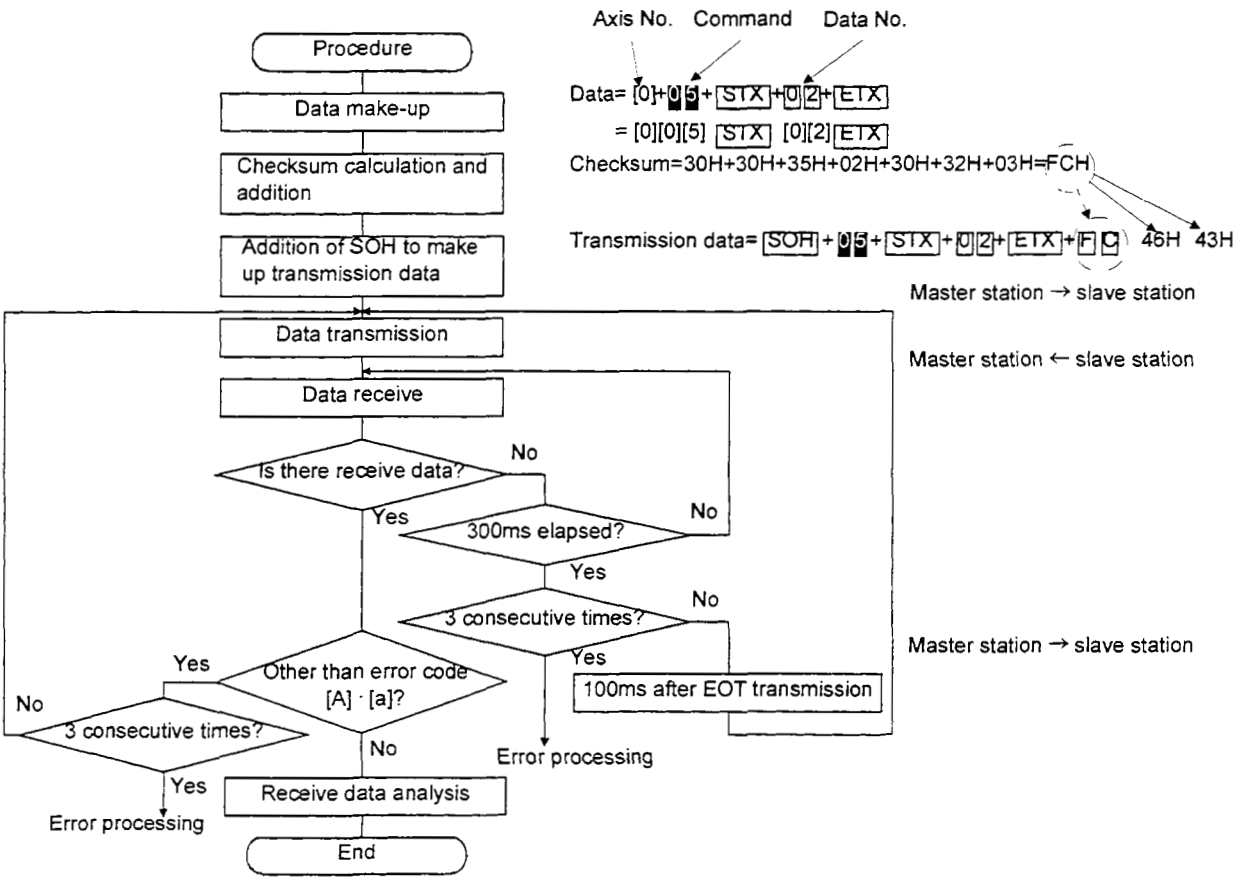
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

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	Frame Length
[0][1]	[8][0]	Status display data value and processing information (current position)	12
[0][1]	[8][1]	Status display data value and processing information (command position)	12
[0][1]	[8][2]	Status display data value and processing information (command remaining distance)	12
[0][1]	[8][3]	Status display data value and processing information (point table No.)	12
[0][1]	[8][4]	Status display data value and processing information (cumulative feedback pulses)	12
[0][1]	[8][5]	Status display data value and processing information (motor speed)	12
[0][1]	[8][6]	Status display data value and processing information (droop pulses)	12
[0][1]	[8][7]	Status display data value and processing information (override)	12
[0][1]	[8][8]	Status display data value and processing information (torque limit voltage)	12
[0][1]	[8][9]	Status display data value and processing information (regenerative load ratio)	12
[0][1]	[8][A]	Status display data value and processing information (effective load ratio)	12
[0][1]	[8][B]	Status display data value and processing information (peak load ratio)	12
[0][1]	[8][C]	Status display data value and processing information (within one-revolution position)	12
[0][1]	[8][D]	Status display data value and processing information (ABS counter)	12
[0][1]	[8][E]	Status display data value and processing information (load inertia moment ratio)	12

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

Command	Data No.	Description	Frame Length
[0][5]	[0][0]~ [3][5]	Current value of each parameter (Decimal number of data No. 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	Frame Length
[3][3]	[1][0]	Alarm number in alarm history (most recent alarm)	4
[3][3]	[1][1]	Alarm number in alarm history (first alarm in past)	4
[3][3]	[1][2]	Alarm number in alarm history (second alarm in past)	4
[3][3]	[1][3]	Alarm number in alarm history (third alarm in past)	4
[3][3]	[1][4]	Alarm number in alarm history (fourth alarm in past)	4
[3][3]	[1][5]	Alarm number in alarm history (fifth alarm in past)	4
[3][3]	[2][0]	Alarm occurrence time in alarm history (most recent alarm)	8
[3][3]	[2][1]	Alarm occurrence time in alarm history (first alarm in past)	8
[3][3]	[2][2]	Alarm occurrence time in alarm history (second alarm in past)	8
[3][3]	[2][3]	Alarm occurrence time in alarm history (third alarm in past)	8
[3][3]	[2][4]	Alarm occurrence time in alarm history (fourth alarm in past)	8
[3][3]	[2][5]	Alarm occurrence time in alarm history (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
[3][5]	[8][0]	Status display data value and processing information at alarm occurrence (current position)	12
[3][5]	[8][1]	Status display data value and processing information at alarm occurrence (command position)	12
[3][5]	[8][2]	Status display data value and processing information at alarm occurrence (command remaining distance)	12
[3][5]	[8][3]	Status display data value and processing information at alarm occurrence (point table No.)	12
[3][5]	[8][4]	Status display data value and processing information at alarm occurrence (cumulative feedback pulses)	12
[3][5]	[8][5]	Status display data value and processing information at alarm occurrence (motor speed)	12
[3][5]	[8][6]	Status display data value and processing information at alarm occurrence (droop pulses)	12
[3][5]	[8][7]	Status display data value and processing information at alarm occurrence (override)	12
[3][5]	[8][8]	Status display data value and processing information at alarm occurrence (torque limit voltage)	12
[3][5]	[8][9]	Status display data value and processing information at alarm occurrence (regenerative load ratio)	12
[3][5]	[8][A]	Status display data value and processing information at alarm occurrence (effective load ratio)	12
[3][5]	[8][B]	Status display data value and processing information at alarm occurrence (peak load ratio)	12
[3][5]	[8][C]	Status display data value and processing information at alarm occurrence (within one-revolution position)	12
[3][5]	[8][D]	Status display data value and processing information at alarm occurrence (ABS counter)	12
[3][5]	[8][E]	Status display data value and processing information at alarm occurrence (load inertia moment ratio)	12

(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

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]~ [3][5]	Each parameter write (Decimal number of data No. 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

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

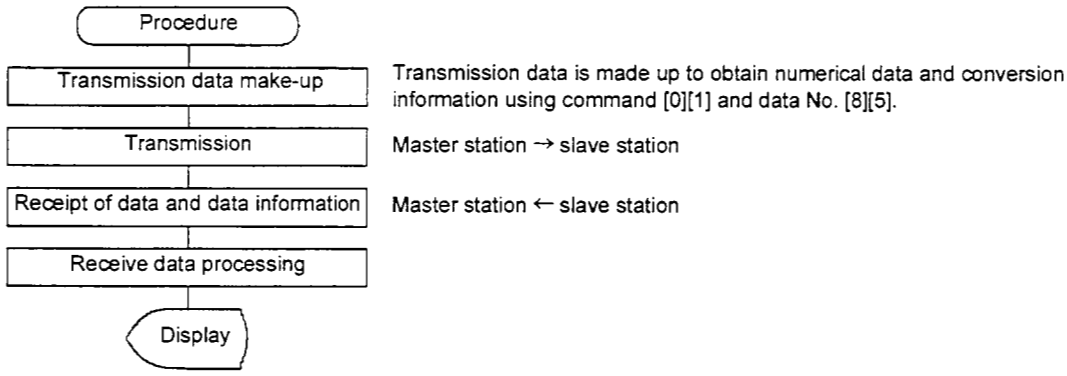
Command	Data No.	Description	Setting Range	Frame Length
[9][F]	[0][0]	Group setting		4

8.12 Detailed Explanations of Commands

8.12.1 Data processing

When the master station sends a command and data No. or a command, data No. and data to the slave station,the servo amplifier sends back a reply or data according to the purpose. These transmission data and receive data may be used to represent numerical values such as decimal and hexadecimal numbers. This information is also included in the data sent back.
Receive data used should be the data which has been processed by numerical conversion or decimal point operation. Data transmitted should be the data processed according to this rule.

Example : To obtain data to display the analog speed command voltage on the display device of the master station in terms of voltage [V].



When the display type is 0, 8-character data is converted from hexadecimal into decimal and is provided with a decimal point according to the decimal point position information.
When the display type is 1, 8-character data remains unchanged.

Example : Receive data is ■■3000000929
Since 00000929H is converted into 2345 and the decimal point position is 3 (lower third digit), the display value is 23.45.

Whether data should be processed or not and the processing method depend on the monitoring, parameters, etc. Follow the corresponding detailed explanations.

8.12.2 Status display

(1) Status display data read

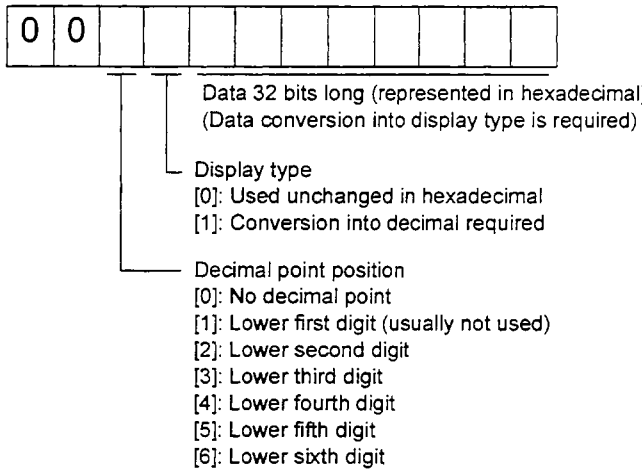
When the master station transmits the data No. (refer to the following table for assignment) to the slave station, the slave station sends back the data value and data processing information.

1) Transmission

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

2) 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.

Transmission

Command	Data No.	Data
[8][1]	[0][0]	[1][E][A][5]

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.

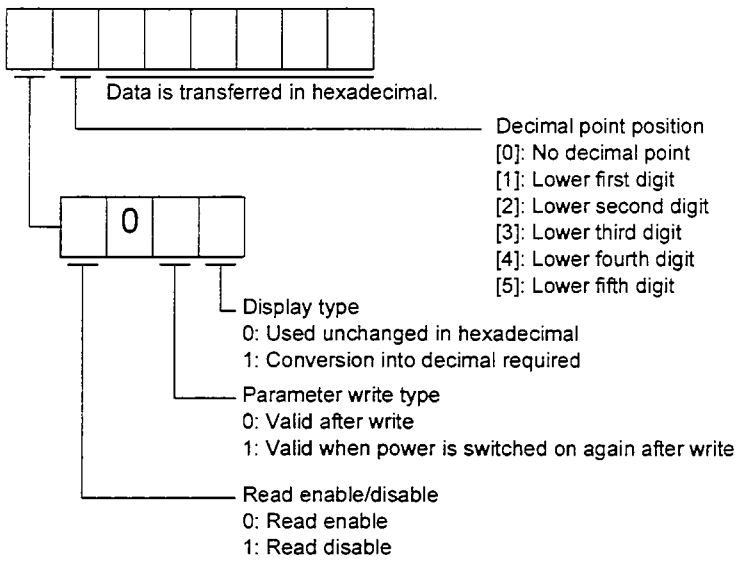
1) Transmission

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

Command	Data No.	Data No. Definition
[0][5]	[0][0]~ [3][5]	Corresponds to the parameter No.

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.

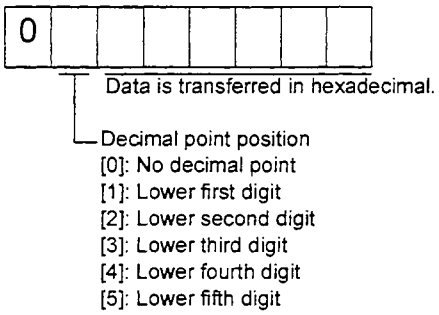
Transmission

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

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]~ [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.

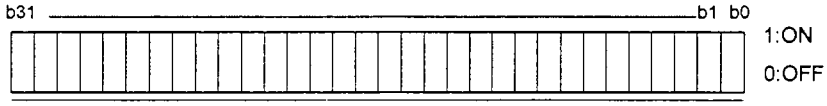
1) Transmission

Transmit command [1][2] and data No. [0][0].

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

2) 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 (MDO)
18	Proximity dog (DOG)
19	Program No. selection 1 (PS0)

bit	Signal Name
20	Program No. selection 2 (PS1)
21	Program No. selection 3 (PS2)
22	Program No. selection 4 (PS3)
23	Override selection (OVR)
24	Temporary stop/restart (STP)
25	External pulse multiplication 1 (TP0)
26	External pulse multiplication 2 (TP1)
27	Program input 1 (PI1)
28	Program input 2 (PI2)
29	Program input 3 (PI3)

(2) External input pin status read

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

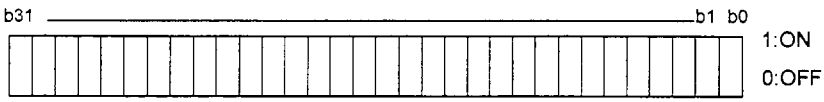
1) Transmission

Transmit command [1][2] and data No. [4][0].

Command	Data No.
[1][2]	[4][0]

2) 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	CN1B-19

(3) Read of the statuses of input devices switched on through communication

Read the ON/OFF statuses of the input devices switched on through communication.

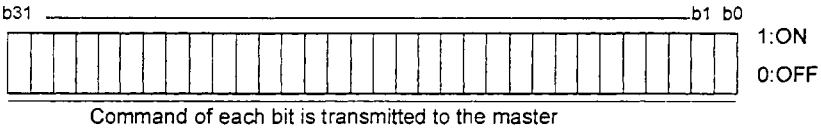
1) Transmission

Transmit command [1][2] and data No. [6][0].

Command	Data No.
[1][2]	[6][0]

2) 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 (MDO)
18	Proximity dog (DOG)
19	Program No. selection 1 (PS0)

bit	Signal Name
20	Program No. selection 2 (PS1)
21	Program No. selection 3 (PS2)
22	Program No. selection 4 (PS3)
23	Override selection (OVR)
24	Temporary stop/restart (STP)
25	External pulse multiplication 1 (TP0)
26	External pulse multiplication 2 (TP1)
27	Program input 1 (PI1)
28	Program input 2 (PI2)
29	Program input 3 (PI3)

(4) External output pin status read

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

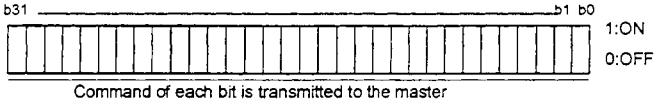
1) Transmission

Transmit command [1][2] and data No. [C][0].

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

2) 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

(5) Read of the statuses of output devices

Read the ON/OFF statuses of the output devices.

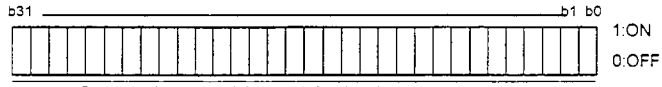
1) Transmission

Transmit command [1][2] and data No. [8][0].

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

2) 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	
6	
7	Warning (WNG)
8	Trouble (ALM)

bit	Signal Name
9	
10	Electromagnetic brake (MBR)
11	Dynamic brake (DBR)
12	
13	
14	
15	Battery warning (BWNG)
16	
17	Zeroing completion (ZP)

bit	Signal Name
18	Position range output (POT)
19	Temporary stop (PUS)
20	Program output 1 (OUT1)
21	Program output 2 (OUT2)
22	Program output 3 (OUT3)
23	SYNC synchronous (SOUT)
24	Movement completion (PED)
25	
26	

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.

Transmission

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 (MDO)
18	Proximity dog (DOG)
19	Point table selection 1 (DI0)

bit	Signal Name
20	Program No. selection 2 (PS1)
21	Program No. selection 3 (PS2)
22	Program No. selection 4 (PS3)
23	Override selection (OVR)
24	Temporary stop/restart (STP)
25	External pulse multiplication 1 (TP0)
26	External pulse multiplication 2 (TP1)
27	Program input 1 (PI1)
28	Program input 2 (PI2)
29	Program input 3 (PI3)

8.12.6 Alarm history

(1) Alarm No. read

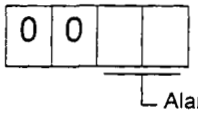
Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No.0 (last alarm) to No.5 (sixth alarm in the past) are read.

1) Transmission

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

2) Reply

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



Example:
A.32 : 0032
A.50 : 0050
A._ : 00FF (no alarm)

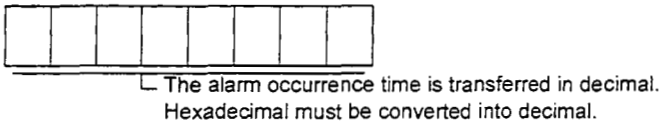
(2) Alarm occurrence time read

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.

1) Transmission

Send command [3][3] and data No. [2][0] to [2][5].
Refer to Section 8.11.1.

2) Reply



Example:
For data [0][1][F][5], the alarm occurred in 501 hours after start of operation.

(3) Alarm history clear

Erase the alarm history.

Transmission

Send command [8][2] and data No. [2][0].

Command	Data No.	Data
[8][2]	[2][0]	[1][E][A][5]

8.12.7 Current alarm

(1) Current alarm read

Read the alarm which is occurring currently.

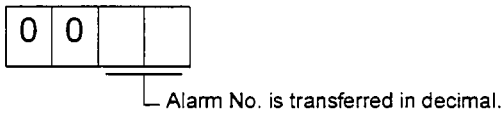
1) Transmission

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

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

2) Reply

The slave station sends back the alarm currently occurring.



Example:

A.32 : 0032

A.50 : 0050

A._ : 00FF (no alarm)

(2) Read of the status display at alarm occurrence

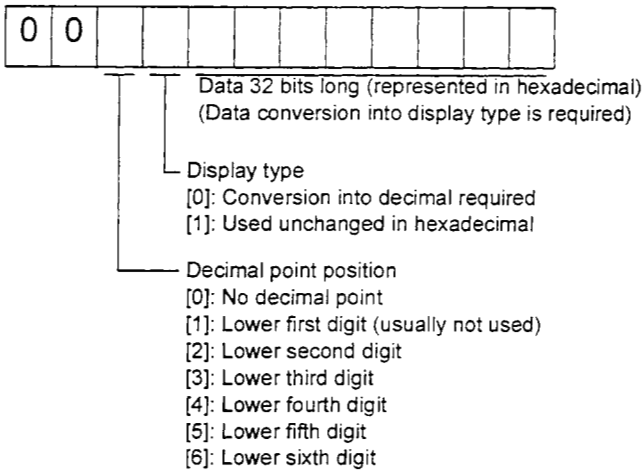
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

1) 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.

2) 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]	[1][E][A][5]

8.12.8 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-485 communication.

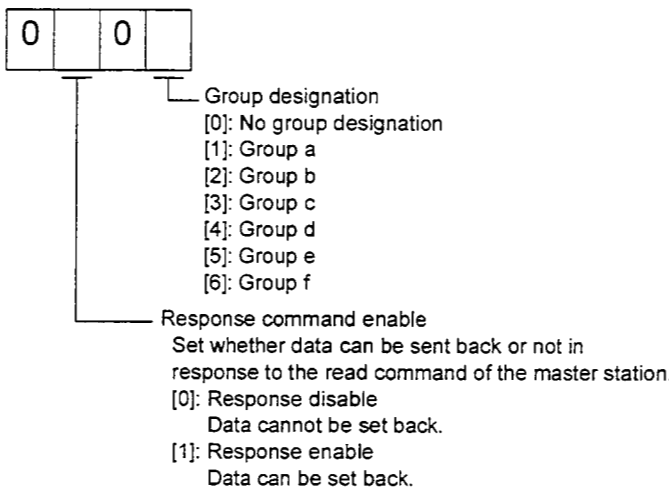
(1) Group setting write

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.

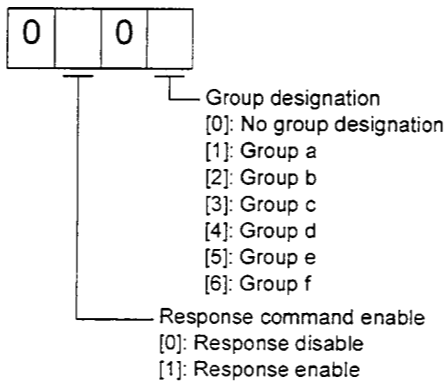
1) Transmission

Transmit command [1][F] and data No. [0][0].

Command	Data No.
[1][F]	[0][0]

2) Reply

The slave station sends back the group setting of the point table requested.



8.12.9 Other commands

(1) Servo motor end pulse unit absolute position

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

1) Transmission

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

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

2) 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)

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.

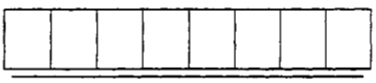
1) Transmission

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

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

2) 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)

Example:

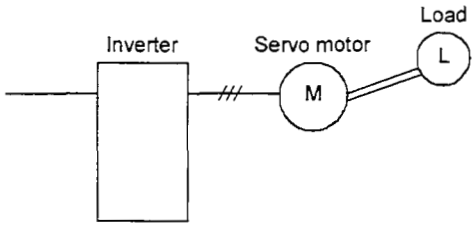
Data "000186A0" is 100000 [pulse] in the command unit.

9. ADJUSTMENT

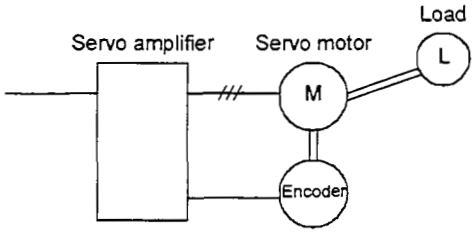
9.1 What Is Gain Adjustment?

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). Hence, the driver side supplies operation power independently of the motor and machine motions.

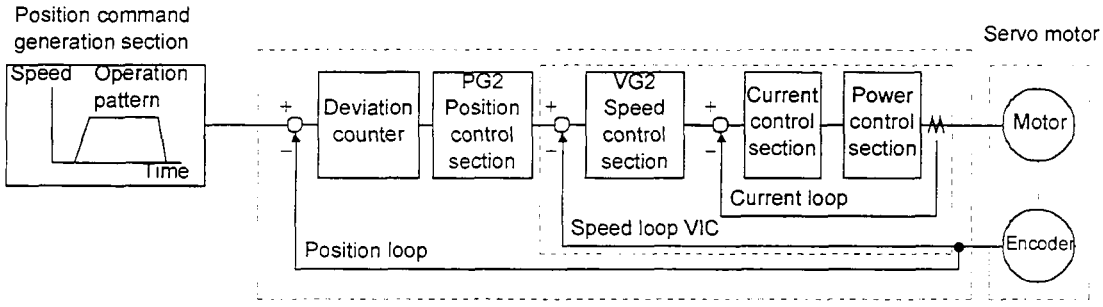


On the other hand, the servo amplifier always detects the positions and speeds of the motor and machine using the servo motor encoder, and exercises control to match the position and speed commands with the actual motor (machine) position and speed. In the servo system, adjustment is needed because:



1) Control performance changes according to the inertia moment of the machine;
2) Detected speed varies due to the resonance point, etc. peculiar to the machine; or
3) Operation is delayed to meet the accuracy specifications due to differences in operation delay and accuracy specifications between machines.

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 MELSERVO-J2-C, 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.

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

$$\text{m: Load inertia moment ratio } \left[= \frac{J_L}{J_M}\right]$$

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 f_p[rad/s] = amplifier gain setting PG2[rad/s]

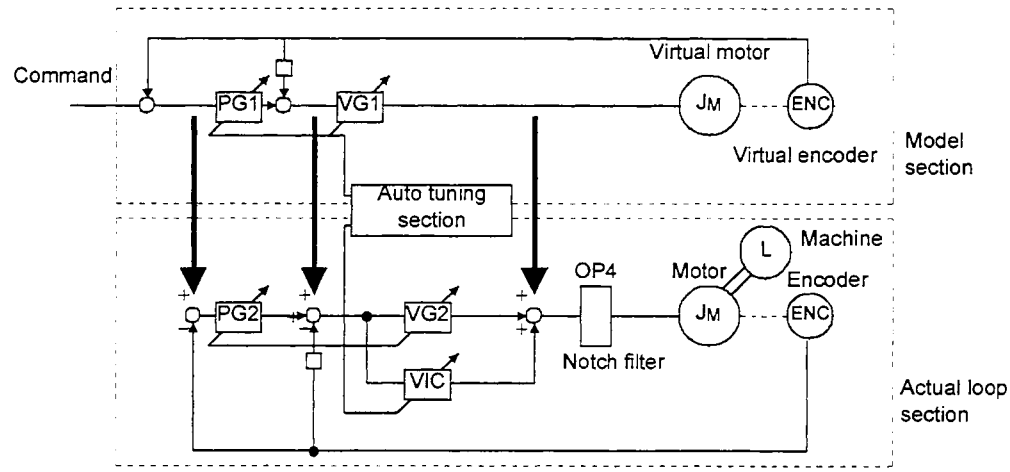
When the motor is installed to the machine, the gain must be adjusted to satisfy $f_v = 4$ to $6f_p$ according to the load inertia moment ratio m.

9.2 Gain adjustment

9.2.1 Parameters required for gain adjustment

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

9.2.2 Block diagram



The block diagram of the MELSERVO-J2-C-S100 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.

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

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".
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 (Note)		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	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

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) Operation pattern

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

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" auto tuning in parameter No.3.
3) Gradually decrease the speed integral compensation VIC (parameter No.38) setting.

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.
   Set 2□□□ or 3□□□ in 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 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

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 filter.
   Set 2□□□ or 3□□□ in parameter No.22.
3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) Increase the machine resonance filter value gradually and repeat step 3).
   The optimum value is provided at the point just before vibration increases.
5) To further shorten the settling time, gradually increase the response setting in parameter No.3 and repeat steps 1) to 4).

Adjustment 2

1) Choose the response setting of slow response.
   Set 0101 in parameter No.3.
2) 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 parameter No.34 value.

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

3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) Decrease the speed loop gain 2 (parameter No.37) to a value about 1000 smaller than the automati-cally set value and repeat steps 2) to 4) in Adjustment 1.
   The optimum value is provided at the point just before vibration increases.
5) When there is no machine resonance, check the operating status and gradually increase the speed loop gain 2 (parameter No.37) and repeat steps 2) to 4) in Adjustment 1.
   Set the value about 50 to 100 smaller than the value at which gear sound begins to be generated.
   Increase this gain if there is variation in the machine because a timing belt or the like is used.
6) To further shorten the settling time, gradually increase the response setting of parameter No.3 and repeat steps 1) to 5).

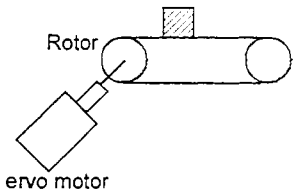
9.4.3 Load inertia moment is 20 or more times

(1) Machine condition

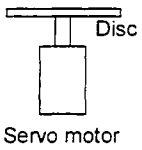
The machine inertia moment is 20 times or more and the servo motor oscillates at low frequency (5Hz or more). At this time, servo motor shaft vibration can be confirmed visually.

This adjustment method is valid for the following machines:

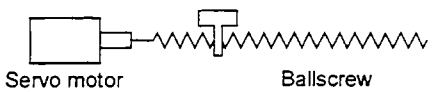
1) Machine in which a timing belt is driven without reduction gear



2) Machine in which a disc is rotated without reduction gear



3) Machine of which ballscrew lead is long



(2) Adjustment procedure

1) Choose the response setting of slow response.
   Set 0101 in parameter No.3.

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 parameter No.34 value.

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

3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.

4) If vibration still persists, repeat steps 2) and 3).

5) If vibration still persists, make Adjustment 1 and Adjustment 2 in paragraph (2) of Section 9.4.2.

6) After the end of the above adjustment, make Adjustment 1 in Section 9.4.1 to further improve performance.

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.
4) 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 parameter No.34 value.

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

4) Set □2□□ in parameter No.3 to make auto tuning invalid.
   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
No.7	PG1	Position loop gain 1	Higher setting shortens the settling time but is liable to cause overshooting.
No.35	PG2	Position loop gain 2	
No.36	VG1	Speed loop gain 1	Higher setting improves the servo response leve l but is liable to cause vibration.
No.37	VG2	Speed loop gain 2	
No.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 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.

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

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

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

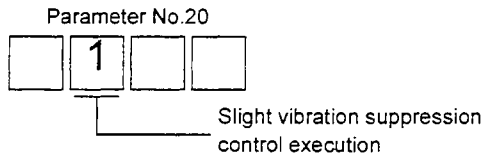
3) Match position loop gain 1 to the minimum value of each axis to make the gains of all axes equal.

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 in 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 and/or inspection, make sure that the charge lamp is off more than 10 minutes after power-off.
  Then, confirm that the voltage is safe in the tester or the like. Otherwise, you may get an electric shock.
- Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your safes representative.

POINT

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

(1) Inspection

It is recommended to make the following checks periodically:

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

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

(2) Life

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

Part Name		Standard Life	Remarks
Servo amplifier	Smoothing capacitor	10 years	Standard life is given for your reference. If the part has not yet reached the end of its standard life, it must be changed as soon as it is found faulty.
	Relay	-	
	Cooling fan	10,000 to 30,000 hours (2 to 3 years)	
	Absolute position battery	10,000 hours	

(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 at cumulative 100,000 switching times (switching life), which depends on the power supply capacity.

(c) Servo amplifier cooling fan : The cooling fan bearings reach the end of their life in 10,000 to 35,000 hours. Normally, therefore, the fan must be changed in a few years of continuous operation as a guideline.
It must also be changed if unusual noise or vibration is found during inspection.

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 CN2 are disconnected.	1) Power supply voltage fault 2) Servo amplifier is faulty.	-
			Improved when connectors CN1A and CN1B are disconnected.	Power supply of CN1 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1) Power supply of encoder cabling is shorted. 2) Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply is shorted.	
		Alarm occurs.	Refer to Section 11.2 and remove cause.		Section 11.2
2	Switch on servo-on Signal.	Alarm occurs.	Refer to Section 11.2 and remove cause.		Section 11.2
		Servo motor shaft is not servo-locked (is free).	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 accelerati on and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
4	Cyclic operation	Position shift occurs	Confirm the cumulative comm and pulses, cumulative feedback pulses and actual servo motor position.	Communication command error, machine slip, etc.	Section 11.2

11.2 When Alarm or Warning Has Occurred

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.

	Display	Name	(Note) Deactivation by Alarm Reset (RES)
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	×
	A. 17	Board error 2	×
	A. 18	Board error 3	×
	A. 20	Encoder error 2	×
	A. 24	Motor output ground fault	×
	A. 25	Absolute position erase	×
	A. 30	Regenerative error	○
	A. 31	Overspeed	○
	A. 32	Overcurrent	○
	A. 33	Overvoltage	○
	A. 35	Manual pulse generator input error	○
	A. 37	Parameter error	×
	A. 39	Program error	×
	A. 46	Servo motor overheat	○
	A. 50	Overload 1	○
	A. 51	Overload 2	○
	A. 52	Error excessive	○
	A. 63	Zeroing incomplete	○
	A. 64	Zero setting error	○
	A. 8A	Serial communication time-out	○
	A. 8E	Seal communication error	○
	8888	Watchdog	×
	A. 92	Open battery cable warning	
	A. 98	Software limit warning	
	A. 9F	Battery warning	
	A. E0	Excessive regenerative load warning	
	A. E1	Overload warning	
	A. E3	Absolute position counter warning	
	A. E6	Servo emergency stop	
	A. E9	Main circuit off warning	

Note: ○: Deactivation by alarm reset (RES) or power OFF→ON

×: Deactivation by power OFF→ON

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 30 minutes for cooling before resuming operation.
  If operation is resumed by switching control circuit power off, then on to reset the alarm, the servo amplifier, servo motor and regenerative brake option may become faulty.
  - Regenerative alarm (A. 30)
  - 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.

When an alarm occurs, the trouble signal (ALM) switches off and the display shows the corresponding alarm number. The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section.
The optional Configuration Software may be used to refer to the cause. The "O" mark in the "Deactivation by Alarm Reset (RES)" field in the list indicates that the alarm may be deactivated not only by switching power off, then on but also by using alarm reset (RES).

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
A. 10	Undervoltage	Power supply voltage dropped. 160V or less	1. Power supply voltage is low.	Review the power supply.	O
			2. Power failed instantaneously for 15ms or longer.		
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.		
			4. Power switched on within 5s after it had switched off.		
			5. Faulty parts in the servo amplifier Checking method Alarm (10) occurs if power is switched on after all 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 all connectors are disconnected.	Change the servo amplifier.	×
A. 12	Memory error 1	RAM, ROM fault			
A. 13	Clock error	Printed board fault			
A. 15	Memory error 2	EEPROM fault			
A. 16	Encoder error 1	Communication error occurred between encoder and servo amplifier.	1. Encode connector disconnected.	Connect correctly.	
			2. Encoder fault	Change the servo motor.	
			3. Encoder cable faulty (Wire breakage or short)	Repair or change cable.	

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
A. 17	Board error 2	CPU/parts fault	Faulty parts in the servo amplifier Checking method Alarm (A. 17 or A. 18) occurs if power is switched on after all connectors have been disconnected.	Change the servo amplifier.	×
A. 18	Board error 3	Printed board fault			×
A. 20	Encoder error 2	Communication error occurred between encoder and servo amplifier.	1. Encoder connector disconnected.	Connect correctly.	×
			2. Encoder cable faulty (wire breakage or short)	Repair or change the cable.	
A. 24	Motor outout ground fault	Ground fault occurred at the servo motor outputs (U,V and W phases) of the servo Amplifier.	1.Power input cable and servo motor output cable are making contact at the main circuit terminal block (TE1).	Connect correctly.	×
			2.Servo motor power cable insulation deteriorated.	Change the cable.	
A. 25	Absolute position erase	Absolute position data in error	1. Reduced voltage of super capacitor in encoder	After alarm has occurred, hold power on for a few minutes, and switch it off once, then on again. Make home position return again.	×
			2. Battery voltage low	Change battery. Make home position return again.	
			3. Battery cable or battery is faulty.		
A. 30	Regenerative alarm	Permissible Regenerative power of the built-in regenerative brake resistor or regenerative brake option is exceeded.	1. Wrong setting of parameter No. 0	Set correctly.	○
			2. Built-in regenerative brake resistor or regenerative brake option is not connected.	Connect correctly	
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative brake option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative brake option of larger capacity. 3. Reduce the load.	
			Power supply voltage is abnormal. 260V or more	Review power supply	
		Regenerative transistor fault	5. Regenerative transistor faulty. Checking method 1) The regenerative brake option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative brake resistor or regenerative brake option.	Change the servo amplifier.	
			6. Built-in regenerative brake resistor or regenerative brake option faulty.	Change servo amplifier or regenerative brake option.	
		Cooling fan stop (MR-J2-200C-S100 · 350C-S100)	7. Unusual overheat due to cooling fan stop	1. Change the servo amplifier or cooling fan. 2. Reduce ambient temperature.	

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
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 constant.	
			4. Encoder faulty.	Change the servo motor.	
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 (IPM) of the servo amplifier faulty. Checking method Alarm (A. 32) occurs if power is switched on after U, V and W are disconnected.	Change the servo amplifier.	
			3. Ground fault occurred in servo amplifier output phases U, V and W.	Correct the wiring.	
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.	
A. 33	Overvoltage	Converter bus voltage exceeded 400V.	1. Lead of built-in regenerative brake resistor or regenerative brake option is open or disconnected.	1. Change lead. 2. Connect correctly.	○
			2. Regenerative transistor faulty.	Change servo amplifier	
			3. Wire breakage of built-in regenerative brake resistor or regenerative brake option	1. For wire breakage of built-in regenerative brake resistor, change servo amplifier. 2. For wire breakage of regenerative brake option, change regenerative brake option.	
			3. Capacity of built-in regenerative brake resistor or regenerative brake option is insufficient.	Add regenerative brake option or increase capacity.	
A. 35	Manual pulse generator input 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 command pulse frequency to a proper value.	○
			2.Noise entered the pulses of the manual pulse generator.	Take action against noise.	
			3.Manual pulse generator failure	Change the manual pulse generator.	

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
A. 37	Parameter error	Parameter setting is wrong.	1. Servo amplifier fault caused the Parameter setting to be rewritten.	Change the servo amplifier.	×
			2. Regenerative brake option not used with servo amplifier was selected in parameter No.0.	Set parameter No.0 correctly .	
			3. Point table data is in error.	Set the point table data correctly.	
A. 39	Program error	Program sum check error	Program sum check is different at the power on.	Check the program	×
A. 46	Servo motor overheat	Servo motor temperature rise actuated the thermal protector.	1. Ambient temperature of servo motor is over 40℃.	Review environment so that ambient temperature is 0 to 40℃.	○
			2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.	
			3. Thermal protector in encoder faulty.	Change servo motor.	
A. 50	Overload 1	Load exceeded overload protection characteristic servo amplifier. Load ratio 300%: 2.5s or more Load ratio 200%: 100s or more Servo motor locked: 1s or more	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 2. 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 slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	Change the servo motor.	

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
A. 51	Overload 2	Machine collision or the like caused max. output current to flow successively for several seconds.	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.	O
			3. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.	
			3. Servo system is instable and hunting .	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.	
			4. Encoder faulty. Checking method When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	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.	O
			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.	
			4. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 2. Use servo motor that provides larger output.	
			6. Machine struck something.	1. Review operation pattern. 2. Install limit switches.	

Display	Name	Definition	Cause	Action	Deactivation by Alarm Reset (RES)
A. 52	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 terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.	
A. 63	Zeroing incomplete	In incremental system: 1. Positioning operatio was erformed without zeroing. 2. Zeroing ended abnormally	1. Positioning operation was performed without zeroing. 2. Zeroing speed could not be decreased to creep speed. 3. Limit switch was actuated during zeroing starting at other than position beyond dog.	1. Positioning operation was performed without zeroing. 2. Zeroing speed could not be decreased to creep speed. 3. Limit switch was actuated during zeroing starting at other than position beyond dog.	○
		In absolute position detection system: 1. Positioning operation was performed without zero setting. 2. Zero setting ended abnormally.	1. Positioning operation was performed without zero setting. 2. Zero setting speed could not be decreased to creep speed. 3. Limit switch was actuated during zero setting starting at other than position beyond dog.	1. Perform zero setting. 3. Review zero setting speed/creep speed/moving distance after proximity dog.	
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 connecto disconnected.	Connect correctly.	○
			2. Communication cable fault	Repair or change the cable.	
			2. 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.	○
			3. 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 all connectors are disconnected.	Change servo amplifier.	×

11.2.3 Remedies for Warnings

If a warning occurs, the servo amplifier does not go into a servo off status. However, if operation is continued in the warning status, an alarm may occur or proper operation not performed.
Eliminate the cause of the warning according to this section. Use the optional set-up software to refer to the cause of warning.

Display	Name	Definition	Cause	Action
A. 92	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or change battery.
			2. Battery voltage dropped to 2.8V or less.	Change battery.
A. 96	Zero setting error	1. In incremental system: Zeroing could not be made. 3. In absolute position detection system: Zero setting 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.
A. 9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less.	Change the battery.
A. E0	Excessive regenerative load warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative brake resistor or regenerative brake option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative brake resistor or regenerative brake option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenaratiove brake option for the one with larger capacity 3. Reduce load.
A. E1	Overload warning	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to 50, 51.	Refer to A. 50, A. 51.
A. E3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change servo motor.
A. E6	Servo emergency stop	EMG-SG are open.	External emergency stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate emergency stop.
A. E9	Main circuit off warning	Servo was switched on with main circuit power off.		Switch on main circuit power.

12. SPECIFICATIONS

12.1 Servo Amplifier Standard Specifications

Item \ Servo Amplifier MR-J2-□			10C -S100	20C -S100	40C -S100	60C -S100	70C -S100	100C -S100	200C -S100	350C -S100
Power supply	Voltage/frequency		Three-phase 200 to 230VAC, 50/60Hz or single-phase 230VAC, 50/60Hz (Note)					Three-phase 200 to 230VAC, 50/60Hz		
	Permissible voltage fluctuation		Three-phase 200 to 230VAC: 170 to 253VAC Single-phase 230VAC: 207 to 253VAC					Three-phase 170 to 253VAC		
	Permissible frequency fluctuation		Within ±5%							
	Power supply capacity		Refer to Section13.2							
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, reganerative fault protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection							
Speed frequency response			250Hz or more							
Command system	Programming	Operational specifications	Simple programming language (Programming with configuration S/W). Programming capacity: Up to 8 programs,60steps maximum							
		Position command input	Set by simple programming language. 1-point feed length setting range: ±1[μm] to ±999.999[mm]							
		Speed command input	Set by simple programming language. S-pattern acceleration/deceleration time constant is set in parameter No.14.							
		System	Absolute value command, incremental value command							
		Operational specifications	Positioning using external input or RS-485 (232C) communication data							
	Manual operation mode	Jog	Jog operation is performed in accordance with the parameter-set speed command by contact input or through RS-485 (232C) communication.							
	Manual zeroing mode	Dog type (rear enddetection)	Zeroing is made starting with Z-phase pulse after passage of proximity dog. Zero address may be set. Zero shift distance may be set. Zeroing direction may be selected. Automatic at-dog zeroing return/automatic stroke return function							
		Count (front end detection)	Zeroing is made by counting encoder pulses after contact with proximity dog. Automatic at-dog zeroing return/automatic stroke return function							
		Data setting type	Zeroing is made without dog. Home position may be set at any position by manual operation, etc. Zero address may be set.							
		Stopper type	Zeroing is made by pressing machine part against stroke end. Zero address may be set.							
		Zero ignorance (SON position as zero)	Position where SON signal is switched on is defined as home position. Zero address may be set.							
Other functions			Absolute position detection, backlash function Overtravel prevention using external limit switch Software stroke limit, override using external analog signal							

Item \ Servo Amplifier MR-J2-□		10C -S100	20C -S100	40C -S100	60C -S100	70C -S100	100C -S100	200C -S100	350C -S100
Structure [A]		Open (IP00)							
Environment	Ambient temperature	0 to +55 [°C] (non-freezing)							
		32 to +131 [°F] (non-freezing)							
	Ambient humidity	90%RH or less (non-condensing)							
	storage temperature	−20 to +65 [°C] (non-freezing)							
		−4 to +149 [°F] (non-freezing)							
	storage humidity	90%RH or less (non-condensing)							
	Ambient	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt							
	Altitud	Max. 1000m (3280ft) above sea level							
	Vibration	5.9 [m/s^2] {0.6G} or less							
		19.4 [ft/s^2] or less							
Weight	[kg]	0.7	0.7	1.1	1.1	1.7	1.7	2.0	2.0
	[lb]	1.5	1.5	2.4	2.4	3.75	3.75	4.4	4.4

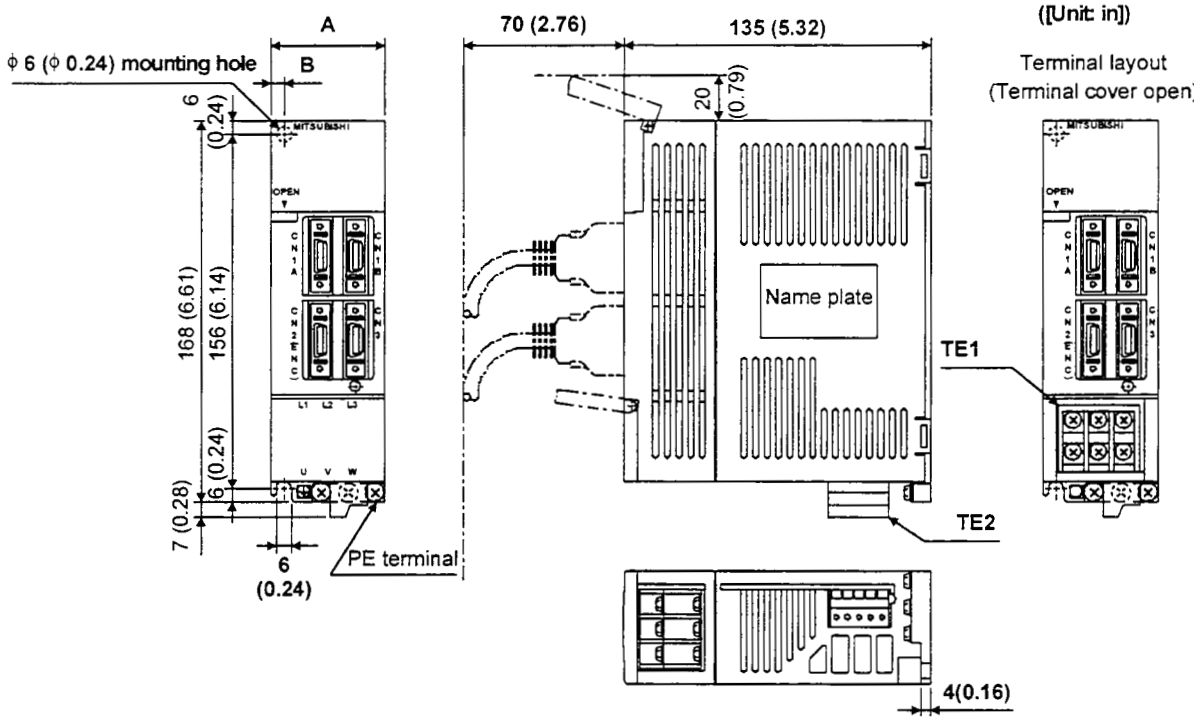
Note: The single-phase 230VAC power supply cannot be used when the servo amplifier is combined with the HC-SF52/53.

12.2 Outline Dimension Drawings

12.2.1 Servo amplifiers

(1) MR-J2-10C-100 to MR-J2-60C-S100

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



Servo Amplifier Model	Variable Dimensions		Weight
	A	B	[kg]([lb])
MR-J2-10C-S100	50 (1.97)	6 (0.24)	0.7 (1.54)
MR-J2-20C-S100			
MR-J2-40C-S100	70 (2.76)	22 (0.87)	1.1 (2.43)
MR-J2-60C-S100			

TE1

L1	L2	L3
U	V	W

Terminal screw: M4×0.7
Tightening torque: 1.24 [N·m] (175.6 [oz·in])

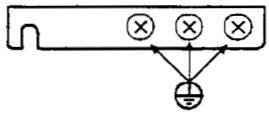
TE2

← Front

D	C	P	L21	L11

Tightening torque: 0.5 to 0.6 [N·m] (70.8 to 85.0 [oz·in])
FRONT MSTB2,5/5-ST-5,08
(Phoenix Contact make)

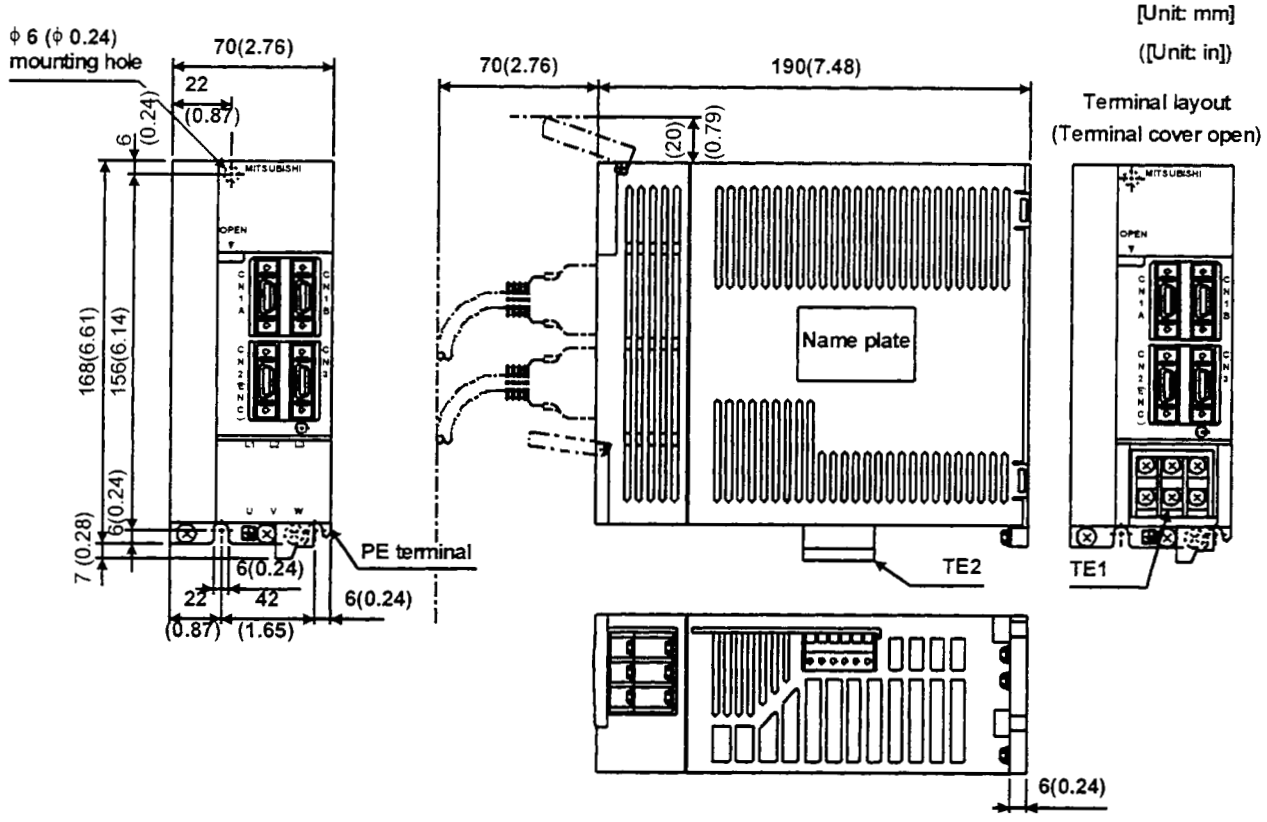
PE terminals



Terminal screw: M4×0.7
Tightening torque: 1.24 [N·m] (175.6 [oz·in])

(2) MR-J2-70C-S100 · MR-J2-100C-S100

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



Servo Amplifier Model	Weight [kg]([lb])
MR-J2-70C-S100	1.7
MR-J2-100C-S100	(3.75)

TE1

L1	L2	L3
U	V	W

Terminal screw: M4×0.7

Tightening torque: 1.24 [N·m] (175.6 [oz·in])

TE2

← Front

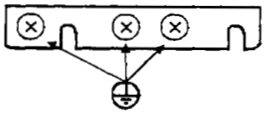
D	C	P	L21	L11	N

FRONT MSTB2,5/6-ST-5,08

(Phoenix Contact make)

Tightening torque: 0.5 to 0.6 [N·m] (70.8 to 85.0 [oz·in])

PE terminals

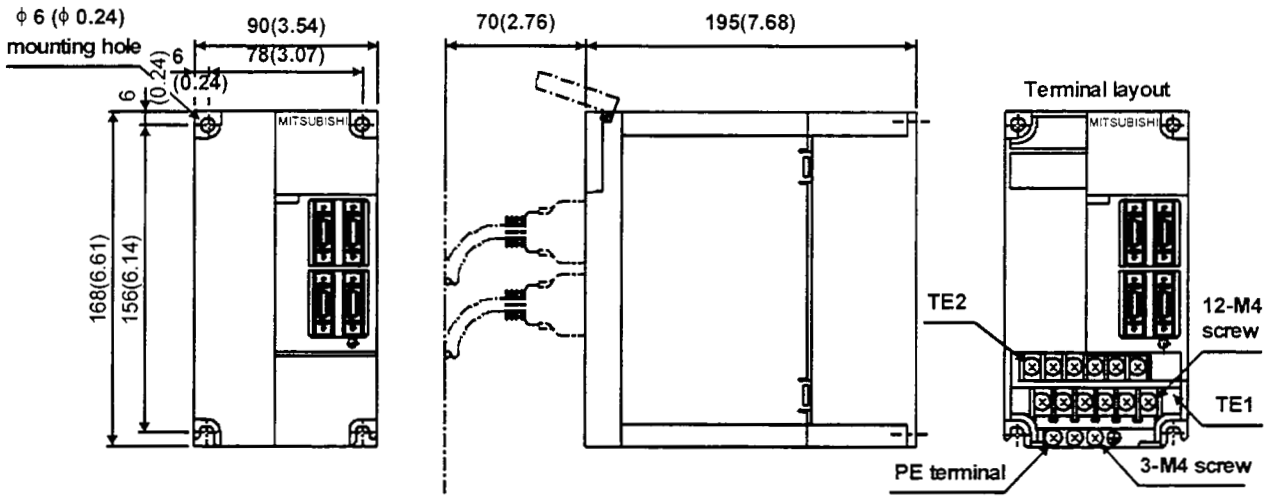


Terminal screw: M4×0.7

Tightening torque: 1.24 [N·m] (175.6 [oz·in])

(3) MR-J2-200C-S100 · MR-J2-350C-S100

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



Servo Amplifier Model	Weight [kg]([lb])
MR-J2-200C-S100	2.0
MR-J2-350C-S100	(4.41)

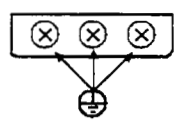
TE1

L1	L2	L3	U	V	W

Terminal screw: M4×0.7

Tightening torque: 1.24 [N·m] (175.6 [oz·in])

PE terminals



Terminal screw: M4×0.7

Tightening torque: 1.24 [N·m] (175.6 [oz·in])

TE2

L11	L21	D	P	C	N

Terminal screw: M4×0.7

Tightening torque: 1.24 [N·m] (175.6 [oz·in])

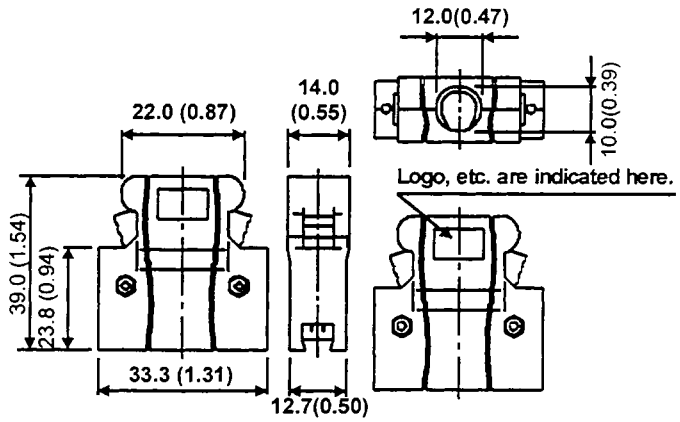
12.2.2 Connectors

(1) Servo amplifier side

Signal connector
<Sumitomo 3M make>

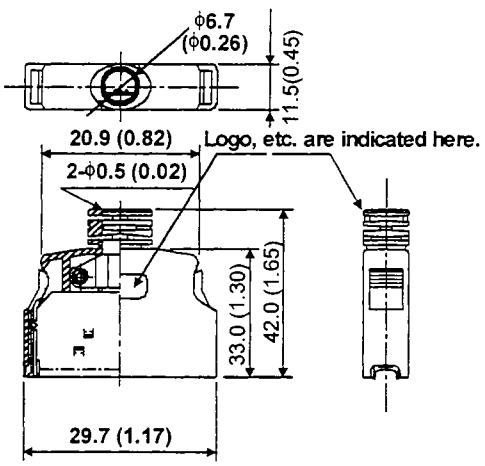
Model
Connector : 10120-3000VE
Shell kit : 10320-52F0-008

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



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

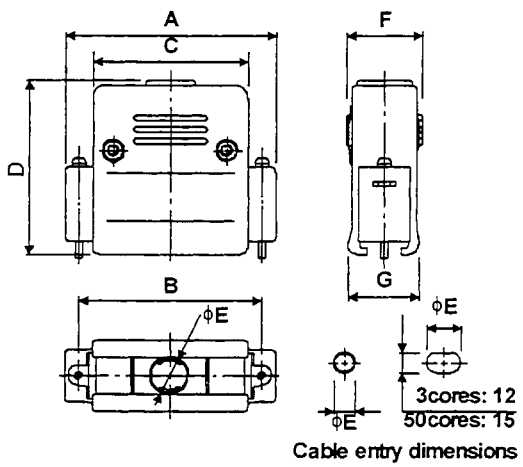
[Unit: mm]
([Unit: in])



(2) Personal computer side

<Honda Tsushin Kogyo make>

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



Cable entry dimensions

Cable entry dimensions	A	B	C	D	E	F
GM-9L	33 (1.30)	24.99 (0.98)	18.5 (0.73)	33 (1.30)	6 (0.24)	17.9 (0.70)
GM-25L (Note)	55 (2.17)	47.04 (1.85)	40 (1.57)	46 (1.81)	10 (0.39)	20.6 (0.81)

Note: The PC-98 (NEC) Notes having connectors of D-SUB25 pins and half-pitch 14 pins are available. For the half-pitch 14 pins, use the following model (3M's connector).
Connecto : 10114-3000
Shell kit : 10314-52F0-008

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.

(1) MR-J2-10C-S100 to MR-J2-100C-S100

a: FH-MF series
HA-FF series
(300W or more)
HC-SF series
HC-UF series

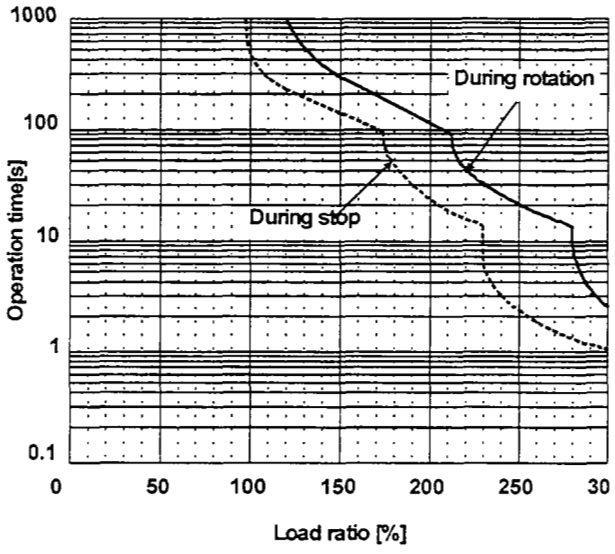


Fig 13.1 Electronic Thermal Relay Protection Characteristics

b: HA-FF series
(200W or less)

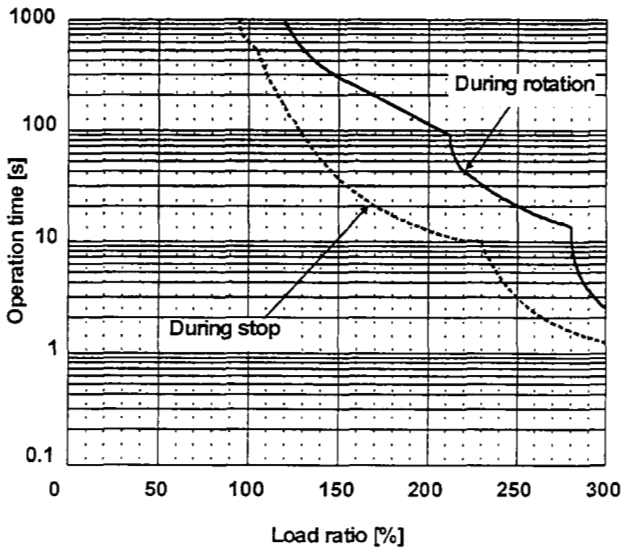


Fig. 13.2 Electronic Thermal Relay Protection Characteristics 2

(2) MR-J2-200C-S100 to MR-J2-350C-S100

HC-SF series
HC-RF series
HC-UF series

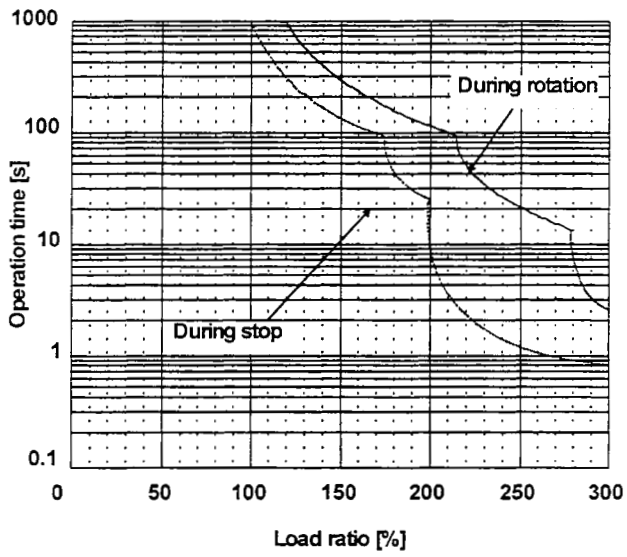


Fig 13.3 Electronic Thermal Relay Protection Characteristics 3

13.2 Power Supply Equipment Capacity and Generated Loss

(1) Amount of heat generated by the servo amplifier

Table 13.1 indicates servo amplifiers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 13.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and zero torque according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the servo amplifier's generated heat will not change.

Table 13.1 Power Supply Capacity and Generated Heat Per Servo Amplifier at Rated Output

Servo Amplifier	Servo Motor	Power Supply Capacity[kVA]	Servo Amplifier-Generated Heat[W]		Area Required for Heat Dissipation	
			At rated torque	With servo off	[m²]	[ft²]
MR-J2-10C-S100	HC-MF053 · 13	0.3	25	15	0.5	5.4
	HA-FF053 · 13	0.3	25	15	0.5	5.4
	HC-UF13	0.3	25	15	0.5	5.4
MR-J2-20C-S100	HC-MF23	0.5	25	15	0.5	5.4
	HA-FF23	0.5	25	15	0.5	5.4
	HC-UF23	0.5	25	15	0.5	5.4
MR-J2-40C-S100	HC-MF43	0.9	35	15	0.7	7.5
	HA-FF33	0.7	35	15	0.7	7.5
	HA-FF43	0.9	35	15	0.7	7.5
	HC-UF43	0.9	35	15	0.7	7.5
MR-J2-60C-S100	HA-FF63	1.1	40	15	0.8	8.6
	HC-SF52	1.0	40	15	0.8	8.6
	HC-SF53	1.0	40	15	1.0	10.8
MR-J2-70C-S100	HC-MF72 · 73	1.3	50	15	1.0	10.8
MR-J2-100C -S100	HC-SF81	1.7	50	15	1.0	10.8
	HC-SF102 · 103	1.7	50	15	1.0	10.8
	HC-SF121	2.1	50	20	1.8	19.4
MR-J2-200C -S100	HC-SF201	3.5	90	20	1.8	19.4
	HC-SF152 · 153	2.5	90	20	1.8	19.4
	HC-SF202 · 203	3.5	90	20	1.8	19.4
	HC-RF103	1.8	90	20	1.8	19.4
	HC-RF153	2.5	90	20	1.8	19.4
	HC-UF152	2.5	90	20	1.8	19.4
MR-J2-350C –S100	HC-SF301	4.8	120	20	2.7	29.1
	HC-SF352 · 353	5.5	130	20	2.7	29.1
	HC-RF203	3.5	90	20	2.7	29.1
	HC-UF202	3.5	90	20	2.7	29.1

Note: 1. Sufficient heat-related capacity (kVA) values are indicated in Table for the power supply. However, since instantaneous power 2 to 2.5 times higher than the rated will be required for servo motor acceleration, use a power supply with small voltage fluctuation which will provide the voltage within the permissible voltage fluctuation at the L1, L2 and L3 terminals of the servo amplifier.
Note that the power supply capacity will vary according to the power supply impedance.

2. Refer to Table for the current capacity of the power supply.
3. When using multi-axes, add the power capacity per axis.
4. Heat generated during regeneration is not included in the servo amplifier-generated heat. To calculate heat generated option, use Equation 14.1 in Section 14.1.1.

(2) Heat dissipation area for enclosed servo amplifier

An enclosure or control box for the servo amplifier should be designed to operate at the ambient temperature of 40°C (104°F) within a temperature rise of 10°C (50°F). (With a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 13.1:

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots (13.1)$$

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

When calculating the heat dissipation area with Equation 13.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 13.1 for heat generated by the servo amplifier. "A" indicates the effective area for heat dissipation, but if the enclosure is directly installed on an insulated wall, that extra amount must be added to the enclosure's surface area.

The required heat dissipation area will vary wit the conditions in the enclosure. If convection in the enclosure is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the enclosure and the use of a fan should be considered.

Table 13.1 lists the enclosure dissipation area for each servo amplifier when the servo amplifier is operated at the ambient temperature of 40°C (104°F) under rated load.

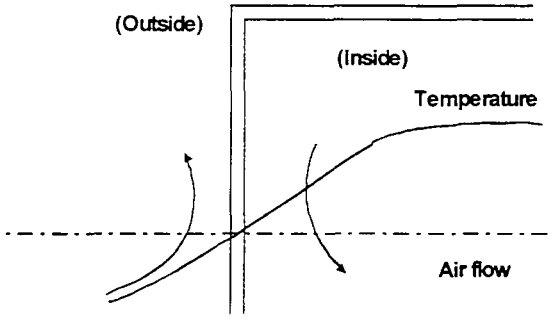


Fig. 13.2 Temperature Distribution in Enclosure

When air flows along the outer wall of the enclosure, effective heat exchange will be possible, because the temperature slope inside and outside the enclosure will be steeper.

13.3 Dynamic Brake Characteristics

When an alarm, emergency stop or power failure occurs, the dynamic brake is operated to bring the servo motor to a sudden stop. Fig. 13.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 13.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to Fig. 13.4 and Table 13.2.)

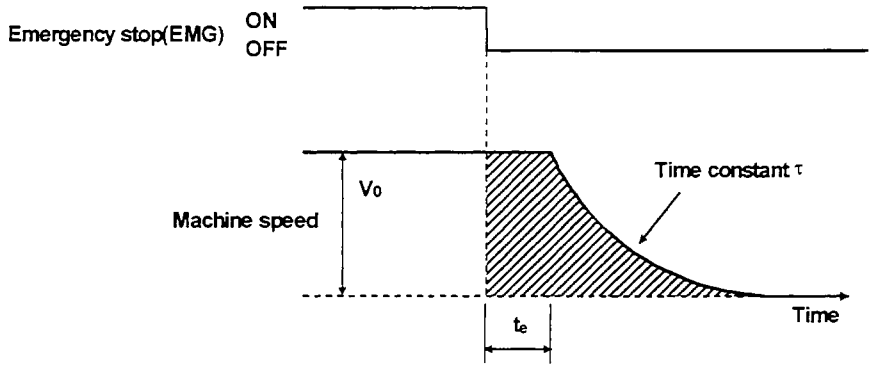
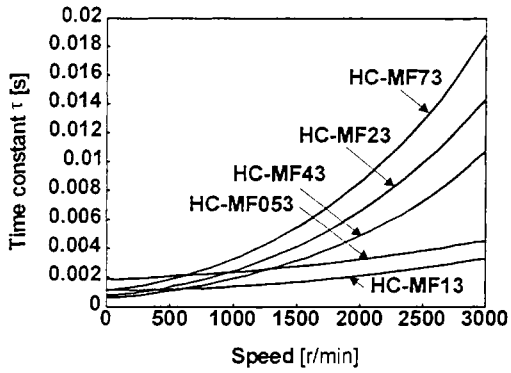


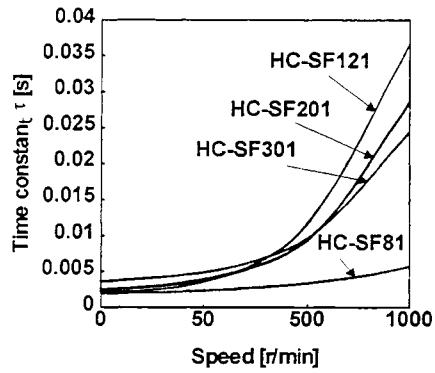
Fig. 13.3 Dynamic Brake Operation Diagram

$$Lmax = \frac{Vo}{60} \cdot \left\{ t_e + \tau \left[1 + \frac{J_L}{J_M} \right] \right\} \quad \cdots\cdots (13.2$$

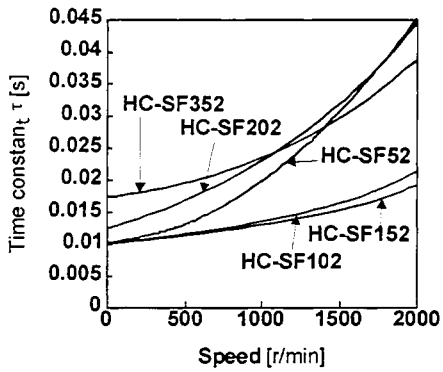
L max : Maximum coasting distance ····· [mm][in]
Vo : Machine rapid feedrate ····· [mm/min][in/min]
J_M : Servo motor inertial moment ····· [kg · cm²][oz · in²]
J_L : Load inertia moment converted into equivalent value on servo motor shaft ····· [kg · cm²][oz · in²]
τ : Brake time constant (Fig. 13.4 · Table 13.2) ····· [s]
t_e : Delay time of control section (Fig. 13.3) ····· [s]
(There is internal relay delay time of about 30ms.)



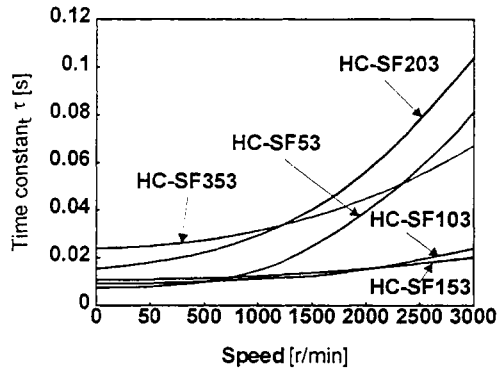
a. HC-MF Series



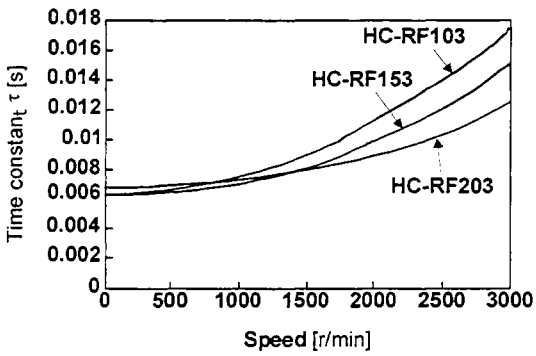
b. HC-SF1000r/min Series



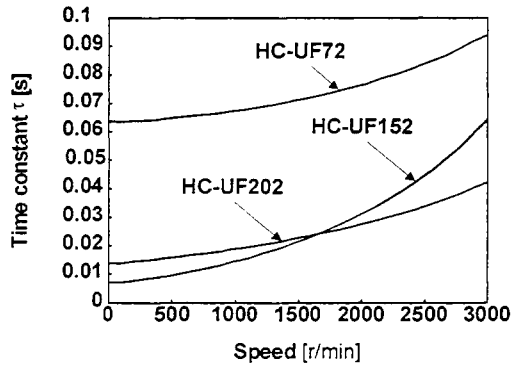
c. HC-SF2000r/min Series



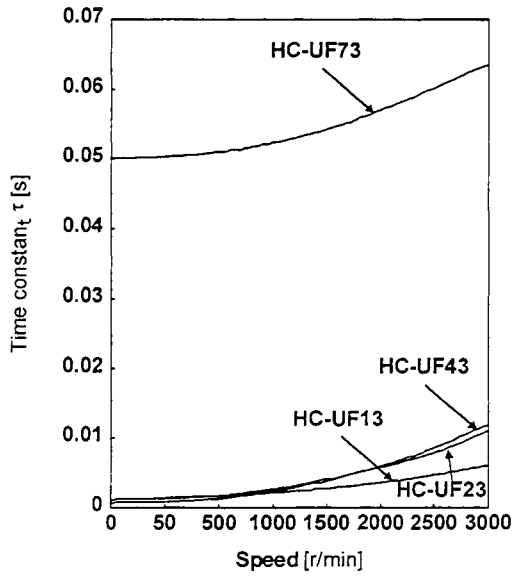
d. HC-SF3000r/min Series



e. HC-RF Series



f. HC-UF 2000r/min Series



g. HC-UF3000r/min Series

Fig. 13.4 Dynamic Brake Time Constant

Table 13.2 HA-FF Dynamic Brake Time Constant

Servo Motor	Brake Time Constant τ [s]
HA-FF053 · 13	0.02
HA-FF23	0.05
HA-FF33	0.07
HA-FF43	0.09
HA-FF63	0.12

Use the dynamic brake at the load inertia moment indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact Mitsubishi.

Servo Amplifier	Load Inertia Moment Ratio [times]
MR-J2-10C-S100 to MR-J2-200C-S100	30
MR-J2-350C-S100	16

14. OPTIONS AND AUXILIARY EQUIPMENT

⚠WARNING	Before connecting any option or auxiliary equipment, make sure that the charge lamp is off more than 10 minutes after power-off, then confirm the voltage with a tester or the like. Otherwise, you may get an electric shock.

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

14.1 Options

14.1.1 Regenerative brake options

⚠CAUTION	The specified combinations of regenerative brake options and servo amplifiers may only be used. Otherwise, a fire may occur.

(1) Combination and regenerative power

Servo Amplifier	(Note) Regenerative Power[W]					
	Built-in regenerative brake resistor	MR-RB032 [40Ω]	MR-RB12 [40Ω]	MR-RB32 [40Ω]	MR-RB30 [13Ω]	MR-RB50 [13Ω]
MR-J2-10C-S100	Without	30	×	×	×	×
MR-J2-20C-S100	10	30	100	×	×	×
MR-J2-40C-S100	10	30	100	×	×	×
MR-J2-60C-S100	10	30	100	×	×	×
MR-J2-70C-S100	20	30	100	300	×	×
MR-J2-100C-S100	20	30	100	300	×	×
MR-J2-200C-S100	100	×	×	×	300	500
MR-J2-350C-S100	100	×	×	×	300	500

Note: This value is not the permissible value of the resistor.

(2) Selection of the regenerative brake option

1) Simple selection method

In horizontal motion applications, select the regenerative brake option as described below:

When the servo motor is run without load in the regenerative mode from the running speed to a stop, the permissible duty is as indicated in the standard specifications (Section 12.1). For the servo motor with a load, the permissible duty changes according to the inertia moment of the load and can be calculated by the following formula:

$$\text{Permissible duty} = \frac{\text{permissible duty for servo motor with no load (value indication Section 12.1)}}{(m+1)} \times \left(\frac{\text{ratedspeed}}{\text{running speed}}\right)^2 \text{[times/min]}$$

where m = load inertia moment/servo motor inertia moment

From the permissible duty, find whether the regenerative brake option is required or not.

Permissible duty > number of positioning times [times/min]

Select the regenerative brake option out of the combinations in (1) in this section.

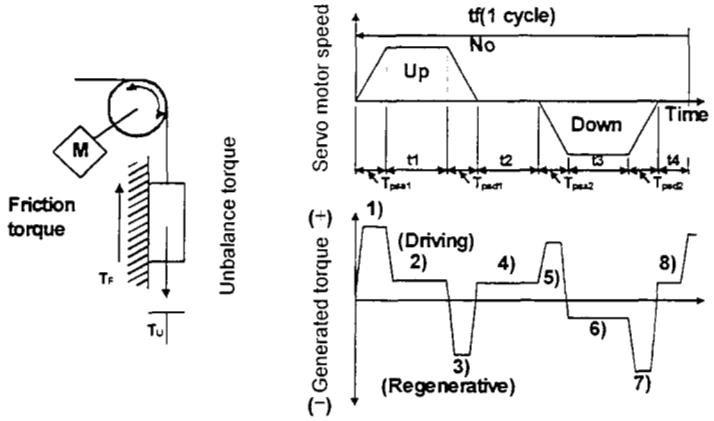
2) To make selection according to regenerative energy

Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make

3) an in-depth selection of the regenerative brake option:

a. Regenerative energy calculation

Use the following table to calculate the regenerative energy.



Formulas for Calculating Torque and Energy in Operation

Regenerative Power	Torque applied to servo motor [N m]	Energy [J]
1)	$T_1 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{Psa1}} + T_U + T_F$	$E_1 = \frac{0.1047}{2} \cdot No \cdot T_1 \cdot T_{Psa1}$
2)	$T_2 = T_U + T_F$	$E_2 = 0.1047 \cdot No \cdot T_2 \cdot t_1$
3)	$T_3 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{Psd1}} + T_U + T_F$	$E_3 = \frac{0.1047}{2} \cdot No \cdot T_3 \cdot T_{Psd1}$
4), 8)	$T_4 = T_U$	$E_4 \geq 0$ (No regeneration)
5)	$T_5 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{Psa2}} - T_U + T_F$	$E_5 = \frac{0.1047}{2} \cdot No \cdot T_5 \cdot T_{Psa2}$
6)	$T_6 = T_U + T_F$	$E_6 = 0.1047 \cdot No \cdot T_6 \cdot t_3$
7)	$T_7 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{Psd2}} - T_U + T_F$	$E7 = \frac{0.1047}{2} \cdot No \cdot T_7 \cdot T_{Psd2}$
Sum total of regenerative energies		Sum total of negative energies in 1) to 8)

b. Losses of servo motor and servo amplifier in regenerative mode

The following table lists the efficiencies and other data of the servo motor and servo amplifier in the regenerative mode.

Servo Amplifier	Inverse Efficiency[%]	Capacitor Charging[J]
MR-J2-10C-S100	55	9
MR-J2-20C-S100	70	9
MR-J2-40C-S100	85	11
MR-J2-60C-S100	85	11
MR-J2-70C-S100	80	18
MR-J2-100C-S100	80	18
MR-J2-200C-S100	85	40
MR-J2-350C-S100	85	40

Inverse efficiency (η) :Efficiency including some efficiencies of the servo motor and servo amplifier when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging (Ec) :Energy charged into the electrolytic capacitor in the servo amplifier.

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative brake option.

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

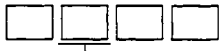
Calculate the power consumption of the regenerative brake option on the basis of single-cycle operation period tf [s] to select the necessary regenerative brake option.

$$PR\ [W] = ER/tf \cdots\cdots (14.1)$$

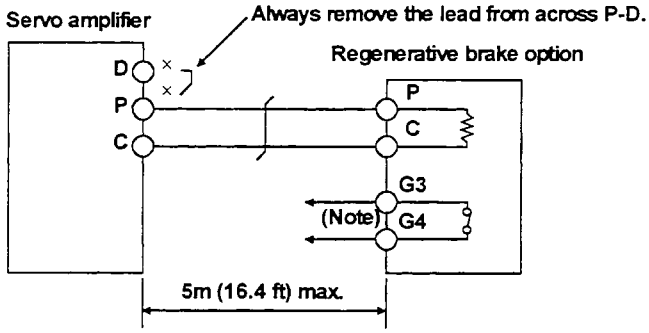
(3) Connection of the regenerative brake option

When using the regenerative brake option, always remove wiring from across P-D and install the regenerative brake option across P-C. Set parameter No.0 according to the option to be used. The regenerative brake option will generate heat of about 100℃. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use fire-retarding cables and keep them clear of the regenerative brake option body. Always use twisted cables of max. 5m length for connection with the servo amplifier.

Parameter No.0



Selection of regenerative
0: Not used.
2: MR-RB 032
3: MR-RB 12
4: MR-RB 32
5: MR-RB 30
6: MR-RB 50

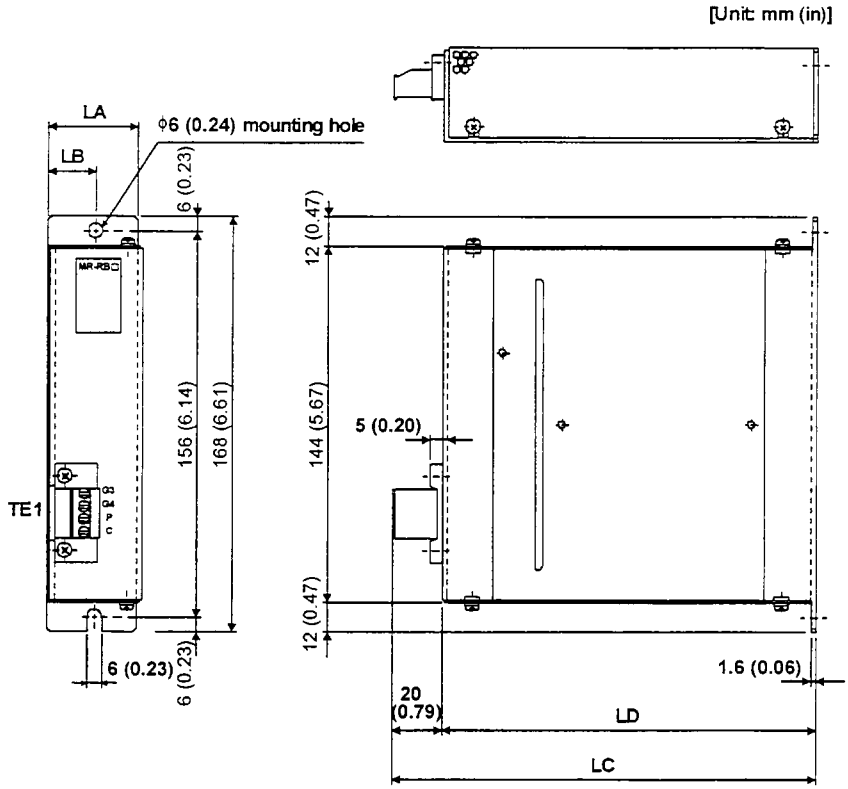


G3·G4: Thermal protector terminals. Abnormal heating will disconnect G3-G4.

Note: Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.

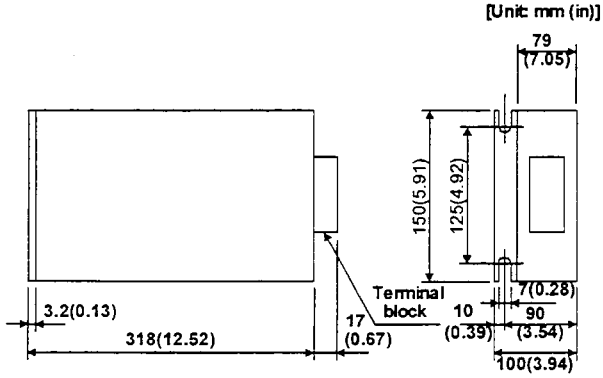
(4) Outline drawing

1) MR-RB032·MR-RB12



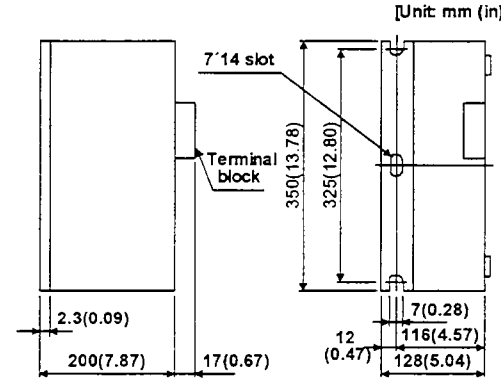
Regenerative Brake Option	Regenerative Power[W]	Resistance [Ω]	Variable Dimensions				Weight	
			LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30	40	30 (1.18)	15 (0.59)	119 (4.69)	99 (3.9)	0.5	1.1
MR-RB12	100	40	40 (1.57)	15 (0.59)	169 (6.69)	149 (5.87)	1.1	2.4

2) MR-RB32·MR-RB30



Regenerative Brake Option	Regenerative Power [W]	Resistance [Ω]	Weight	
			[kg]	[lb]
MR-RB32	300	40	2.9	6.4
MR-RB30	300	13	2.9	6.4

3) MR-RB50

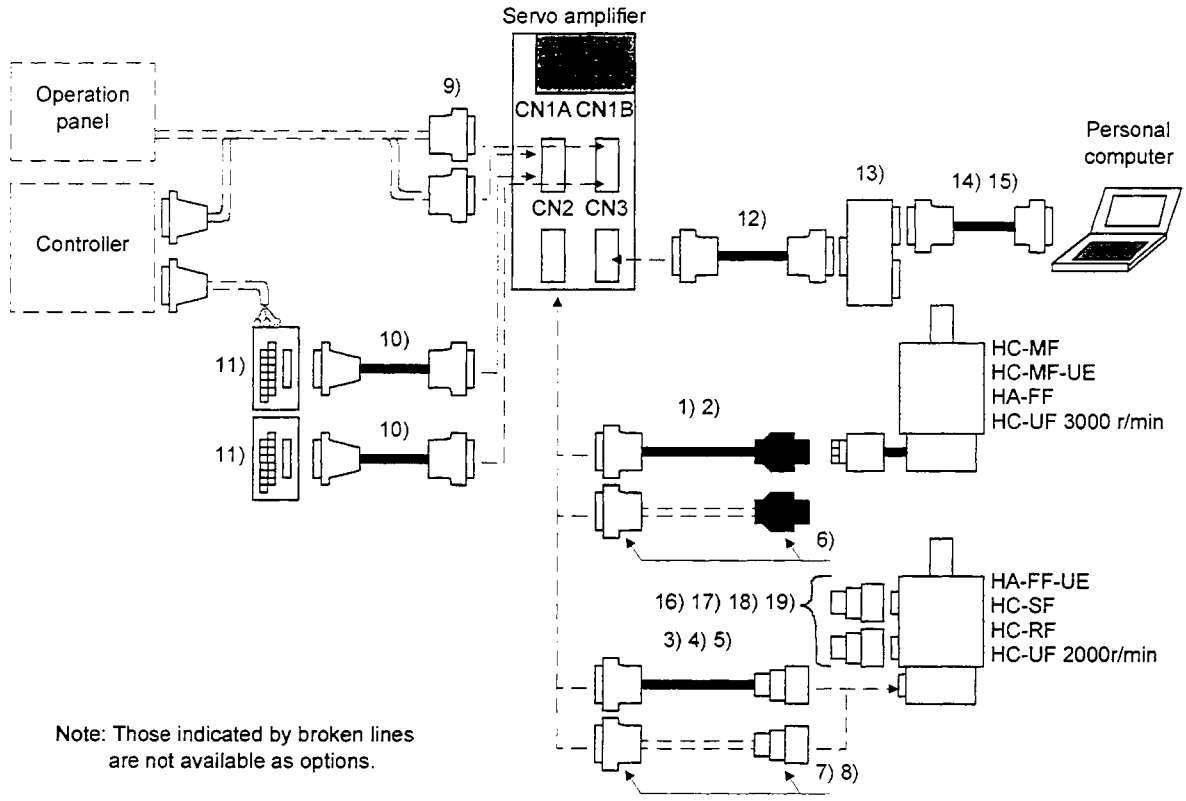


Regenerative Brake Option	Regenerative Power [W]	Resistance [Ω]	Weight	
			[kg]	[lb]
MR-RB50	500	13	5.6	12.3

14.1.2 Cables and connectors

(1) Cable make-up

The following cables are used for connection with the servo motor and other models.



No.	Product	Model	Description		Application
1)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) in this section.	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (3M or equivalent) Housing : 1-172161-9 Connector pin : 170363-1	Standard flexing life
2)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) in this section.			Long flexing life
3)	Standard encoder cable	MR-JHSCBL□M-L Refer to (2) in this section.	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (Japan Aviation Electronics) Connector: MS3106B20-29S Cable clamp: MS-3057-12A	Standard flexing life
4)	Long flexing life encoder cable	MR-JHSCBL□M-H Refer to (2) in this section.			Long flexing life
5)	IP65-compliant encoder cable	MR-ENCBL□M-H Refer to (2) in this section.	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (DDK) Connector : MS3106A20-29S (D190) Cable clamp : CE3057-12A-3 (D265) Back shell: CE02-20BS-S	Long flexing life IP65 compliant
					
6)	Encoder connector set	MR-J2CNM	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (3M or equivalent) Housing : 1-172161-9 Pin : 170363-1 Cable clamp: MTI-0002	IP44 compliant
					
7)	Encoder connector set	MR-J2CNS	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (Japan Aviation Electronics) Connector: MS3106B20-29S Cable clamp: MS-3057-12A	IP44 compliant
					
8)	Encoder connector set	MR-ENCNS	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008	Encoder side connector (DDK) Connector: MS3106A20-29S (D190) Cable clamp: CE3057-12A-3 (D265) Back shell: CE02-20BS-S	IP65 compliant
					

No.	Product	Model	Description	Application
9)	Control signal connector set	MR-J2CN1	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008  Qty: 2 each	
10)	Junction terminal block cable	MR-J2TBL05M Refer to (3) in this section.	Junction terminal block side connector (Hirose Electric) Connector: HIF3BA-20D-2.54R Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008 	For junction terminal block connection
11)	Junction terminal block	MR-TB20	Refer to Section 14.1.5.	
12)	Bus cable	MR-J2HBUS□M Refer to (4) in this section.	3M or equivalent Connector: 1020-3000VE Shell kit: 10320-52F0-008 3M or equivalent Connector: 1020-3000VE Shell kit: 10320-52F0-008 	For maintenance junction card connection
13)	Maintenance junction card	MR-J2CN3TM	Refer to Section 14.1.4.	
14)	Communication cable	MR-CPC98CBL3M Refer to (5) in this section.	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008 Personal computer side connector (Honda Tsushin) Connector: GM-25LM 	For connection with PC-98 (NEC) personal computer
15)	Communication cable	MR-CPCATCBL3M Refer to (5) in this section.	Servo amplifier side connector (3M or equivalent) Connector: 1020-3000VE Shell kit: 10320-52F0-008 Personal computer side connector (Honda Tsushin) Connector: GM-9LM 	For connection with PC-AT-compatible personal computer
16)	Power supply connector set	MR-PWCF	 Connector: CE05-6A14S-2SD-B(DDK) Cable connector:YSO14-9-11(Daiwa Dengyo)	IP65 compliant EN Standard -compliant
17)	Power supply connector set	MR-PWCNS1	 Connector: CE05-6A22-23SD-B-BSS Cable clamp:CE3057-12A-3(D265) (DDK)	IP65 compliant EN Standard -compliant
18)	Power supply connector set	MR-PWCNS2	 Connector: CE05-6A22-10SD-B-BSS Cable clamp: CE3057-16A-2 (D265) (DDK)	IP65 compliant EN Standard -compliant
19)	Brake connector set	MR-BKCN	 Plug: MS3106A10SL-4S (D190) (DDK) Cable connector: YS010-5-8 (Daiwa Dengyo)	IP65 compliant EN Standard -compliant

(2) Encoder cable

⚠CAUTION	If you have fabricated the encoder cable, connect it correctly. Otherwise, misoperation or explosion may occur.

Generally use the encoder cable available as our options. If the required length is not found in the options, fabricate the cable on the customer side.

(a) Selection

The following table lists the encoder cables for use with the servo motors. Choose the appropriate encoder cable according to your operating conditions. The connector sets are also available for your fabrication.

Servo Motor Model	Standard Encoder Cable				Connector Set	
	(Note 1) Model	Use for EN/UL Standard	Long flexing life	IP65 compliance	Model	IP65 compliance
HC-MF-UE HC-FF HC-UF	MR-JCCBL□M-L	○	×	×	MR-J2CNM	×
	MR-JCCBL□M-H	○	○	×		
HA-FF□C-UE HC-SF HC-RF	MR-JHSCBL□M-L	○	×	×	MR-J2CNS	×
	MR-JHSCBL□M-H	○	○	×		
	MR-ENCBL□M-H	○	○	○	MR-ENCNS	○

Note: 1. □ indicates the cable length: 2, 5, 10, 20, 30(m).

2. If the IP65-compliant option is used with the HA-FF□C-UE, the protection system (IP54) of the servo motor is not improved.

(b) MR-JCCBL□M-L · MR-JCCBL□M-H

1) Model explanation

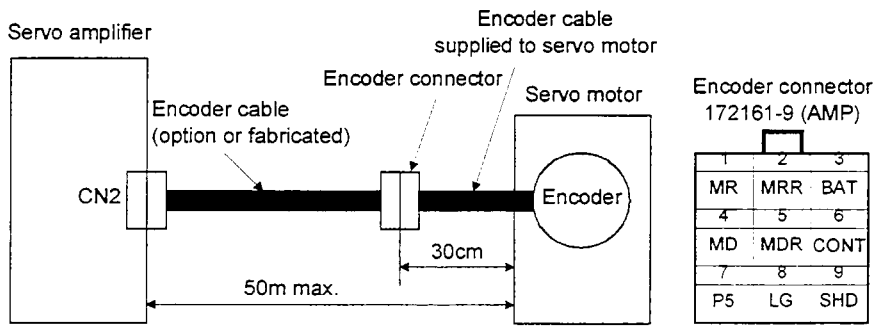
Model: MR-JCCBL□M-□

Symbol	Specifications
L	Standard flexing life
H	Long flexing life

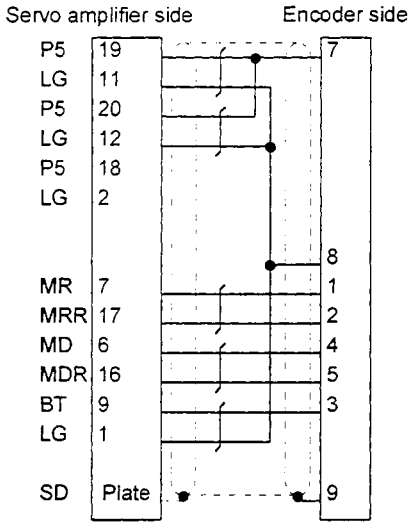
Symbol	Cable Length [m]
2	2
5	5
10	10
20	20
30	30

2) Connection diagram

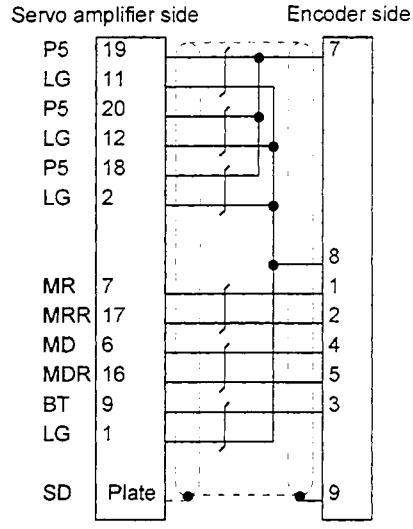
For the pin assignment on the servo amplifier side, refer to Section 3.2.2.



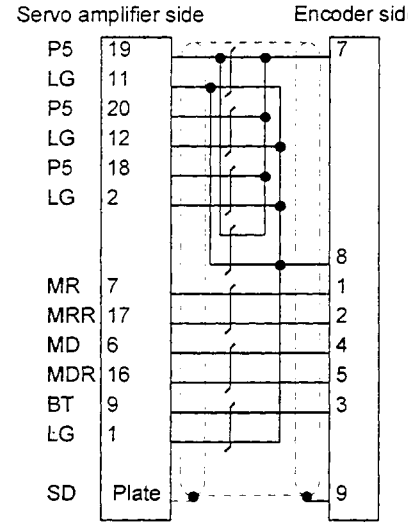
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L
MR-JCCBL20M-L
MR-JCCBL30M-L

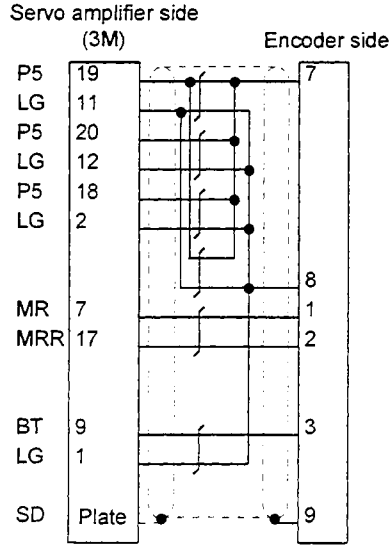


MR-JCCBL10M-H
MR-JCCBL20M-H
MR-JCCBL30M-H

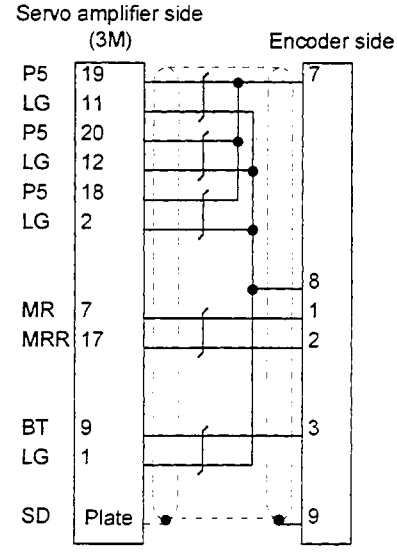


When fabricating an encoder cable, use the recommended wires given in Section 14.2.1 and the MR-J2CNM connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m length including the length of the encoder cable supplied to the servo motor.
Refer to Section 14.2.8 and choose the encode side connector according to the servo motor installation environment.

For use of AWG24



For use of AWG22



(c) MR-JHSCBL□M-L · MR-JHSCBL□M-H · MR-ENCBL□M-H

1) Model explanation

Model: MR-JHSCBL□M-□

Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	Cable Length [m]
2	2
5	5
10	10
20	20
30	30

Model: MR-ENCBL□ M-H

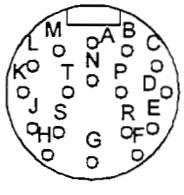
Long flexing life

Symbol	Cable Length [m]
2	2
5	5
10	10
20	20
30	30

2) Connection diagram

For the pin assignment on the servo amplifier side, refer to Section 3.2.2.

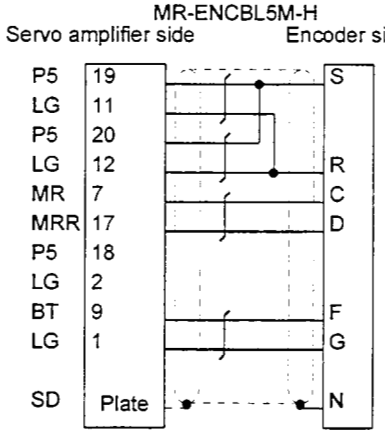
Encoder connector



Pin	Signal
A	—
B	—
C	MR
D	MRR
E	—
F	BAT
G	LG
H	—
J	—

Pin	Signal
K	—
L	—
M	—
N	SD
P	—
R	LG
S	P5
T	—

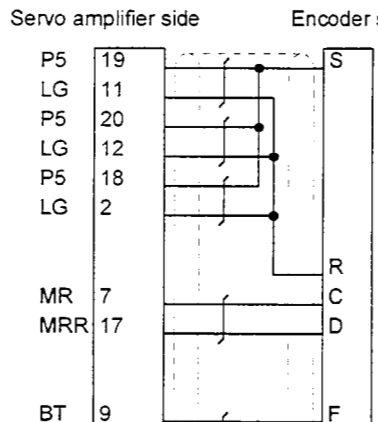
MR-JHSCBL2M-L
MR-JHSCBL5M-L
MR-JHSCBL2M-H
MR-JHSCBL5M-H
MR-ENCBL2M-H
MR-ENCBL5M-H



(Note) Use of AWG24
(Less than 10m)

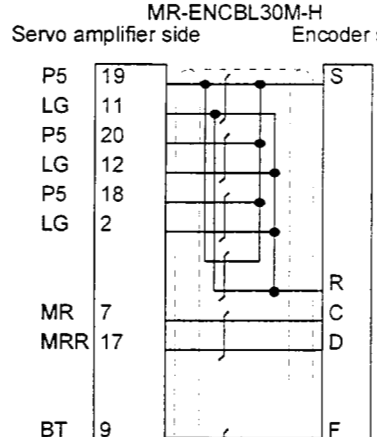
Note: AWG28 can be used for 5m or less.

MR-JHSCBL10M-L
MR-JHSCBL20M-L
MR-JHSCBL30M-H



Use of AWG22
(10m to 50m)

MR-JHSCBL10M-H
MR-JHSCBL20M-H
MR-JHSCBL30M-H
MR-ENCBL10M-H
MR-ENCBL20M-H
MR-ENCBL30M-H



Use of AWG24
(10m to 50m)

When fabricating an encoder cable, use the recommended wires given in Section 14.2.1 and the MR-J2CNS connector set for encoder cable fabrication, and fabricate an encoder cable in accordance with the optional encoder cable wiring diagram given in this section. You can fabricate an encoder cable of up to 50m length. Refer to Chapter 3 of the servo motor instruction guide and choose the encode side connector according to the servo motor installation environment.

(3) Junction terminal block cable (MR-J2TBL05M)

Model: MR-J2TBL05M

Cable length: 0.5[m]

Junction terminal block side connector (Hirose Electric)
HIF38A-20D-2.54R (connector)

Servo amplifier side (CN1A.CN1) connector (3M)
1020-3000VE (connector)
10320-52F0-008 (shell kit)

(Note) Terminal Block Labels		Junction Terminal Block Terminal No.	Pin No.	Pin No.
For CN1A	For CN2A			
LG	LG	10	B1	1
NP	VC	0	A1	2
PP	VDD	11	B2	3
P15R	OPC	1	A2	4
	DIO	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
	D11	6	A7	14
	SON	17	B8	15
	LSP	7	A8	16
	LSN	18	B9	17
ZP	ALM	8	A9	18
	RD	19	B10	19
SD	SD	9	A10	20
				Plate

Note: The labels are designed for position control mode. Since the signals change with parameter setting and control mode, use the accessory signal seals to change the signal symbols.

(4) Bus cable (MR-J2HBUS□M)

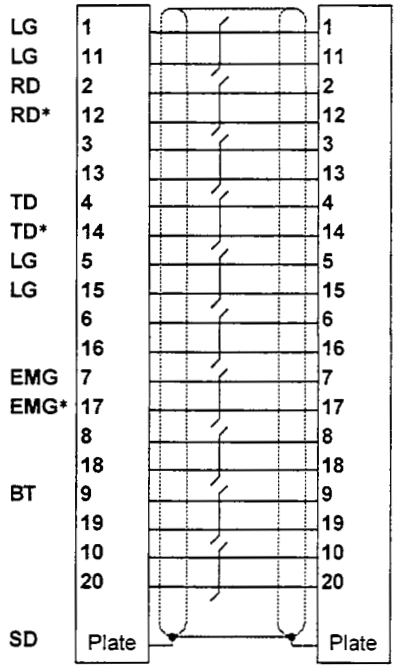
Model: MR-J2HBUS□M

Symbol	Cable length [m]
05	0.5
1	1
5	5

MR-J2HBUS05M
MR-J2HBUS1M
MR-J2HBUS5M

10120-6000VE (connector)
10320-3210-000 (shell kit)

10120-6000VE (connector)
10320-3210-000 (shell kit)



(5) 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.

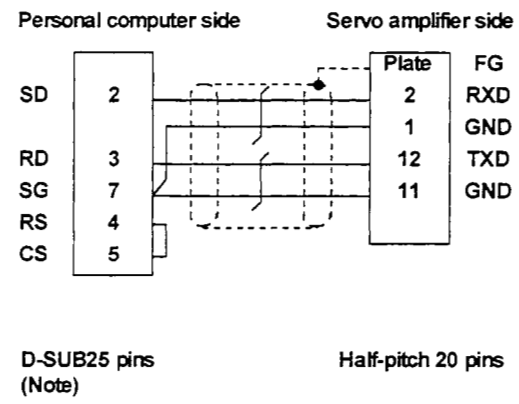
Select the communication cable according to the shape of the RS-232C connector of the personal computer used. When fabricating the cable, refer to the connection diagram in this section.

The following must be observed in fabrication:

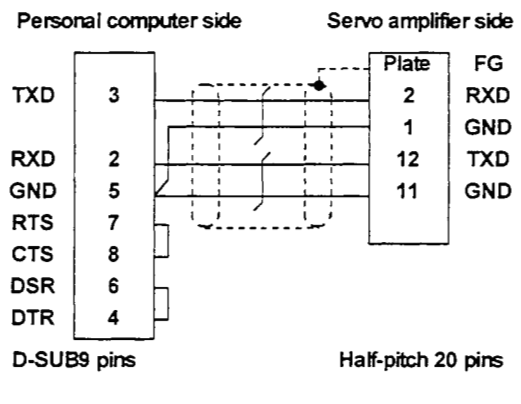
- Always use a shielded, multi-core cable and connect the shield with FG securely.
- The optional communication cable is 3m (10 ft) long. When the cable is fabricated, its maximum length is 15m (49 ft) in offices of good environment with minimal noise.

Connection diagram

· MR-CPC98CBL3M



· MR-CPCATCBL3M

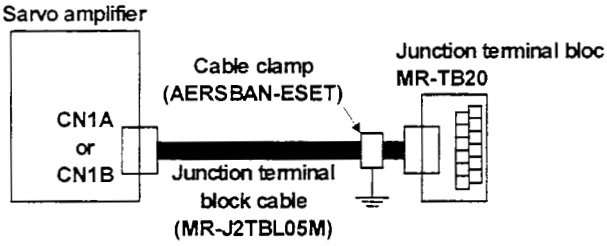


Note: The PC98 Notes having the connector of half-pitch 14 pins are also available. Confirm the shape of the RS-232C connector of the personal computer used.

14.1.3 Junction terminal block (MR-TB20)

(1) How to use the junction terminal block

Always use the junction terminal block (MR-TB20) with the junction terminal block cable (MR-J2TBL05M) as a set. A connection example is shown below:

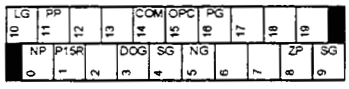


Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to (3), Section 14.2.6

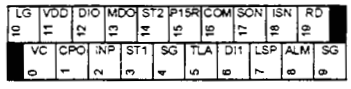
(2) Terminal labels

The junction terminal block is supplied with five terminal block labels which indicate signal assignment. Among these labels, use the two for MR-J2-C. When changing the input signals on the Servo Configuration Software, refer to Section 14.1.2 (3) and Section 3.2.2 and apply the accessory signal seals to the labels.

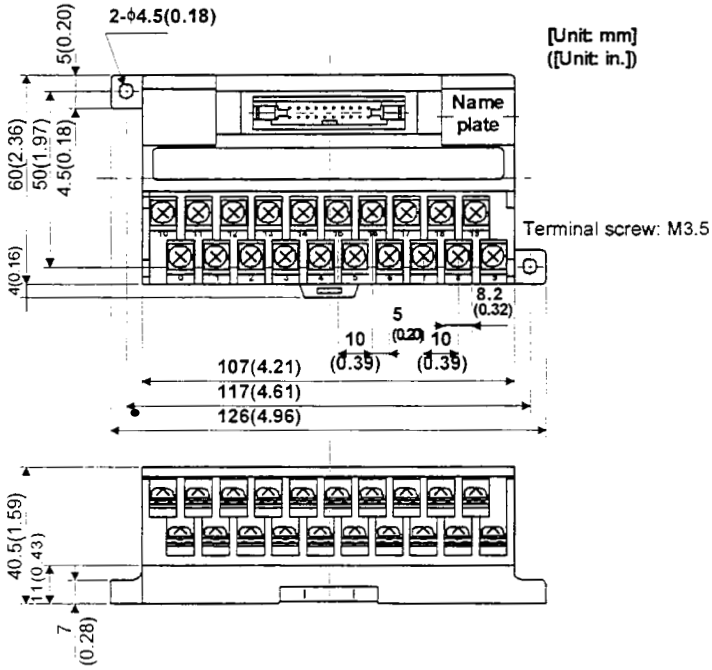
1) For CN1A



2) For CN1B



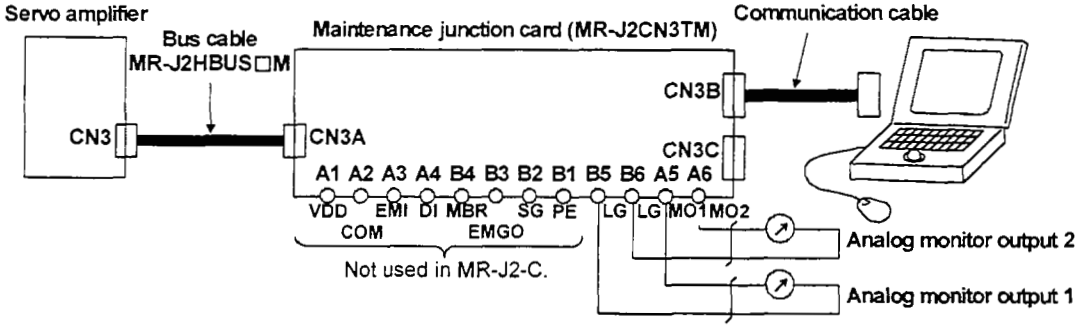
(3) Outline drawing



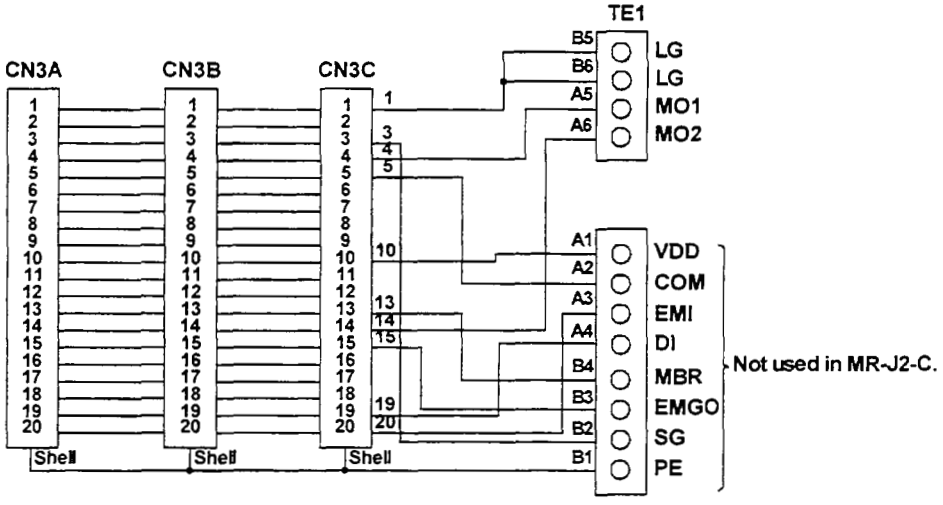
14.1.4 Maintenance junction card (MR-J2CN3TM)

(1) Usage

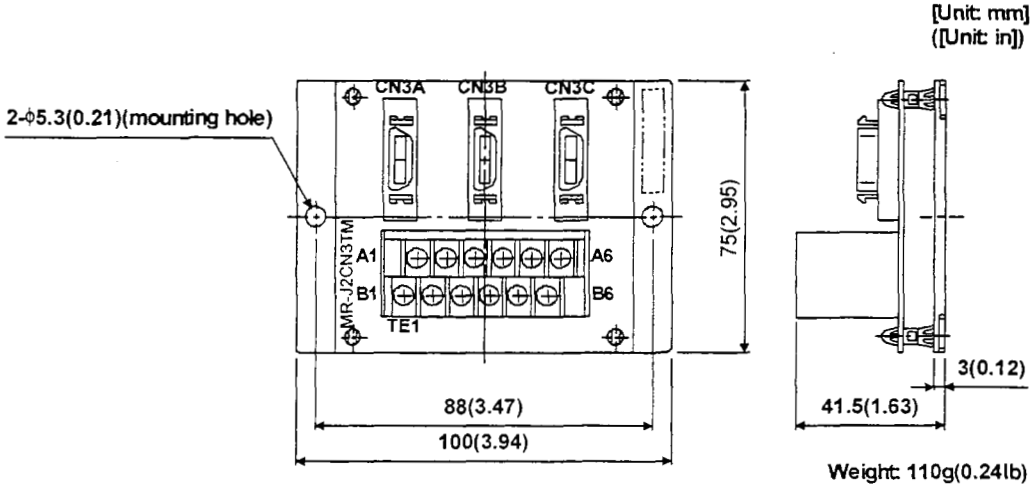
The maintenance junction card (MR-J2CN3TM) is designed for use when a personal computer and analog monitor outputs are used at the same time.



(2) Connection diagram



(3) Outline drawing

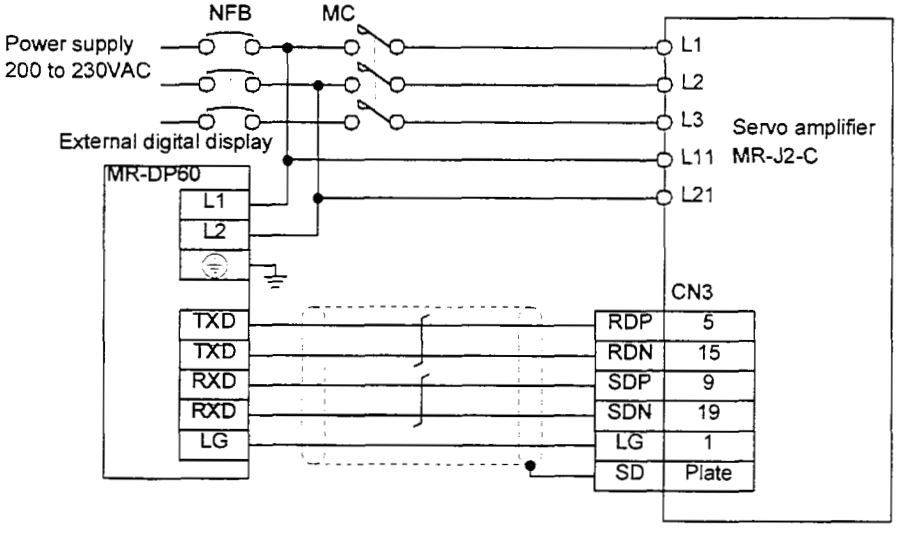


14.1.5 External digital display (MR-DP60)

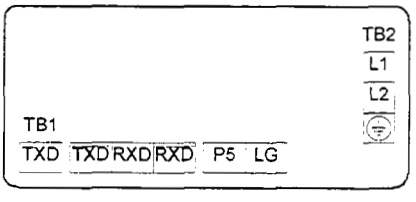
(1) Specifications

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
Operating temperature / humidity range		0°C to + 60°C, 90%RH or less, non-condensing
Storage temperature range		-5°C to + 70°C

(2) Connection example



(3) Terminal arrangement

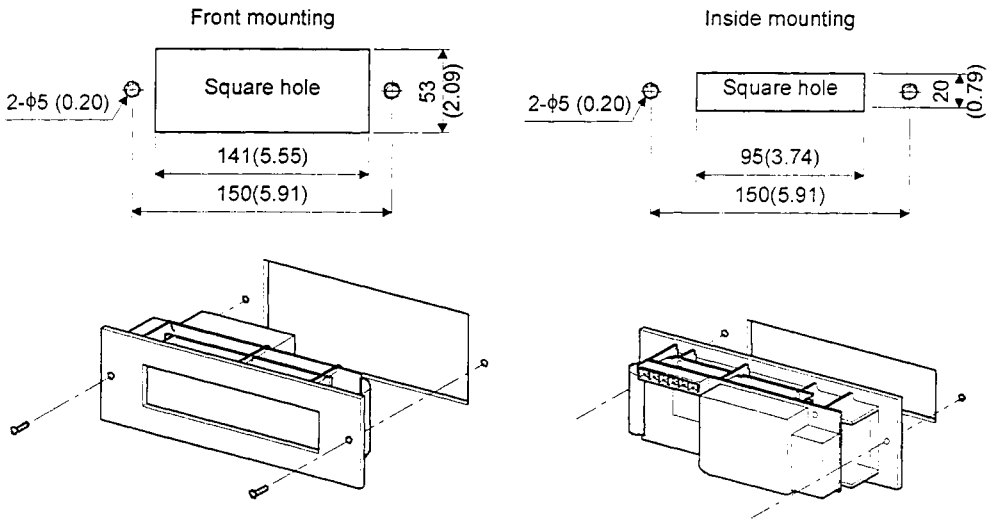


Signal	Description
L1	100 to 200VAC power input
L2	
⏚	Ground
RXD	Receive signal input
$\overline{\text{RXD}}$	Inverse receive signal input
$\overline{\text{TXD}}$	Inverse transmission signal output
TXD	Transmission signal output
P5	5VDC output (Note)
LG	Control common

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.

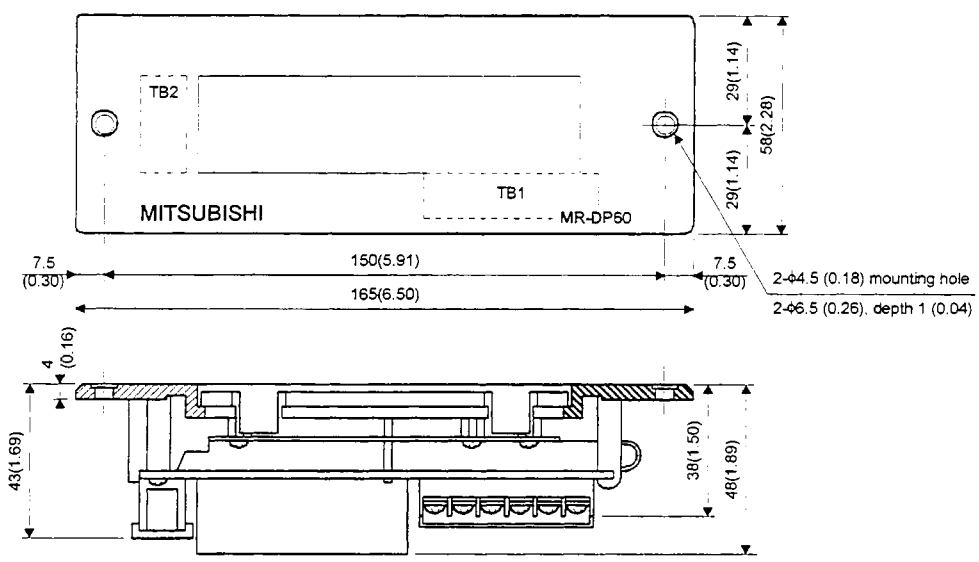
(4) Mounting

[Unit: mm (in)]



(5) Outline dimension drawing

[Unit: mm (in)]

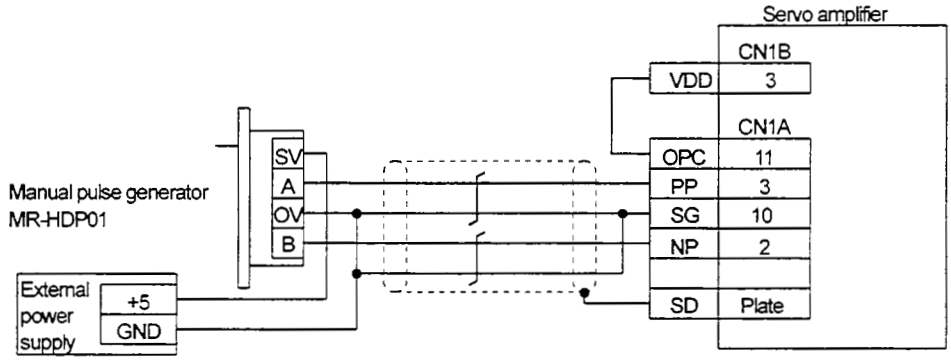


14.1.6 Manual pulse generator (MR-HDP01)

(1) Specifications

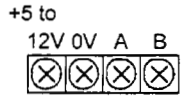
Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA max.
Interface		Output current max. 20mA for open collector output
Pulse signal form		2 A-phase and B-phase signals with 90°phase difference
Pulse resolution		100p / rev
Max. speed		Instantaneous max. 600r/min, ordinary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

(2) Connection example



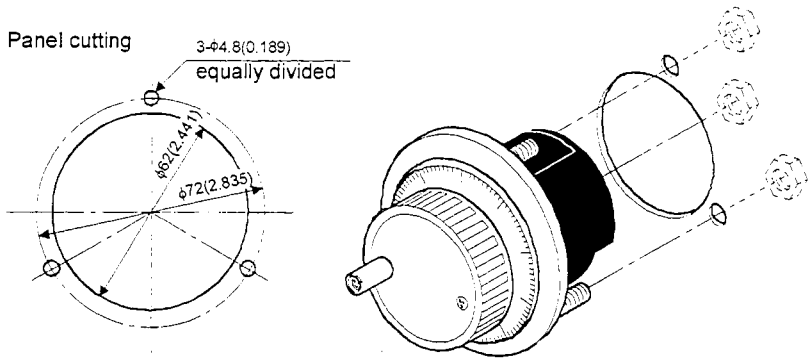
Use an external power supply to supply power to the manual pulse generator.

(3) Terminal arrangement



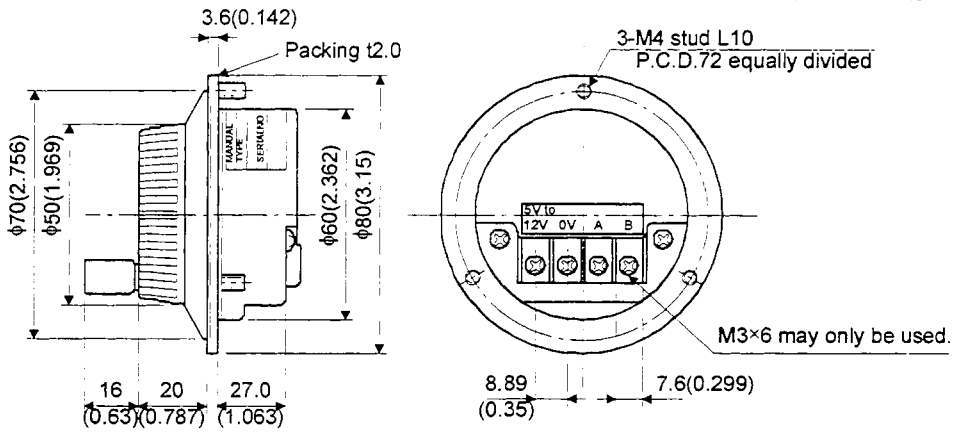
Signal Name	Description
+5 to 12V	Power input
0V	Power and signal common
A	A-phase pulse output
B	B-phase pulse output

(4) Mounting



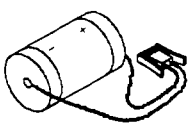
(5) Outline dimension drawing

[Unit: mm(in)]



14.1.7 Battery (MR-BAT, A6BAT)

Use the battery to build an absolute position detection system.



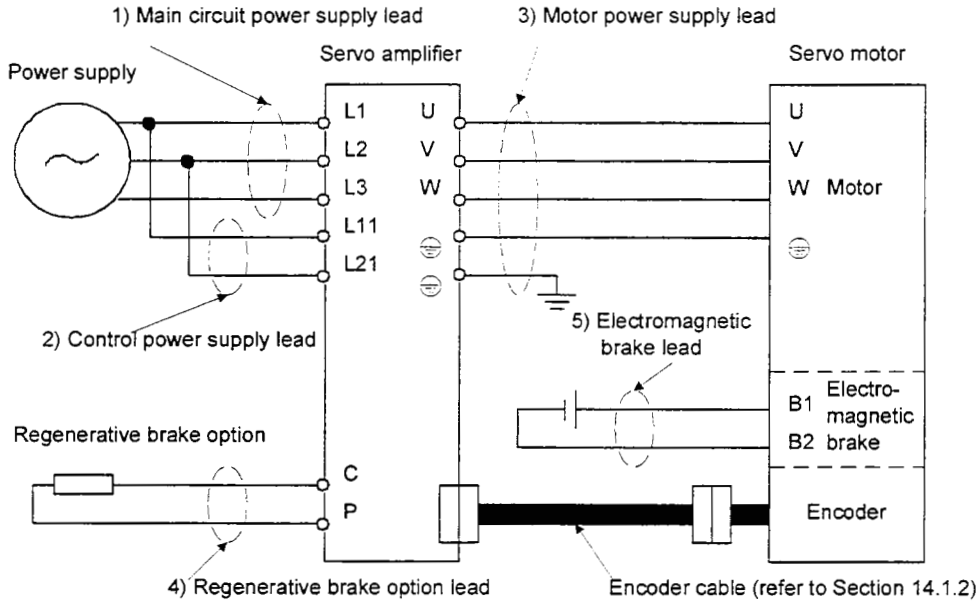
14.2 Auxiliary Equipment

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

The alphabets (a, b) in the table correspond to the crimping terminals (Table 14.2) used to wire the servo amplifier. For connection with the terminal block TE2 of the MR-J2-100C or less, refer to Section 3.7.

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to Section 3.3.

Table 14.1 Recommended Wires

Servo Amplifier	Wires [mm²]				
	1) L1 · L2 · L3	2) L11 · L21	3) U · V · W · ⏚	4) P · C	5) B1 · B2
MR-J2-10C-S100	2 (AWG14) : a	1.25 (AWG16)	1.25 (AWG16) : a	2 (AWG14) : a	1.25 (AWG16)
MR-J2-20C-S100					
MR-J2-40C-S100					
MR-J2-60C-S100					
MR-J2-70C-S100					
MR-J2-100C-S100			2 (AWG14) : a		
MR-J2-200C-S100	3.5 (AWG12) : b		3.5 (AWG12) : b		
MR-J2-350C-S100	5.5 (AWG10) : b		5.5 (AWG10) : b		

Note: For the crimping terminals and applicable tools, see the following table:

Table 14.2 Recommended Crimping Terminals

Symbol	Servo Amplifier Side Crimping Terminals (AMP)	
	Crimping terminal	Applicable tool
a	32959	47387
b	32968	59239

(2) Wires for cables

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

Table 14.3 Wires for Standard Encoder Cables

Wire Model	Core Size [mm²]	Number of Cores	Core Insulation Sheath Outline d [mm] (Note)	Cable Type	Cable Model
UL20276AWG28 7pair (BLAC)	0.08	14 (7 pairs)	0.9~1.27	Standard encoder cable	MR-JCCBL□M-L MR-JHSCBL□M-L
				Communication cable	MR-CPC98CBL□M MR-CPCATCBL□M
UL20276AWG28 10pair (BLAC)	0.08	20 (10 pairs)		Bus cable	MR-J2HBUS□M
UL20276AWG24 7pair (BLAC)	0.2	14 (7 pairs)		Standard encoder cable	MR-JCCBL□M-L MR-JHSCBL□M-L
UL20276AWG22 7pair (BLAC)	0.3			Standard encoder cable	MR-JCCBL□M-L MR-JHSCBL□M-L

Note: d is as shown below:

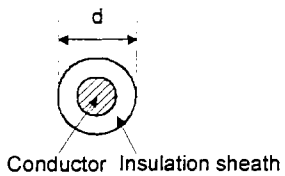


Table 14.4 Wires for Long Flexing Life Encoder Cables

Junkosha's Wire Model	Core Size [mm²]	Number of Cores	Characteristics of 1 Core		Cable Type	Cable Model
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]		
(Note) A14B2343	0.2	12 (6 pairs)	40/0.08	105 max.	Long flexing life encoder cable	MR-JCCBL□M-H MR-JHSCBL□M-H
					IP65-compliant encoder cable	MR-ENCBL□M-H

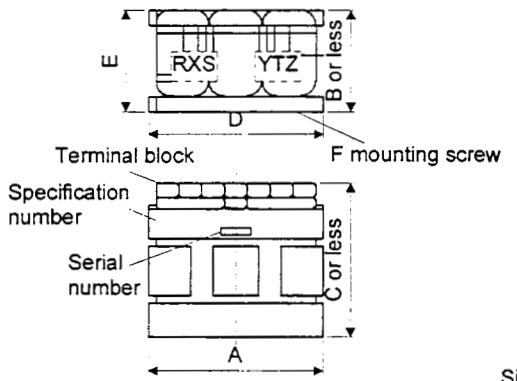
Note: Purchased from Toa Electric Industry

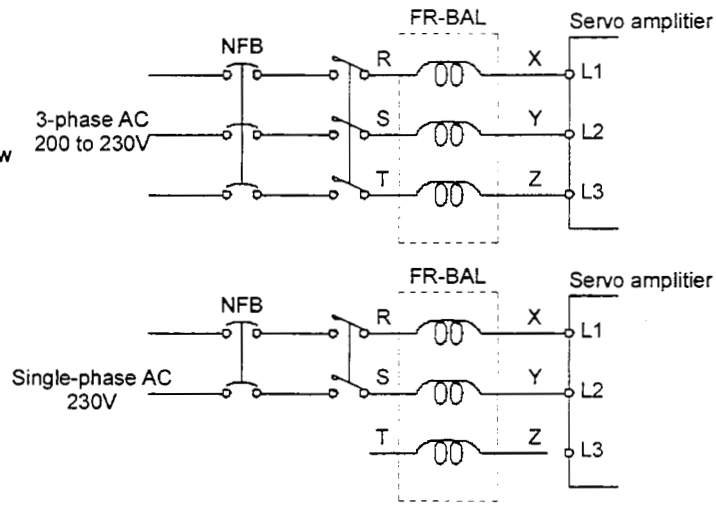
14.2.2 No-fuse breakers, fuses, magnetic contactors

Servo Amplifier	No-Fuse Breaker	Fuse				Magnetic Contactor
		(Note) Model	Class	Current [A]	Voltage [V]	
MR-J2-10C-S100	NF30 type 5A	NON-10 or OT10	K5	10	AC250	S-N10
MR-J2-20C-S100	NF30 type 5A	NON-10 or OT10	K5	10		
MR-J2-40C-S100	NF30 type 10A	NON-15 or OT15	K5	15		
MR-J2-60C-S100	NF30 type 15A	NON-20 or OT20	K5	20		
MR-J2-70C-S100	NF30 type 15A	NON-20 or OT20	K5	20		
MR-J2-100C-S100	NF30 type 15A	NON-25 or OT25	K5	25		
MR-J2-200C-S100	NF30 type 20A	NON-40 or OT40	K5	40		S-N18
MR-J2-350C-S100	NF30 type 30A	NON-70 or OT70	K5	70		S-N20

Note : The NON series is of Buss make and the OT series is Gould make.

14.2.3 Power factor improving reactors





Servo Amplifier	Model	Dimensions [mm (in)]						Weight [kg (lb)]
		A	B	C	D	E	F	
MR-J2-10C/20C-S100	FR-BAL-0.4K	135 (5.31)	64 (2.25)	120 (4.72)	120 (4.72)	45 (1.77)	M4	2 (4.4)
MR-J2-40C-S100	FR-BAL-0.75K	135 (5.31)	74 (2.91)	120 (4.72)	120 (4.72)	57 (2.24)	M4	3 (6.6)
MR-J2-60C/70C-S100	FR-BAL-1.5K	160 (6.30)	76 (2.99)	145 (5.71)	145 (5.71)	55 (2.17)	M4	4 (8.8)
MR-J2-100C-S100	FR-BAL-2.2K	160 (6.30)	96 (3.78)	145 (5.71)	145 (5.71)	75 (2.95)	M4	6 (13.2)
MR-J2-200C-S100	FR-BAL-3.7K	220 (8.66)	95 (3.74)	200 (7.87)	200 (7.87)	70 (2.76)	M5	8.5 (18.7)
MR-J2-350C-S100	FR-BAL-7.5K	220 (8.66)	125 (4.92)	205 (8.07)	200 (7.87)	100 (3.94)	M5	14.5 (32.0)

14.2.4 Relays

The following relays should be used with the interfaces:

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

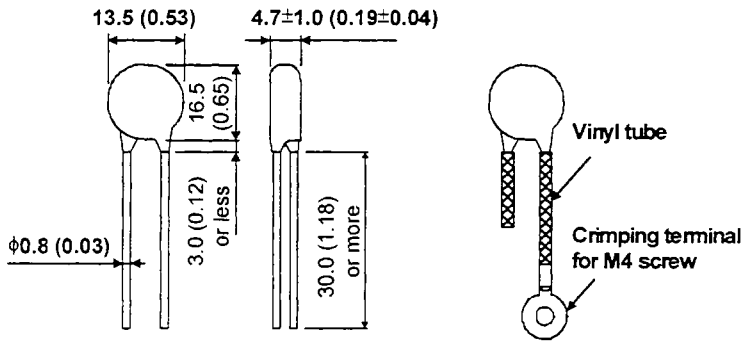
14.2.5 Surge absorbers

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. Insulate the wiring as shown in the diagram.

Maximum Rating					Maximum Limit Voltage		Static Capacity (Reference value)	Varistor Voltage Rating (Range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC[Vma]	DC[V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198~242)

Note: 1 time = 8 × 20μs

(Example) ERZV10D221 (Matsushita Electric)
TNR-12G221K (Marcon Electronics)
Outline drawing [mm] ([in]) (ERZ-C10DK221)



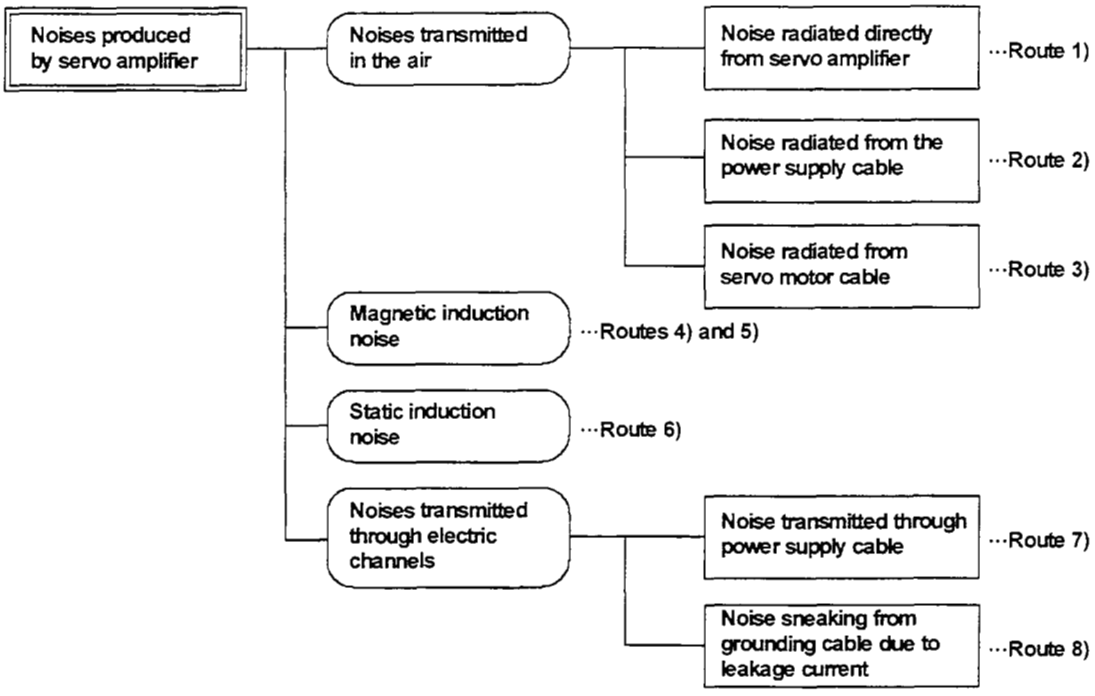
14.2.6 Noise reduction techniques

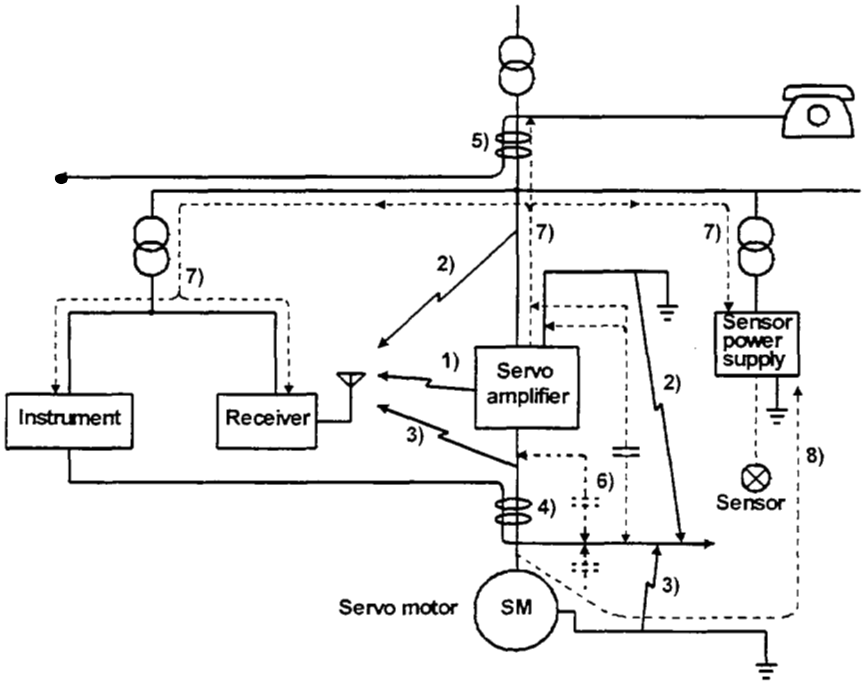
Noises are classified into external noises which enter the servo amplifier to cause it to malfunction and those radiated by the servo amplifier to cause peripheral devices to malfunction. Since the servo amplifier is an electronic device which handles small signals, the following general noise reduction techniques are required.
Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

1) 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 3.6).

2) Reduction techniques for external noises that cause the servo amplifier to malfunction
   If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.
   - Provide surge absorbers on the noise sources to suppress noises.
   - Attach data line filters to the signal cables.
   - Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.

4) 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 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 (I/O cables) of the servo amplifier. (2) Insert the line noise filter (FR-BSF01) on the power cables of the servo amplifier.
8)	When the cables of peripheral devices are connected to the servo amplifier to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(1) Data line filter

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

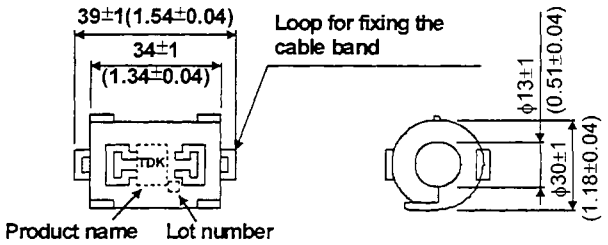
Example: Data line filter: ZCAT3035-1330 [TDK]
ESD-SR-25 [Tokin]

Impedance specifications (ZCAT3035-1330)

Impedance[Ω]	
10~100MHZ	100~500MHZ
80	150

The above impedances are reference values and not guaranteed values.

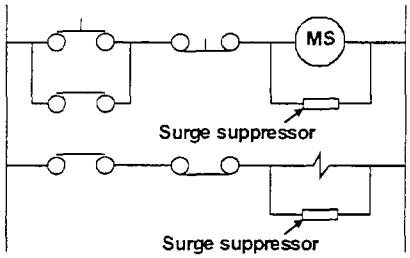
[Unit: mm](Unit: in.])

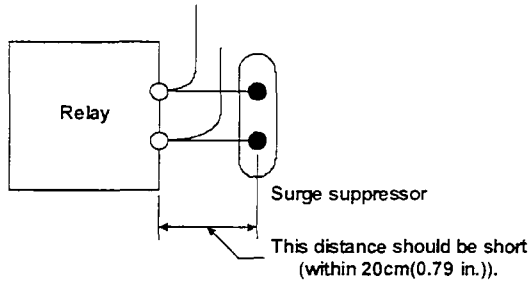


Outline drawing (ZCAT3035-1330)

(3) Surge suppressor

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

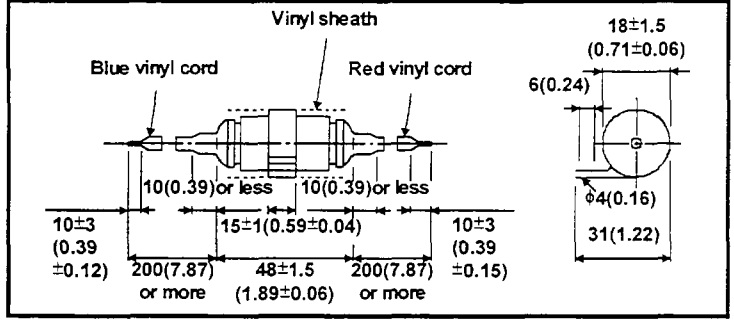




(Ex.) 972A.2003 50411
(Matsuo Electric Co.,Ltd.-200VAC rating)

Rated Voltage AC[V]	C [μF]	R [Ω]	Test Voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1~5s)

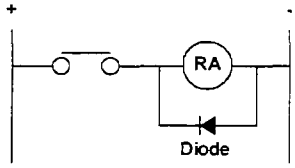
Outline Drawing [Unit: mm] ([Unit: in.])



Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

Maximum current: Not less than twice the drive current of the relay or the like

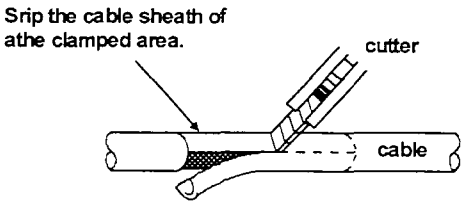


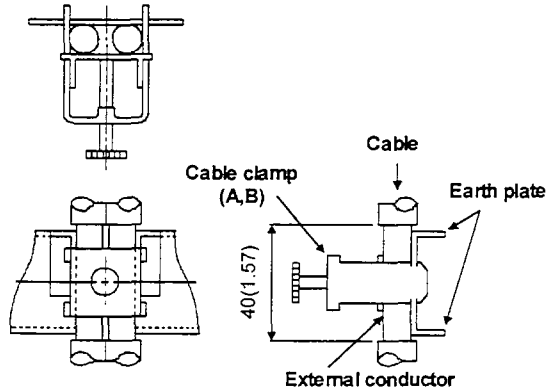
(4) Cable clamp fitting (AERSBAN-□SET)

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below.

Install the earth plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



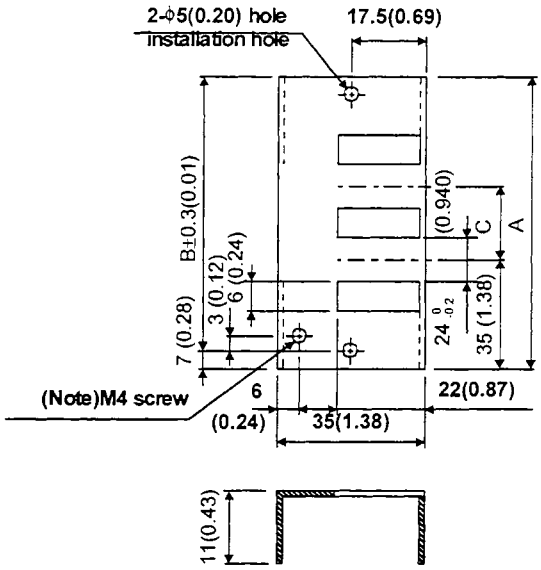


Clamp section diagram

· Outline drawing

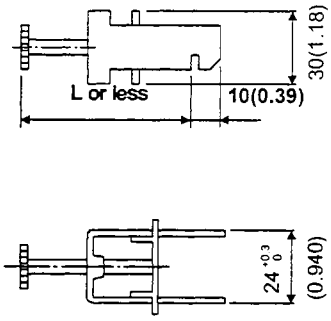
[Unit: mm]
([Unit: in.])

Earth plate



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

Clamp section diagram

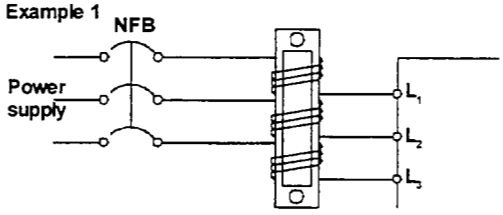
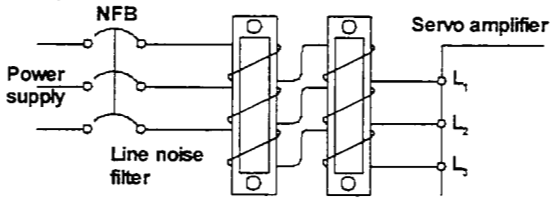
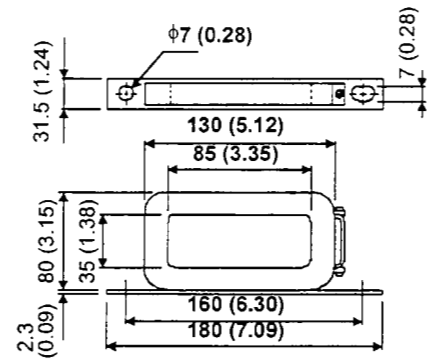
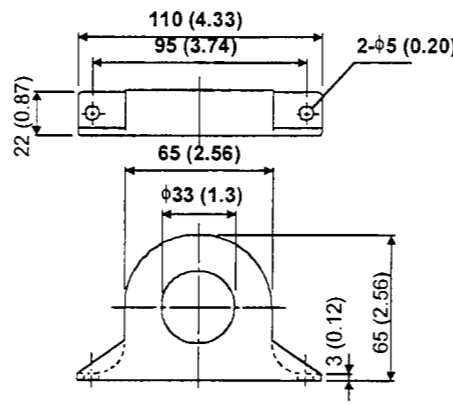


Type	A	B	C	Accessory Fittings
AERSBAN-DSET	100 (3.94)	86 (3.39)	30 (1.18)	clamp A: 2pcs.
AERSBAN-ESET	70 (2.76)	56 (2.20)	—	clamp B: 1pc.

Clamp Fitting	L
A	70 (2.76)
B	45 (1.77)

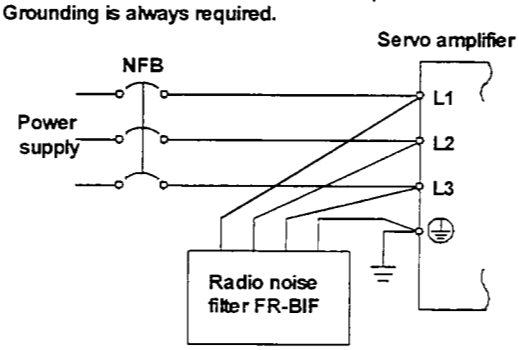
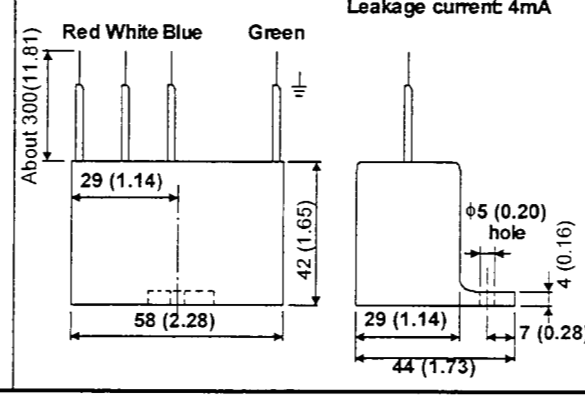
(5) Line noise filter (FR-BLF, FR-BSF01)

This filter is effective in suppressing noises radiated from the power supply side and output side of the servo amplifier and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

Connection Diagram	Outline Drawing [Unit: mm] ([Unit: in.])
· Wind the three-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the servo amplifier. · The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four. On the output side, the number of turns must be four or less. Note 1: Do not wind the grounding wire together with the three-phase wires. The filter effect will decrease. Use special caution when a four-core cable is used. Use a separate wire for grounding. Note 2: If the wires are too thick to be wound, use two or more filters and the number of turns should be as mentioned above. Example 1  (Number of turns: 4) Example 2  Two filters are used (Total number of turns: 4)	FR-BLF(MR-J2-350C)  FR-BSF01(for MR-J2-200C or less) 

(6) Radio noise filter (FR-BIF)...for the input side only

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

Connection Diagram	Outline Drawing (Unit: mm) ([Unit: in.])
Make the connection cables as short as possible. Grounding is always required.  	Leakage current: 4mA 

14.2.7 Leakage current breaker

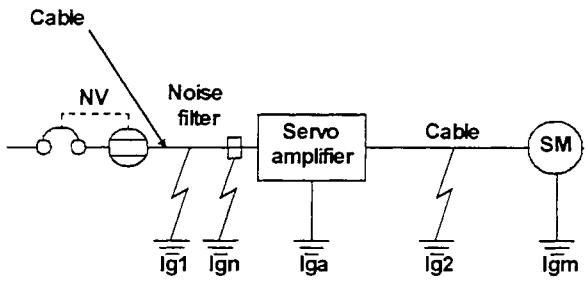
(1) Selection method

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

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

Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm (11.8 in)) to minimize leakage currents.

Rated sensitivity current ≥ 10 · {Ig1+Ign+Iga+K · (Ig2+Igm)} [mA] ····· (14.2)



K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and reduction techniques	NV-SF NV-CF	1
General models	NV-CA NV-CS NV-SS	3

Ig1: Leakage current on the electric channel from the leakage current breaker to the input of the servo amplifier (Found from Fig. 14.1.)

Ig2: Leakage current on the electric channel from the output terminals of the servo amplifier servo motor (Found from Fig. 14.1.)

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

Iga: Leakage current of the servo amplifier (Found from Table 14.6.)

Igm: Leakage current of the servo motor (Found from Table 14.5.)

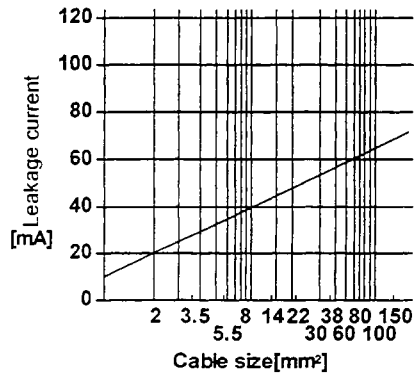


Fig. 14.1 Leakage Current Example (Ig1, Ig2) for CV Cable Run in Metal Conduit

Table 14.5 Servo Motor's Leakage Current Example (Igm)

Servo Motor Output [kW]	Leakage Current [mA]
0.05 to 0.5	0.1
0.6 to 1.0	0.1
1.2 to 2.2	0.2
3 to 3.5	0.3

Table 14.6 Servo Amplifier's Leakage Current Example (Iga)

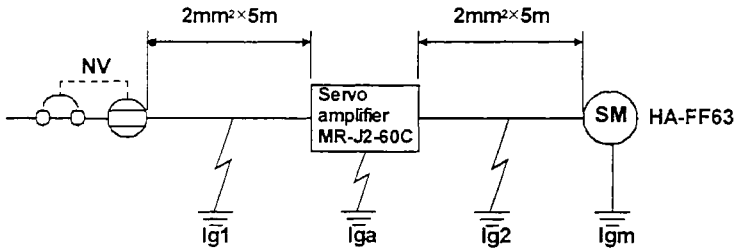
Servo Amplifier Capacity [kW]	Leakage Current [mA]
0.1 to 0.6	0.1
0.7 to 3.5	0.15

Table 14.7 Leakage Circuit Breaker Selection Example

Servo Amplifier	Rated Sensitivity Current of Leakage Circuit Breaker
MR-J2-10C to MR-J2-350C	15 [mA]

(2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions:



Use a leakage current breaker generally available.
Find the terms of Equation (14.2) from the diagram:

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

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

Ign = 0 (not used)

Iga = 0.1 [mA]

Igm = 0.1 [mA]

Insert these values in Equation (14.2):

$$Ig \geq 10 \cdot \{0.1+0+0.1+3 \cdot (0.1+0.1)\}$$

$$\geq 8.5 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 8.5[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-CA/CS/SS series.

14.2.8 EMC filter

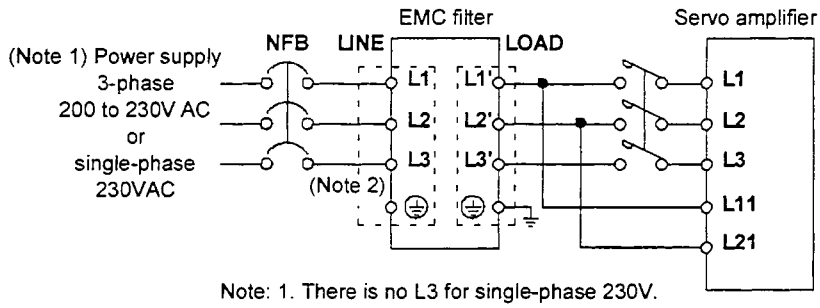
For compliance with the EMC Directive of the EN Standard, it is recommended to use the following filter:

(1) Combination with the servo amplifier

Servo Amplifier	(Note) Recommended Filter	Weight [kg]
MR-J2-10C ~100C-S100	SF1252	0.75
MR-J2-200C ·350C-S100	SF1253	1.37

Note: POXBURGH make

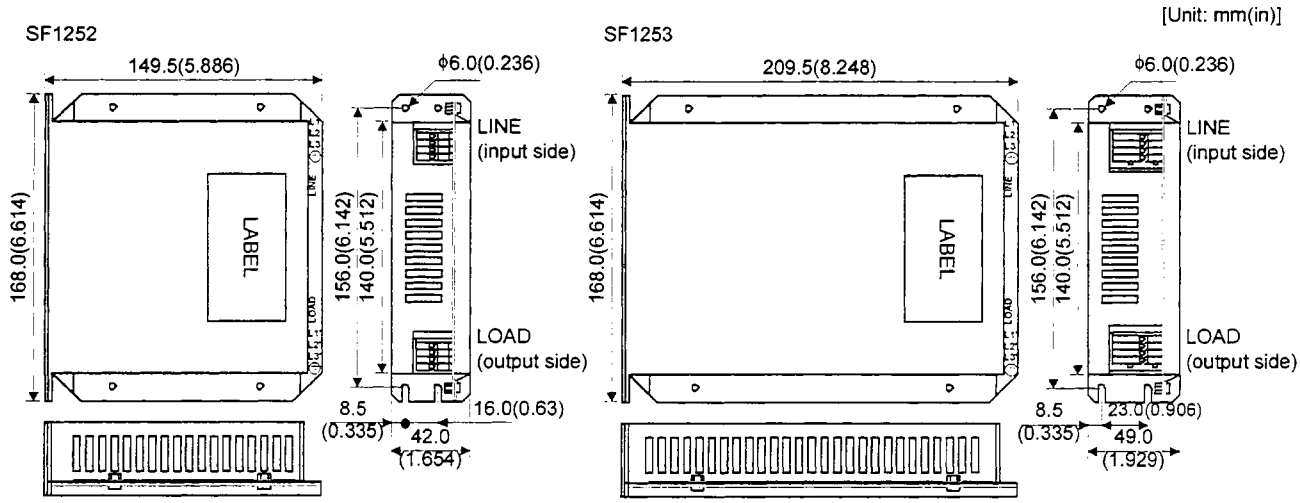
(2) Connection example



Note: 1. There is no L3 for single-phase 230V.
2. Connect when the power supply has earth.

(3) Outline drawing

[Unit: mm(in)]



15. CALCULATION METHODS FOR DESIGNING

15.1 Specification Symbol List

The following symbols are required for selecting the proper servo:

T_a	: Acceleration torque [N · m]		μ	: Friction coefficient	
T_b	: Deceleration torque [N · m]		π	: Circle ratio (3.14)	
T_{Ma}	: Servo motor torque necessary for acceleration	[N · m]	P_t	: Number of feedback pulses in position control mode	[pulse/rev]
T_{Mb}	: Servo motor torque necessary for deceleration	[N · m]	f	: Input pulse frequency in position control mode	[pps]
T_{LH}	: Torque applied during servo motor stop	[N · m]	f_0	: Input pulse frequency during fast feed in position control mode	[pps]
T_L	: Load torque converted into equivalent value on servo motor shaft	[N · m]	T_{psa}	: Acceleration time constant of frequency command in position control mode	[s]
T_{LM}	: Load torque converted into equivalent value on servo motor shaft during stop	[N · m]	T_{psb}	: Deceleration time constant of pulse frequency command in position control	[s]
T_U	: Unbalance torque	[N · m]	K_p	: Position control gain 1	[rad/s]
T_F	: Load friction torque	[N · m]	T_p	: Position control time constant ($T_p=1/K_p$)	[s]
T_{LO}	: Load torque on load shaft	[N · m]	K_v	: Speed control gain	[rad/s]
T_{rms}	:Continuous effective load torque converted into equivalent on servo motor shaft	[N · m]	T_v	: Speed control time constant ($T_v=1/K_v$)	[s]
J_L	: Load inertia moment converted into equivalent value on servo motor shaft	[kg · cm^2]	$\Delta\ell_0$	: Command resolution	[μm/pulse]
			l	: Feed	[mm]
J_{LO}	: Load inertia moment on load shaft	[kg · cm^2]	P	: Number of internal command pulses	[pulse]
J_M	: Servo motor's rotor inertia moment	[kg · cm^2]	t_s	: Internal settling time	[s]
N	: Servo motor speed	[r/min]	t_o	: Positioning time	[s]
N_o	: Servo motor speed during fast feed	[r/min]	t_c	: Time at constant speed of servo motor in 1 cycle	[s]
N_{LO}	: Load shaft speed during fast feed	[r/min]	$t\ell$	: Stopping time in 1 cycle	[s]
V	: Moving part speed	[mm/min]	$\Delta\varepsilon$	: Positioning accuracy	[mm]
V_o	: Moving part speed during fast feed	[mm/min]	ε	: Number of droop pulses	[pulse]
P_B	: Ball screw lead	[mm]	$\Delta\theta$	: Load shaft rotation angle per pulse in position control mode	[degree/pulse]
Z_1	: Number of gear teeth on servo motor shaft		e	: Euler constant = 2.718278	
Z_2	: Number of gear teeth on load gear		ΔS	: Feed per servo motor revolution	[mm/rev]
n	: Gear ratio $n=\frac{Z_2}{Z_1}$ Speed reduced when n>1, Speed increased when n<1				
η	: Drive system efficiency				
g	: Gravitational acceleration (9.8[m/s^2])				

15.2 Stopping Characteristics

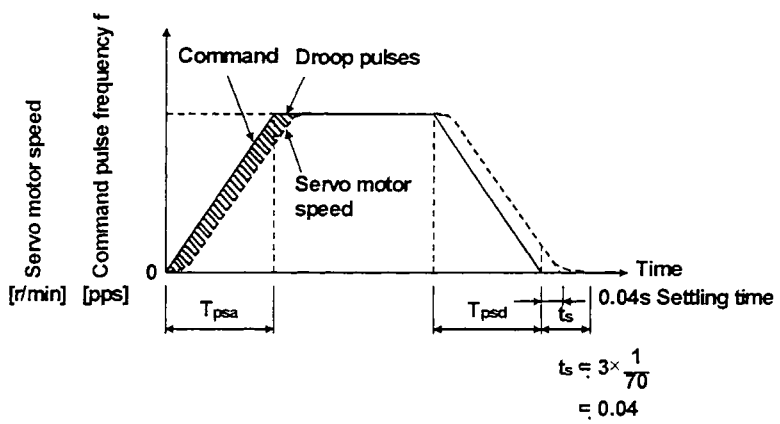
(1) Droop pulses (ε)

When a pulse train command is used to run the servo moter, there is a relationship between the command pulse frequency and servo motor speed as shown in the figure.The difference between the command pulses and feedback pulses during acceleration are called droop pulses, which are accumulated in the servo amplifier's deviation counter. Equation 15.1 defines a relationship between the command pulse frequency (f) and position control gain 1(Kp).

$$\varepsilon \fallingdotseq \frac{fo}{Kp} \text{ [pulse]} \cdots\cdots (15.1)$$

Supposing that the value of position control gain 1 is 70 [rad/s], the droop pulses during operation will be as follows at the command pulse frequency of 200 [kpps] according to Equation 15.1:

$$\varepsilon \fallingdotseq \frac{200 \times 10^3}{70} \fallingdotseq 2858 \text{[pulse]}$$



(2) Settling time (ts) during linear acceleration/deceleration

Since droop pulses still exist when there are no command pulses, settling time (ts) is required until the servo motor stops. Set the operation pattern in consideration for the settling time.
The ts value is obtained according to Equation 15.2:

$$ts \fallingdotseq 3 \cdot Tp$$

$$= 3 \cdot \frac{1}{Kp} \text{ [s]} \cdots\cdots (15.2)$$

*When Kp=70 [rad/s], ts≒0.04 [s]. (Refer to the above diagram.)

The settling time (ts) indicates the time required for the servo motor to stop in the necessary positioning accuracy range. This does not always mean that the servo motor has stopped completely. Thus, especially when the servo motor is used in high-duty operation and positioning accuracy has no margin for travel per pulse ($\Delta\ell$), the value obtained by Equation 15.2 must be increased.
ts will vary with the moving part conditions. Especially when the load friction torque is large, movement may be unstable near the stopping position.

15.3 Capacity Selection

As a first step, confirm the load conditions and temporarily select the servo motor capacity. Then, determine the operation pattern, calculate required torques according to the following equations, and check that the servo motor of the initially selected capacity may be used for operation .

(1) Initial selection of servo motor capacity

After calculating the load torque (TL) and load inertia moment (JL), select a servo motor which will satisfy the following two relationships:

Servo motor's rated torque > TL

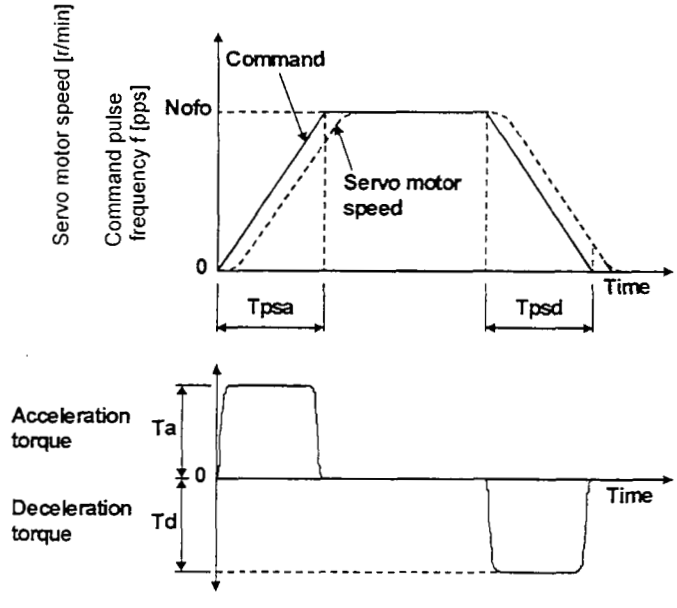
Servo motor JM > JL/m

m=3	: High duty (more than 100 times/min.) Settling time 40ms or less
m=5	: Middle duty (60 to 100 times/min.) Settling time 100ms or less
m=permissible load inertia moment	: Low duty (less than 60 times/min.) Settling time more than 100ms

Find the acceleration and deceleration torques and continuous effective load torque as described in (2) to make a final selection. For high-duty positioning, the JL value should be as small as possible. If positioning is infrequent as in line control, the JL value may be slightly larger than in the above conditions.

(3) Acceleration and deceleration torques

The following equations are used to calculate the acceleration and deceleration torques in the following operation pattern:

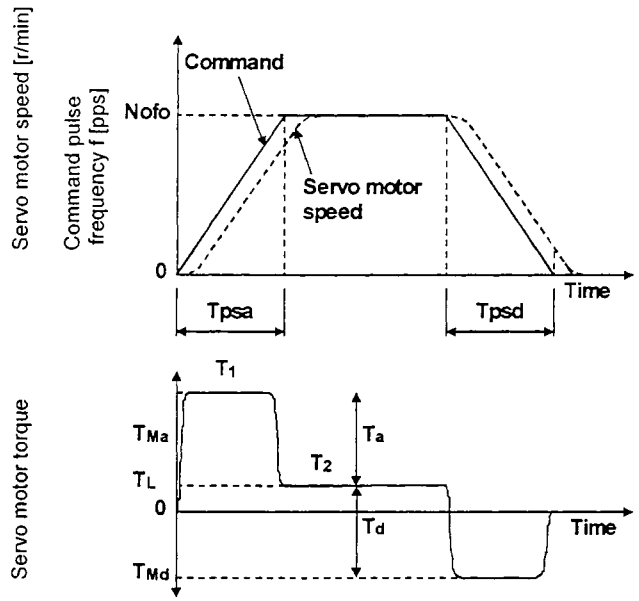


· Acceleration torque $Ta=\frac{(JL+JM)\cdot No}{9.55\times10^4}\cdot\frac{1}{Tpsa}$ ..... (15.3)

· Deceleration torque $Tb=\frac{(JL+JM)\cdot No}{9.55\times10^4}\cdot\frac{1}{Tpsd}$ ..... (15.4)

(4) Torques required for operation

Torques required for the servo motor are the highest during acceleration. If any of the torques obtained with Equations 15.3 to 15.7 exceeds the maximum servo motor torque, the servo motor speed cannot be increased as commanded. Confirm that the calculated value is lower than the servo motor's maximum torque. Since a friction load is normally applied during deceleration, only the acceleration torque needs to be considered.



$$T_1 = T_{Ma} = T_a + T_L \quad \cdots\cdots (15.5)$$

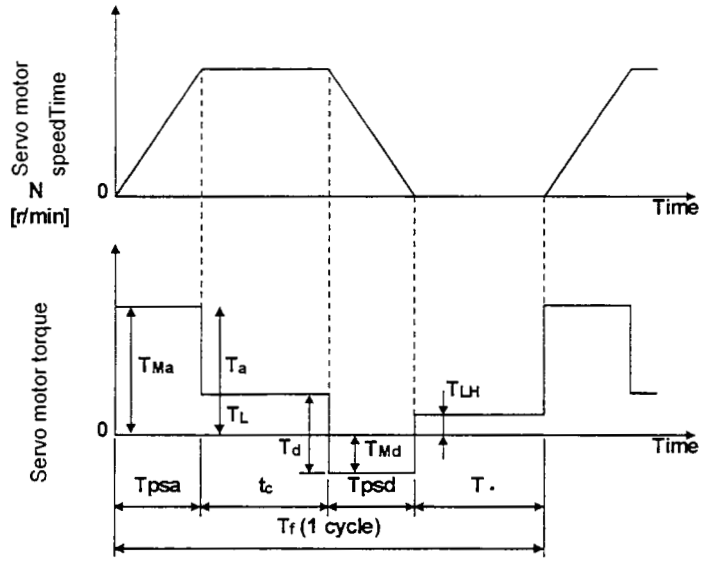
$$T_2 = T_L \quad \cdots\cdots (15.6)$$

$$T_3 = T_{Md} = -T_d + T_L \quad \cdots\cdots (15.7)$$

Note: In the regenerative mode, the value found by Equation 15.7 is negative.

(5) Continuous effective load torque

If the torque required for the servo motor changes with time, the continuous effective load torque should be lower than the rated torque of the servo motor. There may be a servo motor torque delay at the start of acceleration or deceleration due to a delay in the control system. To simplify the calculation, however, it is assumed that constant acceleration and deceleration torques are applied during Tpsa and Tpsd. The following equation is used to calculate the continuous effective load torque in the following operation pattern:

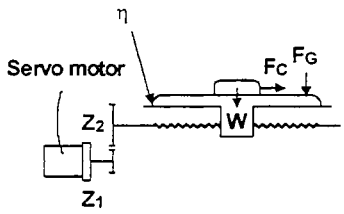
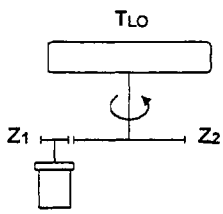
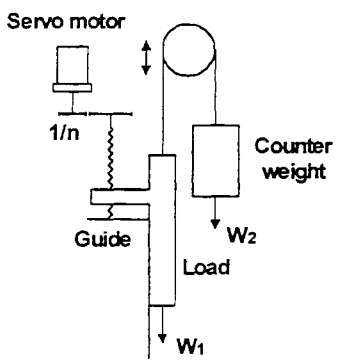


$$Trms=\sqrt{\frac{T^2_{Ma}\cdot T_{psa}+T^2_{L}\cdot t_c+T^2_{Md}\cdot T_{psd}+T^2_{LH}\cdot t_\ell}{tf}} \quad \cdots\cdots (15.8)$$

Note: TLH indicates the torque applied during a servo motor stop. A large torque may be applied especially during a stop in vertical motion applications, and this must be fully taken into consideration. During vertical drive, the unbalanced torque TU will become TLH.

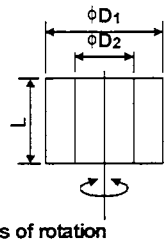
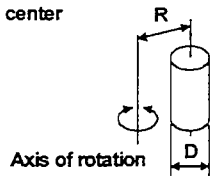
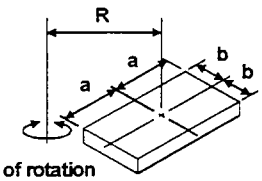
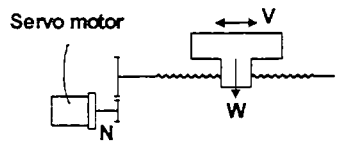
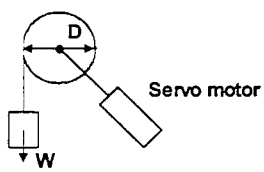
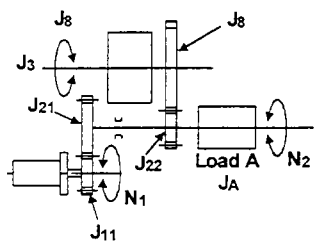
15.4 Load Torque Equations

Typical load torque equations are indicated below:

Type	Mechanism	Equation
Linear Movement		$T_L = \frac{F}{2\times10^3\cdot\pi\cdot\eta}\cdot\frac{V}{N} = \frac{F\cdot\Delta S}{2\times10^3\cdot\pi\cdot\eta}$ ·····(15.9) F : Force in the axial direction of the machine in linear motion [N] F in Equation 15.9 is obtained with Equation 15.10 when the table is moved, for example, as shown in the left diagram. $F = F_C \mp \mu\cdot(W\cdot g + F_G)$ ·····(15.10) F_C : Force applied in the axial direction of the moving part [N] F_G : Tightening force of the table guide surface [N] W : Full weight of the moving part [kg]
Rotary Movement		$T_L = \frac{1}{n}\cdot\frac{1}{\eta}\cdot T_{LO} + T_F$ ·····(15.11) T_F : Load friction torque converted into equivalent value on servo motor shaft [N·m]
Vertical Movement		During rise $T_L = T_U + T_F$ ·····(15.12) During fall $T_L = T_U\cdot\eta^2 + T_F$ ·····(15.13) T_F : Friction torque of the moving part [N·m] $T_U = \frac{(W_1 - W_2)\cdot g}{2\times10^3\cdot\pi\cdot\eta}\cdot\frac{V}{N} = \frac{(W_1 - W_2)\cdot g\cdot\Delta S}{2\times10^3\cdot\pi\cdot\eta}$ ·····(15.14) $T_F = \frac{\mu(W_1+W_2)\cdot g\cdot\Delta S}{2\times10^3\cdot\pi\cdot\eta}$ ·····(15.15) W_1 : Weight of load [kg] W_2 : Weight of counterweight [kg]

15.5 Load Inertia Moment Equations

Typical load inertia moment equations are indicated below:

Type	Mechanism	Equation
Cylinder	Axis of rotation is on the cylinder center 	$J_{LO}=\frac{\pi\cdot\rho\cdot L}{32}\cdot(D_1^4-D_2^4)=\frac{W}{8}\cdot(D_1^2+D_2^2)$ ····· (15.16) ρ : Cylinder material density [kg/cm^3] L : Cylinder length [cm] D1 : Cylinder outside diameter [cm] D2 : Cylinder inside diameter [cm] W : Cylinder weight [kg] Reference data: material density Iron : 7.8×10^{-3} [kg/cm^3] Aluminum : 2.7×10^{-3} [kg/cm^3] Copper : 8.96×10^{-3} [kg/cm^3]
	Axis of rotation is off the cylinder center 	$J_{LO}=\frac{W}{8}\cdot(D^2+8R^2)$ ····· (15.17)
Square block		$J_{LO}=W\cdot\left(\frac{a^2+b^2}{3}+R^2\right)$ ····· (15.18) W : Square block weight [kg] a, b, R : Left diagram [cm]
Object which moves linearly		$J_L=W\cdot\frac{V}{600\cdot\omega}=W\cdot\left(\frac{1}{2\cdot\pi\cdot N}\cdot\frac{V}{10}\right)^2=W\cdot\left(\frac{\Delta S}{20\cdot\pi}\right)^2$ ····· (15.19) V : Speed of object moving linearly [mm/min] ΔS : Moving distance of object moving linearly per servo motor revolution [mm/rev] W : Object weight [kg]
Object that is hung with pulley		$J_L=W\cdot\left(\frac{D}{2}\right)^2+J_P$ ····· (15.20) JP : Pulley inertia moment [kg · cm^2] D : Pulley diameter [cm] W : Object weight [kg]
Converted load		$J_L=J_{11}+(J_{21}+J_{22}+J_A)\cdot\left(\frac{N_2}{N_1}\right)^2+(J_{31}+J_B)\cdot\left(\frac{N_3}{N_1}\right)^2$ ····· (15.21) JA, JB : Inertia moments of loads A, B [kg · cm^2] J11 to J31 : Inertia moments [kg · cm^2] N1 to N3 : Speed of each shaft [r/min]

15.6 Precautions for Zeroing

When a general positioning unit is used, the sequence of events is as shown in Fig. 15.1.

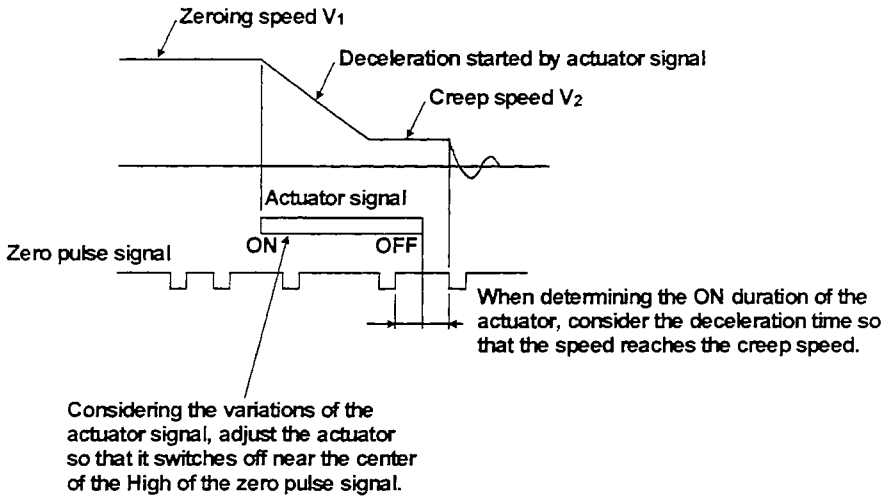
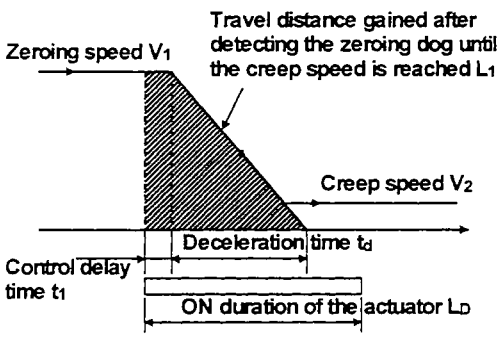


Fig 15.1 Zeroing Using the Actuator

(1) When determining the ON duration of the actuator, consider the delay time of the control section and the deceleration time so that the creep speed is attained. If the actuator signal switches off during deceleration, precise home position return cannot be performed.



Travel distance L1 in the chart can be obtained by Equation 15.22

$$L_1=\frac{1}{60}\cdot V_1\cdot t_1+\frac{1}{120}\cdot V_1\cdot t_d\cdot\left\{1-\left(\frac{V_2}{V_1}\right)^2\right\}+\frac{1}{60}\cdot V_1\cdot T_p \quad \cdots\cdots (15.22)$$

ON duration of the actuator LD [mm] must be longer than L1 obtained by Equation 15.22, as indicated in Equation 15.23

$$L_D > L_1 \quad \cdots\cdots (15.23)$$

where,

V_1, V_2 : As shown in the chart [mm/min]

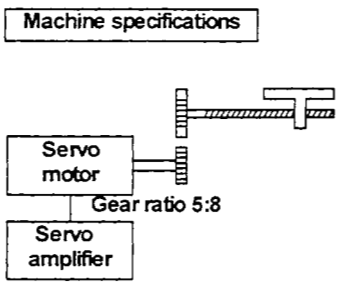
t_1, t_d : As shown in the chart [s]

L_1 : As shown in the chart [mm]

L_D : As shown in the chart [mm]

(2) Set the end (OFF position) of the actuator signal at the middle of two ON positions (Lows) of the zero pulse signal. If it is set near either ON position of the zero pulse signal, the positioning unit is liable to misdetect the zero pulse signal. In this case, a fault will occur, e.g. the home position will shift by one revolution of the servo motor.
The zero pulse output position can be confirmed by OP (encoder Z-phase pulse) on the external I/O signal display.

15.7 Selection Example



Speed of moving part during fast feed	V_o	= 30000[mm/min]
Command resolution	$\Delta\ell$	= 10[μm]
Travel	ℓ	= 400[mm]
Positioning time	t_o	= within 1[s]
Number of feeds		40[times/min]
Operation	t_f	= 1.5[s]
Gear ratio	n	= 8/5
Moving part weight	W	= 60[kg]
Drive system efficiency	η	= 0.8
Friction coefficient	μ	= 0.2
Ball screw lead	P_b	= 16[mm]
Ball screw diameter		20[mm]
Ball screw length		500[mm]
Gear diameter (servo motor)		25[mm]
Gear diameter (load shaft)		40[mm]
Gear face width		10[mm]

(1) Selection of control parameters

Setting of electronic gear (command pulse multiplication numerator, denominator)
There is the following relationship between the multiplication setting and travel per pulse $\Delta\ell$.

$$\Delta\ell = \frac{\text{(ball screw lead)}}{8192 \times \text{(gear ration)}} \times \left(\frac{CMX}{CDV}\right)$$

When the above machining specifications are substituted in the above equation:

$$\frac{CMX}{CDV} = 10 \cdot \frac{8192 \cdot 8/5}{16 \times 1000} = \frac{8192}{1000}$$

Acceptable as CMX/CDV is within 1/20 to 20.

(2) Servo motor speed

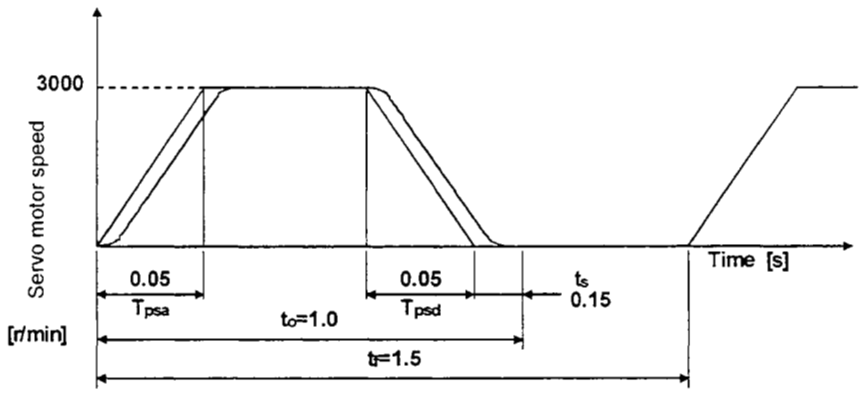
$$No = \frac{V_o}{P_b} \cdot n = \frac{30000}{16} \times \frac{8}{5} = 3000[r/min]$$

(3) Acceleration/deceleration time constant

$$T_{psa} = T_{psd} = to - \frac{\ell}{Vo/60} - ts = 0.05[s]$$

*ts: settling time.(Here, this is assumed to be 0.15s.)

(4) Operation pattern



(5) Load torque (converted into equivalent value on servo motor shaft)

Travel per servo motor revolution

$$\Delta S = Pb \cdot \frac{1}{n} = 16 \times \frac{5}{8} = 10[mm]$$

$$TL = \frac{\mu \cdot W \cdot g \cdot \Delta S}{2 \times 10^3 \cdot \pi \cdot \eta} = \frac{0.2 \cdot 60 \cdot 9.8 \cdot 10}{2 \times 10^3 \cdot 3.14 \cdot 0.8} = 0.23[N \cdot m]$$

For gravitational system of units

$$TL = \frac{\mu \cdot W \cdot \Delta S}{20 \cdot \pi \cdot \eta} = 2.4[kgf \cdot cm]$$

(6) Load inertia moment (converted into equivalent value on servo motor shaft)

Moving part

$$J_{L1} = W \cdot \left(\frac{\Delta S}{20\pi}\right)^2 = 1.52[kg \cdot cm^2]$$

Ball screw

$$J_{L2} = \frac{\pi \cdot \rho \cdot L}{32} \cdot D^4 \cdot \left(\frac{1}{n}\right)^2 = 0.24[kg \cdot cm^2]$$

$*\rho = 7.8 \times 10^{-3}[kg \cdot cm^3]$

Gear (servo motor shaft)

$$J_{L3} = \frac{\pi \cdot \rho \cdot L}{32} \cdot D^4 = 0.03[kg \cdot cm^2]$$

Gear (load shaft)

$$J_{L4} = \frac{\pi \cdot \rho \cdot L}{32} \cdot D^4 \cdot \left(\frac{1}{n}\right)^2 = 0.8[kg \cdot cm^2]$$

Full load inertia moment (converted into equivalent value on servo motor shaft)

$$J_L = J_{L1} + J_{L2} + J_{L3} + J_{L4} = 1.9[kg \cdot cm^2]$$

For gravitational system of units

$GD^2 = 4 \cdot J = 7.6[kgf \cdot cm^2]$

(7) Temporary selection of servo motor

Selection conditions

1) Load torque < servo motor's rated torque

2) Full load inertia moment < 10 × servo motor inertia moment

From the above, the HC-MF23 (200W) is temporarily selected.

(8) Acceleration and deceleration torques

Torque required for servo motor during acceleration

$$T_{Ma} = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4 \cdot T_{psa}} + T_L = 1.7[N \cdot m]$$

For gravitational system of units

$$T_{Ma} = \frac{(GD_L^2 + GD_M^2) \cdot N_o}{37500 \cdot T_{psa}} + T_L = 17.2[kgf \cdot cm]$$

Torque required for servo motor during deceleration

$$T_{Md} = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4 \cdot T_{psd}} + T_L = -1.2[N \cdot m]$$

For gravitational system of units

$$T_{Md} = \frac{(GD_L^2 + GD_M^2) \cdot N_o}{37500 \cdot T_{psd}} + T_L = -12.4[kgf \cdot cm]$$

The torque required for the servo motor during deceleration must be lower than the servo motor's maximum torque.

(9) Continuous effective load torque

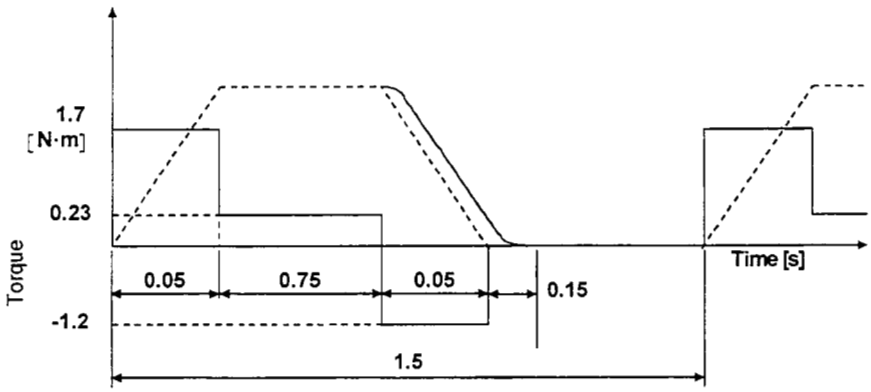
$$Trms = \sqrt{\frac{T_{Ma}^2 \cdot T_{psa} + T_L^2 \cdot tc + T_{Md}^2 \cdot T_{psd}}{tf}} = 0.41[N \cdot m]$$

For gravitational system of units

4.2[kgf · cm]

The continuous effective load torque must be lower than the servo motor's rated torque.

(10) Torque pattern



(11) Selection results

The HC-MF23 servo motor and MR-J2-20C servo amplifier are selected.

1) Electronic gear setting

Parameter No.4	CMX	8192
Parameter No.5	CDV	1000

2) During rapid feed

· Servo motor speed $N_0 = 3000$ [r/min]

3) Acceleration/deceleration time constant

$T_{psa} = T_{psd} = 0.05$[s]

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