MITSUBISHI ELECTRIC

General-Purpose AC Servo

MELSERVO-J2M Series

General-Purpose Interface Compatible

MODEL

MR-J2M-P8A
MR-J2M-□DU
MR-J2M-BU□

SERVO AMPLIFIER
INSTRUCTION MANUAL

E

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ WARNING

- Before wiring or inspection, switch power off and wait for more than 15 minutes. Then, confirm the voltage is safe with voltage tester. Otherwise, you may get an electric shock.
- Connect the base unit 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 for each unit and the servo motor until they are installed. Otherwise, you can obtain the electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.
- During power-on or operation, do not open the front cover of the servo amplifier. You may get an electric shock.
- Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- Except for wiring or periodic inspection, do not remove the front cover even of the servo amplifier if the power is off. The servo amplifier is charged and you may get an electric shock.

2. To prevent fire, note the following:

⚠ CAUTION

- Do not install the base unit, servo motor and regenerative brake resistor on or near combustibles. Otherwise a fire may cause.
- When each unit has become faulty, switch off the main base unit 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.
- Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative brake resistor, servo motor, etc.since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged.
- During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

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

Environment			Conditions		
			Each unit	Servo motor	
Ambient temperature	During operation	[℃]	0 to +55 (non-freezing)	0 to +40 (non-freezing)	
		[°F]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
	In storage	[℃]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)	
		[°F]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)	
Ambient humidity	During operation		90%RH or less (non-condensing)	80%RH or less (non-condensing)	
	In storage		90%RH or less (non-condensing)		
Ambience			Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt		
Altitude			Max. 1000m (3280 ft) above sea level		
(Note) Vibration		[m/s^2]	5.9 or less	HC-KFS Series HC-MFS Series HC-UFS13 to 43	X・Y : 49
		[ft/s^2]	19.4 or less	HC-KFS Series HC-MFS Series HC-UFS13 to 43	X・Y : 161

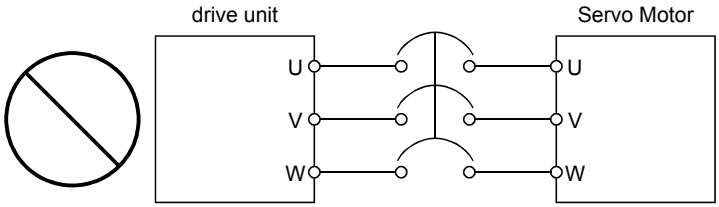
Note. Except the servo motor with reduction gear.

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

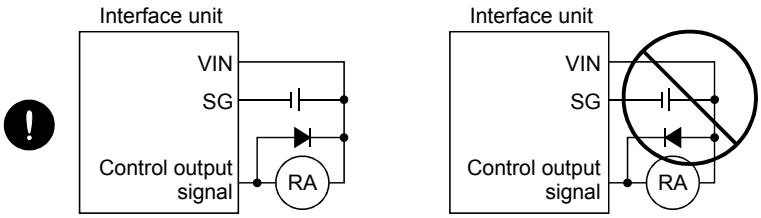
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate.
- Do not install a power capacitor, surge absorber or radio noise filter (FR-BIF option) between the servo motor and drive unit.
- Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.
- Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.



- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay of the servo amplifier must be wired in the specified direction. Otherwise, the forced stop and other protective circuits may not operate.



(3) Test run adjustment

⚠ CAUTION

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

(4) Usage

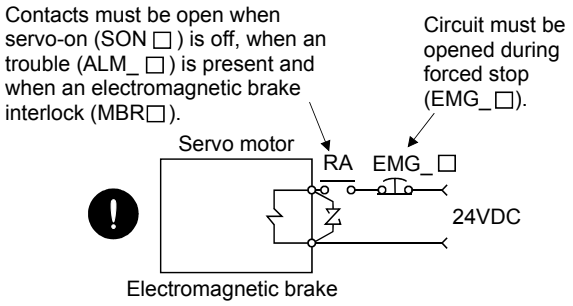
⚠ CAUTION

- Provide an forced stop circuit to ensure that operation can be stopped and power switched off immediately.
- Any person who is involved in disassembly and repair should be fully competent to do the work.
- Before resetting an alarm, make sure that the run signal of the servo amplifier is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
- Do not modify the equipment.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near MELSERVO-J2M.
- Burning or breaking each unit may cause a toxic gas. Do not burn or break each unit.
- Use the drive unit 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 interface unit signals but also by a forced stop (EMG_□).



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

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

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

(7) General instruction

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

● About processing of waste ●

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

⚠ FOR MAXIMUM SAFETY

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

⚠ EEP-ROM life

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

- Write to the EEP-ROM due to parameter setting changes
- Home position setting in the absolute position detection system
- Write to the EEP-ROM due to device changes

Precautions for Choosing the Products

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

COMPLIANCE WITH 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 (MELSERVO-J2M is contained) have been installed.

(1) EMC directive

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

(2) Low voltage directive

The low voltage directive applies also to MELSERVO-J2M. Hence, they are designed to comply with the low voltage directive.
MELSERVO-J2M is certified by TUV, third-party assessment organization, to comply with the low voltage directive.
The MELSERVO-J2M complies with EN50178.

(3) Machine directive

Not being machines, MELSERVO-J2M need not comply with this directive.

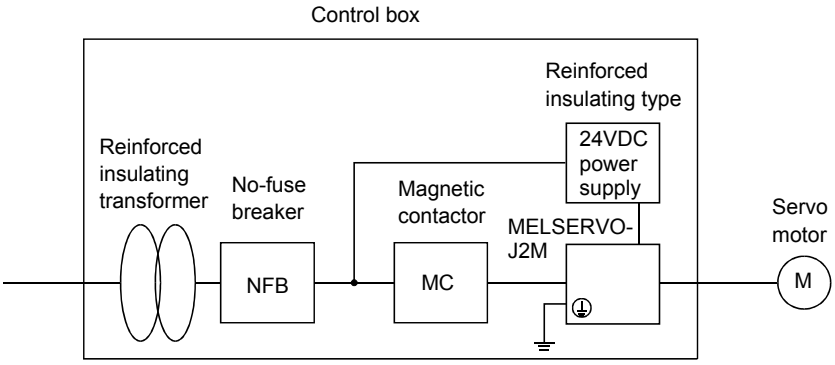
2. PRECAUTIONS FOR COMPLIANCE

(1) Unit and servo motors used

Use each units and servo motors which comply with the standard model.

Interface unit :MR-J2M-P8A
Drive unit :MR-J2M-□DU
Base unit :MR-J2M-BU□
Servo motor :HC-KFS□
HC-MFS□
HC-UFS□

(2) Configuration



(3) Environment

Operate MELSERVO-J2M at or above the contamination level 2 set forth in IEC60664-1 For this purpose, install MELSERVO-J2M in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(4) Power supply

(a) Operate MELSERVO-J2M to meet the requirements of the overvoltage category II set forth in IEC60664-1 For this purpose, a reinforced insulating transformer conforming to the IEC or EN standard should be used in the power input section.

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

(5) Grounding

(a) To prevent an electric shock, always connect the protective earth (PE) terminals (marked ⏚) of the base unit 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 base unit must be connected to the corresponding earth terminals.

(d) The protective earth (PE) of the servo motor is connected to the protective earth of the base unit via the screw which fastens the drive unit to the base unit. When fixing the drive unit to the base unit, therefore, tighten the accessory screw securely.

(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 12.2.2.

(b) The sizes of the cables described in Section 12.2.1 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204-1.

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

(c) Use the EMC filter for noise reduction.

(7) Performing EMC tests

When EMC tests are run on a machine/device into which MELSERVO-J2M has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.

For the other EMC directive guidelines on MELSERVO-J2M, refer to the EMC Installation Guidelines(IB(NA)67310).

CONFORMANCE WITH UL/C-UL STANDARD

The MELSERVO-J2M complies with UL508C.

(1) Unit and servo motors used

Use the each units and servo motors which comply with the standard model.

Interface unit :MR-J2M-P8A
Drive unit :MR-J2M-□DU
Base unit :MR-J2M-BU□
Servo motor :HC-KFS□
HC-MFS□
HC-UFS□

(2) Installation

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

(3) Short circuit rating

MELSERVO-J2M conforms to the circuit whose peak current is limited to 5000A or less. Having been subjected to the short-circuit tests of the UL in the alternating-current circuit, MELSERVO-J2M conforms to the above circuit.

(4) Capacitor discharge time

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

Base unit	Discharge time [min]
MR-J2M-BU4	1
MR-J2M-BU6	1
MR-J2M-BU8	1

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

(6) Attachment of a servo motor

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

(7) About wiring protection

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

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

<<About the manuals>>

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use MELSERVO-J2M for the first time. Always purchase them and use the MELSERVO-J2M safely.
Also read the manual of the servo system controller.

Relevant manuals

Manual name	Manual No.
MELSERVO-J2M Series To Use the AC Servo Safely (Packed with the MR-J2M-P8A, MR-J2M-□DU and MR-J2M-BU□)	IB(NA)0300027
MELSERVO Servo Motor Instruction Manual	SH(NA)3181
EMC Installation Guidelines	IB(NA)67310

In this Instruction Manual, the drive unit, interface unit and base unit may be referred to as follows:
Drive unit : DRU
Interface unit : IFU
Base unit : BU

CONTENTS

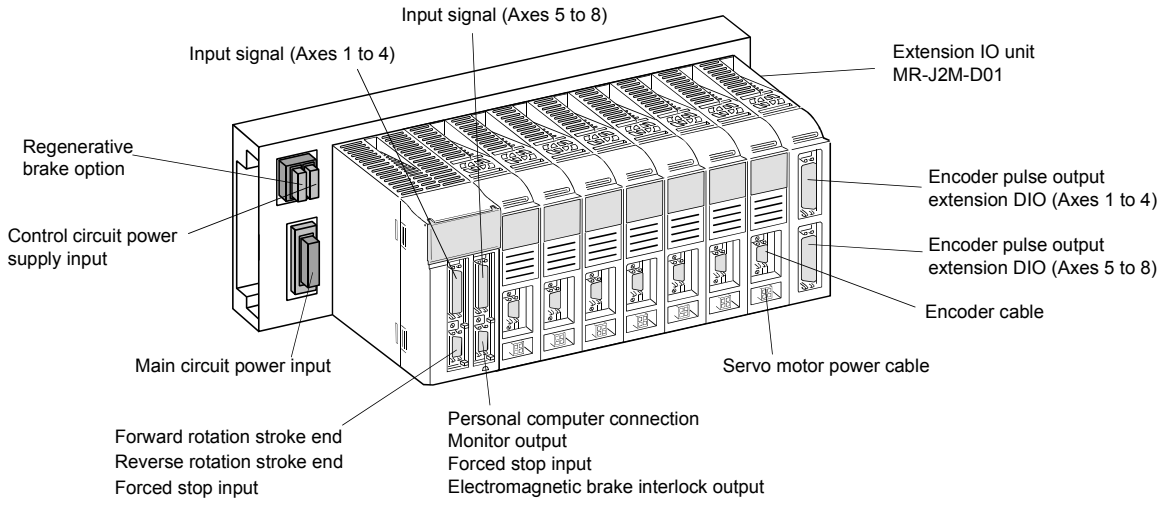
Optional Servo Motor Instruction Manual CONTENTS

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 this Instruction Manual.

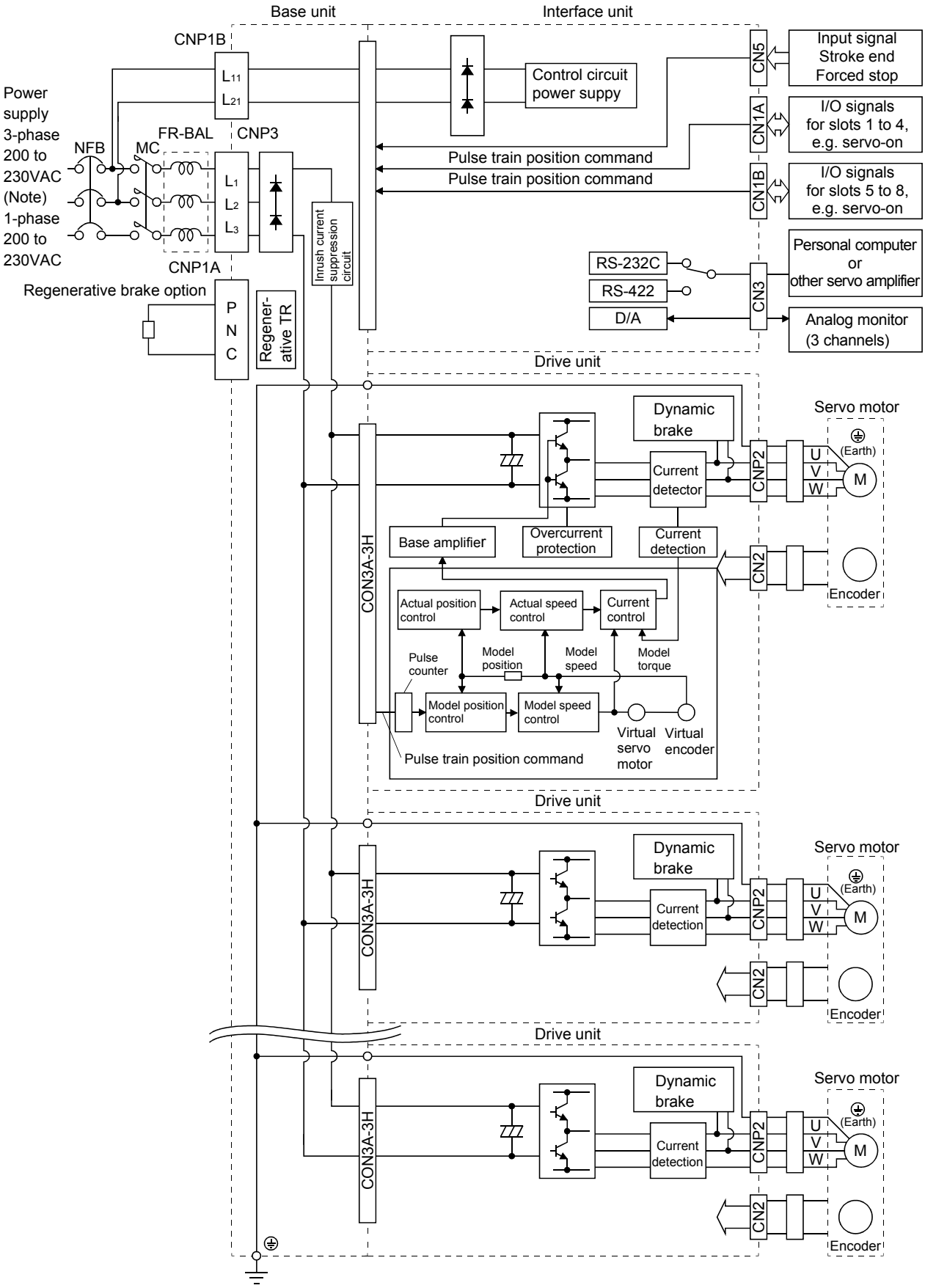
1. FUNCTIONS AND CONFIGURATION

1.1 Overview

The Mitsubishi general-purpose AC servo MELSERVO-J2M series is an AC servo which has realized wiring-saving, energy-saving and space-saving in addition to the high performance and high functions of the MELSERVO-J2-Super series.
The MELSERVO-J2M series consists of an interface unit (abbreviated to the IFU) to be connected with a positioning unit, drive units (abbreviated to the DRU) for driving and controlling servo motors, and a base unit (abbreviated to the BU) where these units are installed.
A torque limit is applied to the drive unit by the clamp circuit to protect the main circuit power transistors from overcurrent caused by abrupt acceleration/deceleration or overload. In addition, the torque limit value can be changed as desired using the parameter.
The interface unit has an RS-232C or RS-422 serial communication function to allow the parameter setting, test operation, status indication monitoring, gain adjustment and others of all units to be performed using a personal computer or like where the MR Configurator (servo configuration software) is installed. By choosing the station number of the drive unit using the MR Configurator (servo configuration software), you can select the unit to communicate with, without changing the cabling.
The real-time auto tuning function automatically adjusts the servo gains according to a machine.
A maximum 500kpps high-speed pulse train is used to control the speed and direction of a motor and execute accurate positioning of 131072 pulses/rev resolution.
The position smoothing function has two different systems to allow you to select the appropriate system for a machine, achieving a smoother start/stop in response to an abrupt position command.
The MELSERVO-J2M series supports as standard the absolute position encoders which have 131072 pulses/rev resolution, ensuring control as accurate as that of the MELSERVO-J2-Super series. Simply adding the optional battery unit configures an absolute position detection system. Hence, merely setting a home position once makes it unnecessary to perform a home position return at power-on, alarm occurrence or like.
The MELSERVO-J2M series has a control circuit power supply in the interface unit and main circuit converter and regenerative functions in the base unit to batch-wire the main circuit power input, regenerative brake connection and control circuit power supply input, achieving wiring-saving.
In the MELSERVO-J2M series, main circuit converter sharing has improved the capacitor regeneration capability dramatically. Except for the operation pattern where all axes slow down simultaneously, the capacitor can be used for regeneration. You can save the energy which used to be consumed by the regenerative brake resistor.



1.2 Function block diagram



Note. For 1-phase 200 to 230VAC, connect the power supply to L1, L2 and leave L3 open.

1.3 Unit standard specifications

(1) Base unit

Model		MR-J2M-BU4	MR-J2M-BU6	MR-J2M-BU8
Number of slots		4 slots	6 slots	8 slots
(Note) Control circuit power supply	Voltage/frequency	3-phase 200 to 230VAC or 1-phase 200 to 230VAC, 50/60Hz		
	Permissible voltage fluctuation	1-phase 170 to 253VAC		
	Permissible frequency fluctuation	Within 5%		
	Inrush current	20A (5ms)		
Main circuit power supply	Voltage/frequency	3-phase 200 to 230VAC or 1-phase 200 to 230VAC, 50/60Hz		
	Permissible voltage fluctuation	3-phase 170 to 253VAC or 1-phase 170 to 253VAC, 50/60 Hz		
	Permissible frequency fluctuation	Within 5%		
	Maximum servo motor connection capacity [W]	1600	2400	3200
	Continuous capacity [W]	1280	1920	2560
	Inrush current	62.5A (15ms)		
Function		Converter function, regenerative control, rushing into current control function		
Protective functions		Regenerative overvoltage shut-off, regenerative fault protection, undervoltage /instantaneous power failure protection		
Mass	[kg]	1.1	1.3	1.5
	[lb]	2.4	2.9	3.3

Note. The control circuit power supply is recorded to the interface unit.

(2) Drive unit

Model		MR-J2M-10DU	MR-J2M-20DU	MR-J2M-40DU	MR-J2M-70DU
Power supply	Voltage/frequency	270 to 311VDC			
	Permissible voltage fluctuation	230 to 342VDC			
Control system		Sine-wave PWM control, current control system			
Dynamic brake		Built-in			
Protective functions		Overcurrent shut-off, functions overload shut-off (electronic thermal relay), servo motor overheat protection, encoder fault protection, overspeed protection, excessive error protection			
Structure		Open (IP00)			
Cooling method		Self-cooled	Force-cooling (With built-in fan unit)		
Mass	[kg]	0.4	0.4	0.4	0.7
	[lb]	0.89	0.89	0.89	1.54

(3) Interface unit

Model		MR-J2M-P8A
Control circuit power supply		Power supply circuit for each unit(8 slots or less)
Interface		Pulse train interface 8 channels RS-232C interface 1 channel RS-422 interface 1 channel
DIO		Forced stop input (2 points), alarm output (2 points), input signal (40 points), output signal (16 points)
AIO		Analog monitor 3channels
Structure		Open (IP00)
Mass	[kg]	0.5
	[lb]	1.10

1.4 Function list

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

(1) Drive unit (Abbreviation DRU)

Function	Description	Reference
High-resolution encoder	High-resolution encoder of 131072 pulses/rev is used as a servo motor encoder.	
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Chapter 7
Gain changing function	You can switch between gains during rotation and gains during stop or use an external signal to change gains during operation.	Section 7.5.4
Adaptive vibration suppression control	MELSERVO-J2M detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 7.3
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 7.4
Position smoothing	Speed can be increased smoothly in response to input pulse.	DRU parameter No. 7
Slight vibration suppression control	Suppresses vibration of 1 pulse produced at a servo motor stop.	DRU parameter No.20
Electronic gear	Input pulses can be multiplied by 1/50 to 50.	DRU parameters No. 3, 4, 69 to 71 Section 5.3.1
Torque limit	Servo motor torque can be limited to any value.	DRU parameters No.28
Command pulse selection	Command pulse train form can be selected from among four different types.	DRU parameter No. 21

(2) Interface unit (Abbreviation IFU)

Function	Description	Reference
Position control mode	This servo is used as position control servo.	Section 2.7 Section 3.1.2 Section 3.1.5
I/O signal selection	The servo-on (SON□), ready (RD□) and other input signals can be reassigned to any other pins.	Section 3.2.6
Status display	Servo status is shown on the 5-digit, 7-segment LED display	Section 4.2.2 Section 4.3.2
Analog monitor	Servo status is output in terms of voltage in real time.	Section 5.3.2

(3) Base unit (Abbreviation BU)

Function	Description	Reference
Regenerative brake option	Used when the built-in regenerative brake resistor of the unit does not have sufficient regenerative capability for the regenerative power generated.	Section 12.1.1

(4) MR Configurator (servo configuration software)

Function	Description	Reference
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results.	
Gain search function	Can simulate machine motions on the basis of the machine analyzer results.	
External I/O signal display	ON/OFF statuses of external I/O signals are shown on the display.	Section 4.3.7
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 4.2.6 Section 4.3.8
Test operation mode	JOG operation and positioning operation are possible.	

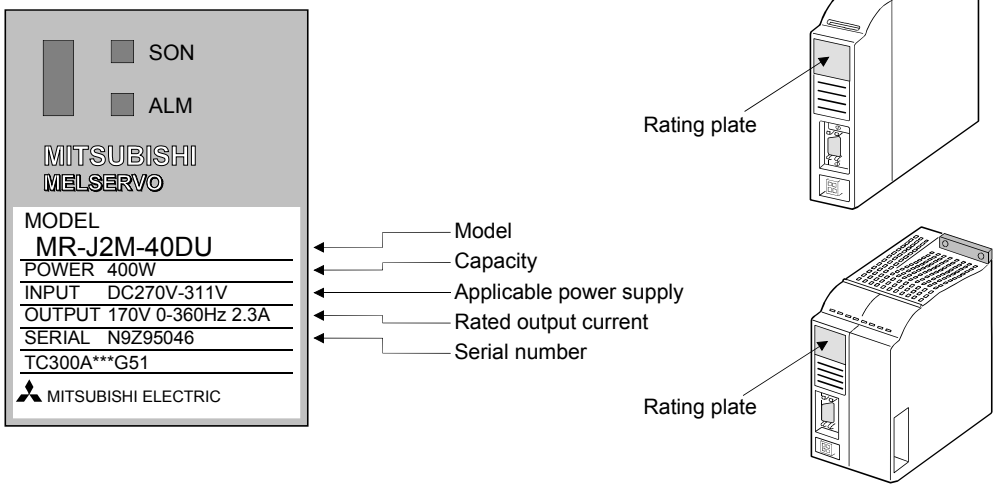
(5) Option unit

Function	Description	Reference
Absolute position detection system	Merely setting a home position once makes home position return unnecessary at every power-on. Battery unit MR-J2M-BT (shortly correspondence schedule) is necessary.	
Encoder pulse output	The encoder feedback is output from extension IO unit MR-J2M-D01 (shortly correspondence schedule) by the A・B・Z phase pulse. The number of pulses output by the parameter can be changed.	

1.5 Model code definition

(1) Drive unit

(a) Rating plate



(b) Model code

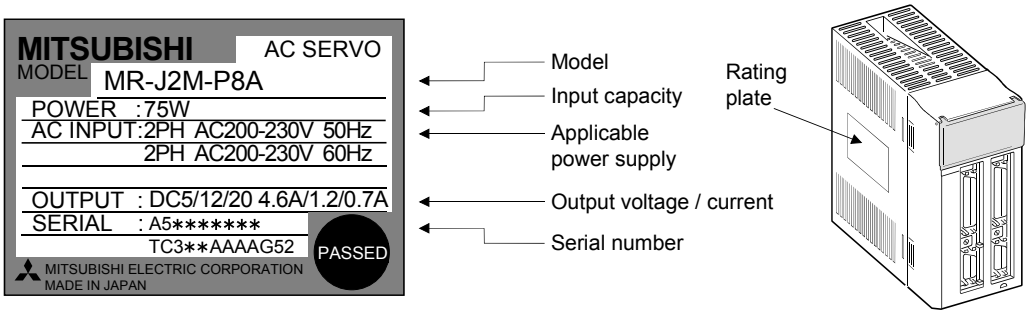
MR-J2M-□DU

Rated output

Symbol	Capacity of applied servo motor
10	100
20	200
40	400
70	750

(2) Interface unit

(a) Rating plate



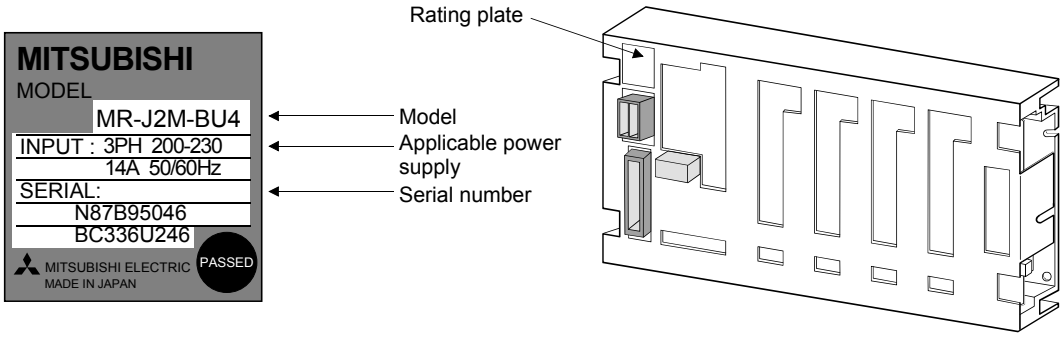
(b) Model code

MR-J2M-P8A

Pulse train interface compatible

(3) Base unit

(a) Rating plate



(b) Model code

MR-J2M-BU☐

Symbol	Number of slots	Maximum servo motor connection capacity [W]	Continuous capacity [W]
4	4	1600	1280
6	6	2400	1920
8	8	3200	2560

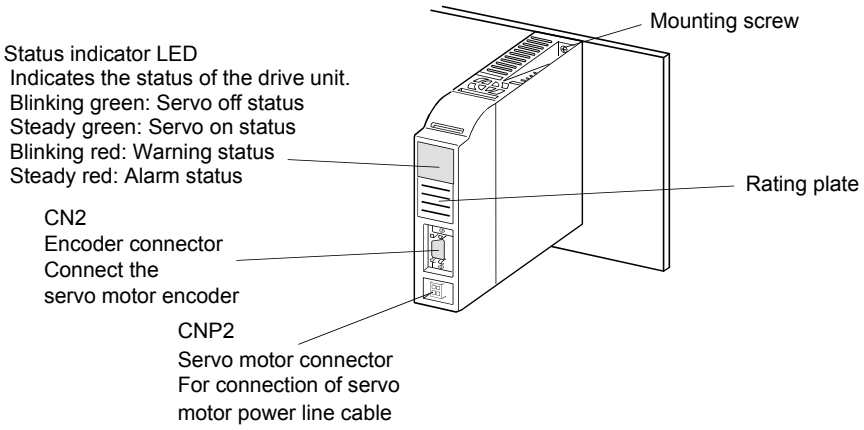
1.6 Combination with servo motor

The following table lists combinations of drive units and servo motors. The same combinations apply to the models with electromagnetic brakes and the models with reduction gears.

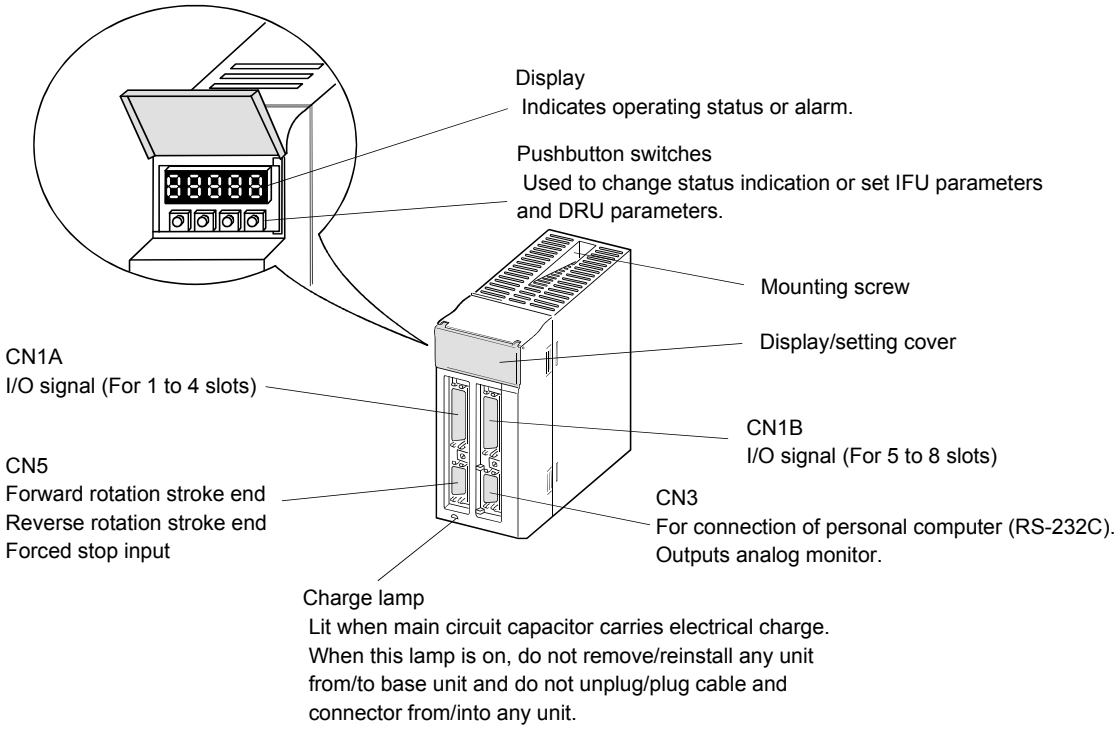
Drive unit	Servo motor		
	HC-KFS☐	HC-MFS☐	HC-UFS☐
MR-J2M-10DU	053 • 13	053 • 13	13
MR-J2M-20DU	23	23	23
MR-J2M-40DU	43	43	43
MR-J2M-70DU	73	73	73

1.7 Parts identification

(1) Drive unit

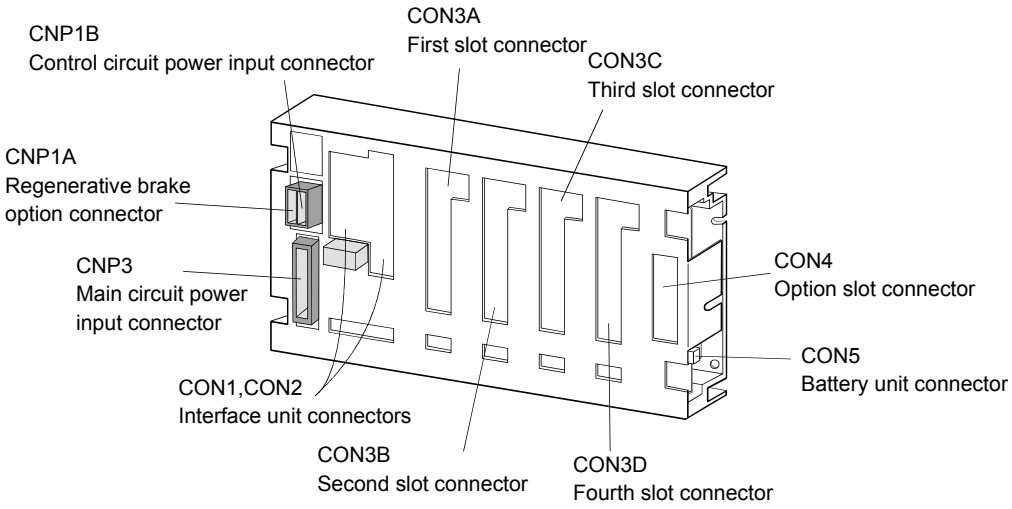


(2) Interface unit



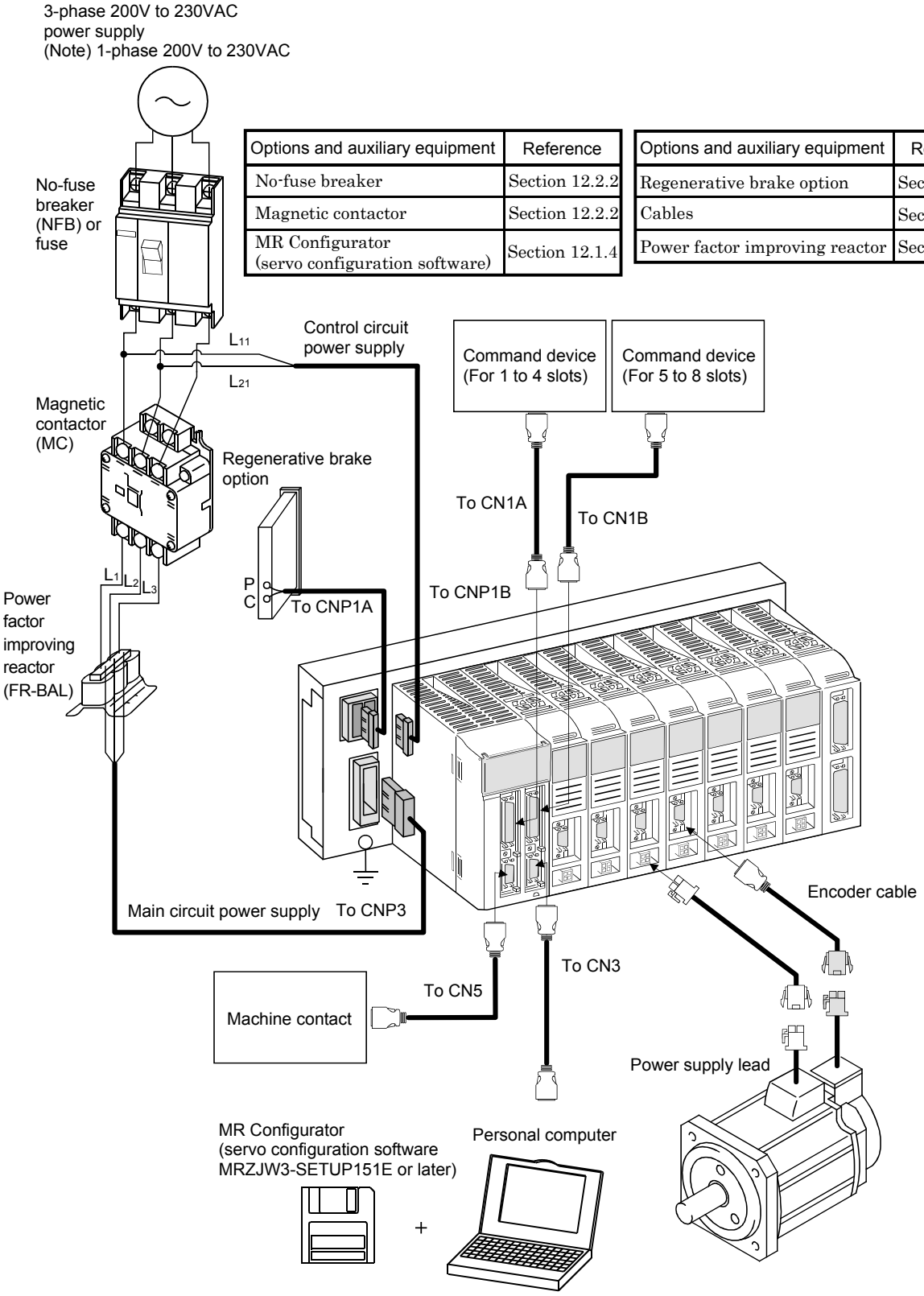
(3) Base unit

The following shows the MR-J2M-BU4.



1.8 Servo system with auxiliary equipment

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



Options and auxiliary equipment	Reference
No-fuse breaker	Section 12.2.2
Magnetic contactor	Section 12.2.2
MR Configurator (servo configuration software)	Section 12.1.4

Options and auxiliary equipment	Reference
Regenerative brake option	Section 12.1.1
Cables	Section 12.2.1
Power factor improving reactor	Section 12.2.3

Note. For 1-phase 200 to 230VAC, connect the power supply to L1, L2 and leave L3 open.

MEMO

2. INSTALLATION AND START UP

⚠ 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 each unit. ・Do not block the intake/exhaust ports of each unit. Otherwise, a fault may occur. ・Do not subject each unit to drop impact or shock loads as they are precision equipment. ・Do not install or operate a faulty unit. ・When the product has been stored for an extended period of time, consult Mitsubishi. ・ When treating the servo amplifier, be careful about the edged parts such as the corners of the servo amplifier.

2.1 Environmental conditions

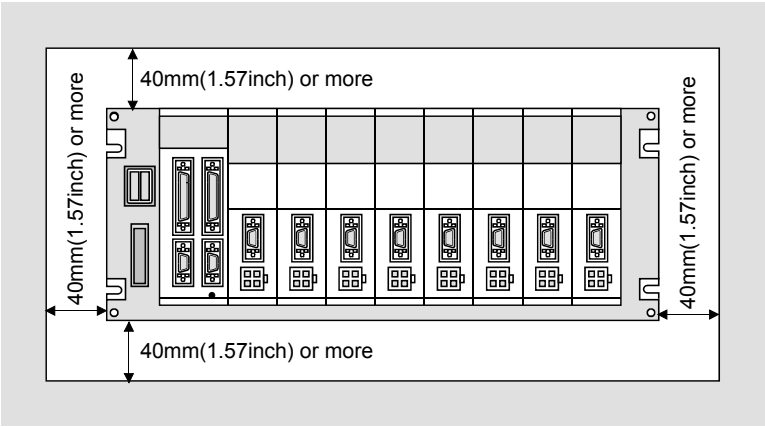
The following environmental conditions are common to the drive unit, interface unit and base unit.

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

2.2 Installation direction and clearances

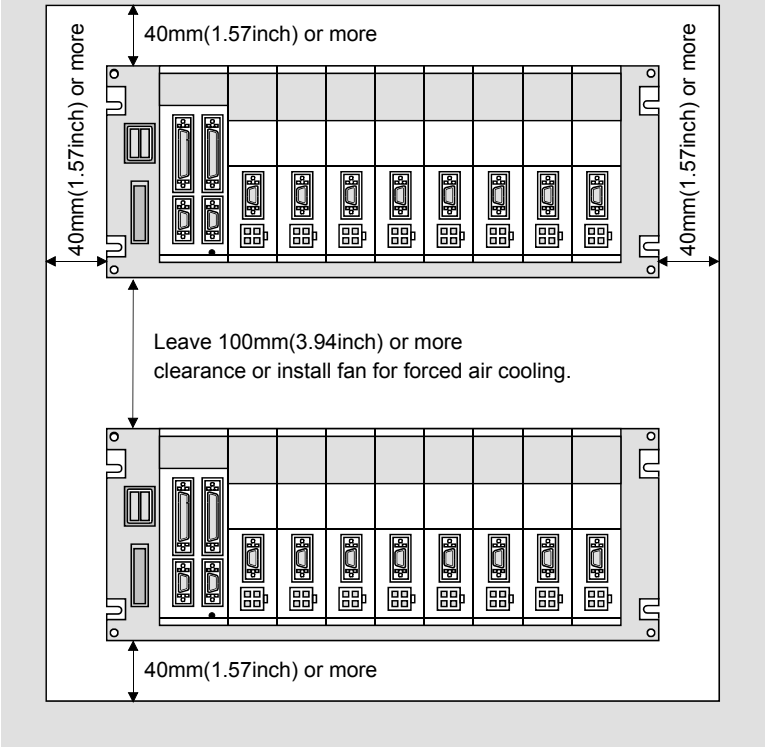
⚠ CAUTION	・The equipment must be installed in the specified direction. Otherwise, a fault may occur. ・Leave specified clearances between each unit and control box inside walls or other equipment.

(1) Installation of one MELSERVO-J2M



(2) Installation of two or more MELSERVO-J2M

When installing two units vertically, heat generated by the lower unit influences the ambient temperature of the upper unit. Suppress temperature rises in the control box so that the temperature between the upper and lower units satisfies the environmental conditions. Also provide adequate clearances between the units or install a fan.



(3) Others

When using heat generating equipment such as the regenerative brake option, install them with full consideration of heat generation so that MELSERVO-J2M is not affected.

Install MELSERVO-J2M 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 each unit.

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

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

2.4 Cable stress

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

(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, brake) supplied with the servo motor, and flex the optional encoder cable or the power supply and brake wiring cables. Use the optional encoder cable within the flexing life range. Use the power supply and brake wiring cables within the flexing life of the cables.

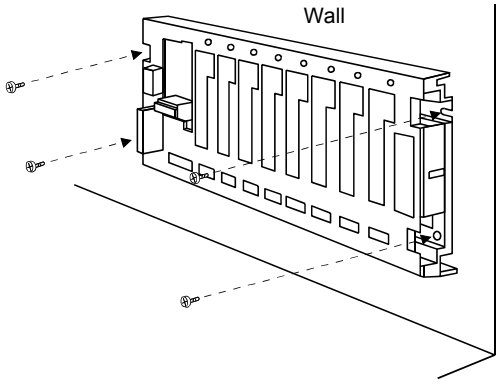
(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.

(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 11.4 for the flexing life.

2.5 Mounting method

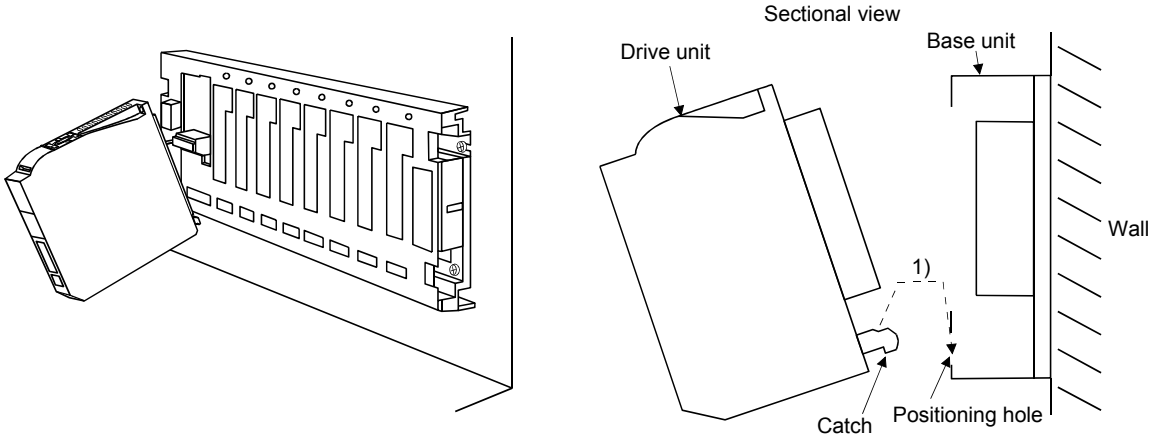
(1) Base unit

As shown below, mount the base unit on the wall of a control box or like with M5 screws.

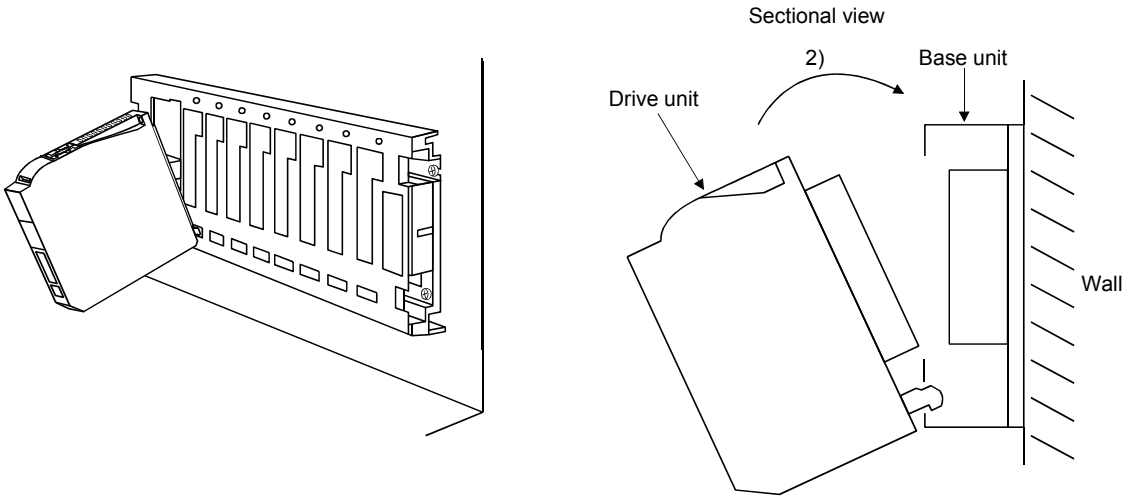


(2) Interface unit/drive unit (MR-J2M-40DU or less)

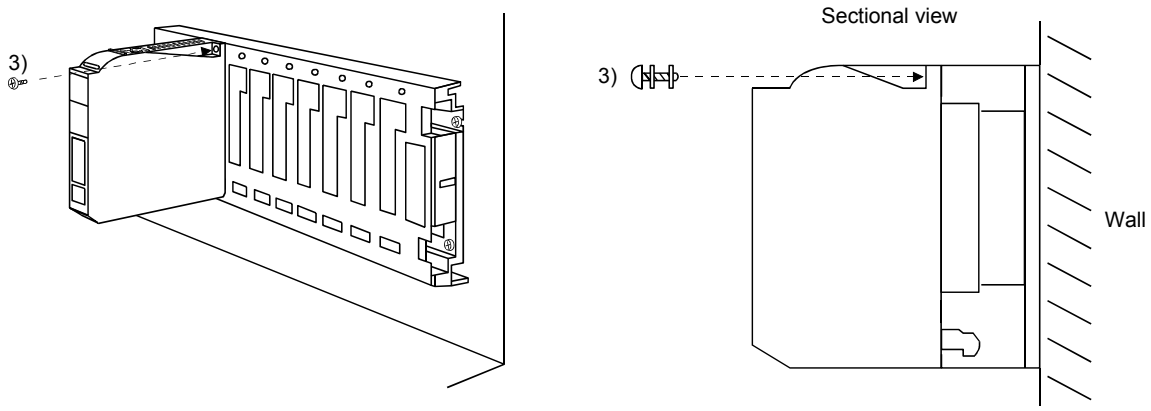
The following example gives installation of the drive unit to the base unit. The same also applies to the interface unit.



1) Hook the catch of the drive unit in the positioning hole of the base unit.

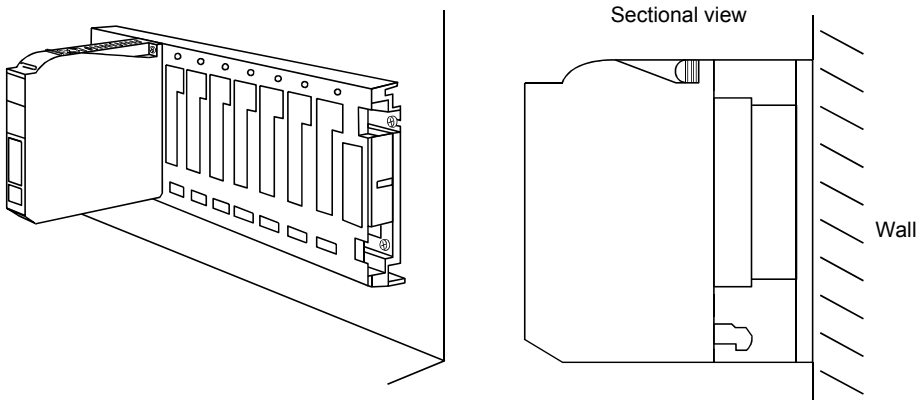


2) Using the catch hooked in the positioning hole as a support, push the drive unit in.



3) Tighten the M4 screw supplied for the base unit to fasten the drive unit to the base unit.

POINT
▪ Securely tighten the drive unit fixing screw.



(3) Drive unit (MR-J2M-70DU)

When using the MR-J2M-70DU, install it on two slots of the base unit. The slot number of this drive unit is that of the left hand side slot of the two occupied slots, when they are viewed from the front of the base unit.

2.6 When switching power on for the first time

Before starting operation, check the following:

(1) Wiring

(a) Check that the control circuit power cable, main circuit power cable and servo motor power cable are fabricated properly.

(b) Check that the control circuit power cable is connected to the CNP1B connector and the main circuit power cable is connected to the CNP3 connector.

(c) Check that the servo motor power cable is connected to the drive unit CNP2 connector.

(d) Check that the base unit is earthed securely. Also check that the drive unit is screwed to the base unit securely.

(e) When using the regenerative brake option, check that the cable using twisted wires is fabricated properly and it is connected to the CNP1A connector properly.

(f) When the MR-J2M-70DU is used, it is wired to have the left-hand side slot number of the two slots.

(g) 24VDC or higher voltages are not applied to the pins of connector CN3.

(h) SD and SG of connector CN1A・CN1B・CN3・CN4A・CN4B and CN5 are not shorted.

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

(j) Check that the encoder cable and servo motor power cable connected to the drive unit are connected to the same servo motor properly.

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

(2) Parameters

(a) Check that the drive unit parameters are set to correct values using the servo system controller screen or MR Configurator (servo configuration software).

(b) Check that the interface unit parameters are set to correct values using the interface unit display or MR Configurator (servo configuration software).

(3) Environment

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

(4) Machine

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

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

2.7 Start up

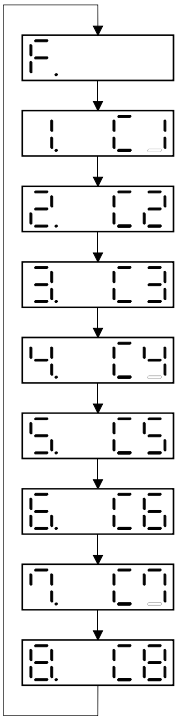
⚠ WARNING	・Do not operate the switches with wet hands. You may get an electric shock. ・Do not operate the controller with the front cover removed. High-voltage terminals and charging area exposed and you may get an electric shock. ・ During power-on or for some time after power-off, do not touch or close a parts (cable etc.) to the regenerative brake resistor, servo motor, etc. Their temperatures may be high and you may get burnt or a parts may damaged.

⚠ CAUTION	・Before starting operation, check the parameters. Some machines may perform unexpected operation. ・Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the servo amplifier heat sink, regenerative brake resistor, servo motor, etc.since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged. ・During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

Connect the servo motor with a machine after confirming that the servo motor operates properly alone.

(1) Power on

Switching on the main circuit power/control circuit power places the interface unit display in the scroll status as shown below.



In the absolute position detection system, first power-on results in the absolute position lost (A.25) alarm and the servo system cannot be switched on. This is not a failure and takes place due to the uncharged capacitor in the encoder.

The alarm can be deactivated by keeping power on for a few minutes in the alarm status and then switching power off once and on again.

Also in the absolute position detection system, if power is switched on at the servo motor speed of 500r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Test operation

Using JOG operation in the test operation mode, make sure that the servo motor operates. (Refer to Section 6.8.2.)

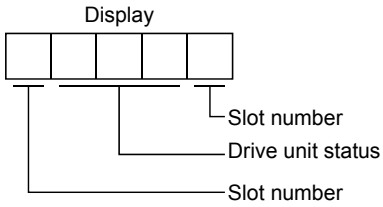
(3) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to Chapter 5 for the parameter definitions.

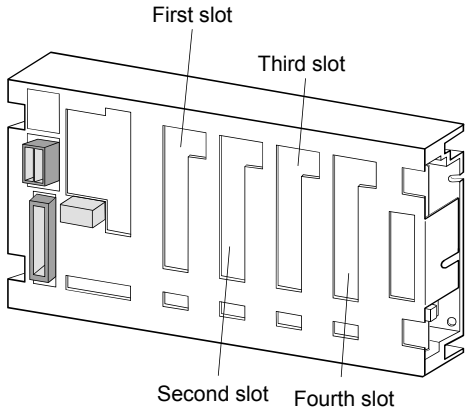
After setting the parameters, switch power off once.

(4) Slot number confirmation

Confirm the slot number in the interface unit display section of the installed drive unit.



For MR-J2M-BU4



(5) Servo-on

Switch the servo-on in the following procedure:

1) Switch on main circuit/control power supply.

2) Turn on the servo-on (SON□).

When the servo-on status is established, operation is enabled and the servo motor is locked. At this time, the interface unit displays "@□□d@". (@ represents the slot number.)

(6) Command pulse input

Entry of a pulse train from the positioning device rotates the servo motor. At first, run it at low speed and check the rotation direction, etc. If it does not run in the intended direction, check the input signal.

On the status display, check the speed, command pulse frequency, load factor, etc. of the servo motor.

When machine operation check is over, check automatic operation with the program of the positioning device.

This servo amplifier has a real-time auto tuning function under model adaptive control. Performing operation automatically adjusts gains. The optimum tuning results are provided by setting the response level appropriate for the machine in DRU parameter No. 2. (Refer to chapter 7.)

(7) Home position return

Make home position return as required.

(8) Stop

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

Refer to Section 3.8, (2) for the servo motor equipped with electromagnetic brake. Note that the stop pattern of forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) OFF is as described below.

(a) Servo-on (SON□) OFF

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

(b) Alarm occurrence

When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.

(c) Forced stop (EMG_□) OFF

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

(d) Forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) OFF

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

POINT
· A sudden stop indicates deceleration to a stop at the deceleration time constant of zero.

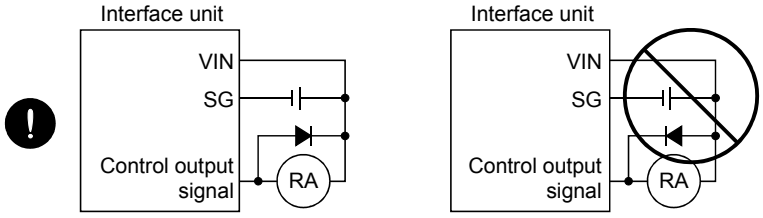
3. SIGNALS AND WIRING

⚠ 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 base unit and the servo motor securely.
- Do not attempt to wire each unit and servo motor until they have been installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠ CAUTION

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

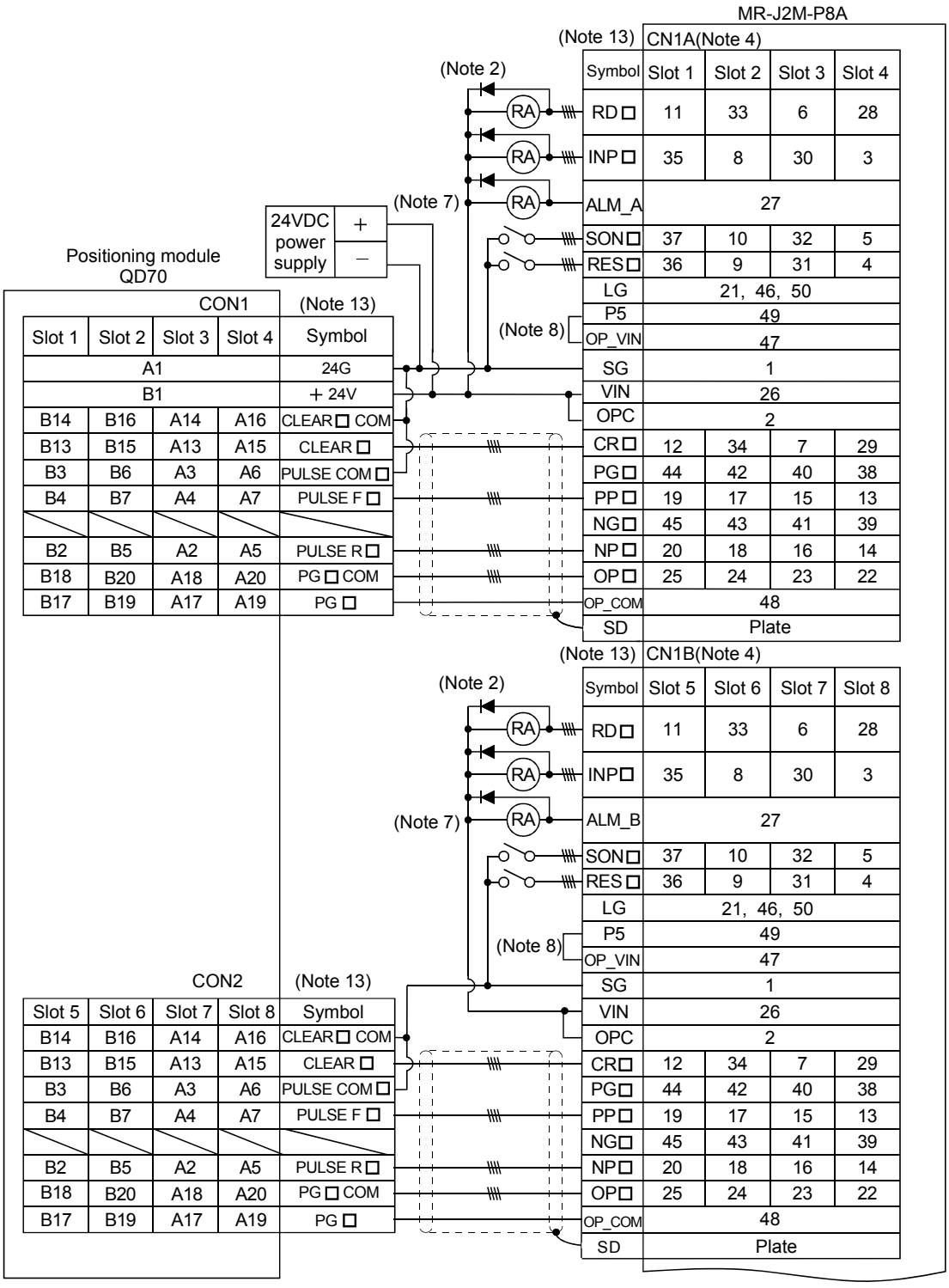


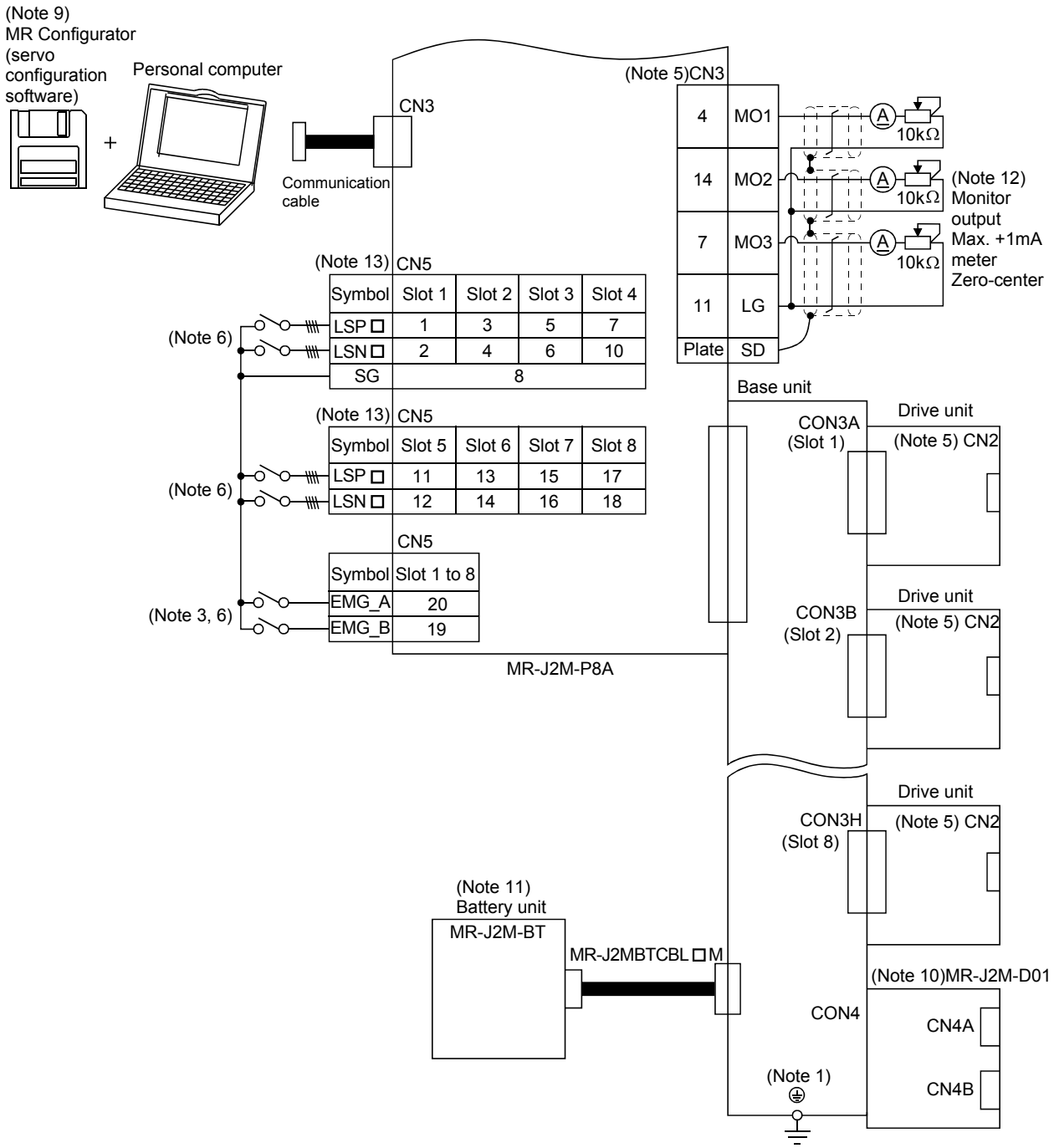
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near each unit.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo motor.
- When using the regenerative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

3.1 Control signal line connection example

POINT

- Refer to Section 3.4 for connection of the power supply line and to Section 3.5 for connection with servo motors.




(Note 9)
MR Configurator
(servo
configuration
software)
Personal computer
CN3
Communication
cable
(Note 5)CN3
4 MO1
14 MO2
7 MO3
11 LG
Plate SD
10kΩ
10kΩ
10kΩ
(Note 12)
Monitor
output
Max. +1mA
meter
Zero-center
(Note 13) CN5
Symbol Slot 1 Slot 2 Slot 3 Slot 4
LSP□ 1 3 5 7
LSN□ 2 4 6 10
SG 8
(Note 6)
(Note 13) CN5
Symbol Slot 5 Slot 6 Slot 7 Slot 8
LSP□ 11 13 15 17
LSN□ 12 14 16 18
(Note 6)
CN5
Symbol Slot 1 to 8
EMG_A 20
EMG_B 19
(Note 3, 6)
MR-J2M-P8A
Base unit
CON3A
(Slot 1)
Drive unit
(Note 5) CN2
CON3B
(Slot 2)
Drive unit
(Note 5) CN2
CON3H
(Slot 8)
Drive unit
(Note 5) CN2
(Note 11)
Battery unit
MR-J2M-BT
MR-J2MBTCBL□M
(Note 10)MR-J2M-D01
CON4
CN4A
CN4B
(Note 1)

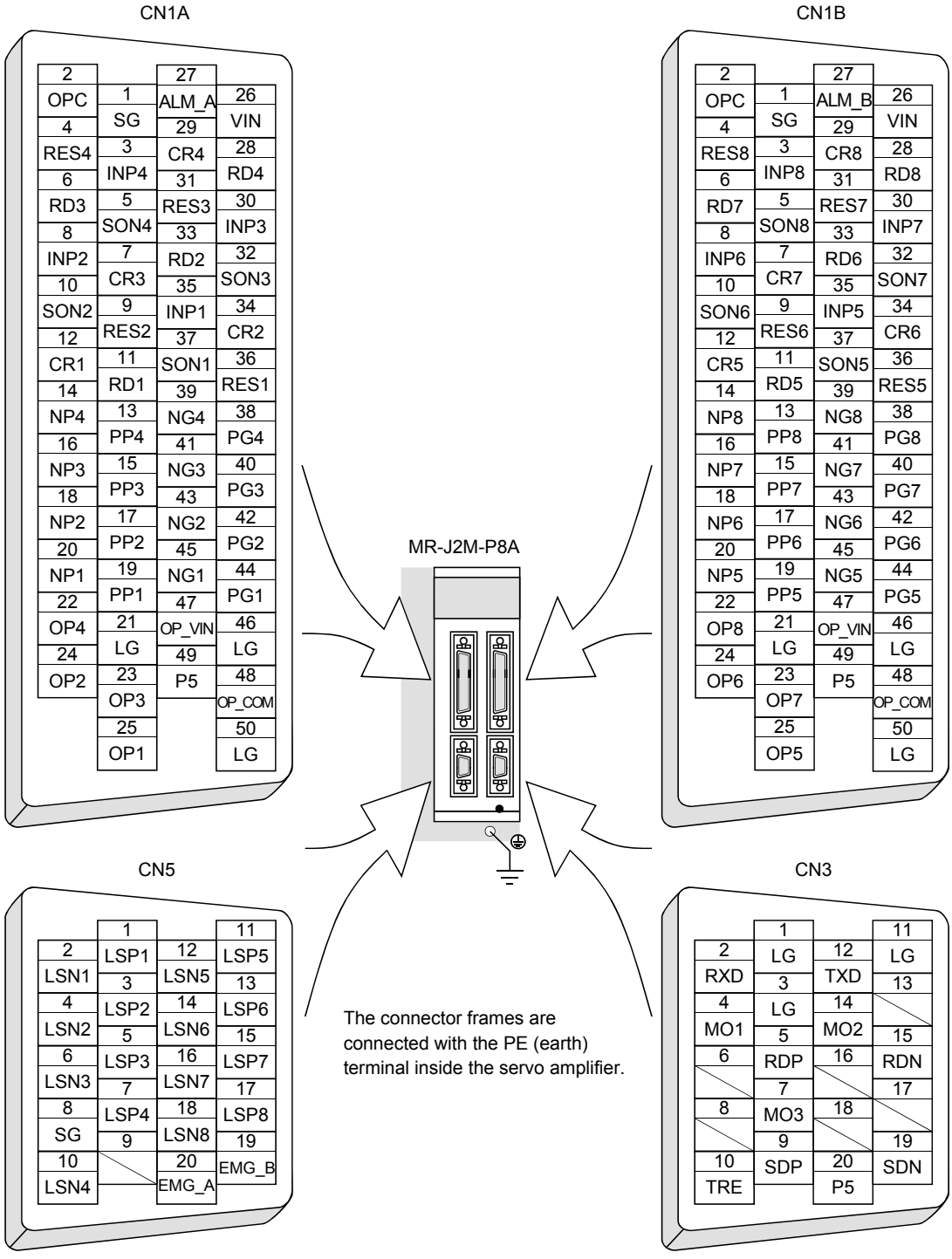
Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the base unit to the protective earth (PE) of the control box.
2. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. CN1A・CN1B, CN4A・CN4B have the same shape. Wrong connection of the connectors will lead to a fault.
5. CN2 and CN3 have the same shape. Wrong connection of the connectors can cause a fault.
6. When starting operation, always connect the forced stop (EMG_A) and forward/reverse rotation stroke end (LSN□/LSP□) with SG. (Normally closed contacts)
7. Trouble (ALM_□) is connected with COM in normal alarm-free condition. When this signal is switched off (at occurrence of an alarm), the output of the programmable controller should be stopped by the sequence program.
8. Always connect P5-OP_VIN when using the 5V output (P5). Keep them open when supplying external power.
9. Use MRZJW3-SETUP151E.
10. Refer to Section 3.3 for the MR-J2M-D01 extension IO unit.
11. The MR-J2M-BT battery unit is required to configure an absolute position detection system. Refer to Chapter 14 for details.
12. When connecting the personal computer together with monitor outputs 1, 2, use the maintenance junction card (MR-J2CN3TM). (Refer to Section 12.1.2)
13. □ in Symbol indicates a slot number.

3.2 I/O signals of interface unit

3.2.1 Connectors and signal arrangements

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

(1) Signal arrangement



3.2.2 Signal explanations

For the I/O interfaces (symbols in I/O column in the table), refer to Section 3.2.5.
The pin No.s in the connector pin No. column are those in the initial status.

(1) Input signals

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Servo-on 1	SON 1	CN1A-37	SON 1: Servo-on signal for slot 1 SON 2: Servo-on signal for slot 2 SON 3: Servo-on signal for slot 3 SON 4: Servo-on signal for slot 4 SON 5: Servo-on signal for slot 5 SON 6: Servo-on signal for slot 6 SON 7: Servo-on signal for slot 7 SON 8: Servo-on signal for slot 8 Connect SON□-SG to switch on the base circuit and make the servo amplifier ready to operate (servo-on). Disconnect SON□-SG to shut off the base circuit and coast the servo motor (servo off).	DI-1
Servo-on 2	SON 2	CN1A-10		
Servo-on 3	SON 3	CN1A-32		
Servo-on 4	SON 4	CN1A-5		
Servo-on 5	SON 5	CN1B-37		
Servo-on 6	SON 6	CN1B-10		
Servo-on 7	SON 7	CN1B-32		
Servo-on 8	SON 8	CN1B-5		
Reset 1	RES 1	CN1A-36	RES 1: Reset signal for slot 1 RES 2: Reset signal for slot 2 RES 3: Reset signal for slot 3 RES 4: Reset signal for slot 4 RES 5: Reset signal for slot 5 RES 6: Reset signal for slot 6 RES 7: Reset signal for slot 7 RES 8: Reset signal for slot 8 Disconnect RES□-SG for more than 50ms to reset the alarm. Some alarms cannot be deactivated by the reset (RES□). Refer to Section 9.2. Shorting RES□-SG in an alarm-free status shuts off the base circuit. The base circuit is not shut off when "□ 1 □ □" is set in DRU parameter No. 51 (Function selection 6).	DI-1
Reset 2	RES 2	CN1A-9		
Reset 3	RES 3	CN1A-31		
Reset 4	RES 4	CN1A-4		
Reset 5	RES 5	CN1B-36		
Reset 6	RES 6	CN1B-9		
Reset 7	RES 7	CN1B-31		
Reset 8	RES 8	CN1B-4		

<table>
<tr><th>Signal</th><th>Symbol</th><th>Connector pin No.</th><th>Functions/Applications</th><th>I/O division</th></tr>
<tr><td>Forward rotation stroke end 1</td><td>LSP 1</td><td>CN5-1</td><td rowspan="16">LSP 1: Forward rotation stroke end signal for slot 1
LSP 2: Forward rotation stroke end signal for slot 2
LSP 3: Forward rotation stroke end signal for slot 3
LSP 4: Forward rotation stroke end signal for slot 4
LSP 5: Forward rotation stroke end signal for slot 5
LSP 6: Forward rotation stroke end signal for slot 6
LSP 7: Forward rotation stroke end signal for slot 7
LSP 8: Forward rotation stroke end signal for slot 8
LSN 1: Reverse rotation stroke end signal for slot 1
LSN 2: Reverse rotation stroke end signal for slot 2
LSN 3: Reverse rotation stroke end signal for slot 3
LSN 4: Reverse rotation stroke end signal for slot 4
LSN 5: Reverse rotation stroke end signal for slot 5
LSN 6: Reverse rotation stroke end signal for slot 6
LSN 7: Reverse rotation stroke end signal for slot 7
LSN 8: Reverse rotation stroke end signal for slot 8
To start operation, short LSP□-SG and/or LSN□-SG. Open them to bring the motor to a sudden stop and make it servo-locked.
Set "□ □ □ 1" in parameter No. 22 (Function selection 4) to make a slow stop.
(Refer to Section 5.1.2.)
<table><tr><th colspan="2">(Note) Input signals</th><th colspan="2">Operation</th></tr><tr><th>LSP□</th><th>LSN□</th><th>CCW direction</th><th>CW direction</th></tr><tr><td>1</td><td>1</td><td>○</td><td>○</td></tr><tr><td>0</td><td>1</td><td></td><td>○</td></tr><tr><td>1</td><td>0</td><td>○</td><td></td></tr><tr><td>0</td><td>0</td><td></td><td></td></tr></table>Note. 0: LSP□/LSN□-SG off (open)
1: LSP□/LSN□-SG on (short)</td><td rowspan="16">DI-1</td></tr>
<tr><td>Forward rotation stroke end 2</td><td>LSP 2</td><td>CN5-3</td></tr>
<tr><td>Forward rotation stroke end 3</td><td>LSP 3</td><td>CN5-5</td></tr>
<tr><td>Forward rotation stroke end 4</td><td>LSP 4</td><td>CN5-7</td></tr>
<tr><td>Forward rotation stroke end 5</td><td>LSP 5</td><td>CN5-11</td></tr>
<tr><td>Forward rotation stroke end 6</td><td>LSP 6</td><td>CN5-13</td></tr>
<tr><td>Forward rotation stroke end 7</td><td>LSP 7</td><td>CN5-15</td></tr>
<tr><td>Forward rotation stroke end 8</td><td>LSP 8</td><td>CN5-17</td></tr>
<tr><td>Reverse rotation stroke end 1</td><td>LSN 1</td><td>CN5-2</td></tr>
<tr><td>Reverse rotation stroke end 2</td><td>LSN 2</td><td>CN5-4</td></tr>
<tr><td>Reverse rotation stroke end 3</td><td>LSN 3</td><td>CN5-6</td></tr>
<tr><td>Reverse rotation stroke end 4</td><td>LSN 4</td><td>CN5-10</td></tr>
<tr><td>Reverse rotation stroke end 5</td><td>LSN 5</td><td>CN5-12</td></tr>
<tr><td>Reverse rotation stroke end 6</td><td>LSN 6</td><td>CN5-14</td></tr>
<tr><td>Reverse rotation stroke end 7</td><td>LSN 7</td><td>CN5-16</td></tr>
<tr><td>Reverse rotation stroke end 8</td><td>LSN 8</td><td>CN5-18</td></tr>
<tr><td>Forced stop A</td><td>EMG_A</td><td>CN5-20</td><td rowspan="2">EMG_A: Forced stop signal for slots 1 to 8
EMG_B: Forced stop signal for slots 1 to 8
Disconnect EMG_□-SG to bring the servo motor to forced stop state, in which the servo is switched off and the dynamic brake is operated.
Connect EMG_□-SG in the forced stop state to reset that state.
When either of EMG-A and EMG-B is to be used, short the unused signal with SG.</td><td rowspan="2">DI-1</td></tr>
<tr><td>Forced stop B</td><td>EMG_B</td><td>CN5-19</td></tr>
</table>

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Clear 1	CR 1	CN1A-12	CR 1: Clear signal for slot 1 CR 2: Clear signal for slot 2 CR 3: Clear signal for slot 3 CR 4: Clear signal for slot 4 CR 5: Clear signal for slot 5 CR 6: Clear signal for slot 6 CR 7: Clear signal for slot 7 CR 8: Clear signal for slot 8 Connect CR□-SG to clear the position control counter droop pulses on its leading edge. The pulse width should be 10ms or more. When the DRU parameter No.42 (Input signal selection 1) setting is "□ □ 1 □", the pulses are always cleared while CR□-SG are connected.	DI-1
Clear 2	CR 2	CN1A-34		
Clear 3	CR 3	CN1A-7		
Clear 4	CR 4	CN1A-29		
Clear 5	CR 5	CN1B-12		
Clear 6	CR 6	CN1B-34		
Clear 7	CR 7	CN1B-7		
Clear 8	CR 8	CN1B-29		
Forward rotation pulse train 1	PP 1	CN1A-19	PP 1 NP 1 PG 1 NG 1: Forward/reverse rotation pulse train for slot 1 PP 2 NP 2 PG 2 NG 2: Forward/reverse rotation pulse train for slot 2 PP 3 NP 3 PG 3 NG 3: Forward/reverse rotation pulse train for slot 3 PP 4 NP 4 PG 4 NG 4: Forward/reverse rotation pulse train for slot 4 PP 5 NP 5 PG 5 NG 5: Forward/reverse rotation pulse train for slot 5 PP 6 NP 6 PG 6 NG 6: Forward/reverse rotation pulse train for slot 6 PP 7 NP 7 PG 7 NG 7: Forward/reverse rotation pulse train for slot 7 PP 8 NP 8 PG 8 NG 8: Forward/reverse rotation pulse train for slot 8 Used to enter a command pulse train. ・In the open collector system (max. input frequency 200kpps): Forward rotation pulse train across PP□-SG Reverse rotation pulse train across NP□-SG ・In the differential receiver system (max. input frequency 500kpps): Forward rotation pulse train across PG□-PP□ Reverse rotation pulse train across NG□-NP□ The command pulse train form can be changed using DRU parameter No. 21 (Function selection 3).	DI-2
Reverse rotation pulse train 1	NG 1	CN1A-45		
Forward rotation pulse train 2	PP 2	CN1A-17		
Reverse rotation pulse train 2	NP 2	CN1A-18		
Forward rotation pulse train 3	PG 2	CN1A-42		
Reverse rotation pulse train 3	NG 2	CN1A-43		
Forward rotation pulse train 4	PP 3	CN1A-15		
Reverse rotation pulse train 4	NP 3	CN1A-16		
Forward rotation pulse train 5	PG 3	CN1A-40		
Reverse rotation pulse train 5	NG 3	CN1A-41		
Forward rotation pulse train 6	PP 4	CN1A-13		
Reverse rotation pulse train 6	NP 4	CN1A-14		
Forward rotation pulse train 7	PG 4	CN1A-38		
Reverse rotation pulse train 7	NG 4	CN1A-39		
Forward rotation pulse train 8	PP 5	CN1B-19		
Reverse rotation pulse train 8	NP 5	CN1B-20		
	PG 5	CN1B-44		
	NG 5	CN1B-45		
	PP 6	CN1B-17		
	NP 6	CN1B-18		
	PG 6	CN1B-42		
	NG 6	CN1B-43		
	PP 7	CN1B-15		
	NP 7	CN1B-16		
	PG 7	CN1B-40		
	NG 7	CN1B-41		
	PP 8	CN1B-13		
	NP 8	CN1B-14		
	PG 8	CN1B-38		
	NG 8	CN1B-39		

(2) Output signals

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Trouble A	ALM_A	CN1A-27	ALM_A: Alarm signal for slot 1 to 4 ALM_B: Alarm signal for slot 5 to 8 ALM□-SG are disconnected when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm, ALM□-SG are connected within about 3s after power on.	DO-1
Trouble B	ALM_B	CN1B-27		
Ready 1	RD 1	CN1A-11	RD 1: Ready signal for slot 1 RD 2: Ready signal for slot 2 RD 3: Ready signal for slot 3 RD 4: Ready signal for slot 4 RD 5: Ready signal for slot 5 RD 6: Ready signal for slot 6 RD 7: Ready signal for slot 7 RD 8: Ready signal for slot 8 RD□-SG are connected when the servo is switched on and the servo amplifier is ready to operate.	DO-1
Ready 2	RD 2	CN1A-33		
Ready 3	RD 3	CN1A-6		
Ready 4	RD 4	CN1A-28		
Ready 5	RD 5	CN1B-11		
Ready 6	RD 6	CN1B-33		
Ready 7	RD 7	CN1B-6		
Ready 8	RD 8	CN1B-28		
In position 1	INP 1	CN1A-35	INP 1: In position signal for slot 1 INP 2: In position signal for slot 2 INP 3: In position signal for slot 3 INP 4: In position signal for slot 4 INP 5: In position signal for slot 5 INP 6: In position signal for slot 6 INP 7: In position signal for slot 7 INP 8: In position signal for slot 8 INP□-SG are connected when the number of droop pulses is in the preset in-position range. The in-position range can be changed using DRU parameter No. 5. When the in-position range is increased, INP□-SG may be kept connected during low-speed rotation.	DO-1
In position 2	INP 2	CN1A-8		
In position 3	INP 3	CN1A-30		
In position 4	INP 4	CN1A-3		
In position 5	INP 5	CN1B-35		
In position 6	INP 6	CN1B-8		
In position 7	INP 7	CN1B-30		
In position 8	INP 8	CN1B-3		
Encoder Z-phase pulse 1	OP 1	CN1A-25	OP 1: Encoder Z-phase pulse signal for slot 1 OP 2: Encoder Z-phase pulse signal for slot 2 OP 3: Encoder Z-phase pulse signal for slot 3 OP 4: Encoder Z-phase pulse signal for slot 4 OP 5: Encoder Z-phase pulse signal for slot 5 OP 6: Encoder Z-phase pulse signal for slot 6 OP 7: Encoder Z-phase pulse signal for slot 7 OP 8: Encoder Z-phase pulse signal for slot 8 Outputs the zero-point signal of the encoder. One pulse is output per servo motor revolution. OP and LG are connected when the zero-point position is reached. (Negative logic) The minimum pulse width is about 400μs. For home position return using this pulse, set the creep speed to 100r/min. or less.	DO-2
Encoder Z-phase pulse 2	OP 2	CN1A-24		
Encoder Z-phase pulse 3	OP 3	CN1A-23		
Encoder Z-phase pulse 4	OP 4	CN1A-22		
Encoder Z-phase pulse 5	OP 5	CN1B-25		
Encoder Z-phase pulse 6	OP 6	CN1B-24		
Encoder Z-phase pulse 7	OP 7	CN1B-23		
Encoder Z-phase pulse 8	OP 8	CN1B-22		
Analog monitor 1	MO1	CN3-4	Used to output the data set in IFU parameter No.3 (Analog monitor 1 output) to across MO1-LG in terms of voltage. Resolution 10 bits	Analog output
Analog monitor 2	MO2	CN3-14	Used to output the data set in IFU parameter No.4 (Analog monitor 2 output) to across MO2-LG in terms of voltage. Resolution 10 bits	Analog output
Analog monitor 3	MO3	CN3-7	Used to output the data set in IFU parameter No.5 (Analog monitor 3 output) to across MO3-LG in terms of voltage. Resolution 10 bits	Analog output

(3) Communication

POINT
・Refer to Chapter 13 for the communication function.

Signal	Symbol	Connector pin No.	Functions/Applications
RS-422 I/F	SDP SDN RDP RDN	CN3-9 CN3-19 CN3-5 CN3-15	RS-422 and RS-232C functions cannot be used together. Choose either one in IFU parameter No. 16.
RS-422 termination	TRE	CN3-10	Termination resistor connection terminal of RS-422 interface. When the servo amplifier is the termination axis, connect this terminal to RDN (CN3-15).
RS-232C I/F	RXD TXD	CN3-2 CN3-12	RS-422 and RS-232C functions cannot be used together. Choose either one in IFU parameter No. 0.

(4) Power supply

Signal	Symbol	Connector pin No.	Functions/Applications
Digital I/F power supply input	VIN	CN1A-26 CN1B-26	Driver power input terminal for digital interface. Input 24VDC (300mA or more) for input interface. 24VDC±10%
Digital I/F common	SG	CN1A-1 CN1B-1 CN5-8	Common terminal of VIN. Pins are connected internally. Separated from LG.
5V output	P5	CN1A-49 CN1B-49 CN3-20	Internal power supply for encoder Z-phase pulses. Connect P5-OP_VIN when using this power supply as an encoder Z-phase pulse common. 5VDC±5%
Encoder Z-phase pulse power supply	OP_VIN	CN1A-47 CN1B-47	Power input for encoder Z-phase pulse common. Connect P5-OP_VIN when using the 5V output (P5) as an encoder Z-phase pulse common. Supply power to OP_VIN when using an external power supply as an encoder Z-phase pulse common. At this time, do not connect P5-OP_VIN.
Encoder Z-phase pulse common	OP_COM	CN1A-48 CN1B-48	Common for encoder Z-phase pulses. Power input to OP_VIN is output from OP_COM.
Control common	LG	CN1A-50 CN1A-46 CN1A-21 CN1B-50 CN1B-46 CN1B-21 CN3-1 CN3-3 CN3-11 CN3-13	Common terminal for MO1, MO2 and MO3.
Shield	SD	Plate	Connect the external conductor of the shield cable.

3.2.3 Detailed description of the signals

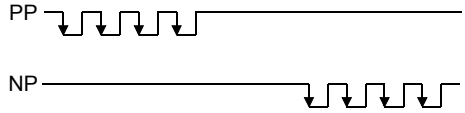
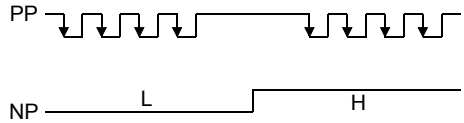
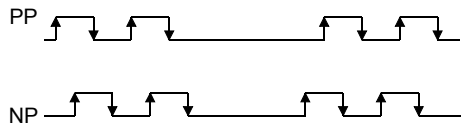
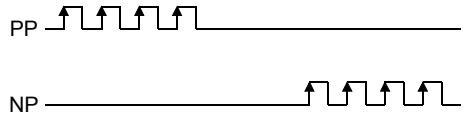
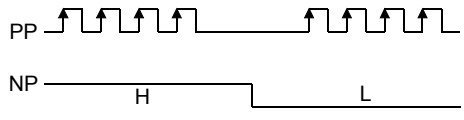
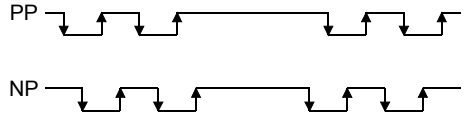
(1) Pulse train input

(a) Input pulse waveform selection

Encoder pulses may be input in any of three different forms, for which positive or negative logic can be chosen. Set the command pulse train form in DRU parameter No. 21.

Arrow ⌐↑ or ⌐↓ in the table indicates the timing of importing a pulse train.

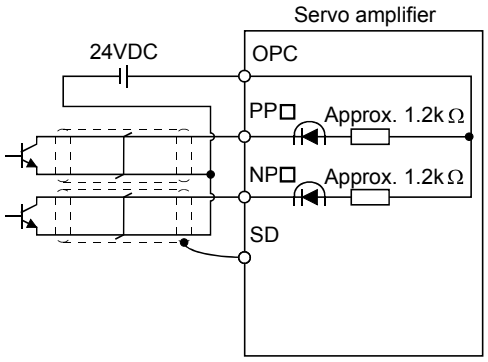
A- and B-phase pulse trains are imported after they have been multiplied by 4.

Pulse train form		Forward rotation command	Reverse rotation command	DRU parameter No. 21 (Command pulse train)
Negative logic	Forward rotation pulse train Reverse rotation pulse train			0010
	Pulse train + sign			0011
	A-phase pulse train B-phase pulse train			0012
Positive logic	Forward rotation pulse train Reverse rotation pulse train			0000
	Pulse train + sign			0001
	A-phase pulse train B-phase pulse train			0002

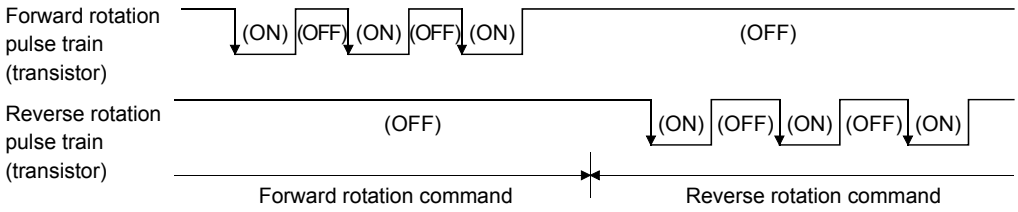
(b) Connections and waveforms

1) Open collector system

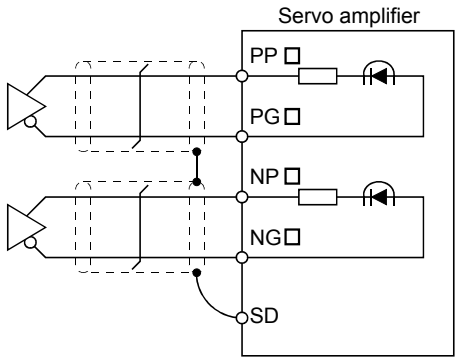
Connect as shown below:



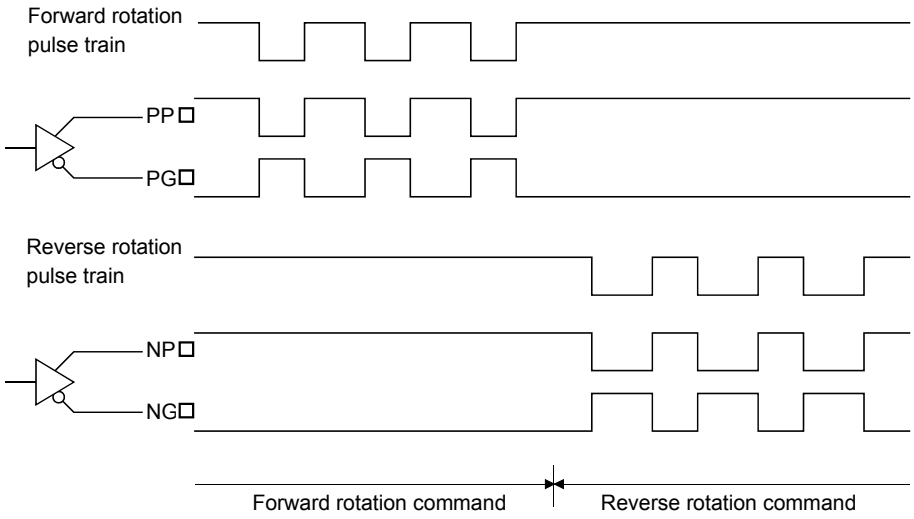
The explanation assumes that the input waveform has been set to the negative logic and forward and reverse rotation pulse trains (DRU parameter No.21 has been set to 0010). The waveforms in the table in (a), (1) of this section are voltage waveforms of PP□ and NP□ based on SG. Their relationships with transistor ON/OFF are as follows:



2) Differential line driver system
Connect as shown below:

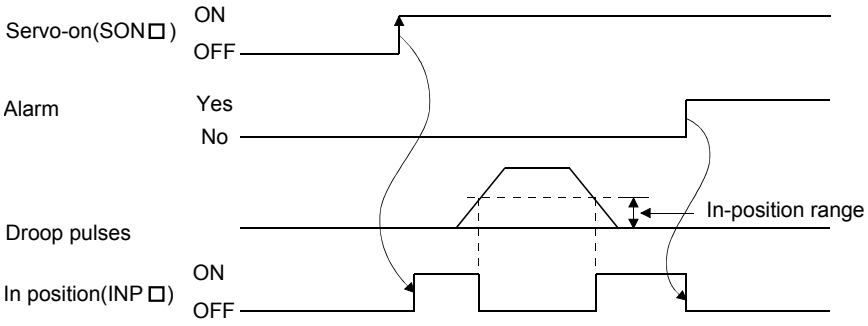


The explanation assumes that the input waveform has been set to the negative logic and forward and reverse rotation pulse trains (DRU parameter No.21 has been set to 0010).
For the differential line driver, the waveforms in the table in (a), (1) of this section are as follows. The waveforms of PP□, PG□, NP□ and NG□ are based on that of the ground of the differential line driver.

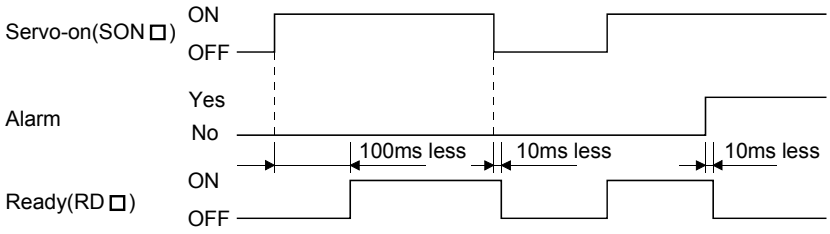


(2) In-position (INP□)

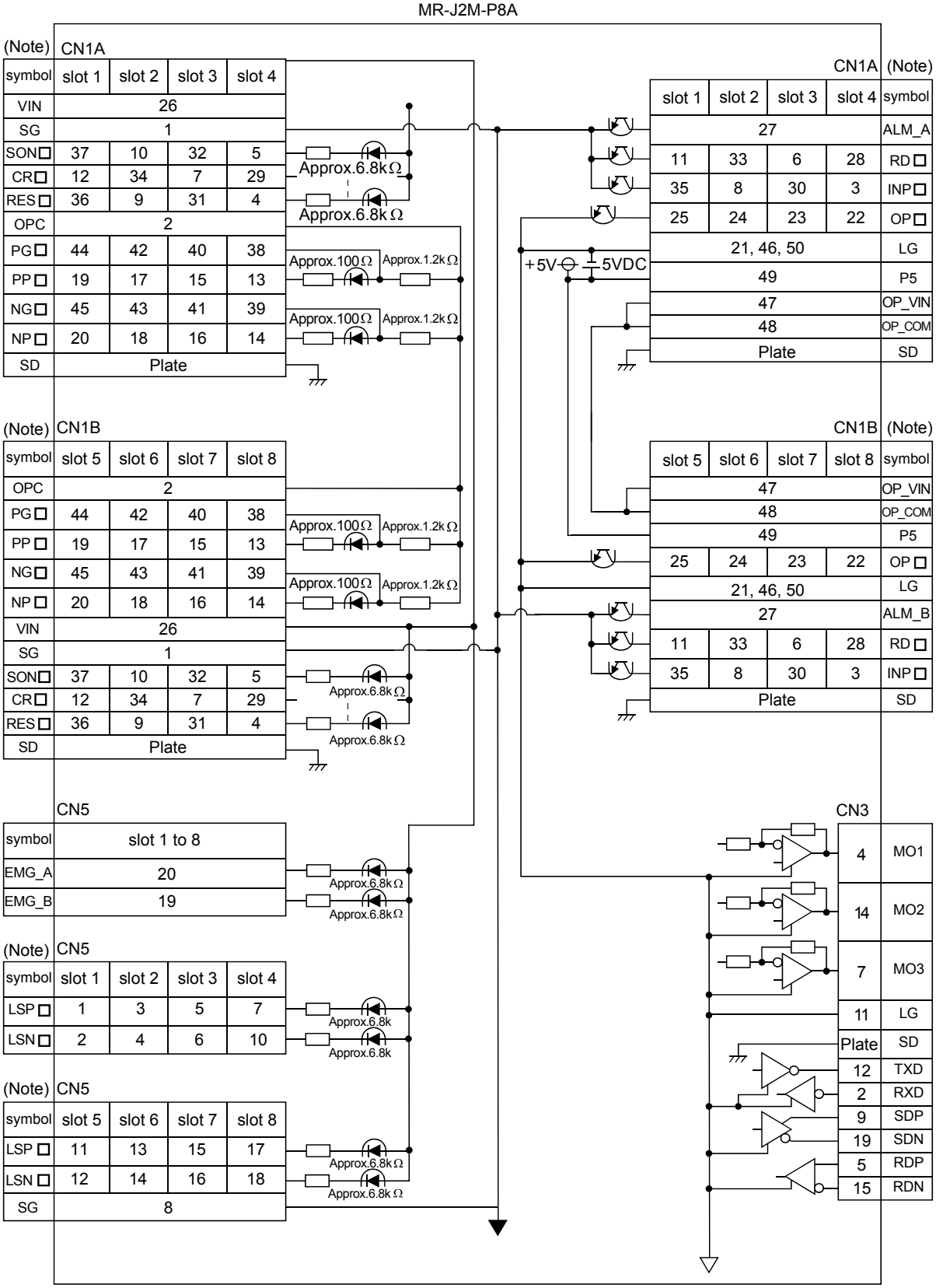
PF-SG are connected when the number of droop pulses in the deviation counter falls within the preset in-position range (DRU parameter No. 5). INP□-SG may remain connected when low-speed operation is performed with a large value set as the in-position range.



(3) Ready (RD□)



3.2.4 Internal connection diagram

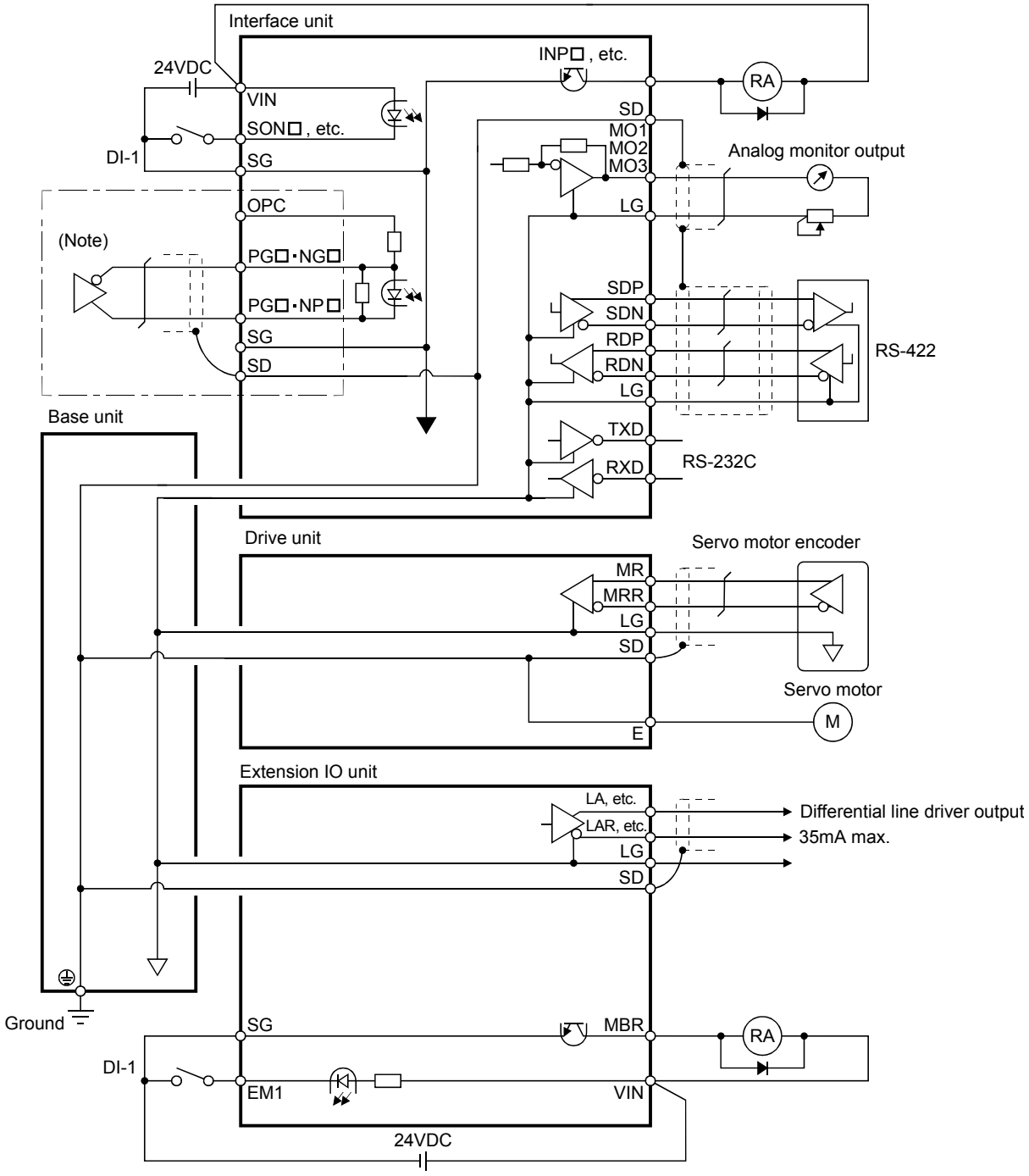


Note. □ in Symbol indicates the slot number.

3.2.5 Interface

(1) Common line

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



Note. Assumes a differential line driver pulse train input.

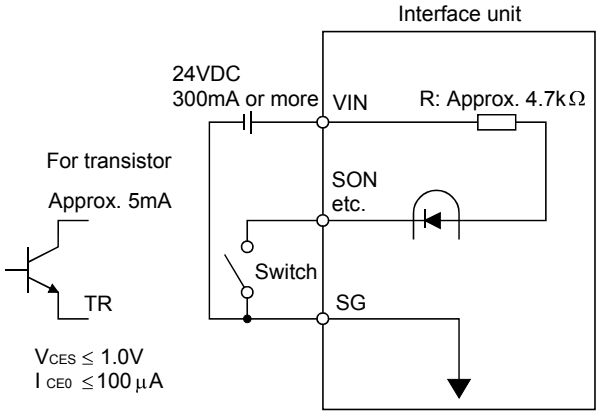
(2) Detailed description of the interfaces

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

Refer to this section and connect the interfaces with the external equipment.

(a) Digital input interface DI-1

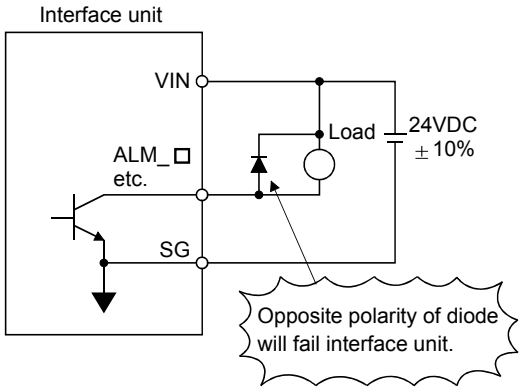
Give a signal with a relay or open collector transistor.



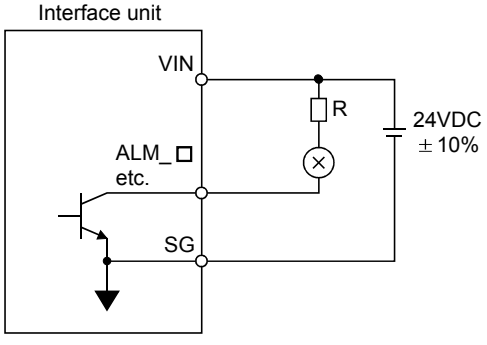
(b) Digital output interface DO-1

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



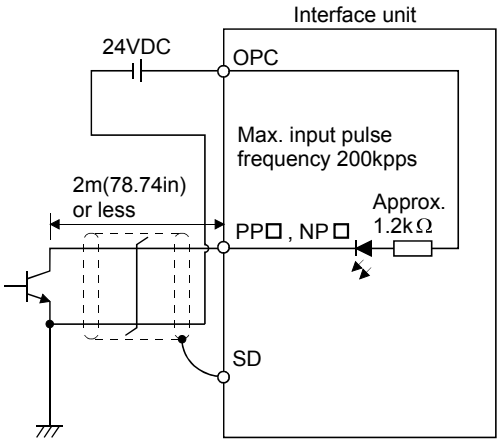
2) Lamp load

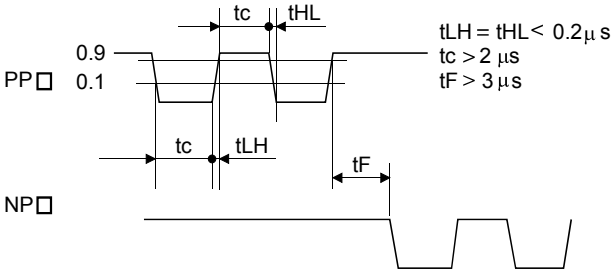


(c) Pulse train input interface DI-2

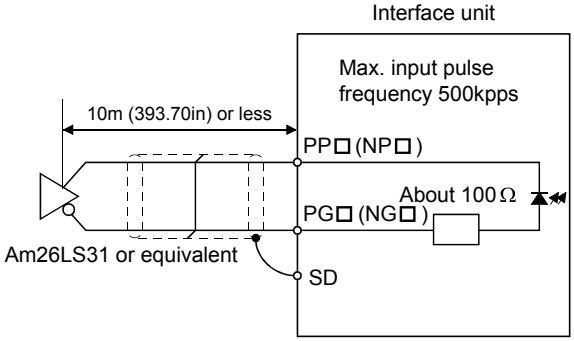
Give a pulse train signal in an open collector or differential line driver system.

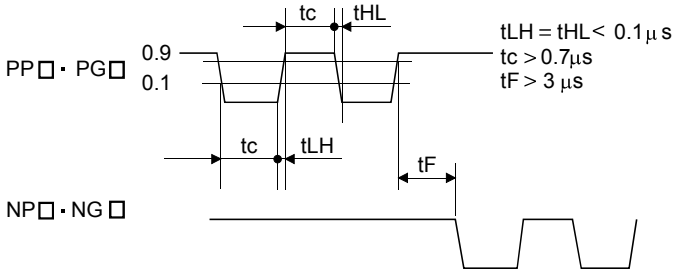
1) Open collector system





2) Differential line driver system

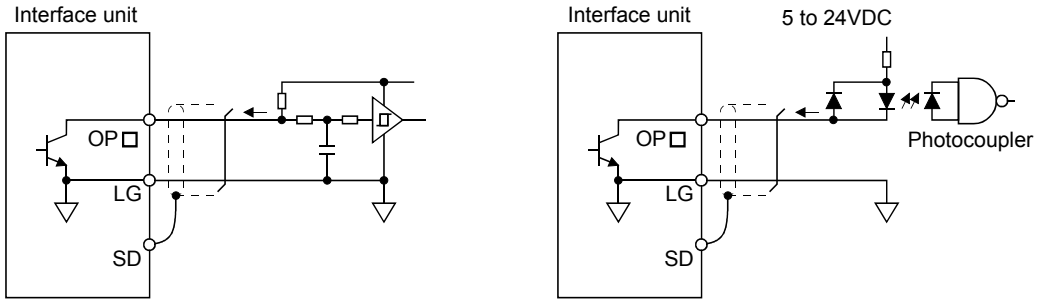




(d) Encoder pulse output DO-2

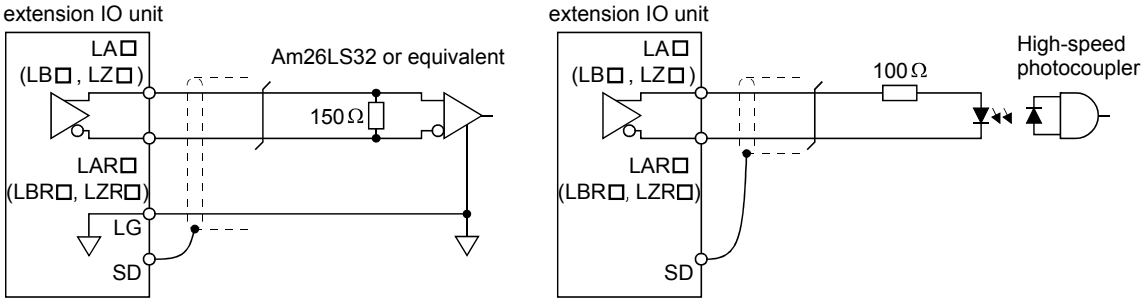
1) Open collector system

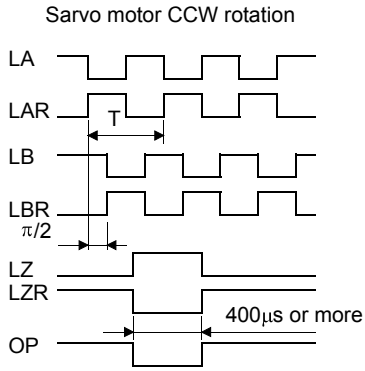
Max. intake current 35mA



2) Differential line driver system

Max. output current 35mA



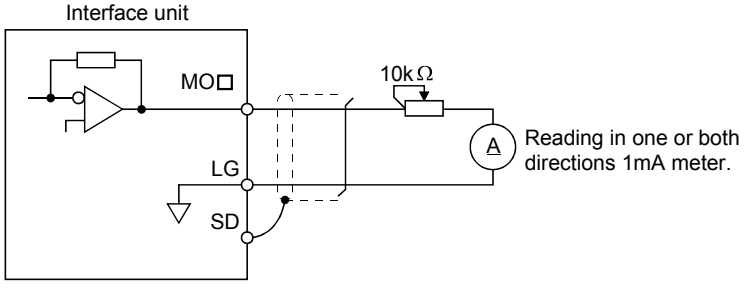


(e) Analog output

Output voltage: ±4V

Max. output current: 0.5mA

Resolution: 10bit

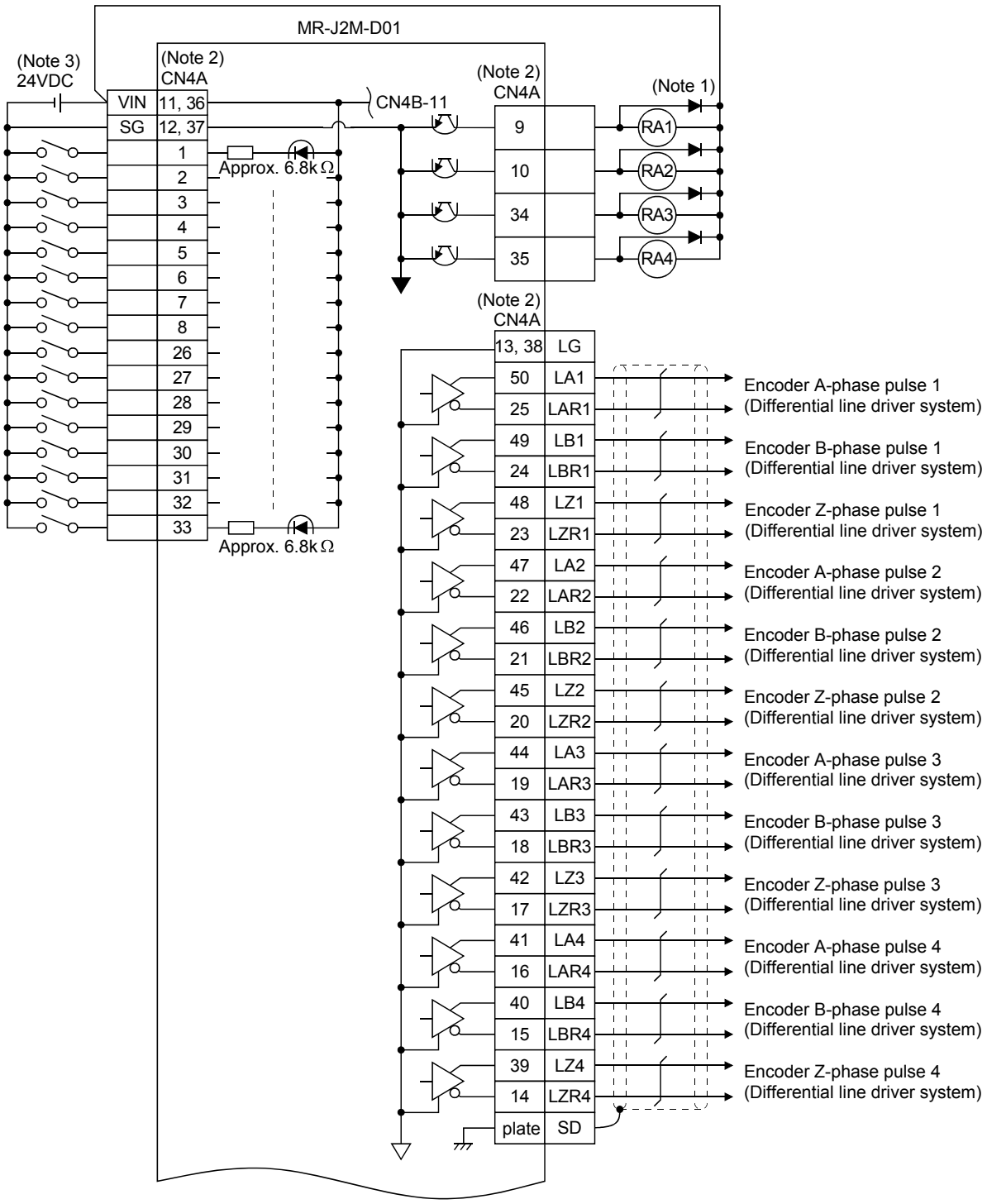


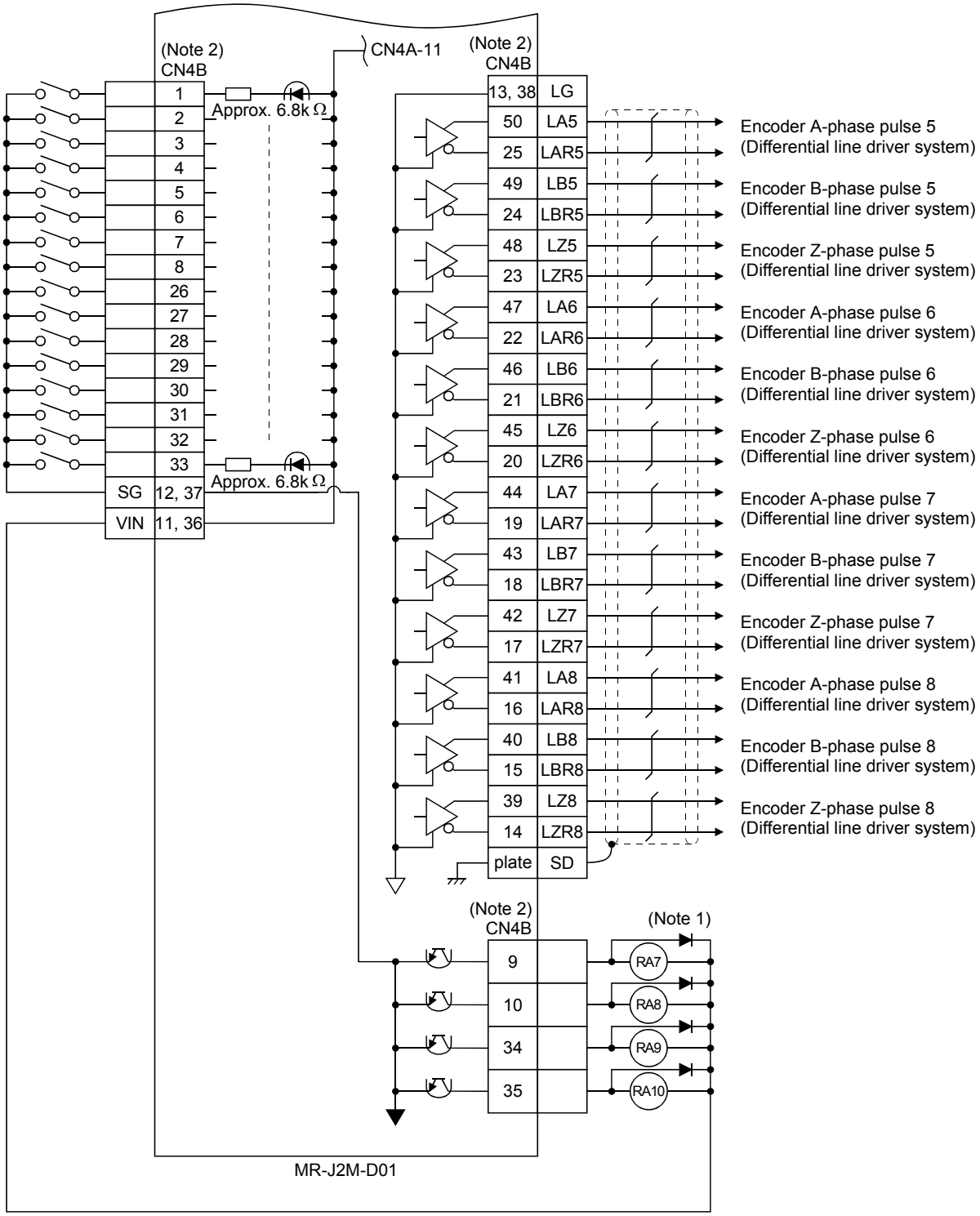
3.3 Signal and wiring for extension IO unit

3.3.1 Connection example

POINT

- The pins without symbols can be assigned any devices using the MR Configurator (servo configuration software).





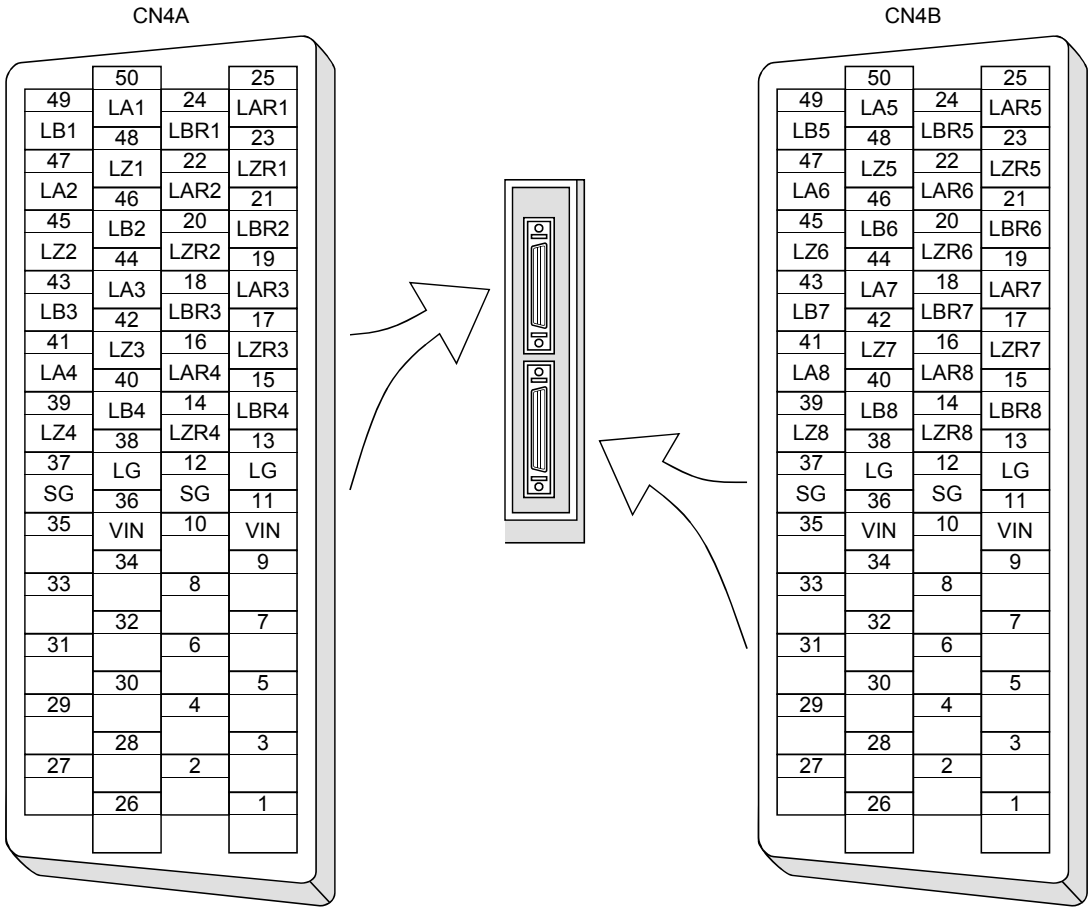
Note 1. Connect the diodes in the correct orientation. Opposite connection may cause the servo amplifier to be faulty and disable the signals from being output, making the forced stop and other protective circuits inoperative.
2. The signals having the same name are connected to the inside of the servo amplifier.
3. Always connect 24VDC (200mA).

3.3.2 Connectors and signal configurations

(1) Signal configurations

POINT

- The pin configurations of the connectors are as viewed from the cable connector wiring section.
- The pins without symbols can be assigned any devices using the MR Configurator (servo configuration software).



3.3.3 Signal explanations

For the IO interfaces (system in I/O column in the table), refer to section 3.2.5.

(1) Input signal

<table>
<tr><th>Signal</th><th>Symbol</th><th>Connector pin No.</th><th>Functions/Applications</th><th>I/O division</th></tr>
<tr><td></td><td></td><td>CN4A-1
CN4A-2
CN4A-3
CN4A-4
CN4A-5
CN4A-6
CN4A-7
CN4A-8
CN4A-26
CN4A-27
CN4A-28
CN4A-29
CN4A-30
CN4A-31
CN4A-32
CN4A-33
CN4B-1
CN4B-2
CN4B-3
CN4B-4
CN4B-5
CN4B-6
CN4B-7
CN4B-8
CN4B-26
CN4B-27
CN4B-28
CN4B-29
CN4B-30
CN4B-31
CN4B-32
CN4B-33</td><td>No signals are factory-assigned to these pins. Using the MR Configurator (servo configuration software), you can assign the input devices for corresponding slots as signals. Refer to Section 3.3.4 for assignable devices.
<table>
<tr><th>Device Name</th><th>Symbol</th><th>Device Name</th><th>Symbol</th></tr>
<tr><td>Servo-on</td><td>SON□</td><td>Forward rotation stroke end</td><td>LSP□</td></tr>
<tr><td>Reset</td><td>RES□</td><td>Reverse rotation stroke end</td><td>LSN□</td></tr>
<tr><td>Proportion control</td><td>PC□</td><td>Clear</td><td>CR□</td></tr>
<tr><td>Internal torque limit selection</td><td>TL1□</td><td>(Note) External torque limit</td><td>TL□</td></tr>
<tr><td>Electronic gear selection 1</td><td>CM1□</td><td>(Note) Speed selection 1</td><td>SP1□</td></tr>
<tr><td>Electronic gear selection 2</td><td>CM2□</td><td>(Note) Speed selection 2</td><td>SP2□</td></tr>
<tr><td>Gain switching selection</td><td>CDP□</td><td>(Note) Speed selection 3</td><td>SP3□</td></tr>
</table>
Note. You cannot select these devices when using the MR-J2M-P8A interface unit.</td><td>DI-1</td></tr>
</table>

(2) Output signal

<table>
<tr><th>Signal</th><th>Symbol</th><th>Connector pin No.</th><th>Functions/Applications</th><th>I/O division</th></tr>
<tr><td></td><td></td><td>CN4A-9
CN4A-10
CN4A-34
CN4A-35
CN4B-9
CN4B-10
CN4B-34
CN4B-35</td><td>No signals are factory-assigned to these pins. Using the MR Configurator (servo configuration software), you can assign the input devices for corresponding slots as signals. Refer to Section 3.3.4 for assignable devices.
<table>
<tr><th>Device Name</th><th>Symbol</th><th>Device Name</th><th>Symbol</th></tr>
<tr><td>Ready</td><td>RD□</td><td>Limiting torque</td><td>TLC□</td></tr>
<tr><td>Electromagnetic brake interlock</td><td>MBR□</td><td>(Note) Limiting speed</td><td>VLC□</td></tr>
<tr><td>In position</td><td>INP□</td><td>Trouble</td><td>ALM_□</td></tr>
<tr><td>(Note) Up to speed</td><td>SA□</td><td>Warning</td><td>WNG□</td></tr>
<tr><td>Zero speed detection</td><td>ZSP□</td><td>Battery warning</td><td>BWNG□</td></tr>
</table>
Note. You cannot select these devices when using the MR-J2M-P8A interface unit.</td><td>DO-1</td></tr>
</table>

<table>
<tr><th>Signal</th><th>Symbol</th><th>Connector pin No.</th><th>Functions/Applications</th><th>I/O division</th></tr>
<tr><td>Encoder A-phase pulse 1</td><td>LA1</td><td>CN4A-50</td><td rowspan="8">As LA□, LAR□, LB□ and LBR□, the pulses per servo motor revolution set in the DRU parameter No. 27 (Encoder output pulses) of the corresponding slots are output in the differential line driver system.
In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of π/2.
The relationships between rotation direction and phase difference of the A- and B-phase pulses can be changed using DRU parameter No. 54 (Function selection 9).
As LZ□ and LZR□ the zero-point signals of the encoders of the corresponding slots are output. One pulse is output per servo motor revolution. The same signals as OP□ are output in the differential line driver system.
・Encoder pulse outputs for slot 1
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 1</td><td>LA1・LAR1</td></tr><tr><td>Encoder B-phase pulse 1</td><td>LB1・LBR1</td></tr><tr><td>Encoder Z-phase pulse 1</td><td>LZ1・LZR1</td></tr></table>・Encoder pulse outputs for slot 2
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 2</td><td>LA2・LAR2</td></tr><tr><td>Encoder B-phase pulse 2</td><td>LB2・LBR2</td></tr><tr><td>Encoder Z-phase pulse 2</td><td>LZ2・LZR2</td></tr></table>・Encoder pulse outputs for slot 3
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 3</td><td>LA3・LAR3</td></tr><tr><td>Encoder B-phase pulse 3</td><td>LB3・LBR3</td></tr><tr><td>Encoder Z-phase pulse 3</td><td>LZ3・LZR3</td></tr></table>・Encoder pulse outputs for slot 4
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 4</td><td>LA4・LAR4</td></tr><tr><td>Encoder B-phase pulse 4</td><td>LB4・LBR4</td></tr><tr><td>Encoder Z-phase pulse 4</td><td>LZ4・LZR4</td></tr></table>・Encoder pulse outputs for slot 5
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 5</td><td>LA5・LAR5</td></tr><tr><td>Encoder B-phase pulse 5</td><td>LB5・LBR5</td></tr><tr><td>Encoder Z-phase pulse 5</td><td>LZ5・LZR5</td></tr></table>・Encoder pulse outputs for slot 6
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 6</td><td>LA6・LAR6</td></tr><tr><td>Encoder B-phase pulse 6</td><td>LB6・LBR6</td></tr><tr><td>Encoder Z-phase pulse 6</td><td>LZ6・LZR6</td></tr></table>・Encoder pulse outputs for slot 7
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 7</td><td>LA7・LAR7</td></tr><tr><td>Encoder B-phase pulse 7</td><td>LB7・LBR7</td></tr><tr><td>Encoder Z-phase pulse 7</td><td>LZ7・LZR7</td></tr></table>・Encoder pulse outputs for slot 8
<table><tr><th>Signal</th><th>Symbol</th></tr><tr><td>Encoder A-phase pulse 8</td><td>LA8・LAR8</td></tr><tr><td>Encoder B-phase pulse 8</td><td>LB8・LBR8</td></tr><tr><td>Encoder Z-phase pulse 8</td><td>LZ8・LZR8</td></tr></table></td><td rowspan="8">DO-2</td></tr>
<tr><td>Encoder A-phase pulse 1</td><td>LAR1</td><td>CN4A-25</td></tr>
<tr><td>Encoder B-phase pulse 1</td><td>LB1</td><td>CN4A-49</td></tr>
<tr><td>Encoder B-phase pulse 1</td><td>LBR1</td><td>CN4A-24</td></tr>
<tr><td>Encoder Z-phase pulse 1</td><td>LZ1</td><td>CN4A-48</td></tr>
<tr><td></td><td>LZR1</td><td>CN4A-23</td></tr>
<tr><td>Encoder A-phase pulse 2</td><td>LA2</td><td>CN4A-47</td></tr>
<tr><td>Encoder B-phase pulse 2</td><td>LAR2</td><td>CN4A-22</td></tr>
<tr><td></td><td>LB2</td><td>CN4A-46</td></tr>
<tr><td></td><td>LBR2</td><td>CN4A-21</td></tr>
<tr><td>Encoder Z-phase pulse 2</td><td>LZ2</td><td>CN4A-45</td></tr>
<tr><td></td><td>LZR2</td><td>CN4A-20</td></tr>
<tr><td>Encoder A-phase pulse 3</td><td>LA3</td><td>CN4A-44</td></tr>
<tr><td>Encoder B-phase pulse 3</td><td>LAR3</td><td>CN4A-19</td></tr>
<tr><td></td><td>LB3</td><td>CN4A-43</td></tr>
<tr><td></td><td>LBR3</td><td>CN4A-18</td></tr>
<tr><td>Encoder Z-phase pulse 3</td><td>LZ3</td><td>CN4A-42</td></tr>
<tr><td></td><td>LZR3</td><td>CN4A-17</td></tr>
<tr><td>Encoder A-phase pulse 4</td><td>LA4</td><td>CN4A-41</td></tr>
<tr><td>Encoder B-phase pulse 4</td><td>LAR4</td><td>CN4A-16</td></tr>
<tr><td></td><td>LB4</td><td>CN4A-40</td></tr>
<tr><td></td><td>LBR4</td><td>CN4A-15</td></tr>
<tr><td>Encoder Z-phase pulse 4</td><td>LZ4</td><td>CN4A-39</td></tr>
<tr><td></td><td>LZR4</td><td>CN4A-14</td></tr>
<tr><td>Encoder A-phase pulse 5</td><td>LA5</td><td>CN4B-50</td></tr>
<tr><td>Encoder B-phase pulse 5</td><td>LAR5</td><td>CN4B-25</td></tr>
<tr><td></td><td>LB5</td><td>CN4B-49</td></tr>
<tr><td></td><td>LBR5</td><td>CN4B-24</td></tr>
<tr><td>Encoder Z-phase pulse 5</td><td>LZ5</td><td>CN4B-48</td></tr>
<tr><td></td><td>LZR5</td><td>CN4B-23</td></tr>
<tr><td>Encoder A-phase pulse 6</td><td>LA6</td><td>CN4B-47</td></tr>
<tr><td>Encoder B-phase pulse 6</td><td>LAR6</td><td>CN4B-22</td></tr>
<tr><td></td><td>LB6</td><td>CN4B-46</td></tr>
<tr><td></td><td>LBR6</td><td>CN4B-21</td></tr>
<tr><td>Encoder Z-phase pulse 6</td><td>LZ6</td><td>CN4B-45</td></tr>
<tr><td></td><td>LZR6</td><td>CN4B-20</td></tr>
<tr><td>Encoder A-phase pulse 7</td><td>LA7</td><td>CN4B-44</td></tr>
<tr><td>Encoder B-phase pulse 7</td><td>LAR7</td><td>CN4B-19</td></tr>
<tr><td></td><td>LB7</td><td>CN4B-43</td></tr>
<tr><td></td><td>LBR7</td><td>CN4B-18</td></tr>
<tr><td>Encoder Z-phase pulse 7</td><td>LZ7</td><td>CN4B-42</td></tr>
<tr><td></td><td>LZR7</td><td>CN4B-17</td></tr>
<tr><td>Encoder A-phase pulse 8</td><td>LA8</td><td>CN4B-41</td></tr>
<tr><td>Encoder B-phase pulse 8</td><td>LAR8</td><td>CN4B-16</td></tr>
<tr><td></td><td>LB8</td><td>CN4B-40</td></tr>
<tr><td></td><td>LBR8</td><td>CN4B-15</td></tr>
<tr><td>Encoder Z-phase pulse 8</td><td>LZ8</td><td>CN4B-39</td></tr>
<tr><td></td><td>LZR8</td><td>CN4B-14</td></tr>
</table>

(3) Power supply

Signal	Symbol	Connector pin No.	Functions/Applications
Power input for digital interface	VIN	CN4A-11 CN4A-36 CN4B-11 CN4B-36	Driver power input terminal for digital interface. Used to input 24VDC (200mA or more) for input interface. 24VDC±10% Not connected to VIN of the interface unit.
Common for digital interface	SG	CN4A-12 CN4A-37 CN4B-12 CN4B-37	Common terminal to VIN. Pins are connected internally. Separated from LG. Not connected to SG of the interface unit.
Control common	LG	CN4A-13 CN4A-38 CN4B-13 CN4B-38	Common terminal to MO1, MO2 and MO3.
Shield	SD	Plate	Connect the external conductor of the shield cable.

3.3.4 Device explanations

(1) Input device

Using the MR Configurator (servo configuration software), you can assign the devices given in this section to the pins of connectors CN4A and CN4B of the MR-J2M-D01 extension IO unit.

Device name	Symbol	Functions/Applications
Internal torque limit selection 1	TL11	TL11: Internal torque limit selection device for slot 1 TL12: Internal torque limit selection device for slot 2 TL13: Internal torque limit selection device for slot 3 TL14: Internal torque limit selection device for slot 4 TL15: Internal torque limit selection device for slot 5 TL16: Internal torque limit selection device for slot 6 TL17: Internal torque limit selection device for slot 7 TL18: Internal torque limit selection device for slot 8 Refer to Section 3.3.5 (2) for details.
Internal torque limit selection 2	TL12	
Internal torque limit selection 3	TL13	
Internal torque limit selection 4	TL14	
Internal torque limit selection 5	TL15	
Internal torque limit selection 6	TL16	
Internal torque limit selection 7	TL17	
Internal torque limit selection 8	TL18	
Proportion control 1	PC1	PC1: Proportion control device for slot 1 PC2: Proportion control device for slot 2 PC3: Proportion control device for slot 3 PC4: Proportion control device for slot 4 PC5: Proportion control device for slot 5 PC6: Proportion control device for slot 6 PC7: Proportion control device for slot 7 PC8: Proportion control device for slot 8 Short PC□-SG to switch the speed amplifier from the proportional integral type to the proportional type. If the servo motor at a stop is rotated even one pulse due to any external factor, it generates torque to compensate for a position shift. When the servo motor shaft is to be locked mechanically after positioning completion (stop), switching on the proportion control (PC□) upon positioning completion will suppress the unnecessary torque generated to compensate for a position shift.
Proportion control 2	PC2	
Proportion control 3	PC3	
Proportion control 4	PC4	
Proportion control 5	PC5	
Proportion control 6	PC6	
Proportion control 7	PC7	
Proportion control 8	PC8	

<table>
<tr><th>Device name</th><th>Symbol</th><th>Functions/Applications</th></tr>
<tr><td>Electronic gear selection 11</td><td>CM11</td><td rowspan="2">CM11: Electronic gear selection 1 device for slot 1
CM12: Electronic gear selection 1 device for slot 2
CM13: Electronic gear selection 1 device for slot 3
CM14: Electronic gear selection 1 device for slot 4
CM15: Electronic gear selection 1 device for slot 5
CM16: Electronic gear selection 1 device for slot 6
CM17: Electronic gear selection 1 device for slot 7
CM18: Electronic gear selection 1 device for slot 8
CM21: Electronic gear selection 2 device for slot 1
CM22: Electronic gear selection 2 device for slot 2
CM23: Electronic gear selection 2 device for slot 3
CM24: Electronic gear selection 2 device for slot 4
CM25: Electronic gear selection 2 device for slot 5
CM26: Electronic gear selection 2 device for slot 6
CM27: Electronic gear selection 2 device for slot 7
CM28: Electronic gear selection 2 device for slot 8
The combination of CM1□-SG and CM2□-SG gives you a choice of four different electronic gear numerators set in the DRU parameters.
CM1□ and CM2□ cannot be used in the absolute position detection system.
<table><tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Electronic gear numerator</th></tr><tr><th>CM2□</th><th>CM1□</th></tr><tr><td>0</td><td>0</td><td>DRU parameter No.3</td></tr><tr><td>0</td><td>1</td><td>DRU parameter No.69</td></tr><tr><td>1</td><td>0</td><td>DRU parameter No.70</td></tr><tr><td>1</td><td>1</td><td>DRU parameter No.71</td></tr></table>Note. 0: Off across terminal-SG (open)
1: On across terminal-SG (shorted)</td></tr>
<tr><td>Electronic gear selection 12</td><td>CM12</td></tr>
<tr><td>Electronic gear selection 13</td><td>CM13</td><td rowspan="2">CDP1: Gain switching device for slot 1
CDP2: Gain switching device for slot 2
CDP3: Gain switching device for slot 3
CDP4: Gain switching device for slot 4
CDP5: Gain switching device for slot 5
CDP6: Gain switching device for slot 6
CDP7: Gain switching device for slot 7
CDP8: Gain switching device for slot 8
Connect CDP□-SG to change the load inertia moment ratio into the DRU parameter No. 61 setting and the gain values into the values multiplied by the DRU parameter No. 62 to 64 settings.</td></tr>
<tr><td>Electronic gear selection 14</td><td>CM14</td></tr>
<tr><td>Electronic gear selection 15</td><td>CM15</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 16</td><td>CM16</td></tr>
<tr><td>Electronic gear selection 17</td><td>CM17</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 18</td><td>CM18</td></tr>
<tr><td>Electronic gear selection 21</td><td>CM21</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 22</td><td>CM22</td></tr>
<tr><td>Electronic gear selection 23</td><td>CM23</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 24</td><td>CM24</td></tr>
<tr><td>Electronic gear selection 25</td><td>CM25</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 26</td><td>CM26</td></tr>
<tr><td>Electronic gear selection 27</td><td>CM27</td><td rowspan="2"></td></tr>
<tr><td>Electronic gear selection 28</td><td>CM28</td></tr>
<tr><td>Gain switching 1</td><td>CDP1</td><td rowspan="2"></td></tr>
<tr><td>Gain switching 2</td><td>CDP2</td></tr>
<tr><td>Gain switching 3</td><td>CDP3</td><td rowspan="2"></td></tr>
<tr><td>Gain switching 4</td><td>CDP4</td></tr>
<tr><td>Gain switching 5</td><td>CDP5</td><td rowspan="2"></td></tr>
<tr><td>Gain switching 6</td><td>CDP6</td></tr>
<tr><td>Gain switching 7</td><td>CDP7</td><td rowspan="2"></td></tr>
<tr><td>Gain switching 8</td><td>CDP8</td></tr>
</table>

(2) Output device

Device name	Symbol	Functions/Applications
Ready 1	RD1	RD1: Ready device for slot 1 RD2: Ready device for slot 2 RD3: Ready device for slot 3 RD4: Ready device for slot 4 RD5: Ready device for slot 5 RD6: Ready device for slot 6 RD7: Ready device for slot 7 RD8: Ready device for slot 8 RD□-SG are connected when the servo is switched on and the servo amplifier is ready to operate.
Ready 2	RD2	
Ready 3	RD3	
Ready 4	RD4	
Ready 5	RD5	
Ready 6	RD6	
Ready 7	RD7	
Ready 8	RD8	
In position 1	INP1	INP1: In position device for slot 1 INP2: In position device for slot 2 INP3: In position device for slot 3 INP4: In position device for slot 4 INP5: In position device for slot 5 INP6: In position device for slot 6 INP7: In position device for slot 7 INP8: In position device for slot 8 INP□-SG are connected when the number of droop pulses is in the preset in-position range. The in-position range can be changed using DRU parameter No. 5. When the in-position range is increased, INP□-SG may be kept connected during low-speed rotation.
In position 2	INP2	
In position 3	INP3	
In position 4	INP4	
In position 5	INP5	
In position 6	INP6	
In position 7	INP7	
In position 8	INP8	
Limiting torque 1	TLC1	TLC1: Limiting torque device for slot 1 TLC2: Limiting torque device for slot 2 TLC3: Limiting torque device for slot 3 TLC4: Limiting torque device for slot 4 TLC5: Limiting torque device for slot 5 TLC6: Limiting torque device for slot 6 TLC7: Limiting torque device for slot 7 TLC8: Limiting torque device for slot 8 TLC□-SG are connected when the torque generated reaches the value set to the internal torque limit 1 (DRU parameter No. 28) or internal torque limit 2(DRU parameter No. 76).
Limiting torque 2	TLC2	
Limiting torque 3	TLC3	
Limiting torque 4	TLC4	
Limiting torque 5	TLC5	
Limiting torque 6	TLC6	
Limiting torque 7	TLC7	
Limiting torque 8	TLC8	
Zero speed detection 1	ZSP1	ZSP1: Zero speed detection device for slot 1 ZSP2: Zero speed detection device for slot 2 ZSP3: Zero speed detection device for slot 3 ZSP4: Zero speed detection device for slot 4 ZSP5: Zero speed detection device for slot 5 ZSP6: Zero speed detection device for slot 6 ZSP7: Zero speed detection device for slot 7 ZSP8: Zero speed detection device for slot 8 ZSP□-SG are connected when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed using DRU parameter No. 24.
Zero speed detection 2	ZSP2	
Zero speed detection 3	ZSP3	
Zero speed detection 4	ZSP4	
Zero speed detection 5	ZSP5	
Zero speed detection 6	ZSP6	
Zero speed detection 7	ZSP7	
Zero speed detection 8	ZSP8	
Electromagnetic brake interlock 1	MBR1	MBR1: Electromagnetic brake interlock device for slot 1 MBR2: Electromagnetic brake interlock device for slot 2 MBR3: Electromagnetic brake interlock device for slot 3 MBR4: Electromagnetic brake interlock device for slot 4 MBR5: Electromagnetic brake interlock device for slot 5 MBR6: Electromagnetic brake interlock device for slot 6 MBR7: Electromagnetic brake interlock device for slot 7 MBR8: Electromagnetic brake interlock device for slot 8 In the servo-off or alarm status, MBR□-SG are disconnected.
Electromagnetic brake interlock 2	MBR2	
Electromagnetic brake interlock 3	MBR3	
Electromagnetic brake interlock 4	MBR4	
Electromagnetic brake interlock 5	MBR5	
Electromagnetic brake interlock 6	MBR6	
Electromagnetic brake interlock 7	MBR7	
Electromagnetic brake interlock 8	MBR8	

Device name	Symbol	Functions/Applications
Warning 1	WNG1	WNG1: Warning device for slot 1 WNG2: Warning device for slot 2 WNG3: Warning device for slot 3 WNG4: Warning device for slot 4 WNG5: Warning device for slot 5 WNG6: Warning device for slot 6 WNG7: Warning device for slot 7 WNG8: Warning device for slot 8 When warning has occurred, WNG□-SG are connected. When there is no warning, WNG□-SG are disconnected within about 3 second after power-on.
Warning 2	WNG2	
Warning 3	WNG3	
Warning 4	WNG4	
Warning 5	WNG5	
Warning 6	WNG6	
Warning 7	WNG7	
Warning 8	WNG8	
Battery warning 1	BWNG1	BWNG1: Battery warning device for slot 1 BWNG2: Battery warning device for slot 2 BWNG3: Battery warning device for slot 3 BWNG4: Battery warning device for slot 4 BWNG5: Battery warning device for slot 5 BWNG6: Battery warning device for slot 6 BWNG7: Battery warning device for slot 7 BWNG8: Battery warning device for slot 8 BWNG□-SG are connected when battery cable breakage warning (A.92) or battery warning (A.9F) has occurred. When there is no battery warning, BWNG□-SG are disconnected within about 3 second after power-on
Battery warning 2	BWNG2	
Battery warning 3	BWNG3	
Battery warning 4	BWNG4	
Battery warning 5	BWNG5	
Battery warning 6	BWNG6	
Battery warning 7	BWNG7	
Battery warning 8	BWNG8	

3.3.5 Detailed description of the device

(1) Electronic gear switching

The combination of CM1□-SG and CM2□-SG gives you a choice of four different electronic gear numerators set in the DRU parameters.

As soon as Electronic gear selection (CM1□) / Electronic gear selection 2 (CM2□) is turned ON or OFF, the denominator of the electronic gear changes. Therefore, if any shock occurs at this change, use position smoothing (DRU parameter No. 7) to relieve shock.

(Note) External input signal		Electronic gear numerator
CM2□	CM1□	
0	0	DRU parameter No. 3
0	1	DRU parameter No. 69
1	0	DRU parameter No. 70
1	1	DRU parameter No. 71

Note. 0: CM1□/CM2□-SG off(open)
1: CM1□/CM2□-SG on(short)

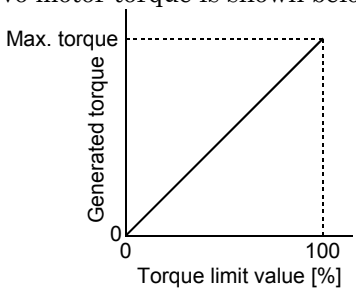
(2) Torque limit

CAUTION

- Releasing the torque limit during servo lock may cause the servo motor to suddenly rotate according to the position deviation from the instructed position.

(a) Torque limit and torque

By setting DRU parameter No. 28 (internal torque limit 1), and DRU parameter No. 76 (internal torque limit 2), torque is always limited to the maximum value during operation. A relationship between the limit value and servo motor torque is shown below.



(b) Torque limit value selection

By making internal torque limit selection (TL1□) usable, you can select the torque limit value as indicated below.

(Note 1) External input signals	(Note 2) Torque limit value made valid
TL1	
0	Internal torque limit 1 (DRU parameter No. 28)
1	DRU parameter No. 76 > DRU parameter No. 28: DRU parameter No. 28 DRU parameter No. 76 < DRU parameter No. 28: DRU parameter No. 76

Note 1. 0: TL1□-SG off (open)
1: TL1□-SG on (short)
2. Releasing the torque limit during servo lock may cause the servo motor to suddenly rotate according to the position deviation from the instructed position.

(c) Limiting torque (TLC□)

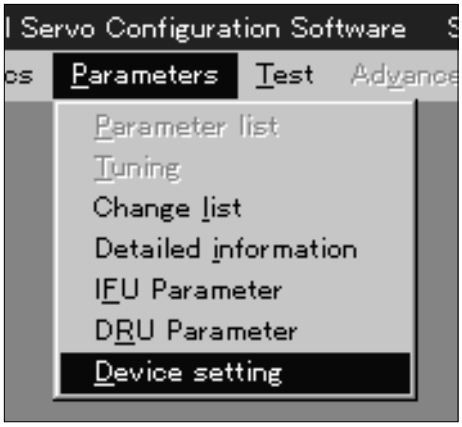
TLC-SG are connected when the torque by the servo motor reaches the torque set to internal torque limit 1 or internal torque limit 2.

3.3.6 Device assignment method

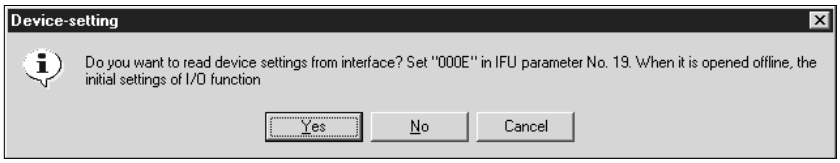
POINT
When using the device setting, preset "000E" in IFU parameter No. 19.

(1) How to open the setting screen

Click "Parameters" on the menu bar and click "Device setting" in the menu.



Making selection displays the following window.

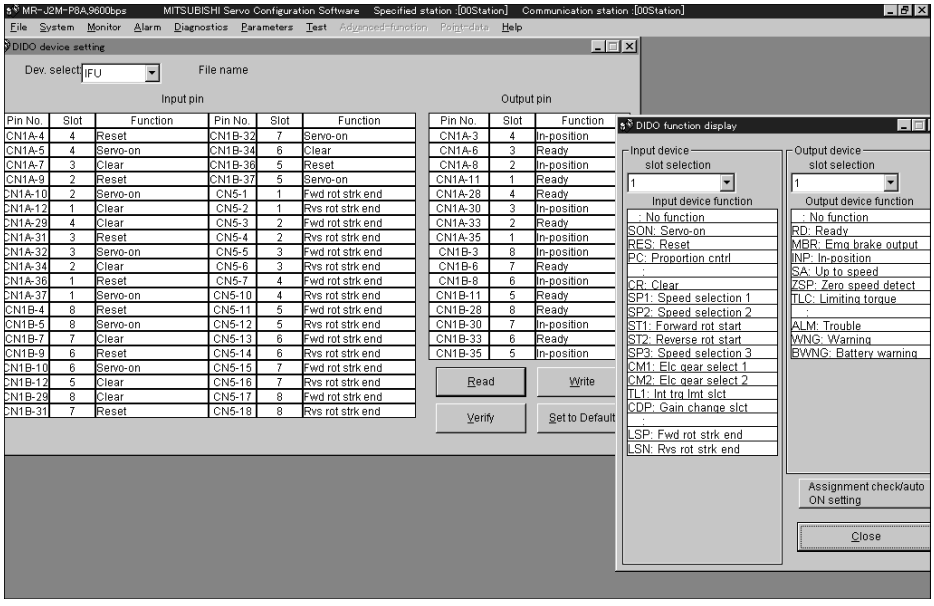


Click "Yes" button reads and displays the function assigned to each pin from the interface unit and extension IO unit.

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

Click "Cancel" button terminates the processing.

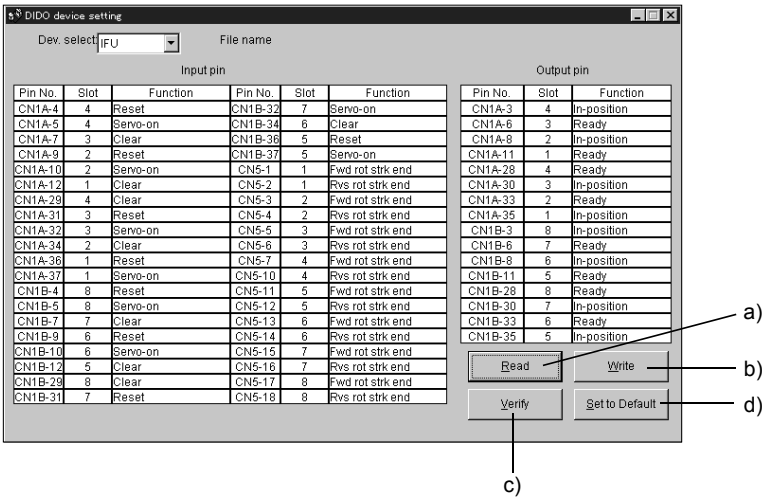
Click "Yes" button or "No" button displays the following two windows.



(2) Screen explanation

(a) DIDO device setting window screen

This is the device assignment screen of the interface unit/option unit. In Dev. selection, choose the IFU (interface unit) or D01 (extension IO unit). Making selection displays the pin assignment status per unit.



Input pin						Output pin		
Pin No.	Slot	Function	Pin No.	Slot	Function	Pin No.	Slot	Function
CN1A-4	4	Reset	CN1B-32	7	Servo-on	CN1A-3	4	In-position
CN1A-5	4	Servo-on	CN1B-34	6	Clear	CN1A-6	3	Ready
CN1A-7	3	Clear	CN1B-36	5	Reset	CN1A-8	2	In-position
CN1A-9	2	Reset	CN1B-37	5	Servo-on	CN1A-11	1	Ready
CN1A-10	2	Servo-on	CN5-1	1	Fwd rot strk end	CN1A-28	4	Ready
CN1A-12	1	Clear	CN5-2	1	Rvs rot strk end	CN1A-30	3	In-position
CN1A-29	4	Clear	CN5-3	2	Fwd rot strk end	CN1A-33	2	Ready
CN1A-31	3	Reset	CN5-4	2	Rvs rot strk end	CN1A-35	1	In-position
CN1A-32	3	Servo-on	CN5-5	3	Fwd rot strk end	CN1B-3	8	In-position
CN1A-34	2	Clear	CN5-6	3	Rvs rot strk end	CN1B-6	7	Ready
CN1A-36	1	Reset	CN5-7	4	Fwd rot strk end	CN1B-8	6	In-position
CN1A-37	1	Servo-on	CN5-10	4	Rvs rot strk end	CN1B-11	5	Ready
CN1B-4	8	Reset	CN5-11	5	Fwd rot strk end	CN1B-28	8	Ready
CN1B-5	8	Servo-on	CN5-12	5	Rvs rot strk end	CN1B-30	7	In-position
CN1B-7	7	Clear	CN5-13	6	Fwd rot strk end	CN1B-33	6	Ready
CN1B-9	6	Reset	CN5-14	6	Rvs rot strk end	CN1B-35	5	In-position
CN1B-10	6	Servo-on	CN5-15	7	Fwd rot strk end			
CN1B-12	5	Clear	CN5-16	7	Rvs rot strk end			
CN1B-29	8	Clear	CN5-17	8	Fwd rot strk end			
CN1B-31	7	Reset	CN5-18	8	Rvs rot strk end			

1) Read of function assignment (a))

Click the "Read" button reads and displays all functions assigned to the pins from the interface unit and extension IO unit.

2) Write of function assignment (b))

Click the "Write" button writes all pins that are assigned the functions to the interface unit and extension IO unit.

3) Verify of function assignment (c))

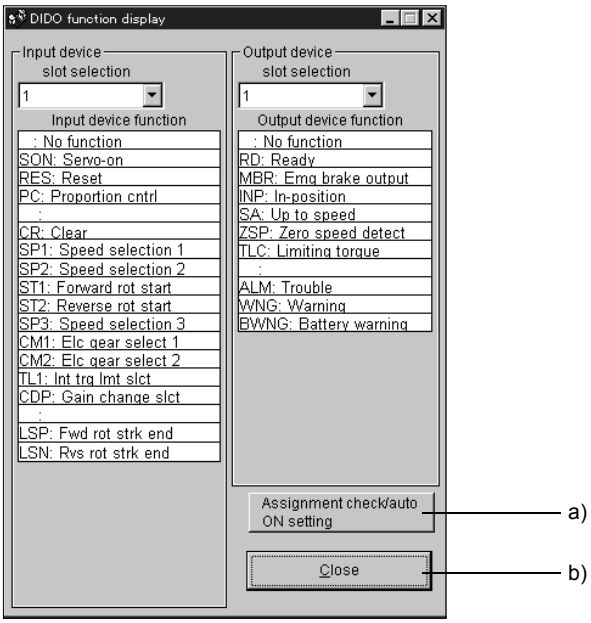
Click the "Verify" button verifies the function assignment in the interface unit and extension IO unit with the device information on the screen.

4) Initial setting of function assignment (d))

Click the "Set to Default" button initializes the function assignment.

(b) DIDO function display window screen

This screen is used to select the slot numbers and functions assigned to the pins.
Choose the slot numbers in Input device slot selection and Output device slot selection.
The functions displayed below Input device function and Output device function are assignable.



In the DIDO function display window, choose the slot numbers where you want to assign the functions.
Move the pointer to the place of the function to be assigned. Drag and drop it as-is to the pin you want to assign in the DIDO device setting window.

1) Assignment check/auto ON setting (a))

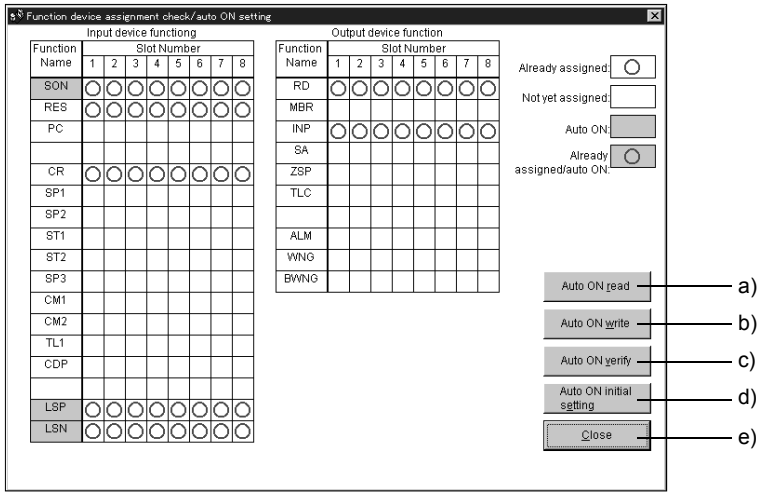
Press this button to display the screen that shows the slot-by-slot assignment list and enables auto ON setting.
Refer to this section (4) for more information.

2) Quitting

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

(C) Function device assignment check/auto ON setting display

Click the "Function device assignment check/auto ON setting" button in the DIDO function display window displays the following window.



The assigned functions are indicated by ○.

The functions assigned by auto ON are grayed. When you want to set auto ON to the function that is enabled for auto ON, click the corresponding cell. Clicking it again disables auto ON.

1) Auto ON read of function assignment (a))

Click "Auto ON read" button reads the functions set for auto ON from the interface unit and extension IO unit.

2) Auto ON write of function assignment (b))

Click "Auto ON write" button writes the functions currently set for auto ON to the interface unit and extension IO unit.

3) Auto ON verify of function assignment (c))

Click "Auto ON verify" button verifies the current auto ON setting in the interface unit and extension IO unit with the auto ON setting on the screen.

4) Auto ON initial setting of function assignment (d))

Click "Auto ON initial setting" button initializes the auto ON setting.

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

Click "Close" button exits from the window.

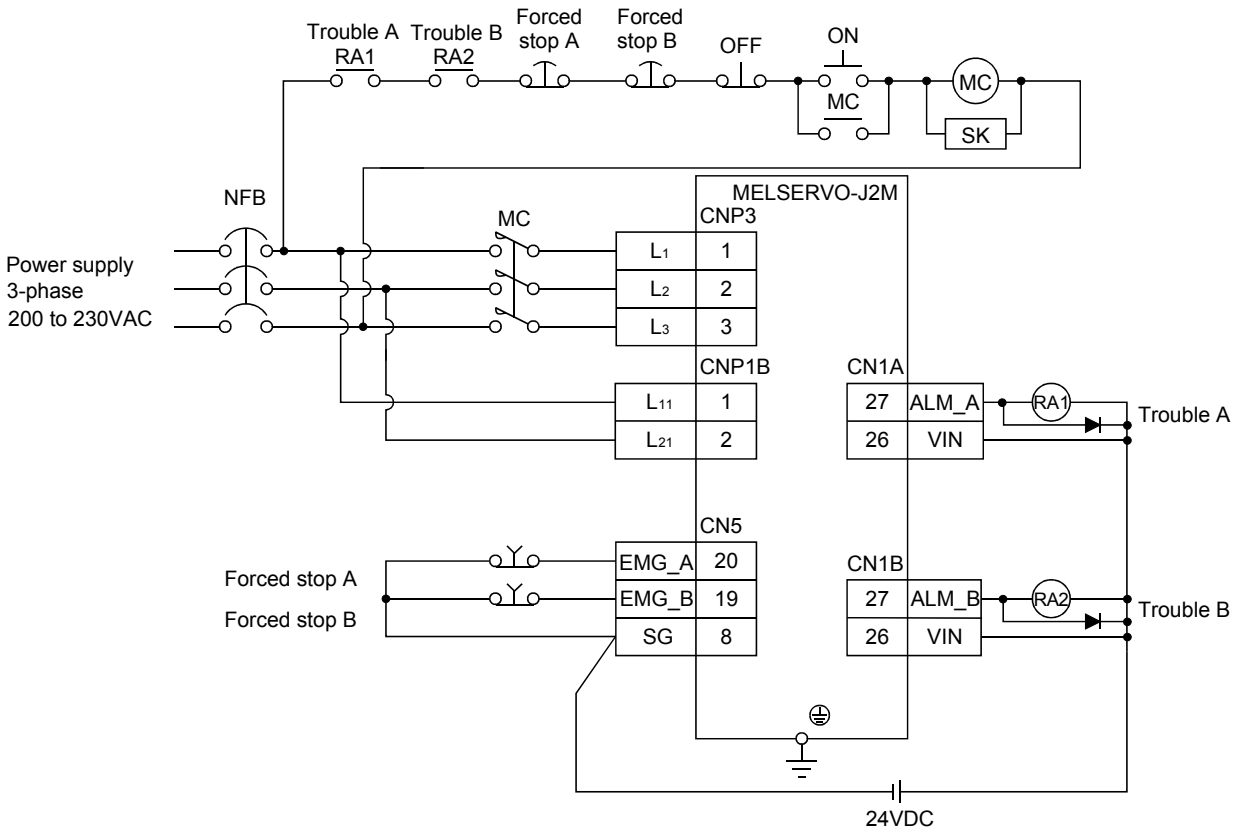
3.4 Signals and wiring for base unit

⚠ CAUTION	・When each unit 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 (ALM_□) to switch power off. Otherwise, a regenerative brake transistor fault or the like may overheat the regenerative brake resistor, causing a fire. ・Fabricate the cables noting the shapes of the CNP1A housing (X type) and CNP1B housing (Y type).

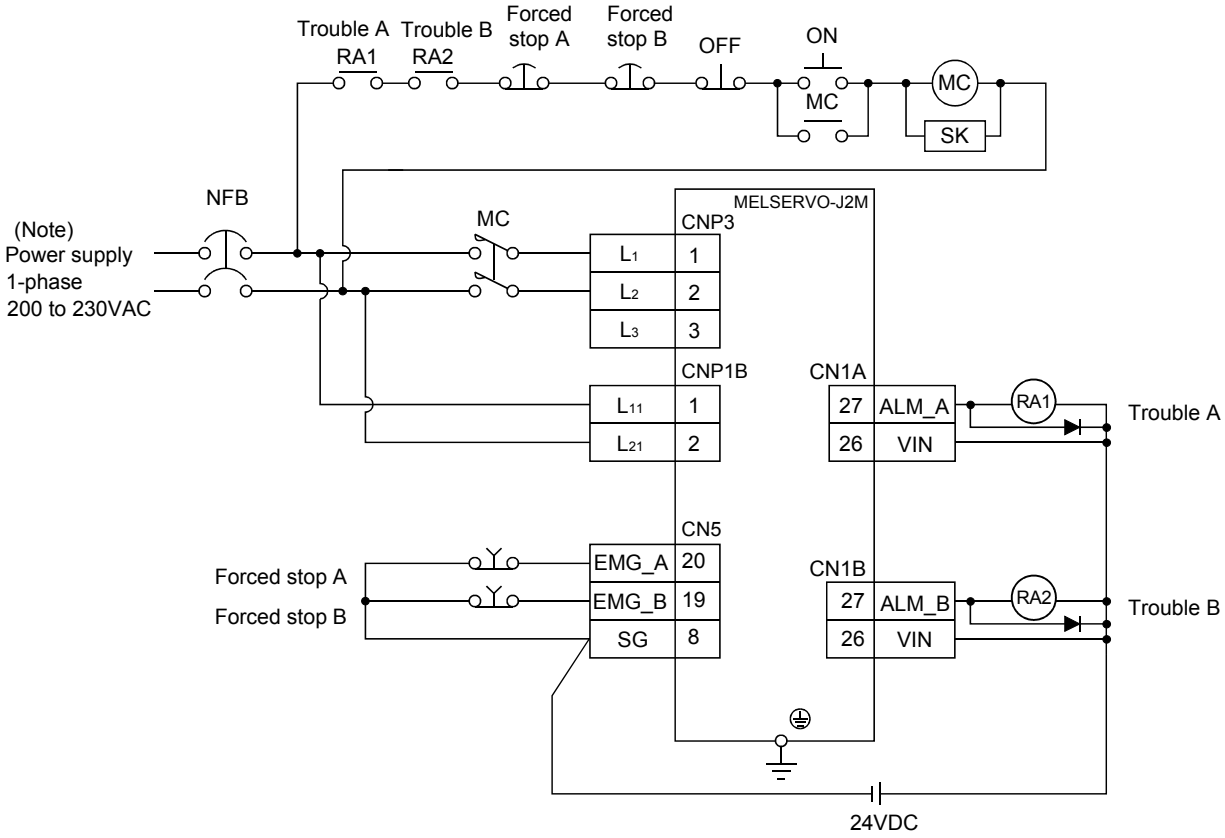
3.4.1 Connection example for power line circuit

Wire the power supply and main circuit as shown below so that the servo-on (SON□) turns off as soon as alarm occurrence, or a servo forced stop is made valid is detected and power is shut off.
A no-fuse breaker (NFB) must be used with the input cables of the power supply.

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



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

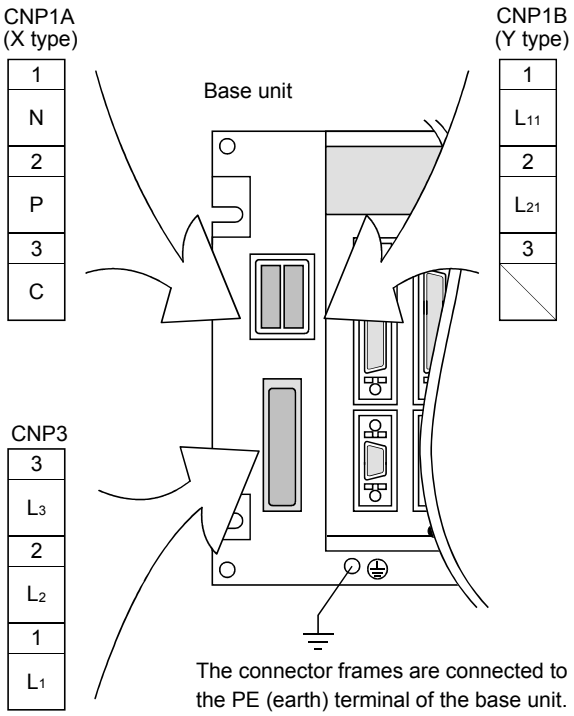


Note. Connect a 1-phase 200 to 230VAC power supply to L1/L2 and keep L3 open.

3.4.2 Connectors and signal configurations

POINT

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



Connector	Cable side connector	
	Model	Maker
CNP1A	Housing: 1-178128-3 (X type) Contact: 917511-2 (max. sheath OD: ϕ 2.8[mm] (ϕ 0.11[in])) 353717-2 (max. sheath OD: ϕ 3.4[mm] (ϕ 0.13[in])) (Note)	Tyco Electronics
CNP1B	Housing: 2-178128-3 (Y type) Contact: 917511-2 (max. sheath OD: ϕ 2.8[mm] (ϕ 0.11[in])) 353717-2 (max. sheath OD: ϕ 3.4[mm] (ϕ 0.13[in])) (Note)	
CNP3	Housing: 1-179958-3 Contact: 316041-2	

Note. This contact is not included in the option (MR-J2MCNM).

3.4.3 Terminals

Refer to Section 10.2 for the layouts and signal configurations of the terminal blocks.

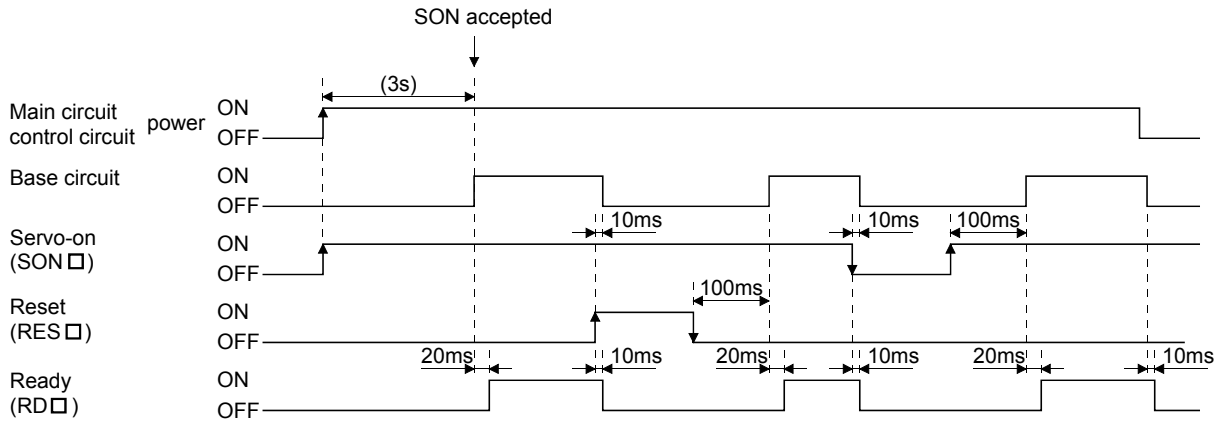
Connector	Pin No.	Code	Connection target (Application)	Description
CNP3	1	L_1	Main circuit power	(1) When using a three -phase power supply Supply L_1, L_2 and L_3 with three-phase, 200 to 230VAC, 50/60Hz power. (2) When using a signal -phase power supply Supply L_1 and L_2 with signal-phase, 200 to 230VAC, 50/60Hz power.
	2	L_2		
	3	L_3		
CNP1B	1	L_{11}	Control circuit power	Supply L_{11} and L_{21} with single-phase, 200 to 230VAC, 50/60Hz power.
	2	L_{21}		
	3			
CNP1A	1	N	Regenerative brake option	Connect the regenerative brake option across P-C. Accidental connection of the regenerative brake option to P-N may cause burning (Refer to Section 12.1.1)
	2	P		
	3	C		
		⏚ (Earth)	Protective earth (PE)	Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.

3.4.4 Power-on sequence

(1) Power-on procedure

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

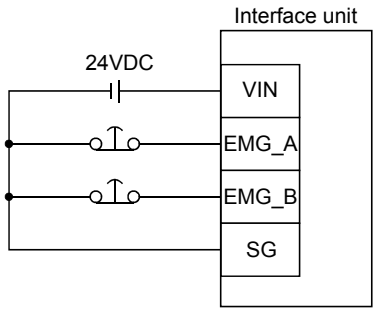
(2) Timing chart



(3) Forced stop

⚠ CAUTION	・Install an forced stop circuit externally to ensure that operation can be stopped and power shut off immediately.

Make up a circuit which shuts off main circuit power as soon as EMG_□-SG are opened at a forced stop. To ensure safety, always install a forced stop switch across EMG_□-SG. By disconnecting EMG_□-SG, the dynamic brake is operated to bring the servo motor to a stop. At this time, the display shows the servo forced stop warning (A.E6).
During ordinary operation, do not use forced stop (EMG_□) to alternate stop and run. The service life of each drive unit may be shortened.



3.5 Connection of drive unit and servo motor

3.5.1 Connection instructions

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

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

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

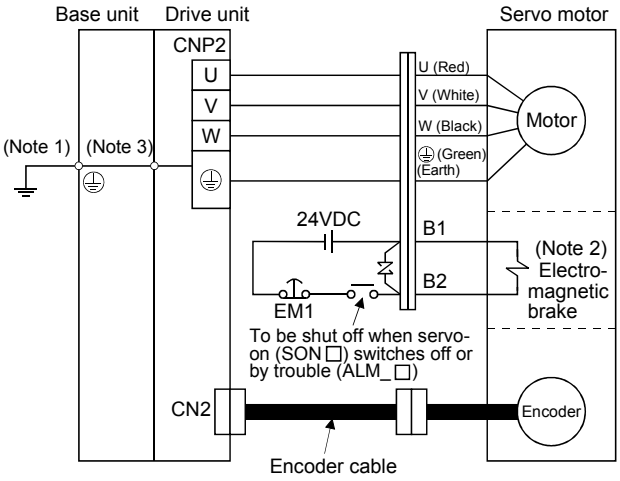
(1) The protective earth of the servo motor joins to the base unit via the drive unit mounting screw. Connect the protective earth terminal of the base unit to the protective earth of the control box to discharge electricity to the earth.

(2) The power supply for the electromagnetic brake should not be used as the 24VDC power supply for interface. Always use the power supply for electromagnetic brake only.

3.5.2 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 12.2.1. For encoder cable connection, refer to Section 12.1.2. For the signal layouts of the connectors, refer to Section 3.5.3.

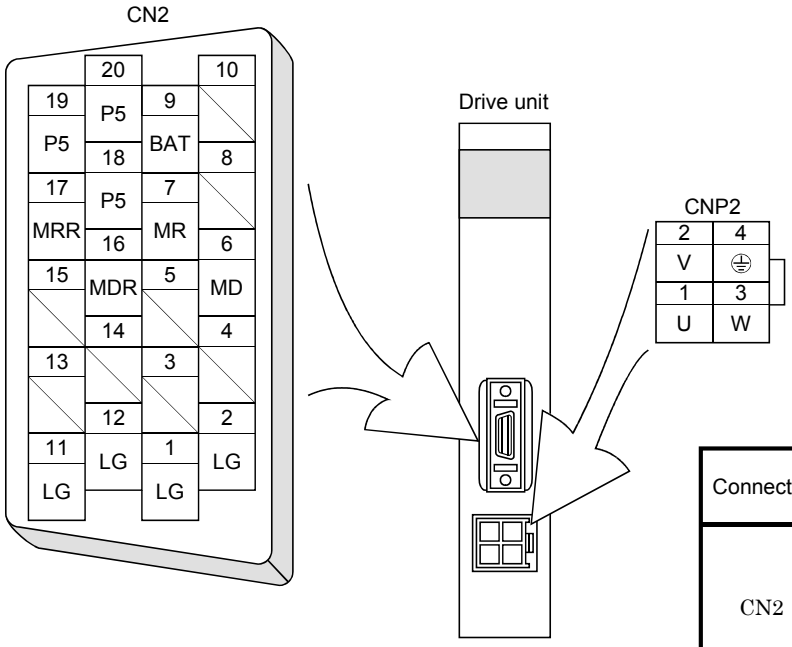
For the servo motor connector, refer to Chapter 3 of the Servo Motor Instruction Manual.

Servo motor	Connection diagram
HC-KFS053 (B) to 73 (B) HC-MFS053 (B) to 73 (B) HC-UFS13 (B) to 73 (B)	 Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal of the base unit to the protective earth (PE) of the control box. 2. This circuit applies to the servo motor with electromagnetic brake. 3. The protective earth of the servo motor is connected to the base unit via the drive unit mounting screw.

3.5.3 I/O terminals

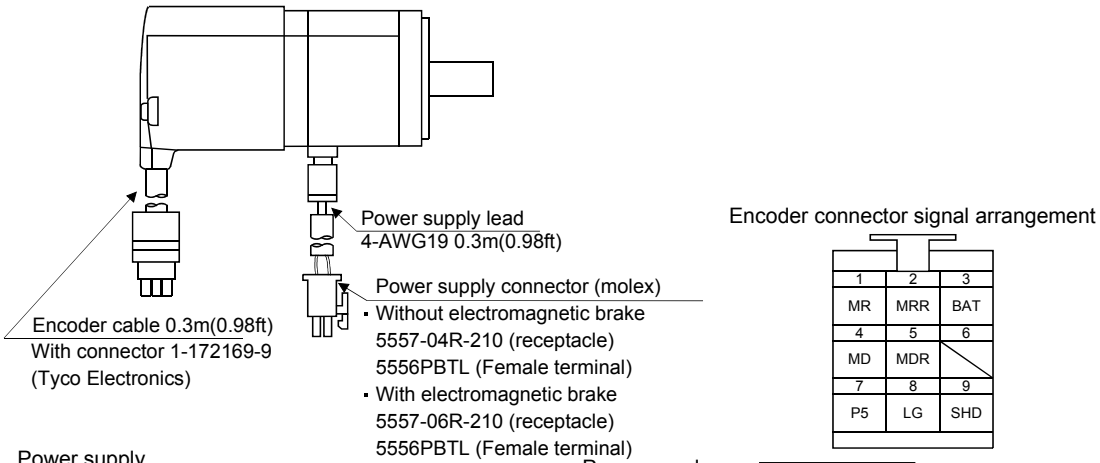
(1) Drive unit

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



Connector	Cable side connector	
	Model	Maker
CN2	1. Soldering type Connector: 10120-3000VE Shell kit: 10320-52F0-008 2. Insulation displacement type Connector: 10120-6000EL Shell kit: 10320-3210-000	3M
CNP2	Housing: 5557-04R-210 Terminal: 5556PBT3L	molex

(2) Servo motor (HC-KFS・HC-MFS・HC-UFS3000r/min series)



Pin	Signal
1	U
2	V
3	W
4	⏚ (Earth)

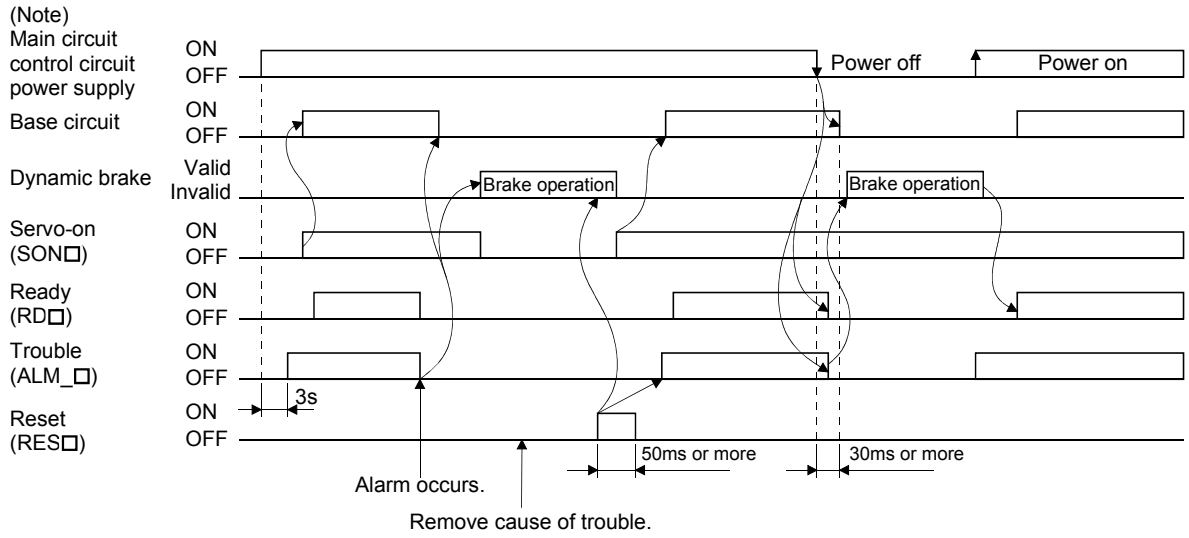
Pin	Signal
1	U
2	V
3	W
4	⏚ (Earth)
(Note) 5	B1
(Note) 6	B2

Note. Supply electromagnetic brake power (24VDC).
There is no polarity.

3.6 Alarm occurrence timing chart

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

When an alarm occurs in the MELSERVO-J2M, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To reset the alarm, switch the control circuit power supply from off to on, or turn the reset (RES□) from off to on. However, the alarm cannot be reset unless its cause is removed.



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

(1) Overcurrent, overload 1 or overload 2

If operation is repeated by switching control circuit power off, then on to reset the overcurrent (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

Undervoltage (A.10) occurs when the input power is in either of the following statuses.

・A power failure of the control circuit power supply continues for 30ms or longer and the control circuit is not completely off.

・The bus voltage dropped to 200VDC or less.

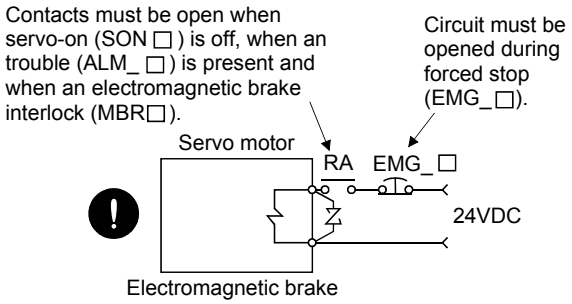
(4) Incremental

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

3.7 Servo motor with electromagnetic brake

⚠ CAUTION

- Configure the electromagnetic brake operation circuit so that it is activated not only by the interface unit signals but also by an external forced stop (EMG_□).



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

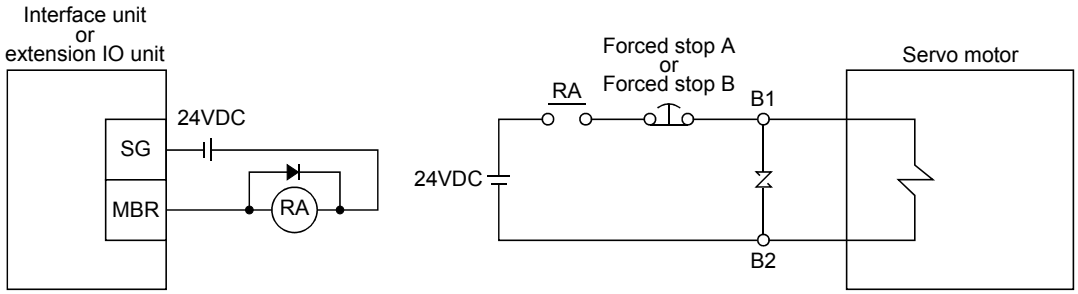
POINT

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

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

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

(1) Connection diagram



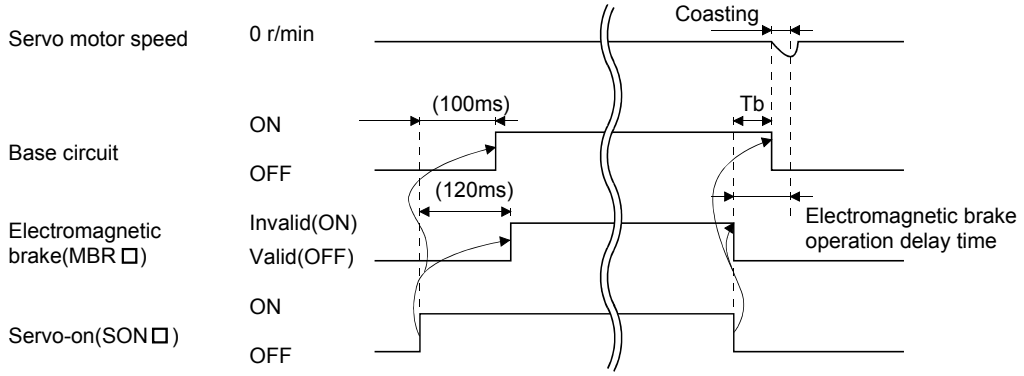
(2) Setting

1) Using the MR Configurator (servo configuration software), make the electromagnetic brake interlock (MBR□) valid.
2) In DRU parameter No.33 (electromagnetic brake sequence output), set the delay time (Tb) from electromagnetic brake operation to base circuit shut-off at a servo off time as in the timing chart in (3) in this section.

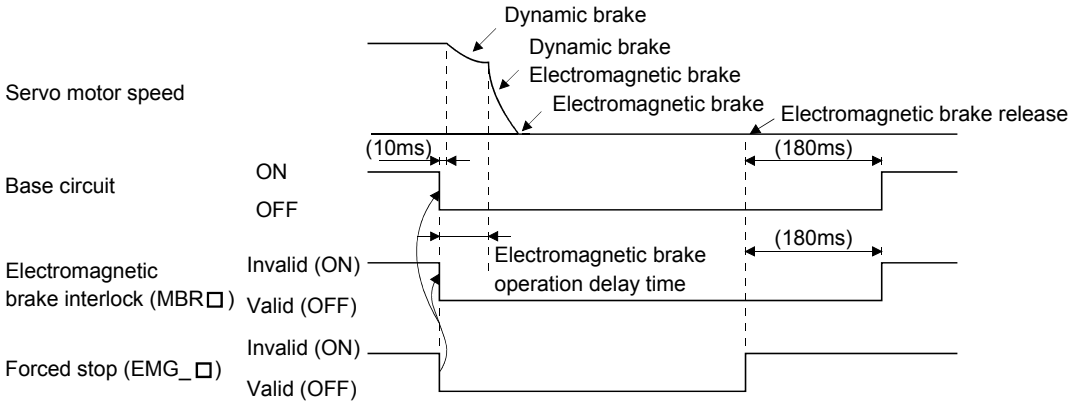
(3) Timing charts

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

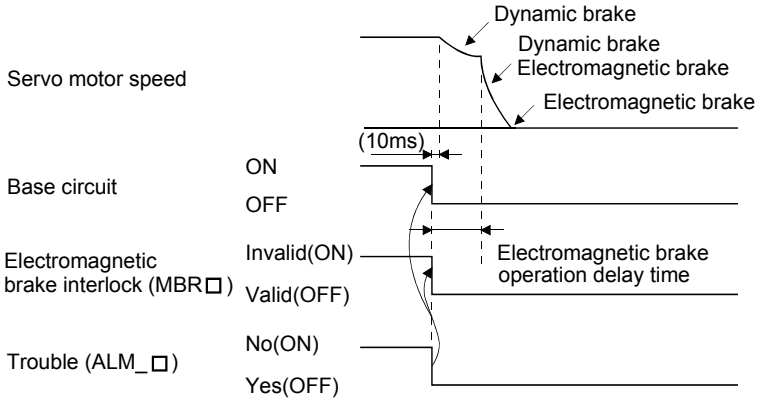
Tb [ms] after the servo-on (SON□) is switched off, the servo lock is released and the servo motor coasts. If the electromagnetic brake is made valid in the servo lock status, the brake life may be shorter. Therefore, when using the electromagnetic brake in a vertical lift application or the like, set delay time (Tb) to about the same as the electromagnetic brake operation delay time to prevent a drop.



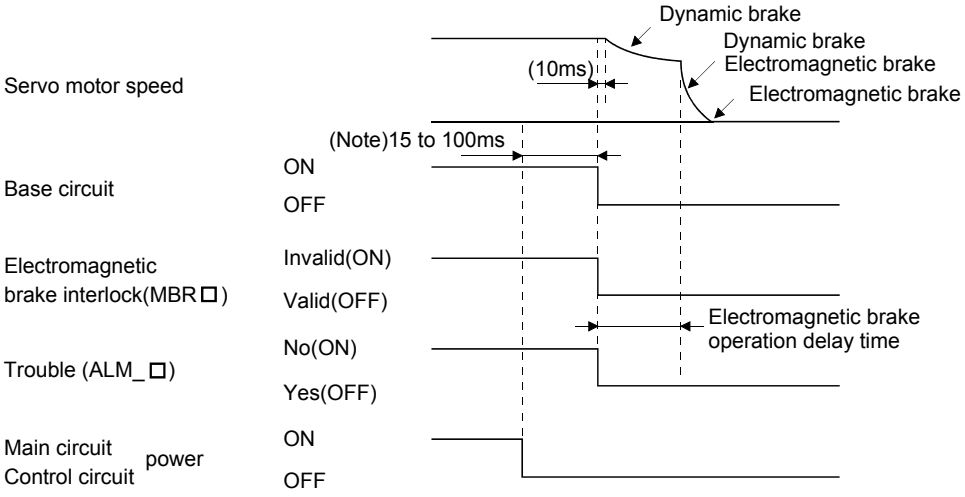
(b) Forced stop (EMG_□) ON/OFF



(c) Alarm occurrence

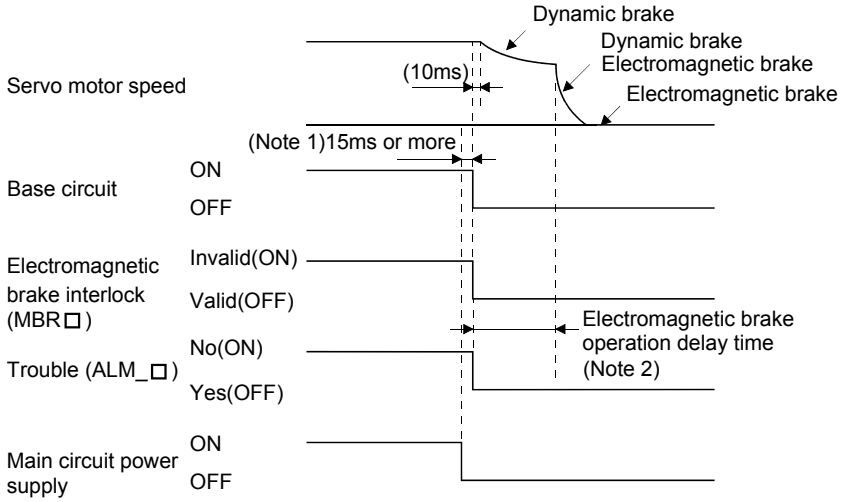


(d) Both main and control circuit power supplies off



Note. Changes with the operating status.

(e) Only main circuit power supply off (control circuit power supply remains on)

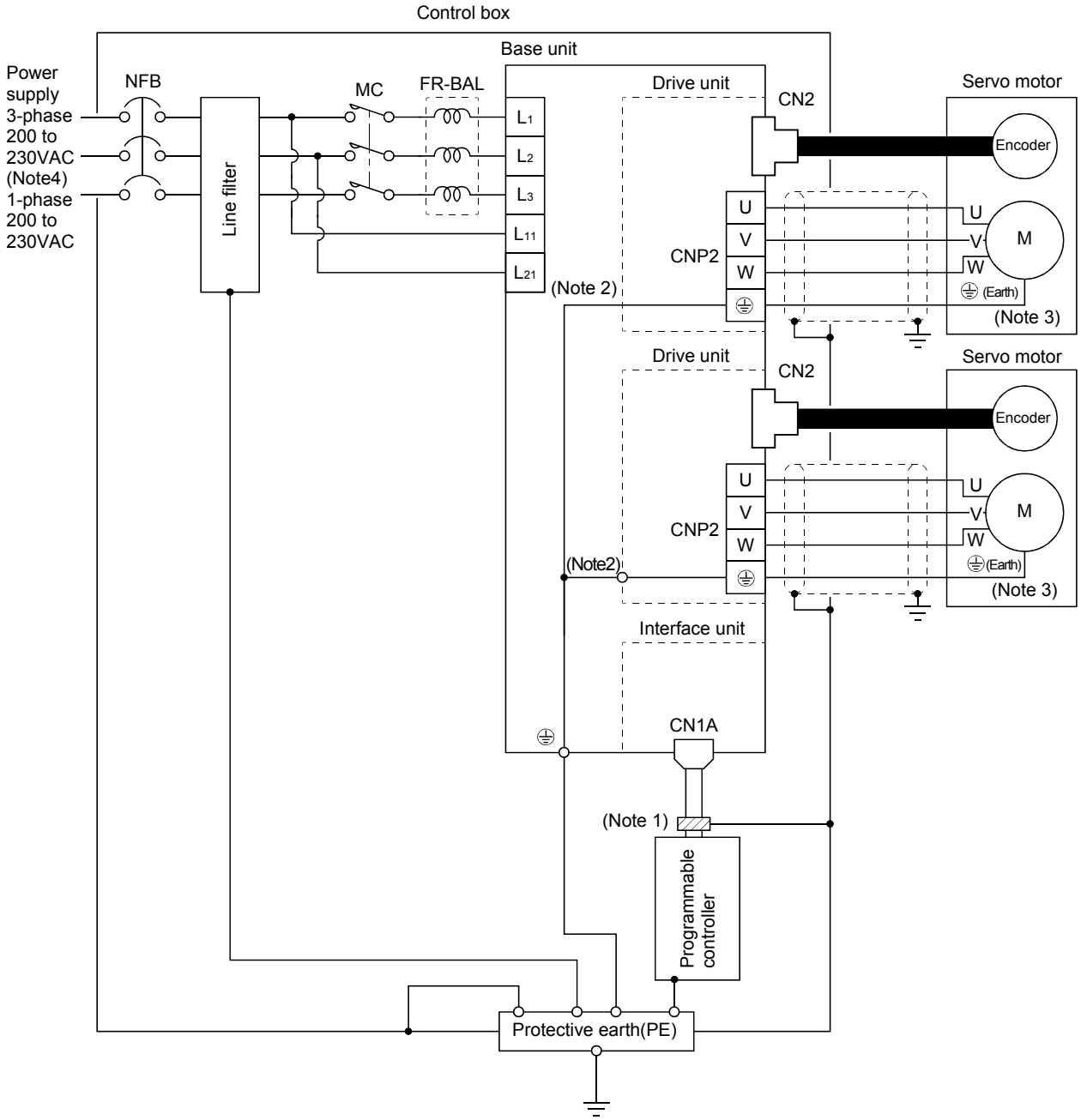


Note 1. Changes with the operating status.
2. When the main circuit power supply is off in a motor stop status, the main circuit off warning (A.E9) occurs and the trouble (ALM_ □) does not turn off.

3.8 Grounding

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

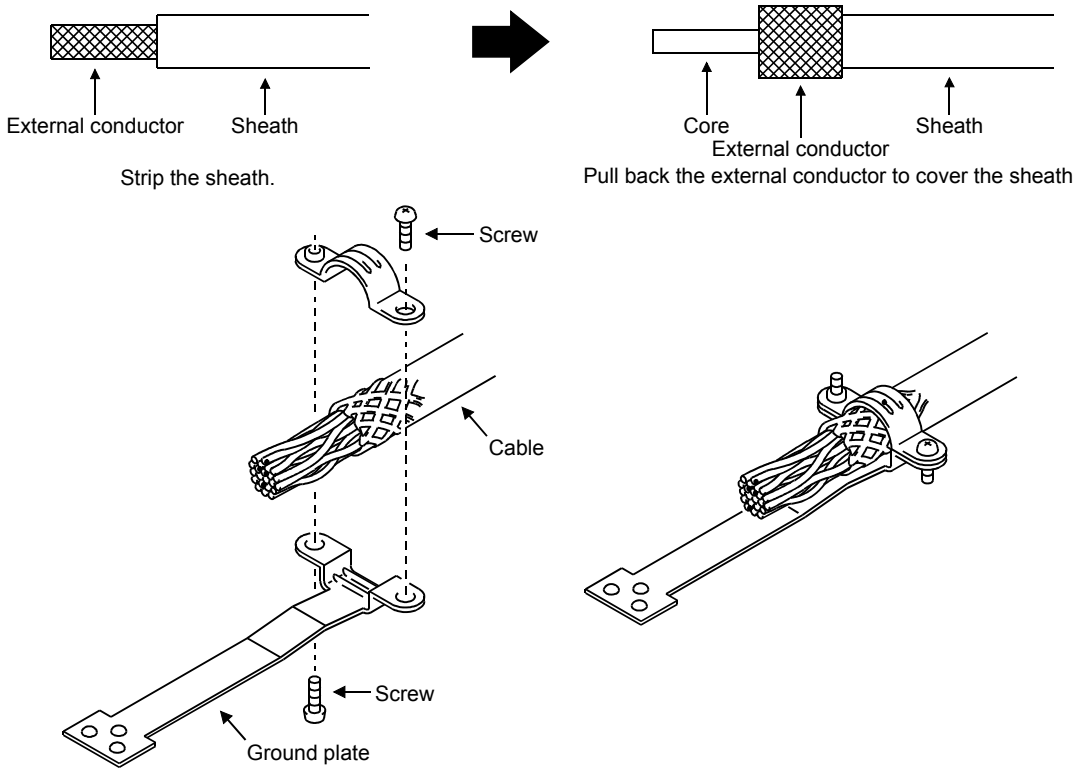
The base unit switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cablerouting, MELSERVO-J2M may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground. To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).



Note 1. To reduce the influence of external noise, we recommend you to ground the bus cable near the controller using a cable clamping fixture or to connect three or four data line filters in series.
2. The mounting screw of the drive unit is also used for PE connection of the servo motor.
3. Ensure to connect it to PE terminal of the drive unit. Do not connect it directly to the protective earth of the control panel.
4. For 1-phase 230VAC, connect the power supply to L_1 ・L_2 and leave L_3 open.

3.9 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.



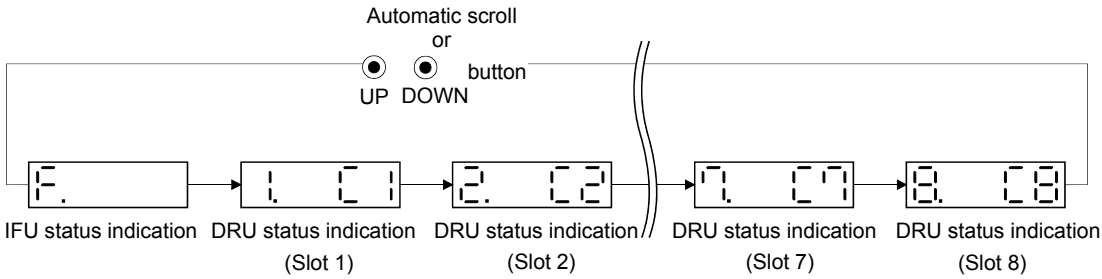
MEMO

4. OPERATION AND DISPLAY

On the interface unit display (5-digit, seven-segment display), check the status of communication with the servo system controller at power-on, check the slot number, and diagnose a fault at occurrence of an alarm.

4.1 Display flowchart

When powered on, the MELSERVO-J2M is placed in the automatic scroll mode in which the statuses of the interface unit/drive units installed on the base unit appear at intervals of 2 seconds in due order. At this time, open slot numbers do not appear.
In the initial status, the indication is in the automatic scroll mode. Pressing the "SET" button switches the automatic scroll mode to the fixed mode. In the fixed mode, pressing the "UP" or "DOWN" button displays the status of the subsequent-slot drive unit.
If an alarm/warning occurs in the interface unit/drive units, the alarm/warning number of the interface unit/drive unit appears. (Refer to Section 4.1.2)



In the automatic scroll mode, pressing the "MODE" button for 2s or more switches between the normal indication and the corresponding unit-related display screen. (Refer to Section 4.2/ Section 4.3.)

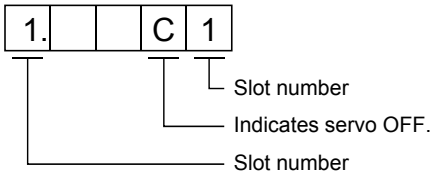
4.1.1 Normal indication

The normal indication shows the interface unit status or the slot number and current status (during servo ON or during servo OFF) of the corresponding drive unit to allow you to diagnose faults at alarm occurrence.
The following are the drive unit status display data in the normal indication.

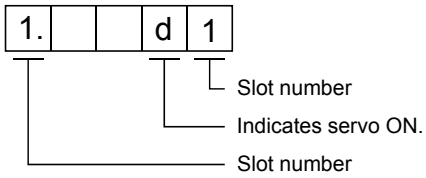
(Note 1)Indication	Status	Description
@ C@	Servo off	Servo off status.
@ d@	Servo-on	Servo on status.
(Note 2) @A**@	Alarm/Warning	The encountered alarm/warning number is displayed. (Refer to Section 9.1.)
@T d@. @T C@.	Test operation mode	Test operation mode status using the MR Configurator (servo configuration software). Displayed for JOG operation, positioning operation, motor-less operation or D0 forced output. The indication varies with the current condition.

Note 1. @ denotes the slot number of the base unit.
2. ** indicates the warning/alarm No.

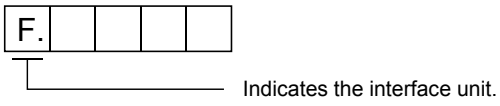
(1) When the drive unit is during servo off



(2) When the drive unit is during servo on



(3) When the interface unit is normal

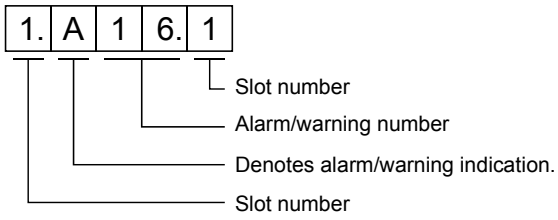


4.1.2 If alarm/warning occurs

(1) If alarm/warning occurs in drive unit

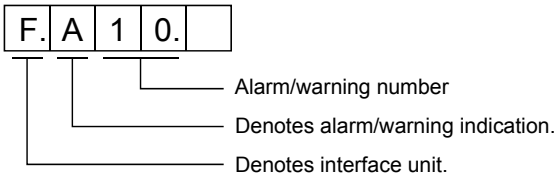
An alarm/warning which occurred in the drive unit is represented by the following indication.

The following indication example assumes that an encoder error (A.16) occurred in the drive unit of installed on slot 1. During alarm occurrence digits flicker.



(2) If alarm/warning occurs in interface unit

An alarm/warning which occurred in the interface unit is represented by the following indication. The following indication example assumes that interface unit undervoltage (A.10) occurred. During alarm occurrence digits flicker.

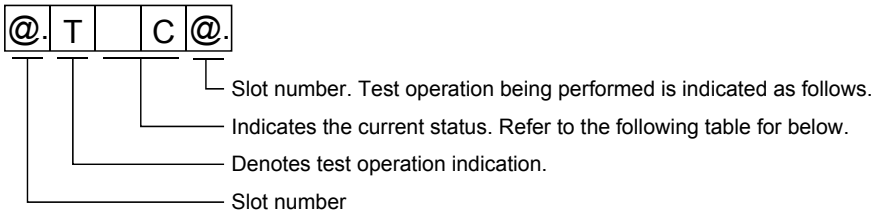


4.1.3 If test operation

POINT
・Test operation can be performed using the MR Configurator (servo configuration software).

(1) When test operation is being performed

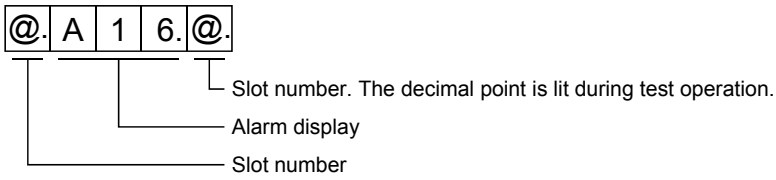
Test operation being performed is indicated as follows.



Indication	Current Status
@T C@.	Servo off status
@T d@.	Servo on status

(2) When alarm occurs during test operation

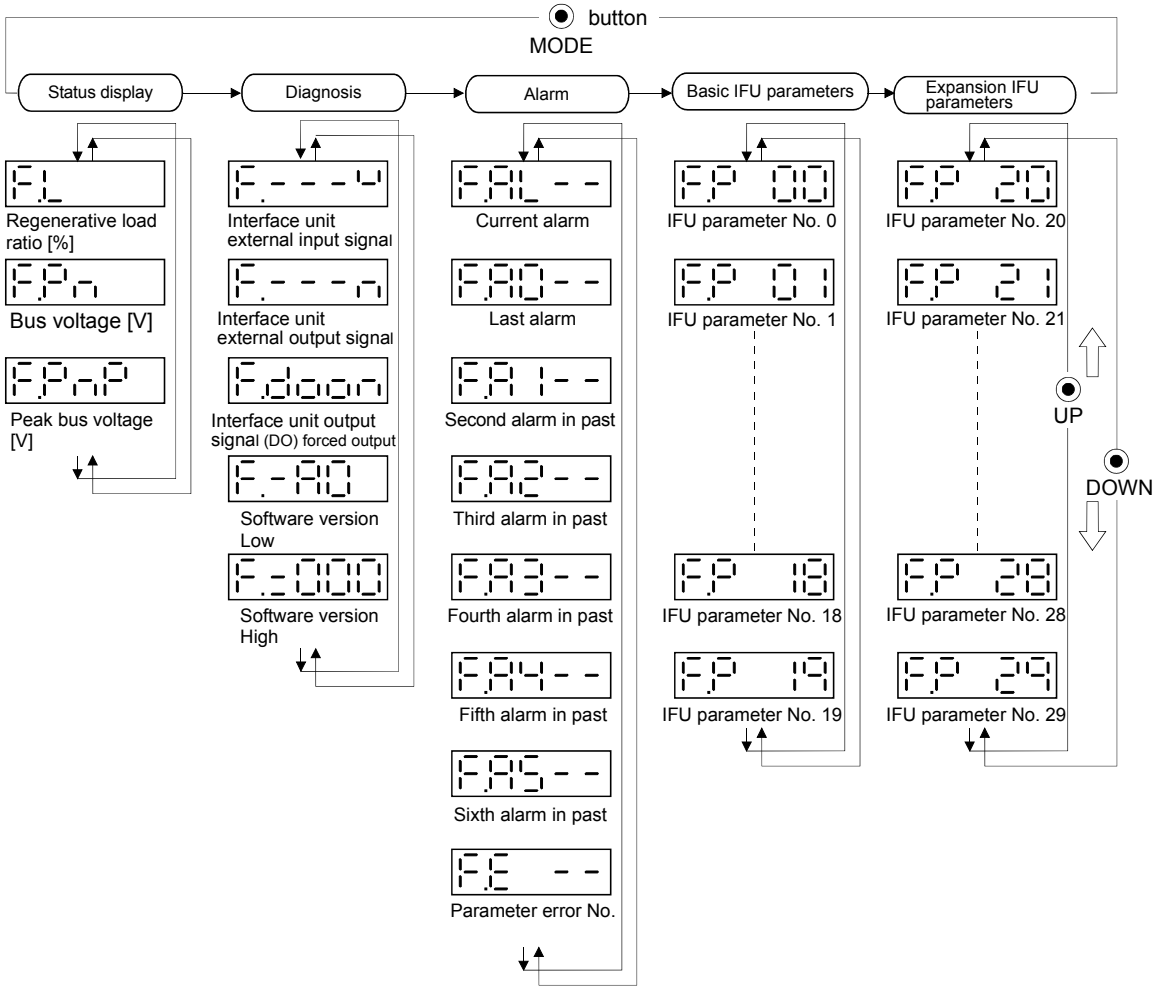
Any alarm that occurred during test operation is indicated as follows.



4.2 Interface unit display

4.2.1 Display flowchart of interface unit

Use the display (5-digit, 7-segment LED) on the front panel of the interface unit for status display, parameter setting, etc. Set the parameters before operation, diagnose an alarm, confirm external sequences, and/or confirm the operation status.
The automatic scroll mode is selected at power-on. Before starting use, therefore, press the "UP" or "DOWN" button to change the fifth digit to "F" and press the "MODE" button for 2s or more to change the indication.
Press the "MODE" "UP" or "DOWN" button once to move to the next screen.



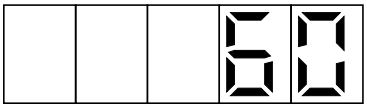
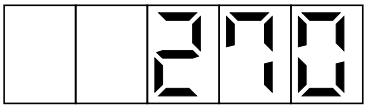
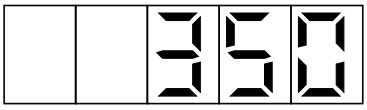
Note. The parameter display range varies with the parameter write inhibit.

4.2.2 Status display of interface unit

MELSERVO-J2M status during operation is shown on the 5-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol appears. Press the "SET" button to display its data.

(1) Display examples

The following table lists display examples:

Item	Status	Displayed data Interface unit display
Regenerative load ratio	60%	
Bus voltage	270V	
Peak bus voltage	350V	

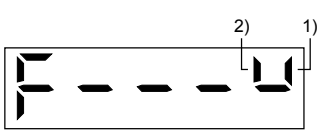
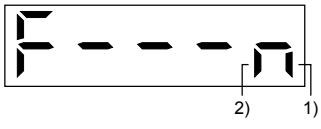
(2) Interface unit status display list

The following table indicates the MELSERVO-J2M statuses that can be shown. After it has been selected, each status display changes to a symbol display. Press the "SET" button to show the definition of the status display. Refer to Appendix 1 for the measurement point.

Pressing the "MODE" button during a status definition display returns to a symbol display.

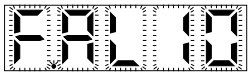
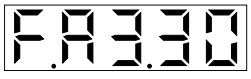
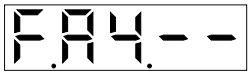
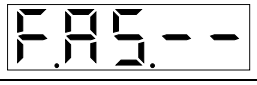
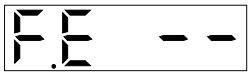
Name	Symbol	Unit	Description	Display range
Regenerative load ratio	F.L	%	The ratio of regenerative power to permissible regenerative power is displayed in %.	0 to 100
Bus voltage	F.Pn	V	The voltage (across P-N) of the main circuit converter is displayed.	0 to 450
Peak bus voltage	F.PnP	V	Shows the maximum voltage of the main circuit converter (across P-N). The maximum value during past 15s is displayed.	0 to 450

4.2.3 Diagnostic mode of interface unit

Name	Display	Description
Interface unit external input signal		Shows the ON/OFF states of the external input signals. 1) Forced stop A (EMG_A) ON: On OFF: Off 2) Forced stop B (EMG_B) ON: On OFF: Off
Interface unit external output signal		Shows the ON/OFF states of the external output signals. 1) Trouble A (ALM_A) ON: On OFF: Off 2) Trouble B (ALM_B) ON: On OFF: Off
Interface unit output signal (DO) forced output		The digital output signal can be forced on/off. For more information, refer to section 4.2.6. During output signal (DO) forced output, the decimal point in the first digit is lit.
Software version Low		Indicates the version of the software.
Software version High		Indicates the system number of the software.

4.2.4 Alarm mode of interface unit

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

Name	Display	Description
Current alarm		Indicates no occurrence of an alarm in the interface unit.
		Indicates the occurrence of overvoltage (A.10) in the interface unit. Flickers at occurrence of the alarm.
Alarm history		Indicates that the last alarm is base unit error (A.1C) in the interface unit.
		Indicates that the second alarm in the past is overvoltage (A.33) in the interface unit.
		Indicates that the third alarm in the past is undervoltage (A.10) in the interface unit.
		Indicates that the fourth alarm in the past is over regenerative (A.30) in the interface unit.
		Indicates that there is no fifth alarm in the past of the interface unit.
		Indicates that there is no sixth alarm in the past of the interface unit.
Parameter error No.		Indicates no occurrence of parameter error (A.37) of the interface unit.
		Indicates that the data of parameter No. 1 is faulty of the interface unit.

Functions at occurrence of an alarm

(1) Any mode screen displays 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) For any alarm, remove its cause and clear it in any of the following: (for clearable alarms, refer to Section 9.2)

(a) Switch power OFF, then ON.

(b) Press the "SET" button on the current alarm screen.

(4) Use IFU parameter No. 0 to clear the alarm history.

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

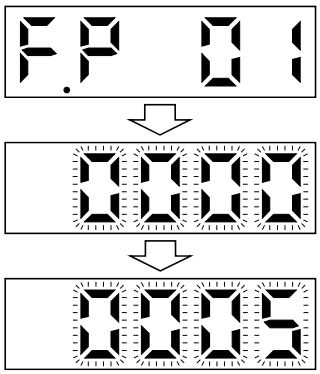
(6) Press "UP" or "DOWN" button to move to the next history.

(7) Pressing the "MODE" button on the alarm detail display screen returns to the alarm history display.

4.2.5 Interface unit parameter mode

The parameters whose abbreviations are marked* are made valid by changing the setting and then switching power off once and switching it on again. Refer to Section 5.2.2.

The following example shows the operation procedure performed after power-on to change the regenerative brake resistor (IFU parameter No. 1) to 0005 (MR-RB15).
Using the "MODE" button, show the basic parameter screen.



..... The parameter number is displayed.
Press UP or DOWN button to change the number.
Press SET twice.
..... The set value of the specified parameter number flickers.
Press UP fifth.
..... During flickering, the set value can be changed.
Use UP or DOWN button .
(□□□5: regenerative brake option MR-RB14)
Press SET to enter.

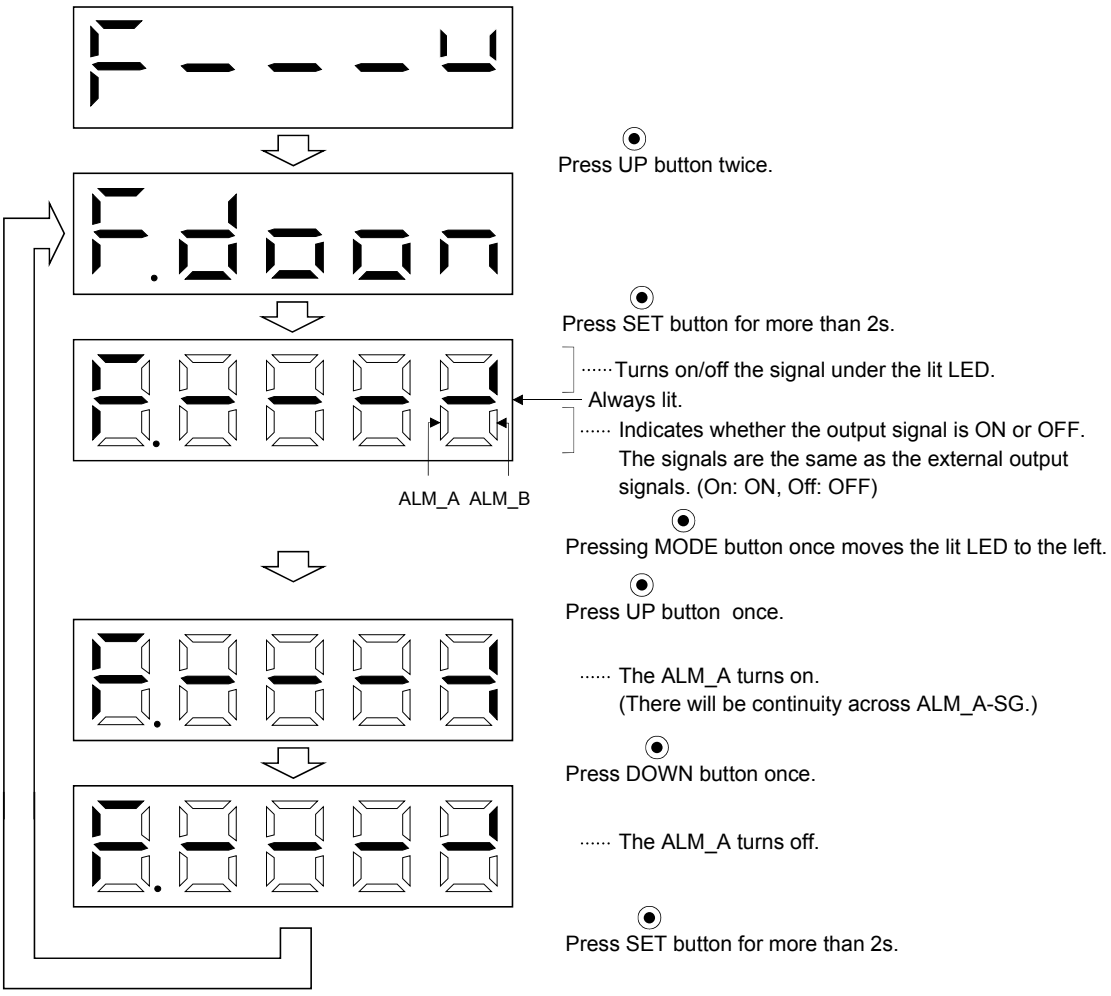
Pressing the "MODE" button during a parameter setting display or setting change display cancels the processing and returns to a parameter number display.
To shift to the next parameter, press the "UP" or "DOWN" button.

4.2.6 Interface unit output signal (DO) forced output

POINT
・This function is available during test operation.

The output signal can be forced on/off independently of the servo status. This function is used for output signal wiring check, etc. This operation must be performed in the servo off state (SON□ off).

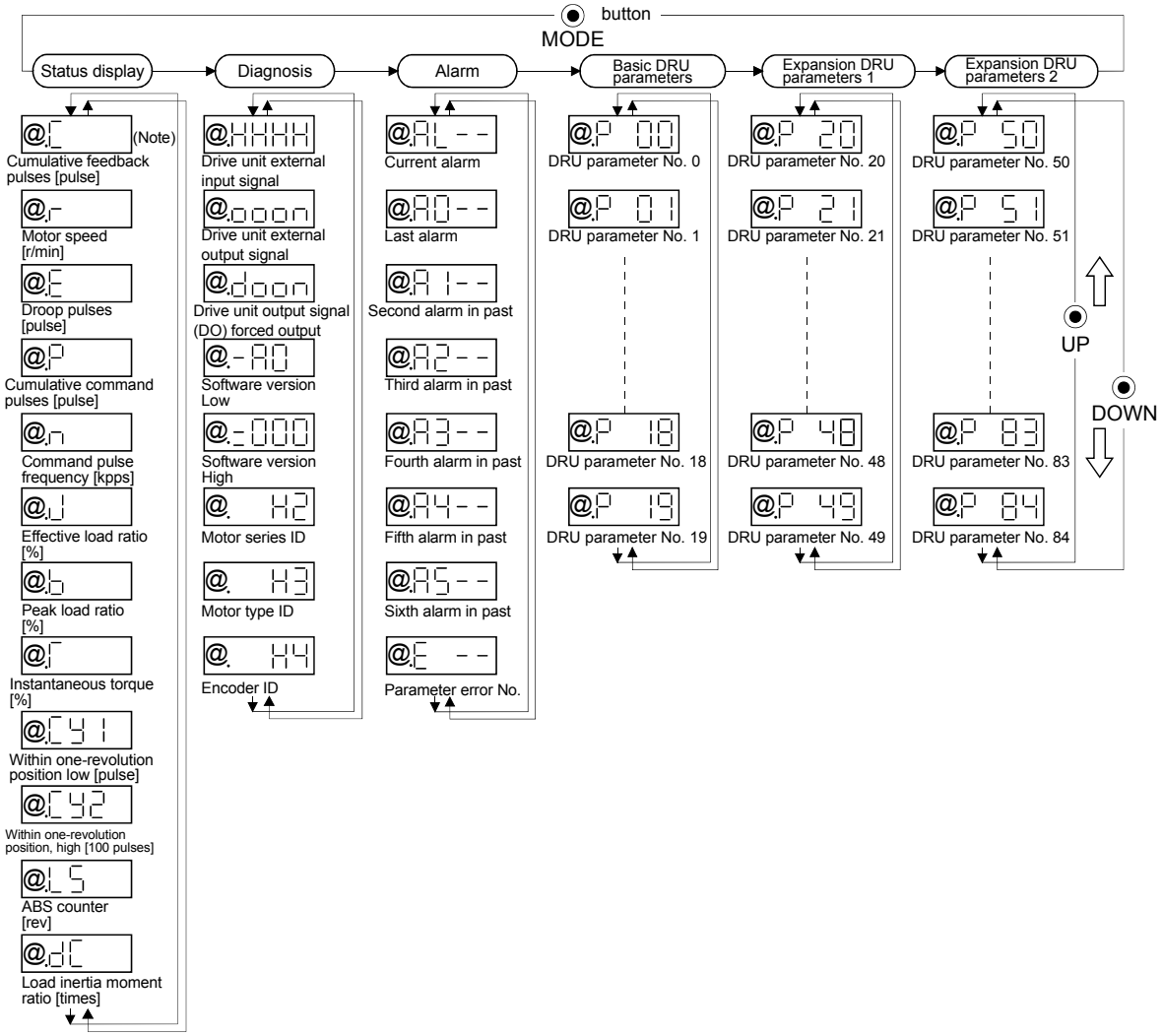
Call the display screen shown after power-on. Using the "MODE" button, show the diagnostic screen.



4.3 Drive unit display

4.3.1 Drive unit display sequence

Use the display (5-digit, 7-segment LED) on the front panel of the servo amplifier for status display, parameter setting, etc. Set the parameters before operation, diagnose an alarm, confirm external sequences, and/or confirm the operation status.
The automatic scroll mode is selected at power-on. Before starting use, therefore, press the "UP" or "DOWN" button to change the fifth digit to the necessary slot number "1" to "8" and press the "MODE" button for 2s or more to change the indication.
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 DRU parameter No. 19 (parameter write disable).



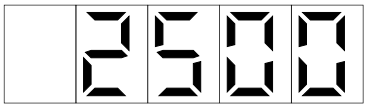
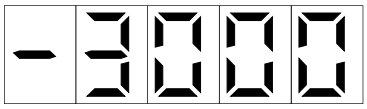
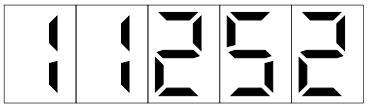
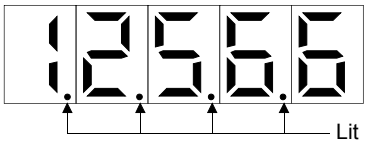
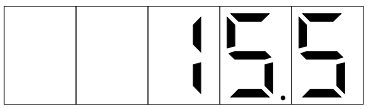
Note 1. @ indicates the slot number.
2. The parameter display range varies with the parameter write inhibit.

4.3.2 Status display of drive unit

The servo status during operation is shown on the 5-digit, 7-segment LED display. Press the "UP" or "DOWN" button to change display data as desired. When the required data is selected, the corresponding symbol appears. Press the "SET" button to display its data.

(1) Display examples

The following table lists display examples:

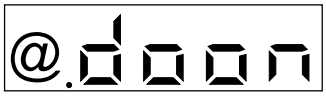
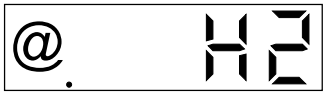
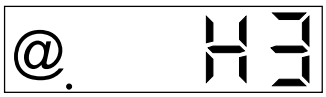
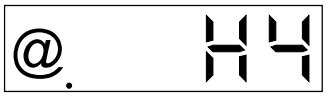
Item	Status	Displayed data Servo amplifier display
Motor speed	Forward rotation at 3000r/min	
	Reverse rotation at 3000r/min	 Reverse rotation is indicated by "−".
Multi-revolution counter	11252pulse	
	−12566pulse	 Lit Negative value is indicated by the lit decimal points in the upper four digits.
Load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

(2) Drive unit status display list

The following table lists the servo statuses that may be shown:
Refer to Appendix 2 for the measurement point.

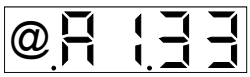
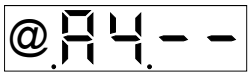
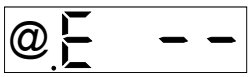
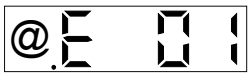
Name	Symbol	Unit	Description	Display range
Cumulative feedback pulses	@.C	pulse	Feedback pulses from the servo motor encoder are counted and displayed. The value in excess of ±99999 is counted, bus since the interface display is five digits, it shows the lower five digits of the actual value. Press the "SET" button to reset the display value to zero. Reverse rotation is indicated by the lit decimal points in the upper four digits.	−99999 to 99999
Servo motor speed	@.r	r/min	The servo motor speed is displayed. The value rounded off is displayed in ×0.1r/min.	−5400 to 5400
Droop pulses	@.E	pulse	The number of droop pulses in the deviation counter is displayed. When the servo motor is rotating in the reverse direction, the decimal points in the upper four digits are lit. Since the servo amplifier display is five digits, it shows the lower five digits of the actual value. The number of pulses displayed is not yet multiplied by the electronic gear.	−99999 to 99999
Cumulative command pulses	@.P	pulse	The position command input pulses are counted and displayed. As the value displayed is not yet multiplied by the electronic gear (CMX/CDV), it may not match the indication of the cumulative feedback pulses. The value in excess of ±99999 is counted, but since the interface display is five digits, it shows the lower five digits of the actual value. Press the "SET" button to reset the display value to zero. When the servo motor is rotating in the reverse direction, the decimal points in the upper four digits are lit.	−99999 to 99999
Command pulse frequency	@.n	kpps	The frequency of the position command input pulses is displayed. The value displayed is not multiplied by the electronic gear (CMX/CDV).	−800 to 800
Effective load ratio	@.J	%	The continuous effective load torque is displayed. The effective value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 300
Peak load ratio	@.b	%	The maximum torque generated during acceleration/deceleration, etc. The highest value in the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 400
Instantaneous torque	@.T	%	Torque that occurred instantaneously is displayed. The value of the torque that occurred is displayed in real time relative to the rate torque of 100%.	0 to 400
Within one-revolution position Low	@.CY1	pulse	Position within one revolution is displayed in encoder pulses. The value returns to "0" when it exceeds the maximum number of pulses. The value is incremented in the "CCW" direction of rotation.	0 to 99999
Within one-revolution position High	@.CY2	100 pulse	The within one-revolution position is displayed in 100 pulse increments of the encoder. The value returns to "0" when it exceeds the maximum number of pulses. The value is incremented in the "CCW" direction of rotation.	0 to 13107
ABS counter	@.LS	rev	Travel value from the home position in the absolute position detection systems is displayed in terms of the absolute position detectors counter value.	−32768 to 32768
Load inertia moment ratio	@.dC	0.1 Times	The estimated ratio of the load inertia moment to the servo motor shaft inertia moment is displayed.	0.0 to 300.0

4.3.3 Diagnostic mode of drive unit

Name	(Note) Display	Description
Drive unit external input signal	Refer to section 4.3.6.	Shows the ON/OFF statuses of the external input signals. Each signal corresponds to the function assignment. (The corresponding segment is lit when the function-assigned signal turns on.)
Drive unit external output signal	Refer to section 4.3.6.	Shows the ON/OFF statuses of the external output signals. When the corresponding segment is lit, the output is provided to the assigned signal.
Drive unit output signal (DO) forced output		The digital output signal can be forced on/off. For more information, refer to section 4.3.8.
Software version Low		Indicates the version of the drive unit software.
Software version High		Indicates the system number of the drive unit software.
Motor series ID		Press the "SET" button to show the motor series ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.
Motor type ID		Press the "SET" button to show the motor type ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.
Encoder ID		Press the "SET" button to show the encoder ID of the servo motor currently connected. For indication details, refer to the optional MELSERVO Servo Motor Instruction Manual.

Note. @ indicates the slot number.

4.3.4 Alarm mode of drive unit

Name	(Note) Display	Description
Current alarm		Indicates no occurrence of an alarm in the drive unit.
		Indicates the occurrence of overvoltage (A.33) in the drive unit. Flickers at occurrence of the alarm.
Alarm history		Indicates that the last alarm is overload 1 (A.50) in the drive unit.
		Indicates that the second alarm in the past is overvoltage (A.33) in the drive unit.
		Indicates that the third alarm in the past is undervoltage (A.52) in the drive unit.
		Indicates that the fourth alarm in the past is encoder error (A.20) in the drive unit.
		Indicates that there is no fifth alarm in the past in the drive unit.
		Indicates that there is no sixth alarm in the past in the drive unit.
Parameter error No.		Indicates no occurrence of parameter error (A.37) in the drive unit.
		Indicates that the data of parameter No. 1 is faulty in the drive unit.

Note. @ indicates the slot number.

Functions at occurrence of an alarm

(1) Any mode screen displays 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) For any alarm, remove its cause and clear it in any of the following methods: (for clearable alarms, refer to Section 9.2)

(a) Switch power OFF, then ON.

(b) Turn on the reset (RES□).

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

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

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

4.3.5 Drive unit parameter mode

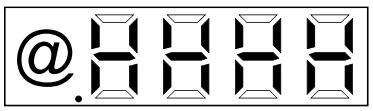
The parameter setting of the drive unit is the same as that of the interface unit. Refer to Section 4.2.5.
To use the expansion parameters, change the setting of DRU parameter No. 19 (parameter write disable). Refer to section 5.1.1.

4.3.6 Drive unit external input signal display

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

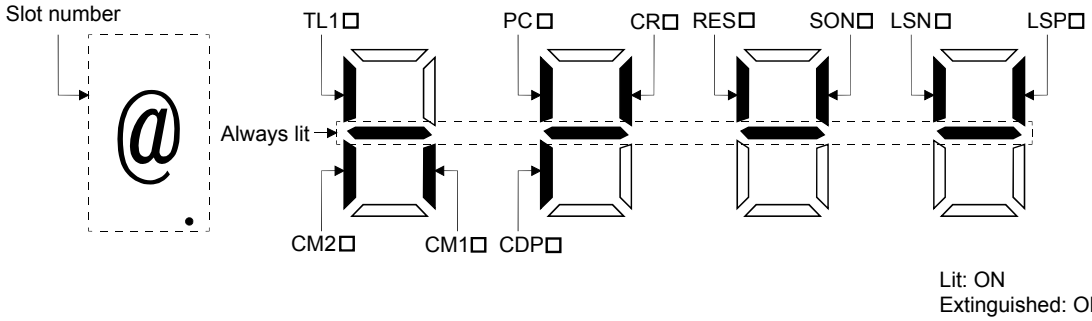
(1) Operation

Call the display screen shown after power-on.
Using the "MODE" button, show the diagnostic screen.



(2) Display definition

Corresponds to the signals of the seven-segment LED.



The 7-segment LED shown above indicates ON/OFF.
Each segment at top indicates the input signal and each segment at bottom indicates the output signal.
The following table indicates the signal names.

Signal Name List

Signal	Signal Name	Signal	Signal Name
LSP□	Forward rotation stroke end	PC□	Proportion control
LSN□	Reverse rotation stroke end	TL1□	Internal torque limit selection
SON□	Servo-on	CM1□	Electronic gear 1 selection
RES□	Reset	CM2□	Electronic gear 2 selection
CR□	Clear	CDP□	Gain switch selection

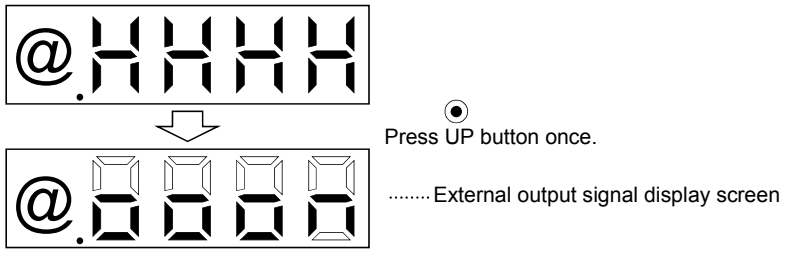
4.3.7 Drive unit external output signal display

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

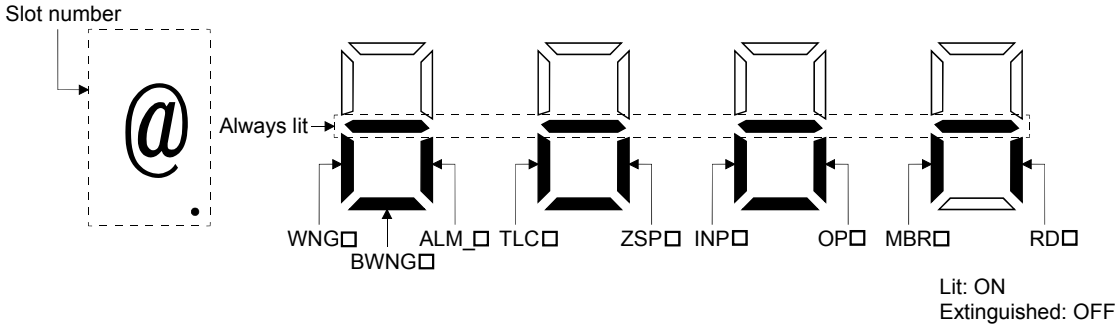
(1) Operation

Call the display screen shown after power-on.

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



(2) Display definition



The 7-segment LED shown above indicates ON/OFF.
Each segment at top indicates the input signal and each segment at bottom indicates the output signal.
The following table indicates the signal names.

Signal Name List

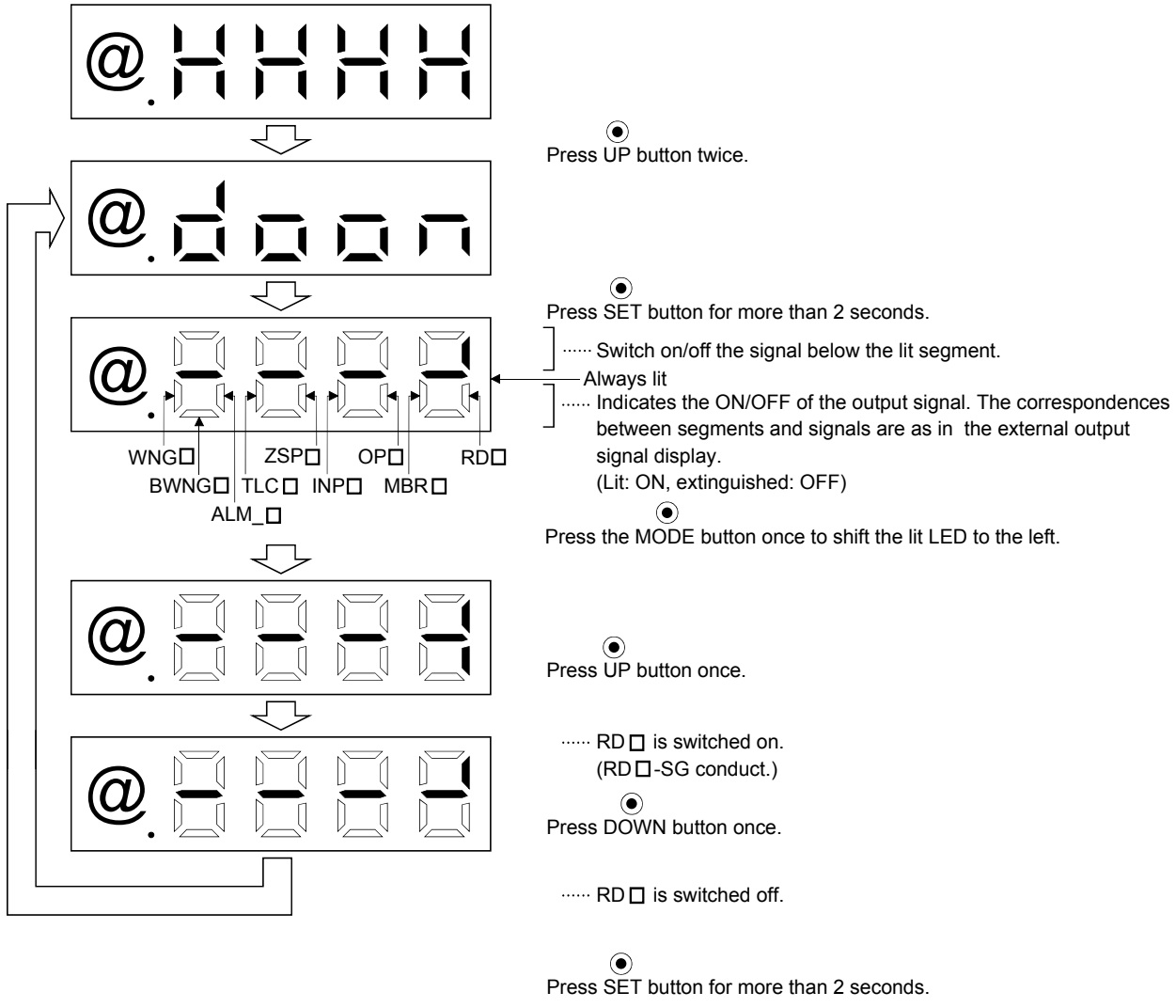
Signal	Signal Name	Signal	Signal Name
RD□	Ready	TLC□	Limiting torque
MBR□	Electromagnetic brake sequence output	ALM_□	Trouble
OP□	Encoder Z-phase pulse	WNG□	Warning
INP□	In position	BWNG□	Battery warning
ZSP□	Zero speed		

4.3.8 Drive unit output signal (DO) forced output

POINT
▪ This function is usable during test operation only.

The output signal can be forced on/off independently of the servo status. This function is used for output signal wiring check, etc. This operation must be performed in the servo off state (SON□ off).

Call the display screen shown after power-on.
Using the "MODE" button, show the diagnostic screen.



5. PARAMETERS

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

5.1 DRU parameter list

5.1.1 DRU parameter write inhibit

> **POINT**
> - After setting the DRU parameter No. 19 value, switch power off, then on to make that setting valid.

In the MELSERVO-J2M servo amplifier, its parameters are classified into the DRU basic parameters (No. 0 to 19), DRU expansion parameters 1 (No. 20 to 49) and DRU expansion parameters 2 (No.50 to 84) 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 DRU expansion parameter values. When fine adjustment, e.g. gain adjustment, is required, change the DRU parameter No. 19 setting to make the expansion parameters write-enabled.
The following table indicates the parameters which are enabled for reference and write by the setting of DRU parameter No. 19. Operation can be performed for the DRU parameters marked ○.

DRU parameter No. 19 setting	Operation	DRU basic parameters No. 0 to 19	DRU expansion parameters 1 No. 20 to 49	DRU expansion parameters 2 No. 50 to 84
0000 (initial value)	Reference	○		
	Write	○		
000A	Reference	No. 19 only		
	Write	No. 19 only		
000B	Reference	○	○	
	Write	○		
000C	Reference	○	○	
	Write	○	○	
000E	Reference	○	○	○
	Write	○	○	○
100B	Reference	○		
	Write	No. 19 only		
100C	Reference	○	○	
	Write	No. 19 only		
100E	Reference	○	○	○
	Write	No. 19 only		

5.1.2 Lists

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

(1) Item list

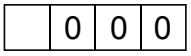
	No.	Symbol	Name	Initial value	Unit	Customer setting
Basic DRU parameters	0		For manufacturer setting	0000		
	1	*OP1	Function selection 1	0000		
	2	ATU	Auto tuning	0105		
	3	CMX	Electronic gear numerator (Command pulse multiplying factor numerator)	1		
	4	CDV	Electronic gear denominator (Command pulse multiplying factor denominator)	1		
	5	INP	In-position range	100	pulse	
	6	PG1	Position loop gain 1	35	rad/s	
	7	PST	Position command acceleration/deceleration time constant (Position smoothing)	3	ms	
	8		For manufacturer setting	100		
	9			500		
	10			1000		
	11			0		
	12			0		
	13			0		
	14			0		
	15			0		
	16	*BPS	Alarm history clear	0000		
	17		For manufacturer setting	0100		
	18			0000		
	19	*BLK	DRU parameter write inhibit	0000		

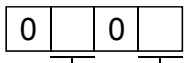
	No.	Symbol	Name	Initial value	Unit	Customer setting
Expansion DRU parameters 1	20	*OP2	Function selection 2	0000		
	21	*OP3	Function selection 3 (Command pulse selection)	0000		
	22	*OP4	Function selection 4	0000		
	23	FFC	Feed forward gain	0	%	
	24	ZSP	Zero speed	50	r/min	
	25		For manufacturer setting	0		
	26			100		
	27	*ENR	Encoder output pulses	4000	pulse /rev	
	28	TL1	Internal torque limit 1	100	%	
	29		For manufacturer setting	0		
	30			0		
	31			0		
	32			0		
	33	MBR	Electromagnetic brake sequence output	100	ms	
	34	GD2	Ratio of load inertia moment to servo motor inertia moment	70	0.1 times	
	35	PG2	Position loop gain 2	35	rad/s	
	36	VG1	Speed loop gain 1	177	rad/s	
	37	VG2	Speed loop gain 2	817	rad/s	
	38	VIC	Speed integral compensation	48	ms	
	39	VDC	Speed differential compensation	980		
	40		For manufacturer setting	0		
	41	*DIA		0000		
	42	*DI1	Input signal selection 1	0003		
	43		For manufacturer setting	0000		
	44			0000		
	45			0000		
	46			0000		
	47			0000		
	48			0000		
	49			0000		

	No.	Symbol	Name	Initial value	Unit	Customer setting
Expansion DRU parameters 2	50		For manufacturer setting	0000		
	51	*OP6	Function selection 6	0000		
	52		For manufacturer setting	0000		
	53			0000		
	54	*OP9	Function selection 9	0000		
	55	*OPA	Function selection A	0000		
	56		For manufacturer setting	0		
	57			10		
	58	NH1	Machine resonance suppression filter 1	0000		
	59	NH2	Machine resonance suppression filter 2	0000		
	60	LPF	Low-pass filter, adaptive vibration suppression control	0000		
	61	GD2B	Ratio of load inertia moment to Servo motor inertia moment 2	70	0.1 times	
	62	PG2B	Position control gain 2 changing ratio	100	%	
	63	VG2B	Speed control gain 2 changing ratio	100	%	
	64	VICB	Speed integral compensation changing ratio	100	%	
	65	*CDP	Gain changing selection	0000		
	66	CDS	Gain changing condition	10	(Note)	
	67	CDT	Gain changing time constant	1	ms	
	68		For manufacturer setting	0		
	69	CMX2	Command pulse multiplying factor numerator 2	1		
	70	CMX3	Command pulse multiplying factor numerator 3	1		
	71	CMX4	Command pulse multiplying factor numerator 4	1		
	72		For manufacturer setting	200		
	73			300		
	74			500		
	75			800		
	76	TL2	Internal torque limit 2	100	%	
	77		For manufacturer setting	100		
	78			10000		
	79			10		
	80			10		
	81			100		
	82			100		
	83			100		
	84			0		

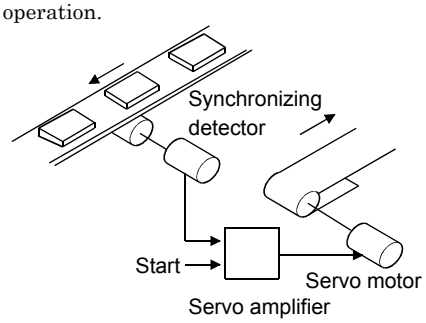
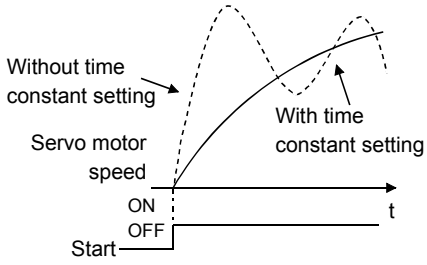
Note. Depends on the parameter No. 65 setting.

(2) Details list

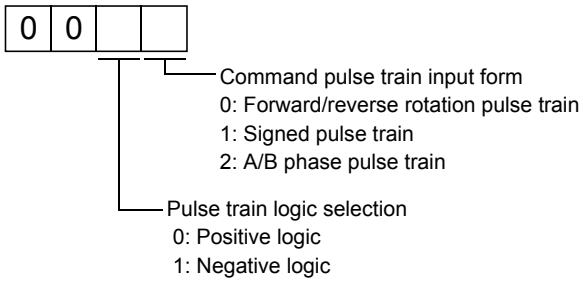
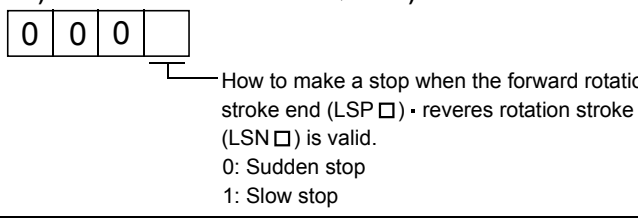
<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td rowspan="3">Basic DRU parameters</td><td>0</td><td></td><td>For manufacturer setting
Do not change this value any means.</td><td>0000</td><td></td><td></td></tr>
<tr><td>1</td><td>*OP1</td><td>Function selection 1
Used to select the absolute position detection system.
 

Selection of absolute position detection system
(Refer to Chapter 15)
0: Used in incremental system
1: Used in absolute position detection system
(Serial communication)</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>2</td><td>ATU</td><td>Auto tuning
Used to selection the response level, etc. for execution of auto tuning.
Refer to Chapter 6.
 

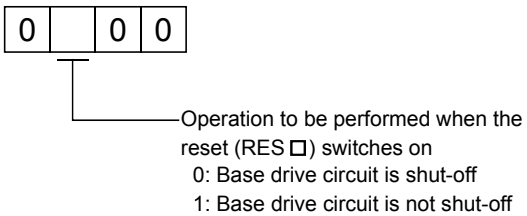
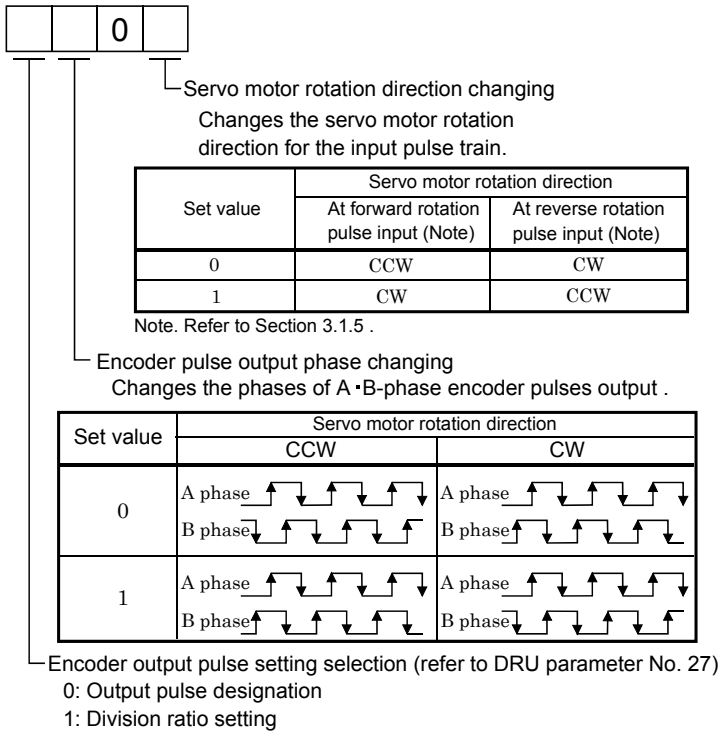
Auto tuning response level setting
<table><tr><th>Set value</th><th>Response level</th><th>Machine resonance frequency guideline</th></tr><tr><td>1</td><td rowspan="16">Low response
↑
Middle response
↓
↑
High response</td><td>15Hz</td></tr><tr><td>2</td><td>20Hz</td></tr><tr><td>3</td><td>25Hz</td></tr><tr><td>4</td><td>30Hz</td></tr><tr><td>5</td><td>35Hz</td></tr><tr><td>6</td><td>45Hz</td></tr><tr><td>7</td><td>55Hz</td></tr><tr><td>8</td><td>70Hz</td></tr><tr><td>9</td><td>85Hz</td></tr><tr><td>A</td><td>105Hz</td></tr><tr><td>B</td><td>130Hz</td></tr><tr><td>C</td><td>160Hz</td></tr><tr><td>D</td><td>200Hz</td></tr><tr><td>E</td><td>240Hz</td></tr><tr><td>F</td><td>300Hz</td></tr></table>· If the machine hunts or generates large gear sound, decrease the set value.
· To improve performance, e.g. shorten the settling time, increase the set value.
Gain adjustment mode selection
(For more information, refer to Section 6.1.1.)
<table><tr><th>Set value</th><th>Gain adjustment mode</th><th>Description</th></tr><tr><td>0</td><td>Interpolation mode</td><td>Fixes position control gain 1 (DRU parameter No. 6).</td></tr><tr><td>1</td><td>Auto tuning mode 1</td><td>Ordinary auto tuning.</td></tr><tr><td>2</td><td>Auto tuning mode 2</td><td>Fixes the load inertia moment ratio set in DRU parameter No. 34. Response level setting can be changed.</td></tr><tr><td>3</td><td>Manual mode 1</td><td>Simple manual adjustment.</td></tr><tr><td>4</td><td>Manual mode 2</td><td>Manual adjustment of all gains.</td></tr></table></td><td>0105</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

Class	No.	Symbol	Name and function	Initial value	Unit	Setting range
Basic DRU parameters	3	CMX	Electronic gear numerator (Command pulse multiplying factor numerator) Used to set the electronic gear numerator value. For the setting, refer to Section 5.2.1. Setting "0" automatically sets the resolution of the servo motor connected. For the HC-MFS series, 131072 pulses are set for example.	1		0 ▪ 1 to 65535
	4	CDV	Electronic gear denominator (Command pulse multiplying factor denominator) Used to set the electronic gear denominator value. For the setting, refer to Section 5.2.1.	1		1 to 65535
	5	INP	In-position range Set the in-position (INP□) output range in the command pulse unit that was used before electronic gear calculation. For example, when you want to set 100 μm when the ballscrew is directly coupled, the lead is 10mm, the feedback pulse count is 131072 pulses/rev, and the electronic gear numerator (CMX)/electronic gear denominator (CDV) is 16384/125 (setting in units of 10 μm per pulse), set "10" as indicated by the following expression. $\frac{100[\mu m]\times 10^{-6}}{10[mm]\times 10^{-3}}\times 131072[pulse/rev]\times \frac{125}{16384} \fallingdotseq 10$	100	pulse	0 to 10000
	6	PG1	Position loop gain 1 Used to set the gain of position loop. Increase the gain to improve trackability in response to the position command. When auto turning mode 1,2 is selected, the result of auto turning is automatically used.	35	red/s	4 to 2000
	7	PST	Position command acceleration/deceleration time constant (position smoothing) Used to set the time constant of a low pass filter in response to the position command. You can use DRU parameter No. 55 to choose the primary delay or linear acceleration/deceleration control system. When you choose linear acceleration/deceleration, the setting range is 0 to 10ms. Setting of longer than 10ms is recognized as 10ms. Example: When a command is given from a synchronizing detector, synchronous operation can be started smoothly if started during line operation.   	3	ms	0 to 20000

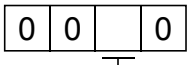
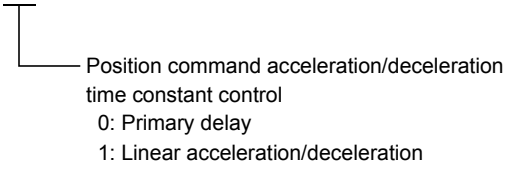
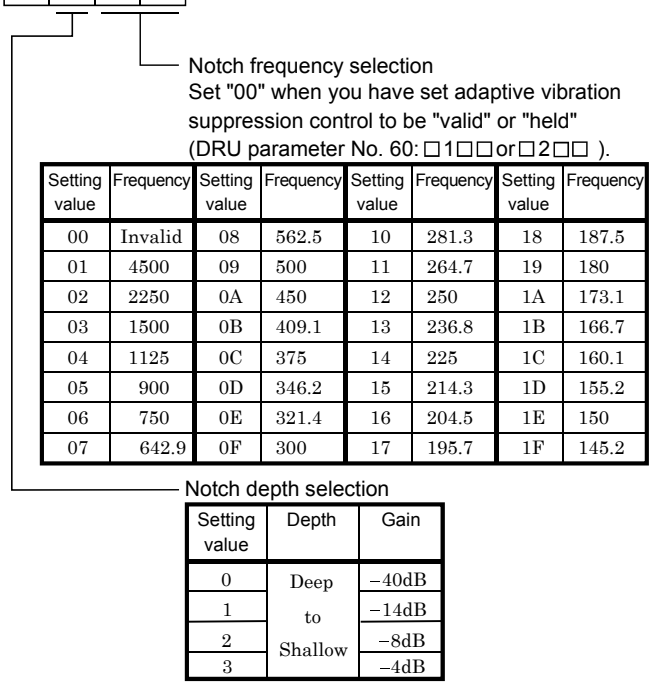
<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td rowspan="20">Basic DRU parameters</td><td>8</td><td rowspan="8"></td><td rowspan="8">For manufacturer setting
Do not change this value any means.</td><td>100</td><td rowspan="8"></td><td rowspan="8"></td></tr>
<tr><td>9</td><td>500</td></tr>
<tr><td>10</td><td>1000</td></tr>
<tr><td>11</td><td>0</td></tr>
<tr><td>12</td><td>0</td></tr>
<tr><td>13</td><td>0</td></tr>
<tr><td>14</td><td>0</td></tr>
<tr><td>15</td><td>0</td></tr>
<tr><td>16</td><td>*BPS</td><td>Alarm history clear
Clear the alarm history.
0 0 _ 0
Alarm history clear
0: Invalid
1: Valid
When alarm history clear is made valid,
the alarm history is cleared at next power-on.
After the alarm history is cleared, the setting
is automatically made invalid (reset to 0).</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>17</td><td rowspan="2"></td><td rowspan="2">For manufacturer setting
Do not change this value any means.</td><td>0100</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>18</td><td>0000</td></tr>
<tr><td>19</td><td>*BLK</td><td>DRU parameter write inhibit
Used to select the reference and write ranges of the parameters.
Operation can be performed for the parameters marked ○.
<table>
<tr><th>Set value</th><th>Operation</th><th>Basic DRU parameters No. 0 to No. 19</th><th>Expansion DRU parameters 1 No. 20 to No. 49</th><th>Expansion DRU parameters 2 No. 50 to No. 84</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">000E</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">100B</td><td>Reference</td><td>○</td><td></td><td></td></tr>
<tr><td>Write</td><td>No. 19 only</td><td></td><td></td></tr>
<tr><td rowspan="2">100C</td><td>Reference</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>No. 19 only</td><td></td><td></td></tr>
<tr><td rowspan="2">100E</td><td>Reference</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Write</td><td>No. 19 only</td><td></td><td></td></tr>
</table></td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td rowspan="2">Expansion DRU parameters 1</td><td>20</td><td>*OP2</td><td>Function selection 2
Used to select slight vibration suppression control.
_ _ 0 0
Slight vibration suppression control
Made valid when auto tuning selection is
set to "0400" in DRU parameter No. 2.
Used to suppress vibration at a stop.
0: Invalid
1: Valid
Encoder cable selection
0: 2-wire type (when MR-JCCBL□M-L/H is used)
1: 4-wire type (when MR-JC4CBL□M-H is used)</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

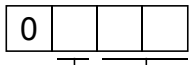
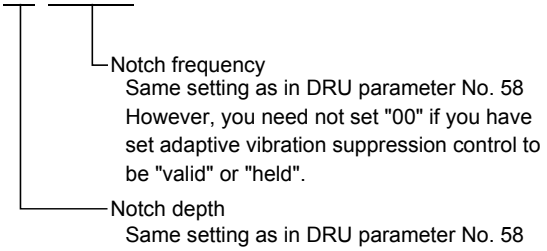
Class	No.	Symbol	Name and function	Initial value	Unit	Setting range
Expansion DRU parameters 1	21	*OP3	Function selection 3 (Command pulse selection) Used to select the input form of the pulse train input signal. (Refer to Section 3.2.3.) 	0000		Refer to Name and function column.
	22	*OP4	Function selection 4 Used to select stop processing at the forward rotation stroke end (LSP□) · reveres rotation stroke end (LSN□) off. 	0000		Refer to Name and function column.
	23	FFC	Feed forward gain Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1s or more as the acceleration/deceleration time constant up to the rated speed.	0	%	0 to 100
	24	ZSP	Zero speed Used to set the output range of the zero speed (ZSP□).	50	r/min	0 to 10000
	25		For manufacturer setting Do not change this value any means.	0		
	26			100		
	27	*ENR	Encoder output pulses POINT · The MR-J2M-D01 extension IO unit is required to output the encoder pulses (A phase, B phase, Z phase). Used to set the encoder pulses (A-phase, B-phase) output by the servo amplifier. Set the value 4 times greater than the A-phase or B-phase pulses. You can use DRU parameter No. 54 to choose the output pulse setting or output division ratio setting. The number of A/B-phase pulses actually output is 1/4 times greater than the preset number of pulses. The maximum output frequency is 1.3Mpps (after multiplication by 4). Use this parameter within this range. · For output pulse designation Set " 0 □□□ " (initial value) in DRU parameter No. 54. Set the number of pulses per servo motor revolution. Output pulse = set value [pulses/rev] At the setting of 5600, for example, the actually output A/B-phase pulses are as indicated below: A·B-phase output pulses = $\frac{5600}{4}$ = 1400[pulse/rev] · For output division ratio setting Set " 1□□□ " in DRU parameter No. 54. The number of pulses per servo motor revolution is divided by the set value. Output pulse = $\frac{\text{Resolution per servo motor revolution}}{\text{Set value}}$ [pulses/rev] At the setting of 8, for example, the actually output A/B-phase pulses are as indicated below: A·B-phase output pulses = $\frac{131072}{8} \cdot \frac{1}{4}$ = 4096[pulse/rev]	4000	pulse/ rev	1 to 65535

Class	No.	Symbol	Name and function	Initial value	Unit	Setting range
Expansion DRU parameters 1	28	TL1	Internal torque limit 1 Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%]. When 0 is set, torque is not produced. When torque is output in analog monitor, this set value is the maximum output voltage (+4V). (Refer to Section 3.3.5 (2))	100	%	0 to 100
	29		For manufacturer setting Do not change this value any means.	0		
	30			0		
	31			0		
	32			0		
	33	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between electronic brake interlock (MBR□) and the base drive circuit is shut-off.	100	ms	0 to 1000
	34	GD2	Ratio of load inertia moment to servo motor inertia moment Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 6.2.1) In this case, it varies between 0 and 1000.	70	0.1 times	0 to 3000
	35	PG2	Position loop gain 2 Used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.	35	rad/s	1 to 1000
	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 mode 1・2, manual mode and interpolation mode is selected, the result of auto tuning is automatically used.	177	rad/s	20 to 8000
	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 mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.	817	rad/s	20 to 20000
	38	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. Lower setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1・2 and interpolation mode is selected, the result of auto tuning is automatically used.	48	ms	1 to 1000
	39	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control (PC□) is switched on.	980		0 to 1000
	40		For manufacturer setting Do not change this value any means.	0		
	41			0000		
	42	*DI1	Input signal selection 1 Used to set the clear (CR□). 0 0 _ 3 Clear (CR□) selection 0: Droop pulses are cleared on the leading edge. 1: While on, droop pulses are always cleared.	0003		Refer to Name and function column.

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td rowspan="11">Expansion DRU parameters 2</td><td>43</td><td rowspan="8"></td><td rowspan="8">For manufacturer setting
Do not change this value any means.</td><td>0000</td><td rowspan="8"></td><td rowspan="8"></td></tr>
<tr><td>44</td><td>0000</td></tr>
<tr><td>45</td><td>0000</td></tr>
<tr><td>46</td><td>0000</td></tr>
<tr><td>47</td><td>0000</td></tr>
<tr><td>48</td><td>0000</td></tr>
<tr><td>49</td><td>0000</td></tr>
<tr><td>50</td><td>0000</td></tr>
<tr><td>51</td><td>*OP6</td><td>Function selection 6
Used to select the operation to be performed when the reset (RES□) switches on.
 
</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>52</td><td rowspan="2"></td><td rowspan="2">For manufacturer setting
Do not change this value any means.</td><td>0000</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>53</td><td>0000</td></tr>
<tr><td>54</td><td>*OP9</td><td>Function selection 9
Use to select the command pulse rotation direction, encoder output pulse direction and encoder pulse output setting.
 

<table>
<tr><th rowspan="2">Set value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>At forward rotation pulse input (Note)</th><th>At reverse rotation pulse input (Note)</th></tr>
<tr><td>0</td><td>CCW</td><td>CW</td></tr>
<tr><td>1</td><td>CW</td><td>CCW</td></tr>
</table>
Note. Refer to Section 3.1.5 .
<table>
<tr><th rowspan="2">Set value</th><th colspan="2">Servo motor rotation direction</th></tr>
<tr><th>CCW</th><th>CW</th></tr>
<tr><td>0</td><td>A phase
B phase</td><td>A phase
B phase</td></tr>
<tr><td>1</td><td>A phase
B phase</td><td>A phase
B phase</td></tr>
</table></td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

<table>
<tr><th>Class</th><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td rowspan="4">Expansion DRU parameters 2</td><td>55</td><td>*OPA</td><td>Function selection A
Used to select the position command acceleration/deceleration time constant (DRU parameter No. 7) control system.
 
 
</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>56</td><td></td><td rowspan="2">For manufacturer setting
Do not change this value any means.</td><td>0
10</td><td></td><td></td></tr>
<tr><td>57</td></tr>
<tr><td>58</td><td>NH1</td><td>Machine resonance suppression filter 1
Used to selection the machine resonance suppression filter.
(Refer to Section 7.2.)
 
 

<table>
<tr><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th><th>Setting value</th><th>Frequency</th></tr>
<tr><td>00</td><td>Invalid</td><td>08</td><td>562.5</td><td>10</td><td>281.3</td><td>18</td><td>187.5</td></tr>
<tr><td>01</td><td>4500</td><td>09</td><td>500</td><td>11</td><td>264.7</td><td>19</td><td>180</td></tr>
<tr><td>02</td><td>2250</td><td>0A</td><td>450</td><td>12</td><td>250</td><td>1A</td><td>173.1</td></tr>
<tr><td>03</td><td>1500</td><td>0B</td><td>409.1</td><td>13</td><td>236.8</td><td>1B</td><td>166.7</td></tr>
<tr><td>04</td><td>1125</td><td>0C</td><td>375</td><td>14</td><td>225</td><td>1C</td><td>160.1</td></tr>
<tr><td>05</td><td>900</td><td>0D</td><td>346.2</td><td>15</td><td>214.3</td><td>1D</td><td>155.2</td></tr>
<tr><td>06</td><td>750</td><td>0E</td><td>321.4</td><td>16</td><td>204.5</td><td>1E</td><td>150</td></tr>
<tr><td>07</td><td>642.9</td><td>0F</td><td>300</td><td>17</td><td>195.7</td><td>1F</td><td>145.2</td></tr>
</table>
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td rowspan="4">Deep
to
Shallow</td><td>−40dB</td></tr>
<tr><td>1</td><td>−14dB</td></tr>
<tr><td>2</td><td>−8dB</td></tr>
<tr><td>3</td><td>−4dB</td></tr>
</table></td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
<tr><td>59</td><td>NH2</td><td>Machine resonance suppression filter 2
Used to set the machine resonance suppression filter.
 
 
</td><td>0000</td><td></td><td>Refer to Name and function column.</td></tr>
</table>

Class	No.	Symbol	Name and function	Initial value	Unit	Setting range
Expansion DRU parameters 2	60	LPF	Low-pass filter/adaptive vibration suppression control Used to selection the low-pass filter and adaptive vibration suppression control. (Refer to Chapter 7.) □□□0 Low-pass filter selection 0: Valid (Automatic adjustment) 1: Invalid When you choose "valid", $\frac{\text{VG2 setting}\times 10}{2\pi(1+\text{GD2 setting}\times 0.1)}$ [Hz] bandwidth filter is set automatically. Adaptive vibration suppression control selection Choosing "valid" or "held" in adaptive vibration suppression control selection makes the machine resonance control filter 1 (DRU parameter No. 58) invalid. 0: Invalid 1: Valid Machine resonance frequency is always detected and the filter is generated in response to resonance to suppress machine vibration. 2: Held The characteristics of the filter generated so far are held, and detection of machine resonance is stopped. Adaptive vibration suppression control sensitivity selection Used to set the sensitivity of machine resonance detection. 0: Normal 1: Large sensitivity	0000		Refer to Name and function column.
	61	GD2B	Ratio of load inertia moment to servo motor inertia moment 2 Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. Made valid when auto tuning is invalid.	70	×0.1 times	0 to 3000
	62	PG2B	Position control gain 2 changing ratio Used to set the ratio of changing the position control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	63	VG2B	Speed control gain 2 changing ratio Used to set the ratio of changing the speed control gain 2 when gain changing is valid. Made valid when auto tuning is invalid.	100	%	10 to 200
	64	VICB	Speed integral compensation changing ratio Used to set the ratio of changing the speed integral compensation when gain changing is valid. Made valid when auto tuning is invalid.	100	%	50 to 1000
	65	*CDP	Gain changing selection Used to select the gain changing condition. (Refer to Section 7.5.) 000□ Gain changing selection Gains are changed in accordance with the settings of DRU parameters No. 61 to 64 under any of the following conditions: 0: Invalid 1: Gain changing (CDP□) is ON 2: Command frequency is equal to higher than DRU parameter No. 66 setting 3: Droop pulse value is equal to higher than DRU parameter No. 66 setting 4: Servo motor speed is equal to higher than DRU parameter No. 66 setting	0000		Refer to Name and function column.

Class	No.	Symbol	Name and function	Initial value	Unit	Setting range
Expansion DRU parameters 2	66	CDS	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No. 65 (Gain changing selection). The set value unit changes with the changing condition item. (Refer to Section 7.5.)	10	kpps pulse r/min	10 to 9999
	67	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No. 65 and 66. (Refer to Section 7.5.)	1	ms	0 to 100
	68		For manufacturer setting Do not change this value any means.	0		
	69	CMX2	Command pulse multiplying factor numerator 2 Used to set the multiplier for the command pulse. Setting "0" automatically sets the connected motor resolution.	1		0･1 to 65535
	70	CMX3	Command pulse multiplying factor numerator 3 Used to set the multiplier for the command pulse. Setting "0" automatically sets the connected motor resolution.	1		0･1 to 65535
	71	CMX4	Command pulse multiplying factor numerator 4 Used to set the multiplier for the command pulse. Setting "0" automatically sets the connected motor resolution.	1		0･1 to 65535
	72		For manufacturer setting Do not change this value any means.	200		
	73			300		
	74			500		
	75			800		
	76	TL2	Internal torque limit 2 Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%]. When 0 is set, torque is not produced. When torque is output in analog monitor, this set value is the maximum output voltage (+4V). (Refer to Section 3.3.5 (2))	100	%	0 to 100
	77		For manufacturer setting Do not change this value any means.	100		
	78			10000		
	79			10		
	80			10		
	81			100		
	82			100		
	83			100		
	84			0		

5.2 Interface unit

5.2.1 IFU parameter write inhibit

> **POINT**
>
> ・Use the unit operation section pushbutton switches or MR Configurator (servo configuration software) to set the IFU parameters of the interface unit.

Use the unit pushbutton switches or MR Configurator (servo configuration software) to set the interface unit parameters.
When assigning the devices, change the setting to "000E".
The following table indicates the IFU parameters which are made valid for reference and write by setting the IFU parameter No. 19.

Setting	Setting operation	IFU basic parameter	Expansion IFU parameter	I/O assignment
0000 (initial value)	Reference	○		
	Write	○		
000A	Reference	IFU parameter No. 19		
	Write	IFU parameter No. 19		
000B	Reference	○	○	
	Write	○		
000C	Reference	○	○	
	Write	○	○	
000E	Reference	○	○	○
	Write	○	○	○
100B	Reference	○		
	Write	IFU parameter No. 19		
100C	Reference	○	○	
	Write	IFU parameter No. 19		

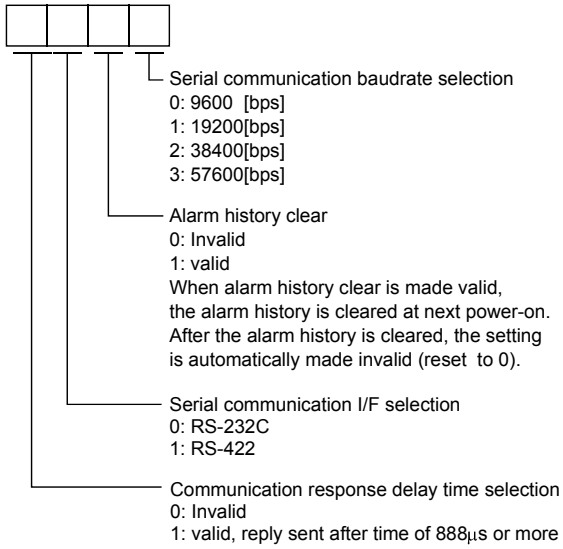
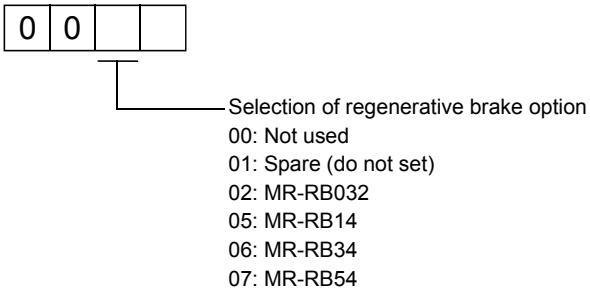
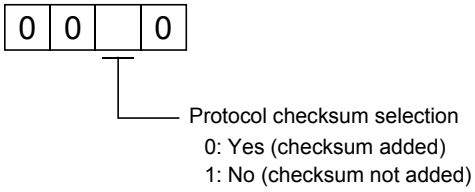
5.2.2 Lists

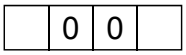
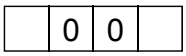
> **POINT**
>
> ・For any parameter whose symbol is preceded by *, set the IFU parameter value and switch power off once, then switch it on again to make that parameter setting valid.

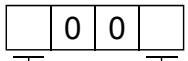
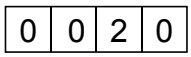
(1) Item list

Classification	No.	Symbol	Name	Initial Value	Unit	Customer setting
Basic IFU parameters	0	*BPS	Serial communication function selection, alarm history clear	0000		
	1	SIC	Regenerative brake option selection	0		
	2	*OP1	Function selection 1	0000		
	3	MD1	Analog monitor 1 output	0000		
	4	MD2	Analog monitor 2 output	0000		
	5	MD3	Analog monitor 3 output	0000		
	6	MO1	Analog monitor 1 offset	0	mV	
	7	MO2	Analog monitor 2 offset	0	mV	
	8	MO3	Analog monitor 3 offset	0	mV	
	9	*OP2	Function selection 2	0020		
	10	*ISN	Interface unit serial communication station number selection	0		
	11	*SL1	1 slot serial communication station number selection	0		
	12	*SL2	2 slot serial communication station number selection	1		
	13	*SL3	3 slot serial communication station number selection	2		
	14	*SL4	4 slot serial communication station number selection	3		
	15	*SL5	5 slot serial communication station number selection	4		
	16	*SL6	6 slot serial communication station number selection	5		
	17	*SL7	7 slot serial communication station number selection	6		
	18	*SL8	8 slot serial communication station number selection	7		
	19	*BLK	IFU parameter write inhibit	0000		
Expansion IFU parameter	20	SIC	Serial communication time-out selection	0	s	
	21		For manufacturer setting	0		
	22			0		
	23			0		
	24			0		
	25			0		
	26			0		
	27			0		
	28			0		
	29			0		

(2) Details list

Classification	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Basic IFU parameters	0	*BPS	Serial communication function selection, alarm history clear Used to select the serial communication baudrate function selection, select various communication conditions, and clear the alarm history.  	0000		Refer to name and function column.
	1	*REG	Regenerative brake option selection Used to select the regenerative brake option.  	0000		Refer to Name and function column.
	2	*OP1	Function selection 1 Used to select the protocol of serial communication.  	0000		Refer to name and function column.

Classifi-cation	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Basic IFU parameters	3	MD1	Analog monitor 1 output Choose the signal to be output to analog monitor 1.  Analog monitor 1 selection 0: Servo motor speed (±4V/max. Servo motor speed) 1: Torque (±4V/max. Torque) 2: Servo motor speed (±4V/max. Servo motor speed) 3: Torque (+4V/max. Torque) 4: Current command (±4V/max. Current command) 5: Command pulse frequency(±4V/500kpps) 6: Droop pulses (±4V/128pulse) 7: Droop pulses (±4V/2048pulse) 8: Droop pulses (±4V/8192pulse) 9: Droop pulses (±4V/32768pulse) A: Droop pulses (±4V/131072pulse) B: Bus voltage (+4V/400V) C: In position (+4V/ON) D: Ready (+4V/ON) E: Trouble (+4V/ON) Slot number of analog monitor 1 Choose the slot number output to analog monitor 1. Slot number = set value. Selecting "0" disables output.	0000		Refer to name and function column.
	4	*MD2	Analog monitor 2 output Choose the signal to be output to analog monitor 2.  Analog monitor 2 selection 0: Servo motor speed (±4V/max. Servo motor speed) 1: Torque (+4V/max. Torque) 2: Servo motor speed (±4V/max. Servo motor speed) 3: Torque (+4V/max. Torque) 4: Current command (±4V/max. Current command) 5: Command pulse frequency (±4V/500kpps) 6: Droop pulses (±4V/128pulse) 7: Droop pulses (±4V/2048pulse) 8: Droop pulses (±4V/8192pulse) 9: Droop pulses (±4V/32768pulse) A: Droop pulses (±4V/131072pulse) B: Bus voltage (+4V/400V) C: In position (+4V/ON) D: Ready (+4V/ON) E: Trouble (+4V/ON) Slot number of analog monitor 2 Choose the slot number output to analog monitor 2. Slot number = set value. Selecting "0" disables output.	0000		Refer to name and function column.

Classifi-cation	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Basic IFU parameters	5	*MD3	Analog monitor 3 output Choose the signal to be output to analog monitor 3.  Analog monitor 3 selection 0: Servo motor speed (±4V/max. Servo motor speed) 1: Torque (+4V/max. Torque) 2: Servo motor speed (±4V/max. Servo motor speed) 3: Torque (+4V/max. Torque) 4: Current command (±4V/max. Current command) 5: Command pulse frequency (±4V/500kpps) 6: Droop pulses (±4V/128pulse) 7: Droop pulses (±4V/2048pulse) 8: Droop pulses (±4V/8192pulse) 9: Droop pulses (±4V/32768pulse) A: Droop pulses (±4V/131072pulse) B: Bus voltage (+4V/400V) C: In position (+4V/ON) D: Ready (+4V/ON) E: Trouble (+4V/ON) Slot number of analog monitor 3 Choose the slot number output to analog monitor 3. Slot number = set value. Selecting "0" disables output.	0000		Refer to name and function column.
	6	MO1	Analog monitor 1 offset Used to set the offset voltage of the analog monitor 1 (MO1).	0	mV	−999 to 999
	7	MO2	Analog monitor 2 offset Used to set the offset voltage of the analog monitor 2 (MO2).	0	mV	−999 to 999
	8	MO3	Analog monitor 3 offset Used to set the offset voltage of the analog monitor 3 (MO2).	0	mV	−999 to 999
	9	*OP2	Function selection 2 Used to select the input signal filter.  Input signal filter 0 : None 1 : 1.777ms 2 : 3.555ms	0200		Refer to name and function column.

Classifi-cation	No.	Symbol	Name and Function	Initial Value	Unit	Setting Range
Basic IFU parameters	10	*INS	Interface unit serial communication Choose the serial communication station number of the interface unit. When making selection, avoid setting the station number used by any other unit.	0		0 to 31
	11	*SL1	1 slot serial communication station number selection Choose the station number of the drive unit connected to the first slot of the base unit. When making selection, avoid setting the station number used by any other unit.	1		0 to 31
	12	*SL2	2 slot serial communication station number selection Choose the station number of the drive unit connected to the second slot of the base unit. When making selection, avoid setting the station number used by any other unit.	2		0 to 31
	13	*SL3	3 slot serial communication station number selection Choose the station number of the drive unit connected to the third slot of the base unit. When making selection, avoid setting the station number used by any other unit.	3		0 to 31
	14	*SL4	4 slot serial communication station number selection Choose the station number of the drive unit connected to the fourth slot of the base unit. When making selection, avoid setting the station number used by any other unit.	4		0 to 31
	15	*SL5	5 slot serial communication station number selection Choose the station number of the drive unit connected to the fifth slot of the base unit. When making selection, avoid setting the station number used by any other unit.	5		0 to 31

<table>
<tr><th>Classifi-cation</th><th>No.</th><th>Symbol</th><th>Name and Function</th><th>Initial Value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="20">Basic IFU parameters</td><td>16</td><td>*SL6</td><td>6 slot serial communication station number selection
Choose the station number of the drive unit connected to the sixth slot of the base unit.
When making selection, avoid setting the station number used by any other unit.</td><td>6</td><td></td><td>0
to
31</td></tr>
<tr><td>17</td><td>*SL7</td><td>7 slot serial communication station number selection
Choose the station number of the drive unit connected to the seventh slot of the base unit.
When making selection, avoid setting the station number used by any other unit.</td><td>7</td><td></td><td>0
to
31</td></tr>
<tr><td>18</td><td>*SL8</td><td>8 slot serial communication station number selection
Choose the station number of the drive unit connected to the eighth slot of the base unit.
When making selection, avoid setting the station number used by any other unit.</td><td>8</td><td></td><td>0
to
31</td></tr>
<tr><td>19</td><td>*BLK</td><td>Parameter write inhibit
Used to select reference and write ranges of the parameters.
<table>
<tr><th>Setting</th><th>Setting operation</th><th>IFU basic parameter</th><th>Expansion IFU parameter</th><th>I/O assignment</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>IFU parameter No. 19</td><td></td><td></td></tr>
<tr><td>Write</td><td>IFU parameter No. 19</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">000E</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">100B</td><td>Reference</td><td>○</td><td></td><td></td></tr>
<tr><td>Write</td><td>IFU parameter No. 19</td><td></td><td></td></tr>
<tr><td rowspan="2">100C</td><td>Reference</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Write</td><td>IFU parameter No. 19</td><td></td><td></td></tr>
</table></td><td>0000</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td rowspan="10">Expansion IFU parameter</td><td>20</td><td>SIC</td><td>Serial communication time-out selection
Set the time-out period of the communication protocol in the [s] unit.
Setting "0" disables time-out checking.</td><td>0</td><td>s</td><td>0
to
60</td></tr>
<tr><td>21</td><td rowspan="9"></td><td rowspan="9">For manufacturer setting
Do not change this value any means.</td><td rowspan="9">0</td><td rowspan="9"></td><td rowspan="9"></td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

5.3 Detailed description

5.3.1 Electronic gear

CAUTION ・Wrong setting can lead to unexpected fast rotation, causing injury.

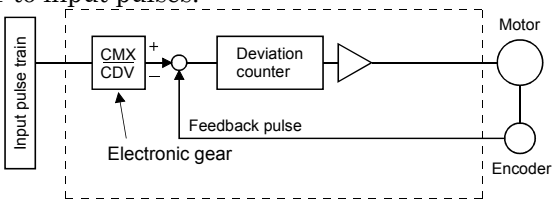
POINT

・The guideline of the electronic gear setting range is $\frac{1}{50} < \frac{CMX}{CDV} < 500$.
If the set value is outside this range, noise may be generated during acceleration/ deceleration or operation may not be performed at the preset speed and/or acceleration/deceleration time constants.
・The following specification symbols are required to calculate the electronic gear.

(1) Concept of electronic gear

The machine can be moved at any multiplication factor to input pulses.

$$\frac{CMX}{CDV} = \frac{\text{DRU parameter No.3}}{\text{DRU parameter No.4}}$$



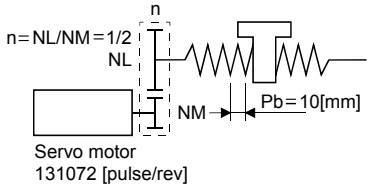
The following setting examples are used to explain how to calculate the electronic gear:

POINT

・The following specification symbols are required to calculate the electronic gear
Pb ：Ballscrew lead [mm]
n ：Reduction ratio
Pt ：Servo motor resolution [pulses/rev]
$\Delta \ell_0$: Travel per command pulse [mm/pulse]
ΔS ：Travel per servo motor revolution [mm/rev]
$\Delta\theta°$ ：Angle per pulse [° /pulse]
$\Delta\theta$ ：Angle per revolution [° /rev]

(a) For motion in increments of 10μm per pulse

Machine specifications



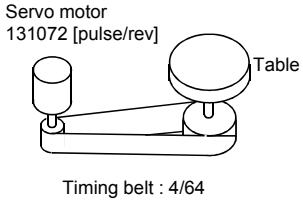
Ballscrew lead Pb =10 [mm]
Reduction ratio: n = 1/2
Servo motor resolution: Pt = 131072 [pulses/rev]

$$\frac{CMX}{CDV} = \Delta\ell_0 \cdot \frac{Pt}{\Delta S} = \Delta\ell_0 \cdot \frac{Pt}{n \cdot Pb} = 10 \times 10^{-3} \cdot \frac{131072}{1/2 \cdot 10} = \frac{262144}{1000} = \frac{32768}{125}$$

Hence, set 32768 to CMX and 125 to CDV.

(b) Conveyor setting example

For rotation in increments of 0.01° per pulse



Machine specifications

Table : 360°/rev
Reduction ratio: n = 4/64
Servo motor resolution: Pt = 131072 [pulses/rev]

$$\frac{CMX}{CDV} = \Delta\theta^\circ \cdot \frac{Pt}{\Delta\theta} = 0.01 \cdot \frac{131072}{4/64 \cdot 360} = \frac{65536}{1125} \quad \cdots\cdots (5.1)$$

Since CMX is not within the setting range in this status, it must be reduced to the lowest term. When CMX has been reduced to a value within the setting range, round off the value to the nearest unit.

$$\frac{CMX}{CDV} = \frac{65536}{1125} = \frac{26214.4}{450} \cong \frac{26214}{450}$$

Hence, set 26214 to CMX and 450 to CDV.

> POINT
>
> - When "0" is set to parameter No.3 (CMX), CMX is automatically set to the servo motor resolution. Therefore, in the case of Expression (5.1), setting 0 to CMX and 2250 to CDX concludes in the following expression: CMX/CDV=131072/2250, and electric gear can be set without the necessity to reduce the fraction to the lowest term.
> - For unlimited one-way rotation, e.g. an index table, indexing positions will be missed due to cumulative error produced by rounding off.
>
> For example, entering a command of 36000 pulses in the above example causes the table to rotate only:
>
> $$36000 \cdot \frac{26214}{450} \cdot \frac{1}{131072} \cdot \frac{4}{64} \cdot 360^\circ = 359.995^\circ$$
>
> Therefore, indexing cannot be done in the same position on the table.

(2) Instructions for reduction

The calculated value before reduction must be as near as possible to the calculated value after reduction.

In the case of (1), (b) in this section, an error will be smaller if reduction is made to provide no fraction for CDV. The fraction of Expression (5.1) before reduction is calculated as follows.

$$\frac{CMX}{CDV} = \frac{65536}{1125} = 58.25422 \quad \cdots\cdots (5.2)$$

The result of reduction to provide no fraction for CMX is as follows.

$$\frac{CMX}{CDV} = \frac{65536}{1125} = \frac{32768}{562.5} \cong \frac{32768}{563} = 58.20249 \quad \cdots\cdots (5.3)$$

The result of reduction to provide no fraction for CDV is as follows.

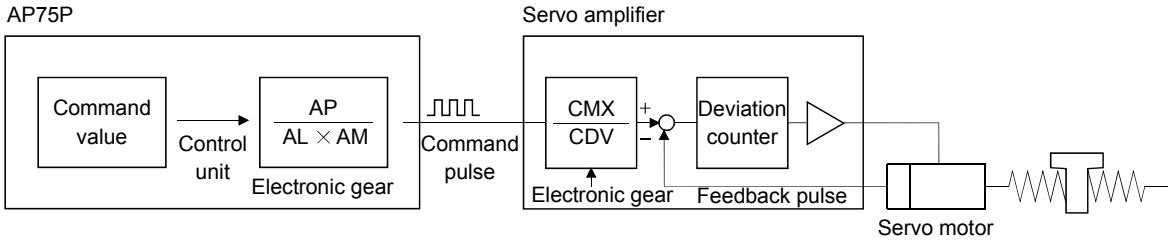
$$\frac{CMX}{CDV} = \frac{65536}{1125} = \frac{26214.4}{450} \cong \frac{26214}{450} = 58.25333 \quad \cdots\cdots (5.4)$$

As a result, it is understood that the value nearer to the calculation result of Expression (5.2) is the result of Expression (5.4). Accordingly, the set values of (1), (b) in this section are CMX=26214, CDV=450.

(3) Setting for use of AD75P

The AD75P also has the following electronic gear parameters. Normally, the servo amplifier side electronic gear must also be set due to the restriction on the command pulse frequency (differential 400kpulse/s, open collector 200kpulse/s).

AP: Number of pulses per motor revolution
AL: Moving distance per motor revolution
AM: Unit scale factor



The resolution of the servo motor is 131072 pulses/rev. For example, the pulse command needed to rotate the servo motor is as follows

Servo motor speed [r/min]	Required pulse command
2000	131072×2000/60=4369066 pulse/s
3000	131072×3000/60=6553600 pulse/s

For the AD75P, the maximum value of the pulse command that may be output is 200kpulse/s in the open collector system or 400kpulse/s in the differential line driver system. Hence, either of the servo motor speeds exceeds the maximum output pulse command of the AD75P.
Use the electronic gear of the servo amplifier to run the servo motor under the maximum output pulse command of the AD75P.

To rotate the servo motor at 3000r/min in the open collector system (200kpulse/s), set the electronic gear as follows

$$f \cdot \frac{CMX}{CDV} = \frac{N_0}{60} \cdot pt$$

f : Input pulses [pulse/s]
N_0 : Servo motor speed [r/min]
Pt : Servo motor resolution [pulse/rev]

$$200 \cdot 10^3 \cdot \frac{CMX}{CDV} = \frac{3000}{60} \cdot 131072$$

$$\frac{CMX}{CDV} = \frac{3000}{60} \cdot \frac{131072}{200^3} = \frac{3000 \cdot 131072}{60 \cdot 200000} = \frac{4096}{125}$$

The following table indicates the electronic gear setting example (ballscrew lead = 10mm) when the AD75P is used in this way.

Rated servo motor speed				3000r/min		2000r/min	
Servo amplifier	Input system			Open collector	Differential line driver	Open collector	Differential line driver
	Max. input pulse frequency [kpulse/s]			200	500	200	500
	Feedback pulse/revolution [pulse/rev]			131072		131072	
	Electronic gear (CMX/CDV)			4096/125	2048/125	8192/375	4096/375
AD75P	Command pulse frequency [kpulse/s] (Note)			200	400	200	400
	Number of pulses per servo motor revolution as viewed from AD75P[pulse/rev]			4000	8000	6000	12000
	Electronic gear	Minimum command unit 1pulse	AP	1	1	1	1
			AL	1	1	1	1
			AM	1	1	1	1
		Minimum command unit 0.1μm	AP	4000	8000	6000	12000
			AL	1000.0 [μm]	1000.0 [μm]	1000.0 [μm]	1000.0 [μm]
			AM	10	10	10	10

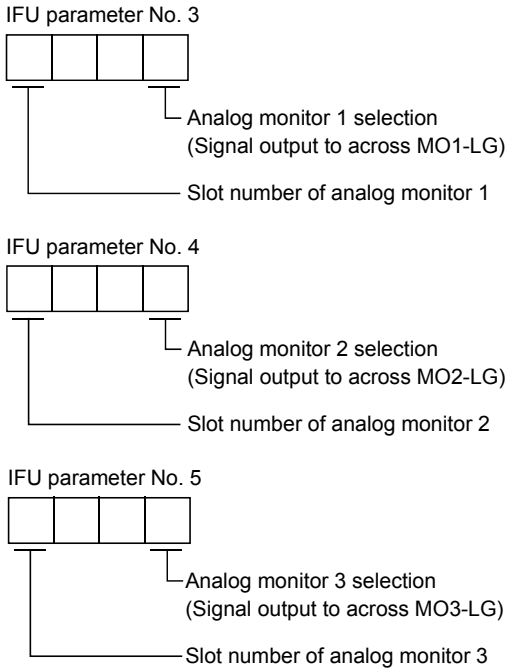
Note. Command pulse frequency at rated speed

5.3.2 Analog monitor

The servo status can be output to 3 channels in terms of voltage. Using an ammeter enables monitoring the servo status.

(1) Setting

Change the following digits of IFU parameter No.3 to 5:



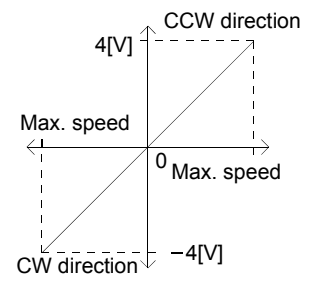
IFU parameters No.6 to 8 can be used to set the offset voltages to the analog output voltages. The setting range is between −999 and 999mV.

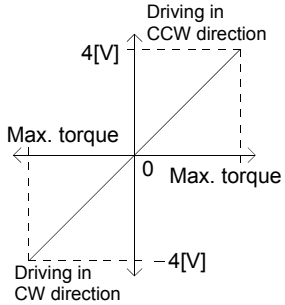
IFU parameter No.	Description	Setting range [mV]
6	Used to set the offset voltage for the analog monitor 1.	−999 to 999
7	Used to set the offset voltage for the analog monitor 2.	
8	Used to set the offset voltage for the analog monitor 3.	

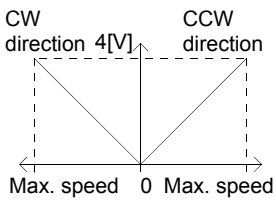
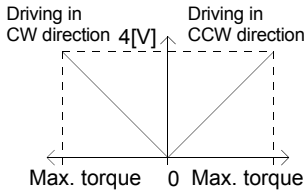
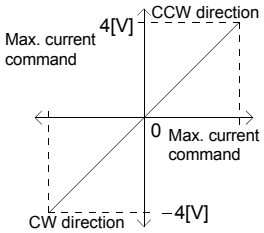
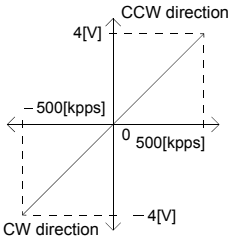
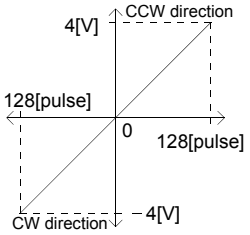
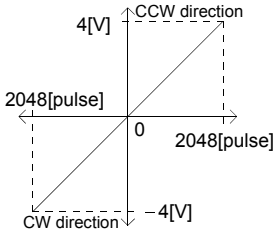
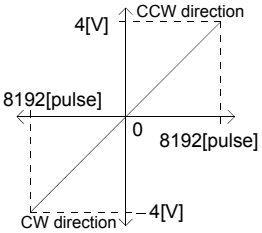
(2) Settings

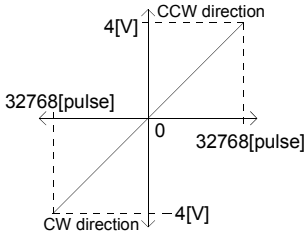
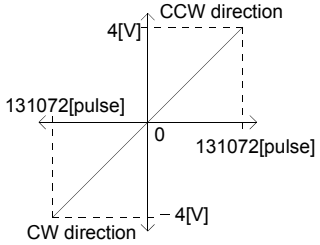
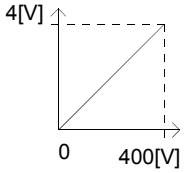
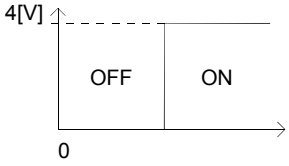
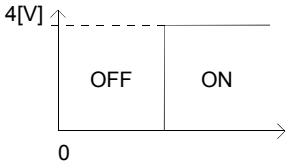
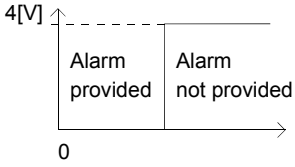
The three channels are all factory-set to output servo motor speeds. By changing the IFU parameter No. 3 to 5 values, you can change the data as shown in the following tale.

Refer to (3) for measurement points.

Setting	Output item	Data
0	Servo motor speed	

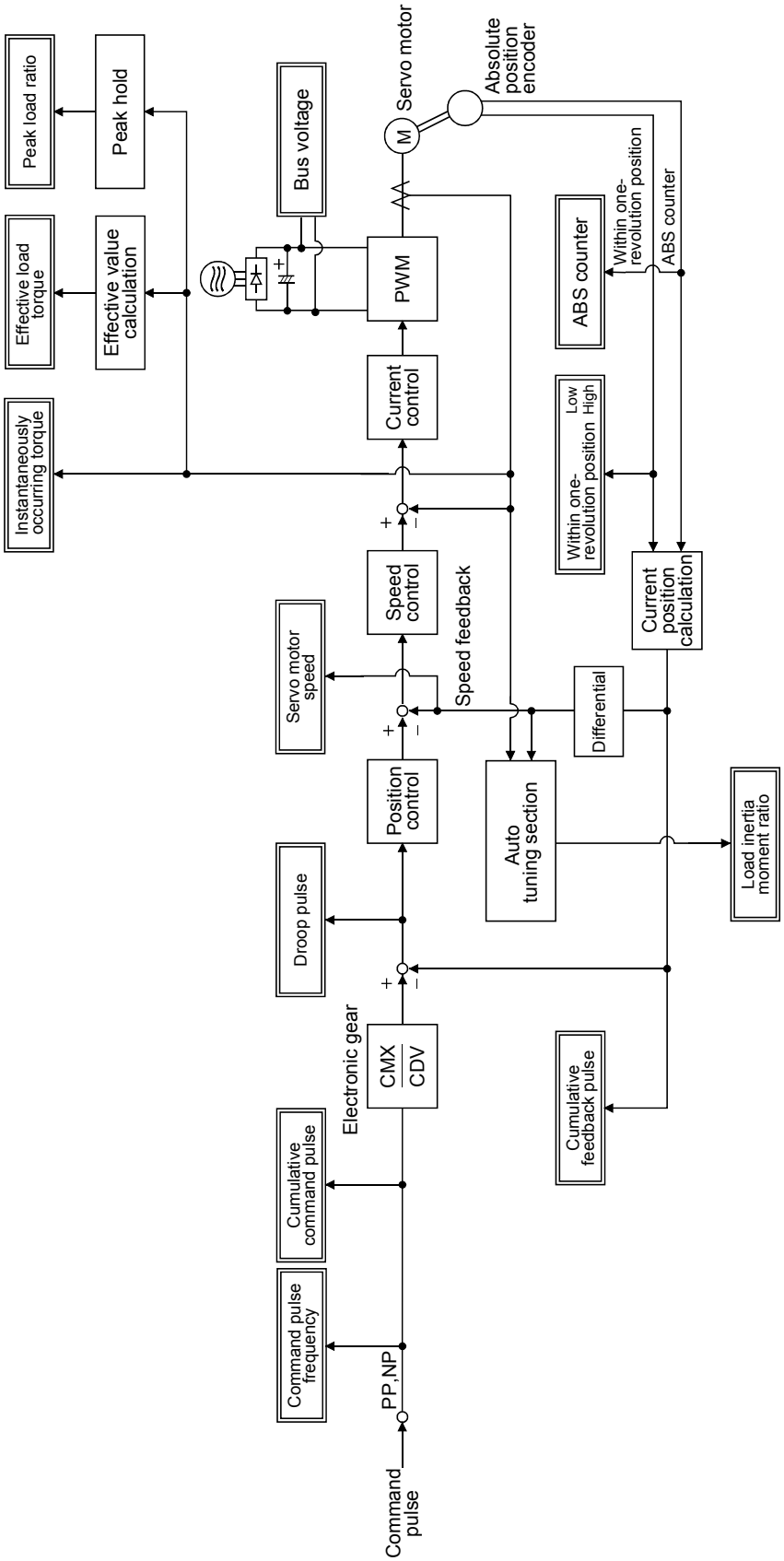
Setting	Output item	Data
1	Torque (Note)	

Setting	Output item	Data
2	Servo motor speed	
3	Torque (Note)	
4	Current command	
5	Command pulse frequency	
6	Droop pulses (±4V/128pulse)	
7	Droop pulses (±4V/2048pulse)	
8	Droop pulses (±4V/8192pulse)	

Setting	Output item	Data
9	Droop pulses (±4V/32768pulse)	
A	Droop pulses (±4V/131072pulse)	
B	Bus voltage	
C	In-position	
D	Ready	
E	Failure	

Note. 4V is outputted at the maximum torque. However, when DRU parameter No. 28 · 76 are set to limit torque, 4V is outputted at the torque highly limited.

(3) Analog monitor block diagram



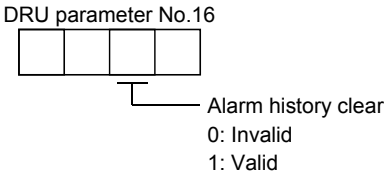
5.3.3 Using forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) to change the stopping pattern

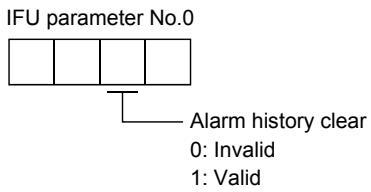
The stopping pattern is factory-set to make a sudden stop when the forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) is made valid. A slow stop can be made by changing the DRU parameter No. 22 (Function selection 2) value.

DRU parameter No.22 Setting	Stopping method
□□□0 (initial value)	Sudden stop Motor stops with droop pulses cleared.
□□□1	Slow stop The motor is decelerated to a stop in accordance with the DRU parameter No. 7 value. (Position command acceleration/deceleration time constant)

5.3.4 Alarm history clear

The servo amplifier stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using DRU parameter No.16 or IFU parameter No.0 before starting operation.
These parameters are made valid when you switch power off, then on after setting their values. DRU parameter No. 16 and IFU parameter No. 0 return to "□□0□" automatically when the alarm history is cleared.

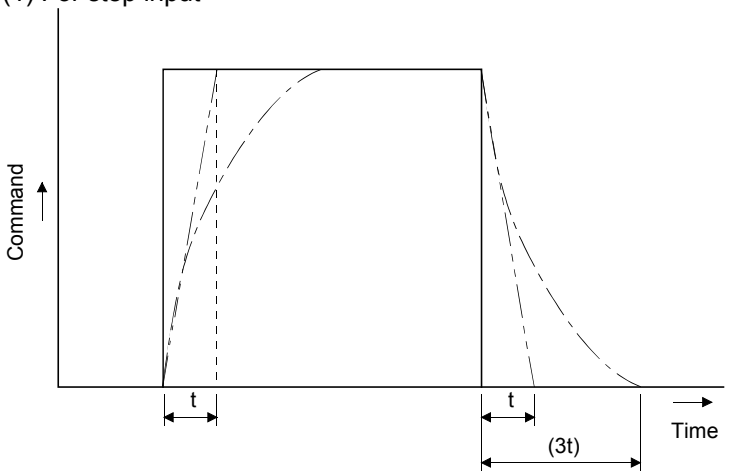




5.3.5 Position smoothing

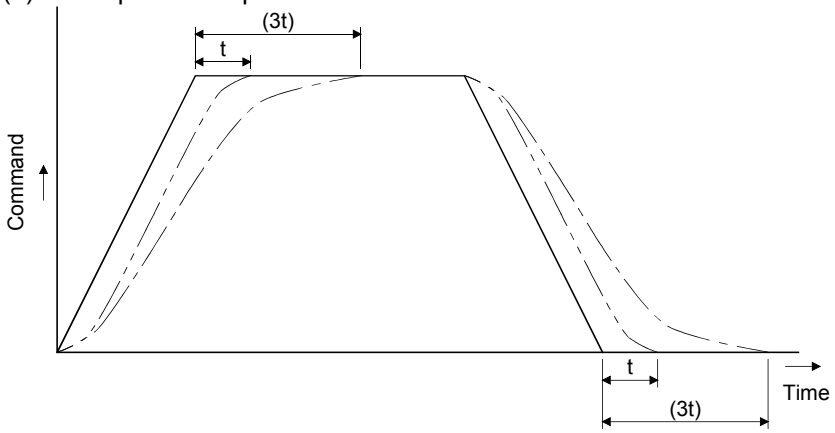
By setting the position command acceleration/deceleration time constant (DRU parameter No.7), you can run the servo motor smoothly in response to a sudden position command.
The following diagrams show the operation patterns of the servo motor in response to a position command when you have set the position command acceleration/deceleration time constant.
Choose the primary delay or linear acceleration/deceleration in DRU parameter No. 55 according to the machine used.

(1) For step input



——— : Input position command
— — — : Position command after filtering for primary delay
— - - — : Position command after filtering for linear acceleration/deceleration
t : Position command acceleration/deceleration time constant (DRU parameter No. 7)

(2) For trapezoidal input



——— : Input position command
— — — : Position command after filtering for linear acceleration/deceleration
— - - — : Position command after filtering for primary delay
t : Position command acceleration/deceleration time constant (DRU parameter No. 7)

MEMO

6. GENERAL GAIN ADJUSTMENT

6.1 Different adjustment methods

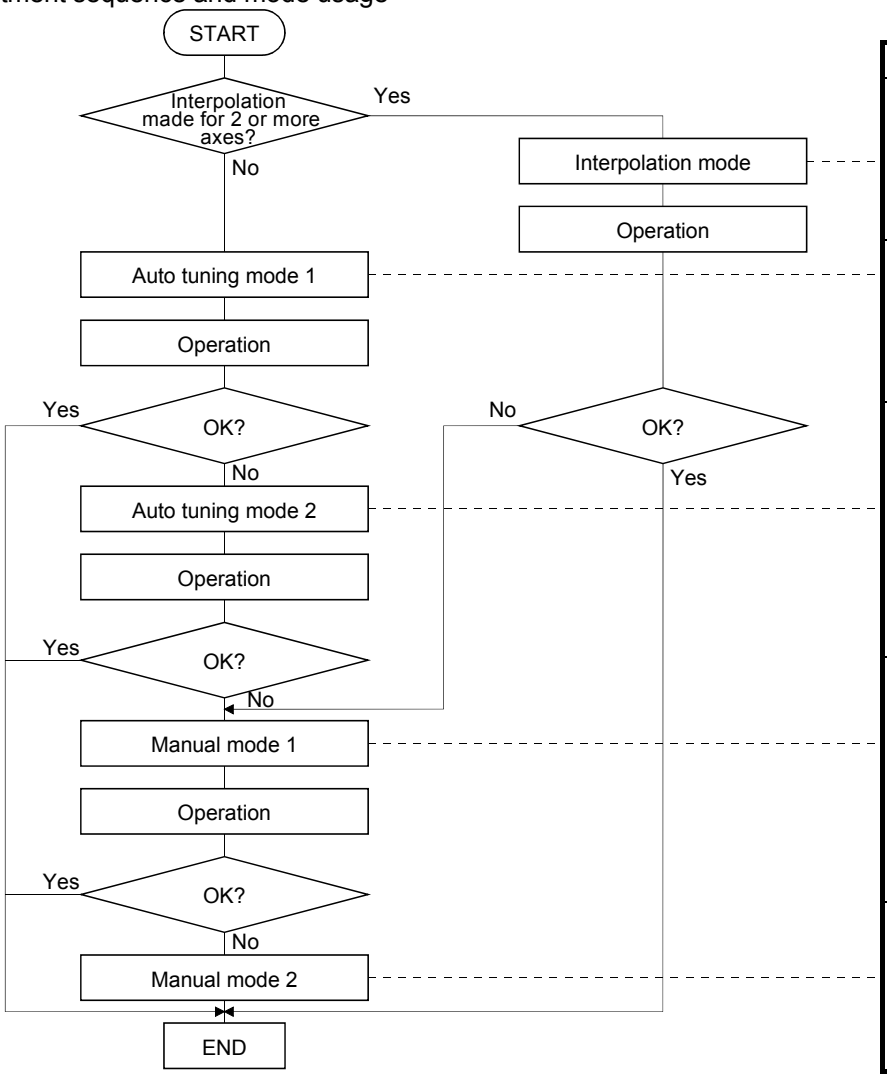
6.1.1 Adjustment on a MELSERVO-J2M

The gain adjustment in this section can be made on the MELSERVO-J2M. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2, manual mode 1 and manual mode 2 in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	DRU parameter No. 2 setting	Estimation of load inertia moment ratio	Automatically set DRU parameters	Manually set DRU parameters
Auto tuning mode 1 (initial value)	010□	Always estimated	PG1 (DRU parameter No. 6) GD2 (DRU parameter No. 34) PG2 (DRU parameter No. 35) VG1 (DRU parameter No. 36) VG2 (DRU parameter No. 37) VIC (DRU parameter No. 38)	Response level setting of DRU parameter No. 2
Auto tuning mode 2	020□	Fixed to parameter No. 34 value	PG1 (DRU parameter No. 6) PG2 (DRU parameter No. 35) VG1 (DRU parameter No. 36) VG2 (DRU parameter No. 37) VIC (DRU parameter No. 38)	GD2 (DRU parameter No. 34) Response level setting of parameter No. 2
Manual mode 1	030□		PG2 (DRU parameter No. 35) VG1 (DRU parameter No. 36)	PG1 (DRU parameter No. 6) GD2 (DRU parameter No. 34) VG2 (DRU parameter No. 37) VIC (DRU parameter No. 38)
Manual mode 2	040□			PG1 (DRU parameter No. 6) GD2 (DRU parameter No. 34) PG2 (DRU parameter No. 35) VG1 (DRU parameter No. 36) VG2 (DRU parameter No. 37) VIC (DRU parameter No. 38)
Interpolation mode	000□	Always estimated	GD2 (DRU parameter No. 34) PG2 (DRU parameter No. 35) VG2 (DRU parameter No. 37) VIC (DRU parameter No. 38)	PG1 (DRU parameter No. 6) VG1 (DRU parameter No. 36)

(2) Adjustment sequence and mode usage



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

6.1.2 Adjustment using MR Configurator (servo configuration software)

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

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

6.2 Auto tuning

6.2.1 Auto tuning mode

The MELSERVO-J2M has a real-time auto tuning function which estimates the machine characteristic (load inertia moment ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the MELSERVO-J2M.

(1) Auto tuning mode 1

The MELSERVO-J2M is factory-set to the auto tuning mode 1.

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

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

DRU parameter No.	Abbreviation	Name
6	PG1	Position control gain 1
34	GD2	Ratio of load inertia moment to servo motor inertia moment
35	PG2	Position control gain 2
36	VG1	Speed control gain 1
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

POINT

- The auto tuning mode 1 may not be performed properly if the following conditions are not satisfied.
  - Time to reach 2000r/min is the acceleration/deceleration time constant of 5s or less.
  - Speed is 150r/min or higher.
  - The ratio of load inertia moment to servo motor is not more than 100 times.
  - The acceleration/deceleration torque is 10% or more of the rated torque.
- Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode 1 • 2 to make gain adjustment.

(2) Auto tuning mode 2

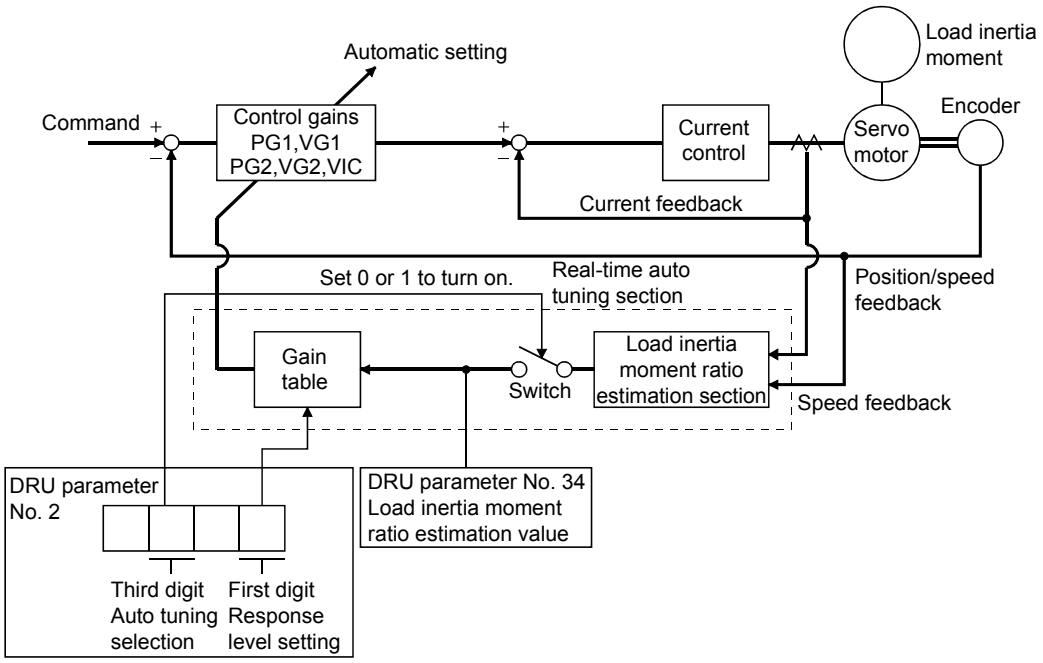
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (DRU parameter No. 34).

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

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

6.2.2 Auto tuning mode operation

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



When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to DRU parameter No. 34 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the servo amplifier display section.

If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, chose the "auto tuning mode 2" (DRU parameter No.2: □2□□) to stop the estimation of the load inertia moment ratio (Switch in above diagram turned off), and set the load inertia moment ratio (DRU parameter No. 34) manually.

From the preset load inertia moment ratio (DRU parameter No. 34) value and response level (The first digit of DRU parameter No. 2), the optimum control gains are automatically set on the basis of the internal gain tale.

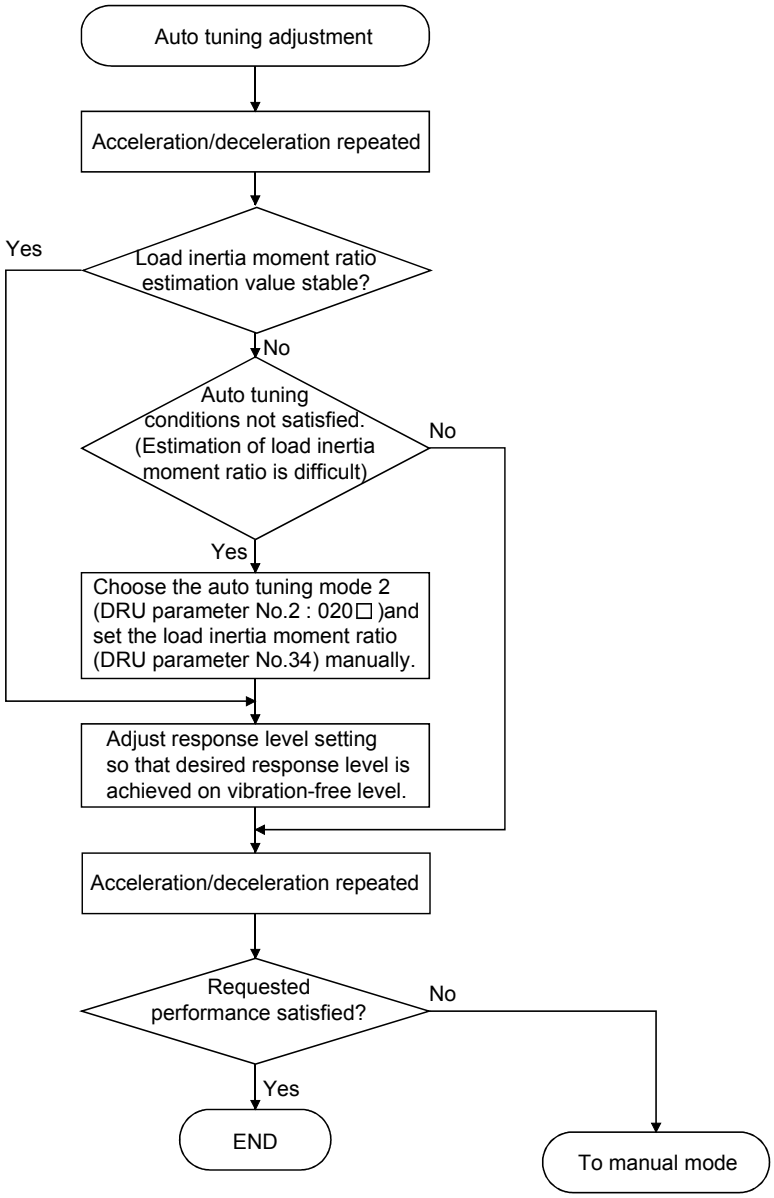
The auto tuning results are saved in the EEP-ROM of the servo amplifier every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each control gain saved in the EEP-ROM being used as an initial value.

POINT

- If sudden disturbance torque is imposed during operation, the estimation of the inertia moment ratio may malfunction temporarily. In such a case, choose the "auto tuning mode 2" (DRU parameter No. 2: 020□) and set the correct load inertia moment ratio in DRU parameter No. 34.
- When any of the auto tuning mode 1, auto tuning mode 2 and manual mode 1 settings is changed to the manual mode 2 setting, the current control gains and load inertia moment ratio estimation value are saved in the EEP-ROM.

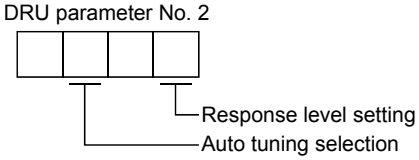
6.2.3 Adjustment procedure by auto tuning

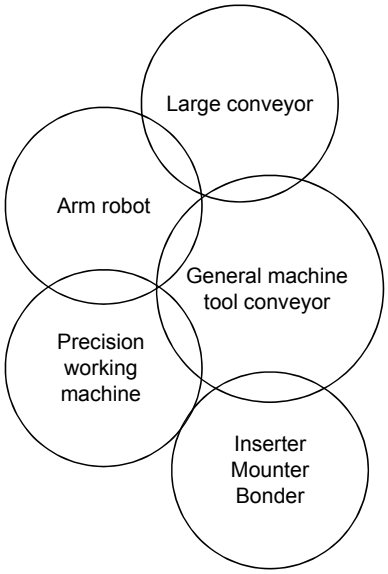
Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



6.2.4 Response level setting in auto tuning mode

Set the response (The first digit of DRU parameter No.2) of the whole servo system. As the response level setting is increased, the trackability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range.
If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100Hz, adaptive vibration suppression control (DRU parameter No. 60) or machine resonance suppression filter (DRU parameter No. 58・59) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to Section 7.2 for adaptive vibration suppression control and machine resonance suppression filter.



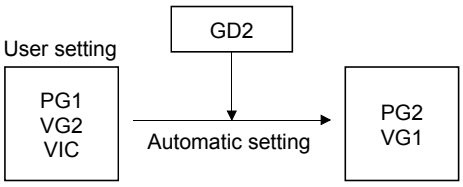
Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	15Hz	
2		20Hz	
3		25Hz	
4	↑	30Hz	
5		35Hz	
6		45Hz	
7		55Hz	
8	Middle	70Hz	
9		85Hz	
A		105Hz	
B		130Hz	
C	↓	160Hz	
D		200Hz	
E		240Hz	
F	High	300Hz	

6.3 Manual mode 1 (simple manual adjustment)

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

6.3.1 Operation of manual mode 1

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



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

6.3.2 Adjustment by manual mode 1

POINT

- If machine resonance occurs, adaptive vibration suppression control (DRU parameter No. 60) or machine resonance suppression filter (DRU parameter No. 58 · 59) may be used to suppress machine resonance. (Refer to Section 7.1.)

(1) DRU parameters

The following parameters are used for gain adjustment:

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

(2) Adjustment procedure

Step	Operation	Description
1	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment (DRU parameter No. 34).	
2	Set a slightly smaller value to the position control gain 1 (DRU parameter No. 6).	
3	Increase the speed control gain 2 (DRU parameter No. 37) within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed control gain.
4	Decrease the speed integral compensation (DRU parameter No. 38) within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
5	Increase the position control gain 1 (DRU parameter No. 6).	Increase the position control gain.
6	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with adaptive vibration suppression control or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to Section 7.1.
7	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(3) Adjustment description

(a) Position control gain 1 (DRU parameter No. 6)

This parameter determines the response level of the position control loop. Increasing position control gain 1 improves trackability to a position command but a too high value will make overshooting liable to occur at the time of settling.

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

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

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression:

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

(c) Speed integral compensation (DRU parameter No. 38)

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

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

6.4 Interpolation mode

The interpolation mode is used to match the position control gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, the position control gain 2 and speed control gain 2 which determine command trackability are set manually and the other parameter for gain adjustment are set automatically.

(1) Parameter

(a) Automatically adjusted parameters

The following parameters are automatically adjusted by auto tuning.

DRU parameter No.	Abbreviation	Name
34	GD2	Ratio of load inertia moment to servo motor inertia moment
35	PG2	Position control gain 2
37	VG2	Speed control gain 2
38	VIC	Speed integral compensation

(b) Manually adjusted parameters

The following parameters are adjustable manually.

DRU parameter No.	Abbreviation	Name
6	PG1	Position control gain 1
36	VG1	Speed control gain 1

(2) Adjustment procedure

Step	Operation	Description
1	Set 15Hz (DRU parameter No. 2: 010 □) as the machine resonance frequency of response in the auto tuning mode 1.	Select the auto tuning mode 1.
2	During operation, increase the response level setting (DRU parameter No. 2), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of position control gain 1 (DRU parameter No. 6) and speed control gain 1 (DRU parameter No. 36).	Check the upper setting limits.
4	Set the interpolation mode (DRU parameter No. 2: 000 □).	Select the interpolation mode.
5	Using the position control gain 1 value checked in step 3 as the guideline of the upper limit, set in PG1 the value identical to the position loop gain of the axis to be interpolated.	Set position control gain 1.
6	Using the speed control gain 1 value checked in step 3 as the guideline of the upper limit, look at the rotation status and set in speed control gain 1 the value three or more times greater than the position control gain 1 setting.	Set speed control gain 1.
7	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

(a) Position control gain 1 (DRU parameter No.6)

This parameter determines the response level of the position control loop. Increasing position control gain 1 improves trackability to a position command but a too high value will make overshooting liable to occur at the time of settling. The droop pulse value is determined by the following expression.

$$\text{Droop pulse value (pulse)} = \frac{\frac{\text{Rotation speed (r/min)}}{60} \times 131072\text{(pulse)}}{\text{Position control gain set value}}$$

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

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

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

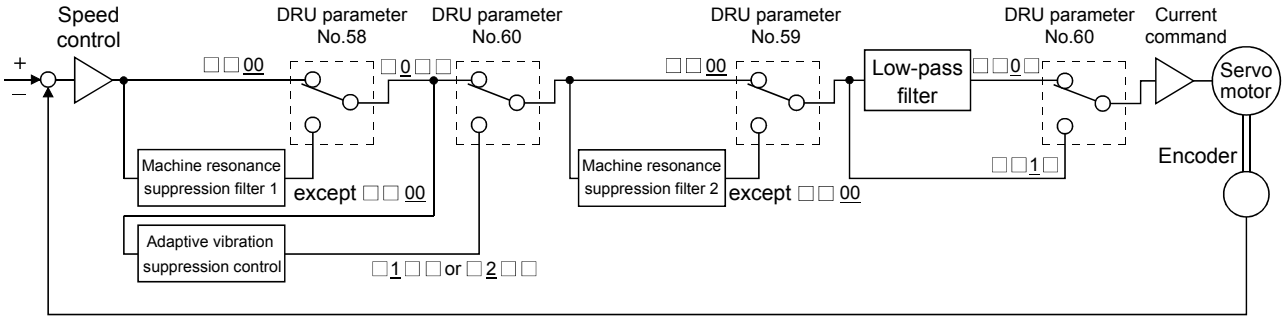
MEMO

7. SPECIAL ADJUSTMENT FUNCTIONS

> **POINT**
>
> ▪ The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in Chapter 6.

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

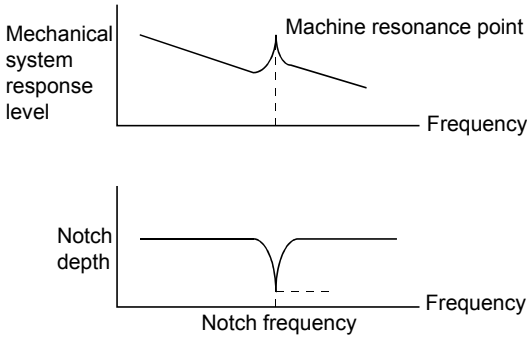
7.1 Function block diagram



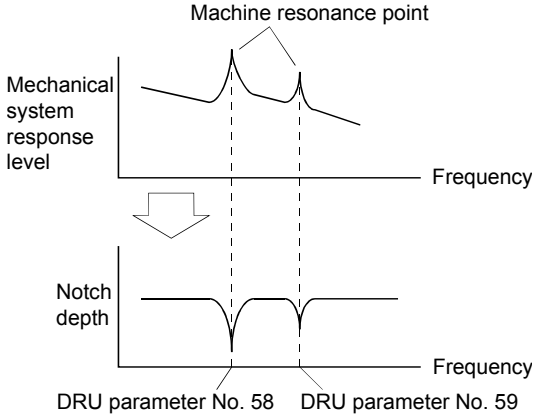
7.2 Machine resonance suppression filter

(1) Function

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



You can use the machine resonance suppression filter 1 (DRU parameter No. 58) and machine resonance suppression filter 2 (DRU parameter No. 59) to suppress the vibration of two resonance frequencies. Note that if adaptive vibration suppression control is made valid, the machine resonance suppression filter 1 (DRU parameter No. 58) is made invalid.



POINT

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

(2) Parameters

(a) Machine resonance suppression filter 1 (DRU parameter No. 58)

Set the notch frequency and notch depth of the machine resonance suppression filter 1 (DRU parameter No. 58)

When you have made adaptive vibration suppression control selection (DRU parameter No. 60) "valid" or "held", make the machine resonance suppression filter 1 invalid (DRU parameter No. 58: 0000).

DRU parameter No. 58

0			

Notch frequency

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

Notch depth

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

POINT

- If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal.
- A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
- The machine characteristic can be grasped beforehand by the machine analyzer on the MR Configurator (servo configuration software). This allows the required notch frequency and depth to be determined.
- Resonance may occur if DRU parameter No. 58・59 is used to select a close notch frequency and set a deep notch.

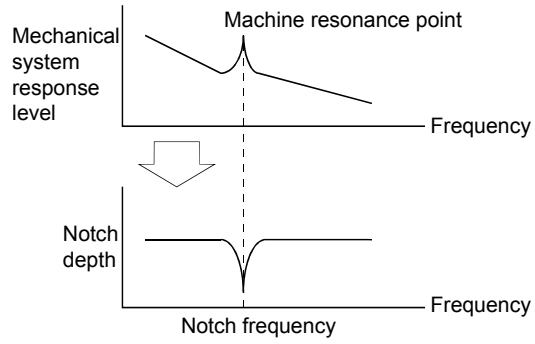
(b) Machine resonance suppression filter 2 (DRU parameter No. 59)

The setting method of machine resonance suppression filter 2 (DRU parameter No. 59) is the same as that of machine resonance suppression filter 1 (DRU parameter No. 58). However, the machine resonance suppression filter 2 can be set independently of whether adaptive vibration suppression control is valid or invalid.

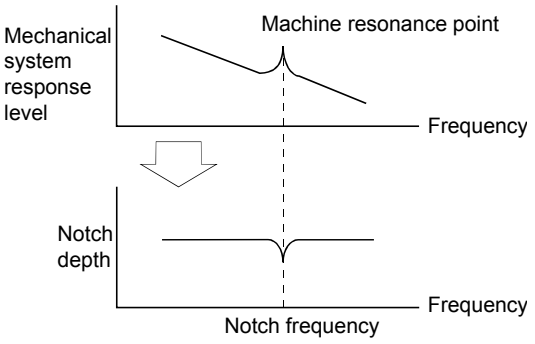
7.3 Adaptive vibration suppression control

(1) Function

Adaptive vibration suppression control is a function in which the drive unit detects machine resonance and sets the filter characteristics automatically to suppress mechanical system vibration. Since the filter characteristics (frequency, depth) are set automatically, you need not be conscious of the resonance frequency of a mechanical system. Also, while adaptive vibration suppression control is valid, the servo amplifier always detects machine resonance, and if the resonance frequency changes, it changes the filter characteristics in response to that frequency.



When machine resonance is large and frequency is low



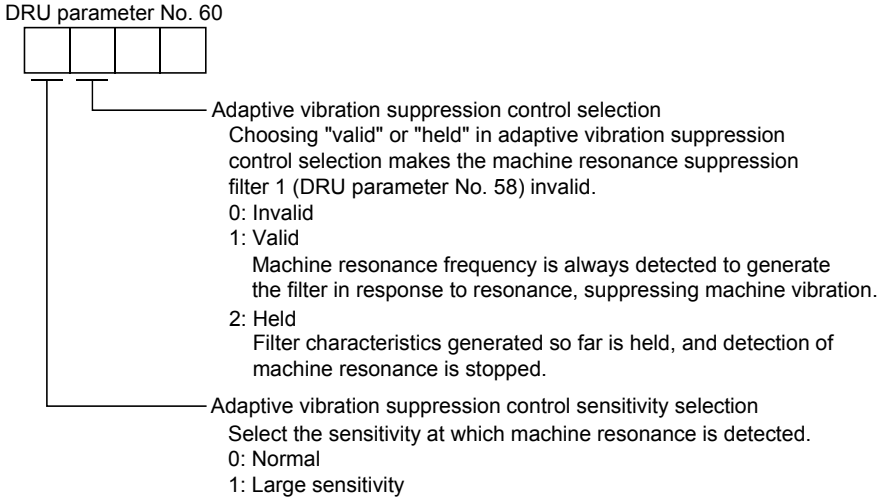
When machine resonance is small and frequency is high

POINT

- The machine resonance frequency which adaptive vibration suppression control can respond to is about 150 to 500Hz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range. Use the machine resonance suppression filter for the machine resonance of such frequency.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics or which has too large resonance.
- Under operating conditions in which sudden disturbance torque is imposed during operation, the detection of the resonance frequency may malfunction temporarily, causing machine vibration. In such a case, set adaptive vibration suppression control to be "held" (DRU parameter No. 60: □2□□) to fix the characteristics of the adaptive vibration suppression control filter.

(2) Parameters

The operation of adaptive vibration suppression control selection (DRU parameter No.60).



POINT

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

7.4 Low-pass filter

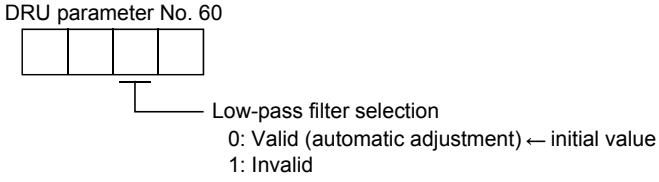
(1) Function

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

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

(2) Parameter

Set the operation of the low-pass filter (DRU parameter No. 60.)



POINT

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

7.5 Gain changing function

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

7.5.1 Applications

This function is used when:

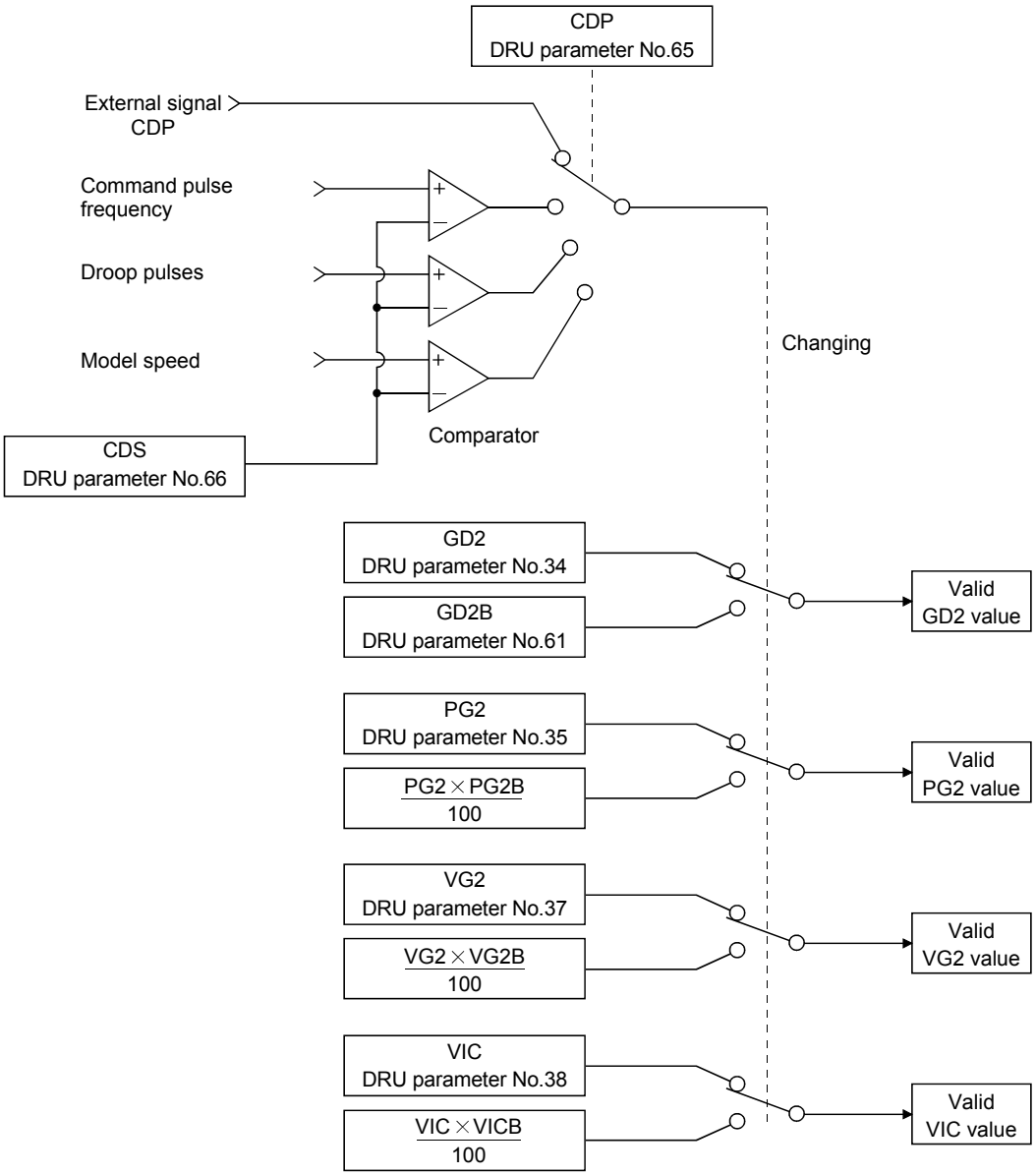
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

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

(3) You want to change the gains using an external signal to ensure stability of the servo system since the load inertia moment ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

7.5.2 Function block diagram

The valid control gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection (DRU parameter No. 65) and gain changing condition (DRU parameter No. 66).



7.5.3 Parameters

When using the gain changing function, always set "□□4□" in DRU parameter No.2 (auto tuning) to choose the manual mode of the gain adjustment modes. The gain changing function cannot be used in the auto tuning mode.

DRU parameter No.	Abbrevi-ation	Name	Unit	Description
6	PG1	Position control gain 1	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
36	VG1	Speed control gain 1	rad/s	
34	GD2	Ratio of load inertia moment to servo motor inertia moment	0.1 times	Control parameters before changing
35	PG2	Position control gain 2	rad/s	
37	VG2	Speed control gain 2	rad/s	
38	VIC	Speed integral compensation	ms	
61	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	0.1 times	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
62	PG2B	Position control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing position control gain 2 to position control gain 2.
63	VG2B	Speed control gain 2 changing ratio	%	Used to set the ratio (%) of the after-changing speed control gain 2 to speed control gain 2.
64	VICB	Speed integral compensation changing ratio	%	Used to set the ratio (%) of the after-changing speed integral compensation to speed integral compensation.
65	CDP	Gain changing selection		Used to select the changing condition.
66	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
67	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.

(1) DRU parameters No. 6 ▪ 34 to 38

These parameters are the same as in ordinary manual adjustment. Gain changing allows the values of ratio of load inertia moment to servo motor inertia moment, position control gain 2, speed control gain 2 and speed integral compensation to be changed.

(2) Ratio of load inertia moment to servo motor inertia moment 2 (GD2B: DRU parameter No. 61)

Set the ratio of load inertia moment to servo motor inertia moment after changing. If the load inertia moment ratio does not change, set it to the same value as ratio of load inertia moment to servo motor inertia moment (DRU parameter No. 34).

(3) Position control gain 2 changing ratio (DRU parameter No. 62), speed control gain 2 changing ratio (DRU parameter No. 63), speed integral compensation changing ratio (DRU parameter No. 64)

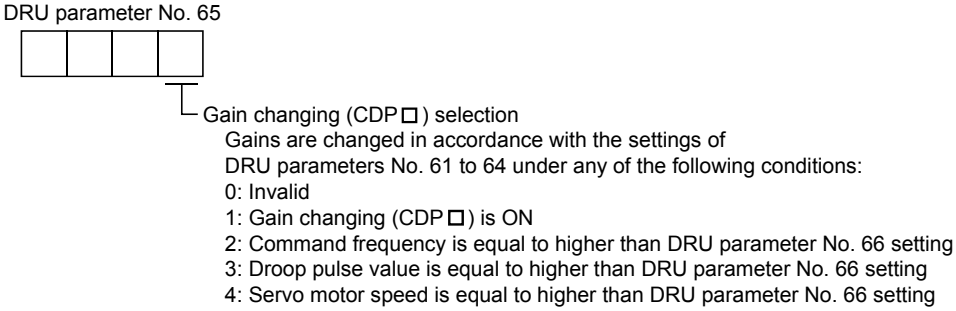
Set the values of after-changing position control gain 2, speed control gain 2 and speed integral compensation in ratio (%). 100% setting means no gain change.

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

Position control gain 2 = Position control gain 2 × Position control gain 2 changing ratio /100=180rad/s
Speed control gain 2 = Speed control gain 2 × Speed control gain 2 changing ratio /100 = 3000rad/s
Speed integral compensation = Speed integral compensation × Speed integral compensation changing ratio /100 = 16ms

(4) Gain changing selection (DRU parameter No. 65)

Used to set the gain changing condition. Choose the changing condition in the first digit. If you set "1" here, you can use the gain changing (CDP□) external input signal for gain changing. The gain changing (CDP□) can be assigned to the pins using DRU parameters No. 43 to 48.



(5) Gain changing condition (DRU parameter No. 66)

When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (DRU parameter No.65), set the gain changing level.

The setting unit is as follows:

Gain changing condition	Unit
Command frequency	kpps
Droop pulses	pulse
Servo motor speed	r/min

(6) Gain changing time constant (DRU parameter No. 67)

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

7.5.4 Gain changing operation

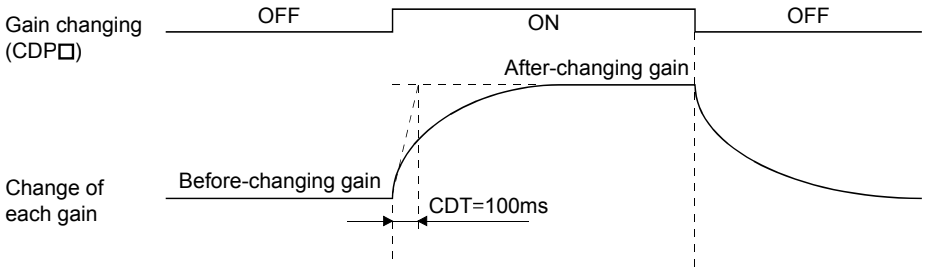
This operation will be described by way of setting examples.

(1) When you choose changing by external input

(a) Setting

DRU parameter No.	Abbreviation	Name	Setting	Unit
6	PG1	Position control gain 1	100	rad/s
36	VG1	Speed control gain 1	1000	rad/s
34	GD2	Ratio of load inertia moment to servo motor inertia moment	4	0.1 times
35	PG2	Position control gain 2	120	rad/s
37	VG2	Speed control gain 2	3000	rad/s
38	VIC	Speed integral compensation	20	ms
61	GD2B	Ratio of load inertia moment to servo motor inertia moment 2	100	0.1 times
62	PG2B	Position control gain 2 changing ratio	70	%
63	VG2B	Speed control gain 2 changing ratio	133	%
64	VICB	Speed integral compensation changing ratio	250	%
65	CDP	Gain changing selection	0001 (Changed by ON/OFF of pin CN1A-8)	
67	CDT	Gain changing time constant	100	ms

(b) Changing operation



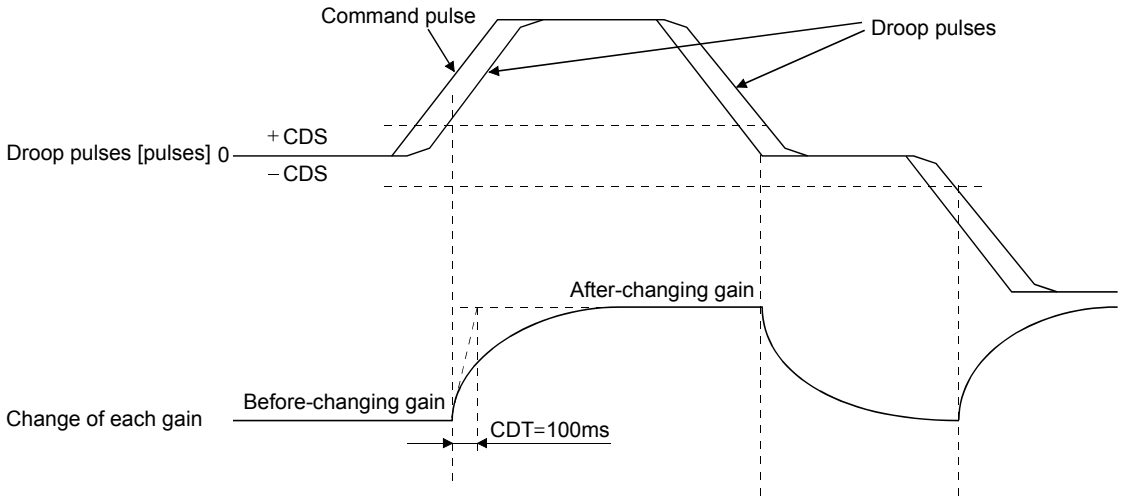
Position control gain 1	100			
Speed control gain 1	1000			
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→ 4.0
Position control gain 2	120	→	84	→ 120
Speed control gain 2	3000	→	4000	→ 3000
Speed integral compensation	20	→	50	→ 20

(2) When you choose changing by droop pulses

(a) Setting

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

(b) Changing operation



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

MEMO

8. INSPECTION

⚠ WARNING

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

POINT

- Do not test MELSERVO-J2M with a megger (measure insulation resistance), or it may become faulty.
- Do not disassemble and/or repair the equipment on customer side.

(1) Inspection

It is recommended to make the following checks periodically:

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

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

(2) Life

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

Part name	Life guideline
Smoothing capacitor	10 years
Relay	Number of power-on and number of forced Stop times:100,000times.
Cooling fan	10,000 to 30,000hours (2 to 3 years)
Absolute position battery unit	Refer to Section 13.2

(a) Smoothing capacitor

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

(b) Relays

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

(c) Drive unit cooling fan

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

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

MEMO

9. TROUBLESHOOTING

9.1 Trouble at start-up

> **CAUTION** ・Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

> **POINT**
> ・Using the optional MR Configurator (servo configuration software), you can refer to unrotated servo motor reasons, etc.

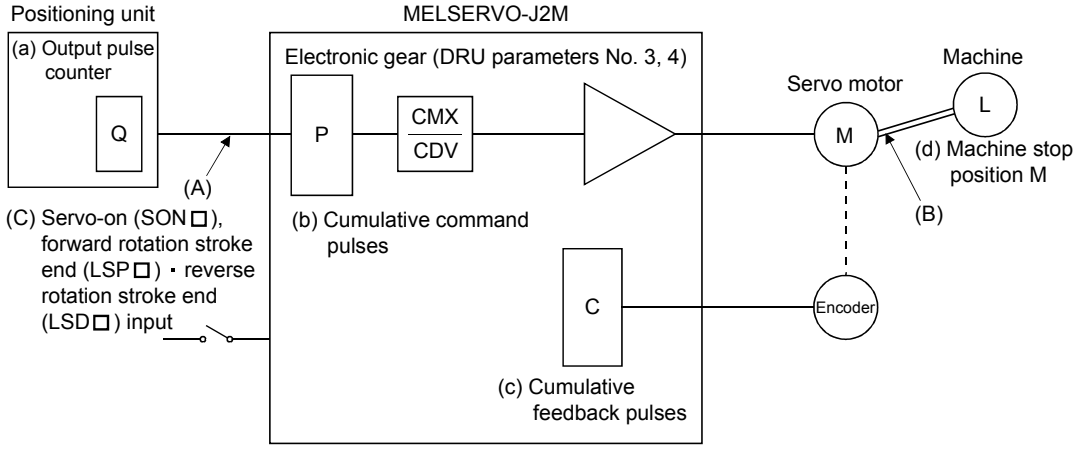
The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

(1) Troubleshooting

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・LED is not lit. ・LED flickers.	Not improved if connectors CN1A, CN1B, CN2 and CN3 are disconnected.	1. Power supply voltage fault 2. MELSERVO-J2M is faulty.	
			Improved when connectors CN1A and CN1B are disconnected.	Power supply of CNP1 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to Section 9.2 and remove cause.		Section 9.2
2	Switch on servo-on (SON□).	Alarm occurs.	Refer to Section 9.2 and remove cause.		Section 9.2
		Servo motor shaft is not servo-locked (is free).	1. Check the display to see if the servo amplifier is ready to operate. 2. Check the external I/O signal indication to see if the servo-on (SON□) is ON.	1. Servo-on (SON□) is not input. (Wiring mistake) 2. 24VDC power is not supplied to VIN.	Section 4.3.6
3	Enter input command. (Test operation)	Servo motor does not rotate.	Check cumulative command pulses.	1. Wiring mistake (a) For open collector pulse train input, 24VDC power is not supplied to OPC. (b) LSP□/LSN□-SG are not connected. 2. No pulses is input.	Section 4.3.2
		Servo motor run in reverse direction.		1. Mistake in wiring to controller. 2. Mistake in setting of DRU parameter No. 54.	Chapter 5

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
4	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 6
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 6
5	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	(2) in this section

(2) How to find the cause of position shift



When a position shift occurs, check (a) output pulse counter, (b) cumulative command pulse display, (c) cumulative feedback pulse display, and (d) machine stop position in the above diagram.
(A), (B) and (C) indicate position shift causes. For example, (A) indicates that noise entered the wiring between positioning unit and servo amplifier, causing pulses to be mis-counted.

In a normal status without position shift, there are the following relationships:

1) Q = P (positioning unit's output counter = servo amplifier's cumulative command pulses)

2) $P \cdot \frac{CMX(\text{parameter No.3})}{CDV(\text{parameter No.4})}$

= C (cumulative command pulses × electronic gear = cumulative feedback pulses)

3) $C \cdot \Delta\ell = M$ (cumulative feedback pulses × travel per pulse = machine position)

Check for a position shift in the following sequence:

1) When $Q \neq P$

Noise entered the pulse train signal wiring between positioning unit and servo amplifier, causing pulses to be miss-counted. (Cause A)

Make the following check or take the following measures:

- Check how the shielding is done.
- Change the open collector system to the differential line driver system.
- Run wiring away from the power circuit.
- Install a data line filter. (Refer to (2)(a) Section 12.2.6.)

2) When $P \cdot \frac{CMX}{CDV} \neq C$

During operation, the servo-on (SON□) or forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) was switched off or the clear (CR□) and the reset (RES□) switched on. (Cause C)

If a malfunction may occur due to much noise, increase the input filter setting (DRU parameter No. 1).

3) When $C \cdot \Delta\ell \neq M$

Mechanical slip occurred between the servo motor and machine. (Cause B)

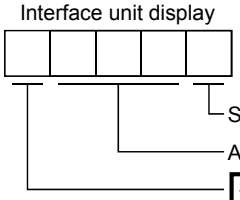
9.2 Alarms and warning list

> **POINT**
>
> ・The alarm/warning whose indication is not given does not exist in that unit.

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to Section 9.3 or 9.4 and take the appropriate action.
When an alarm occurs in any of slots 1 to 4, ALM_A-SG open. When an alarm occurs in any of slots 5 to 8, ALM_B-SG open.
The alarm can be canceled by turning the power OFF to ON.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

When an alarm/warning occurs, the interface unit display shows the corresponding unit and alarm number.



Symbol	Definition (Slot)
F	Interface unit
1	First slot
2	Second slot
3	Third slot
4	Fourth slot
5	Fifth slot
6	Sixth slot
7	Seventh slot
8	Eight slot

	Display	Name	Alarm deactivation		
			Power OFF→ON	Press "SET" on current alarm screen.	Reset (RES)
Alarms	A.10	Undervoltage	○	○	○
	A.12	Memory error 1	○		
	A.13	Clock error	○		
	A.15	Memory error 2	○		
	A.16	Encoder error 1	○		
	A.17	Board error	○		
	A.19	Memory error 3	○		
	A.1A	Servo motor combination error	○		
	A.1C	Base unit bus error 1	○		
	A.1D	Base unit bus error 2	○		
	A.1E	Drive unit mounting error	○		
	A.20	Encoder error 2	○		
	A.24	Main circuit error	○	○	
	A.25	Absolute position erase	○		
	A.30	Regenerative error	○ (Note 1)	○ (Note 1)	○ (Note 1)
	A.31	Overspeed	○		○
	A.32	Overcurrent	○		○
	A.33	Overvoltage	○	○	○
	A.35	Command pulse frequency error	○		○
	A.37	IFU parameter error	○		
		DRU parameter error	○		○
	A.45	Main circuit device overheat	○ (Note 1)		○ (Note 1)
	A.46	Servo motor overheat	○ (Note 1)		○ (Note 1)
	A.50	Overload 1	○ (Note 1)		○ (Note 1)
	A.51	Overload 2	○ (Note 1)		○ (Note 1)
	A.52	Error excessive	○		○
	A.53	Multiple axis overload	○	○	○
	A.54	Drive unit alarm	○ (Note 2)	○ (Note 2)	○ (Note 2)
	A.78	Option slot fault			
	A.79	Option slot loading error			
	A.8A	Serial communication time-out	○	○	○
	A.8E	Serial communication error	○	○	○
	88888	Watchdog	○		
Warnings	A.92	Open battery cable warning	Removing the cause of occurrence deactivates the alarm automatically.		
	A.96	Home position setting warning			
	A.9F	Battery warning			
	A.E0	Excessive regenerative warning			
	A.E1	Overload warning			
	A.E3	Absolute position counter warning			
	A.E6	Servo forced stop warning			
	A.E9	Main circuit off warning			

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

2. Automatically deactivated when the alarm of the drive unit is reset.

9.3 Remedies for alarms

⚠ CAUTION

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.
- If an absolute position erase (A.25) occurred, always make home position setting again. Otherwise, misoperation may occur.
- As soon as an alarm occurs, turn off Servo-on (SON□) and power off the main circuit.

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, each unit and servo motor may become faulty.
- Regenerative error (A.30)
- Overload 2 (A.51)
- Overload 1 (A.50)
- The alarm can be deactivated by switching power off, then on press the "SET" button on the interface unit current alarm screen or by turning on the reset (RES□). For details, refer to Section 9.2.

When an alarm occurs, the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No. The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. The optional MR Configurator (servo configuration software) may be used to refer to the cause.

@ in the Indication field denotes the slot number of the base unit.

Display		Name	Definition	Cause	Action
IFU	DRU				
FA.10		Undervoltage	Power supply voltage fell to or below 160VAC.	1. Power supply voltage is low.	Review the power supply.
				2. There was an instantaneous control circuit power failure of 30ms or longer.	
				3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
				4. Power was restored after the bus voltage had dropped to 200VDC. (Main circuit power switched on within 5s after it had switched off.)	
				5. Faulty parts in the base unit. Checking method Alarm (A.10) occurs if interface unit is changed.	Change the base unit.
				6. Faulty parts in interface unit. Checking method Alarm (A.10) occurs if base unit is changed.	Change the interface unit.
				7. CNP3 or CNP1B connector unplugged.	Connect properly.
FA.12		Memory error 1	RAM, memory fault	Faulty parts in the interface unit. Checking method Alarm (any of A.11 and 13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the interface unit.
FA.13		Clock error	Printed board fault.		
FA.15		Memory error 2	EEP-ROM fault		

Display		Name	Definition	Cause	Action
IFU	DRU				
	@A.12@	Memory error 1	RAM, memory fault	1. Faulty parts in the drive unit Checking method Alarm (A.15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the drive unit.
	@A.13@	Clock error	Printed board fault.		
	@A.15@	Memory error 2	EEP-ROM fault	2. The number of write times to EEP-ROM exceeded 100,000.	
	@A.16@	Encoder error 1	Communication error occurred between encoder and servo amplifier.	1. Encoder connector (CN2) disconnected.	Connect correctly.
				2. Encoder fault.	Change the servo motor.
				3. Encoder cable faulty. (Wire breakage or shorted)	Repair or change cable.
	@A.17@	Board error 2	CPU/parts fault	1. Faulty parts in the drive unit. Checking method Alarm (A.17) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the drive unit.
			The output terminals U, V, W of the drive unit and the input terminals U, V, W of the servo motor are not connected.	2. The wiring of U, V, W is disconnected or not connected.	Correctly connect the output terminals U, V, W of the drive unit and the input terminals U, V, W of the servo motor.
FA.19	@A.19@	Memory error 3	ROM memory fault	Faulty parts in the interface unit or drive unit. Checking method Alarm (A.19) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the interface unit or drive unit.
	@A.1A@	Servo motor combination error	Wrong combination of drive unit and servo motor.	Wrong combination of drive unit and servo motor connected.	Use correct combination.
FA.1C		Base unit bus error 1	There is error in communication between interface unit and drive unit.	1. Interface unit connection fault.	Connect the interface unit to the base unit properly.
				2. Interface unit failure.	Change the interface unit.
				3. Base unit failure.	Change the base unit.
FA.1D		Base unit bus error 2	There is error in communication between interface unit and drive unit.	1. Drive unit connection fault.	Connect the drive unit to the base unit properly.
				2. Drive unit failure.	Change the drive unit.
				3. Base unit failure.	Change the base unit.
FA.1E		Drive unit mounting error	Drive unit came off the base unit after initialization.	1. Drive unit connection fault.	Connect the drive unit to the base unit properly.
				2. Base unit failure.	Change the base unit.
				3. Faulty parts in drive unit. Checking method Alarm (A.1E) occurs if power is switched on after disconnection of the U, V, W power cables.	Change the drive unit.
	@A.20@	Encoder error 2	Communication error occurred between encoder and drive unit.	1. Encoder connector (CN2) disconnected.	Connect correctly.
				2. Encoder fault.	Change the servo motor.
				3. Encoder cable faulty. (Wire breakage or shorted)	Repair or change cable.

Display		Name	Definition	Cause	Action
IFU	DRU				
	@A.24@	Main circuit error	Ground fault occurred at the servo motor outputs (U,V and W phases) of the drive unit.	1. Power input wires and servo motor output wires are in contact at CNP2.	Connect correctly.
				2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
				3. Main circuit of drive unit failed. Checking method Alarm (A.24) occurs if power is switched on after disconnection of the U, V, W power cables.	Change the drive unit.
	@A.25@	Absolute position erase	Absolute position data in error.	1. Battery voltage low.	Change battery. Always make home position setting again.
				2. Battery cable or battery is faulty.	
			Power was switched on for the first time in the absolute position detection system.	3. Super capacitor of the absolute position encoder is not charged.	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
FA.30		Regenerative alarm	Permissible regenerative power of the regenerative brake option is exceeded.	1. Mismatch between used regenerative brake option and IFU parameter No. 1 setting.	Set correctly.
				2. 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.
				4. Power supply voltage rose to or above 260VAC.	Review power supply.
				5. Regenerative brake option faulty.	Change regenerative brake option.
			Regenerative transistor fault	6. 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 drive unit.

Display		Name	Definition	Cause	Action
IFU	DRU				
	@A.31@	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency is too high.	Set the command pulse 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. Reset servo gain to proper value. 2. If servo gain cannot be set to proper value: 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
				4. Electronic gear ratio is large. (DRU parameter No. 3 ▪ 4)	Set correctly.
				5. Encoder faulty.	Change the servo motor.
	@A.32@	Overcurrent	Current that flew is higher than the permissible current of the drive unit.	1. Short occurred in drive unit output phases U, V and W.	Correct the wiring.
				2. Transistor of the servo drive unit faulty. Checking method Alarm (A.32) occurs if power is switched on after disconnection of the U, V, W power cables.	Change the drive unit.
				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.
FA.33		Overvoltage	Converter bus voltage exceeded 400VDC.	1. Regenerative brake option is not used.	Use the regenerative brake option.
				2. Though the regenerative brake option is used, the IFU parameter No. 1 setting is "□□00 (not used)".	Make correct setting.
				3. Regenerative brake option is open or disconnected.	1. Change lead. 2. Connect correctly.
				4. Regenerative transistor faulty.	Change drive unit.
				5. Wire breakage of regenerative brake option.	For wire breakage of regenerative brake option, change regenerative brake option.
				6. Power supply voltage high.	Review the power supply.
	@A.35@	Command pulse frequency error	Input frequency of command pulse is too high.	1. Command given is greater than the maximum speed of the servo motor.	Review operation program.
				2. Noise entered bus cable.	Take action against noise.
				3. Servo system controller failure.	Change the servo system controller.

Display		Name	Definition	Cause	Action
IFU	DRU				
FA.37		IFU parameter error	IFU parameter setting is wrong.	1. Interface unit fault caused the IFU parameter setting to be rewritten.	Change the interface unit.
				2. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, program write, etc.	Change the interface unit
	@A.37@	DRU parameter error	DRU parameter setting is wrong.	1. Drive unit fault caused the DRU parameter setting to be rewritten.	Change the drive unit.
				2. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, program write, etc.	Change the drive unit.
	@A.45@	Main circuit device overheat	Main circuit device overheat.	1. Drive unit faulty.	Change the drive unit.
				2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
				3. Air cooling fan of drive unit stops.	1. Change the drive unit or cooling fan. 2. Reduce ambient temperature.
	@A.46@	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃.	Review environment so that ambient temperature is 0 to 40℃.
				2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
				3. Thermal sensor in encoder is faulty.	Change servo motor.
	@A.50@	Overload 1	Load exceeded overload protection characteristic of servo amplifier.	1. Drive unit is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
				2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response level 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. Drive unit's output U, V, W do not match servo motor's input U, V, W.	Connect correctly.
				5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.

Display		Name	Definition	Cause	Action
IFU	DRU				
	@A.51@	Overload 2	Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked: 0.3s or more During rotation: 2.5s or more	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
				2. Wrong connection of servo motor. Drive unit's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
				3. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
				4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
	@A.52@	Error excessive	The difference between the model position and the actual servo motor position exceeds 2.5 rotations. (Refer to the function block diagram in Section 1.2)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/ deceleration time constant.
				2. Torque limit value (DRU 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 (DRU parameter No.36) value is small.	Increase set value and adjust to ensure proper operation.
				5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
				6. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
				7. Encoder faulty.	Change the servo motor.
				8. Wrong connection of servo motor. Drive unit's output U, V, W do not match servo motor's input U, V, W.	Connect correctly.

Display		Name	Definition	Cause	Action
IFU	DRU				
FA.53		Multiple axis overload	Drive unit whose effective load factor is 85% or more is adjacent.	1. Drive unit having large load is adjacent.	1. Change the slot of the drive unit whose load is large. 2. Reduce the load. 3. Reexamine the operation pattern. 4. Use a servo motor whose output is large.
				2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration and perform auto tuning. 2. Change the response setting of auto tuning. 3. Turn off auto tuning and make gain adjustment manually.
				3. Encoder cable and power cable (U, V, W) coming out of one drive unit are connected to the incorrect servo motor.	Make correct connection.
FA.54		Drive unit alarm	Alarm occurred in one or more axes of drive units installed to the base unit.	Alarm occurred in one or more axes of drive units installed to the base unit.	Remove the alarm causes of all drive units where alarm has occurred.
FA.78		Option slot fault	Extension IO unit is faulty.	1. Extension IO unit is not inserted properly.	Insert correctly.
				2. Incompatibility with the extension IO unit.	Change the interface unit for the one compatible with the extension IO unit.
				3. Extension IO unit is faulty.	Change the extension IO unit.
				4. Base unit is faulty.	Change the base unit.
FA.79		Option slot loading error	Extension IO unit is connected improperly.	Extension IO unit is disconnected.	Switch power off and reinsert the extension IO unit.
FA.8A		Serial communication time-out	Serial communication stopped for longer than the time set in IFU parameter No.20.	1. Communication cable fault. (Wire break or short circuit)	Repair or change the cable.
				2. Communication cycle is longer than the IFU parameter No.20 setting.	Set the IFU parameter value correctly.
				3. Protocol is incorrect.	Correct the protocol.
FA.8E		Serial communication error	Serial communication error occurred between interface unit and communication device (e.g. personal computer).	1. Communication cable fault. (Open cable or short circuit)	Repair or change the cable.
				2. Communication device (e.g. personal computer) faulty.	Change the communication device (e.g. personal computer).
88888		Watchdog	CPU, parts faulty	Fault of parts in interface unit. Checking method Alarm (8888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change interface unit.

9.4 Remedies for warnings

⚠ CAUTION

- If an absolute position counter warning (A.E3) occurred, always make home position setting again. Otherwise, misoperation may occur.

POINT

- When any of the following alarms has occurred, do not resume operation by switching power of the servo amplifier OFF/ON repeatedly. The servo amplifier and servo motor may become faulty. If the power of the servo amplifier is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
- Excessive regenerative warning (A.E0)
- Overload warning 1 (A.E1)

If servo forced stop warning (A.E6) or main circuit off warning (A.E9) occurs, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed. Eliminate the cause of the warning according to this section. Use the optional MR Configurator (servo configuration software) to refer to the cause of warning.
@ in the Indication field denotes the slot number of the base unit.

Display		Name	Definition	Cause	Action
IFU	DRU				
	@A.92@	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or changed.
				2. Battery voltage supplied from the battery unit to the encoder fell to about 3.2V or less. (Detected with the encoder)	Change battery unit.
				3. Encoder cable is open.	Change the encoder cable.
	@A.96@	Home position setting warning	Home position return could not be made in the precise position.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence.
				2. Home position return was executed during operation command.	Reduce creep speed.
				3. Creep speed high.	
FA.9F		Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the servo amplifier)	Change the battery unit.
FA.E0		Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of regenerative brake option.	Regenerative power increased to 85% or more of permissible regenerative power of regenerative brake option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenerative 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 A.50, A.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.
			The multi-revolution counter value of the absolute position encoder exceeded the maximum revolution range.	3. The movement amount from the home position exceeded a 32767 rotation or -37268 rotation in succession.	Make home position setting again.
FA.E6		Servo forced stop warning	EMG_□-SG are open.	External forced stop was made valid. (EMG_□-SG opened.)	Ensure safety and deactivate forced stop.
FA.E9		Main circuit off warning	Servo-on (SON□) was turned on with main circuit power off.		Switch on main circuit power.

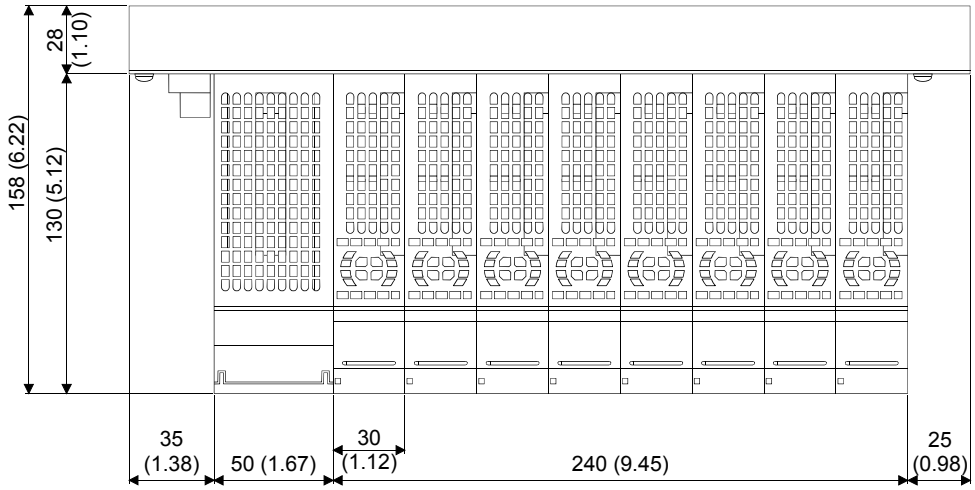
MEMO

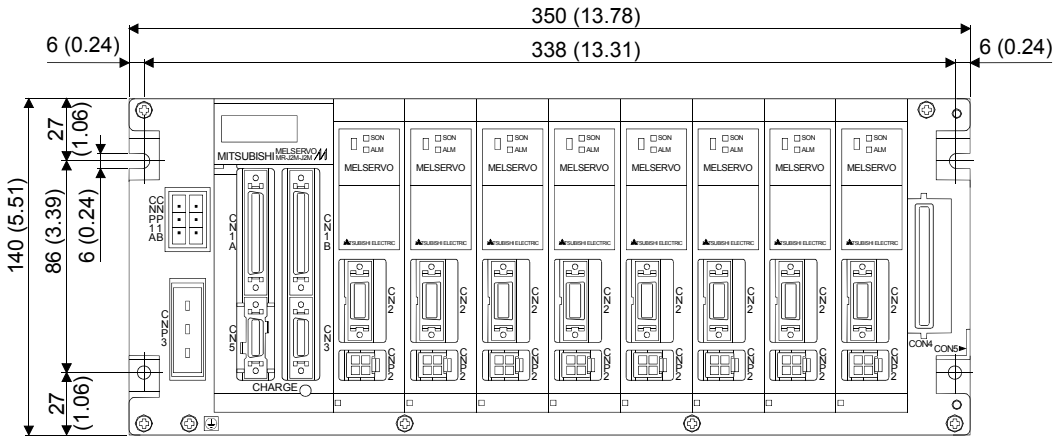
10. OUTLINE DRAWINGS

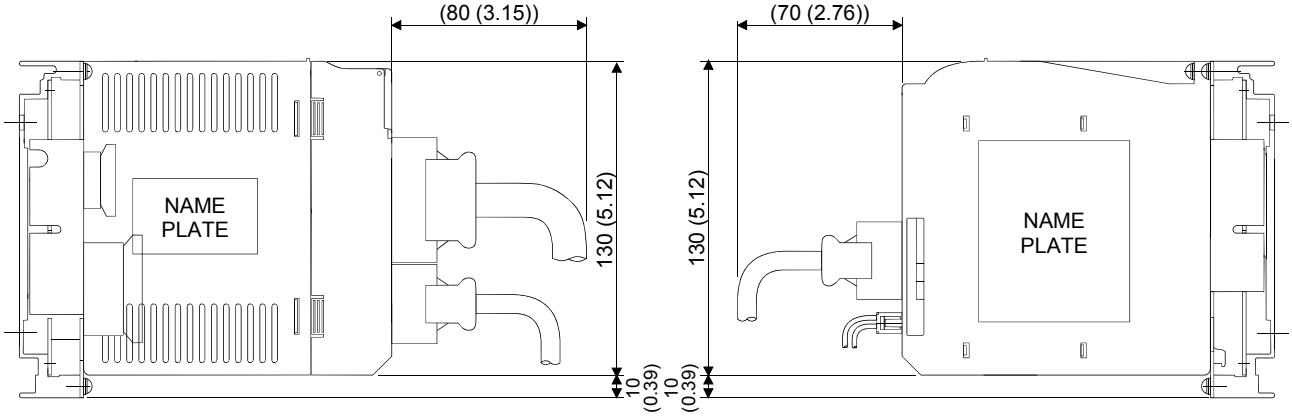
10.1 MELSERVO-J2M configuration example

The following diagram shows the MR-J2M-BU8 base unit where one interface unit and eight drive units are installed.

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





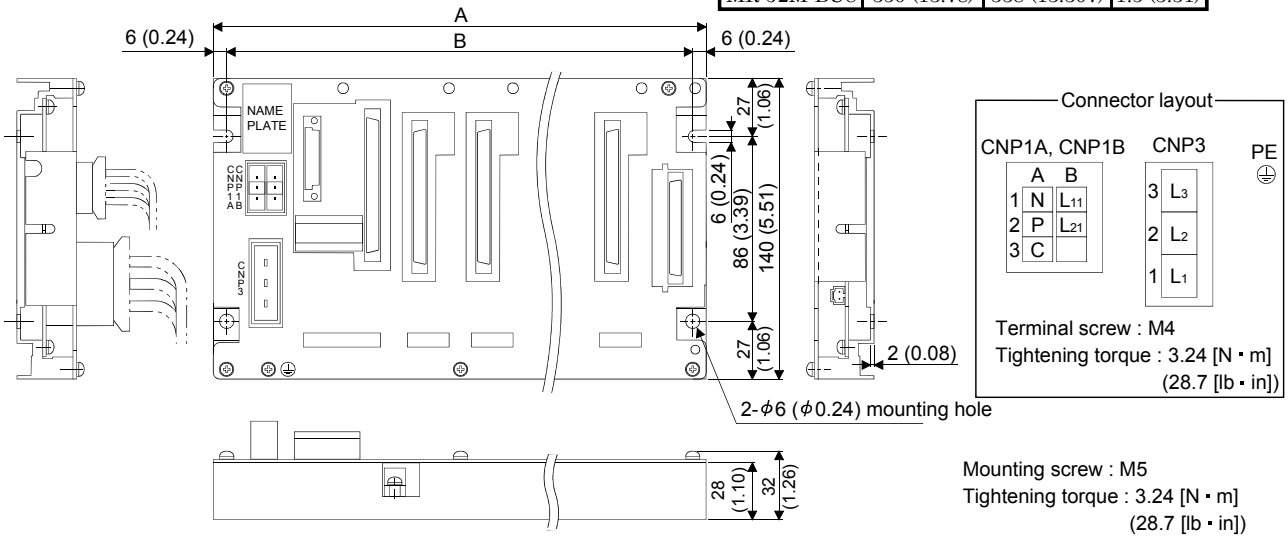


10.2 Unit outline drawings

10.2.1 Base unit (MR-J2M-BU□)

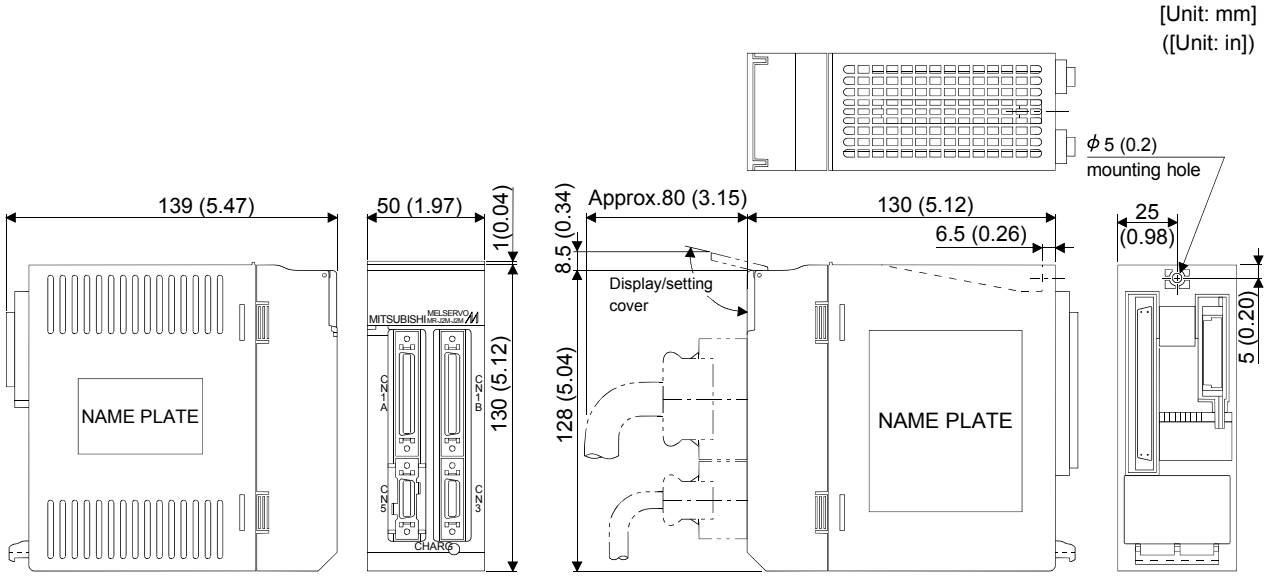
[Unit: mm]
([Unit: in])

Base Unit	Variable Dimensions		Mass [kg]([lb])
	A	B	
MR-J2M-BU4	230 (9.06)	218 (8.58)	1.1 (2.43)
MR-J2M-BU6	290 (11.42)	278 (10.95)	1.3 (2.87)
MR-J2M-BU8	350 (13.78)	338 (13.307)	1.5 (3.31)



10.2.2 Interface unit (MR-J2M-P8A)

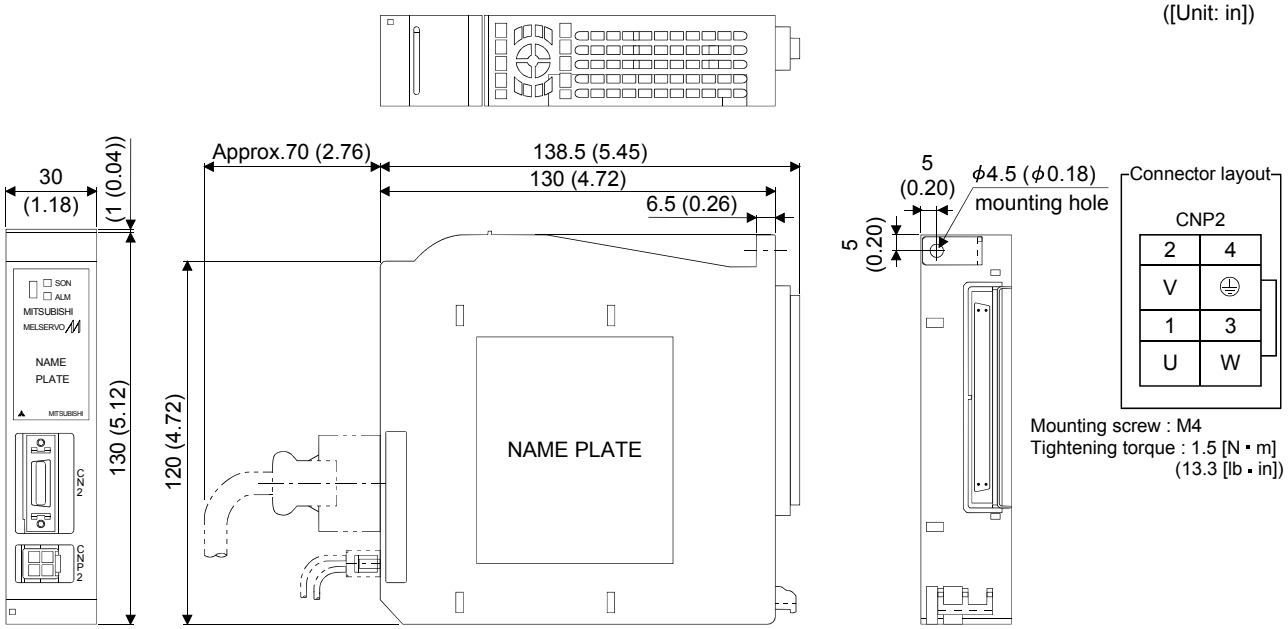
[Unit: mm]
([Unit: in])



10.2.3 Drive unit (MR-J2M-□DU)

(1) MR-J2M-10DU to MR-J2M-40DU

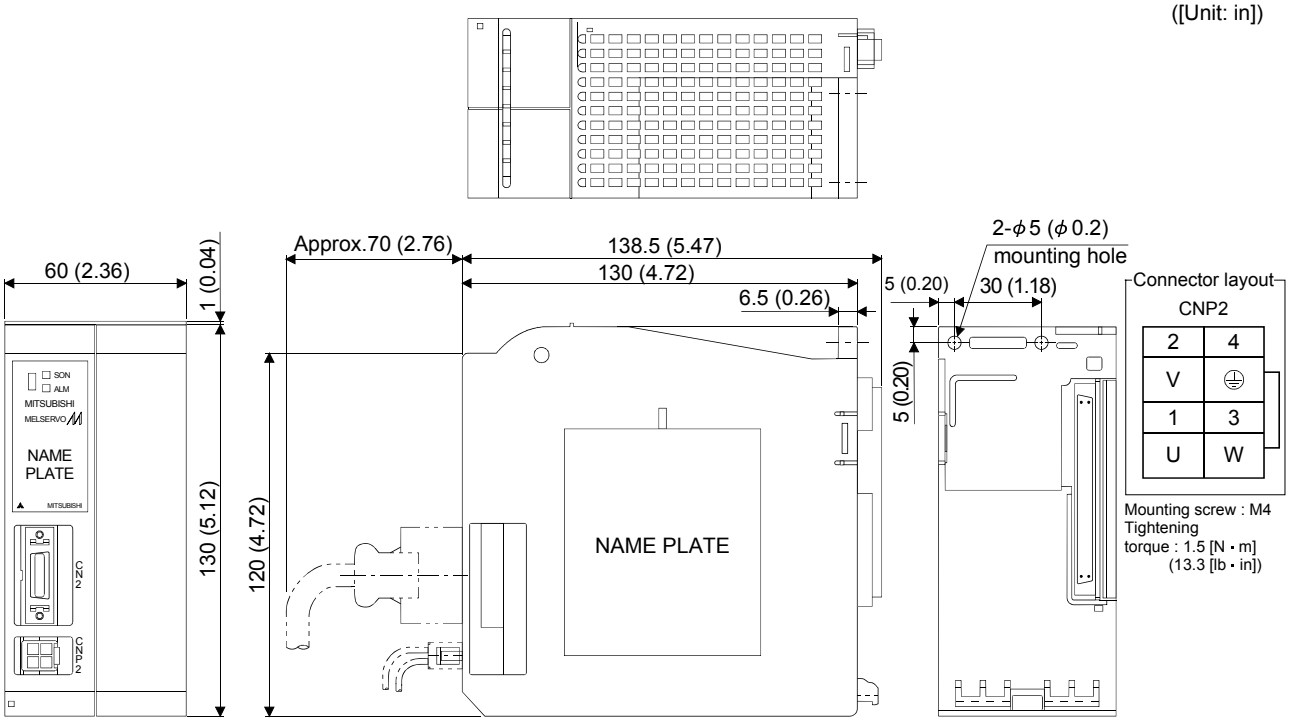
[Unit: mm]
([Unit: in])



Mass: 0.4kg (0.88lb)

(2) MR-J2M-70DU

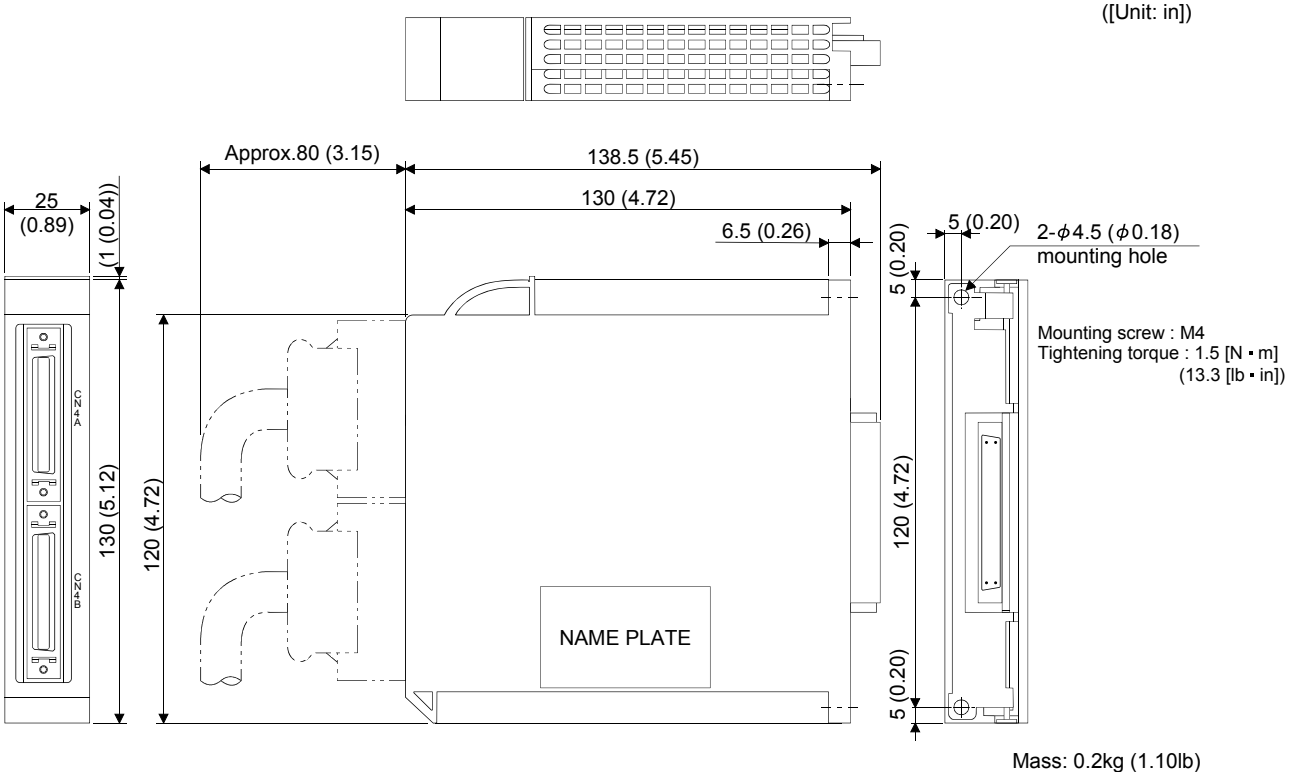
[Unit: mm]
([Unit: in])



Mass: 0.7kg (1.54lb)

10.2.4 Extension IO unit (MR-J2M-D01)

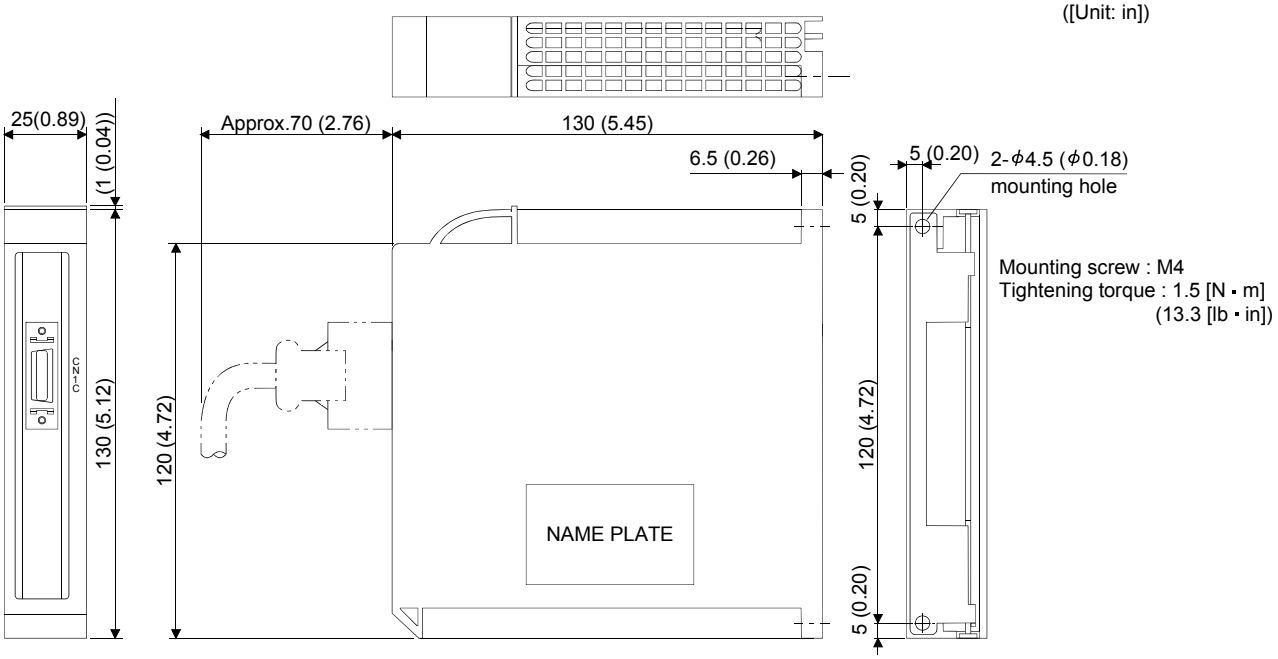
[Unit: mm]
([Unit: in])



Mass: 0.2kg (1.10lb)

10.2.5 Battery unit (MR-J2M-BT)

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



Mass: 0.3kg (0.66lb)

10.3 Connectors

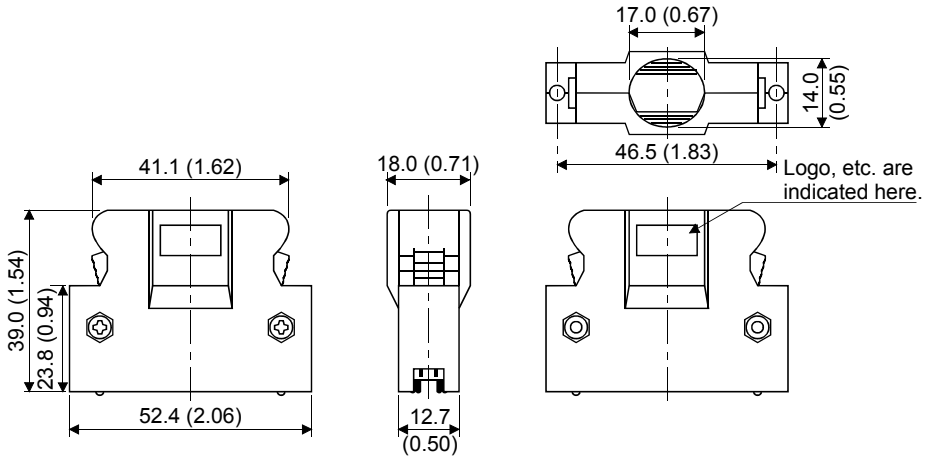
(1) CN1A・CN1B・CN4A・CN4B connector

<3M>

(a) Soldered type

Model Connector : 10150-3000VE
Shell kit : 10350-52F0-008

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

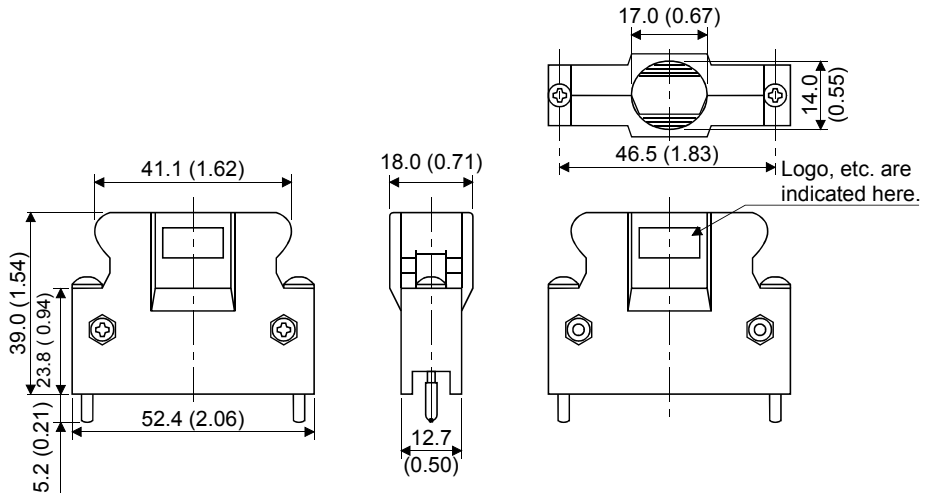


(b) Threaded type

Model Connector : 10150-3000VE
Shell kit : 10350-52A0-008

Note. This is not available as option and should be user-prepared.

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



(2) CN2・CN3 connector

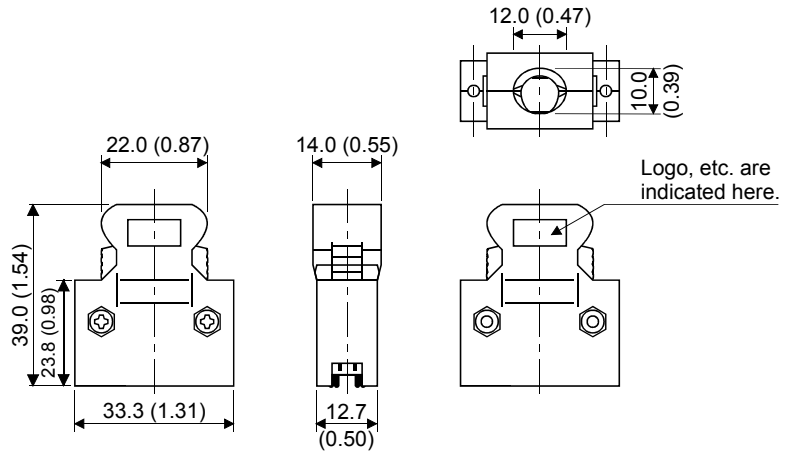
<3M>

(a) Soldered type

Model Connector : 10120-3000VE

Shell kit : 10320-52F0-008

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



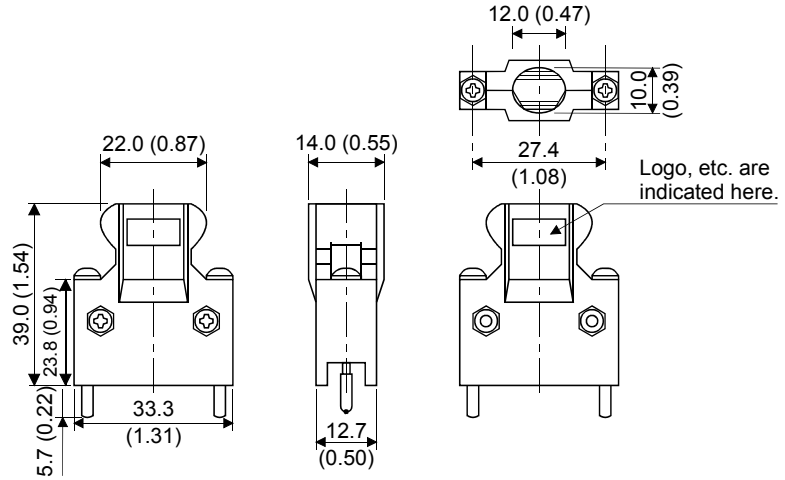
(b) Threaded type

Model Connector : 10120-3000VE

Shell kit : 10320-52A0-008

Note. This is not available as option and should be user-prepared.

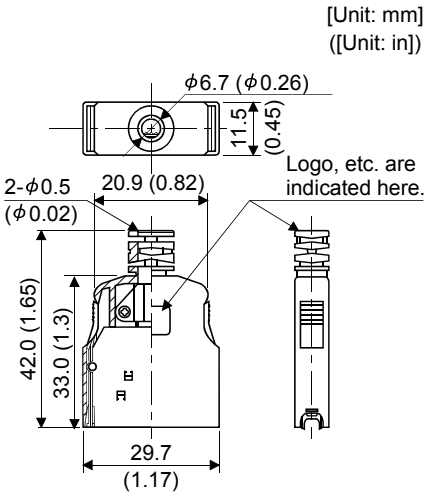
[Unit: mm]
([Unit: in])



(c) Insulation displacement type

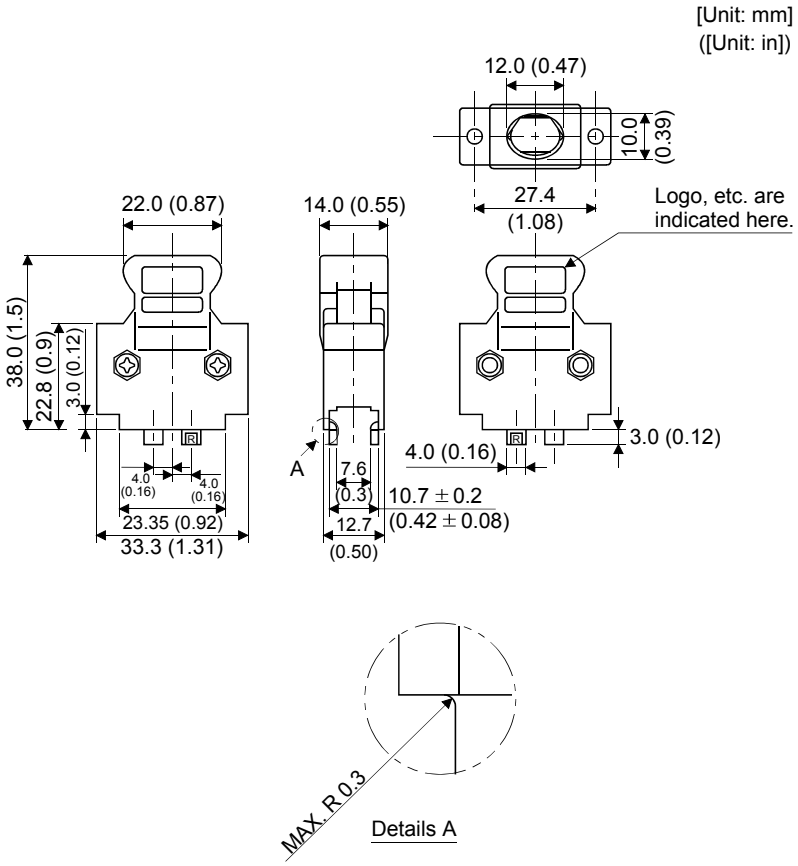
Model Connector : 10120-6000EL

Shell kit : 10320-3210-000



(3) CN5 connector

<3M>



(4) CNP1A/CNP1B connector

<Tyco Electronics>

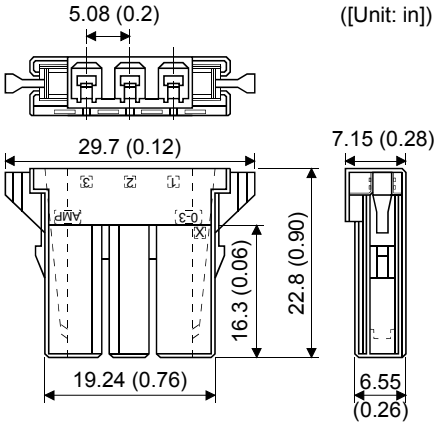
Model CNP1A housing : 1-178128-3

CNP1B housing : 2-178128-3

Contact : 917511-2 (max. sheath OD: ϕ 2.8 [mm] (ϕ 0.11 [in]))
353717-2 (max. sheath OD: ϕ 3.4 [mm] (ϕ 0.13 [in]))

Applicable tool : 91560-1 (for 917511-2)
937315-1 (for 353717-2)

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



(5) CNP3 connector

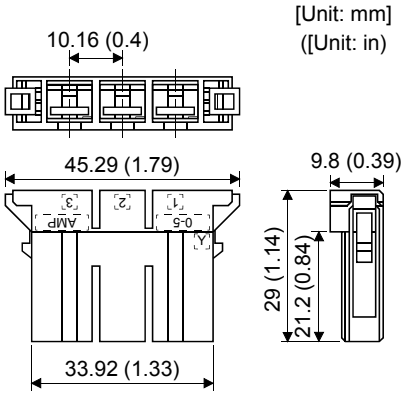
<AMP>

Model Housing : 1-179958-3

Contact : 316041-2

Applicable tool : 234171-1

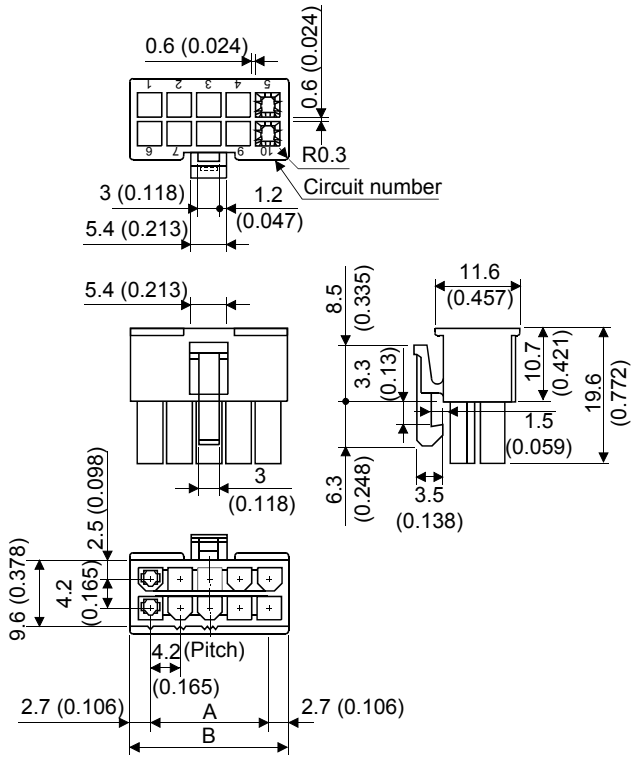
[Unit: mm]
([Unit: in)



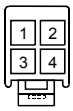
(6) Connectors for CNP2

<molex>

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



Layout diagrams classified by the number of poles

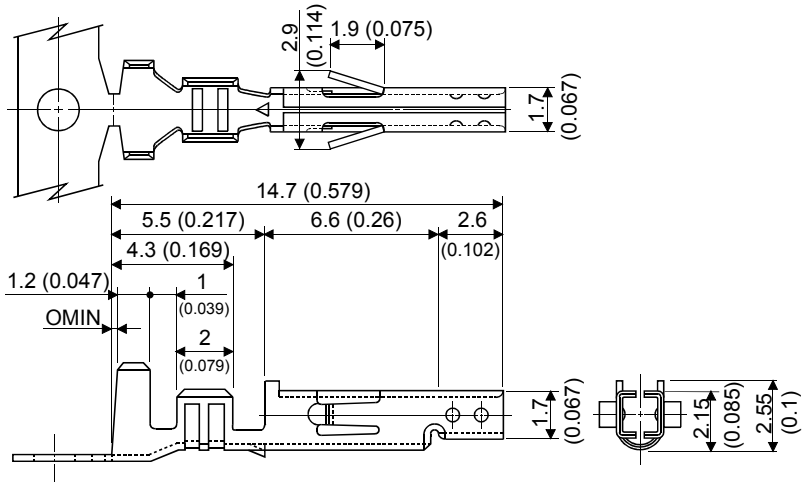


4 poles

Model	Variable Dimensions	
	A	B
5557-04R	4.2 (0.165)	9.6 (0.378)

Terminal
Model: 5556

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



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

Exclusive tools

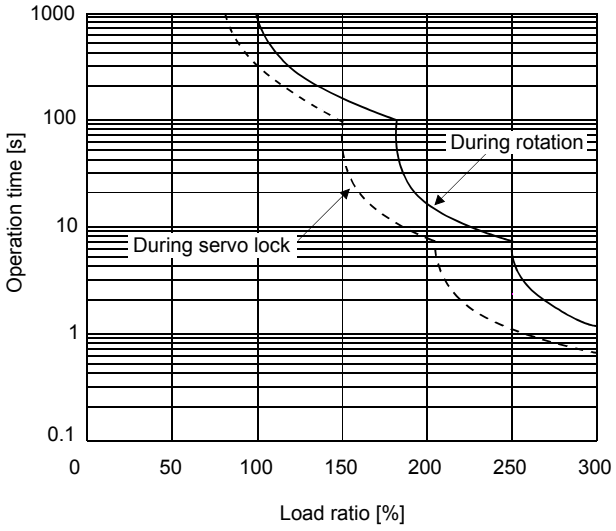
Terminal	Wire specifications		Tool number
	Core size	Sheath OD [mm(inch)]	
5556-PBL	AWG18 to AWG24	1.5 to 2.2 (0.06 to 0.09)	57026-5000
		2.3 to 3.1 (0.06 to 0.12)	57027-5000
5556-PBT2L	AWG28		57064-5000
5556-PBT3L	AWG16		57022-5300

MEMO

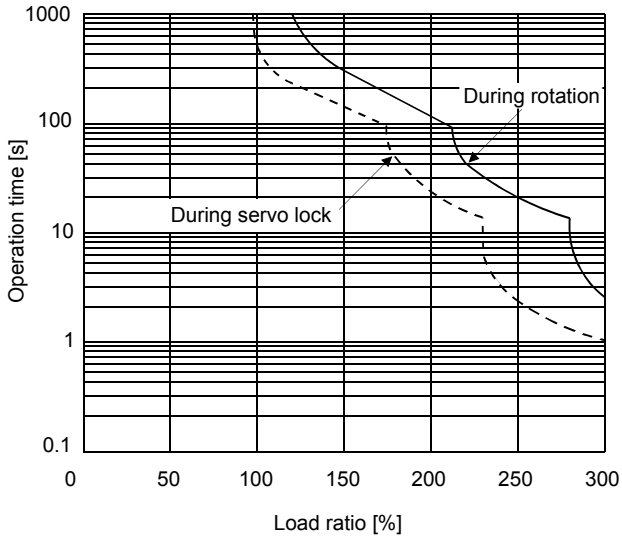
11. CHARACTERISTICS

11.1 Overload protection characteristics

An electronic thermal relay is built in the drive unit to protect the servo motor and drive unit from overloads.
Overload 1 alarm (A.50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 11.1. Overload 2 alarm (A.51) occurs if the maximum current flows continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.
In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.
The overload protection characteristic is about 20% lower than that of the MELSERVO-J2-Super series. However, operation at the 100% continuous rating can be performed.



a. MR-J2M-10DU to MR-J2M-40DU



b. MR-J2M-70DU

Fig 11.1 Electronic thermal relay protection characteristics

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the servo amplifier may fail even when the electronic thermal relay protection is not activated.

11.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the drive unit

Table 11.1 indicates drive unit's power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 11.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo off according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the drive unit's generated heat will not change.

Table 11.1 Power supply capacity and generated heat at rated output

Unit	Servo motor	(Note 1) Power supply capacity[kVA]	(Note 2) Generated heat[W]		Area required for heat dissipation	
			At rated torque	At servo off	[m²]	[ft²]
MR-J2M-10DU	HC-KFS053・13	0.3	11	6	0.2	2.16
	HC-MFS053・13	0.3	11	6	0.2	2.16
	HC-UFS13	0.3	11	6	0.2	2.16
MR-J2M-20DU	HC-KFS23	0.5	14	6	0.3	3.24
	HC-MFS23	0.5	14	6	0.3	3.24
	HC-UFS23	0.5	14	6	0.3	3.24
MR-J2M-40DU	HC-KFS43	0.9	20	6	0.4	4.32
	HC-MFS43	0.9	20	6	0.4	4.32
MR-J2M-70DU	HC-KFS73	1.3	40	6	0.7	7.54
	HC-MFS73	1.3	40	6	0.7	7.54
	HC-UFS73	1.3	40	6	0.7	7.54
MR-J2M-P8A		0.1	9	9	0.2	2.16
MR-J2M-BU4		0	4	4	0.1	1.08
MR-J2M-BU6		0	4	4	0.1	1.08
MR-J2M-BU8		0	4	4	0.1	1.08

Note 1. Note that the power supply capacity will vary according to the power supply impedance.
This value applies to the case where the power factor improving reactor is not used.

2. Heat generated during regeneration is not included in the drive unit-generated heat. To calculate heat generated by the regenerative brake option, use Equation 12.1 in Section 12.1.1.

(2) Heat dissipation area for enclosed drive unit

The enclosed control box (hereafter called the control box) which will contain the drive unit should be designed to ensure that its temperature rise is within +10℃ (50℉) at the ambient temperature of 40℃. (With a 5℃ (41℉) safety margin, the system should operate within a maximum 55℃ (131℉) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 11.1:

$$A = \frac{P}{K \cdot \Delta T} \quad \text{.....(11.1)}$$

where, A : Heat dissipation area [m²]
P : Loss generated in the control box [W]
ΔT : Difference between internal and ambient temperatures [℃]
K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 11.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 11.1 for heat generated by the drive unit. "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 11.1 lists the enclosure dissipation area for each drive unit when the drive unit is operated at the ambient temperature of 40℃ (104℉) under rated load.

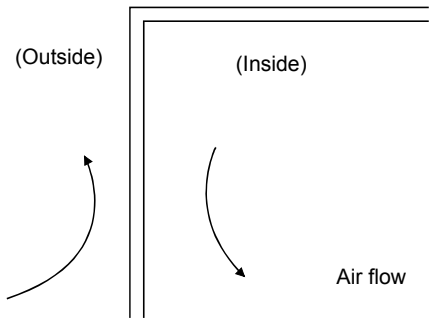


Fig. 11.2 Temperature distribution in enclosure

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.

11.3 Dynamic brake characteristics

Fig. 11.4 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 11.2 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. 11.4)

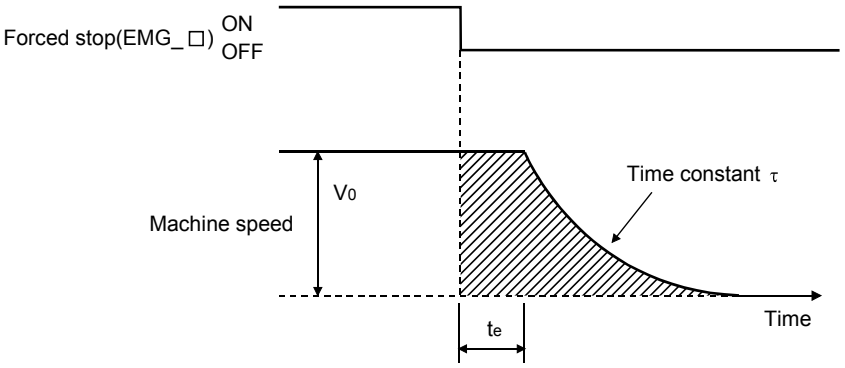
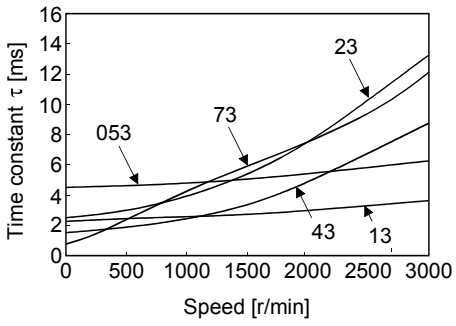


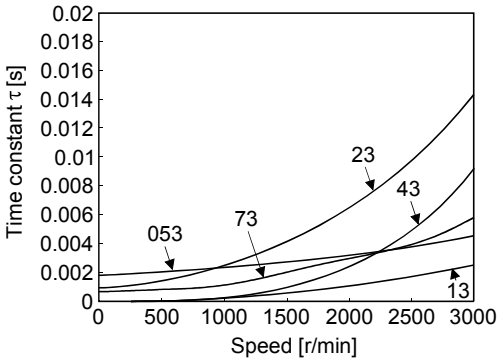
Fig. 11.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad (11.2)$$

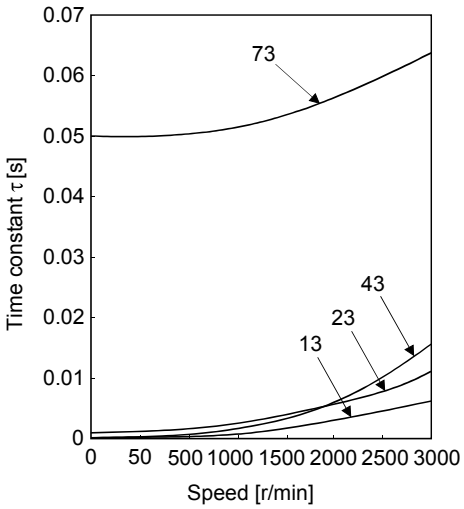
L_{max} : Maximum coasting distance ..... [mm][in]
V_0 : Machine rapid feedrate ..... [mm/min][in/min]
J_M : Servo motor inertial moment ..... [kg · cm²][oz · in²]
J_L : Load inertia moment converted into equivalent value on servo motor shaft ..... [kg · cm²][oz · in²]
τ : Brake time constant ..... [s]
t_e : Delay time of control section ..... [s]
(There is internal relay delay time of about 30ms.)



a. HC-KFS series



b. HC-MFS series



c. HC-UFS3000r/min series

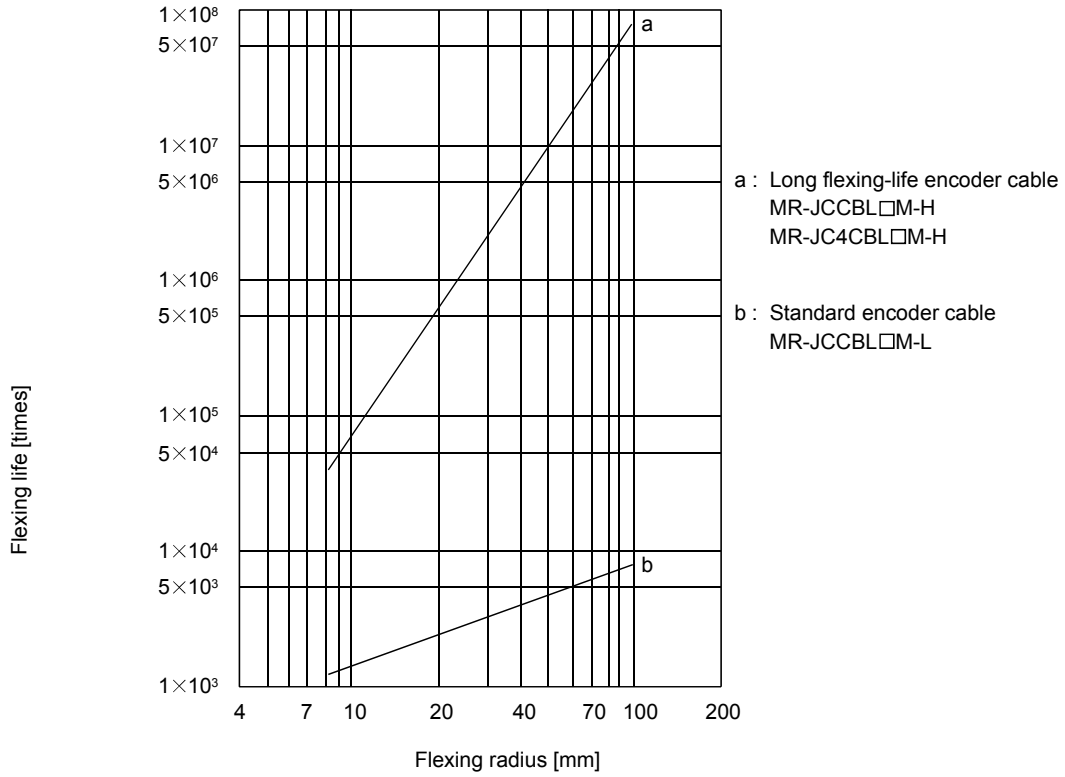
Fig. 11.4 Dynamic brake time constant

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

Drive unit	Load inertia moment ratio [times]
MR-J2M-10DU MR-J2M-20DU MR-J2M-40DU MR-J2M-70DU	30

11.4 Encoder cable flexing life

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



12. OPTIONS AND AUXILIARY EQUIPMENT

⚠ WARNING

- Before connecting any option or auxiliary equipment, make sure that the charge lamp is off more than 15 minutes after power-off, then confirm the voltage with a tester or the like. Otherwise, you may get an electric shock.

⚠ CAUTION

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

12.1 Options

12.1.1 Regenerative brake options

⚠ CAUTION

- The specified combinations of regenerative brake options and base units may only be used. Otherwise, a fire may occur.

(1) Combinations and regenerative powers

The power values in the table are resistor-generated powers and not rated powers.

Base unit	Regenerative power [W]			
	MR-RB032 [40Ω]	MR-RB14 [26Ω]	MR-RB34 [26Ω]	MR-RB54 [26Ω]
MR-J2M-BU4 MR-J2M-BU6 MR-J2M-BU8	30	100	300	500

(2) Selection of regenerative brake option

(a) Simple judgment of regenerative brake option necessity

The MELSERVO-J2M series does not contain a regenerative brake resistor. Check whether the regenerative brake option is needed or not in the following method.

1) Requirements

The drive units mounted to the same base unit are all horizontal axes.

The operation pattern is clear and the load inertia moments of the axes to be decelerated simultaneously are clear.

2) Checking method

The following table gives the permissible load inertia moment that does not require the regenerative brake option when speed is reduced from 3000r/min.

Drive unit	Permissible Load Inertia Moment
MR-J2M-10DU MR-J2M-20DU MR-J2M-40DU	1.42kg・cm^2
MR-J2M-70DU	4.94kg・cm^2

Calculate the 3000r/min-equivalent inertia moment of each drive unit.

(Load inertia moment equivalent for 3000r/min) = $(J_L+J_M)\times$(running speed/3000)^2

Calculate the total of the 3000r/min-equivalent inertia moments of the axes to be decelerated simultaneously, and find the maximum total of 3000r/min-equivalent inertia moments.
Also find the sum total of permissible load inertia moments of the drive units installed on the same base unit.

(Maximum total of 3000r/min-equivalent inertia moments) < (Sum total of permissible load inertia moments of drive units)×1.42

→Regenerative brake option is unnecessary.

(Maximum total of 3000r/min-equivalent inertia moments) > (Sum total of permissible load inertia moments of drive units)×1.42

→Regenerative brake option is necessary.

3) Confirmation example

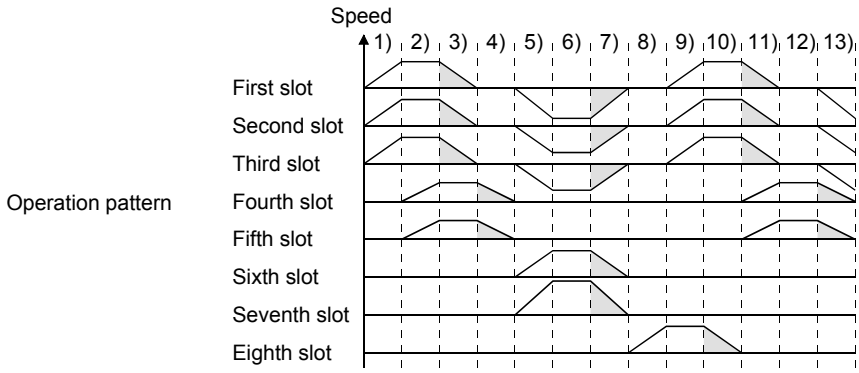
In the following 8-axis system, the total 3000r/min-equivalent inertia moment is maximum (9.75kg・cm^2) at the timing of 7). The permissible inertia moment of this 8-axis system is 11.36[kg・cm^2] as indicated by the following expression.

8 [axes]×1.42[kg・cm^2] =11.36[kg・cm^2]

Hence,

(Maximum total of 3000r/min-equivalent load inertia moments=9.75) < 11.36[kg・cm^2]

The regenerative brake option is unnecessary.



Axis No.	Servo Motor Model	Servo Motor Inertia Moment kg・cm^2	Load Inertia Moment (Servo motor shaft equivalent) kg・cm^2	Total inertia moment kg・cm^2	Running speed r/min	3000r/min-equivalent Total Inertia Moment kg・cm^2	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)
First slot	HC-KFS13	0.084	1.3	1.384	3000	1.38			1.38				1.38				1.38		
Second slot	HC-KFS23	0.42	2.1	2.52	3000	2.52			2.52				2.52				2.52		
Third slot	HC-KFS43	0.67	2.0	2.67	3000	2.67			2.67				2.67				2.67		
Fourth slot	HC-KFS13	0.084	0.8	0.884	2500	0.61				0.61									0.61
Fifth slot	HC-MFS13	0.03	0.9	0.93	2500	0.65				0.65									0.65
Sixth slot	HC-MFS23	0.088	2.5	2.588	3000	2.59							2.59						
Seventh slot	HC-KFS13	0.084	0.4	0.484	3300	0.59							0.59						
Eighth slot	HC-KFS43	0.67	5.83	6.5	3000	6.5										6.5			
3000r/min-equivalent total inertia moment kg・cm^2									6.57	1.26			9.75			6.5	6.57		1.26

Simultaneous deceleration total inertia moment maximum value

(b) To make selection according to regenerative energy

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

1) 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)	$T_7 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{psd2}} - T_U + T_F$	$E_7 = \frac{0.1047}{2} \cdot No \cdot T_7 \cdot T_{psd2}$

From the calculation results in 1) to 8), find the absolute value (Es) of the sum total of negative energies.

2) Losses of servo motor and drive unit in regenerative mode

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

Drive unit	Inverse efficiency [%]	C charging [J]
MR-J2M-10DU	55	5.5
MR-J2M-20DU	70	
MR-J2M-40DU	85	
MR-J2M-70DU	80	18

Using the following expression, find the total of C charging [J] of the MELSERVO-J2M.

Number of drive unit axes×5.5J

Then, find the energy at each timing in a single-cycle operation pattern. The energy is positive in the driving mode and negative in the regenerative mode. Enter signed driving/regenerative energy values into the following calculation table. The shaded areas indicate negative values.

<Entry example>

Timing	1)	2)	3)	4)	5)	6)	7)	8)
First slot	E1	E2	E3	E4	E1	E2	E3	E4
Second slot	E1	E2	E3	E4	E1	E2	E3	E4
Third slot	E1	E2	E3	E4	E5	E6	E7	E8
Fourth slot	E4	E4	E1	E2	E3	E4	E4	E4
Fifth slot	E4	E4	E4	E4	E4	E1	E2	E3
Sixth slot	E1	E2	E2	E3	E4	E4	E1	E2
Seventh slot	E1	E2	E2	E3	E4	E4	E1	E2
Eighth slot	E1	E2	E2	E3	E4	E4	E1	E2
Total	E 1)	E 2)	E 3)	E 4)	E 5)	E 6)	E 7)	E 8)
Regenerative ES			ES 3)	ES 4)				
|ES|-EC			ER	ER				
PR(W)			ER/t_f					

Calculate the total of energies at each timing. Only when the total is negative (timings 3, 4 in the example), use the following expression for calculation.

Energy total ER = regenerative energy ES (absolute value) − C charging total (EC)

If the subtraction results are negative at all timings, the regenerative brake option is not needed. From the total of ER's whose subtraction results are positive and a single-cycle period, the power consumption of the regenerative brake option can be calculated with the following expression.

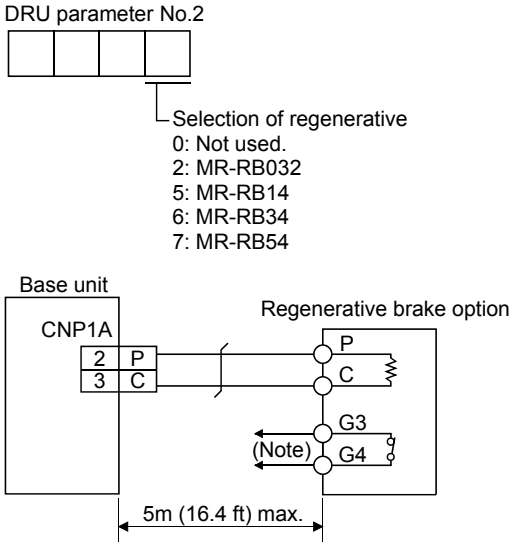
Power consumption PR [W] = (total of positive ER's)/1-cycle operation period (t_f)

(3) Connection of the regenerative brake option

POINT
・When using the MR-RB54, cooling by a fan is required. Please obtain a cooling fan at your discretion.

Set IFU parameter No.1 according to the option to be used. The regenerative brake option will generate heat of about 100℃(212℉). Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use flame-resistant cables and keep them clear of the regenerative brake option body. Always use twisted cables of max. 5m(16.4ft) length for connection with the base unit.

The G3 and G4 terminals act as a thermal sensor. G3-G4 are disconnected when the regenerative brake option overheats abnormally.

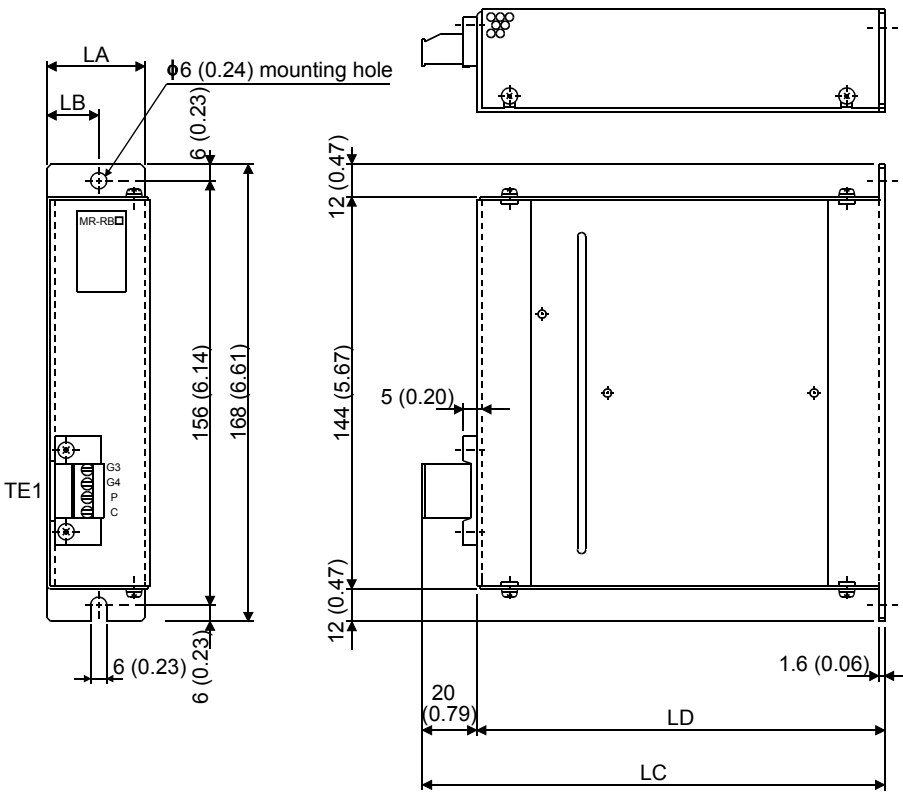


Note. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5V/4.8VDC
Maximum capacity: 2.4VA

(4) Outline drawing

(a) MR-RB032 • MR-RB14

[Unit: mm (in)]



• TE1
Terminal block

G3
G4
P
C

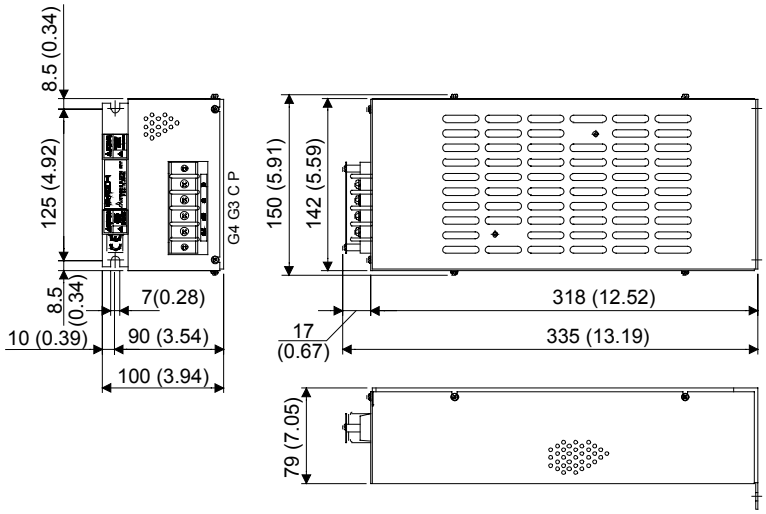
Terminal screw: M3
Tightening torque:
0.5 to 0.6 [N•m](4 to 5 [lb•in])

• Mounting screw
Screw size: M5
Tightening torque:
3.2 [N•m](28.32 [lb•in])

Regenerative brake option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
MR-RB032	30 (1.18)	15 (0.59)	119 (4.69)	99 (3.9)	0.5	1.1
MR-RB14	40 (1.57)	15 (0.59)	169 (6.69)	149 (5.87)	1.1	2.4

(b) MR-RB34

[Unit: mm (in)]



• Terminal block

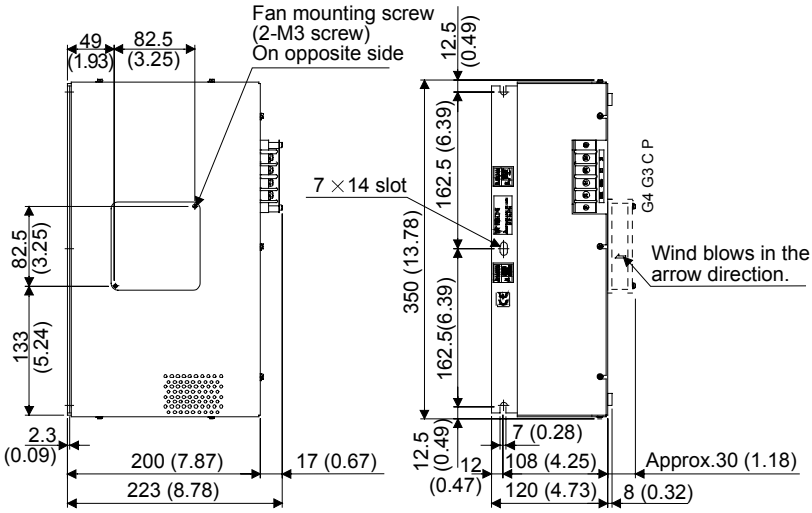
P
C
G3
G4

Terminal screw: M4
Tightening torque: 1.2 [N•m] (10.6 [lb • in])

• Mounting screw
Screw : M6
Tightening torque: 5.4 [N•m](47.79 [lb•in])

Regenerative Brake Option	Mass [kg(lb)]
MR-RB34	2.9 (6.393)

(c) MR-RB54



- Terminal block [Unit: mm (in)]

P C G3 G4	Terminal screw: M4 Tightening torque: 1.2 [N·m](10.6 [lb · in])

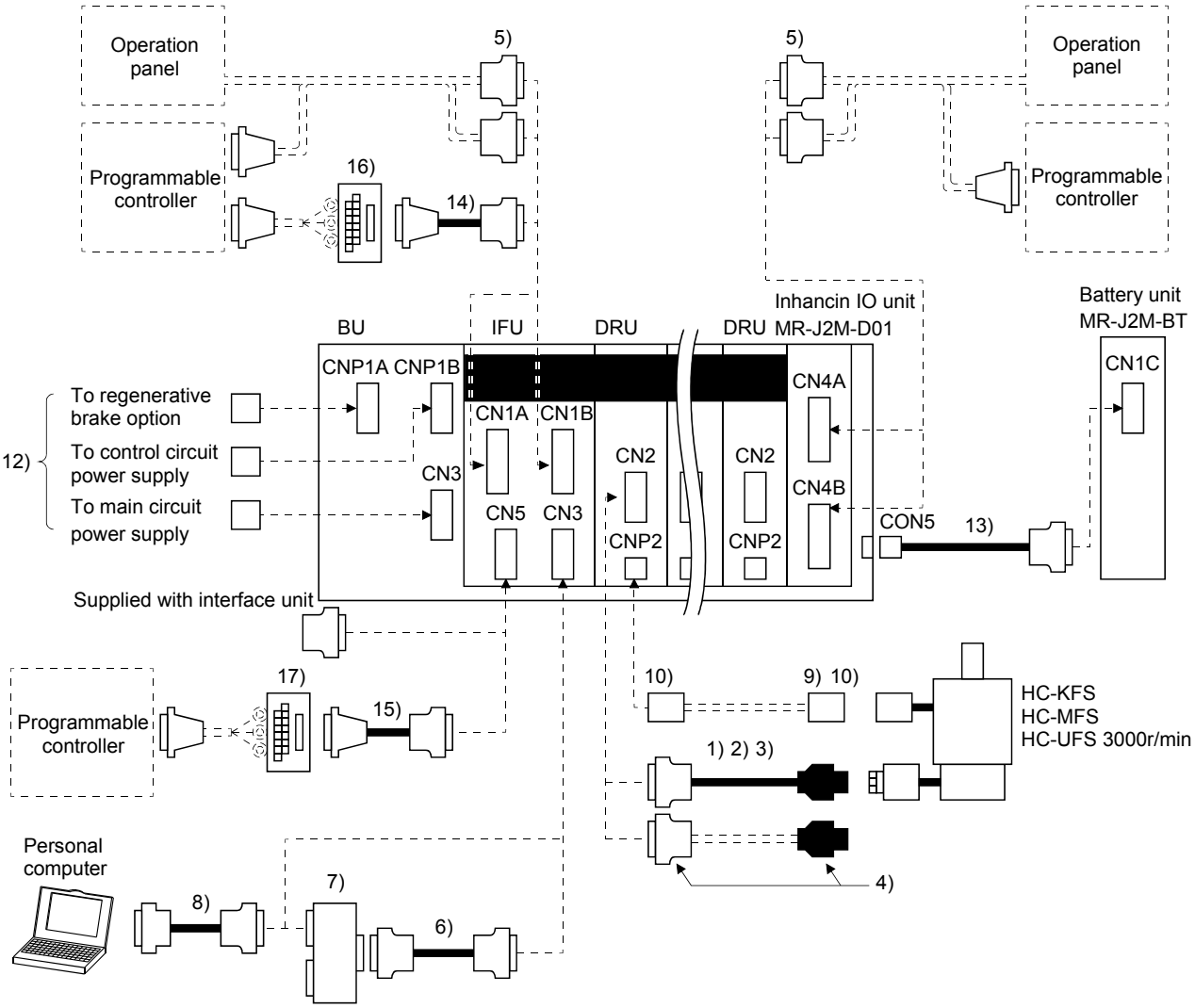
- Mounting screw
  Screw : M6
  Tightening torque: 5.4 [N·m](47.79 [lb·in])

Regenerative Brake Option	Mass [kg(lb)]
MR-RB54	5.6 (12.346)

12.1.2 Cables and connectors

(1) Cable make-up

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



No.	Product	Model	Description	Application
1)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) (a) in this section.	Connector: 10120-3000VE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry)	Standard flexing life IP20
2)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) (a) in this section.		Long flexing life IP20
3)		MR-JC4CBL□M-H Refer to (2) (b) in this section.		4 line type Long flexing life IP20
4)	Encoder connector set	MR-J2CNM	Connector: 10120-3000VE Shell kit: 10320-52F0-008 (3M or equivalent) Housing: 1-172161-9 Pin: 170359-1 (Tyco Electronics or equivalent) Cable clamp: MTI-0002 (Toa Electric Industry) 	IP20
5)	Connector set	MR-J2MCN1	Connector: 10150-3000VE Shell kit: 10350-52F0-008 (3M or equivalent)  Qty: 2 each	
6)	Bus cable	MR-J2HBUS□M Refer to section 12.1.4 (4).	Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	
7)	Maintenance junction card	MR-J2CN3TM	Refer to Section 12.1.4.	
8)	Communication cable	MR-CPCATCBL3M Refer to (3) in this section.	Connector: DE-9SF-N Case: DE-C1-J6-S6 (Japan Aviation Electronics) Connector: 10120-6000EL Shell kit: 10320-3210-000 (3M or equivalent) 	For connection with PC-AT-compatible personal computer
9)	Power supply connector set	MR-PWCNK1	 Plug: 5559-04P-210 Terminal: 5558PBT3L (For AWG16)(6 pcs.) (Molex)	IP20
10)	Power supply connector set	MR-PWCNK2	 Plug: 5559-06P-210 Terminal: 5558PBT3L (For AWG16)(8 pcs.) (Molex)	For motor with brake IP20

No.	Product	Model	Description	Application
11)	Power supply connector	MR-PWCNK3	 Plug: 5557-04R-210 Terminal: 5556PBT3L (for AWG16) (6 pcs.) (Molex)	Servo motor power cable
12)	Base unit connector set	MR-J2MCNM	 Housing: 2-178128-3 (5 pcs.) Contact: 917511-2 (max. sheath OD ϕ 2.8 [mm] (ϕ 0.11[in]) 15 pcs.) (Tyco Electronics)	For CNP1B
			 Housing: 1-178128-3 (5 pcs.) Contact: 917511-2 (max. sheath OD ϕ 2.8 [mm] (ϕ 0.11[in]) 15 pcs.) (Tyco Electronics)	For CNP1A
			 Housing: 1-179958-3 (5 pcs.) Contact: 316041-2 (20 pcs.) (Tyco Electronics)	For CNP3
13)	Battery cable	MR-J2MBTCBL□M	Housing: 51030-0230 Terminal: 50083-8160 (molex) Connector: 10120-3000VE Shell kit: 10320-52F0-008 (3M or equivalent) 	
14)	Junction terminal block cable	MR-J2M-CN1TBL□M Cable length 0.5, 1m (1.64, 3.28ft)	Junction terminal block connector (3M) D7950-B500FL (connector) Interface unit connector (3M or equivalent) 10150-6000EL(connector) 10350-3210-000(shell kit) 	For MR-TB50
15)		MR-J2TBL□M-1A Cable length 0.5, 1m (1.64, 3.28ft)	Junction terminal block connector (3M) D7920-B500FL (connector) Interface unit connector (3M or equivalent) 10120-6000EL(connector) 10320-52F0-F08-M1A(shell kit) 	For MR-TB20
16)	Junction terminal	MR-TB50	Refer to Section 12.1.3	
17)		MR-TB20	Refer to Section 12.1.4	

(2) Encoder cable

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

POINT

・The encoder cable is not oil resistant.
・Refer to Section 11.4 for the flexing life of the encoder cable.
・When the encoder cable is used, the sum of the resistance values of the cable used for P5 and the cable used for LG should be within 2.4Ω.
・When soldering the wire to the connector pin, insulate and protect the connection portion using heat-shrinkable tubing.

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

(a) MR-JCCBL□M-L/H

1) Model explanation

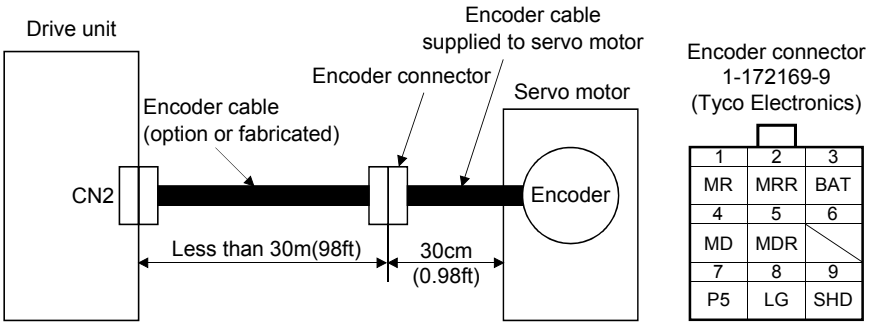
Model: MR-JCCBL□M-□

Symbol	Specifications
L	Standard flexing life
H	Long flexing life

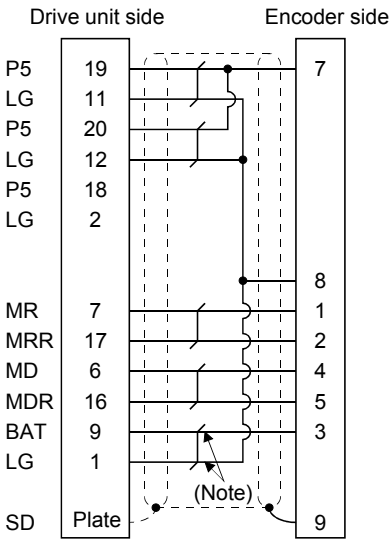
Symbol	Cable length [m(ft)]
2	2 (6.56)
5	5 (16.4)
10	10 (32.8)
20	20 (65.6)

2) Connection diagram

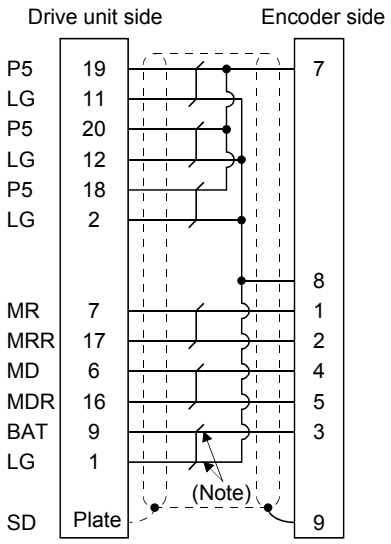
The signal assignment of the encoder connector is as viewed from the pin side. For the pin assignment on the drive unit side, refer to Section 3.5.3



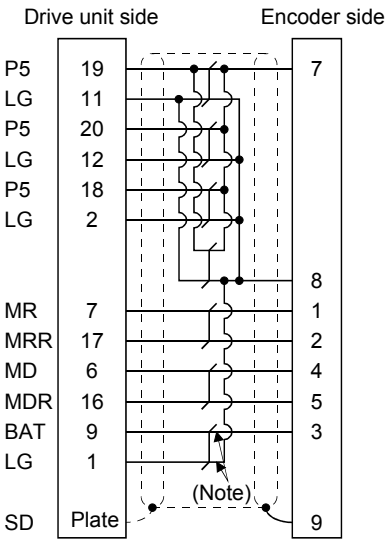
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L
·
·
·
MR-JCCBL20M-L



MR-JCCBL10M-H
·
·
·
MR-JCCBL20M-H



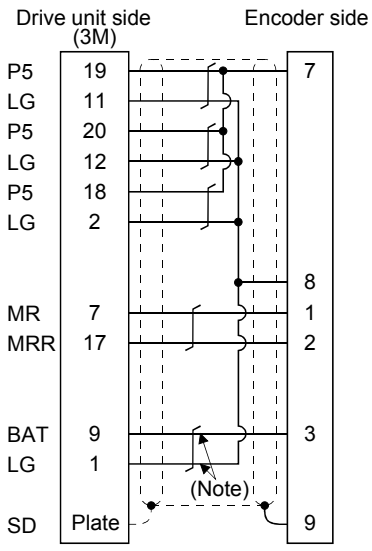
Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 12.2.1 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 less than 30m(98ft) length including the length of the encoder cable supplied to the servo motor.

When the encoder cable is to be fabricated by the customer, the wiring of MD and MDR is not required.

Refer to Chapter 3 of the servo motor instruction manual and choose the encode side connector according to the servo motor installation environment.

For use of AWG22



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

(b) MR-JC4CBL□M-H

POINT
・When using this encoder cable, set "1□□□" in DRU parameter No. 20.

1) Model explanation

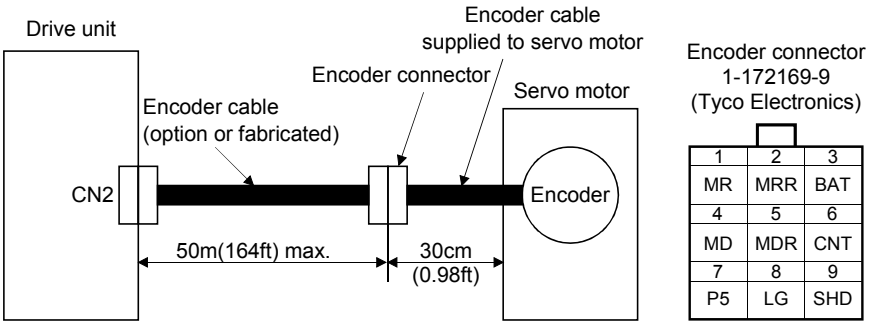
Model: MR-JC4CBL□M-H

Long flexing life

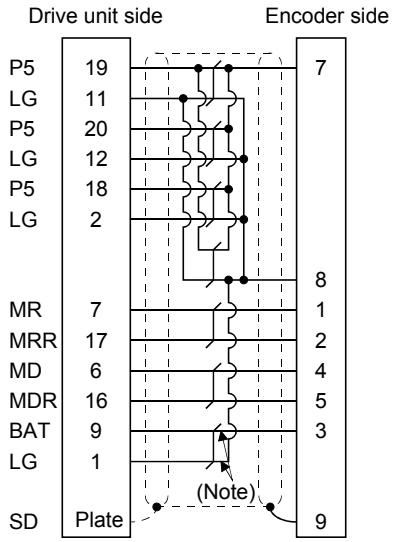
Symbol	Cable length [m(ft)]
30	30 (98.4)
40	40 (131.2)
50	50 (164.0)

2) Connection diagram

The signal assignment of the encoder connector is as viewed from the pin side. For the pin assignment on the drive unit side, refer to Section 3.5.3.



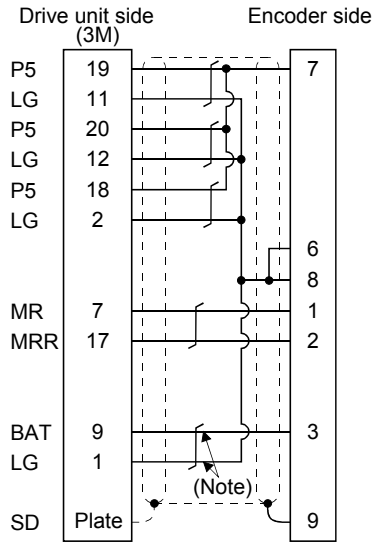
MR-JC4CBL30M-H
to
MR-JC4CBL50M-H



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 12.2.1 and the MR-J2CNM connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m(164.0ft) length.
When the encoder cable is to be fabricated by the customer, the wiring of MD and MDR is not required.
Refer to Chapter 3 of the servo motor instruction manual and choose the encode side connector according to the servo motor installation environment.

For use of AWG22



Note. Always make connection for use in an absolute position detection system.
This wiring is not needed for use in an incremental system.

(3) Communication cable

POINT
▪ This cable may not be used with some personal computers. After fully examining the signals of the RS-232C connector, refer to this section and fabricate the cable.

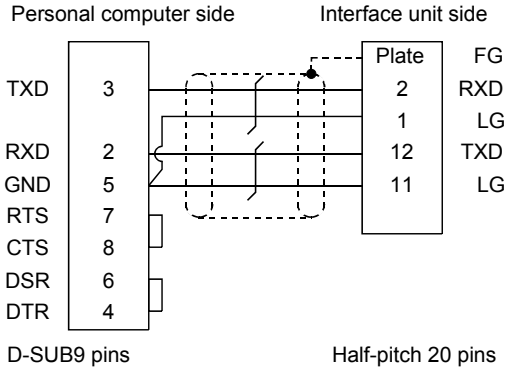
(a) Model definition

Model : MR-CPCATCBL3M

Cable length 3[m](10[ft])

(b) Connection diagram

▪ MR-CPCATCBL3M



When fabricating the cable, refer to the connection diagram in this section.

The following must be observed in fabrication:

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

2) The optional communication cable is 3m(10ft) long. When the cable is fabricated, its maximum length is 15m(49ft) in offices of good environment with minimal noise.

(4) Battery cable

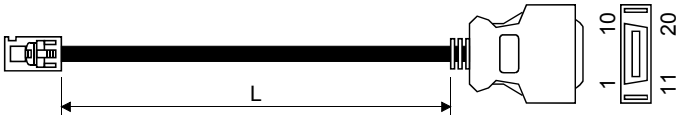
When fabricating, use the recommended wire given in Section 12.2.1 and fabricate as in the connection diagram shown in this section.

(a) Definition of model

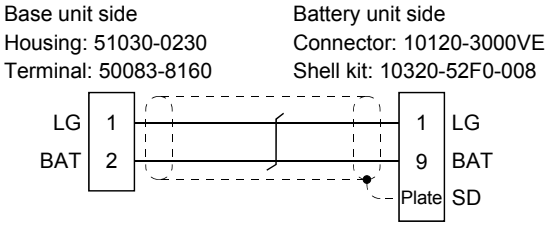
Model: MR-J2MBTCBL□M

Symbol	Cable Length L [m(ft)]
03	0.3 (0.1)
1	1 (3.28)

(b) Outline drawing



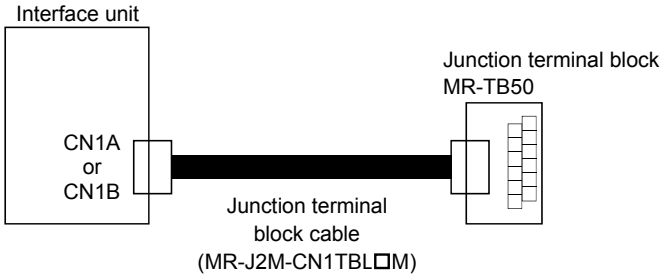
(c) Connection diagram



12.1.3 Junction terminal block (MR-TB50)

(1) How to use the junction terminal block

Always use the junction terminal block (MR-TB50) with the junction terminal block cable (MR-J2M-CN1TBL □ M) as a set. A connection example is shown below:



Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to Section 12.2.6, (2)(c).

(2) Terminal labels

Use the following junction terminal block labels.

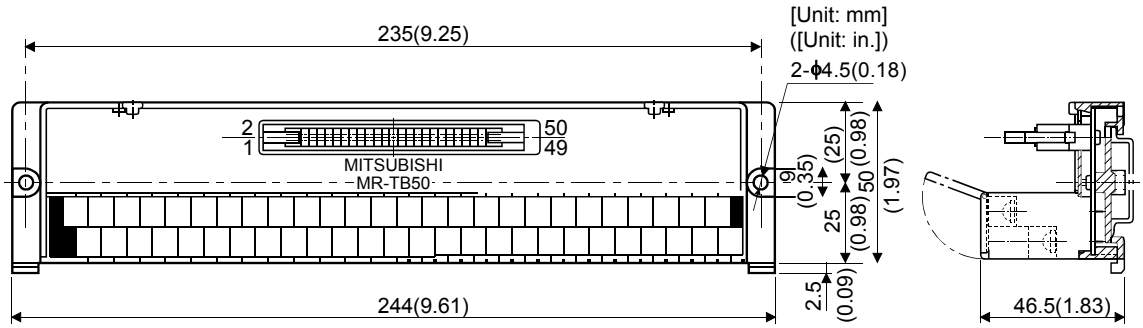
(a) For CN1A

SG	INP4	SON4	CR3	RES2	RD1	PP4	PP3	PP2	PP1	LG	OP3	OP1	ALM_A	CR4	RES3	RD2	INP1	SON1	NG4	NG3	NG2	NG1	OP_VIN	P5						
	OPC	RES4	RD3	INP2	SON2	CR1	NP4	NP3	NP2	NP1	OP4	OP2	VIN	RD4	INP3	SON3	CR2	RES1	PG4	PG3	PG2	PG1	LG	OP_COM							

(b) For CN1B

SG	INP8	SON8	CR7	RES6	RD5	PP8	PP7	PP6	PP5	LG	OP7	OP5	ALM_B	CR8	RES7	RD6	INP5	SON5	NG8	NG7	NG6	NG5	OP_VIN	P5						
	OPC	RES8	RD7	INP6	SON6	CR5	NP8	NP7	NP6	NP5	OP8	OP6	VIN	RD8	INP7	SON7	CR6	RES5	PG8	PG7	PG6	PG5	LG	OP_COM							

(3) Outline drawing



Terminal screw: M3.5
Applicable cable: 2mm^2
Crimping terminal width: 7.2mm (0.283 in) max.

(4) Junction terminal block cable (MR-J2M-CN1TBL□M)

(a) Model explanation

Model: MR-J2M-CN1TBL□M

Symbol	Cable length[m(ft)]
05	0.5 (1.64)
1	1 (3.28)

(b) Connection diagram

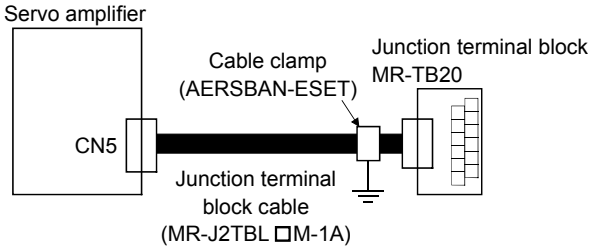
PCR-S50FS(Servo amplifier side) JE1S-501(Junction terminal side)

Symbol		Pin No.	Pin No.
CN1A	CN1B		
SG	SG	1	1
OPC	OPC	2	2
INP4	INP8	3	3
RES4	RES8	4	4
SON4	SON8	5	5
RD3	RD7	6	6
CR3	CR7	7	7
INP2	INP6	8	8
RES2	RES6	9	9
SON2	SON6	10	10
RD1	RD5	11	11
CR1	CR5	12	12
PP4	PP8	13	13
NP4	NP8	14	14
PP3	PP7	15	15
NP3	NP7	16	16
PP2	PP6	17	17
NP2	NP6	18	18
PP1	PP5	19	19
NP1	NP5	20	20
LG	LG	21	21
OP4	OP8	22	22
OP3	OP7	23	23
OP2	OP6	24	24
OP1	OP5	25	25
VIN	VIN	26	26
ALM_A	ALM_B	27	27
RD4	RD8	28	28
CR4	CR8	29	29
INP3	INP7	30	30
RES3	RES7	31	31
SON3	SON7	32	32
RD2	RD6	33	33
CR2	CR6	34	34
INP1	INP5	35	35
RES1	RES5	36	36
SON1	SON5	37	37
PG4	PG8	38	38
NG4	NG8	39	39
PG3	PG7	40	40
NG3	NG7	41	41
PG2	PG6	42	42
NG2	NG6	43	43
PG1	PG5	44	44
NG1	NG5	45	45
LG	LG	46	46
OP_VIN	OP_VIN	47	47
OP_COM	OP_COM	48	48
P5	P5	49	49
LG	LG	50	50
SD	SD	plate	

12.1.4 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-J2TBL□M-1A) as a set. A connection example is shown below:



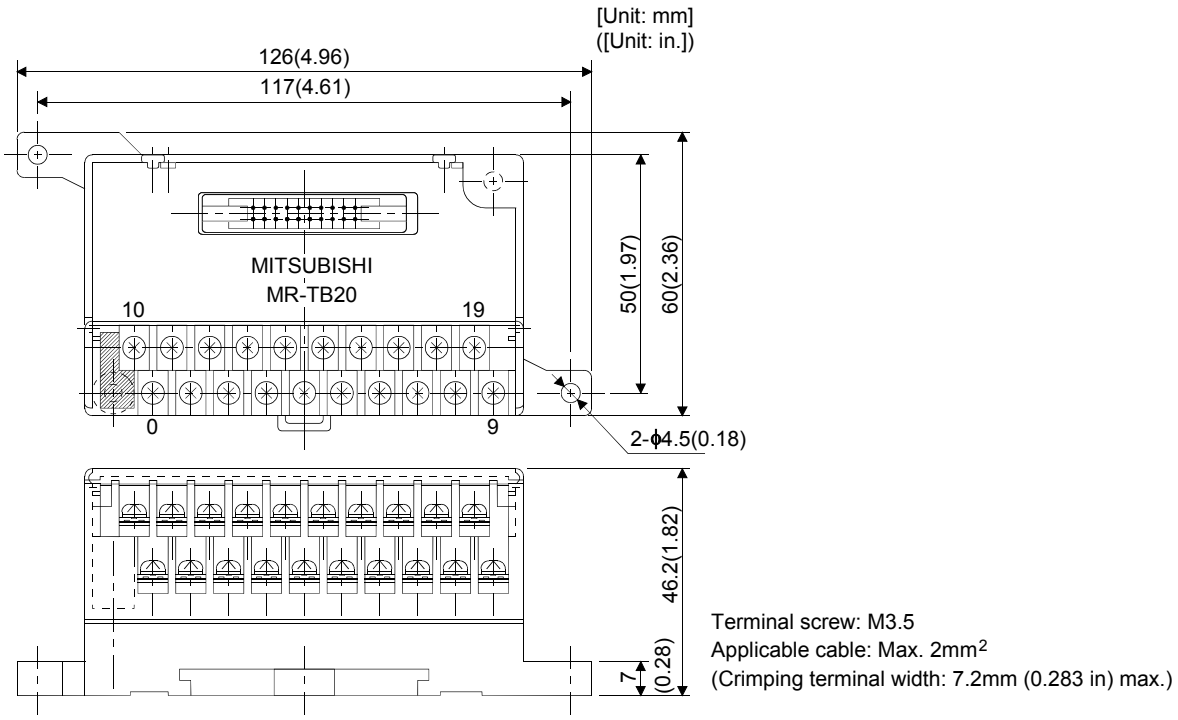
Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to Section 13.2.6, (2)(c).

(2) Terminal labels

Use the following junction terminal block label designed for CN5. When changing the input signals in parameters No. 43 to 48, refer to (4) in this section and Section 3.2.1 and apply the accessory signal seals to the labels.

LSN1 10	LSN2 11	LSN3 12	SG 13	LSP5 14	LSP6 15	LSP7 16	LSP8 17	EMG_B 18	SD 19	
	LSP1 0	LSP2 1	LSP3 2	LSP4 3	LSN4 4	LSN5 5	LSN6 6	LSN7 7	LSN8 8	EMG_A 9

(3) Outline drawing



Terminal screw: M3.5
Applicable cable: Max. 2mm^2
(Crimping terminal width: 7.2mm (0.283 in) max.)

(4) Junction terminal block cable (MR-J2TBL□M-1A)

(a) Model explanation

Model: MR-J2TBL□M-1A

Symbol	Cable length[m(ft)]
05	0.5 (1.64)
1	1 (3.28)

(b) Connection diagram

Junction terminal block side connector(3M)
D7920-B500FL(Connector)

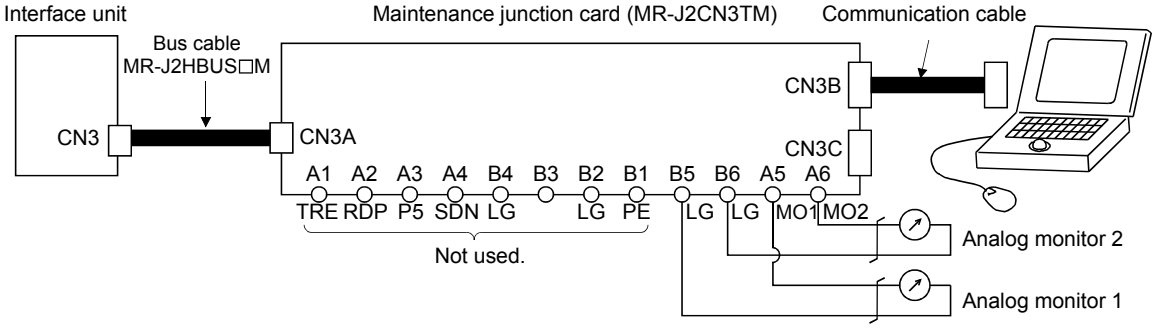
Servo amplifierside(CN5)connector(3M)
10120-6000EL(Connector)
10320-52F0-R08-M1A(Shell kit)

Symbol CN5	Junction Terminal Block No.	Pin No.	Pin No.
LSP1	0	1	1
LSN1	10	2	2
LSP2	1	3	3
LSN2	11	4	4
LSP3	2	5	5
LSN3	12	6	6
LSP4	3	7	7
SG	13	8	8
			9
LSN4	4	9	10
LSP5	14	10	11
LSN5	5	11	12
LSP6	15	12	13
LSN6	6	13	14
LSP7	16	14	15
LSN7	7	15	16
LSP8	17	16	17
LSN8	8	17	18
EMG_B	18	18	19
EMG_A	9	19	20
SD	19	20	plate

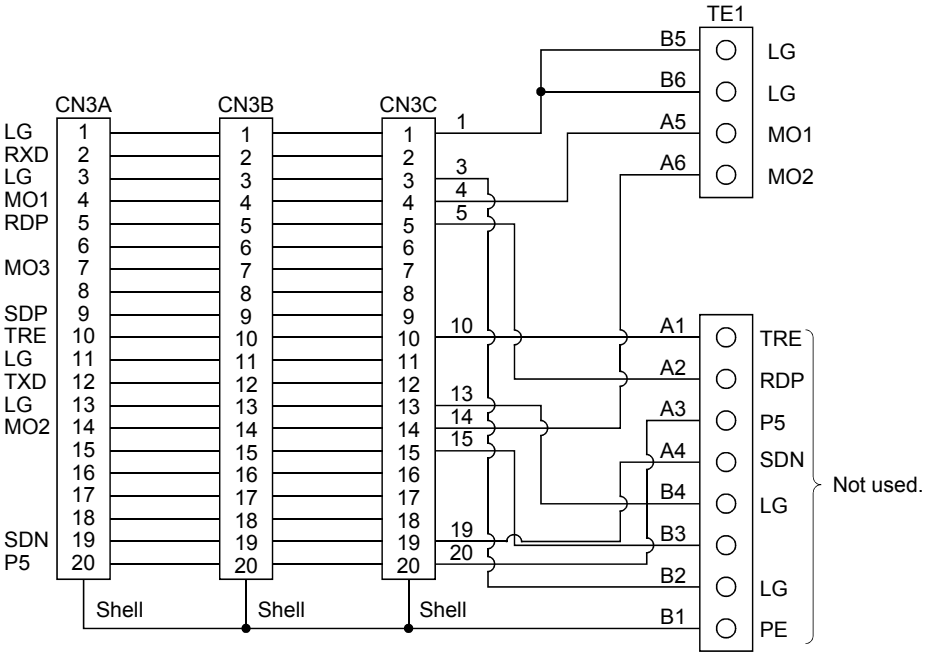
12.1.5 Maintenance junction card (MR-J2CN3TM)

(1) Usage

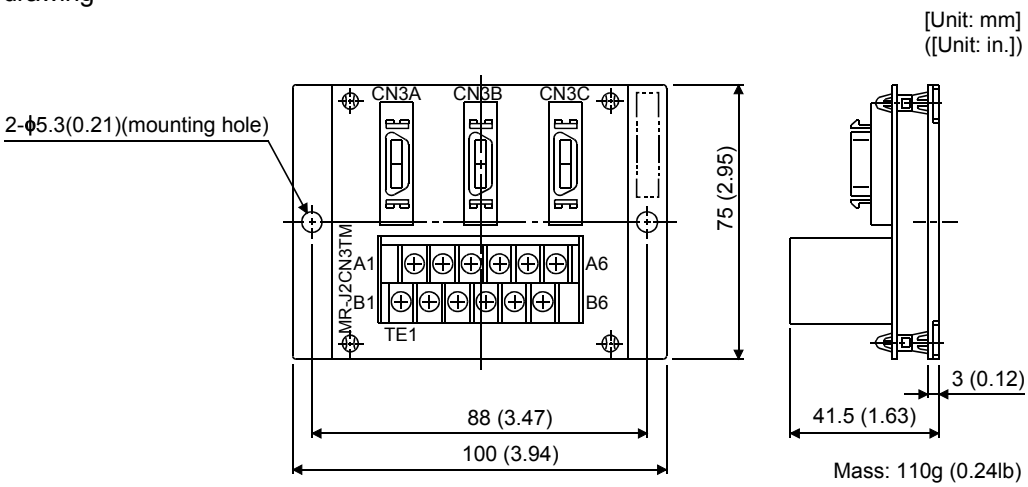
The maintenance junction card (MR-J2CN3TM) is designed for use when a personal computer and analog monitor are used at the same time.



(2) Connection diagram



(3) Outline drawing



(4) Bus cable (MR-J2HBUS□M)

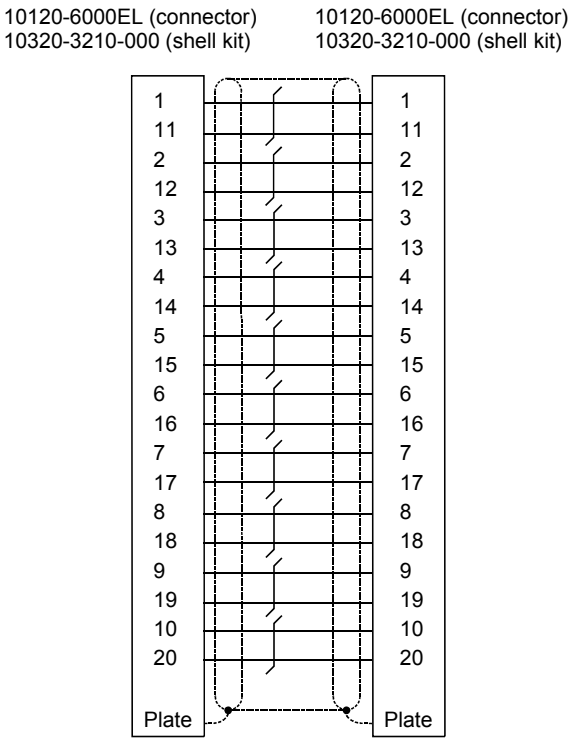
(a) Model explanation

Model: MR-J2HBUS□M

Symbol	Cable length [m(ft)]
05	0.5 (1.64)
1	1 (3.28)
5	5 (16.4)

(b) Connection diagram

MR-J2HBUS05M
MR-J2HBUS1M
MR-J2HBUS5M



12.1.6 MR Configurator (servo configurations software)

POINT
・ Required to assign devices to the pins of CN4A and CN4B of the MR-J2M-D01 extension IO unit.

The MR Configurator (servo configuration software) uses the communication function of the interface unit to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

(1) Specifications

Item	Description
Communication signal	Conforms to RS-232C.
Baudrate [bps]	57600, 38400, 19200, 9600
System	Station selection, automatic demo
Monitor	Display, high speed monitor, trend graph Minimum resolution changes with the processing speed of the personal computer.
Alarm	Display, history, amplifier data
Diagnostic	Digital I/O, function device display no motor rotation, total power-on time, amplifier version info, motor information, tuning data, absolute encoder data, Axis name setting, unit composition listing.
Parameters	Turning, change list, detailed information, IFU parameter, DRU parameter, device setting.
Test operation	Jog operation, positioning operation, operation w/o motor, forced output, demo mode.
Advanced function	Machine analyzer, gain search, machine simulation.
File operation	Data read, save, print
Others	Automatic demo, help display

(2) System configuration

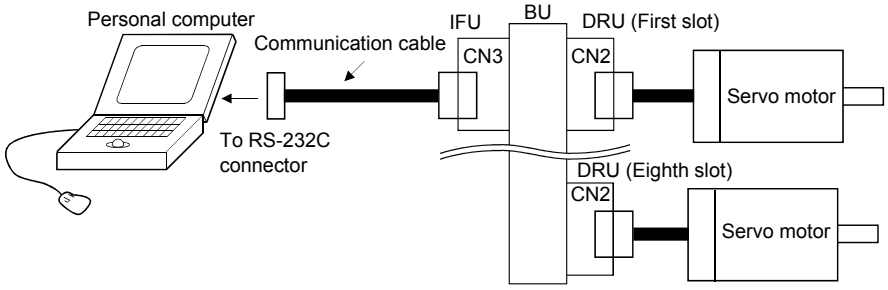
(a) Components

To use this software, the following components are required in addition to MELSERVO-J2M and servo motor:

Model	(Note 1) Description
(Note 2) Personal computer	IBM PC-AT compatible where the English version of Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0 or Windows® 2000 Professional operates Processor: Pentium® 133MHz or more (Windows® 95, Windows® 98, Windows NT® Workstation 4.0, Windows® 2000 Professional) Pentium® 150MHz or more (Windows® Me) Memory: 16MB or more (Windows® 95), 24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional) Free hard disk space: 60MB or more Serial port used
OS	Windows® 95, Windows® 98, Windows® Me, Windows NT® Workstation 4.0, Windows® 2000 Professional (English version)
Display	One whose resolution is 800×600 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.
Keyboard	Connectable with the above personal computer.
Mouse	Connectable with the above personal computer. Note that a serial mouse is not used.
Printer	Connectable with the above personal computer.
Communication cable	MR-CPCATCBL3M When this cannot be used, refer to (3) Section 12.1.2 and fabricate.

Note 1. Windows and Windows NT are the registered trademarks of Microsoft Corporation in the United State and other countries.
Pentium is the registered trademarks of Intel Corporation.
2. On some personal computers, this software may not run properly.

(b) Configuration diagram



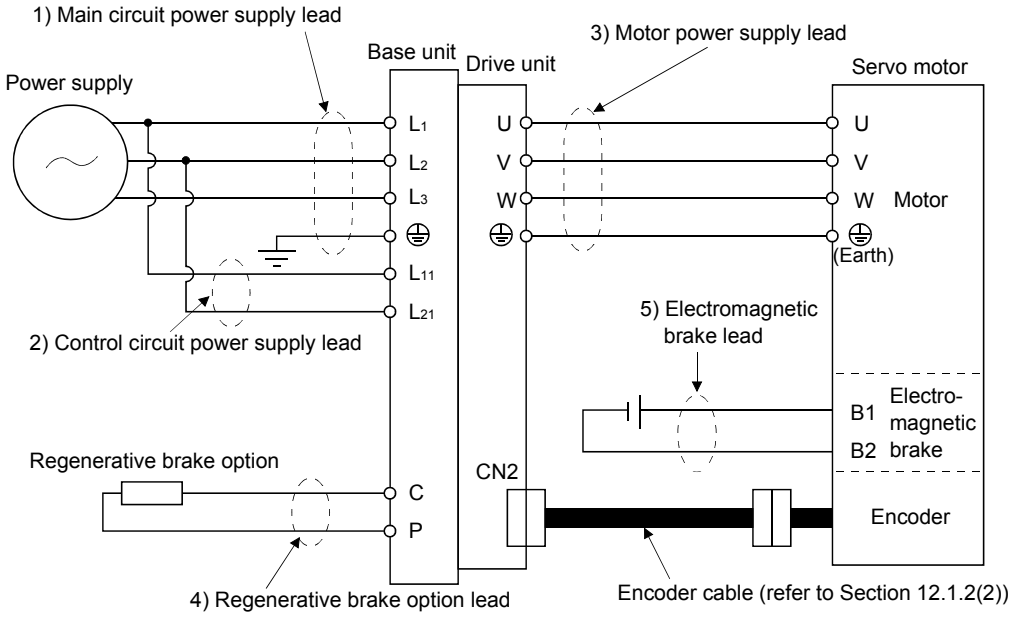
12.2 Auxiliary equipment

Always use the devices indicated in this section or equivalent. To comply with the EN Standard or UL/C-UL (CSA) Standard, use the products which conform to the corresponding standard.

12.2.1 Recommended wires

(1) Wires for power supply wiring

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m(98.4ft) max. If the wiring distance is over 30m(98.4ft), choose the wire size in consideration of voltage drop.

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to Section 3.5.3.

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

Table 12.1 Recommended wires

Unit	Wires [mm^2]				
	1) L1・L2・L3・⏚	2) L11・L21	3) U・V・W・⏚	4) P・C	5) B1・B2
MR-J2M-BU4	2 (AWG14)	2 (AWG14)		2 (AWG14)	
MR-J2M-BU6	3.5 (AWG12)				
MR-J2M-BU8	5.5 (AWG10)				
MR-J2M-10DU			1.25 (AWG16)		1.25 (AWG16)
MR-J2M-20DU					
MR-J2M-40DU					
MR-J2M-70DU					

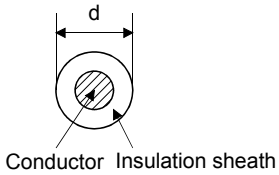
(2) Wires for cables

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

Table 12.2 Wires for option cables

Type	Model	Length [m(ft)]	Core size [mm^2]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance[Ω/mm]	Insulation coating ODd[mm] (Note 1)		
Encoder cable	MR-JCCBL□M-L	2 to 10 (6.56 to 32.8)	0.08	12 (6 pairs)	7/0.127	222	0.38	5.6	UL20276 AWG#28 6pair (BLACK)
		20・30 (65.6・98.4)	0.3	12 (6 pairs)	12/0.18	62	1.2	8.2	UL20276 AWG#22 6pair (BLACK)
	MR-JCCBL□M-H	2・5 (6.56・16.4)	0.2	12 (6 pairs)	40/0.08	105	0.88	7.2	(Note 2) A14B2343 6P
		10 to 20 (32.8 to 65.6)	0.2	14 (7 pairs)	40/0.08	105	0.88	8.0	(Note 2) A14B0238 7P
	MR-JC4CBL□M-H	30 to 50 (98.4 to 164)	0.2	14 (7 pairs)	40/0.08	105	0.88	8.0	(Note 2) A14B0238 7P
Communication cable	MR-CPCATCBL3M	3 (9.84)	0.08	6 (3 pairs)	7/0.127	222	0.38	4.6	UL20276 AWG#28 3pair (BLACK)
Bus cable	MR-J2HBUS□M	0.5 to 5 (1.64 to 16.4)	0.08	20 (10 pairs)	7/0.127	222	0.38	6.1	UL20276 AWG#28 10pair (CREAM)
Battery unit cable	MR-J2MBATCBL□M	0.3・1 (0.98・3.28)	0.3	2 (1 pairs)	12/0.18	63	1.5	5.1	MVVS IP×0.3mm^2

Note 1. d is as shown below:



2. Purchased from Toa Electric Industry
3. Standard OD. Max. OD is about 10% greater.

12.2.2 No-fuse breakers, fuses, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one drive unit. Make selection as indicated below according to the total output value of the servo motors connected to one base unit. When using a fuse instead of the no-fuse breaker, use the one having the specifications given in this section.

(1) No-fuse breaker

Servo motor output total	No-fuse breaker	Rated current [A]
550W max.	30A frame 5A	5
More than 550W to 1100W max.	30A frame 10A	10
More than 1100W to 1650W max.	30A frame 15A	15
More than 1650W to 2200W max.	30A frame 20A	20
More than 2200W to 3300W max.	30A frame 30A	30

(2) Fuse

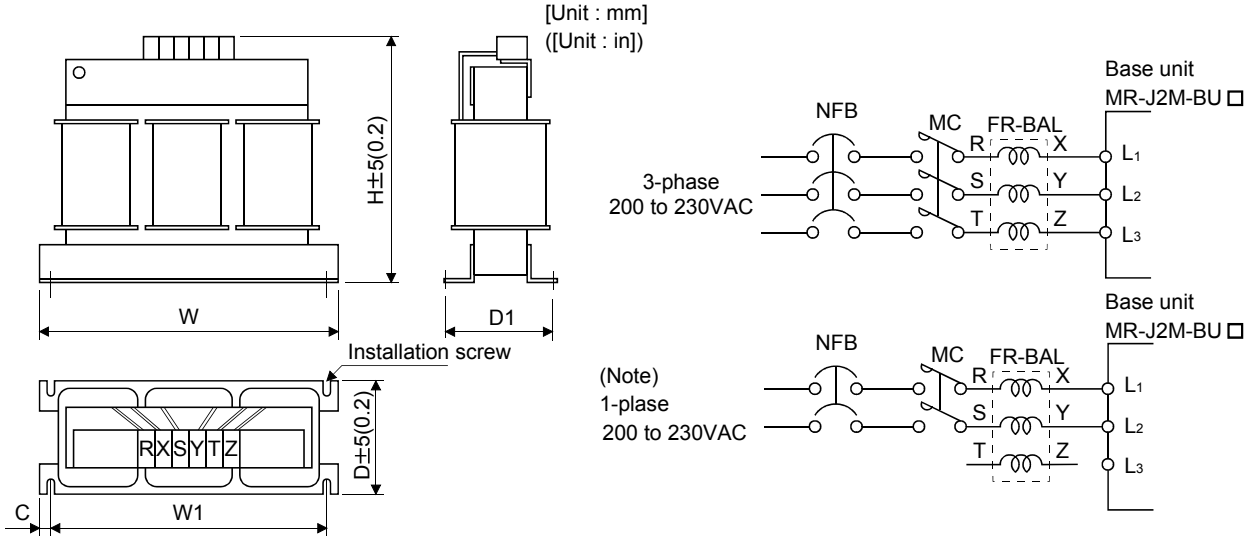
Servo motor output total	Fuse		
	Class	Current [A]	Voltage [V]
800W max.	K5	15	AC250
More than 800W to 1100W max.	K5	20	AC250
More than 1100W to 1650W max.	K5	30	AC250
More than 1650W to 2200W max.	K5	40	AC250
More than 2200W to 3300W max.	K5	70	AC250

(3) Magnetic contactor

Servo motor output total	Magnetic contactor
1700W max.	S-N10
More than 1700W to 2800W max.	S-N18
More than 2800W to 3300W max.	S-N20

12.2.3 Power factor improving reactors

The input power factor is improved to be about 90%. Make selection as described below according to the sum of the outputs of the servo motors connected to one base unit.



Note. Connect a 1-phase 200 to 230VAC power supply to L1/L2 and keep L3 open.

Servo motor output total	Model	Dimensions [mm (in)]						Mounting screw size	Terminal screw size	Mass [kg (lb)]
		W	W1	H	D	D1	C			
300W max.	FR-BAL-0.4K	135 (5.31)	120 (4.72)	115 (4.53)	59 (2.32)	$45_{-2.5}^{0}(1.77_{-0.098}^{0})$	7.5 (0.29)	M4	M3.5	2.0 (4.4)
More than 300W to 450W max.	FR-BAL-0.75K	135 (5.31)	120 (4.72)	115 (4.53)	69 (2.72)	$57_{-2.5}^{0}(2.24_{-0.098}^{0})$	7.5 (0.29)	M4	M3.5	2.8 (6.17)
More than 450W to 750W max.	FR-BAL-1.5K	160 (6.30)	145 (5.71)	140 (5.51)	71 (2.79)	$55_{-2.5}^{0}(2.17_{-0.098}^{0})$	7.5 (0.29)	M4	M3.5	3.7 (8.16)
More than 750W to 1100W max.	FR-BAL-2.2K	160 (6.30)	145 (5.71)	140 (5.51)	91 (3.58)	$75_{-2.5}^{0}(2.95_{-0.098}^{0})$	7.5 (0.29)	M4	M3.5	5.6 (12.35)
More than 1100W to 1900W max.	FR-BAL-3.7K	220 (8.66)	200 (7.87)	192 (7.56)	90 (3.54)	$70_{-2.5}^{0}(2.76_{-0.098}^{0})$	10 (0.39)	M5	M4	8.5 (18.74)
More than 1900W to 2500W max.	FR-BAL-5.5K	220 (8.66)	200 (7.87)	192 (7.56)	96 (3.78)	$75_{-2.5}^{0}(2.95_{-0.098}^{0})$	10 (0.39)	M5	M4	9.5 (20.94)
More than 2500W to 3800W max.	FR-BAL-7.5K	220 (8.66)	200 (7.87)	194 (7.64)	120 (4.72)	$100_{-2.5}^{0}(3.94_{-0.098}^{0})$	10 (0.39)	M5	M5	14.5 (32.0)

12.2.4 Relays

The following relays should be used with the interfaces:

Interface	Selection example
Relay used for digital input signals (interface DI-1)	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) Omron : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small relay with 12VDC or 24VDC of 40mA or less (Ex.) Omron : type MY

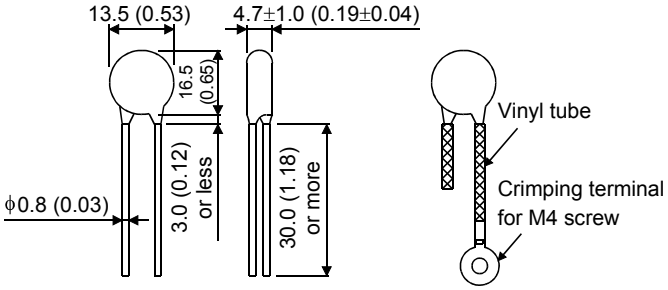
12.2.5 Surge absorbers

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

Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
Permissible circuit voltage		Surge immunity	Energy immunity	Rated power				
AC[Vma]	DC[V]	[A]	[J]	[W]	[A]	[V]	[pF]	[V]
140	180	(Note) 500/time	5	0.4	25	360	300	220 (198 to 242)

Note. 1 time = 8 × 20μs

(Example) ERZV10D221 (Matsushita Electric Industry)
TNR-10V221K (Nippon Chemi-con)
Outline drawing [mm] ([in]) (ERZ-C10DK221)



12.2.6 Noise reduction techniques

Noises are classified into external noises which enter MELSERVO-J2M to cause it to malfunction and those radiated by MELSERVO-J2M to cause peripheral devices to malfunction. Since MELSERVO-J2M is an electronic device which handles small signals, the following general noise reduction techniques are required.

Also, the drive unit 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 drive unit, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

- Avoid laying power lines (input 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 base unit, servo motor, etc. together at one point (refer to Section 3.8).

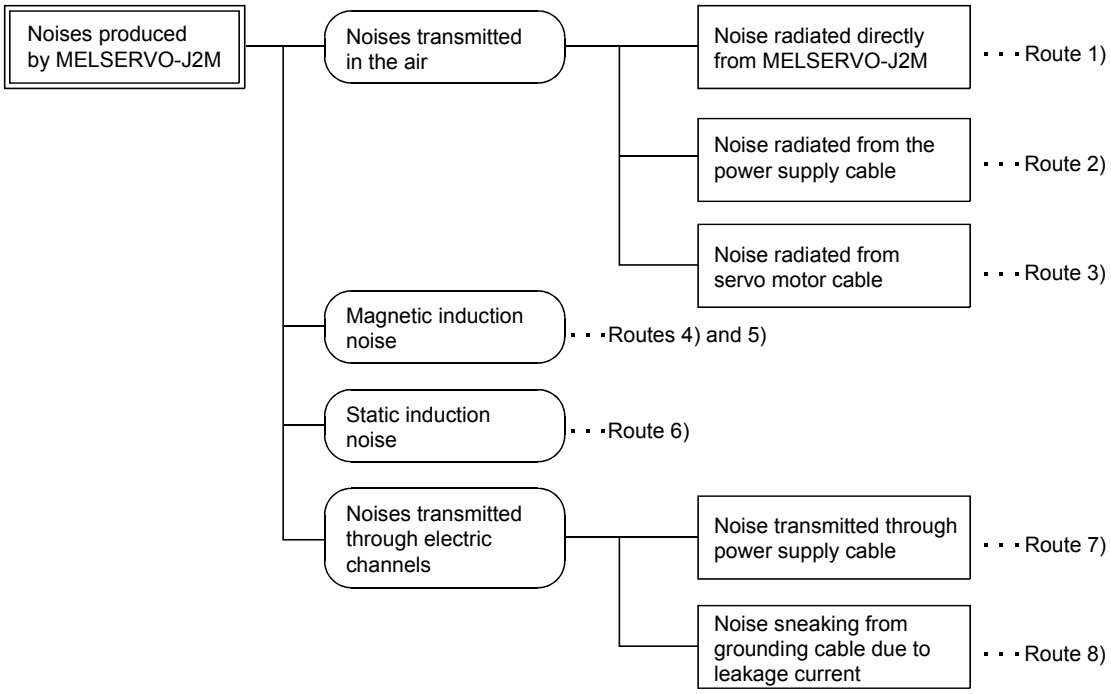
(b) Reduction techniques for external noises that cause MELSERVO-J2M to malfunction

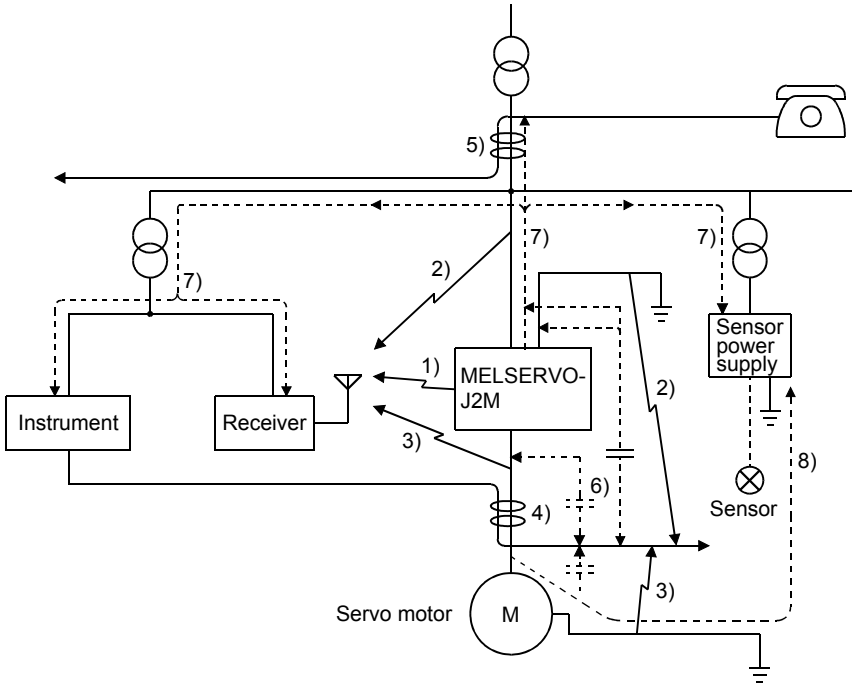
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near MELSERVO-J2M and MELSERVO-J2M may malfunction, the following countermeasures are required.

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

(c) Techniques for noises radiated by MELSERVO-J2M that cause peripheral devices to malfunction

Noises produced by MELSERVO-J2M are classified into those radiated from the cables connected to MELSERVO-J2M 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 MELSERVO-J2M or run near MELSERVO-J2M, 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 MELSERVO-J2M. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of MELSERVO-J2M. 3. Avoid laying the power lines (I/O cables of MELSERVO-J2M) and signal cables side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and MELSERVO-J2M. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of MELSERVO-J2M. 3. Avoid laying the power lines (I/O cables of MELSERVO-J2M) 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 MELSERVO-J2M system, noises produced by MELSERVO-J2M may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Insert the radio noise filter (FR-BIF) on the power cables (input cables) of MELSERVO-J2M. 2. Insert the line noise filter (FR-BSF01・FR-BLF) on the power cables of MELSERVO-J2M.
8)	When the cables of peripheral devices are connected to MELSERVO-J2M to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction products

(a) Data line filter

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

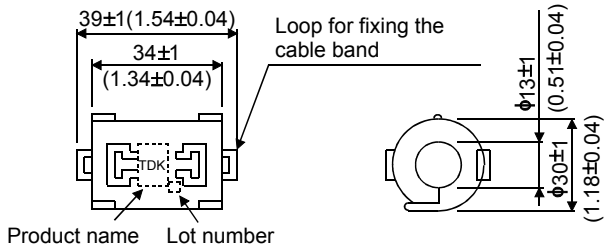
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC TOKIN are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

This impedances are reference values and not guaranteed values.

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

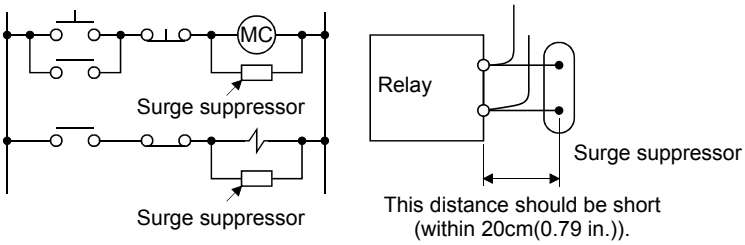
[Unit: mm]([Unit: in.])



Outline drawing (ZCAT3035-1330)

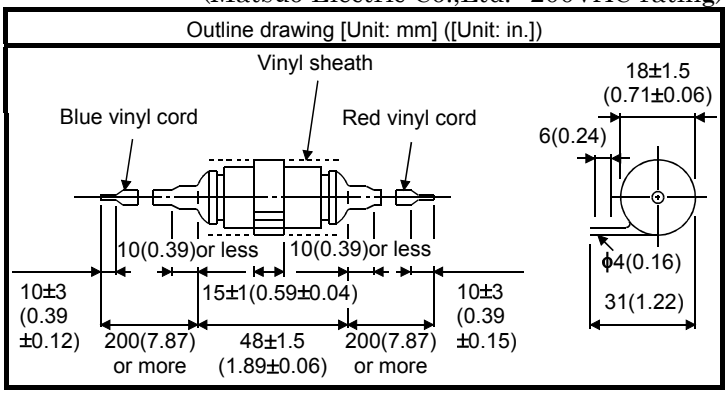
(b) Surge suppressor

The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near MELSERVO-J2M is shown below. Use this product or equivalent.



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

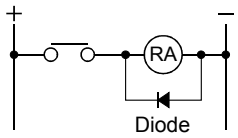
Rated voltage AC[V]	C [μF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)



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

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

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

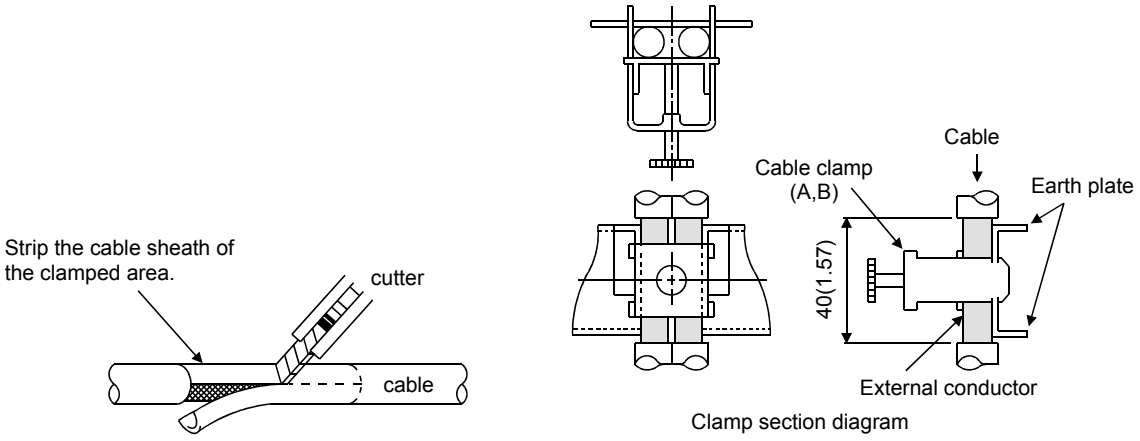


(c) Cable clamp fitting (AERSBAN□-SET)

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

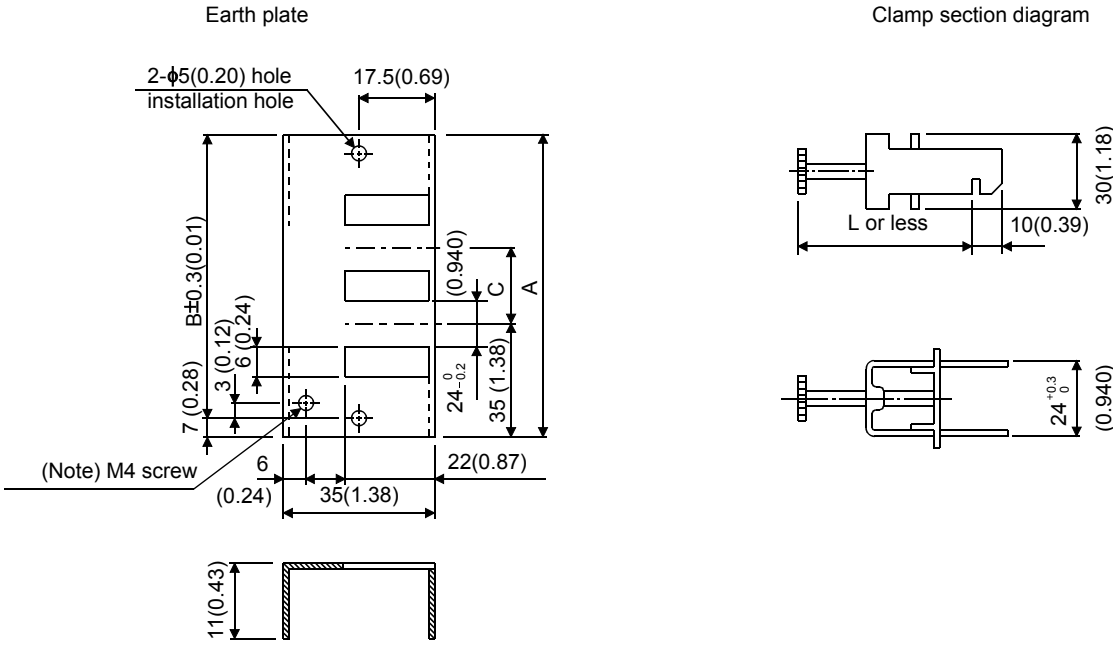
Install the earth plate near the drive unit for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



▪ Outline drawing

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



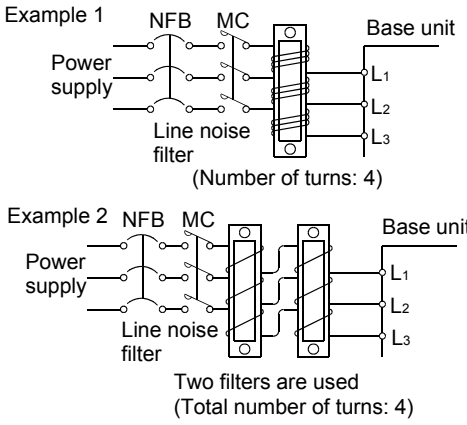
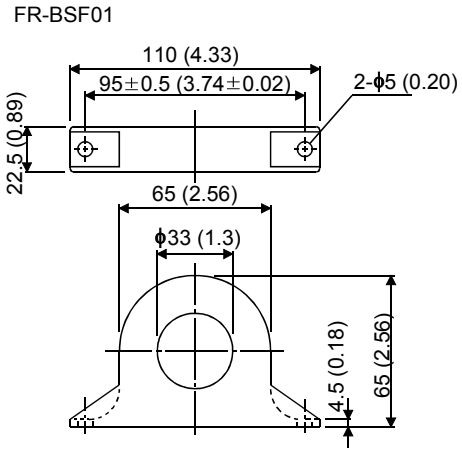
Note. Screw hole for grounding. Connect it to the earth plate of the control box.

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

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

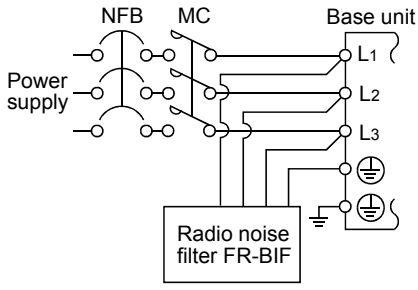
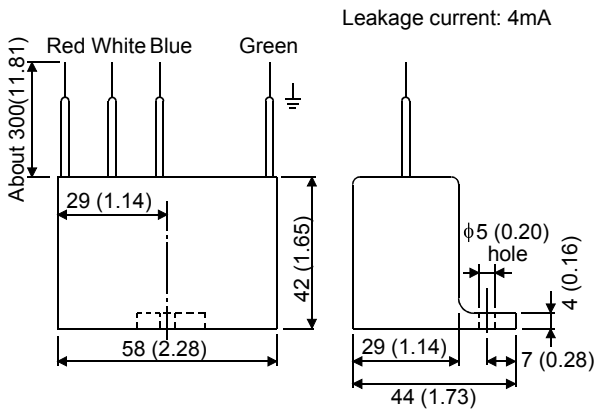
(d) Line noise filter (FR-BLF, FR-BSF01)

This filter is effective in suppressing noises radiated from the power supply side and output side of MELSERVO-J2M and also in suppressing high-frequency leakage current side (zero-phase current) especially within 0.5MHz to 5MHz band.

Connection diagram	Outline drawing [Unit: mm] ([Unit: in])
Wind the 3-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the base unit. The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four. If the wires are too thick to be wound, use two or more filters and make the total number of turns as mentioned above. On the output side, the number of turns must be four or less. Do not wind the grounding wire together with the 3-phase wires. The filter effect will decrease. Use a separate wire for grounding. 	

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

This filter is effective in suppressing noises radiated from the power supply side of MELSERVO-J2M 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. When using the FR-BIF with a single-phase wire, always insulate the wires that are not used for wiring. 	

12.2.7 Leakage current breaker

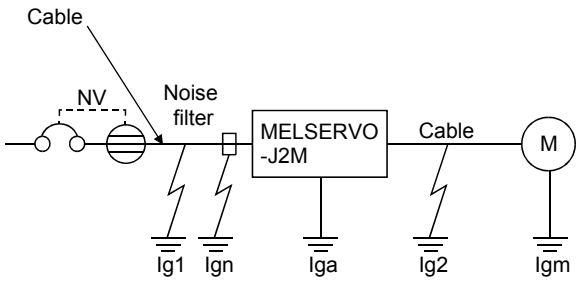
(1) Selection method

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 base unit, 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] .....(12.1)



K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-HW	1
General models	BV-C1 NFB NV-L	3

Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the base unit (Found from Fig. 12.1.)

Ig2: Leakage current on the electric channel from the output terminals of the drive unit to the servo motor (Found from Fig. 12.1.)

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

Iga: Leakage current of the drive unit (Found from Table 12.4.)

Igm: Leakage current of the servo motor (Found from Table 12.3.)

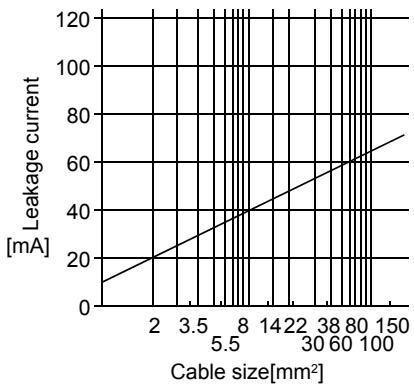


Fig. 12.1 Leakage current example (Ig1, Ig2) for CV cable run in metal conduit

Table 12.3 Servo motor's leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 0.4	0.1

Table 12.4 Drive unit's leakage current example (Iga)

Drive unit capacity [kW]	Leakage current [mA]
0.1 to 0.4	0.3
0.75	0.6

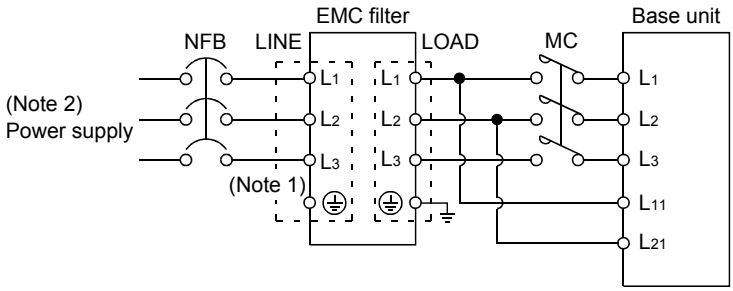
12.2.8 EMC filter

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

(1) Combination with the base unit

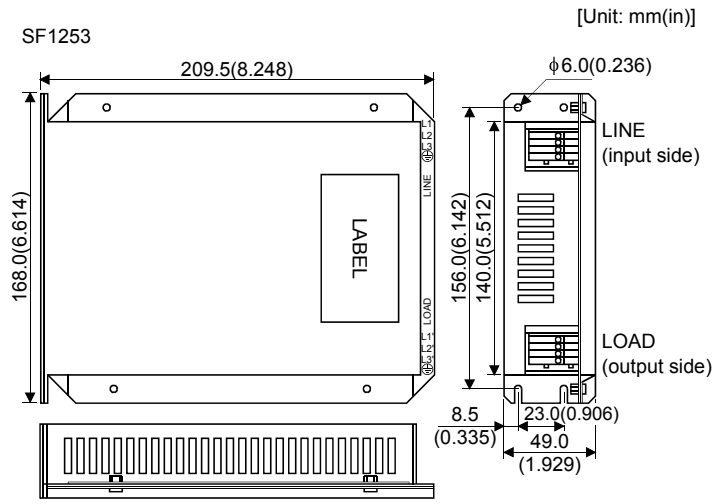
Base unit	Recommended filter		Mass [kg(lb)]
	Model	Leakage current [mA]	
MR-J2M-BU4 MR-J2M-BU6 MR-J2M-BU8	SF1253	57	1.37 (3.02)

(2) Connection example



Note 1. Connect when the power supply has earth.
2. Connect a 1-phase 200 to 230VAC power supply to L1/L2 and keep L3 open.

(3) Outline drawing



MEMO

13. COMMUNICATION FUNCTIONS

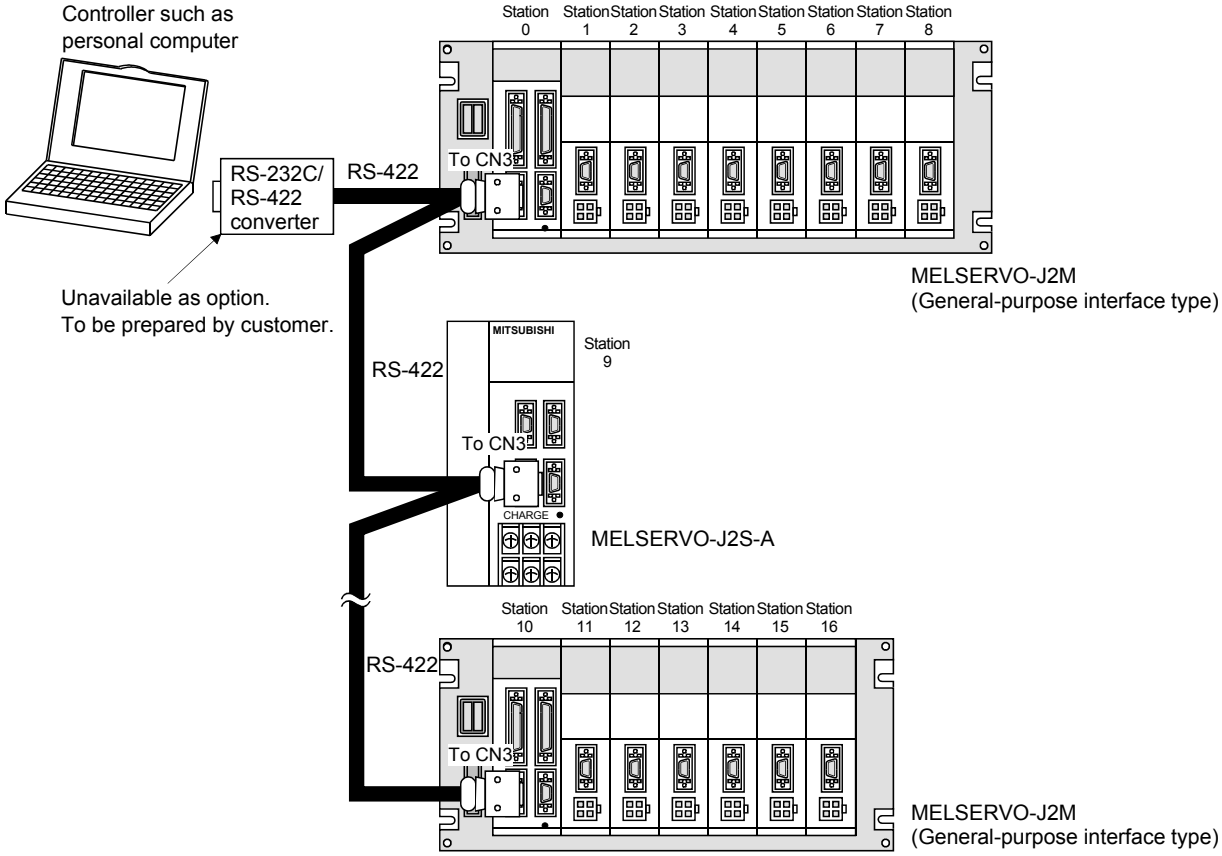
MELSERVO-J2M has the RS-422 and RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.
However, the RS-422 and RS-232C communication functions cannot be used together. Select between RS-422 and RS-232C with IFU parameter No.0. (Refer to Section 13.2.2.)

13.1 Configuration

13.1.1 RS-422 configuration

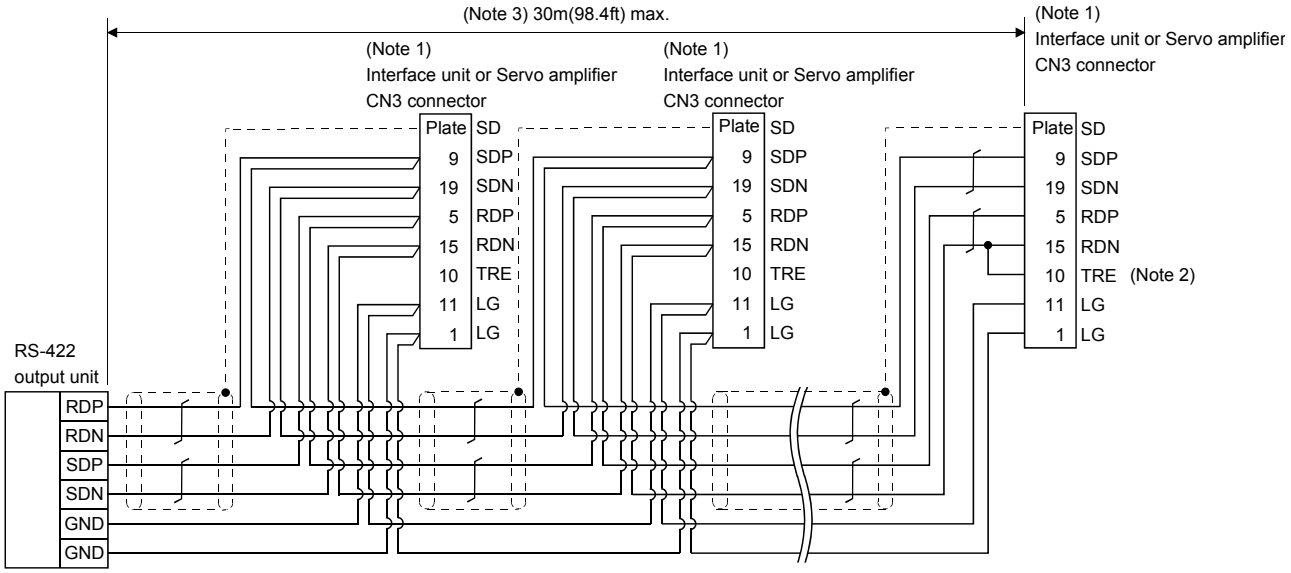
(1) Outline (Example)

The interface unit and drive units of stations 0 to 31 can be run/operated on the same bus.
Similarly, any servo amplifiers that enable station number setting can be connected on the same bus.
It should be noted that the commands/data should be handled without mistakes since they are specific to each servo amplifier.



(2) Cable connection diagram

Wire as shown below:



Note 1. Connector set MR-J2CN1 (3M or equivalent)

Connector: 10120-3000VE

Shell kit: 10320-52F0-008

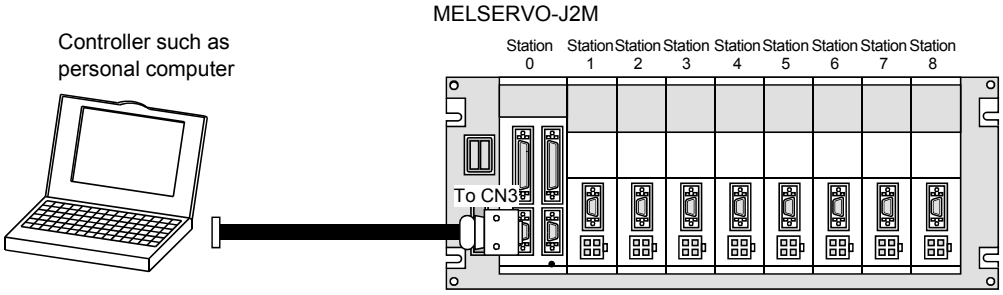
2. In the last axis, connect TRE and RDN.

3. 30m (98.4ft) max. in environment of little noise.

13.1.2 RS-232C configuration

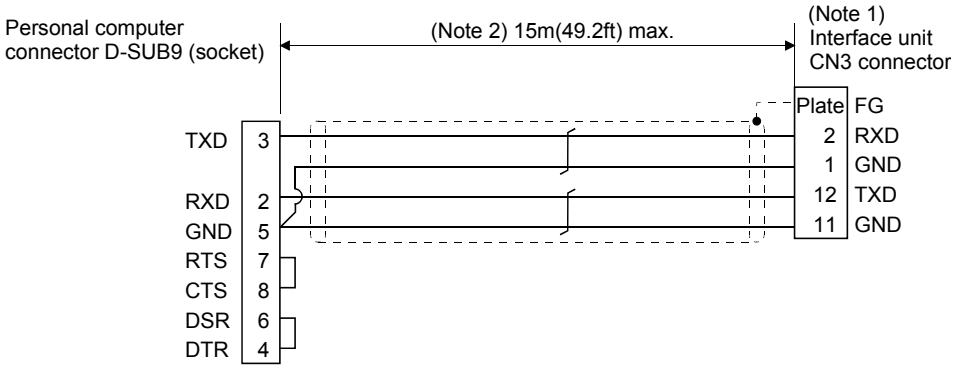
(1) Outline (Example)

Run/operate.



(2) Cable connection diagram

Wire as shown below. The communication cable for connection with the personal computer (MR-CPCATCBL3M) is available. (Refer to Section 12.1.2 (3))



Note 1. For CN3 connector (3M)

Connector: 10120-6000EL

Shell kit: 10320-3210-000

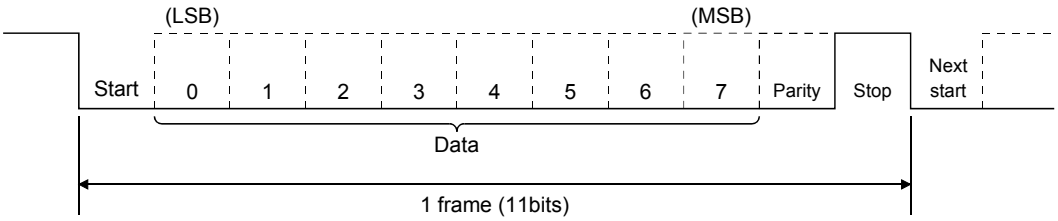
2. 15m(49.2ft) max. in environment of little noise. However, this distance should be 3m(9.84ft) max. for use at 38400bps or more baudrate.

13.2 Communication specifications

13.2.1 Communication overview

This servo amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (e.g. personal computer) is called a master station and the device which sends a reply in response to the instruction (drive unit) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Description
Baudrate	9600/19200/38400/57600 asynchronous system
Transfer code	Start bit ：1 bit Data bit ：8 bits Parity bit：1 bit (even) Stop bit ：1 bit
Transfer protocol	Character system, half-duplex communication system



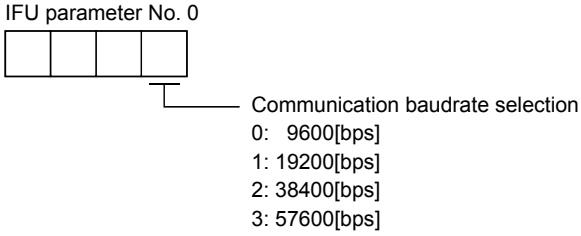
13.2.2 Parameter setting

When the RS-422/RS-232C communication function is used to operate the servo, set the communication specifications of the servo amplifier in the corresponding parameters.
After setting the values of these parameters, they are made valid by switching power off once, then on again.

(1) Serial communication baudrate

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

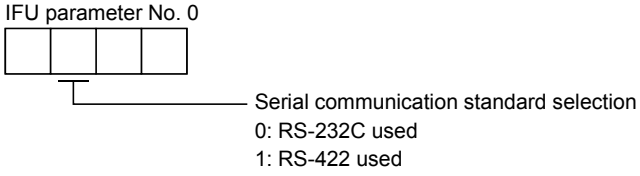
IFU parameter No. 0



(2) Serial communication selection

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

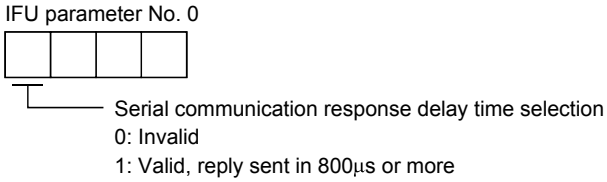
IFU parameter No. 0



(3) Serial communication response delay time

Set the time from when the servo amplifier (slave station) receives communication data to when it sends back data. Set "0" to send back data in less than 800μs or "1" to send back data in 800μs or more.

IFU parameter No. 0



(4) Station number setting

In IFU parameter No. 10 to 18, set the station numbers of the units connected to the slots. Do not use the station numbers used by the other units.

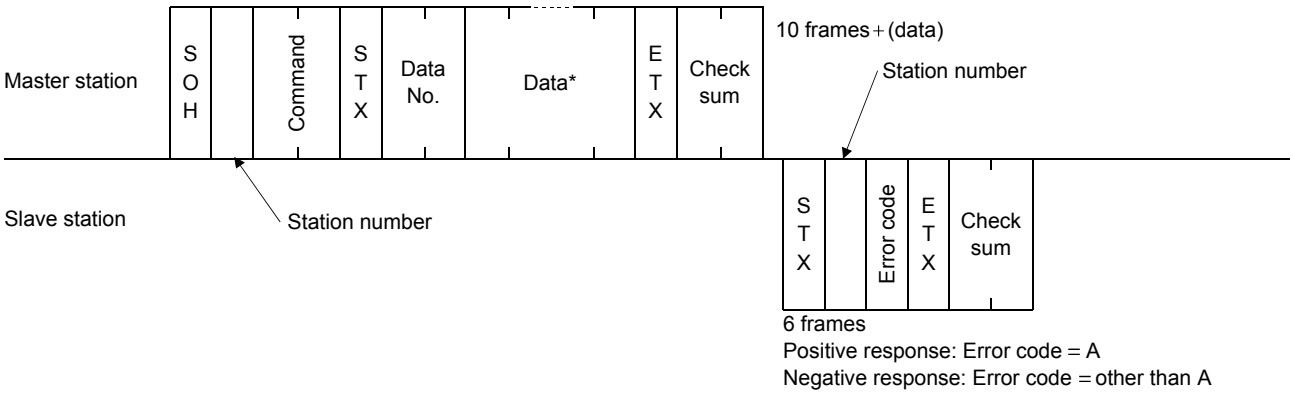
IFU parameter No.	Slot Whose Station Number Is Set	Default Station Number	Usable Station Numbers
10	Interface unit slot	0	0 to 31
11	Slot 1	1	
12	Slot 2	2	
13	Slot 3	3	
14	Slot 4	4	
15	Slot 5	5	
16	Slot 6	6	
17	Slot 7	7	
18	Slot 8	8	

13.3 Protocol

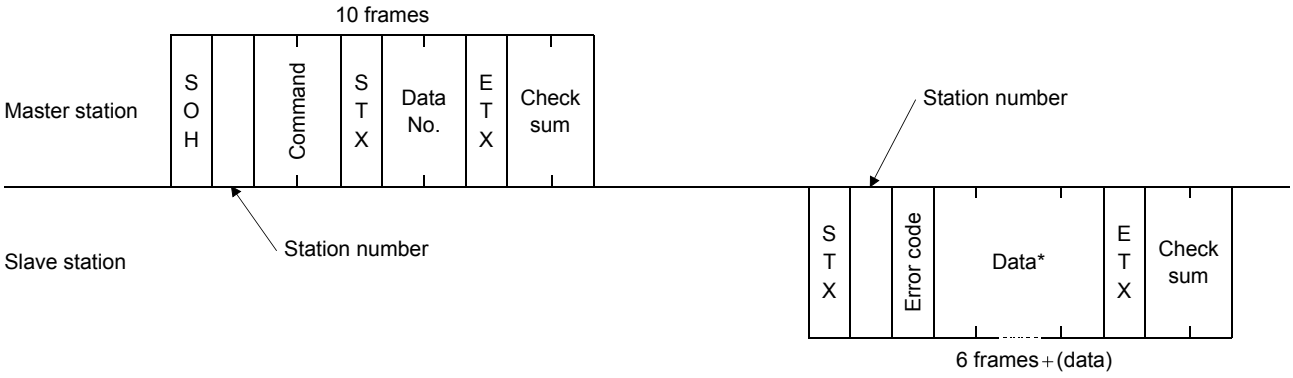
> **POINT**
>
> ▪ Whether station number setting will be made or not must be selected if the RS-232C communication function is used.

Since up to 32 axes may be connected to the bus, add a station number to the command, data No., etc. to determine the destination unit of data communication. Set the station number per unit using the IFU parameters. Send data are valid for the unit of the specified station number.

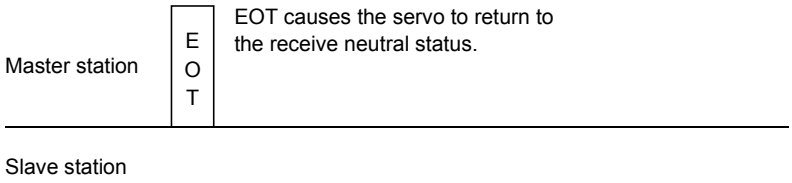
(1) Transmission of data from the controller to the servo



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

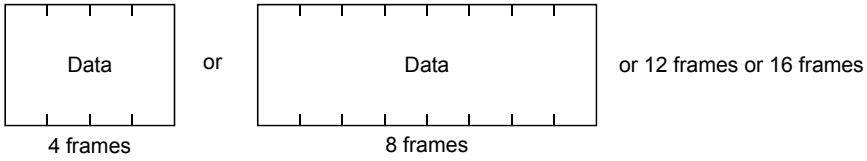


(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



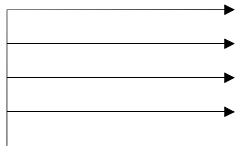
13.4 Character codes

(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 to b_5	b_4	b_3	b_2	b_1	CR	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	Space	0	@	P	`	p
	0	0	0	1	1	SOH	DC_1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC_2	"	2	B	R	b	r
	0	0	1	1	3	ETX	DC_3	#	3	C	S	c	s
	0	1	0	0	4			$	4	D	T	d	t
	0	1	0	1	5			%	5	E	U	e	u
	0	1	1	0	6			&	6	F	V	f	v
	0	1	1	1	7			'	7	G	W	g	w
	1	0	0	0	8			(	8	H	X	h	x
	1	0	0	1	9			)	9	I	Y	i	y
	1	0	1	0	10			*	:	J	Z	j	z
	1	0	1	1	11			+	;	K	[	k	{
	1	1	0	0	12			,	<	L	¥	l	|
	1	1	0	1	13			−	=	M	]	m	}
	1	1	1	0	14			.	>	N	^	n	¯
	1	1	1	1	15			/	?	O	_	o	DEL

(3) Station numbers

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

Station number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASCII code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Station number	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ASCII code	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

For example, "30H" is transmitted in hexadecimal for the station number of "0".

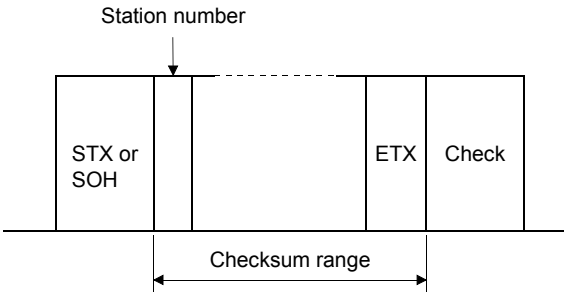
13.5 Error codes

Error codes are used in the following cases and an error code of single-code length is transmitted.
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.
The error code sent in upper case indicates that the MELSERVO-J2M is normal and the one in lower case indicates that an alarm occurred.

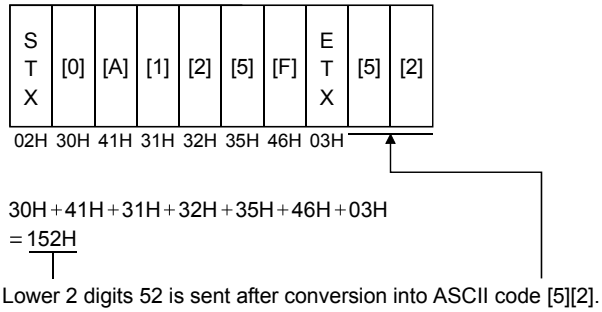
Error code		Error name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	Character not existing in the specifications was transmitted.	
[E]	[e]	Command error	Command not existing in the specifications was transmitted.	
[F]	[f]	Data No. error	Data No. not existing in the specifications was transmitted.	

13.6 Checksum

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

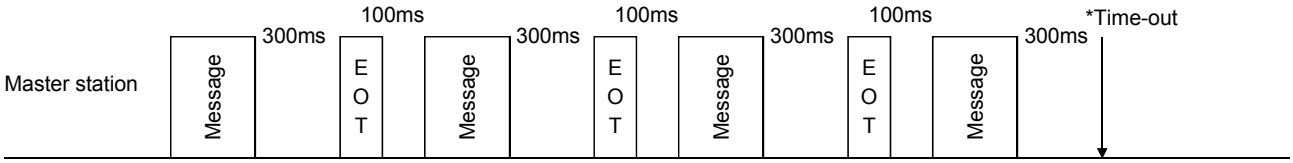


(Example)



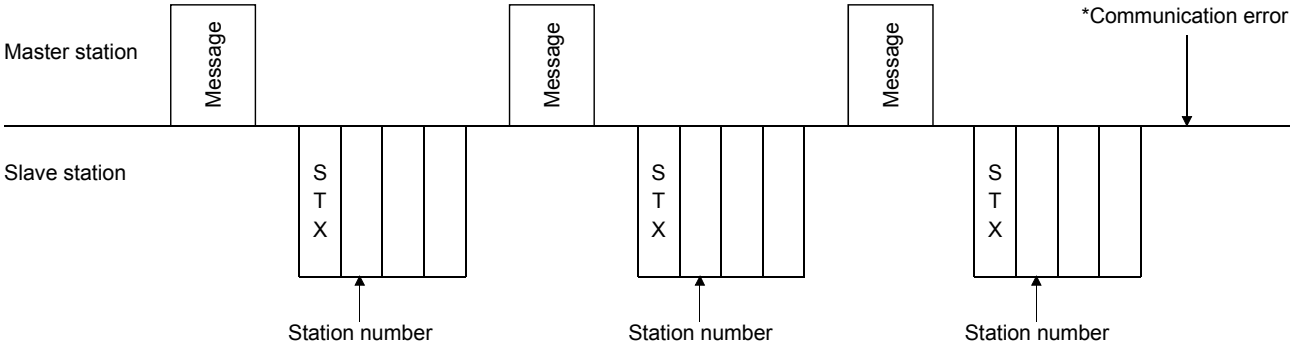
13.7 Time-out operation

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)



13.8 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.

13.9 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:

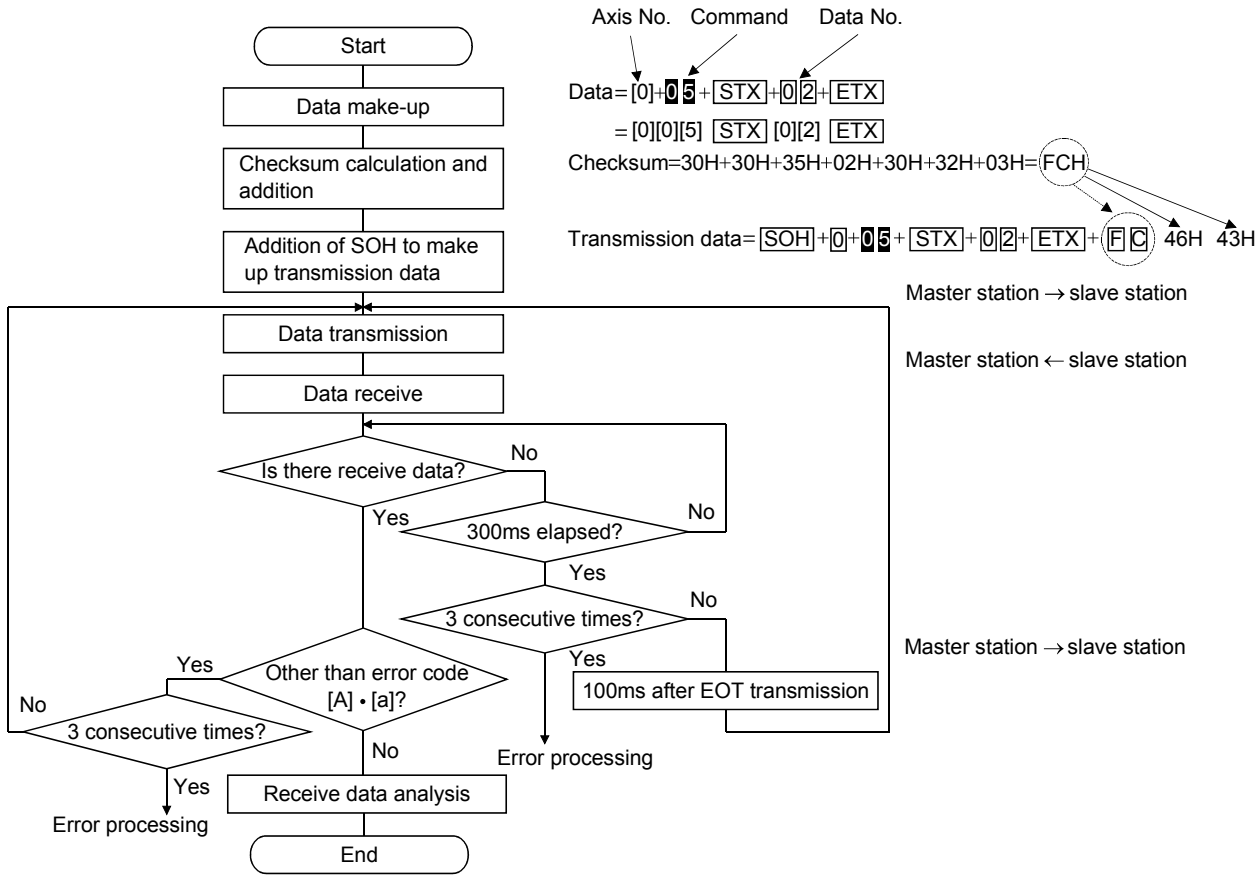
(1) 1s or more time has elapsed after the slave station is switched on; and

(2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

13.10 Communication procedure example

The following example reads the set value of DRU parameter No.2 "function selection 1" from the drive unit of station 0:

Data item	Value	Description
Station number	0	Interface unit station 0
Command	05	Read command
Data No.	02	DRU parameter No.2



13.11 Command and data No. list

POINT

- If the command/data No. is the same, its data may be different from the interface and drive units and other servo amplifiers.

The commands/data No. of the respective interface unit and drive units are those marked ○ in the Unit field.

13.11.1 Read commands

(1) Status display (Command [0][1])

Command	Data No.	Description	Display item	Frame length	Unit	
					IFU	DRU
[0][1]	[8][0]	Status display data value and processing information	regenerative load ratio	12	○	
[0][1]	[8][1]		Bus voltage	12	○	
[0][1]	[8][2]		Peak Bus voltage	12	○	
[0][1]	[8][0]	Status display data value and processing information	cumulative feedback pulses	12		○
[0][1]	[8][1]		Servo motor speed	12		○
[0][1]	[8][2]		droop pulses	12		○
[0][1]	[8][3]		cumulative command pulses	12		○
[0][1]	[8][4]		command pulse frequency	12		○
[0][1]	[8][5]		effective load ratio	12		○
[0][1]	[8][6]		peak load ratio	12		○
[0][1]	[8][7]		Instantaneous torque	12		○
[0][1]	[8][8]		within one-revolution position	12		○
[0][1]	[8][9]		ABS counter	12		○
[0][1]	[8][A]		load inertia moment ratio	12		○

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

Command	Data No.	Description	Frame length	Unit	
				IFU	DRU
[0][5]	[0][0] to [1][D]	Current value of each parameter The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8	○	
[0][5]	[0][0] to [5][4]	Current value of each parameter The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8		○

(3) External I/O signals (Command [1][2])

Command	Data No.	Description	Frame length	Unit	
				IFU	DRU
[1][2]	[4][0]	External input pin statuses	8	○	
[1][2]	[4][1]	External input pin statuses	8	○	
[1][2]	[4][3]	External input pin statuses	8	○	
[1][2]	[C][0]	External output pin statuses	8	○	
[1][2]	[C][1]	External output pin statuses	8	○	

(4) Alarm history (Command [3][3])

Command	Data No.	Description	Alarm occurrence sequence	Frame length	Unit	
					IFU	DRU
[3][3]	[1][0]	Alarm number in alarm history	most recent alarm	4	○	○
[3][3]	[1][1]		first alarm in past	4	○	○
[3][3]	[1][2]		second alarm in past	4	○	○
[3][3]	[1][3]		third alarm in past	4	○	○
[3][3]	[1][4]		fourth alarm in past	4	○	○
[3][3]	[1][5]		fifth alarm in past	4	○	○
[3][3]	[2][0]	Alarm occurrence time in alarm history	most recent alarm	4	○	○
[3][3]	[2][1]		first alarm in past	4	○	○
[3][3]	[2][2]		second alarm in past	4	○	○
[3][3]	[2][3]		third alarm in past	4	○	○
[3][3]	[2][4]		fourth alarm in past	4	○	○
[3][3]	[2][5]		fifth alarm in past	4	○	○

(5) Current alarm (Command [0][2] ▪ [3][5])

Command	Data No.	Description	Frame length	Unit	
				IFU	DRU
[0][2]	[0][0]	Current alarm number	4	○	○

Command	Data No.	Description	Display item	Frame length	Unit	
					IFU	DRU
[3][5]	[8][0]	Status display data value and processing information at alarm occurrence	regenerative load ratio	12	○	
[3][5]	[8][1]		Bus voltage	12	○	
[3][5]	[8][2]		Peak Bus voltage	12	○	
[3][5]	[8][0]	Status display data value and processing information at alarm occurrence	cumulative feedback pulses	12		○
[3][5]	[8][1]		Servo motor speed	12		○
[3][5]	[8][2]		droop pulses	12		○
[3][5]	[8][3]		cumulative command pulses	12		○
[3][5]	[8][4]		command pulse frequency	12		○
[3][5]	[8][5]		effective load ratio	12		○
[3][5]	[8][6]		peak load ratio	12		○
[3][5]	[8][7]		Instantaneous torque	12		○
[3][5]	[8][8]		within one-revolution position	12		○
[3][5]	[8][9]		ABS counter	12		○
[3][5]	[8][A]		load inertia moment ratio	12		○

(6) Others

Command	Data No.	Description	Frame length	Unit	
				IFU	DRU
[0][2]	[9][0]	Servo motor end pulse unit absolute position	8		○
[0][2]	[9][1]	Command unit absolute position	8		○
[0][2]	[7][0]	Software version	16	○	○
[0][0]	[8][0]	Read of slot connection status	8	○	

13.11.2 Write commands

(1) Status display (Command [8][1])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[8][1]	[0][0]	Status display data clear	1EA5	4		○

(2) Parameter (Command [8][4])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[8][4]	[0][0] to [1][D]	Each parameter write The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	Depends on the parameter.	8	○	
[8][4]	[0][0] to [5][4]	Each parameter write The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	Depends on the parameter.	8		○

(3) Alarm history (Command [8][2])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[8][2]	[2][0]	Alarm history clear	1EA5	4	○	○

(4) Current alarm (Command [8][2])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[8][2]	[0][0]	Alarm reset	1EA5	4	○	○

(5) Operation mode selection (Command [8][B])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[8][B]	[0][0]	Exit from test operation mode	0000	4	○	○
		Jog operation	0001			○
		Positioning operation	0002			○
		Motor-less operation	0003			○
		Output signal (DO) forced output	0004		○	○

(6) External input signal disable (Command [9][0])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[9][0]	[0][0]	Turns off the external input signals (DI), external input signals and pulse train inputs with the exception of EMG_□, LSP□ and LSN□, independently of the external ON/OFF statuses.	1EA5	4		○
[9][0]	[0][3]	Changes the external output signals (DO) into the value of command [8][B] or command [A][0] + data No. [0][1].	1EA5	4		○
[9][0]	[1][0]	Enables the disabled external input signals (DI), external input signals and pulse train inputs with the exception of EMG_□, LSP□ and LSN□.	1EA5	4		○
[9][0]	[1][3]	Enables the disabled external output signals (DO).	1EA5	4		○

(7) Data for test operation mode (Command [9][2] · [A][0])

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[9][2]	[0][0]	Input signal for test operation	Refer to section 13.12.6	8		○
[9][2]	[A][0]	Forced output from signal pin	Refer to section 13.12.8	8	○	○

Command	Data No.	Description	Setting range	Frame length	Unit	
					IFU	DRU
[A][0]	[1][0]	Writes the speed of the test operation mode (jog operation, positioning operation).	0000 to Permissible instantaneous speed	4		○
[A][0]	[1][1]	Writes the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	00000000 to 20000	8		○
[A][0]	[1][2]	Clears the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	1EA5	4		○
[A][0]	[1][3]	Writes the moving distance (in pulses) of the test operation mode (jog operation, positioning operation).	80000000 to 7FFFFFFF	8		○
[A][0]	[1][5]	Temporary stop command of the test operation mode (jog operation, positioning operation)	1EA5	4		○

13.12 Detailed explanations of commands

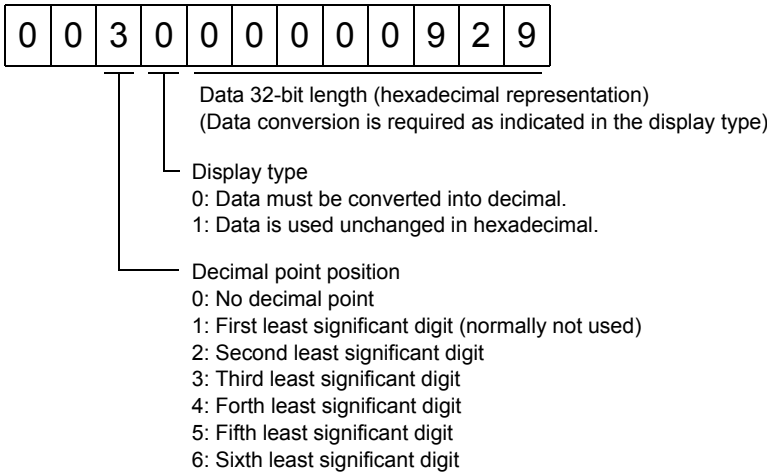
13.12.1 Data processing

When the master station transmits a command + data No. or a command + data No. + data to a slave station, a reply or data is returned from the slave station according to the purpose.
When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.
Therefore, data must be processed according to the application.
Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.
The following methods are how to process send and receive data when reading and writing data.

(1) Processing the read data

When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.
When the display type is 1, the eight-character data is used unchanged.

The following example indicates how to process the receive data "003000000929" given to show.
The receive data is as follows.

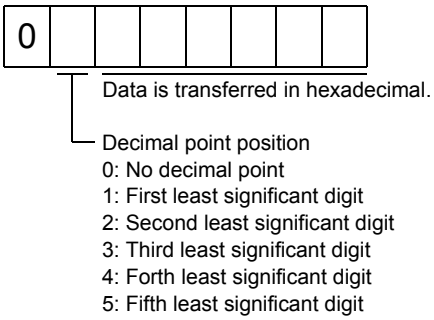


Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
00000929H→2345
As the decimal point position is "3", a decimal point is placed in the third least significant digit.
Hence, "23.45" is displayed.

(2) Writing the processed data

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

The data to be sent is the following value.



By way of example, here is described how to process the set data when a value of "15.5" is sent. Since the decimal point position is the second digit, the decimal point position data is "2".As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

13.12.2 Status display

(1) Status display data read

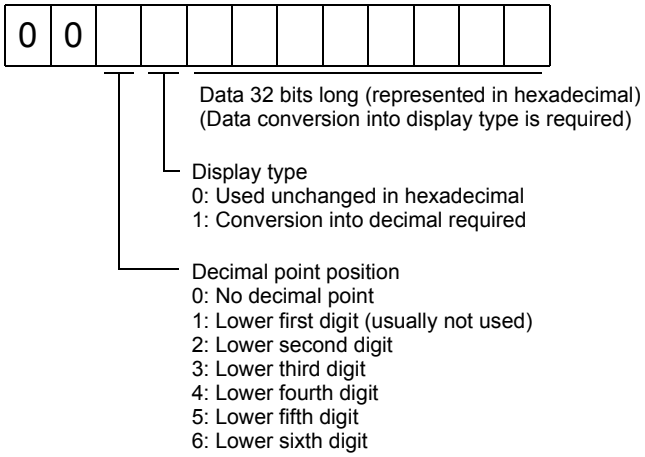
When the master station transmits the data No. (refer to the following table for assignment) to the slave station, the slave station sends back the data value and data processing information.

1) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. Refer to Section 13.11.1.

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.

Command	Data No.	Data	Unit	
			IFU	DRU
[8][1]	[0][0]	1EA5		○

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

13.12.3 Parameter

(1) Parameter read

Read the parameter setting.

1) Transmission

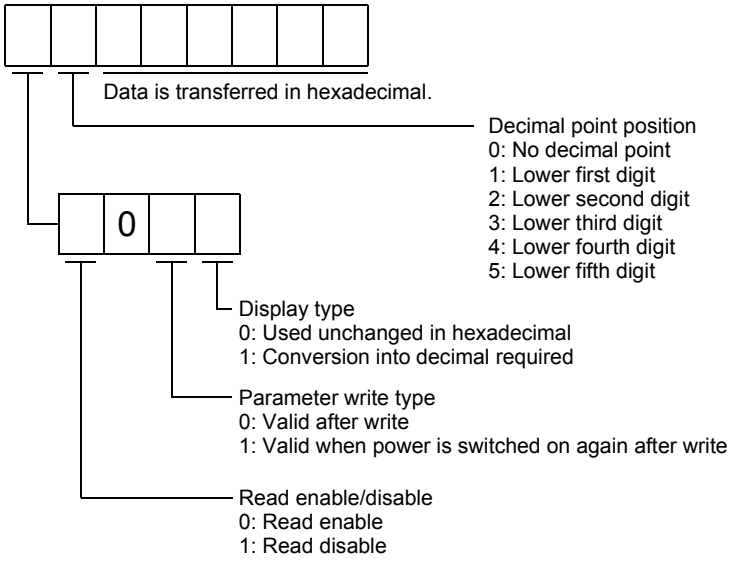
Transmit command [0][5] and the data No. corresponding to the parameter No.

The data No. is expressed in hexadecimal equivalent of the data No. value corresponds to the parameter number.

Command	Data No.	Unit	
		IFU	DRU
[0][5]	[0][0] to [1][D]	○	
[0][5]	[0][0] to [5][4]		○

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

POINT
・The number of write times to the EEP-ROM is limited to 100,000.

Write the parameter setting.
Write the value within the setting range. Refer to Section 5.1 for the setting range.
Transmit command [8][4], the data No., and the set data.
The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.
When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.
Write the data after making sure that it is within the upper/lower limit value range 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	Unit	
			IFU	DRU
[8][4]	[0][0] to [1][D]	See below.	○	
[8][4]	[0][0] to [5][4]			○

Data is transferred in hexadecimal.

Decimal point position
0: No decimal point
1: Lower first digit
2: Lower second digit
3: Lower third digit
4: Lower forth digit
5: Lower fifth digit

Write mode
0: Write to EEP-ROM
3: Write to RAM
When the parameter data is changed frequently through communication,
set "3" to the write mode to change only the RAM data in the servo amplifier.
When changing data frequently (once or more within one hour),
do not write it to the EEP-ROM.

13.12.4 External I/O pin statuses (DIO diagnosis)

(1) External input pin status read (CN1A・CN1B)

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

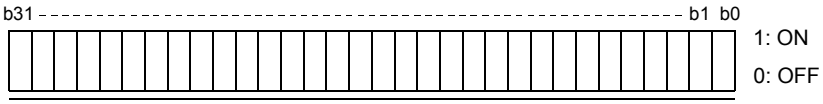
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[1][2]	[4][0]	○	

(b) Reply

The ON/OFF statuses of the input pins are sent back.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	External input pin
0	CN1A-4
1	CN1A-5
2	CN1A-7
3	CN1A-9
4	CN1A-10
5	CN1A-12
6	CN1A-29
7	CN1A-31

bit	External input pin
8	CN1A-32
9	CN1A-34
10	CN1A-36
11	CN1A-37
12	CN1B-4
13	CN1B-5
14	CN1B-7
15	CN1B-9

bit	External input pin
16	CN1B-10
17	CN1B-12
18	CN1B-29
19	CN1B-31
20	CN1B-32
21	CN1B-34
22	CN1B-36
23	CN1B-37

bit	External input pin
24	
25	
26	
27	
28	
29	
30	
31	

(2) External input pin status read (CN5)

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

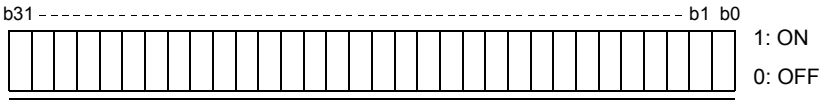
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[1][2]	[4][1]	○	

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	External input pin
0	CN5-1
1	CN5-2
2	CN5-3
3	CN5-4
4	CN5-5
5	CN5-6
6	CN5-7
7	CN5-10

bit	External input pin
8	CN5-11
9	CN5-12
10	CN5-13
11	CN5-14
12	CN5-15
13	CN5-16
14	CN5-17
15	CN5-18

bit	External input pin
16	CN5-20
17	CN5-19
18	
19	
20	
21	
22	
23	

bit	External input pin
24	
25	
26	
27	
28	
29	
30	
31	

(3) External input pin status read (CN4A・CN4B)

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

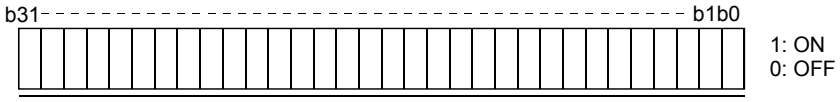
(a) Transmission

Transmit command [1][2] and data No. [4][3].

Command	Data No.	Unit	
		IFU	DRU
[1][2]	[4][3]	○	

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal date.

bit	External input pin
0	CN4A-1
1	CN4A-2
2	CN4A-3
3	CN4A-4
4	CN4A-5
5	CN4A-6
6	CN4A-7
7	CN4A-8

bit	External input pin
8	CN4A-26
9	CN4A-27
10	CN4A-28
11	CN4A-29
12	CN4A-30
13	CN4A-31
14	CN4A-32
15	CN4A-33

bit	External input pin
16	CN4B-1
17	CN4B-2
18	CN4B-3
19	CN4B-4
20	CN4B-5
21	CN4B-6
22	CN4B-7
23	CN4B-8

bit	External input pin
24	CN4B-26
25	CN4B-27
26	CN4B-28
27	CN4B-29
28	CN4B-30
29	CN4B-31
30	CN4B-32
31	CN4B-33

(4) External output pin status read (CN1A・CN1B)

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

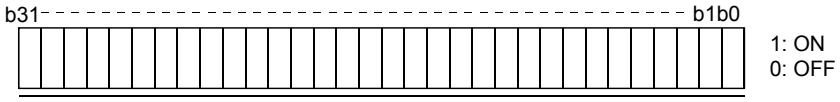
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[1][2]	[C][0]	○	

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal date.

bit	External output pin
0	CN1A-3
1	CN1A-6
2	CN1A-8
3	CN1A-11
4	CN1A-28
5	CN1A-30
6	CN1A-33
7	CN1B-3

bit	External output pin
8	CN1B-6
9	CN1B-8
10	CN1B-11
11	CN1A-11
12	CN1A-28
13	CN1A-30
14	CN1A-32
15	CN1A-35

bit	External output pin
16	CN1A-27
17	CN1B-27
18	CN1A-25
19	CN1A-24
20	CN1A-23
21	CN1A-22
22	CN1B-25
23	CN1B-24

bit	External output pin
24	CN1B-23
25	CN1B-22
26	
27	
28	
29	
30	
31	

(5) External output pin status read (CN4A・CN4B)

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

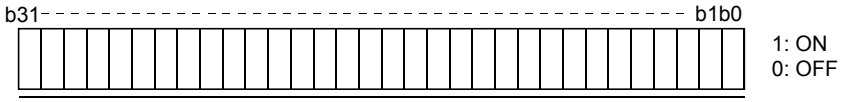
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[1][2]	[C][1]	○	

(b) Reply

The slave station sends back the statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal date.

bit	External output pin
0	CN4A-9
1	CN4A-10
2	CN4A-34
3	CN4A-35
4	CN4B-9
5	CN4B-10
6	CN4B-34
7	CN4B-35

bit	External output pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	External output pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	External output pin
24	
25	
26	
27	
28	
29	
30	
31	

13.12.5 Disable/enable of external I/O signals (DIO)

Inputs can be disabled independently of the external I/O signal ON/OFF. When inputs are disabled, the input signals are recognized as follows. Among the external input signals, forced stop (EMG_□), forward rotation stroke end (LSP□) and reverse rotation stroke end (LSN□) cannot be disabled.

Signal	Status
External input signals (DI)	OFF
Pulse train inputs	None

(1) Disabling/enabling the external input signals (DI), external analog input signals and pulse train inputs with the exception of forced stop (EMG_□), forward rotation stroke end (LSP□) and reverse rotation stroke end (LSN□).
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data	Unit	
			IFU	DRU
[9][0]	[0][0]	1EA5		○

(b) Enable

Command	Data No.	Data	Unit	
			IFU	DRU
[9][0]	[1][0]	1EA5		○

(2) Disabling/enabling the external output signals (DO)
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data	Unit	
			IFU	DRU
[9][0]	[0][3]	1EA5		○

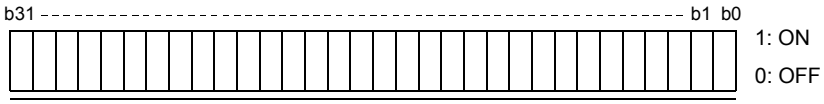
(b) Enable

Command	Data No.	Data	Unit	
			IFU	DRU
[9][0]	[1][3]	1EA5		○

13.12.6 External input signal ON/OFF (test operation)

Each input signal can be turned on/off for test operation. Turn off the external input signals.
Send command [9] [2], data No. [0] [0] and data.

Command	Data No.	Data	Unit	
			IFU	DRU
[9][2]	[0][0]	See below		○



Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Signal abbreviation
0	SON□
1	LSP□
2	LSN□
3	TL□
4	
5	PC□
6	RES□
7	CR□

bit	Signal abbreviation
8	
9	
10	
11	ST1
12	ST2
13	
14	
15	

bit	Signal abbreviation
16	
17	
18	
19	
20	
21	
22	
23	

bit	Signal abbreviation
24	
25	
26	
27	
28	
29	
30	
31	

13.12.7 Test operation mode

(1) Instructions for test operation mode

The test operation mode must be executed in the following procedure. If communication is interrupted for longer than 0.5s during test operation, the servo amplifier causes the motor to be decelerated to a stop and servo-locked. To prevent this, continue communication without a break, e.g. monitor the status display.

(a) Execution of test operation

1) Turn off all external input signals.

2) Disable the external input signals.

Command	Data No.	Data	Unit	
			IFU	DRU
[9][2]	[0][0]	1EA5		○

3) Choose the test operation mode.

Command	Data No.	Transmission data	Selection of test operation mode	Unit	
				IFU	DRU
[8][B]	[0][0]	0000	Test operation mode cancel	○	○
[8][B]	[0][0]	0001	Jog operation		○
[8][B]	[0][0]	0002	Positioning operation		○
[8][B]	[0][0]	0003	Motor-less operation		○
[8][B]	[0][0]	0004	DO forced output	○	○

4) Set the data needed for test operation.

5) Start.

6) Continue communication using the status display or other command.

(b) Termination of test operation

To terminate the test operation mode, complete the corresponding operation and:

1) Clear the test operation acceleration/deceleration time constant.

Command	Data No.	Data	Unit	
			IFU	DRU
[A][0]	[1][2]	1EA5		○

2) Cancel the test operation mode.

Command	Data No.	Data	Unit	
			IFU	DRU
[8][B]	[0][0]	0000	○	○

3) Enable the disabled external input signals.

Command	Data No.	Data	Unit	
			IFU	DRU
[9][0]	[1][0]	1EA5		○

(2) Jog operation

Transmit the following communication commands:

(a) Setting of jog operation data

Item	Command	Data No.	Data	Unit	
				IFU	DRU
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.		○
Acceleration/deceleration time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.		○

(b) Start

Turn on the external input signals servo-on (SON□)・ forward rotation stroke end (LSP□)・ reverse rotation stroke end (LSN□) and ST1/ST2 by using command [9][2] + data No. [0][0].

Item	Command	Data No.	Data	Unit	
				IFU	DRU
Forward rotation start	[9][2]	[0][0]	00000807: Turns on SON□・LSP□・ LSN□ and ST1.		○
Reverse rotation start	[9][2]	[0][0]	00001007: Turns on SON□・LSP□・ LSN□ and ST2.		○
Stop	[9][2]	[0][0]	00000007: Turns on SON□・LSP□ and LSN□.		○

(3) Positioning operation

Transmit the following communication commands:

(a) Setting of positioning operation data

Item	Command	Data No.	Data	Unit	
				IFU	DRU
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.		○
Acceleration/decelera-tion time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.		○
Moving distance	[A][0]	[1][3]	Write the moving distance [pulse] in hexadecimal.		○

(b) Input of servo-on・stroke end

Turn on the external input signals servo-on (SON□)・ forward rotation stroke end (LSP□) and reverse rotation stroke end (LSN□) by using command [9][2] + data No. [0][0].

Item	Command	Data No.	Data	Unit	
				IFU	DRU
Servo-on	[9][2]	[0][0]	00000001: Turns on SON□		○
Servo OFF Stroke end ON	[9][2]	[0][0]	00000006: Turns off SON□ and turns on LSP□・LSN□.		○
Servo-on Stroke end ON	[9][2]	[0][0]	00000007: Turns on SON□・LSP□・LSN□.		○

(c) Start of positioning operation

Transmit the speed and acceleration/deceleration time constant, turn on the servo-on (SON□) and forward rotation stroke end (LSP□) ▪ reverse rotation stroke end (LSN□), and then send the moving distance to start positioning operation. After that, positioning operation will start every time the moving distance is transmitted. To start opposite rotation, send the moving distance of a negative value.

When the servo-on (SON□) and forward rotation stroke end (LSP□) ▪ reverse rotation stroke end (LSN□) are off, the transmission of the moving distance is invalid. Therefore, positioning operation will not start if the servo-on (SON□) and forward rotation stroke end (LSP□) ▪ reverse rotation stroke end (LSN□) are turned on after the setting of the moving distance.

(d) Temporary stop

A temporary stop can be made during positioning operation.

Command	Data No.	Data	Unit	
			IFU	DRU
[A][0]	[1][5]	1EA5		○

Retransmit the same communication commands as at the start time to resume operation.

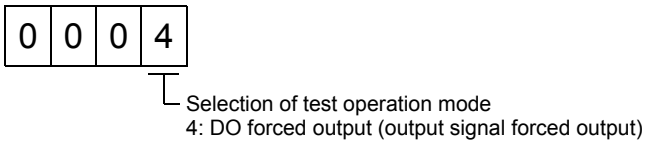
To stop positioning operation after a temporary stop, retransmit the temporary stop communication command. The remaining moving distance is then cleared.

13.12.8 Output signal pin ON/OFF (output signal (DO) forced output)

In the test operation mode, the output signal pins can be turned on/off independently of the servo status. Using command [9][0], disable the output signals in advance.

(1) Choosing DO forced output in test operation mode

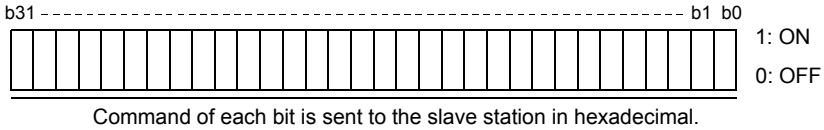
Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.



(2) External output signal ON/OFF

Transmit the following communication commands:

Command	Data No.	Setting data
[9][2]	[A][0]	See below.



bit	External output pin
0	CN1A-19
1	CN1A-18
2	CN1B-19
3	CN1B-6
4	CN1B-4
5	CN1B-18
6	CN1A-14
7	

bit	External output pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	External output pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	External output pin
24	
25	
26	
27	
28	
29	
30	
31	

13.12.9 Alarm history

(1) Alarm No. read

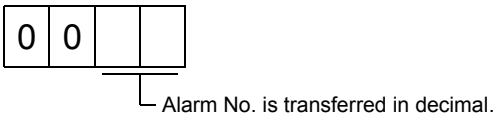
Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No. 0 (last alarm) to No. 5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to Section 13.11.1(4).

(b) Reply

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



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

(2) Alarm occurrence time read

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

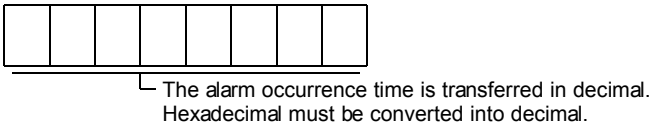
The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

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

Refer to Section 13.11.1(4).

(b) Reply



For example, data "01F5" means that the alarm occurred in 501 hours after start of operation.

(3) Alarm history clear

Erase the alarm history.

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

Command	Data No.	Data	Unit	
			IDU	DRU
[8][2]	[2][0]	1EA5	○	○

13.12.10 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

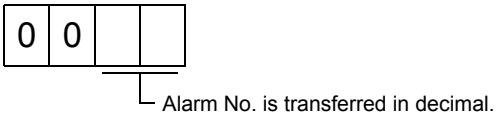
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[0][2]	[0][0]	○	○

(b) Reply

The slave station sends back the alarm currently occurring.



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

(2) Read of the status display at alarm occurrence

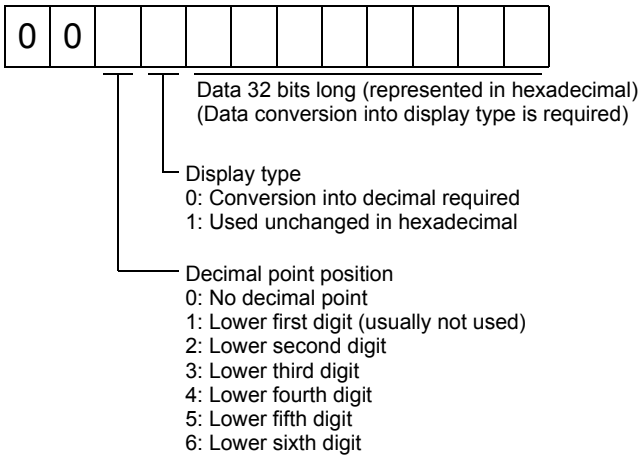
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][A] corresponding to the status display item to be read. Refer to Section 13.11.1 (5).

(b) Reply

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



(3) Current alarm clear

As by the entry of the reset (RES□), reset the servo amplifier alarm to make the servo amplifier ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

Command	Data No.	Data	Unit	
			IFU	DRU
[8][2]	[0][0]	1EA5	○	○

13.12.11 Other commands

(1) Servo motor end pulse unit absolute position

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

Note that overflow will occur in the position of 16384 or more revolutions from the home position.

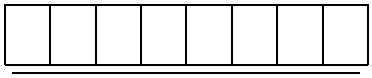
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[0][2]	[9][0]		○

(b) Reply

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



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

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

(2) Command unit absolute position

Read the absolute position in the command unit.

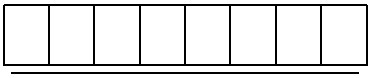
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[0][2]	[9][1]		○

(b) Reply

The slave station sends back the requested command pulses.



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

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

(3) Software version

Reads the software version of the servo amplifier.

(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[0][2]	[7][0]	○	○

(b) Reply

The slave station returns the software version requested.

Space | Software version (15 digits)

(4) Read of slot connection status

Read the absolute position in the command unit.

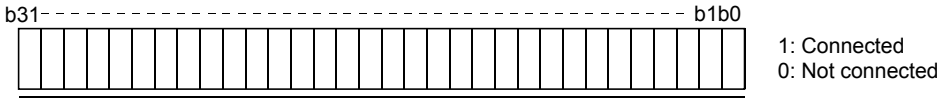
(a) Transmission

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

Command	Data No.	Unit	
		IFU	DRU
[0][0]	[8][0]	○	

(b) Reply

The slave stations send back the statuses of the units connected to the slots.



Command of each bit is sent to the slave station in hexadecimal.

bit	Slot
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8

bit	Slot
8	
9	
10	
11	
12	
13	
14	
15	

bit	Slot
16	Option
17	
18	
19	
20	
21	
22	
23	

bit	Slot
24	
25	
26	
27	
28	
29	
30	
31	

14. ABSOLUTE POSITION DETECTION SYSTEM

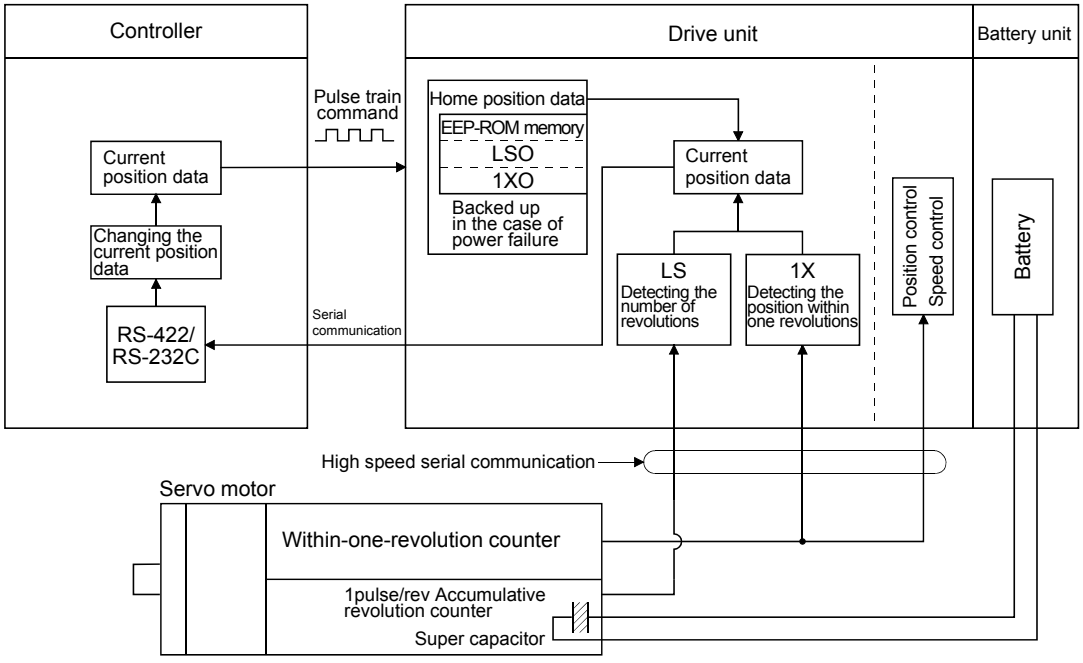
CAUTION

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

14.1 Outline

14.1.1 Features

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.
The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the controller power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.
If a power failure or a fault occurs, restoration is easy.
Also, the absolute position data, which is battery-backed by the super capacitor in the encoder, can be retained within the specified period (cumulative revolution counter value retaining time) if the cable is unplugged or broken.



14.1.2 Restrictions

The absolute position detection system cannot be configured under the following conditions. Test operation cannot be performed in the absolute position detection system, either. To perform test operation, choose incremental in DRU parameter No.1.
(1) Stroke-less coordinate system, e.g. rotary shaft, infinitely long positioning.
(2) Changing of electronic gear after home position setting.

14.2 Specifications

(1) Specification of battery unit MR-J2M-BT

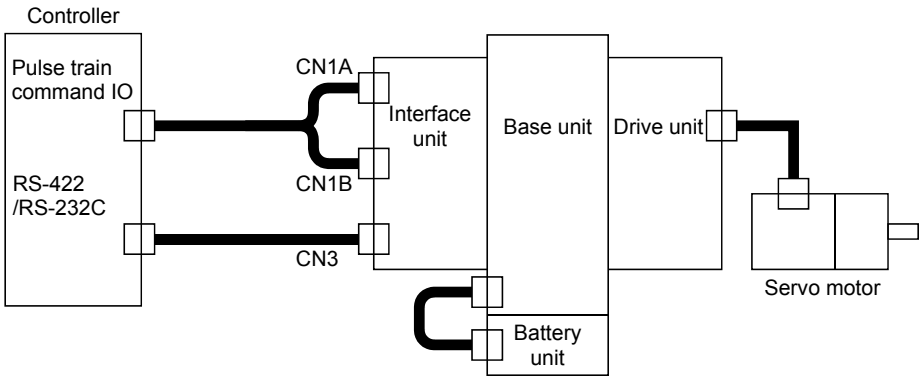
POINT

- The revision (Edition 44) of the Dangerous Goods Rule of the International Air Transport Association (IATA) went into effect on January 1, 2003 and was enforced immediately. In this rule, "provisions of the lithium and lithium ion batteries" were revised to tighten the restrictions on the air transportation of batteries. However, since this battery is dangerous goods (Class 9), requires packing compliant with the Packing Standard 903. When a self-certificate is necessary for battery safety tests, contact our branch or representative. For more information, consult our branch or representative. (As of October, 2005).

Item	Description
Model	MR-J2M-BT
System	Electronic battery backup system
Battery unit	Lithium battery (primary battery, nominal + 3.6V)
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	500r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
(Note 3) Data holding time during battery replacement	2 hours at delivery, 1 hour in 5 years after delivery
Battery storage period	5 years from date of manufacture

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

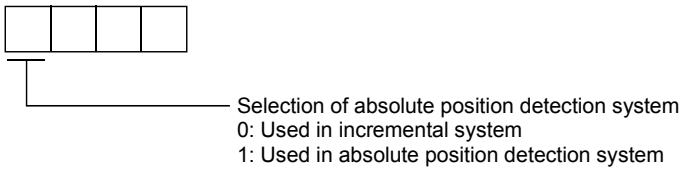
(2) Configuration



(3) DRU parameter setting

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

DRU parameter No. 1



14.3 Signal explanation

The following is the signal used in an absolute position detection system. For the I/O interfaces (symbols in the I/O category column in the table), refer to section 3.2.5.

Signal name	Code	Functions/Applications	I/O category
Clear (home position setting)	CR□	Shorting CR□-SG clears the position control counter and stores the home position data into the non-volatile memory (backup memory).	DI-1

14.4 Serial communication command

The following commands are available for reading absolute position data using the serial communication function. When reading data, take care to specify the correct station number of the drive unit from where the data will be read.

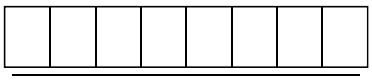
When the master station sends the data No. to the slave station (drive unit), the slave station returns the data value to the master station.

(1) Transmission

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

(2) Reply

The absolute position data in the command pulse unit is returned in hexadecimal.



Data 32-bit length (hexadecimal representation)

14.5 Startup procedure

(1) Connection of a battery unit

(2) Parameter setting

Set "1 □□□"in DRU parameter No. 1 of the servo amplifier and switch power off, then on.

(3) Resetting of absolute position erase (A.25)

After connecting the encoder cable, the absolute position erase (A.25) occurs at first power-on. Leave the alarm as it is for a few minutes, then switch power off, then on to reset the alarm.

(4) Confirmation of absolute position data transfer

After making sure that the ready (RD□) output after the servo-on (SON□) had turned on has turned on, read the absolute value data with the serial communication function.

(5) Home position setting

The home position must be set if:

(a) System setup is performed;

(b) When the drive unit or interface unit is replaced;

(c) The servo motor has been changed; or

(d) The absolute position erase (A.25) occurred.

In the absolute position system, the absolute position coordinates are made up by making home position setting at the time of system setup.

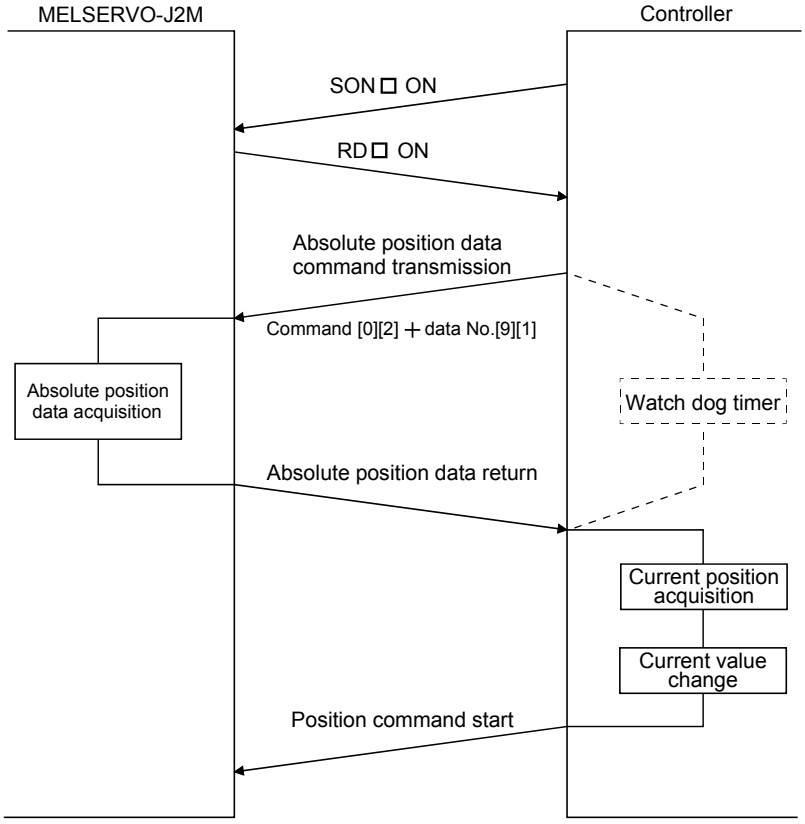
The motor shaft may misoperate if positioning operation is performed without home position setting. Always make home position setting before starting operation.

For the home position setting method and types, refer to Section 14.6.3.

14.6 Absolute position data transfer protocol

14.6.1 Data transfer procedure

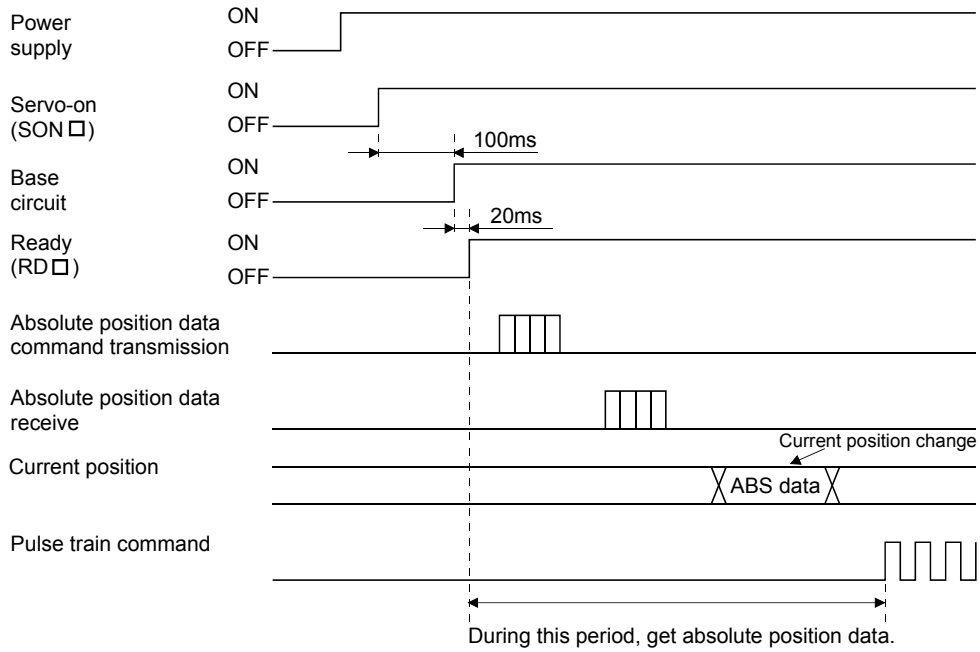
Every time the servo-on (SON□) turns on at power-on or like, the controller must read the current position data in the drive unit. Not performing this operation will cause a position shift.
Time-out monitoring is performed by the controller.



14.6.2 Transfer method

The sequence in which the base circuit is turned ON (servo-on) when it is in the OFF state due to the servo-on (SON□) going OFF, a forced stop, or alarm, is explained below. In the absolute position detection system, always give the serial communication command to read the current position in the drive unit to the controller every time the ready (RD□) turns on. The drive unit sends the current position to the controller on receipt of the command. At the same time, this data is set as a position command value in the drive unit.

(1) Sequence processing at power-on



1) 100ms after the servo-on (SON□) has turned on, the base circuit turns on.
2) After the base circuit has turned on, the ready (RD□) turns on.
3) After the ready (RD□) turned on and the controller acquired the absolute position data, give command pulses to the drive unit. Providing command pulses before the acquisition of the absolute position data can cause a position shift.

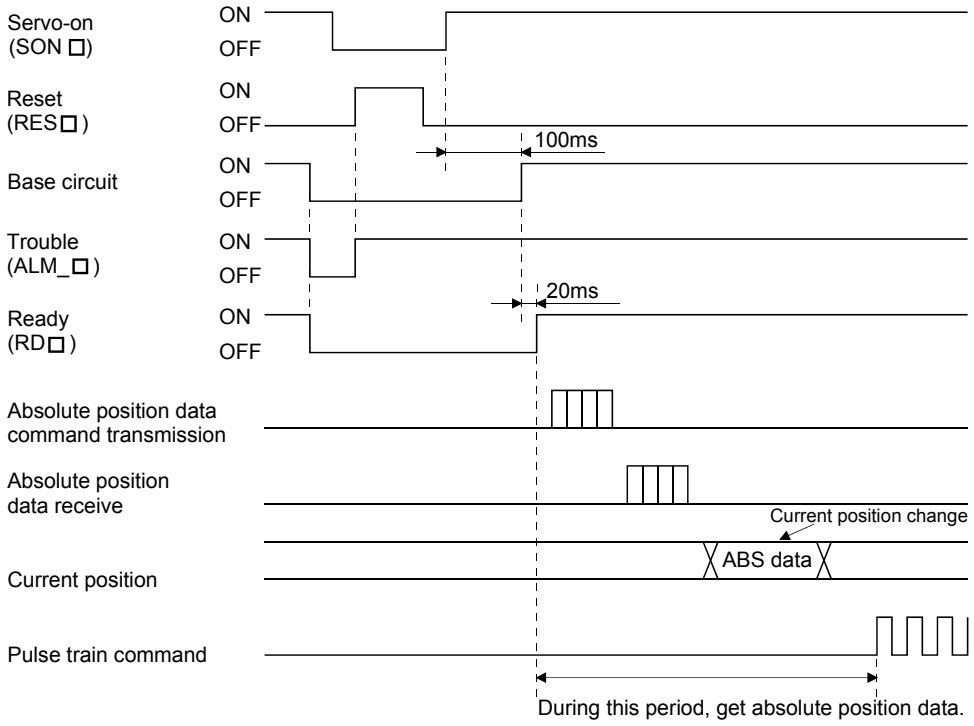
(2) Communication error

If a communication error occurs between the controller and MELSERVO-J2M, the MELSERVO-J2M sends the error code. The definition of the error code is the same as that of the communication function. Refer to Section 13.5 for details.

If a communication error has occurred, perform retry operation. If several retries do not result in a normal termination, perform error processing.

(3) At the time of alarm reset

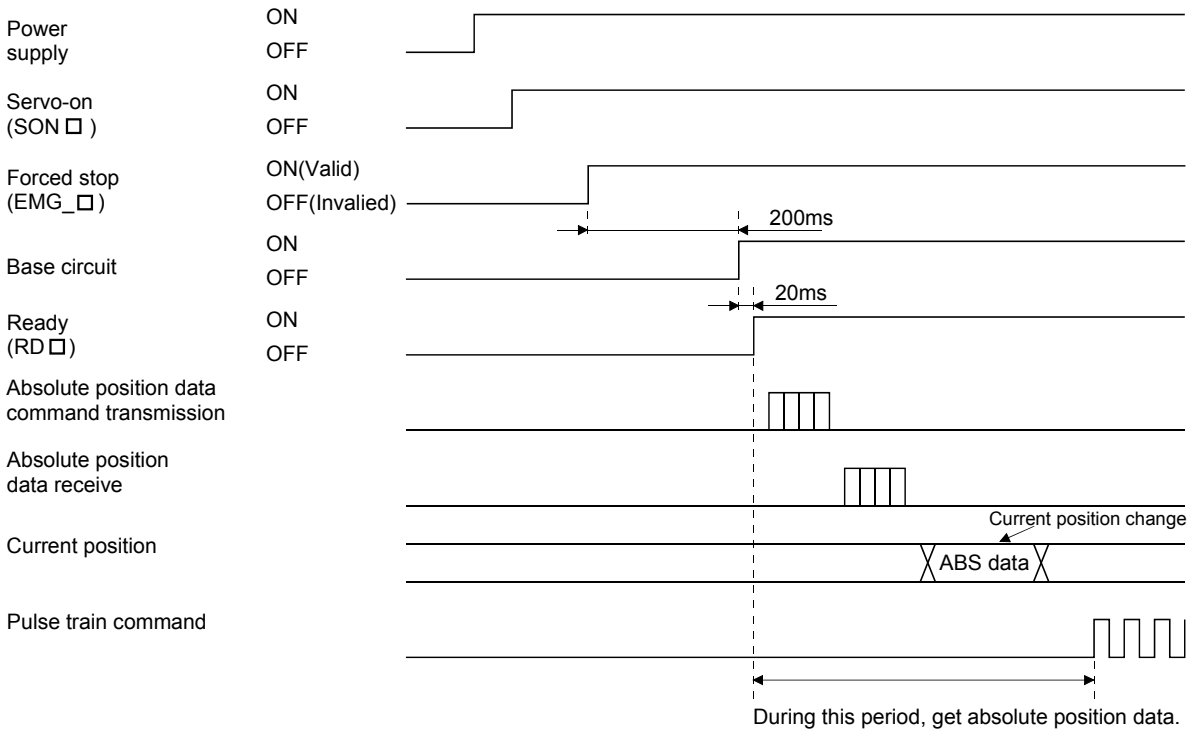
If an alarm has occurred, detect the trouble (ALM_□) and turn off the servo-on (SON□). After removing the alarm occurrence factor and deactivating the alarm, get the absolute position data again from the drive unit in accordance with the procedure in (1) of this section.



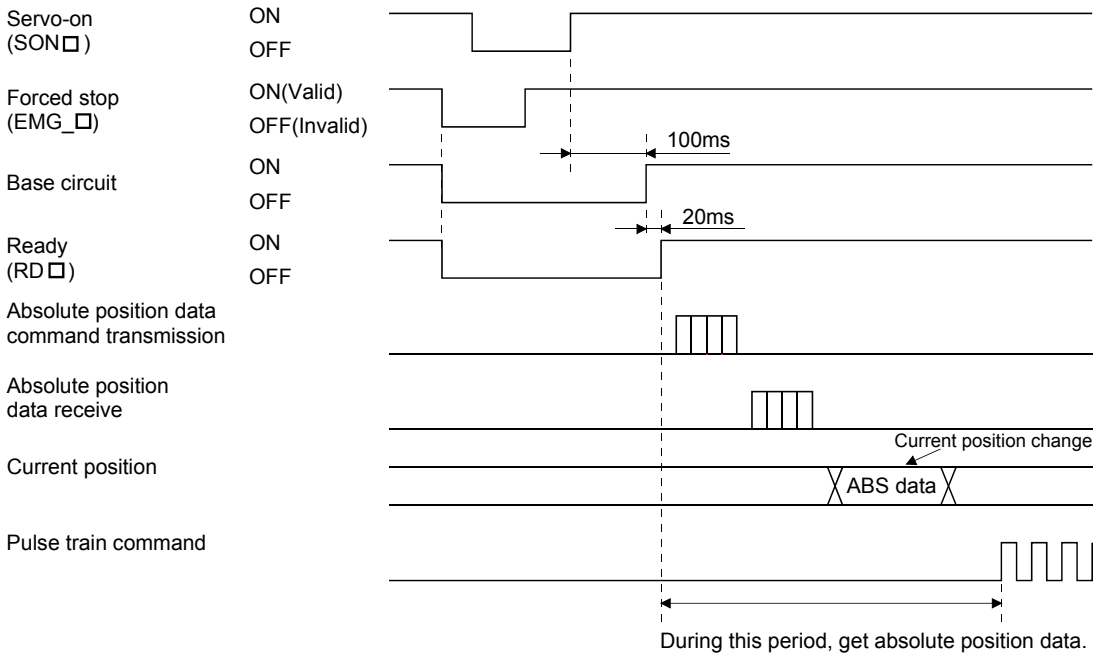
(4) At the time of forced stop reset

200ms after the forced stop is deactivated, the base circuit turns on, and further 20ms after that, the ready (RD□) turns on. Always get the current position data from when the ready (RD□) is triggered until before the position command is issued.

(a) When power is switched on in a forced stop status



(b) When a forced stop is activated during servo on



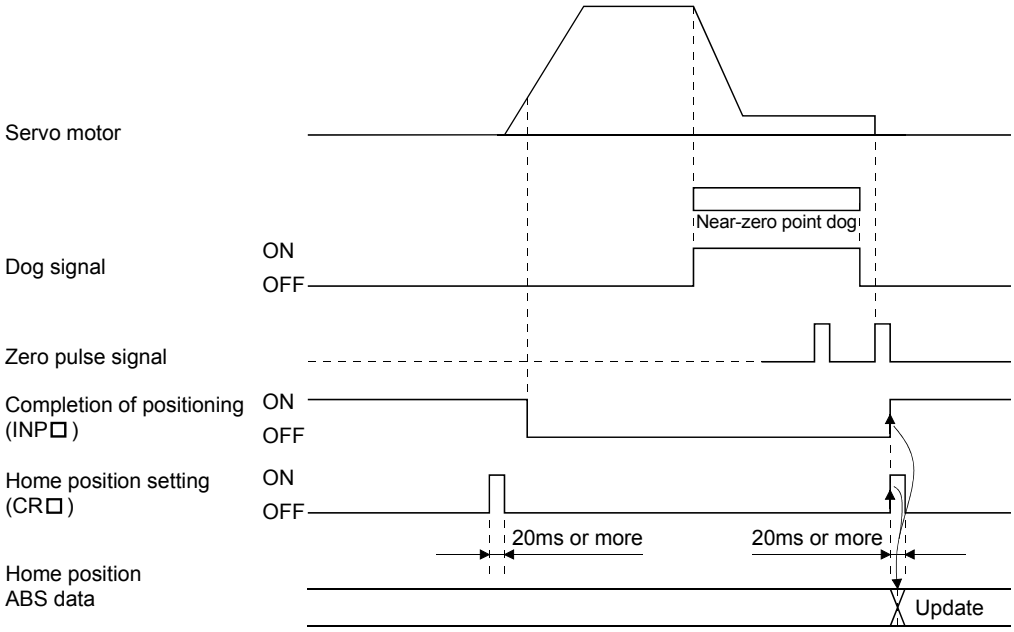
14.6.3 Home position setting

(1) Dog type home position return

Preset a home position return creep speed at which the machine will not be given impact. On detection of a zero pulse, the home position setting (CR□) is turned from off to on. At the same time, the servo amplifier clears the droop pulses, comes to a sudden stop, and stores the stop position into the non-volatile memory as the home position ABS data.

The home position setting (CR□) should be turned on after it has been confirmed that the in-position (INP□) is on. If this condition is not satisfied, the home position setting warning (A.96) will occur, but that warning will be reset automatically by making home position return correctly.

The number of home position setting times is limited to 100,000 times.

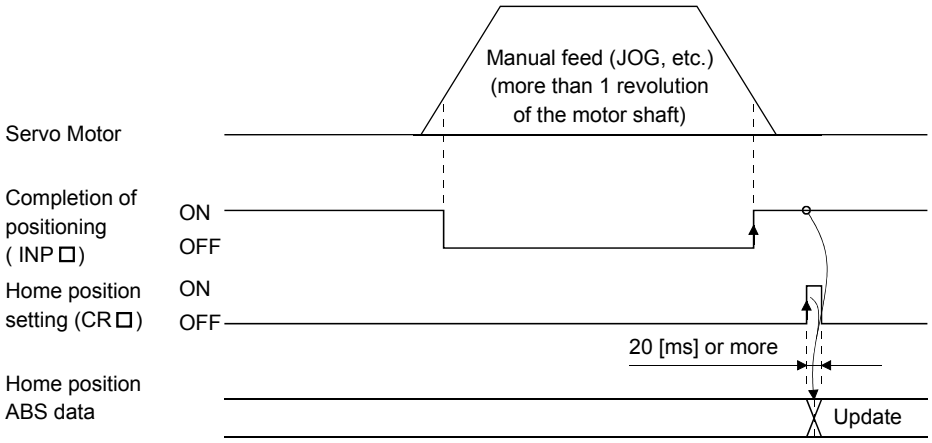


(2) Data set type home position return

POINT

- Never make home position setting during command operation or servo motor rotation. It may cause home position sift.
- It is possible to execute data set type home position return when the servo off.

Perform manual operation such as JOG operation to move to the position where the home position is to be set. When the home position setting (CR□) is on for longer than 20ms, the stop position is stored into the non-volatile memory as the home position ABS data.
When the servo on, set home position setting (CR□) to ON after confirming that the in-position (INP□) is ON. If this condition is not satisfied, the home position setting warning (A.96) will occur, but that warning will be reset automatically by making home position return correctly.
The number of home position setting times is limited to 100,000 times.

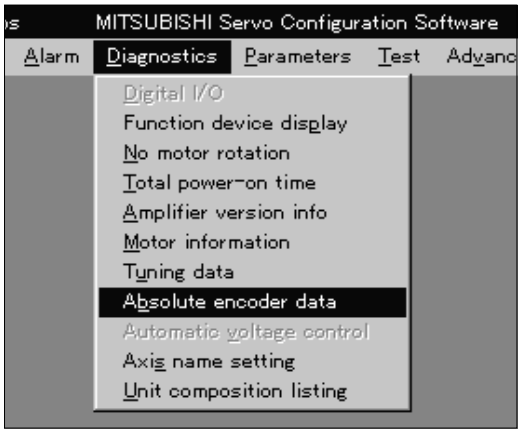


14.6.4 How to process the absolute position data at detection of stroke end

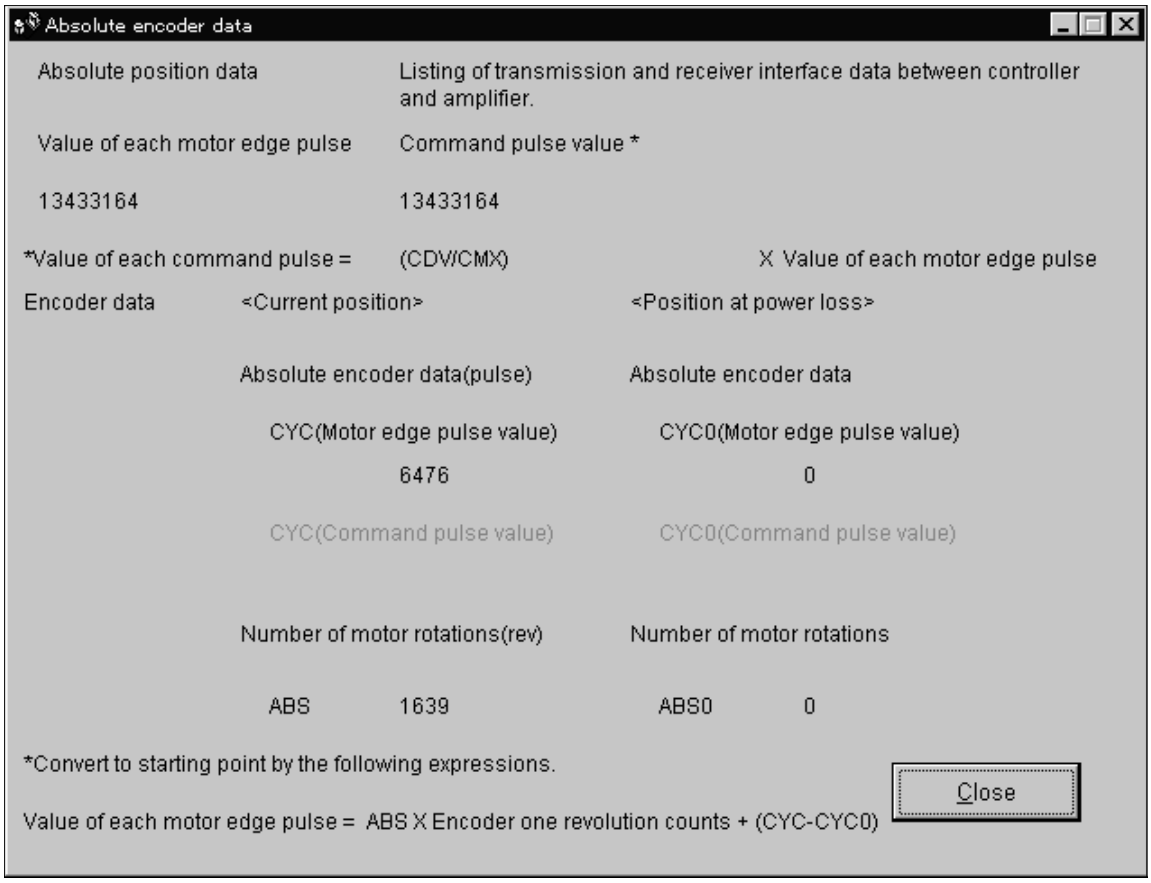
The drive unit stops the acceptance of the command pulse when forward rotation stroke end (LSP□) · reverse rotation stroke end (LSN□) is detected, clears the droop pulses to 0 at the same time, and stops the servo motor rapidly.
At this time, the controller keeps outputting the command pulse. Since this causes a discrepancy between the absolute position data of the servo amplifier and the controller, a difference will occur between the position data of the servo amplifier and that of the controller.
When the stroke end is detected, therefore, perform JOG operation or like to return to the position where stroke end detection can be deactivated, and read the current position data in the drive unit again.

14.7 Confirmation of absolute position detection data

You can confirm the absolute position data with MR Configurator (servo configuration software MRZJW3-SETUP151E).
Clicking "Diagnostics" on the menu bar and click "Absolute encoder data" in the menu.
(1)



(2) By clicking "Absolute encoder data" in the sub-menu, the absolute encoder data display window appears.



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

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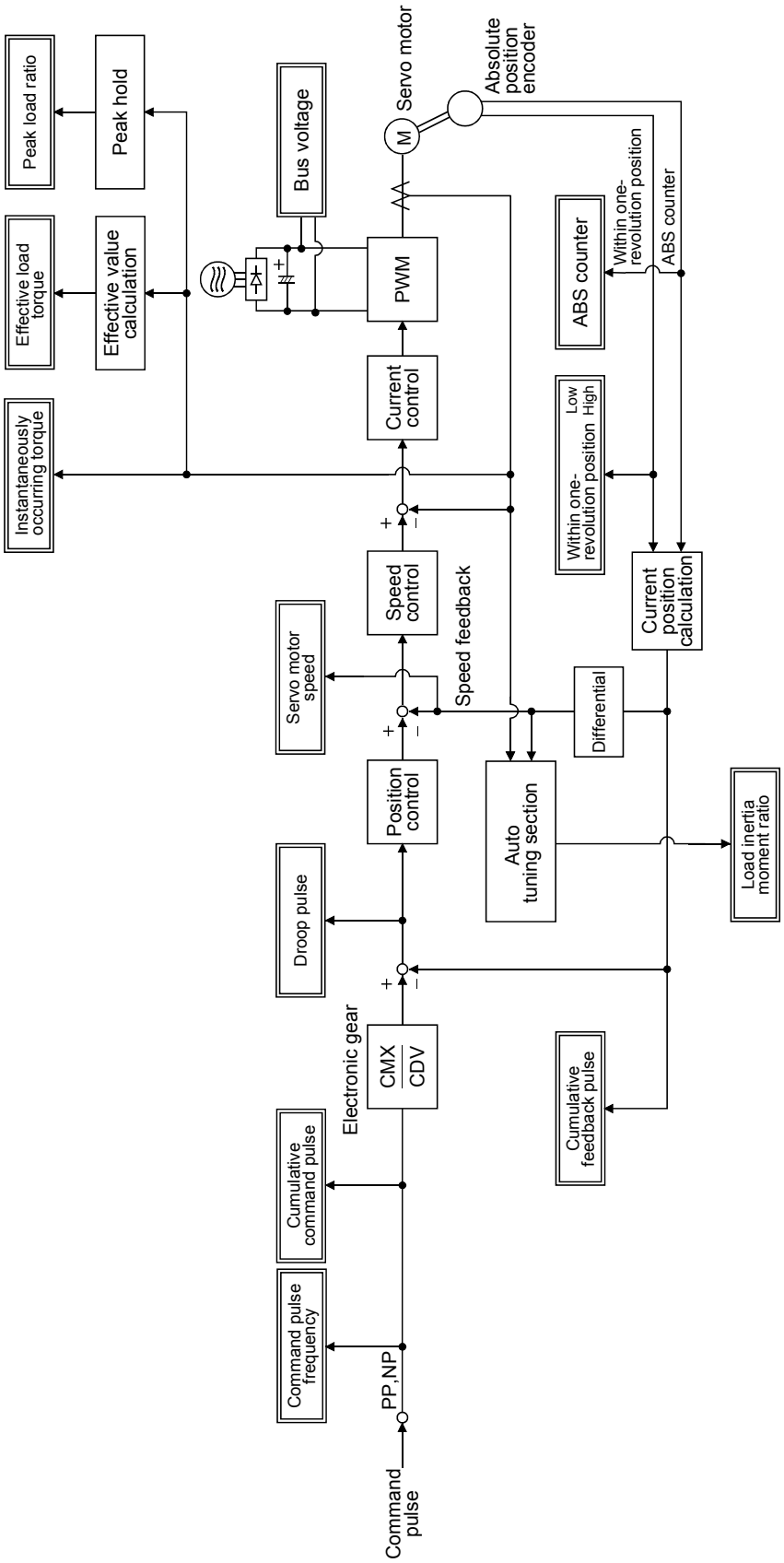
App 1. Status indication block diagram



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REVISIONS

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

Print Data	*Manual Number	Revision
Jan., 2002	SH(NA)030014-A	First edition
Sep., 2002	SH(NA)030014-B	Safety Instructions: Addition of Note to 4. (1) Deletion of (7) in 4. Additional instructions Addition of About processing of waste Addition of EEP-ROM life Section 1.5 (2) (a): Partial change of rating plate Section 2.7: Partial change of CAUTION sentences Section 2.7 (8): Change of POINT Section 3.1: Partial change of drawing Section 3.2.1: Partial change of drawing Section 3.2.2: Addition of forced stop B text Section 3.2.4: Partial change of drawing Section 3.3.1: Partial change of drawing Section 3.4.2: Change of table Section 3.5.1: Addition of POINT Section 3.6: Addition of NOTE Section 5.1.2: Partial change of DRU parameter No. 20 data Section 5.2.1: Partial addition of text, change of table Section 6.2.2: Addition of POINT sentences Section 6.4 (3) (a): Change of expression Section 9.2: Deletion of A. 7A Section 9.3: Deletion of 4. in A. 16A Deletion of A. 7A Section 10.3 (4): Partial addition of contacts and applicable tools Section 11.1: Reexamination Section 11.2: Partial addition of NOTE sentences Section 11.4: Addition of MR-JC4CBL□M-H Section 12.1.1 (1): Addition of text Section 12.1.2: Addition of cable Section 12.1.2 (2): Addition of POINT sentences Section 12.1.2 (2) (a): Addition and change of items, partial change of drawing Section 12.1.2 (2) (b): Addition of item Section 12.1.3 (2): Change of text Section 12.1.4: Deletion of POINT Section 12.1.4 (2): Change of terminal label sketch Section 12.1.4 (4) (b): Partial change of connection diagram Section 12.1.6 (1): Reexamination of table Section 12.1.6 (2): Partial change of contents Section 12.2.1 (2): Addition of cable Section 12.2.8: Partial addition of text Section 13.10: Partial addition of drawing Section 13.12.3 (2): Partial change of drawing Section 14.7: Partial reexamination of text
Mar., 2004	SH(NA)030014-C	Reexamination of description on configuration software Safety Instructions 1. To prevent electric shock: Addition of sentence

Print Data	*Manual Number	Revision
Mar., 2004	SH(NA)030014-C	3. To prevent injury: Reexamination of sentence 4. Additional instructions (1): Addition of Note/Reexamination of sentence (5): Reexamination of wiring drawing COMPLIANCE WITH EC DIRECTIVES 2. PRECAUTIONS FOR COMPLIANCE: IEC664-1 is modified to IEC60664-1 in (3) and (4). CONFORMANCE WITH UL/C-UL STANDARD (2): Reexamination of sentence Section 1.3 (1): Addition of "Inrush current" Section 2.4 (2): Reexamination of sentence Section 2.7: Reexamination and addition of NOTE sentence Section 2.7 (8): Addition of POINT Section 3.1: The following modification is made to the diagram: CLEAR□COMPULSE□COM of positioning module QD70 is connected to SG (24G). Section 3.2.5 (1): Reexamination of diagram Section 3.2.5 (2) (c) 2): Reexamination of diagram Section 3.3.5 (2): Addition of NOTE Section 3.7 (3) (a): Partial change of diagram Section 5.3.1 (1) (b): Addition of POINT sentence Section 9.2: Reexamination of sentence Section 9.3: A.12 to 15: Reexamination of occurrence cause A.37: Addition of occurrence cause A.51: "Rotation: 2.5s or more" is added. A.52: Change of content Section 12.1.1 (4): Addition of terminal block and mounting screw Section 12.1.6 (2) (a): Reexamination of Windows trademark Section 12.1.6 (2) (b): Change of FR-BSF01 outline drawing Section 14.2 (1): Addition of POINT Section 14.6.2 (4): Reexamination of forced stop
Feb., 2005	SH(NA)030014-D	Section 14.2 (1): Error in writing correction of POINT
Oct., 2005	SH(NA)030014-E	Reexamination of description on configuration software Safety Instructions: 1. To prevent electric shock: Change of description from 10 minutes to 15 minutes 4. Additional instructions (2), (4): Addition of instructions COMPLIANCE WITH EC DIRECTIVES: Partial change of sentence CONFORMANCE WITH UL/C-UL STANDARD (4): Partial change of sentence Chapter 2: Addition of CAUTION sentence Chapter 3: Partial change of WARNING sentences Section 3.2.2 (4): Deletion of open collector power input Section 3.2.5 (2) (d) 2): Modification of servo motor CCW rotation Section 3.3.4 (2): Limiting torque: Partial change of sentences Warning ▪ Battery warning: Modification of description from within 3 seconds to after approximately 3 seconds Section 3.6: Addition of CAUTION sentences Section 3.6 (3): Change of sentences Section 3.7: Addition of CAUTION sentences Change of sentences Section 3.7(3): Modification of drawing (d), (e)

Print Data	*Manual Number	Revision
Oct., 2005	SH(NA)030014-E	Section 5.1.2 (2): Correction of DRU parameter No.38 Section 5.3.2: Partial reexamination of sentences Section 5.3.2 (2): Addition of Note in table Chapter 8: Partial change of WARNING sentences Section 9.2: Alarm code No.A. 45 • A.46: Addition of Note in table Section 9.3: Addition of CAUTION sentence DRU parameter No.@A.17@: Addition of contents Section 9.4: Addition of CAUTION sentence Addition of POINT DRU parameter No.@A.92@: Reexamination of Cause 2 IFU parameter No.FA.9F: Partial addition of Cause IFU parameter No.@A.E3@: Addition of contents Section 10.2: Addition of Mounting screw • Tightening torque Section 11.1: Partial change of CAUTION sentences Chapter 12: Partial change of WARNING sentences Section 12.1.1 (3): Addition of POINT Section 12.1.1 (4): Reexamination of Outline drawing (b), (c) Section 12.1.6 (2) (a): Partial reexamination of table and Note Section 12.2.3: Correction of Dimensions for D1 in table Section 12.2.6 (2) (d): Reexamination of Outline drawing for FR-BSF01 Section 12.2.6 (2) (e): Addition of sentences Section 13.12.7 (3) (b): Correction in table Chapter 14: Reexamination of CAUTION sentences

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MODEL	
MODEL CODE	

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