MITSUBISHI

General-Purpose AC Servo

MELSERVO-H Series

Positioning function built-in
MR-H□ACN
Servo Amplifier
Instruction Manual

MITSUBISHI ELECTRIC

B

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ CAUTION

- Before wiring or inspection, switch power off and wait for more than 10 minutes. Then, confirm the voltage is safe with voltage tester. Otherwise, you may get an electric shock.
- Connect the controller and servo motor to ground.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the controller and servo motor until they have been installed. Otherwise, you may get an electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed loaded,, or pinched. Otherwise, you may get an electric shock.
- During power-on or operation, do not open the front cover. You may get an electric shock.
- Do not operate the controller 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 if the power is off. The controller is charged and you may get an electric shock.

2. To prevent fire, note the following:

⚠ CAUTION

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

3. To prevent injury, note the follow

⚠ CAUTION

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

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their weights.
- Use the eye-bolt of the servo motor to only transport the servo motor and do not use it to transport in the condition to have installed a servo motor on the machine.
- Stacking in excess of the specified number of products is not allowed.
- Do not carry the motor by the cables, shaft or encoder.
- Do not hold the front cover to transport the controller. The controller may drop.
- Install the controller in a load-bearing place in accordance with the Instruction Manual.
- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- The controller and servo motor must be installed in the specified direction.
- Leave specified clearances between the controller and control enclosure walls or other equipment.
- Do not install or operate the controller and servo motor which has been damaged or has any parts missing.
- Do not block the intake/exhaust port of the servo motor which has a cooling fan.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the controller.
- Do not drop or strike controller or servo motor. Isolate from all impact loads.
- Use the controller and servo motor under the following environmental conditions:

Environment		Conditions		
		Controller	Servo Motor	
Ambient temperature	[°C]	0 to +55 (non-freezing)	0 to +40 (non-freezing)	
	[°F]	32 to 131 (non-freezing)	32 to 104 (non-freezing)	
Ambient humidity		90%RH or less (non-condensing)	80%RH or less (non-condensing)	
Storage temperature	[°C]	−20 to +65 (non-freezing)	−15 to +70 (non-freezing)	
	[°F]	−4 to 149 (non-freezing)	5 to 158 (non-freezing)	
Storage humidity		90%RH or less (non-condensing)		
Ambience		Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt		
Altitude		Max. 1000m (3280 ft) above sea level		
Vibration	[m/s²]	5.9 {0.6G} or less	HC-MF Series HA-FF Series HC-UF 13 to 73	X · Y : 49.5 {5G}
			HC-SF81 HC-SF52 to 152 HC-SF53 to 153 HC-UF 72 · 152	X · Y : 24.5 {2.5G}
			HC-SF121 · 201 HC-SF202 · 352 HC-SF203 · 353 HC-UF202	X : 24.5 {2.5G} Y : 49 {5G}
			HC-SF301	X : 24.5 {2.5G} Y : 29.4 {3G}
	[ft/s²]	19.4 or less	HC-MF Series HA-FF Series HC-UF 13 to 73	X · Y : 64
			HC-SF81 HC-SF52 to 152 HC-SF53 to 153 HC-UF 72 · 152	X : 32 Y : 80
			HC-SF121 · 201 HC-SF202 · 352 HC-SF203 · 353 HC-UF202	X : 64 Y : 161
			HC-SF301	X : 38 Y : 96

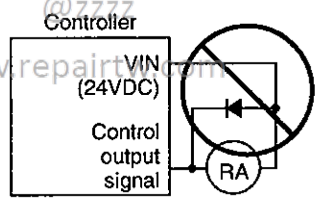
⚠ CAUTION

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

(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate..
- Do not install a power capacitor, surge absorber or radio noise filter (FR-BIF option) between the servo motor and controller.
- Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.
- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay must be wired in the specified direction. Otherwise, the emergency stop and other protective circuits may not operate.



(3) Test run adjustment

⚠ CAUTION

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

(4) Usage

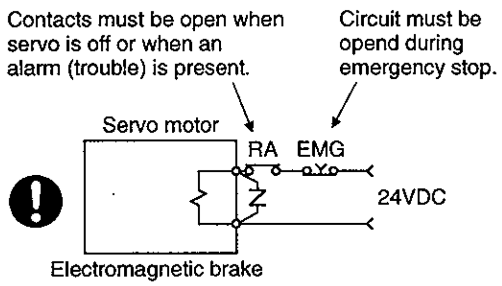
⚠ CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- Any person who is involved in disassembly and repair should be fully competent to do the work.
- The STOP key of the parameter unit is only valid for test run. Provide an emergency stop key independently of the STOP key.
- Before resetting an alarm, make sure that the run signal is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
- Do not modify the equipment.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the controller.
- Use the controller 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 controller signals but also by an external emergency stop signal.



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

(6) Maintenance, inspection and parts replacement

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

(7) Disposal

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

(8) General instruction

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

COMPLIANCE WITH EC DIRECTIVES

Use the controller and servo motor compliant with the EN Standard.
When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.
For the other EMC Directive guidelines on the servo amplifier, refer to the Chapter 9 and "EMC INSTALLATION GUIDELINES"(IB(NA)67303).

CONFORMANCE WITH UL/C-UL STANDARD

Use the controller and servo motor compliant with the UL/C-UL Standard.
Also refer to Chapter 15 and take proper steps.

CONTENTS

13. SPECIFICATIONS 13- 1 to 13- 9

14. CHARACTERISTICS 14- 1 to 14-8

15. OPTIONS AND AUXILIARY EQUIPMENT 15- 1 to 15-56

Appendix App- 1 to App-3

Optional Servo Motor Instruction Manual CONTENTS

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

About the Manuals

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use the Single-axis amplifier built-in controller MR-H-ACN for the first time. Always purchase them and use the MR-H-ACN safely.

Relevant manuals

Manual Name	Manual No.
MELSERVO-H Series TO USE THE AC SERVO SAFETY	IB(NA)67367
MELSERVO Servo Motor Instruction Manual	SH(NA)3181
EMC Installation Guidelines	IB(NA)67310

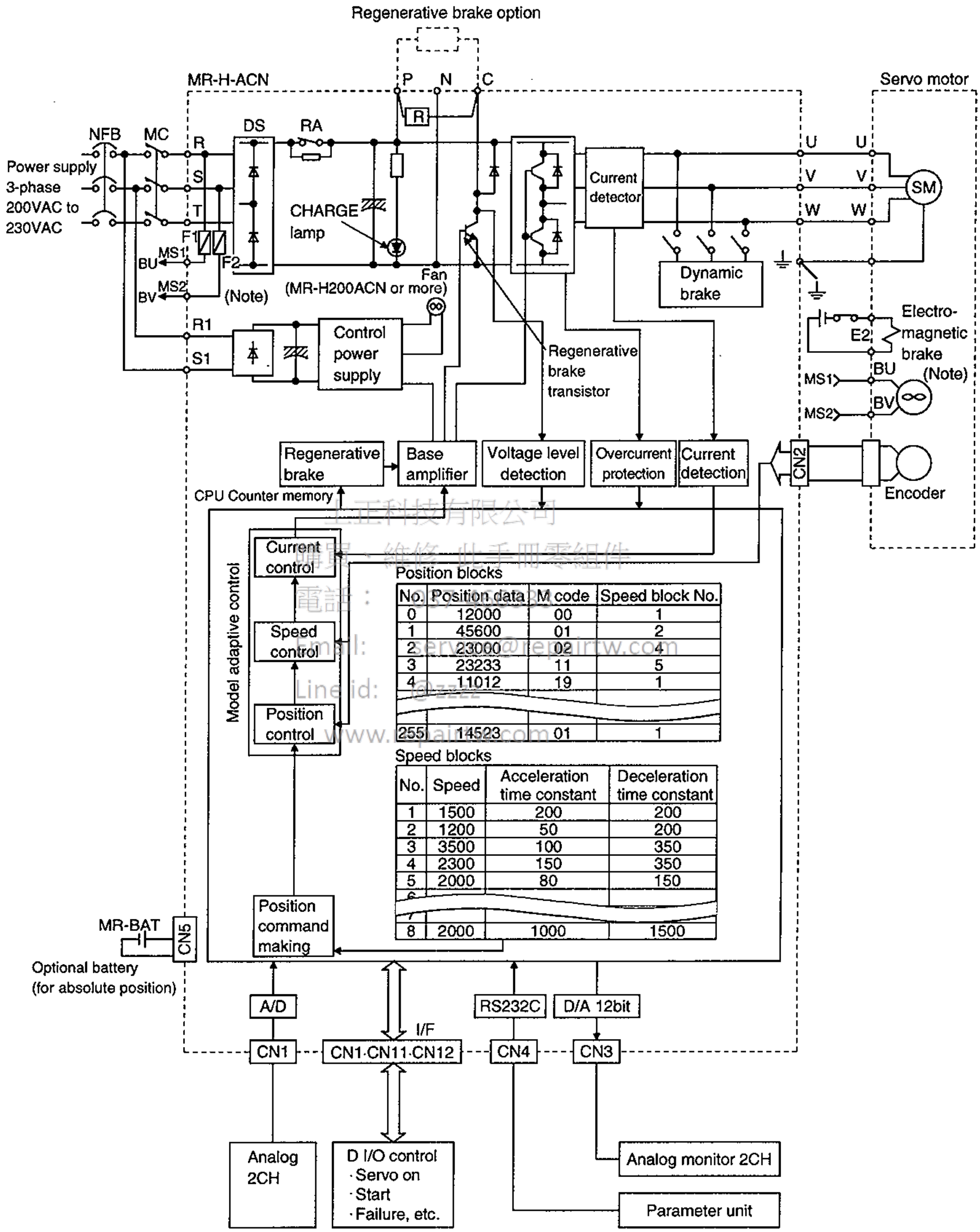
1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The MR-H-ACN single-axis amplifier built-in controller is the MR-H-AN general-purpose AC servo amplifier having a single-axis positioning function. The function performs high-duty, repetitive positioning operation by merely setting the position data (target position), motor speed, acceleration and deceleration time constants, etc. in the point tables (position blocks, speed blocks) as if you were setting the parameter values. It is optimum when you wish to make up a simple positioning system without programs or to simplify the system.
A servo motor equipped with absolute position encoder is available. By simply adding a battery to the controller, you can configures up an absolute position detection system, making zeroing unnecessary at power-on, alarm occurrence or the like.

1.1.1 Function block diagram

The function block diagram of the MR-H-ACN is shown on the next page.



Position blocks

No.	Position data	M code	Speed block No.
0	12000	00	1
1	45600	01	2
2	23000	02	4
3	23233	11	5
4	11012	19	1
255	14523	01	1

Speed blocks

No.	Speed	Acceleration time constant	Deceleration time constant
1	1500	200	200
2	1200	50	200
3	3500	100	350
4	2300	150	350
5	2000	80	150
6			
7			
8	2000	1000	1500

Note: For 11kW or more.

1.1.2 Positioning system

(1) Main functions

(a) Positioning for up to 256 positions using point table numbers. (8 positions as standard, 256 positions when the option card is used)

(b) By using the MR-H-D01 option card, the speed is set externally as desired from among eight speeds.

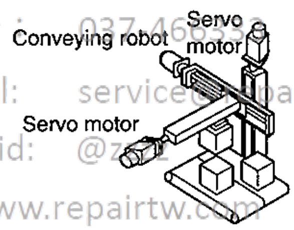
(c) Easily compatible with an absolute position system.

(d) Position data can also be specified externally in six BCD digits. (MR-H-D01 option card used)

(e) Four zeroing methods

- Automatic mode
  - Point table data
  - External position command
- Manual mode
  - Manual pulse generator
  - Jog operation
- Manual zeroing mode
  - Dog type
  - Count type
  - Data setting type
  - Stopper type
- Automatic positioning mode to home position
  - Positioning to home position
  - Positioning to second home position

(2) Configuration example



· Point table

Position Block

Position Block No.	Position Data	M Code	Speed Block No.
0	120000	00	1
1	485690	11	3
2	120000	19	8
3	986723	55	2
⋮	⋮	⋮	⋮
7(255)	120000	01	1

Speed Block

Speed Block No.	Speed	Acceleration Time	Deceleration Time
1	500.0	220	220
2	1200.0	46	50
3	1750.0	65	80
4	1892.0	66	76
5	48.3	23	23
6	3000.0	72	72
7	123.4	125	298
8	2396.9	99	333

1.1.3 Roll feeding system

(1) Main functions

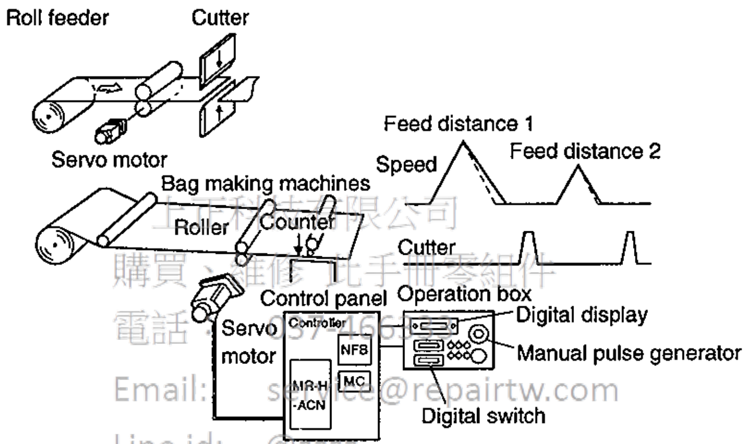
(a) Two different feed distances can be set externally as desired.

(b) Speeds can be specified externally as desired from among two speeds as standard or from among eight speeds when the option card is used.

(c) The feed distance can also be specified externally in six BCD digits. (MR-H-D01 option card used)

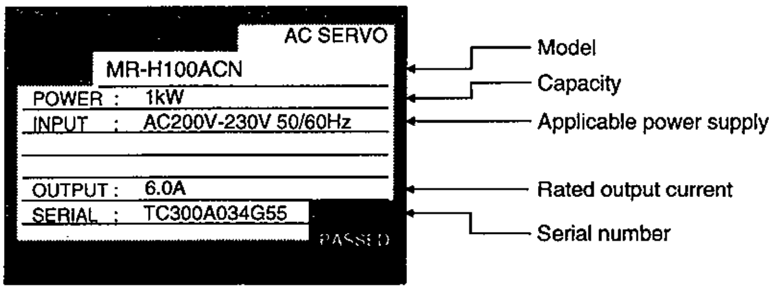
Automatic mode	Position data setting
	External feed distance com-
Manual mode	Manual pulse generator
	Jog feed

(2) Configuration example



1.2 Model Name Make-Up

(1) Name plate



(2) Model

MR-H□ AC□□□

Series name

Compliant Standard

Symbol	Compliant Standard
None	Standard model (in Japan)
-UE	EN Standard · UL/C-UL Standard (Note)

Note: The 11kW and higher controller will be certified by the UL/C-UL Standard.

Optional feature

Symbol	Optional feature
None	Standard
-P90	This symbol is affixed to indicate that the 11kW or higher single-axis amplifier built-in controller does not need the external regenerative resistor equipped as standard because the regenerative brake option (MR-RB65 to 67), brake unit (FR-BU) or power return converter (FR-RC) is purchased.

Corresponding servo motors

Symbol	HA-MH · HA-FH HA-SH · HA-LH HA-UH	HC-MF · HA-FF HC-SF · HC-RF HC-UF
None	O	
N	O	O

Positioning function incorporated

Rated output

Symbol	Rated output (kW)	Symbol	Rated output (kW)
10	0.1	350	3.5
20	0.2	500	5
40	0.4	700	7
60	0.6	11K	11
100	1	15K	15
200	2	22K	22

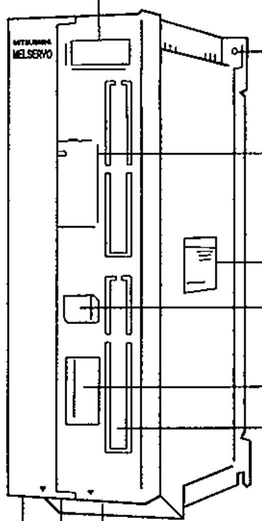
1.3 Combination with Servo Motor

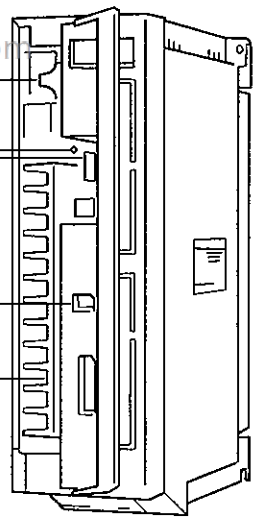
The following table lists combinations of controller and servo motors. The same combinations apply to the models with electromagnetic brakes, the models with reduction gears, the EN Standard-compliant models and the UL/C-UL Standard-compliant models. For combination with the HA-MH, HA-FH, HA-SH and HA-UH series servo motors, refer to parameter No. 1 in Section 6.1.2 (2).

Controller	Servo Motor								
	HC-MF□	HA-FF□	(Note 2) HC-SF□			HC-RF□	(Note 1) HC-UF□		HA-LH□
			1000r/min	2000r/min	3000r/min		2000r/min	3000r/min	
MR-H10ACN		053・13						13	
MR-H20ACN	053・13	23							
MR-H40ACN	23	33・43						23	
MR-H60ACN	43	63		52	53			43	52
MR-H100ACN	73		81	102	103		72	73	
MR-H200ACN			121・201	152・202	153・203	103・153	152		102・152
MR-H350ACN			301	352	353	203	202		202
MR-H500ACN				502		353・503	352・502		302・502
MR-H700ACN				702					702
MR-H11KACN									11K2
MR-H15KACN									15K2
MR-H22KACN									22K2

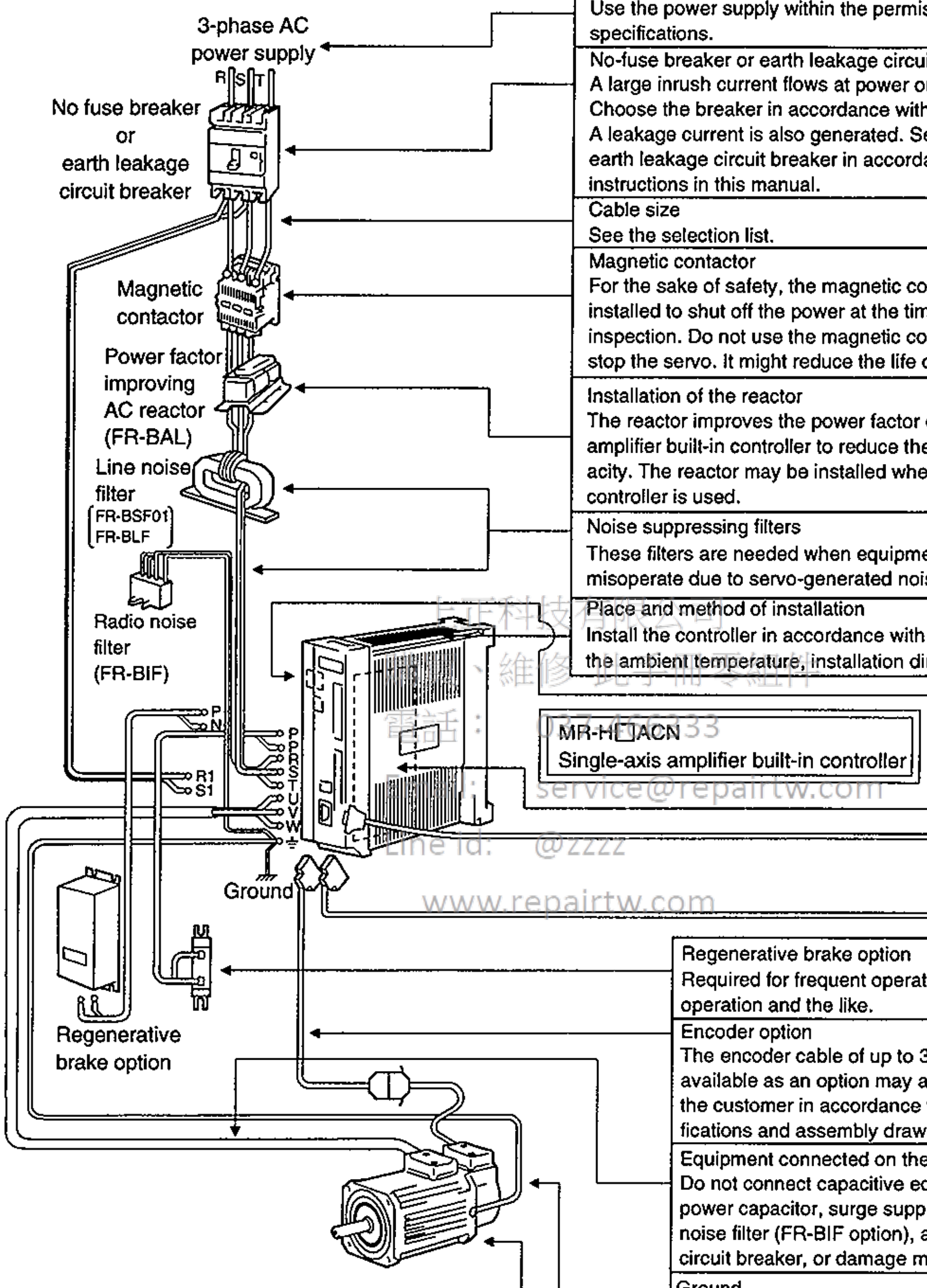
Note 1: The HC-UF73·HC-SF203·HC-SF353 may not be connected depending on the production timing of the servo amplifier. Please contact us.

1.4 Parts Identification



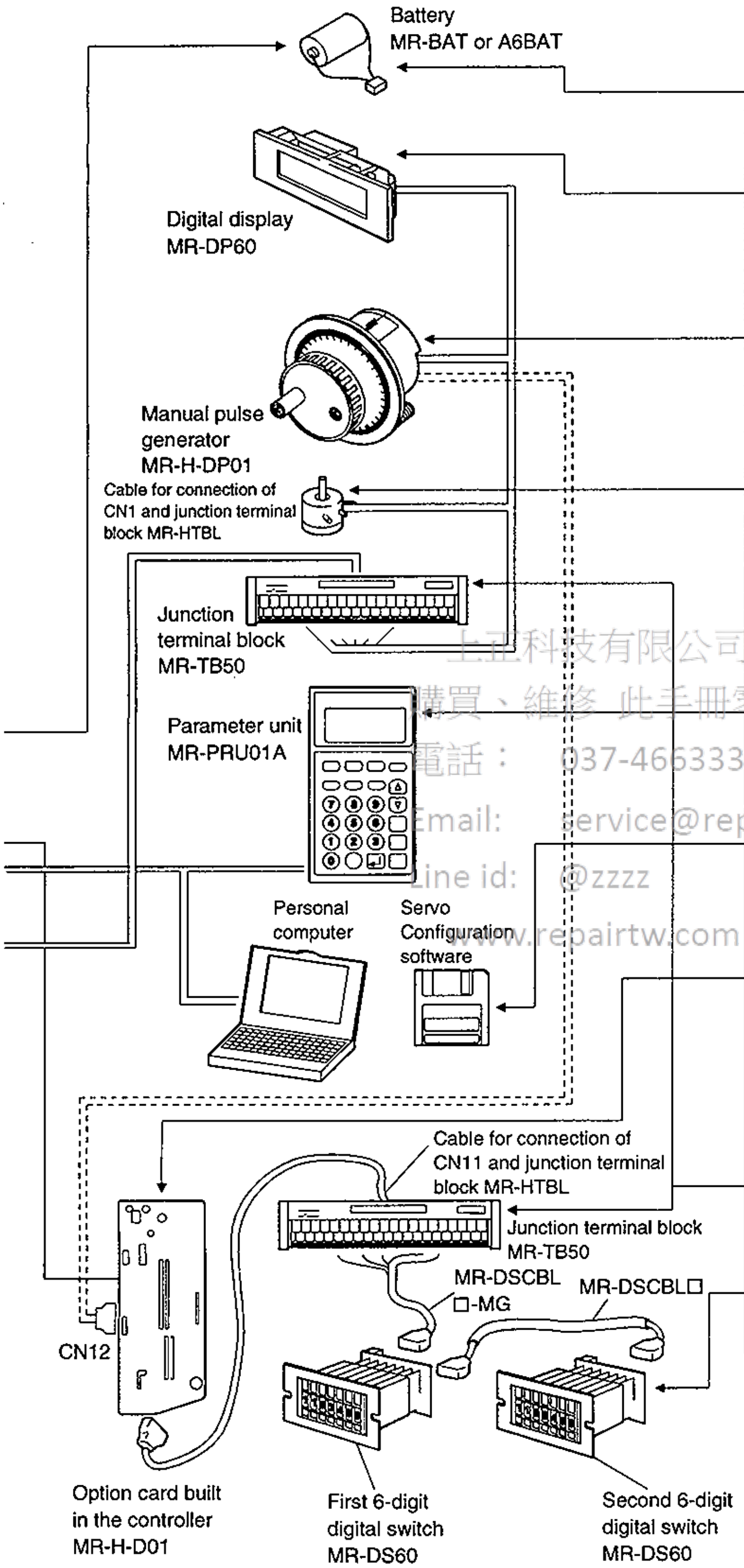


1.5 Controller and Its Auxiliary Equipment



Handling Points	Refer to:
Power supply specifications Use the power supply within the permissible power supply specifications.	Sec. 13.1
No-fuse breaker or earth leakage circuit breaker A large inrush current flows at power on. Choose the breaker in accordance with the selection list. A leakage current is also generated. Set the sensitivity of the earth leakage circuit breaker in accordance with the instructions in this manual.	Sec. 15.2.2 Sec. 15.2.7
Cable size See the selection list.	Sec. 15.2.1
Magnetic contactor For the sake of safety, the magnetic contactor must be installed to shut off the power at the time of alarm and inspection. Do not use the magnetic contactor to start or stop the servo. It might reduce the life of the servo amplifier.	Sec. 15.2.2
Installation of the reactor The reactor improves the power factor of the single-axis amplifier built-in controller to reduce the power supply capacity. The reactor may be installed when a large-capaciy controller is used.	Sec. 15.2.3
Noise suppressing filters These filters are needed when equipment that may misoperate due to servo-generated noise is used nearby.	Sec. 15.2.5 Sec. 15.2.6
Place and method of installation Install the controller in accordance with the instructions on the ambient temperature, installation direction, space, etc.	Chap. 2

Regenerative brake option Required for frequent operation, vertical axis operation and the like.	Sec. 15.1.2
Encoder option The encoder cable of up to 30m (98.425ft) length available as an option may also be fabricated by the customer in accordance with the cable specifications and assembly drawing.	Sec. 15.1.6
Equipment connected on the output side Do not connect capacitive equipment, such as the power capacitor, surge suppressor and radio noise filter (FR-BIF option), and the earth leakage circuit breaker, or damage might result.	Sec. 15.2.5 Sec. 15.2.6
Ground To prevent accidental electric shock and provide measure against noise, the servo motor,servo amplifier, regenerative brake option, etc. must be grounded at one point within the shortest distance.	Sec. 5.6
Servo motor Do not apply impact, e.g. drop or hammering, to the servo motor and encoder which are assembled with high accuracy.	Chap. 2



Handling Points	Refer to:
Battery By only fitting the battery to the controller used with a servo motor provided with an absolute position encoder, positioning can be performed easily.	Sec. 3.5
Digital display · The signed 6-digit display uses seven-segment LEDs to provide clear display information to remote locations. · Any of 14 different display data, such as the current position(absolute position) and machine deceleration can be selected according to applications.	Sec.15.1.11
Manual pulse generator · The manual pulse generator enables the manual feeding of a shifter, rotary table, etc. · Any of three different command pulse magnification, ×1, ×10, and ×100, can be selected by parameter setting.	Sec.15.1.12
Volume · The specified feedrate can be limited at the rate of 0 through 200%. · The specified torque can be limited at the rate of 0 through 100%.	Sec. 15.2.8
Parameter unit · The liquid crystal screen of 13 characters wide by 4 lines long and the 35 keys allow position data to be edited, operation to be taught, various parameters to be set, the operating status such as the current position and machine speed to be monitored, an alarm to be diagnosed, the display language to be selected between Japanese and English, test run to be performed, parameters to be copied	Chap. 7 Sec. 15.1.1
Personal computer, Servo Configuration software Using the Servo Configuration software allows parameter setting, status display monitoring, etc. to be made on a personal computer.	Chap. 8 Sec. 15.1.8
Option card · Addition of the MR-H-D01 option card provides extra I/O signals. · Extra I/O signals(CN11) can be provided to match functions, such as the positioning system and roll feeding system. · Extra pulse train inputs(CN12) allow the manual pulse generator to be connected and 5V power to be supplied.	Sec. 15.1.15
Junction terminal block · Makes soldering in the external connector unnecessary.	Sec.14.1.7
The signed 6-digit digital switch allows: · Position data to be specified; and · Feed distance to be set. (MR-H-D01 is required)	Sec.15.1.14

2. INSTALLATION

⚠ CAUTION

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

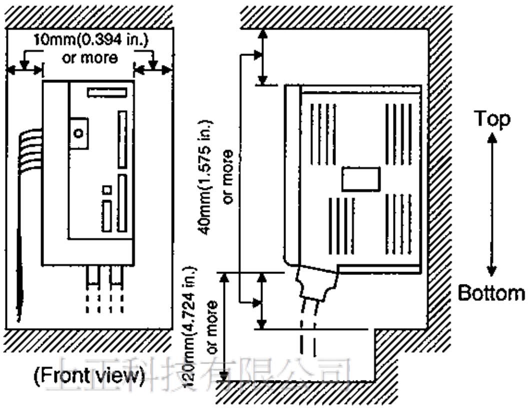
2.1 Environmental conditions

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

2.2 Installation Direction and Clearances

CAUTION	
⚠ CAUTION	• Do not hold the front cover to transport the controller. The controller may drop. • The equipment must be installed in the specified direction. Otherwise, a fault may occur. • Leave specified clearances between the controller and control box inside walls or other equipment.

(1) Installation of one controller



(2) Installation of two or more controllers

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

Reserve an at least 10mm (0.394 in.) clearance between the controllers. For the MR-H10ACN to MR-H60ACN, reserve an at least 15mm (0.591 in.) clearance as a wiring space.

(3) Others

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

Install the controller on a perpendicular wall in the correct vertical direction.

2.3 Keep out foreign materials

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

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

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

2.4 Cable Stress

(1) The way of clamping the cable must be fully examined so that flexing stress and cable's own weight stress are not applied to the cable connection.
(2) In any application where the servo motor moves, the cables should be free from excessive stress. When the servo motor moves, e.g. the encoder cable and servo motor wiring are contained in a cable bearer, run the cables so that their flexing portions fall within the flex life range of the encoder cable. Fix the encoder cable and power cable of the servo motor.
(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.
(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 12.4 for the flexing life.

3 POSITIONING SYSTEM

3.1 Positioning System Specifications

Item			Specifications
Command system	Point table number input	Operational specifications	Position block number is specified for positioning.
		Position command input	• The contact input allows positions to be selected from those in 8 position blocks as standard or from those in 256 position blocks when the option card (MR-H-D01) is used. • Feed length setting range for 1 position: ±1μm to ±999.999m
		Speed command input	Speeds and acceleration/deceleration times are selected from those in 8 speed blocks.
		System	Absolute command (signed)/incremental command
	Position data input Option card (MR-H-D01) used	Operational specifications	Digital switch or contact data input is used for positioning.
		Position command input	• Signed 6-digit BCD digital switch (MR-SD60) or contact input • Feed length input setting range: ±1μm to ±999.999m
		Speed command input	• Using the contact input, speed and acceleration/deceleration time are selected from those in 8 speed blocks.
		System	Absolute command (signed)/incremental command
Operation mode	Automatic mode		Positioning operation is performed once under the speed/position commands
	Manual mode	Jog	Jog operation is performed by the parameter unit or contact input under the speed command.
		Manual pulse generator (MR-HDP01)	Manual pulse generator (MR-HDP01) is used for manual feed. • Input pulse specifications: 2-phase pulse train with 90° phase difference (A phase, B phase) ····· multiplied by 4 • Input pulse form: open collector input • Max. input pulse frequency: open collector input 200kpps • Command pulse magnification: any of × 1, × 10 and × 100 is selected using the internal parameter. The option card (MR-H-D01) may be used to select the above externally.
	(Note) Manual zeroing mode	Dog type	Marking pulse given past the proximity dog is used for zeroing. • Zero address can be set. • Zero shift can be performed. • Zeroing direction can be selected. • Zeroing can be started automatically after a return from the limit. • Zeroing can be started automatically after a return from the dog.
		Count type	Detector pulses counted after contact with the proximity dog are used for zeroing. • Zero address can be set. • Zero shift can be performed. • Zeroing direction can be selected. • Zeroing can be started automatically after a return from the limit. • Zeroing can be started automatically after a return from the dog.
		Data setting type	Dog is not used for zeroing. • Any position can be set as a home position by manual operation, etc. • Zero address can be set.
		Stopper type	Dog is not used for zeroing. • Stop position can be set as a mechanical home position. • Zero address can be set.
	Automatic positioning to home position		• High-speed automatic return to a defined home position. • A second home position can be set.

Note: Similar function is also available for home position setting in absolute position detection system.

Item	Specifications
Functions of positioning control	• Absolute position detection • Teaching function: Teaching can be performed by the parameter unit. • M code output: 0 to 3 as standard, 0 to 99 when the option card (MR-H-D01) is used • Acceleration/deceleration method setting (S-shaped acceleration/deceleration, separate settings for acceleration and deceleration) • Backlash compensation • Alarm code is output using the option card (MR-H-D01) • Prevention of overtravel by the external limit switch

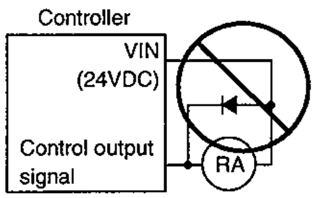
3.2 Standard Connection Examples

⚠ WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before starting wiring, make sure that the charge lamp is off more than 10 minutes after power-off, and then confirm that the voltage across terminals P-N is safe with a tester or similar device. Otherwise, you may get an electric shock.
- Do not attempt to wire the controller 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

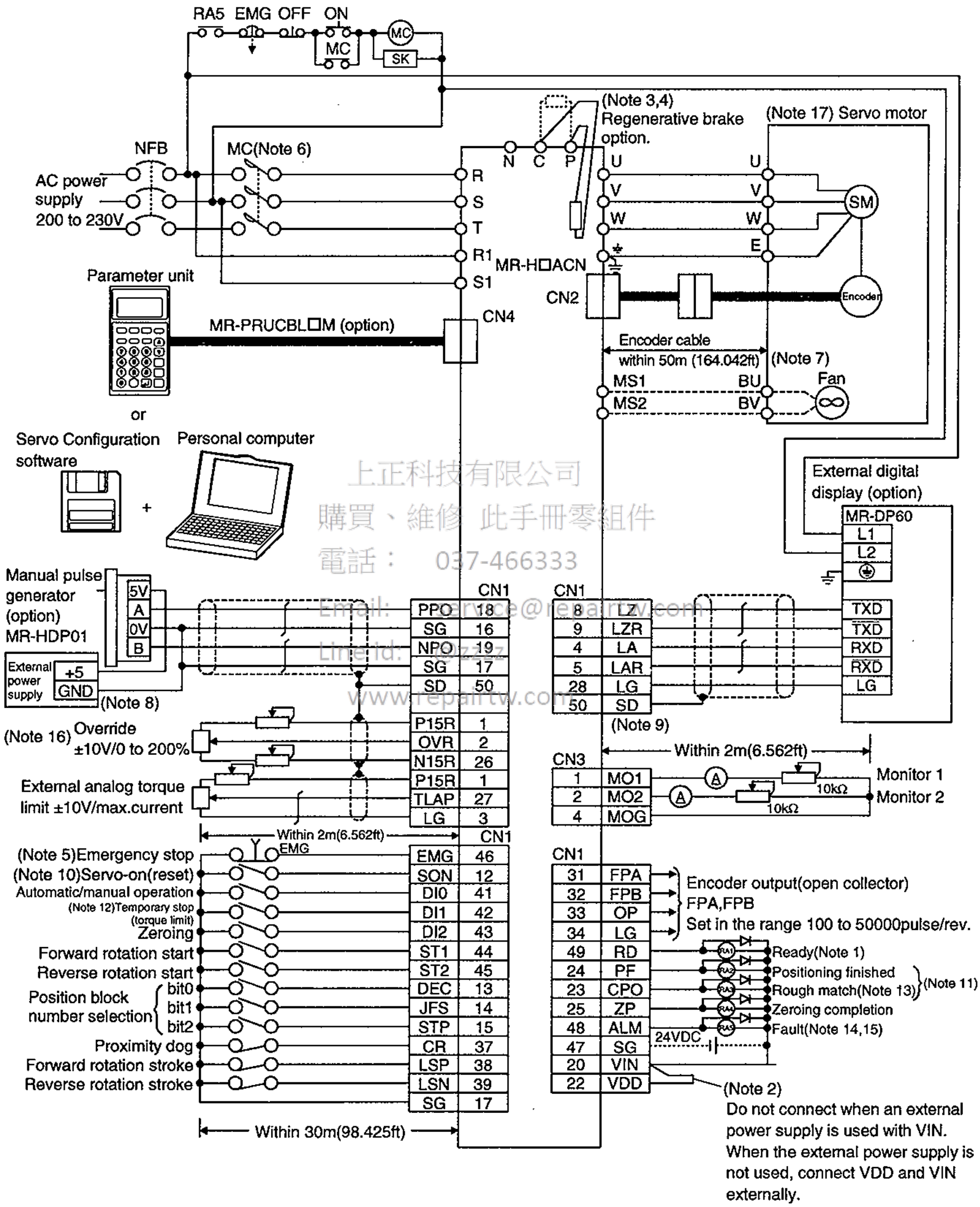
- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, fault, etc. may occur.
- The surge absorbing diode installed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



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

3.2.1 Standard configuration (without the MR-H-D01 option card)

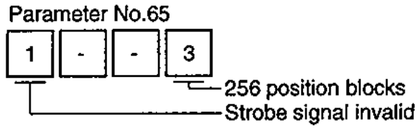
Positioning operation according to 8-position point table

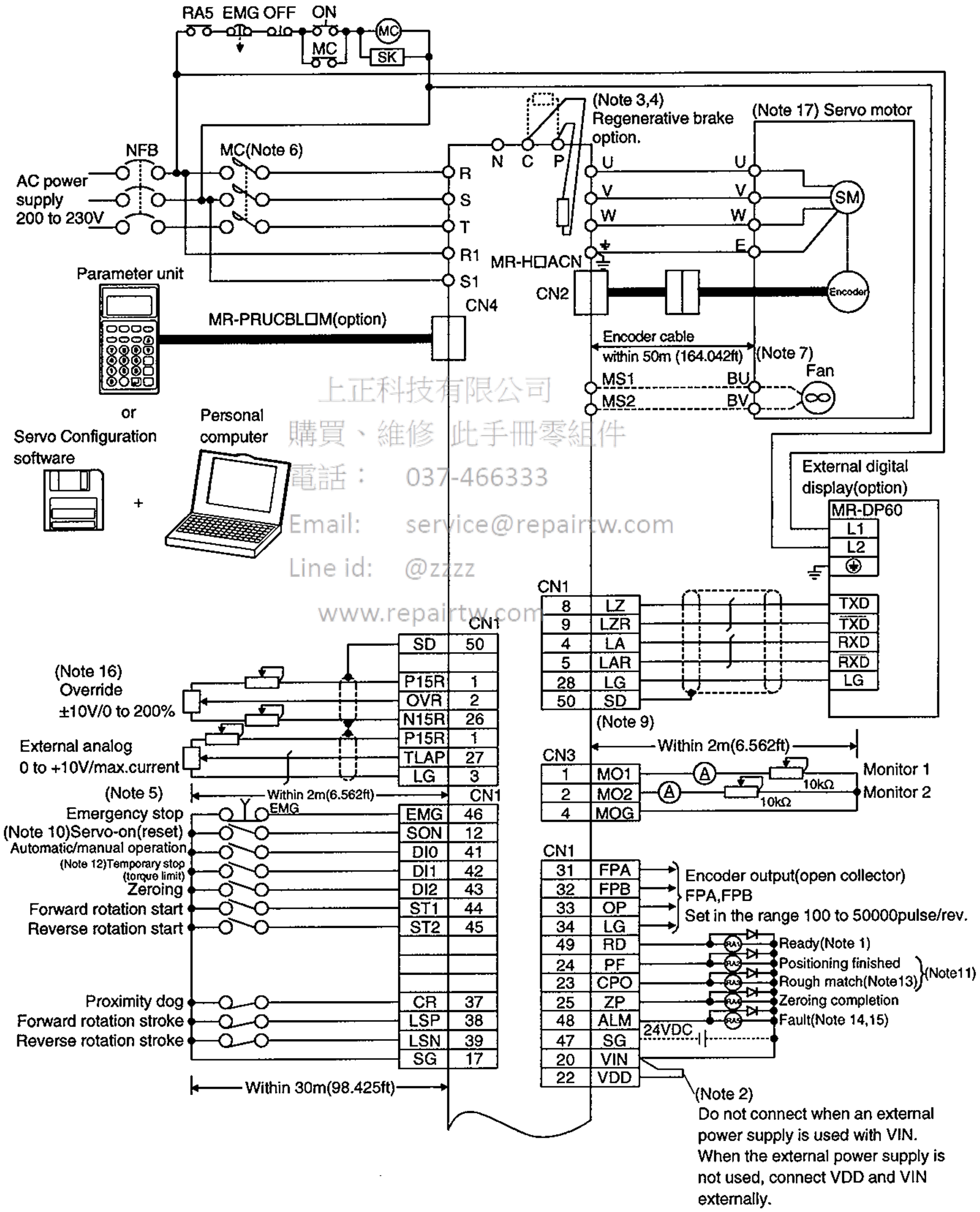


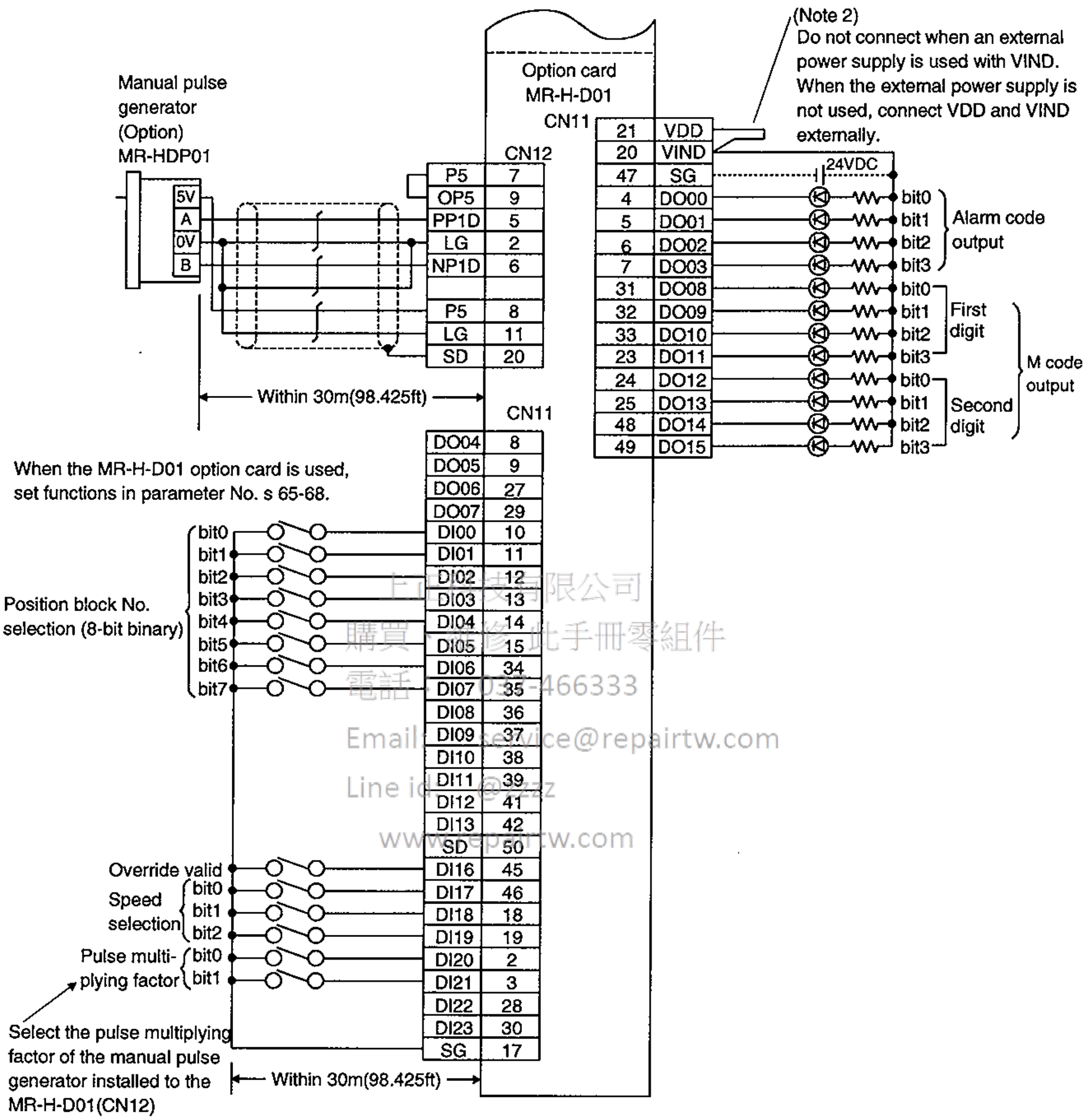
For notes, refer to page 3-10.

3.2.2 Extension configuration 1 (with the MR-H-D01 option card)

Positioning operation according to 256-position point table
Set 1□□3 in parameter No.65.



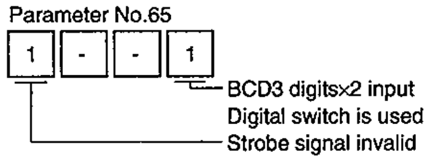


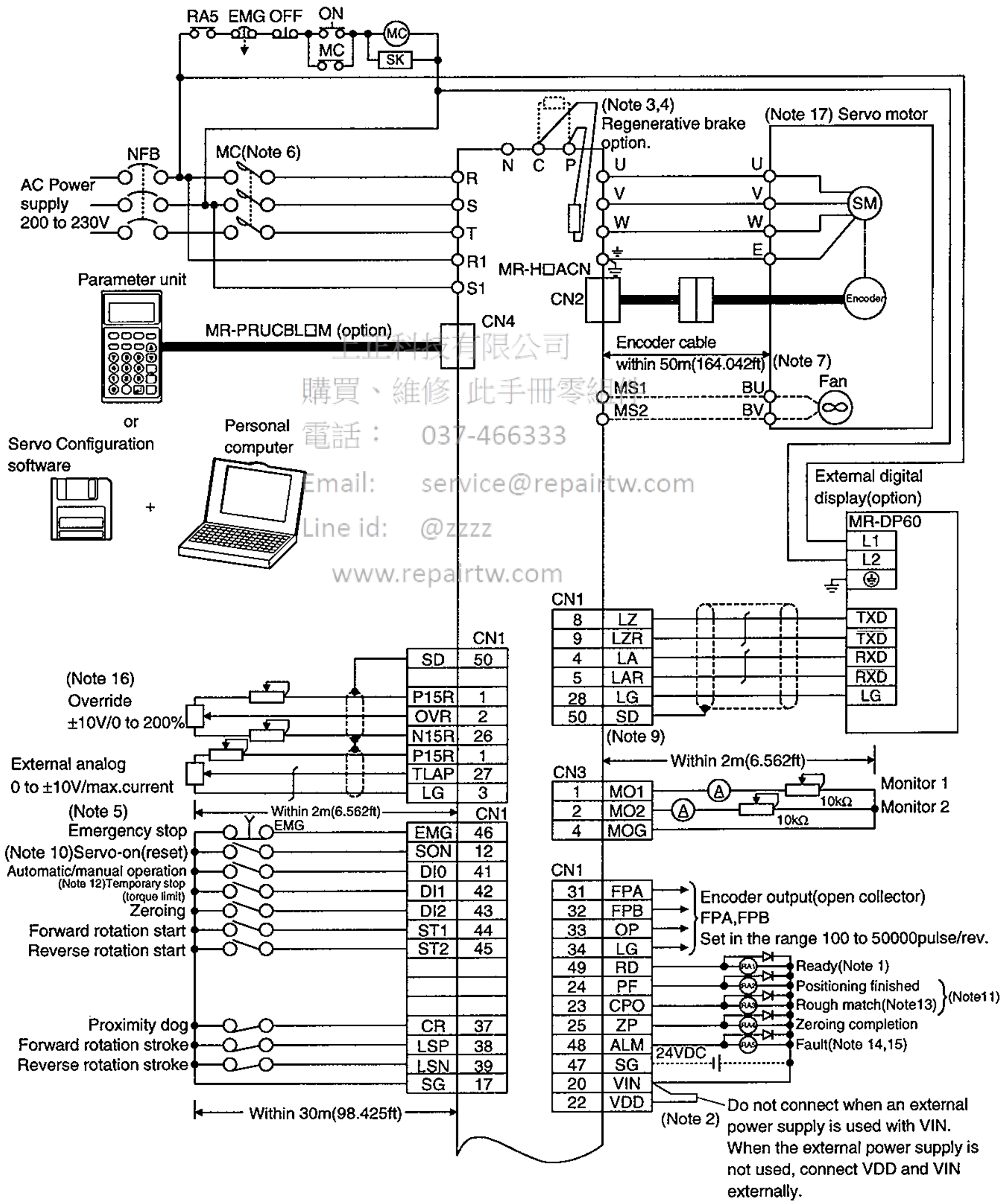


For notes, refer to page 3-10.

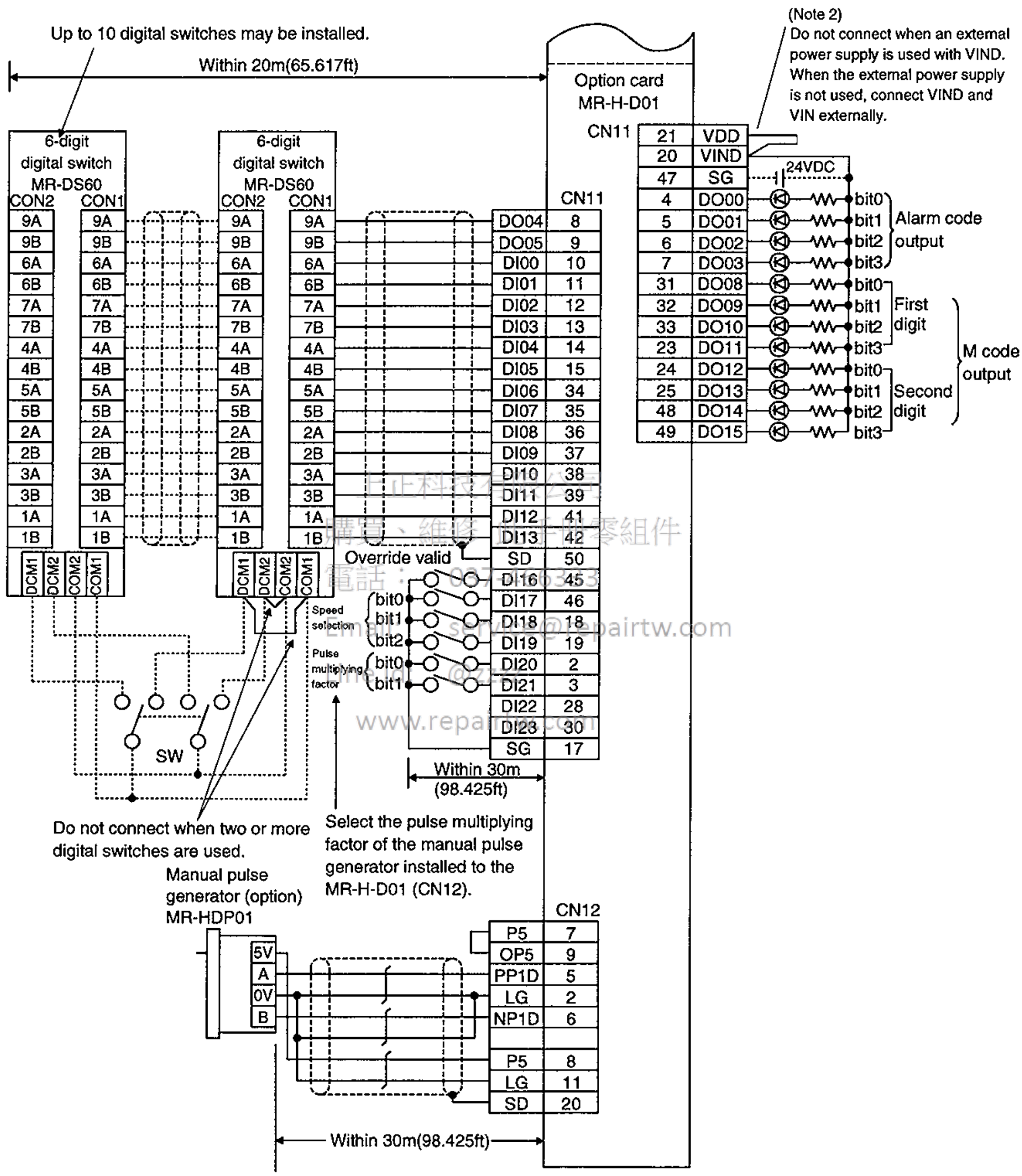
3.2.3 Extension configuration 2 (with the MR-H-D01 option card)

Positioning operation under digital switch (MR-DS60) position data command
The digital switch used must be optional MR-DS60.
Set 1□□1 in parameter No.65.





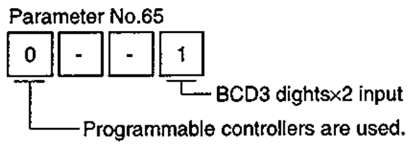
When using the MR-H-D01 option card,
set functions in parameters No. 65 to 68.

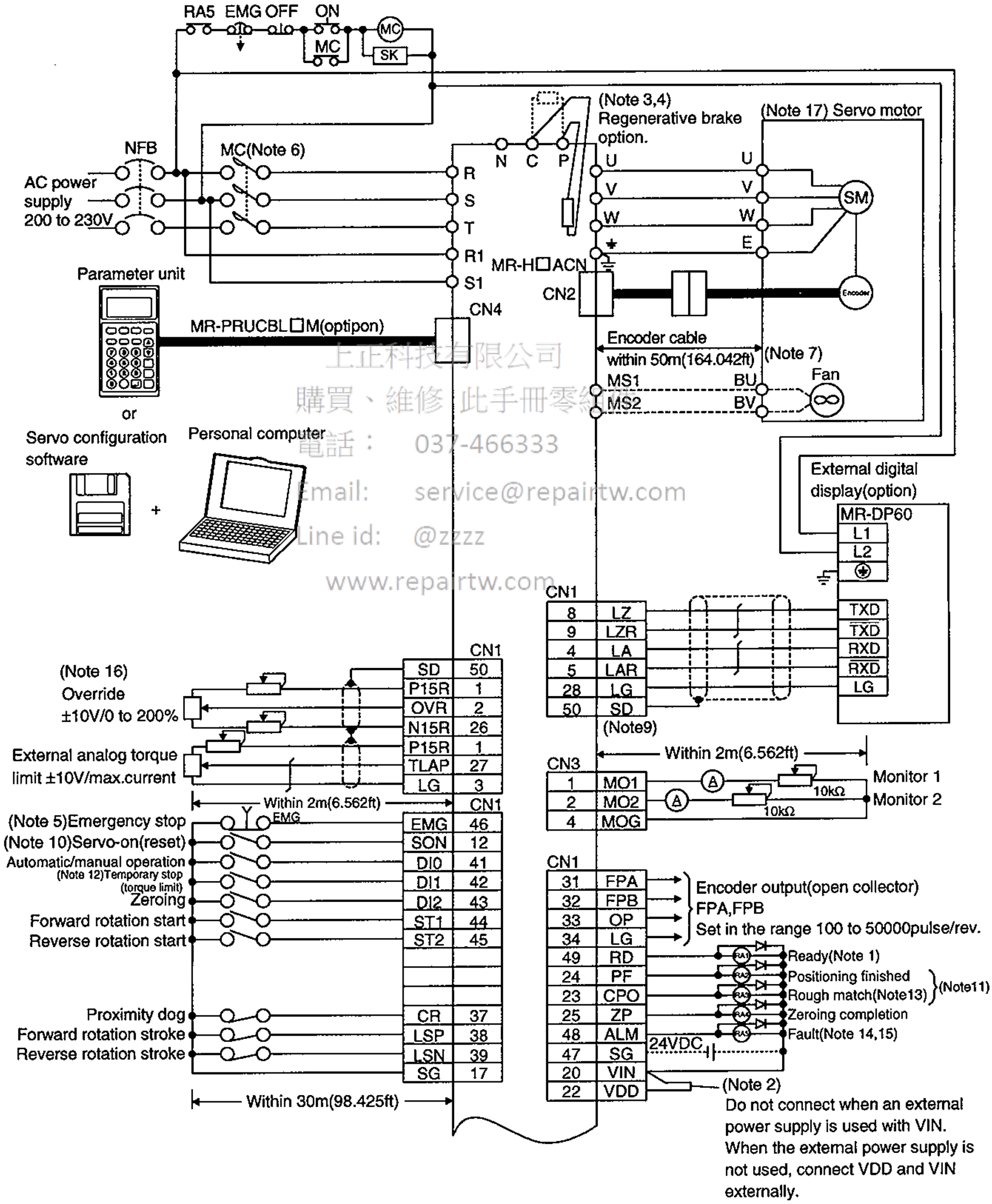


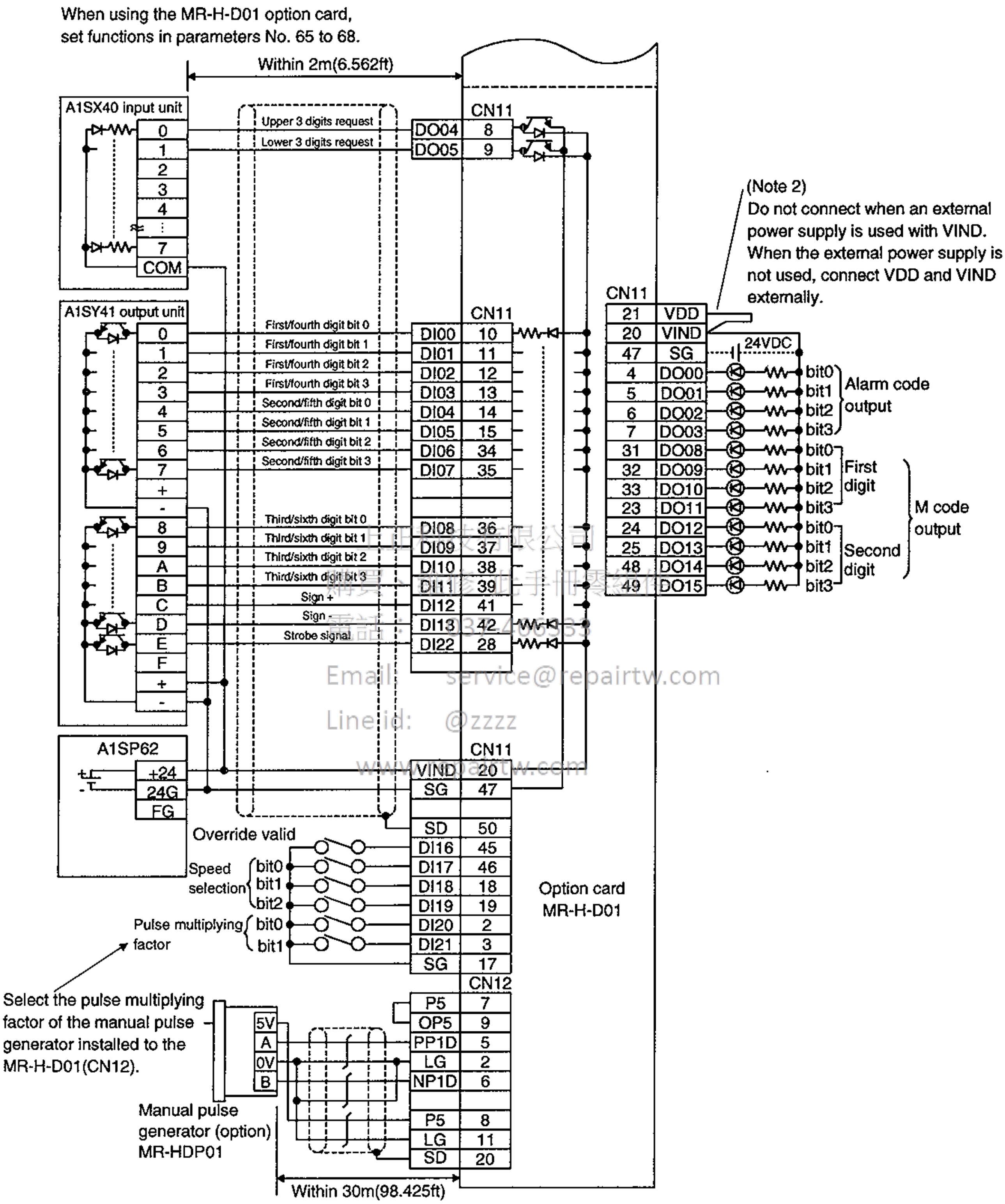
For notes, refer to page 3-10.

3.2.4 Extension configuration 3 (with the MR-H-D01 option card)

Positioning operation under programmable controller position data command
The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controller are used.
When the programmable control are used, set 0□□1 in parameter No.65.







For notes, refer to page 3-10.

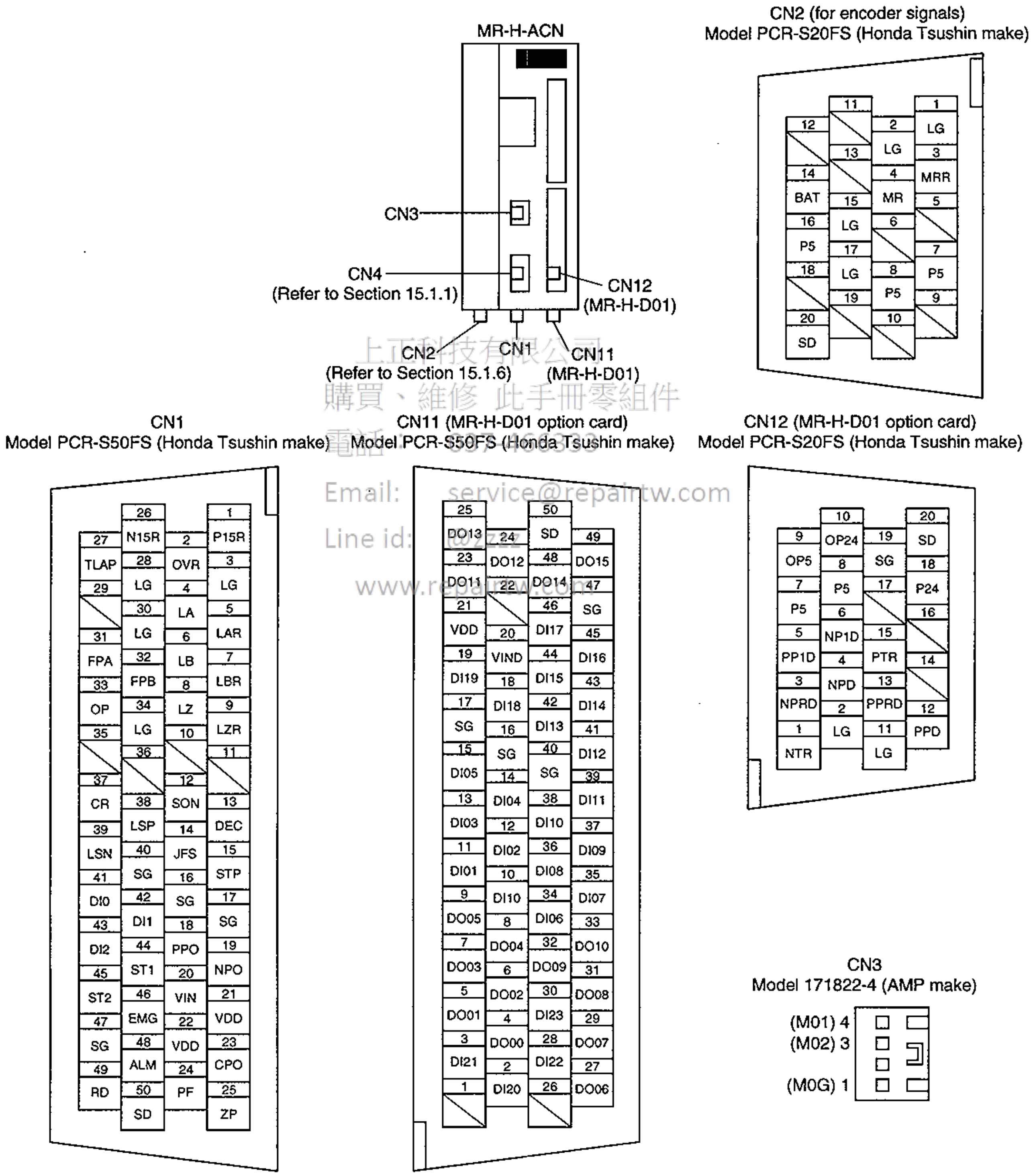
Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.

2. The sum total of currents flowing in the external relays should be 200mA max. If 200mA is exceeded, supply external power to the interface.
3. The controller of 11kW or more dose not contain the regenerative brake resistor. Connect the supplied external regenerative brake resistor.
4. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C.
5. The emergency stop switch must be installed.
6. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
7. For the HA-LH series servo motors of 11kW or more, supply power to the fan terminals. For 11kW or more, connect the fan terminals to the MS1 and MS terminals of the controller. Refer to Section 5.4.4 for connection with the servo motor.
8. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
9. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
10. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
11. Change the setting of parameter No.44 to □□□1 to use PF and CPO as an M code.
12. Change the setting of parameter No.41 to □0□□ to use DI1 as a torque limit signal.
13. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
14. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
15. The trouble (ALM) signal is on under normal conditions.
16. The upper limit of the overriding speed is the permissible speed.
17. The connection method changes with the servo motor series. Refer to Section 5.4.

3.3 I/O Connectors

3.3.1 Connector signal layouts

> **POINT**
> - The signal layouts of the connectors are views from the wiring section of the cable connectors.



3.3.2 Signal explanations

Refer to Section 5.2.2 for the I/O interfaces (symbols in the I/O column in the table).

(1) CN1

Signal Name	Pin Code	Pin No.	Function/Application	I/O Category
Digital I/F power supply input	VIN	20	Driver power supply input terminal for digital interface Input 24VDC±10% for input interface. When using an external power supply, connect a 24VDC power supply of 200mA or more to this terminal. When using the internal power supply (VDD) as the interface power supply, always connect VDD.	
Driver power supply	VDD	21,22	+24V±10% is output across VDD-SG. Connect with VIN when using this power supply for the digital interface. Permissible current: 200mA	
Open collector power input	OPC	11	When using a manual pulse generator, supply 24VDC to this terminal.	
24V common	SG	16,17 40,47	Common terminals for VDD and VIN. Isolated from LG.	
DC power supply	P15R	1	+15VDC is output across P15R-LG. Use as a power supply for OVR/TLAP. Permissible current: 30mA	
	P15N	26	−15VDC is output across P15N-LG. Use as a power supply for OVR/TLAP. Permissible current: 30mA	
Control common	LG	3,28 30,34	Common terminals for OVR, TLAP, LA, LAR, LB, LBR, LZ, LZR, FPA, FPB and OP.	
Shield	SD	50	Connect the servo amplifier end of the shield cable.	
Servo on	SON	12	Operation-ready signal input terminal. Short SON-SG to switch the base circuit on, making the servo amplifier ready to operate. Open them to shut off the base circuit, coasting the servo motor.	DI-1
Reset			Alarm reset signal input terminal. When using the reset signal, set □□□1 in parameter No. 41. At this time, the servo on signal is "automatically turned on internally". Short SON-SG for longer than 20ms to reset the alarm. While SON-SG are shorted, the base circuit is shut off. However, regenerative alarm (AL 30), overload 1 (AL 50) and overload 2 (AL 51) cannot be reset until the regenerative brake resistor and power transistor temperatures reduce. The following alarms can be reset.	DI-1

Display	Name
AL10	Undervoltage
AL24	Ground fault
AL31	Overspeed
AL32	Overcurrent
AL33	Overvoltage
AL35	Command pulse frequency alarm
AL42	Feedback alarm

Display	Name
AL45	Main circuit device overheat
AL46	Servo motor overheat
AL52	Error excessive
AL73	Auxiliary pulse frequency alarm
AL75	Option memory alarm 2
AL8E	RS-232C alarm
AL8F	RS-422 alarm

Signal Name	Pin Code	Pin No.	Function/Application	I/O Category
Forward rotation start	ST1	44	Forward rotation start signal input terminal in incremental command system. In the automatic operation mode, short ST1-SG to start rotation in the forward rotation direction. In the zeroing mode, short ST1-SG to start zeroing. In the jog operation mode, short ST1-SG to perform rotation in the forward rotation direction while they are shorted. Note: Forward rotation is in address increasing direction.	DI-1
			Forward rotation start signal input terminal in absolute command system. In the automatic operation mode, short ST1-SG to make a start. In the zeroing mode, short ST1-SG to start zeroing. In the jog operation mode, short ST1-SG to perform rotation in the forward rotation direction while they are shorted. Note: Forward rotation is in address increasing direction.	
Reverse rotation start	ST2	45	Reverse rotation start signal input terminal. In the automatic operation mode, short ST2-SG to start rotation in the reverse rotation direction. (Incremental command only) In the jog operation mode, short ST2-SG to perform rotation in the reverse rotation direction while they are shorted. Note: Reverse rotation is in address decreasing direction.	DI-1
Automatic/manual selection	DI0	41	Automatic/manual mode selection signal input terminal. Short DI0-SG to choose the automatic operation mode or open them to choose the manual operation mode.	DI-1
Zeroing	DI2	43	Zeroing signal input terminal	DI-1
Temporary stop	DI1	42	Temporary stop signal input terminal When DI1-SG are open, short them to stop operation. Short the open start signal again to resume operation from where it had stopped. Reserve the pulse width of 5ms or longer.	DI-1
Torque limit			Torque limit signal input terminal. When using the torque limit signal, set □0□□ in parameter No. 41. At this time, the temporary stop signal is made invalid. Short DI1-SG to limit the generated torque according to the voltage of the torque limit command (TLP). Open DI1-SG to make the parameter No. 40 setting valid.	DI-1
Position block number selection 1 Position block number selection 2 Position block selection number 3	DEC JFS STP	13 14 15	No. selection signal input terminals. The position block No.s chosen by the combinations of DEC, JFS and STP are listed below:	DI-1

STP	JFS	DEC	Selected Position Block No.
0	0	0	No.0
0	0	1	No.1
0	1	0	No.2
0	1	1	No.3
1	0	0	No.4
1	0	1	No.5
1	1	0	No.6
1	1	1	No.7

Note: 0. Any terminal-SG OFF (open)
1. Any terminal-SG ON (short)

<table>
<tr><th>Signal Name</th><th>Pin Code</th><th>Pin No.</th><th>Function/Application</th><th>I/O Category</th></tr>
<tr><td>Proximity dog</td><td>CR</td><td>37</td><td>Proximity dog signal input terminal for manual zeroing.
Short CR-SG to detect the proximity dog. The polarity of dog detection can be changed with the parameter.
<table>
<tr><th>Parameter No. 9</th><th>Polarity of Proximity Dog Detection</th></tr>
<tr><td>□0□□</td><td>CR-SG open</td></tr>
<tr><td>□1□□ (initial value)</td><td>CR-SG shorted</td></tr>
</table></td><td>DI-1</td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>38</td><td rowspan="2">Stroke end signal input terminals.
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.
When these signals are not used, choose "automatically turned on internally" in parameter No. 42.
<table>
<tr><th colspan="2">(Note) External 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>DI-1</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>39</td><td>DI-1</td></tr>
<tr><td>Manual pulse generator signal</td><td>PPO
NPO</td><td>18
19</td><td>Connect the manual pulse generator (MR-HDP01).
Refer to Section 15.1.12 for details.</td><td>DI-2</td></tr>
<tr><td>Emergency stop</td><td>EMG</td><td>46</td><td>Emergency stop signal input terminal
Opening EMG-SG puts the motor in an emergency stop status, in which the servo is switched off, the dynamic brake is operated, and the motor comes to a sudden stop.
Short EMG-SG in the emergency stop status to exit from the emergency stop status.</td><td>DI-1</td></tr>
<tr><td>Trouble</td><td>ALM</td><td>48</td><td>Trouble signal output terminal.
ALM-SG are disconnected when the protective circuit is activated to shut off the base circuit at power-off or power-on.
They are connected in a normal status at power-on</td><td>DO-1</td></tr>
<tr><td>Rough match</td><td rowspan="3">CPO</td><td rowspan="3">23</td><td>Rough match signal output terminal.
CPO-SG are connected when the command remaining distance is less than the rough match output range set in the parameter.
Not output while the base circuit is on.</td><td>DO-1</td></tr>
<tr><td>Limiting torque</td><td>Limiting torque signal output terminal.
When using the limiting torque signal, make it valid in parameter No. 44.
At this time, the rough match/electromagnetic brake interlock signal is made invalid.
CPO-SG are connected when the internally or externally set torque limit value is reached.</td><td>DO-1</td></tr>
<tr><td>Electromagnetic brake inter lock</td><td>Electromagnetic brake interlock output signal terminal.
When using the electromagnetic brake interlock signal, make it valid in parameter No. 3.
At this time, the rough match/limiting torque signal is made invalid.
The electromagnetic brake interlock signal is output.
CPO-SG are disconnected at servo off or alarm.</td><td>DO-1</td></tr>
<tr><td>In position</td><td>PF</td><td>24</td><td>In-position signal output terminal.
PF-SG are connected when the droop pulse value is less than the in-position range set in the parameter.
Not output while the base circuit is off.</td><td>DO-1</td></tr>
</table>

<table>
<tr><th>Signal Name</th><th>Pin Code</th><th>Pin No.</th><th>Function/Application</th><th>I/O Category</th></tr>
<tr><td>Zeroing completion</td><td>ZP</td><td>25</td><td>ZP-SG are connected on completion of zeroing.
In the absolute position system, ZP-SG are connected when operation is made ready, but are disconnected if:
1) SON-SG are opened;
2) EMG-SG are opened;
3) SON-SG are shorted when SON has been changed into the reset signal;
4) Alarm occurs;
5) Limit switch is opened;</td><td>DO-1</td></tr>
<tr><td>Ready</td><td>RD</td><td>49</td><td>Ready output terminal.
After servo on, RD-SG are connected in a trouble-free ready status.</td><td>DO-1</td></tr>
<tr><td>M code bit0</td><td>PF</td><td>24</td><td rowspan="2">When using these signals, make them valid in parameter No. 44.
M code is output in 2-bit binary.
<table>
<tr><th rowspan="2">M Code</th><th colspan="2">(Note) Output Signals</th></tr>
<tr><th>CPO</th><th>PF</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>1</td><td>0</td></tr>
</table>
Note: 0. CPO/PF-SG OFF (disconnected)
1. CPO/PF-SG ON (connected)</td><td>DO-1</td></tr>
<tr><td>M code bit1</td><td>CPO</td><td>23</td><td>DO-1</td></tr>
<tr><td>Encoder pulse (open collector)</td><td>FPA
FPB</td><td>31
32</td><td>In CCW rotation of the servo motor, FPA leads FPB by $\pi/2$.
Pulses are output in the range 100 to 5000 pulses/rev according to the parameter No. 39 setting.</td><td>DO-2</td></tr>
<tr><td>Encoder Z-phase pulse (differential line driver)</td><td>OP</td><td>33</td><td>Z-phase pulse signal output terminal.
Output the zero-point signal of the servo motor encoder.
OP-SG are connected in the zero-point position. The minimum pulse width is approx 1.77ms.</td><td>DO-2</td></tr>
<tr><td>External digital display signal</td><td>LA
LAR
LZ
LZR</td><td>4
5
8
9</td><td>External digital display signal output terminal.
When using the MR-DP60 external digital display, connect it to this terminal.</td><td>DO-2</td></tr>
<tr><td>Encoder pulse (differential line driver)</td><td>LA
LAR
LB
LBR</td><td>4
5
6
7</td><td>When using the encoder output signal (differential line driver system), make it valid in parameter No. 52.</td><td>DO-2</td></tr>
<tr><td>Override</td><td>OVR</td><td>2</td><td>Apply −10 to +10V across OVR-LG to limit the servo motor speed.
0[%] for −10[V], 100[%] for 0[V], 200[%] for 10[V].</td><td>Analog input</td></tr>
<tr><td>External analog torque limit</td><td>TLAP</td><td>27</td><td>Apply 0 to +10V across TLAP-LG to limit the servo motor-generated torque.
Zero torque for 0[V], max. torque for 10[V].</td><td>Analog input</td></tr>
</table>

(2) CN11 (MR-H-D01)

Pin Code	Pin No.	Functions and Applications: 256-position point data command	Functions and Applications: Position data command	I/O (Note)
D004	8		Position data common 1 terminal (sign. 6th digit, 5th digit, 4th digit)	
D005	9		Position data common 2 terminal (3rd digit, 2nd digit, 1st digit)	
DI00	10	Position block number input terminal, 8-bit binary bit 0	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 0)	DI-1
DI01	11	Position block number input terminal, 8-bit binary bit 1	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 1)	DI-1
DI02	12	Position block number input terminal, 8-bit binary bit 2	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 2)	DI-1
DI03	13	Position block number input terminal, 8-bit binary bit 3	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 3)	DI-1
DI04	14	Position block number input terminal, 8-bit binary bit 4	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 0)	DI-1
DI05	15	Position block number input terminal, 8-bit binary bit 5	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 1)	DI-1
DI06	34	Position block number input terminal, 8-bit binary bit 6	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 2)	DI-1
DI07	35	Position block number input terminal, 8-bit binary bit 7	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 3)	DI-1
DI08	36		Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 0)	DI-1
DI09	37		Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 1)	DI-1
DI10	38		Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 2)	DI-1
DI11	39		Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 3)	DI-1
DI12	41		Position data input terminal (sign +)	DI-1
DI13	42		Position data input terminal (sign –)	DI-1
DI16	45	Override selection input terminal		DI-1
DI17	46	Speed selection input terminal,3-bit binary bit 0		DI-1
DI18	18	Speed selection input terminal,3-bit binary bit 1		DI-1
DI19	19	Speed selection input terminal,3-bit binary bit 2		DI-1
DI20	2	Manual pulse generator magnification selection input terminal, 2-bit binary bit 0		DI-1
DI21	3	Manual pulse generator magnification selection input terminal, 2-bit binary bit 1		DI-1
DI22	28		Strobe input terminal (not required when the 6-digit digital switch is used)	DI-1
DO00	4	Alarm code output terminal, 4-bit binary bit 0		DO-2
DO01	5	Alarm code output terminal, 4-bit binary bit 1		DO-2
DO02	6	Alarm code output terminal, 4-bit binary bit 2		DO-2
DO03	7	Alarm code output terminal, 4-bit binary bit 3		DO-2
DO08	31	M code output terminal, 1st digit, 4-bit binary bit 0		DO-2
DO09	32	M code output terminal, 1st digit, 4-bit binary bit 1		DO-2
DO10	33	M code output terminal, 1st digit, 4-bit binary bit 2		DO-2
DO11	23	M code output terminal, 1st digit, 4-bit binary bit 3		DO-2
DO12	24	M code output terminal, 2nd digit, 4-bit binary bit 0		DO-2
DO13	25	M code output terminal, 2nd digit, 4-bit binary bit 1		DO-2
DO14	48	M code output terminal, 2nd digit, 4-bit binary bit 2		DO-2
DO15	49	M code output terminal, 2nd digit, 4-bit binary bit 3		DO-2
VDD	21	24VDC output terminal		
VIND	20	Connect with VDD or connect an external power supply		
SG	16,17 40,47	24VDC common terminal	Common terminal for 24VDC except position data	
SD	50	Shielding terminal		

(3) CN12 (Connector for connection of MR-H-D01/manual pulse generator)

Pin Code	Pin No.	Functions and Applications: 256-position point data command	Functions and Applications: Position data command	I/O (Note)
PP1D	5	Open collector forward rotation pulse input terminal		DI-2
PN1D	6	Open collector reverse rotation pulse input terminal		DI-2
P5	7,8	5VDC output terminal		
OP5	9	Connect with P5 or connect an external power supply		
LG	2,11	5VDC common terminal		
SD	20	Shielding terminal		

3.3.3 Control input/output signals

(1) Start signals and operation mode select signals

The start signals change as indicated below depending on the operation mode selection conditions. Indicates that the signal is made valid when it is switched from off to on, and is invalid if switched on during operation. Indicates that the signal is valid while it is on, and is made invalid when switched off.

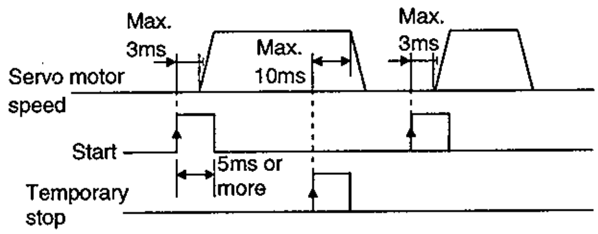
Signal			Automatic Operation: Absolute command	Automatic Operation: Incremental command	Manual Operation	Manual Zeroing	Automatic Positioning to Home Position
CN1	Automatic/ Manual Operation	DI0	ON	ON	OFF	OFF	ON
CN1	Zeroing	DI2	OFF	OFF	OFF	ON	ON
CN1	Forward rotation start	ST1			(Forward rotation JOG)		(First zeroing)
CN1	Reverse rotation start	ST2			(Reverse rotation JOG)		(Second zeroing)
CN1	Temporary stop	DI1					
Manual pulse generator							

Note: If you turn on-off DI0/DI2 during operation in the automatic operation mode, the operation mode cannot be changed. The operation mode is switched to the one specified by DI0 and DI2 after completion of positioning to the target position.

(2) Start and stop signals

1) Make up the sequence so that the start signal is switched on after the main circuit has been set up. The start signal is invalid if it is switched on before the main circuit is set up. Normally interlock is provided between the start signal and ready signal (RD).

2) The controller is started when the start signal is switched from off to on. The internal processing of the controller delays 3ms maximum. The other signal delays 10ms maximum.



3) When using the programmable controller, set the ON time of the start/stop signal to 5ms or longer to prevent a malfunction.

4) The start signal (ST1/ST2) is not accepted during operation. The next operation must be started after the rough match signal has been output with the rough match output range set to zero, or after the in-position signal has been output.

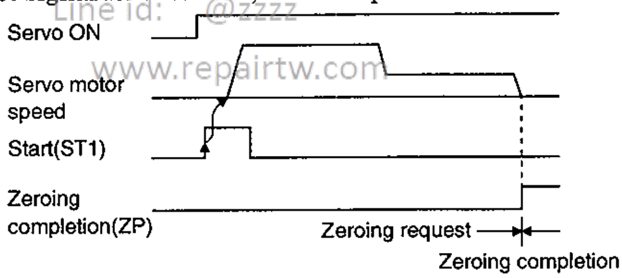
(3) Proximity dog (CR)

Used for dog type and count type manual zeroing as a proximity dog detection signal. Keep this signal on during operation and switch it off when the proximity dog is detected.

(4) Zeroing completion (ZP)

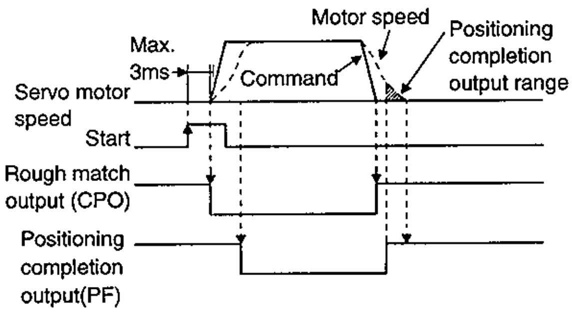
Switched on after completion of manual zeroing performed with power on.

After that, kept on independently of the zeroing method. Use the zeroing completion signal (ZP) when making a zeroing request signal for interlock, for example.



(5) Positioning completion signal (PF)

Switched on when the droop of the deviation counter falls within the present positioning completion range (parameter No.16). When operation is performed at low speed, the low droop may keep the PF signal on if the positioning completion range (parameter No.16) setting is large.



(6) Rough match (CPO)

Switched on when the command remaining distance is less than the rough match output range (parameter No. 17). Refer to the timing chart in (5) of this section.

(7) Override (OVR)

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

Item	Name	Remarks
Analog input signal	Override (OVR)	
Contact input signal	Override selection (DI16)	MR-H-D01 option card used
Parameter	No.24 function selection 5	□□□1 : Override used
	No.47 override offset	–9999 to 9999mV

To use override, make it available by setting □□□1 in parameter No. 24.

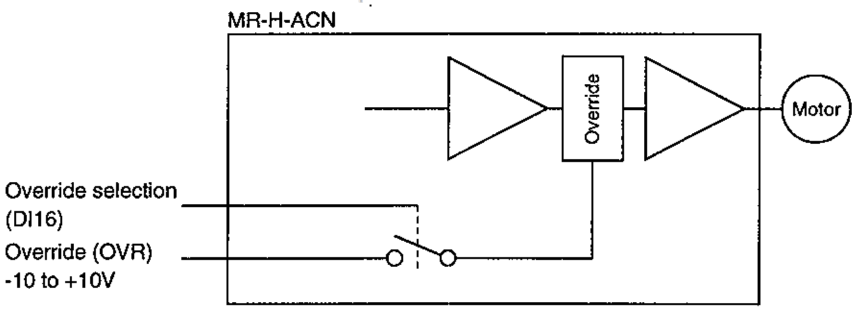
(a) Override (OVR)

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

Refer to the following diagram when using the 15V power output (P15R/N15R) of the controller:

(b) Override selection (DI16)

Used to make the override (OVR) valid or invalid. The MR-H-D01 option card is required to use this signal. Set □□□1 in parameter No. 66 to make override selection valid.



Using the override selection (DI16), choose a change value as follows:

Across DI16-SG	Speed Change Value
Open	No change
Short	Override (OVR) setting is made valid.

(c) Override offset (parameter No.47)

Using parameter No.47, the offset voltage can be set relative to the input voltage for the override (OVR). The setting is between –9999 to 9999mV.

(8) Torque limit

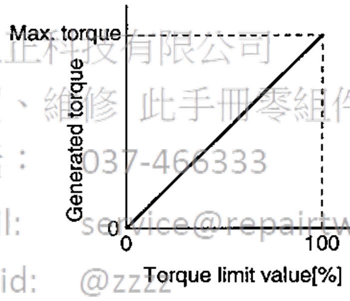
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLAP)	
Contact input signals	Torque limit selection (DI1)	Set □0□□ (initial value) in parameter No. 41.
Contact output signal	Limiting torque (CPO)	
Parameters	No.40 internal torque limit	0 to 100%
	No.54 internal torque limit 2	0 to 100%
	No.48 torque limit offset	-9999 to 9999mV
	No.41 input signal selection	Selection of torque limit value to be used

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

(a) Internal torque limits (parameter No.40,54)

Use parameter No.40 and 54 to set the internal torque limit values. The following graph shows the generated torque relative to the setting.



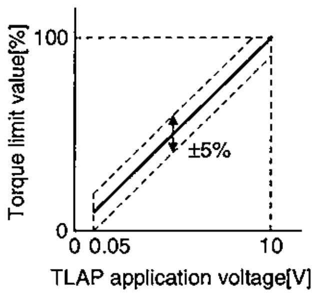
(b) External torque limit (TLAP)

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

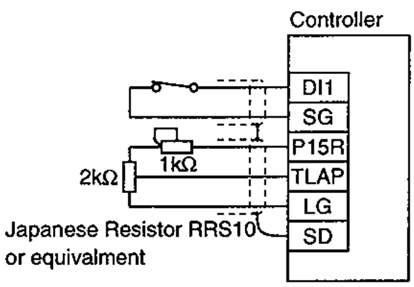
Depending on the controller, the limit value has about 5% variations to the input voltage.

As this may not cause torque to be limited sufficiently at less than 0.05V, use this function at the voltage of 0.05V or more.

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



TLAP Application voltage vs. Torque Limit Value



Connection Example

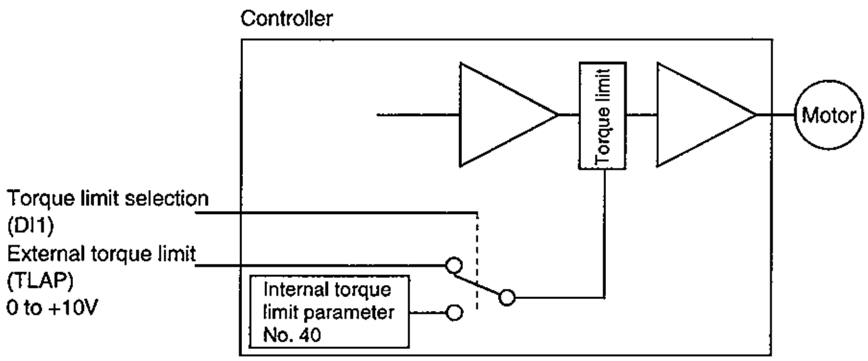
(c) Torque limit selection (DI1)

To use torque limit selection (DI1), set □0□□ in parameter No. 41.

This input signal can be used to choose the torque limit value made valid. When not using torque limit selection (DI1), set □1□□ (initial value) in parameter No. 41. At this time, the internal torque limit (parameter No. 40) setting is always made valid.

1) When □□0□ is set in parameter No. 41

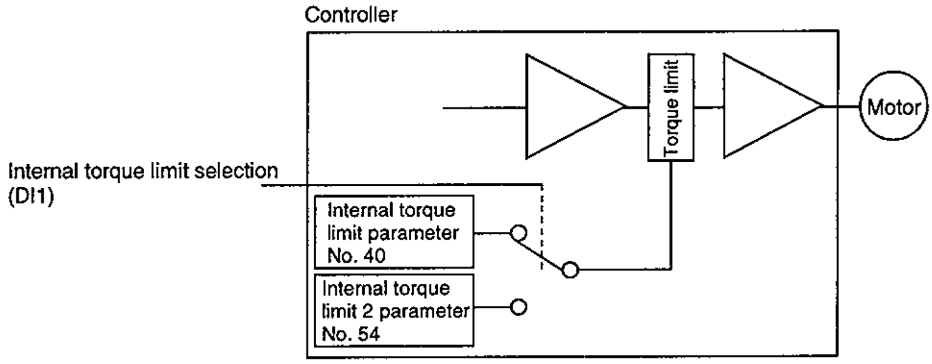
Switched between external torque limit (TLAP) and internal torque limit (parameter No. 40).



Using the internal torque limit selection (DI1), choose the limit value as follows. When DI1-SG are shorted, the smaller value of the external torque limit and internal torque limit is chosen:

Across DI1-SG	Torque Limit Value
Open	External torque limit (TLAP) if External torque limit (TLAP) < internal torque limit
	Internal torque limit if External torque limit (TLAP) > internal torque limit
Short	Internal torque limit

2) When □□1□ is set in parameter No. 41
Switched between internal torque limit (parameter No. 40) and internal torque limit 2 (parameter No. 54).



Using the internal torque limit selection (DI1), choose the limit value as follows. When DI1-SG are shorted, the smaller value of the internal torque limit and internal torque limit 2 is chosen:

Across DI1-SG	Torque Limit Value
Open	Internal torque limit
Short	Internal torque limit if internal torque limit < internal torque limit 2
	Internal torque limit 2 if internal torque limit > internal torque limit 2

(9) Stroke ends (LSP,LSN)

During operation, use limit switches or the like with LSP and LSN to connect with SG. On a machine which dose not have stroke ends, connect LSP and LSN with SG. If they are not connected, the servo motor will not rotate. Disconnection of LSP or LSN from SG during rotation of the servo motor (LSP during CCW rotation, LSN during CW rotation) causes the servo motor to be brought to a sudden stop and servo-locked. At this time, the deviation counter is cleared.

(10) M code output

1) Standard (0 to 2)

When □□□1 is set in parameter No.44, the M code is output in 2-bit binary from CPO and PF.

M code	CPO	PF
0	0	0
1	0	1
2	1	0

Note: 0. CPO/PF-SG OFF

1. CPO/PF-SG ON

2) When option card (MR-H-D01) is used (00 to 99)

When □□1□ is set in parameter No.67, the 1st digit of M code is output from DO08, DO09, DO10 and DO11 of the MR-H-DO1, and the 2nd digit from DO12, DO13, DO14, and DO15, in 4-bit binary.

M code \ 1st digit / 2nd digit	DO11 / DO15	DO10 / DO14	DO09 / DO13	DO08 / DO12
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Note: 0. Any terminal-SG OFF (Open)

1. Any terminal-SG ON (Short)

For the M code output timing, refer to the timing chart in Section 3.4.3.

(11) Manual pulse generator pulse magnification selection (DI20,DI21)

Use the MR-H-D01 option card.

Set □4□□ in parameter No.65 to make this signal valid

Select the pulse magnification across DI20, DI21-SG as indicated in the following table.

Pulse Magnification	(Note) Input signal	
	DI21	DI20
1 time	0	0
10 times	0	1
100 times	1	0

Note: 0. DI21/DI20-SG OFF (Open)

1. DI21/DI20-SG ON (Short)

(12) Alarm code output (DO00,DO01,DO02,DO03)

Use the option card (MR-H-D01).

Set □□□1 in parameter No.67 to make this signal valid. The alarm type is output in 4-bit code. For more information, refer to Section 12.2.1

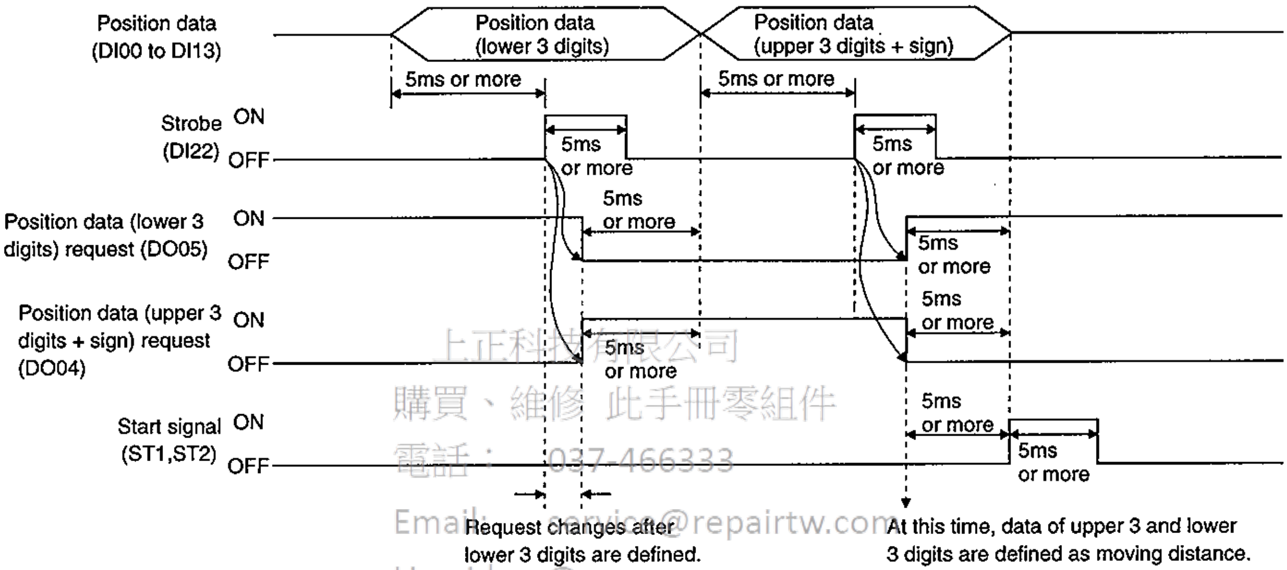
(13) Strobe signal (DI22)

Use the MR-H-D01 option card.

When the programmable controller is used, this signal controls the read timing of position data. Position data is read in two parts separately:

lower 3 digits; and upper 3 digits + sign. Hence, the strobe signal must be switched on twice.

Provide position data and switch the strobe signal on with a delay of 5ms or more. Keep the strobe signal on for 5ms or more and keep the data unchanged during this period. The relationship between the position data and start signal (ST1, ST2) should be as shown in the following timing chart. Two or more pieces of position data cannot be read. After one piece of position data has been read, switch on the start signal.



(14) External speed setting (DI17, DI18, DI19)

The MR-H-D01 option card is used. Set □□1□ in parameter No. 65. Position block data need not be used to specify the speed block No., and the DI17, DI18, DI19 external input signal (3-bit binary) can be used to choose the speed block No.

Speed block No.	(Note) Input Signal		
	DI19	DI18	DI17
	bit2 (MSB)	bit1	bit0 (LSB)
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

Note: 0. Any terminal-SG OFF (Open)

1. Any terminal-SG ON (Short)

3.4 Operation

3.4.1 When Switching Power On for the First Time

(1) Pre-operation checks

Before starting operation, check the following:

(a) Wiring

1) A correct power supply is connected to the power input terminals (R, S, T) of the controller.
2) The servo motor power supply terminals (U, V, W) of the controller match in phase with the power input terminals (U, V, W) of the servo motor.
3) The servo motor power supply terminals (U, V, W) of the controller are not shorted to the power input terminals (R, S, T).
4) The controller and servo motor are grounded securely.
5) When using the regenerative brake option, twisted cables are used and the lead of the built-in regenerative brake resistor has been removed.
6) When stroke end limit switches are used, the signals across LSP-SG and LSN-SG are on during operation.
7) 24VDC or higher voltages are not applied to the pins of connectors CN1.
8) SD and SG of connectors CN1 are not shorted.
9) The wiring cables are free from excessive force.

(b) Environment

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

(c) Machine

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

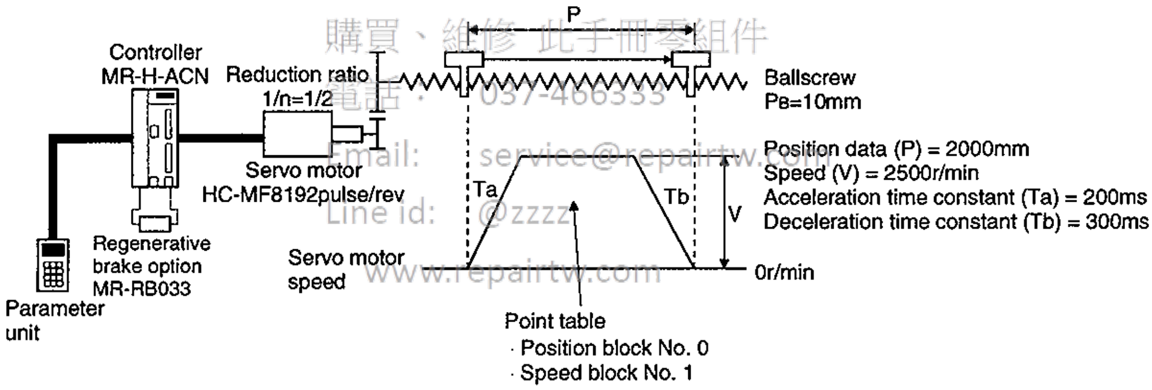
3.4.2 Startup

⚠ 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 are exposed and you may get an electric shock. • During power-on or operation, do not open the front cover. You may get an electric shock.

⚠ CAUTION	• Before starting operation, check the parameters. Some machines may perform unexpected operation. • During power-on or soon after power-off, do not touch the servo amplifier heat sink, regenerative brake resistor, servo motor, etc. as they may be at high temperatures. You may get burnt.

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

(1) Machine conditions



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

$$\frac{\text{CMX (pulse)}}{\text{CDV }(\mu\text{m})}=\frac{8192}{\frac{1}{n}\cdot P_B\cdot 1000}=\frac{8192}{\frac{1}{2}\cdot 10\cdot 1000}=\frac{8192}{5000} \quad \cdots\cdots (3.1)$$

CMX=8192
CDV=5000

5) Position block No.1 is used to execute automatic operation once.

(2) Startup procedure

(a) Power on

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

2) When main circuit power/control circuit power is switched on, "Position" appears on the parameter unit display.

(b) Test operation 1

Using jog operation in the "test operation mode" of the parameter unit, make sure that the servo motor operates. (Refer to Section7.2.)

(c) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to Chapter 6 for the parameter definitions and to Sections 7.2 for the setting method.

Parameter	Name	Setting	Description
No.0	Motor series		Setting is not needed because of HA-FF series servo motor.
No.1	Motor type		Setting is not needed because of HA-FF series servo motor.
No.2	Feed system	□3□2 2: Absolute command system. 3: MR-RB033 regenerative brake option is used.	
No.3	Function selection 1	1□□0 0: Linear acceleration/deceleration system. 1: Used in absolute position detection system.	
No.4	Function selection 2	□001 1: As command resolution is 10μm, feed length multiplying factor of 10 times is chosen. 0: Position data unit [mm] is selected. 0: Digital display, automatic decimal point setting selection.	
No.5	Electronic gear numerator (CMX)	8192	From calculation result of formula (3.1)
No.6	Electronic gear denominator (CDV)	5000	From calculation result of formula (3.1)

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

(d) Position block setting

Set the position block according to the operation pattern. Refer to Section 3.4.4. for the position block details and to Section 3.6 for the setting method.

Setting of position block No.0

Position Data [$\times 10^{STM}$ μm]	M code	Speed Block No.
2000.00	00	1

Setting of speed block No.1

Servo Motor Speed [r/min]	Acceleration Time Constant [ms]	Deceleration Time Constant [ms]
2500	1000	1000

(e) Servo on

Switch the servo on in the following procedure:

1) Switch on main circuit/control power.

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

When placed in the servo-on status, the servo amplifier is ready to operate and the servo motor is locked.

(f) Zeroing

Before starting positioning operation, always make home position return. Refer to Section 3.4 for zeroing types. A parameter setting example for dog type zeroing is given here.

Parameter	Name	Setting	Description
No.9	Zeroing type	□000	Dog type zeroing is selected. Zeroing is started in address incremented direction. Proximity dog signal is valid when DOG-SG are opened.
No.11	Zeroing speed	1000	Motion is made up to proximity dog at 1000r/min.
No.12	Creep speed	10	Motion is made up to home position at 10r/min.
No.13	Zero shift distance	0	No zero shift
No.10	Zeroing position data		Zero address is entered automatically after zeroing.
No.14	Moving distance after proximity dog		Not used in dog type zeroing.

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

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

Device Name	Symbol	ON/OFF	Description
Automatic/manual selection	DI0	OFF	Zeroing mode is selected.
Zeroing	DI2	ON	
Temporary stop	DI1	OFF	
Servo-on	SON	ON	Servo-on status is reached.

(g) Automatic operation

Set the input signals as listed below and switch on the forward rotation start (ST1) to execute automatic operation in accordance with point table No.0.

Device Name	Symbol	ON/OFF	Description
Automatic/manual selection	DI0	ON	Automatic operation mode is selected.
Servo-on	SON	ON	Servo-on status is reached.
Forward rotation stroke end	LSP	ON	Forward rotation side limit switch is turned on.
Reverse rotation stroke end	LSN	ON	Reverse rotation side limit switch is turned on.
Position block number selection 1	DEC	OFF	Position block No.0 is selected.
Position block number selection 2	JFS	OFF	
Position block number selection 3	STP	OFF	

(h) Stop

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

1) Servo-on (SON) OFF
   The base circuit is shut off and the servo motor coasts.
2) Alarm occurrence
   When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.
3) Emergency stop (EMG) OFF
   The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. Alarm ALE6 occurs.
4) Forward/reverse rotation stroke end (LSP/LSN) OFF
   The servo motor is brought to a sudden stop and servo-locked.

3.4.3 Manual operation mode

For manual operation, set the operation mode selection signals (DI0, DI2) as listed below:

Operation Mode Selection Signal	ON/OFF
DI0	OFF
DI2	OFF

(1) Jog operation

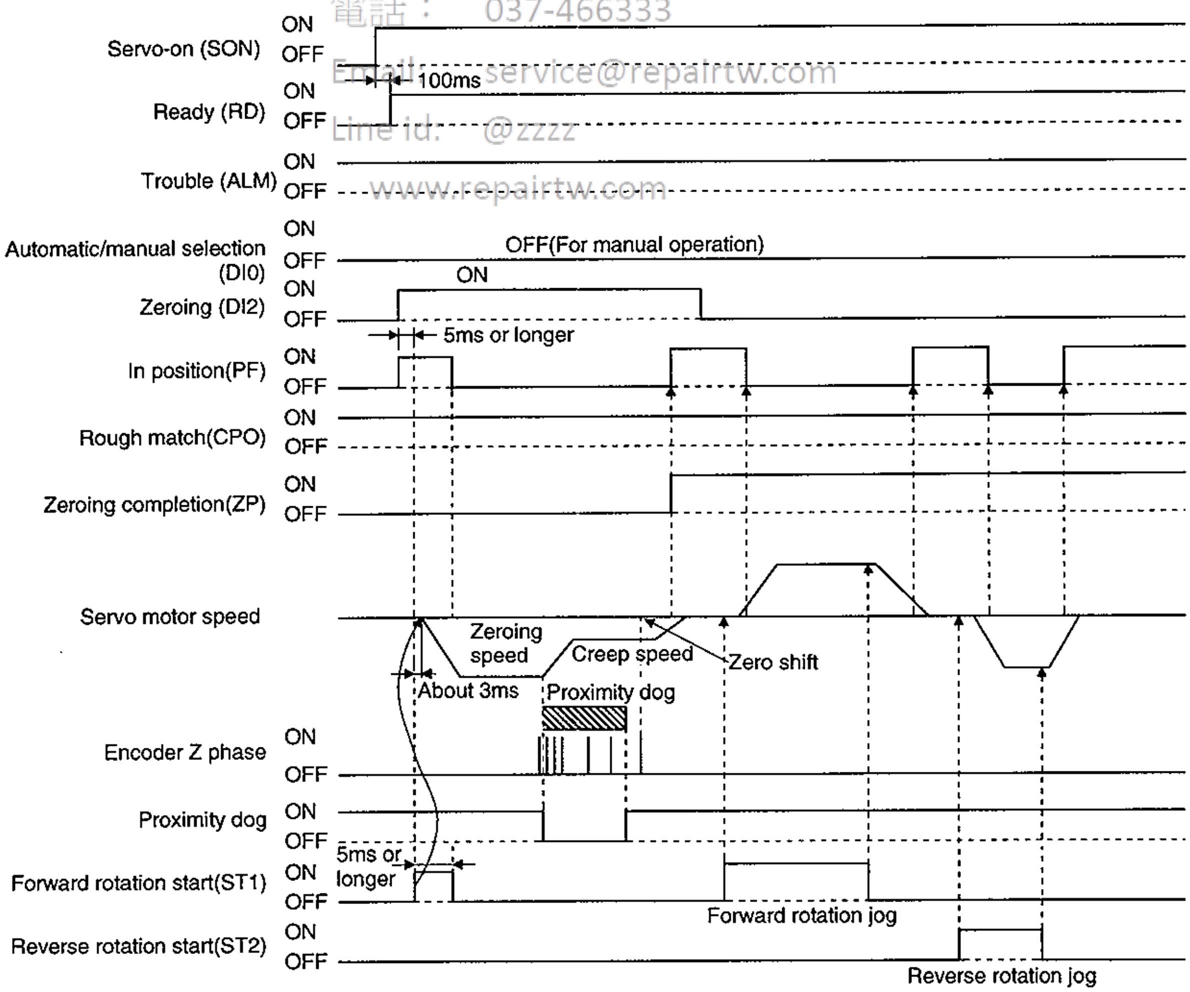
Set the jog speed.

Parameter No.	Setting
8	0 to max. speed (r/min)

Turn on the signal (ST1, ST2) to start jog operation. At this time, the rotation direction is as indicated below. The acceleration/deceleration time constants used are those of speed block No. 1.

Start Signal	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
ST1	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
ST2	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)

The timing chart is as follows:



(2) Manual pulse generator operation

(a) When option card (MR-H-D01) is not used

Set any of 1 to 3 in parameter No. 30 as indicated below to make operation from the manual pulse generator valid. Select the pulse multiplying factor of the manual pulse generator at this time.

Parameter No.30

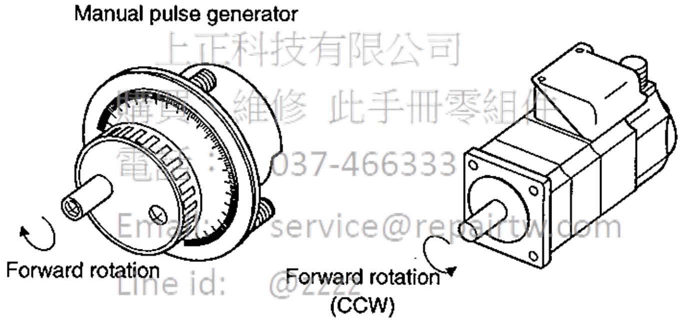
[-][-][-][0]

*Machine feedrate per revolution of manual pulse generator in metric system

Setting	Manual Pulse Generator	*Moving Distance/Number of Revolutions
0	Not used	
1	Used/pulse 1-time multiplication selected	100μm
2	Used/pulse 10-time multiplication selected	1mm
3	Used/pulse 100-time multiplication selected	10mm

Turn the manual pulse generator (MR-H-DP01) to rotate the servo motor. The turning direction of the manual pulse generator corresponds to the rotation direction of the servo motor as listed below:

Turning Direction of Manual Pulse Generator	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
Forward rotation	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
Reverse rotation	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)



(b) When option card (MR-H-D01) is used

The pulse multiplying factor of the manual pulse generator can be changed by using pulse multiplying factor selection in parameter No. 65 and the pulse multiplying factor selection signals (DI20, DI21) of the MR-H-D01. Set any of 1 to 4 in parameter No. 65 as listed below to make operation from the manual pulse generator valid.

Parameter No. 65

[-][ ][-][-]

*Machine feedrate per revolution of manual pulse generator in metric system

Setting	Manual Pulse Generator	*Feed Distance/Number of Revolutions
0	Not used	
1	Used/pulse 1-time multiplication selected	100μm
2	Used/pulse 10-time multiplication selected	1mm
3	Used/pulse 100-time multiplication selected	10mm
4	Used/pulse multiplication selected externally	

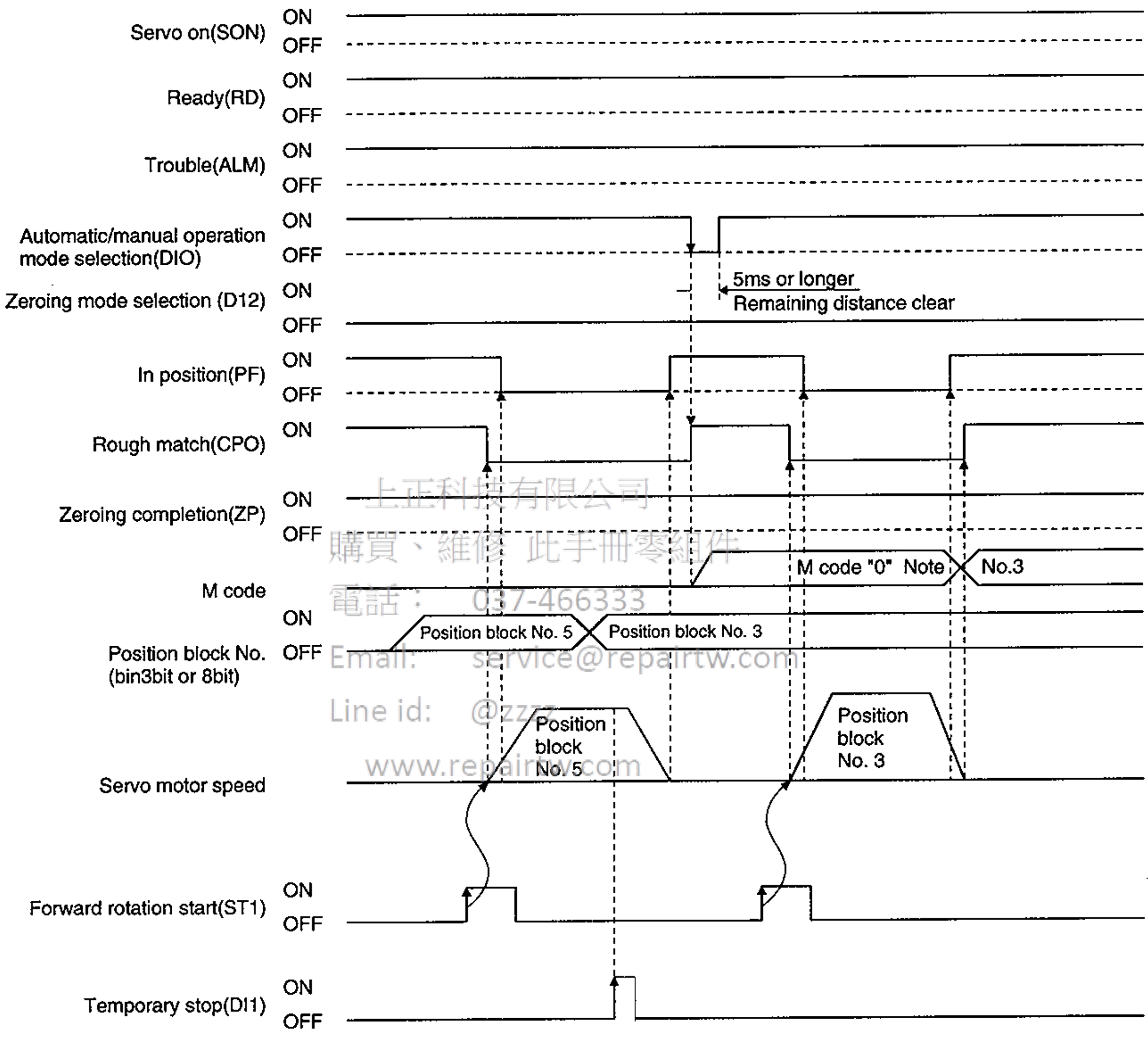
Set □4□□ in parameter No. 65 to set the pulse multiplying factor externally. Relationships between the multiplying factors and pulse multiplying factor selection signals are listed below:

Multiplying Factor	Pulse Multiplying Factor Selection Signals	
	DI21	DI20
1 time	OFF	OFF
10 time	OFF	ON
100 time	ON	OFF

Turn the manual pulse generator to rotate the servo motor. The turning direction is as indicated in (2), (a) of this section.

To erase the command remaining distance after a temporary stop, keep DI0 on for 5ms or longer on the leading edge of PF after the temporary stop. Switching the automatic mode to the manual mode erases the remaining distance. To start positioning operation anew, switch on the start signal (ST1/ST2) after CPO has switched on.

The following timing chart shows operations performed after power-on and zeroing completion:



Note: Switching DIO off outputs "0".

3.4.4 Automatic operation mode

Set the operation mode select signals (DI0,DI2) as listed below.

Operation Mode Select Signal	ON/OFF
DI0	ON
DI2	OFF

(1) Positioning operation according to point table

(a) Setting of position block data

By setting parameter No.2, either absolute command positioning or incremental command positioning can be selected.

Parameter No.2

[-][-][-][ ]

Set Value	Positioning Method
1	Incremental command positioning
2	Absolute command positioning

The number of position blocks that may be set is 8 (position block numbers 0 to 7) as standard, or 256 (position block numbers 0 to 255) when the option card (MR-H-D01) is used. Select it in parameter No.65.

Parameter No.65

[1][-][-][ ]

Set Value	Number of Position Blocks
0	8 points standard
3	Option card is used

For absolute command positioning, set □□□2 in parameter No.2.
Using the parameter unit, set the position data (absolute value), M code and speed block number in the position block. (Refer to the next table.) For the position block setting method, refer to Section 3.5.1.

Position block No.	Position data (Absolute position)	M code	Speed Block No.
0	20000	1	1
1	−100	2	1
2	500	0	2
⋮	⋮	⋮	⋮
7(255)	12000	0	8

Item	Description
Position data	Target position to be reached
M code	Code 0 to 2 output during operation (0 to 99 when the MR-H-D01 is used)
Speed block No.	Speed block number 1 to 8 When speed block number 0 is set, the corresponding position block number is invalid.

The unit ([mm], [inch]) and input range of the position data (absolute value) can be changed by setting parameter No. 4.
If positioning is performed with the setting made in excess of that input range, absolute position counter warning (ALE3) occurs. If power is switch off, then on in that status, the position cannot be restored properly.

Parameter No.4

□ □ □ □

Set Value (STM)	Input Range(mm or inch)
0	-999.999 to +999.999
1	-9999.99 to +9999.99
2	-99999.9 to +99999.9
3	-999999 to +999999

Set Value	Unit
0	mm
1	inch

For the absolute position detection system, the setting range is as given in Expression 3.2

$$\text{Number of encoder pulses} \times 32767 \times \frac{CDV}{CMX} / 10^{STM} \cdots\cdots \quad (3.2)$$

Number of encoder pulses : 8192P/rev or 16384P/rev
CDV : Parameter No.6 (electronic gear)
CMX : Parameter No.5 (electronic gear)
STM : Lowest digit of parameter No.4 (travel magnification)

If the result of Expression 3.2 dose no fall within the range of STM, the input range is as set in STM (parameter No.4).

For incremental command positioning, set □□□1 in parameter No.2.

Using the parameter unit, set the position address (increment), M code and speed block number in the position block of the position data.

Position block No.	Position data (increment)	M code	Speed Block No.
0	20000	1	1
1	15000	2	1
2	500	0	2
⋮	⋮	⋮	⋮
7(255)	12000	0	8

Item	Description
Position data	Incremental value of servo motor
M code	Code 0 to 2 output during operation (0 to 99 when the MR-H-D01 is used)
Speed block No.	Speed block number 1 to 8 When speed block number 0 is set, the corresponding position block number is invalid.

The unit ([mm], [inch]) and input range of the position data (increment) can be changed by setting parameter No.4

Parameter No.4

- - □ □

Set Value (STM)	Input Range(mm or inch)
0	0 to +999.999
1	0 to +9999.99
2	0 to +99999.9
3	0 to +999999

Set Value	Unit
0	mm
1	inch

(b) Setting of speed block data

By setting parameter No.3, either the linear or S-shaped acceleration/deceleration pattern can be selected. The number of speed blocks that may be set is 8 (speed block numbers 1 to 8).

Parameter No.3

- - - □

Set Value	Acceleration/Deceleration Pattern
0	Linear acceleration/deceleration
1	S-shaped acceleration/deceleration

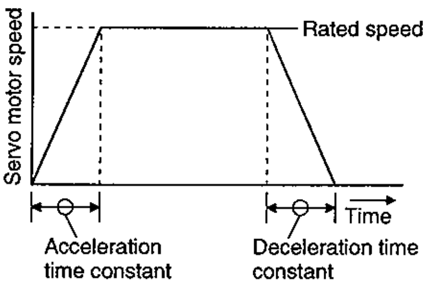
For linear acceleration/deceleration pattern, set □□□0 in parameter No.3.

Using the parameter unit, set the servo motor speed, acceleration time constant and deceleration time constant in the speed block. (Refer to the table on the right.)

Speed Block No.	Speed (r/min)	Acceleration Time Constant (ms)	Deceleration Time Constant (ms)
1	2000	220	20
2	500	100	50
3	1200	50	55
⋮	⋮	⋮	⋮
8	1500	20	30

For the speed block setting method, refer to Section 3.5.

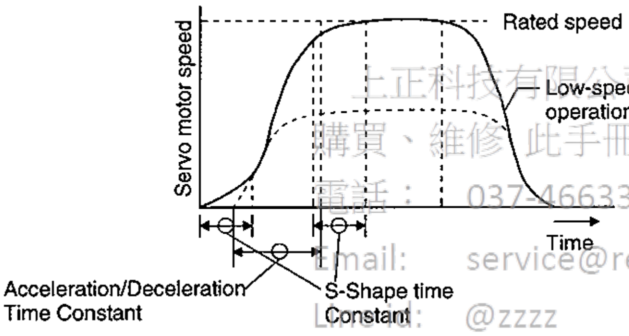
Item	Description
Speed	0 to max. speed r/min
Acceleration/deceleration time constant	0 to 20000ms The acceleration and deceleration time constants set should be the lengths of time (ms) required for the servo motor to rise to and fall from the rated speed, respectively.



For S-shaped acceleration/deceleration pattern, smooths the rise and fall of servo motor rotation. Set □□□1 in parameter No.3.
Using the parameter unit, set the servo motor speed, acceleration/deceleration time constant and S-shape time constant in the speed block. The acceleration time constant is equal to the deceleration time constant.

Speed Block No.	Speed (r/min)	Acceleration Deceleration Time Constant (ms)	S-Shape Time Constant (ms)
1	2000	1000	100
2	500	1500	200
3	1200	1200	100
⋮	⋮	⋮	⋮
8	1500	2000	200

Item	Description
Speed	0 to max. speed r/min
Acceleration/deceleration time constant	0 to 20000ms
S-shape time constant	100 to 450ms Set the S-shape time constant to 10-20% of the acceleration/deceleration time constant.



When the setting of each point table is complete, use the position block select signal (3-bit DEC, JFS, STP as standard) to select the position block number used for positioning. The relationship between the select signal and position block number is as listed below.

Standard (8 positions)

Position Block No.	STP	JFS	DEC
	bit2	bit1	bit0
0	0	0	0
1	0	0	1
2	0	1	0
⋮	⋮	⋮	⋮
7	1	1	1

3-bit binary 0: Any terminal-SG OFF 1: Any terminal-SG ON

MR-H-D01 used (256 positions)

Position Block No.	DI07	DI06	DI05	DI04	DI03	DI02	DI01	DI00
	bit7 (MSB)	bit6	bit5	bit4	bit3	bit2	bit1	bit0 (LSB)
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
255	1	1	1	1	1	1	1	1

8-bit binary 0: Any terminal-SG OFF 1: Any terminal-SG ON

For absolute command positioning, switch the forward rotation start (ST1) on to rotate the servo motor to the present position. The rotation direction of the servo motor depends on the setting of parameter No.2. At this time, the reverse rotation start (ST2) is invalid.

Parameter No.2

[-][-][ ][-]

Set Value	Servo Motor Rotation Direction
0	+ position data for CCW rotation - position data for CW rotation
1	+ position data for CW rotation - position data for CCW rotation

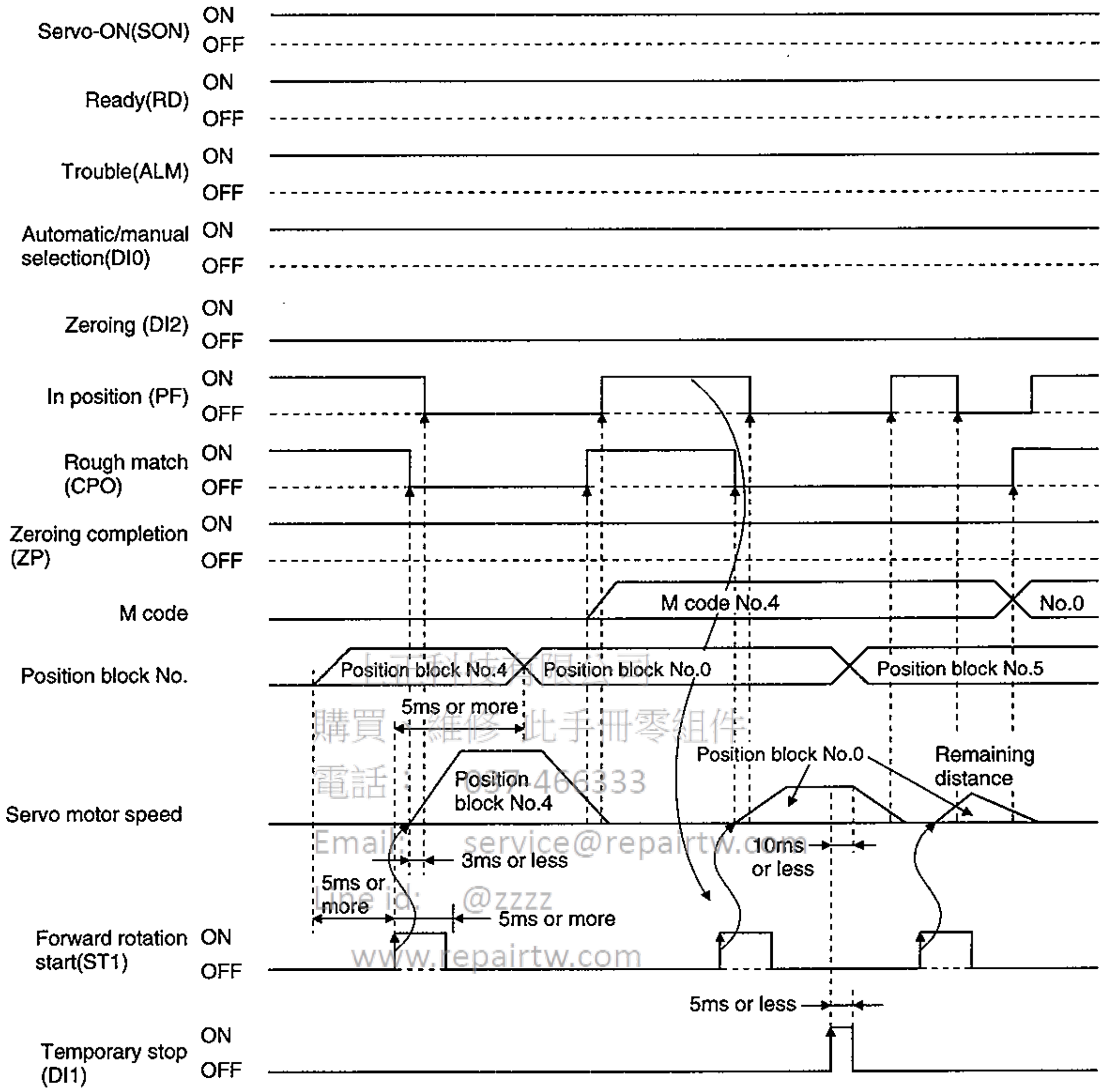
For incremental command positioning switch on the forward rotation start (ST1) or reverse rotation start (ST2) to rotate the servo motor to the present position. The rotation direction of the servo motor depends on the setting of parameter No.2. The relationship between the set value and servo motor rotation is as listed below.

Parameter No.2

[-][-][ ][-]

Set Value	Servo Motor Rotation Direction	
	ST1:ON	ST2:ON
0	CCW rotation (Current value increase)	CW rotation (Current value decrease)
1	CW rotation (Current value increase)	CCW rotation (Current value decrease)
2	CCW rotation (Current value decrease)	CW rotation (Current value increase)
3	CW rotation (Current value decrease)	CW rotation (Current value increase)

Shows operation performed after power on and zeroing completion.



(2) Positioning operation under digital switch position command

This operation requires the option card (MR-H-D01) and digital switch (MR-DS60). For wiring, refer to Section 3.2.3.

Set 1□11 in parameter No.65.

Parameter No.65

1	-	1	1

- 4th digit (1): BDC 3 digits ×2 input is selected.
- 2nd digit (1): External speed block No. select switch is valid.
- 1st digit (1): Digital switch is selected.

By setting parameter No.2, either absolute command positioning or incremental command positioning can be selected.

Parameter No.2

-	-	-	□

Set Value	Positioning method
1	Cremental command positioning
2	Absolute command positioning

For absolute command positioning set □□□2 in parameter No.2.

Using the digital switch (MR-DS60), set the position data (absolute value). The unit ([mm],[inch]) and input range of the position data (absolute value) can be changed by setting parameter No.4.

Parameter No.4

-	-	□	□

Set Value (STM)	Input Range(mm or inch)
0	-999.999 to +999.999
1	-9999.99 to +9999.99
2	-99999.9 to +99999.9
3	-999999 to +999999

Set Value	Unit
0	mm
1	inch

The input range of the absolute position detection system is as indicated in Section 3.4.4 (1).

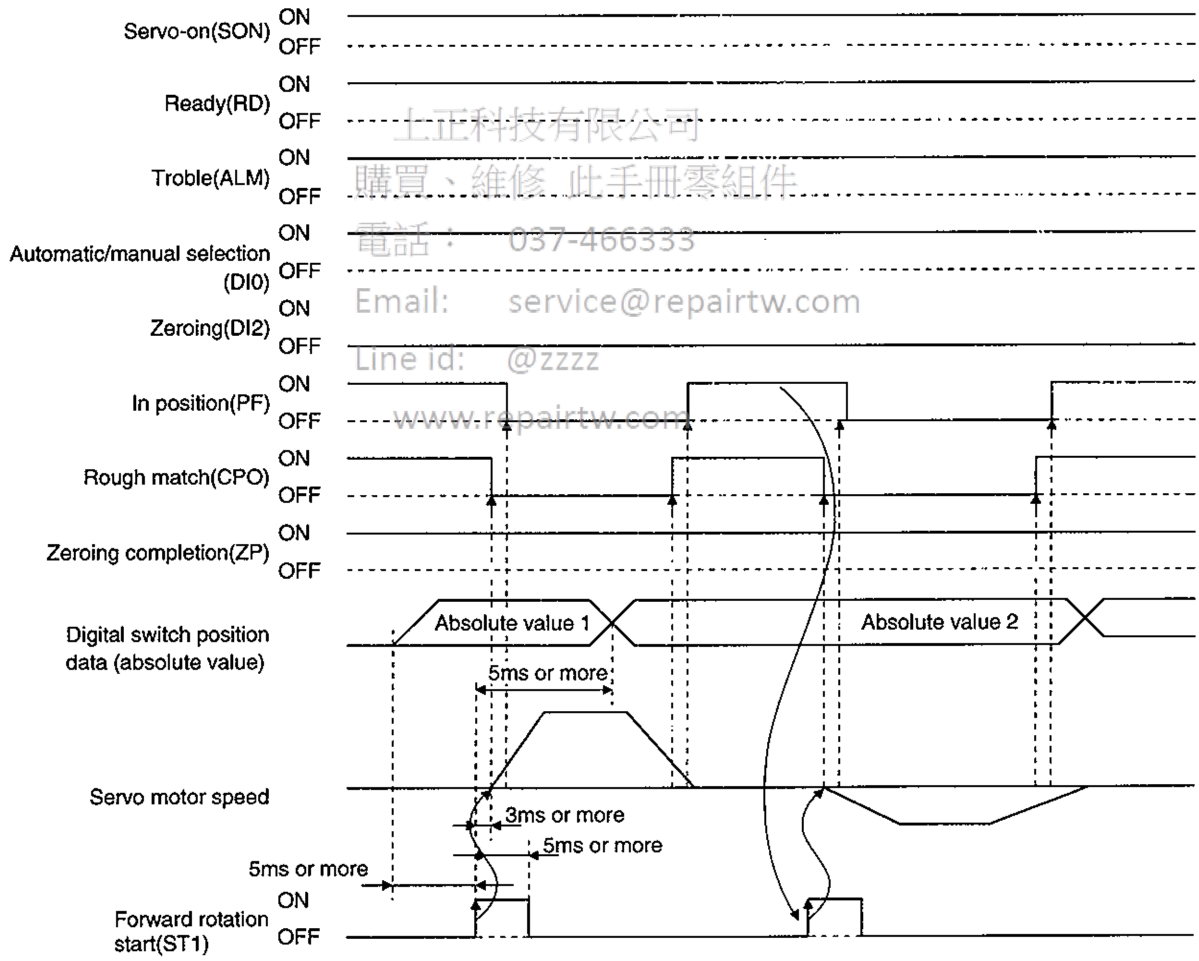
Use the speed select signal (3 bit, DI17, DI18, DI19) to select the speed block. The relationship between the speed select signal and speed block number is as listed on the below. Switch the forward rotation start (ST1) on to rotate the servo motor to the present position. The rotation direction of the servo motor depends on the setting of parameter No.2. Refer to (2), Section3.4.3.

8 speed selection

Speed Block No.	DI19 bit2 (MSB)	DI18 bit1	DI17 bit0 (LSB)
1	0	0	0
2	0	0	1
3	0	1	0
⋮	⋮	⋮	⋮
8	1	1	1

3-bit binary 0: Any terminal-SG OFF 1: Any terminal-SG ON

Shows operation performed after power on and zeroing completion.



For incremental command positioning, set □□□1 in parameter No.2.
Using the digital switch (MR-DS60), set the position data (increment). The unit ([mm],[inch]) and input range of the position data (increment) can be changed by setting parameter No.4.

Parameter No.4

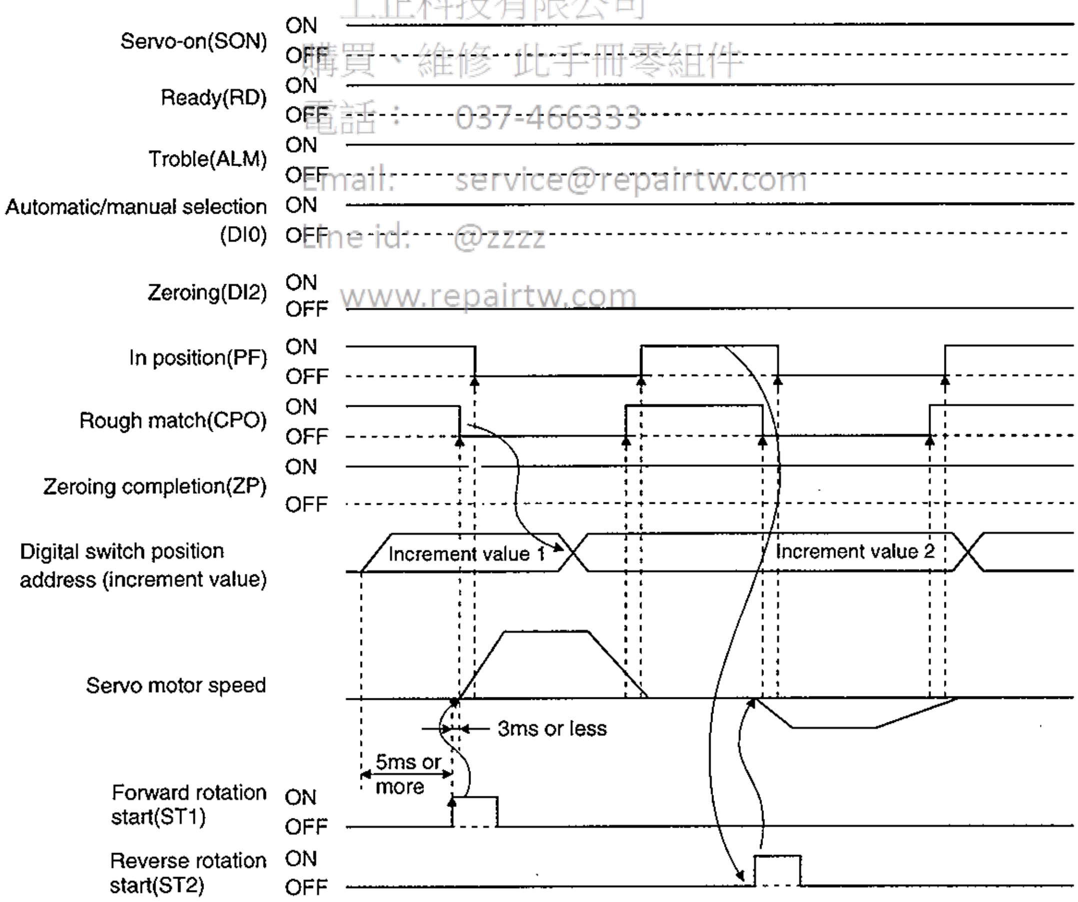
- - □ □

Set Value (STM)	Input Range(mm or inch)
0	0 to +999.999
1	0 to +9999.99
2	0 to +99999.9
3	0 to +999999

Set Value	Unit
0	mm
1	inch

Switch on the forward rotation start (ST1) or reverse rotation start (ST2) to rotate the servo motor to the preset position. Select the speed block as in the above-mentioned absolute command. The rotation direction of the servo motor depends on the setting of parameter No.2, as in the point table.

Shows operation performed after power on and zeroing completion.



(3) Positioning operation under programmable controller position command

This operation requires the option card (MR-H-D01). For wiring, refer to Section 3.2.4. The relationship between the position data and strobe signal is as in (13), Section 3.3.3.

By setting parameter No.2, either absolute command positioning or incremental command positioning can be selected.

Parameter No.2

[-][-][-][ ]

Set Value	Positioning Method
1	Incremental command positioning
2	Absolute command positioning

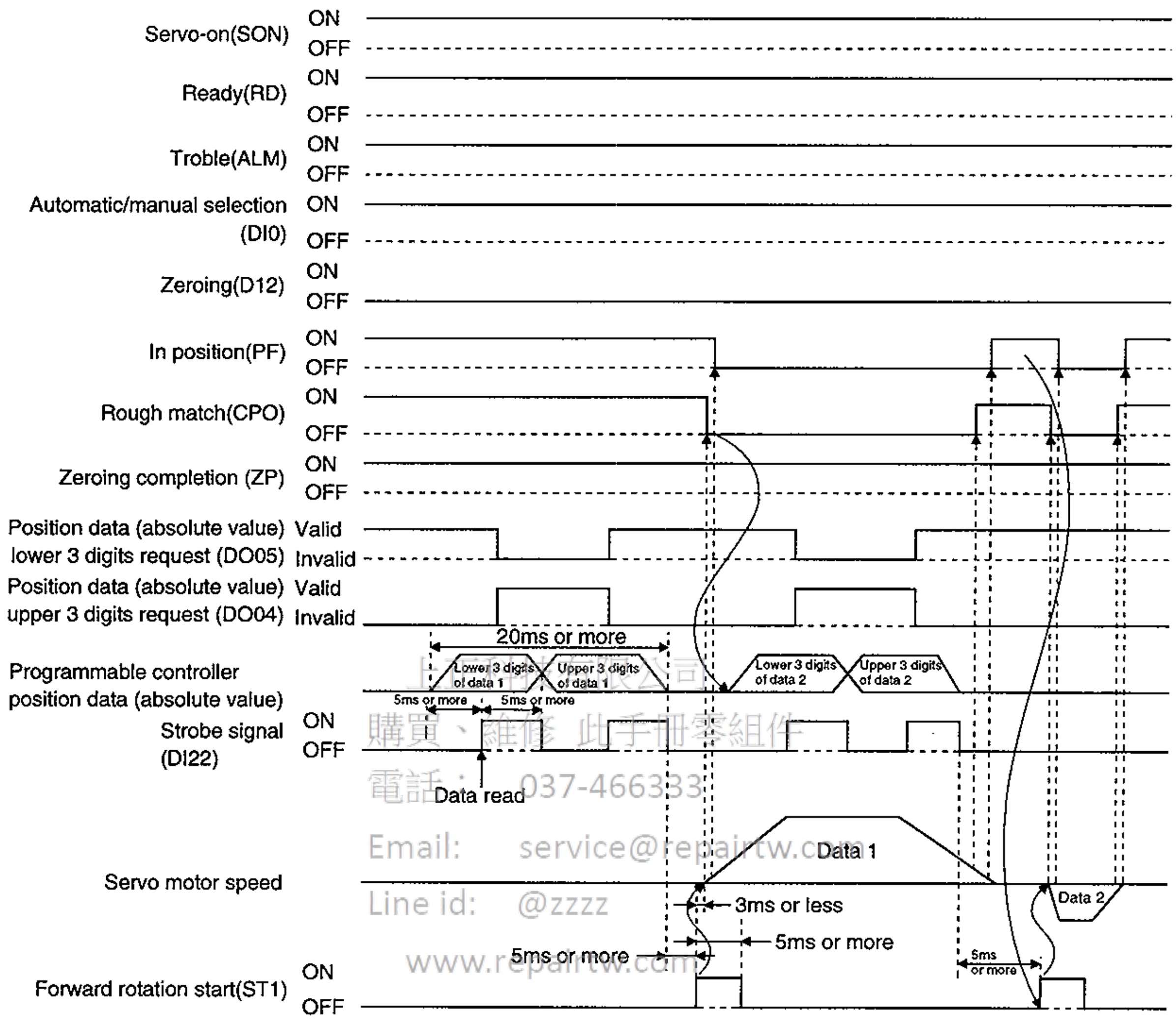
For absolute command positioning, set □□□2 in parameter No.2.

Set 0□□1 in parameter No.65.

Select the input range and speed block number of the position data as in Section 3.4.4, (2).

Switch the forward rotation start (ST1) on to rotate the servo motor to the preset position. The rotation direction of the servo motor depends on the setting of parameter No.2. Refer to (2), Section 3.4.4.

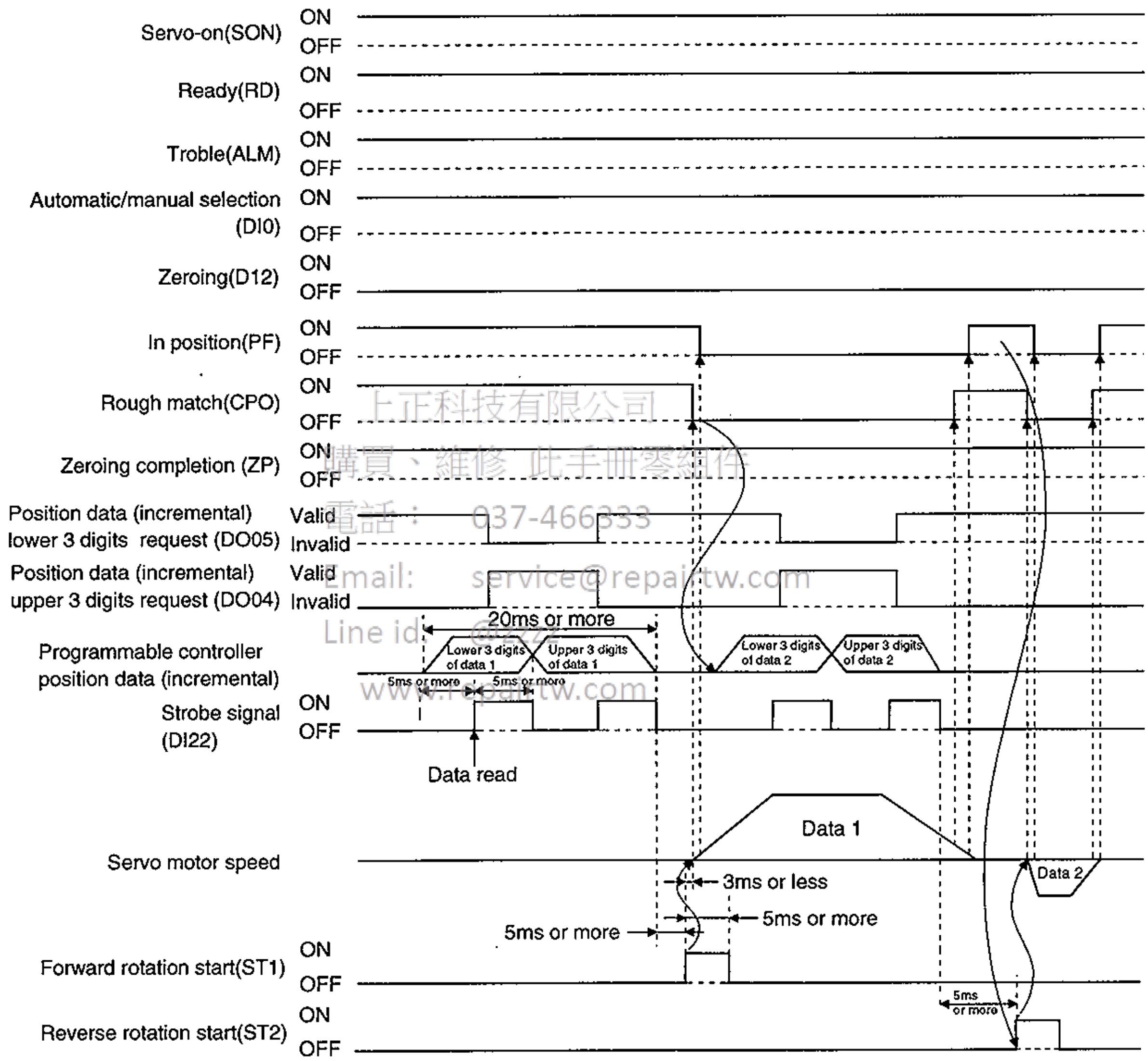
Shows operation performed after power on and zeroing completion.



For incremental command positioning set □□□1 in parameter No.2.

Set 0□□1 in parameter No.65.
The position data input range and speed block No. selection are as in Section 3.4.4 (2), (b).
Switch on the forward rotation start (ST1) or reverse rotation start (ST2) to rotate the servo motor to the present position. For the rotation direction of the servo motor, refer to (1), Section 3.4.4

Shows operation performed after power on and zeroing completion.



3.4.5 Manual zeroing mode

POINT

- When using the HA-MH, HA-FH, HA-SH, HA-LH or HA-UH series servo motor, always rotate the servo motor one or more revolutions before starting zeroing after power-on. You need not do this when using the HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor.

(1) Outline of zeroing

Zeroing is performed to match the command coordinates with the machine coordinates. In the incremental system, zeroing is required every time input power is switched on. In the absolute position detection system, once zeroing is done at the time of installation, the current position is retained if power is switched off. Hence, zeroing is not required when power is switched on again.
The MR-H-ACN has the zeroing methods given in this section. Choose the most appropriate method for your machine structure and application.
The MR-H-ACN has the automatic zeroing return function which executes zeroing by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by jog operation or the like is not required.

(a) Manual zeroing types

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

Type	Zeroing Method	Features
Dog type zeroing	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the zero shift distance starting from the Z-phase signal is defined as a home position.	General zeroing method using a proximity dog. Repeatability of zeroing is excellent and the machine is less burdened. Used when the width of the proximity dog can be set greater than the deceleration distance of the servo motor.
Count type zeroing	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given after advancement over the preset moving distance after the proximity dog or a motion has been made over the zero shift distance starting from the Z-phase signal is defined as a home position.	Zeroing method using a proximity dog. Used when it is desired to minimize the length of the proximity dog.
Data setting type zeroing	The position reached after any automatic motion is defined as a home position.	No proximity dog required.
Stopper type zeroing	The position where the machine stops when its part is pressed against a machine stopper is defined as a home position.	Since the machine part collides with the machine stopper, zeroing speed must be set to a fully low value and the machine and stopper strength must be fully considered.

Note: The Z-phase signal is a pulse generated once per servo motor revolution. It can be output as the encoder Z-phase output signal (OP).

(b) Zeroing parameter

When performing zeroing, set parameter No.9 as follows:

0			

Zeroing system .... 1)
0: Dog type zeroing (dog rear end detection)
1: Count type zeroing (dog front end detection)
2: Data setting type zeroing
3: Stopper type zeroing
4: Zero ignorance (SON position as zero)

Zeroing direction .... 2)
0: Address increment direction
1: Address decrement direction

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

1) Choose the zeroing method.
2) Choose the starting direction of zeroing. Set "0" to start zeroing in the direction in which the address is incremented from the current position, or "1" to start zeroing in the direction in which the address is decremented.
3) Choose the polarity at which the proximity dog is detected. Set "0" to detect the dog when the proximity dog device (across DOG-SG) is opened, or "1" to detect the dog when the device is shorted.

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

(2) Dog type zeroing

A zeroing method using a proximity dog.

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

(a) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (DI0)	Open DI0-SG (OFF).
	Zeroing (DI2)	Short DI2-SG (ON).
Dog type zeroing	Parameter No.9	□□□0: Dog type zeroing is selected.
Zeroing direction	Parameter No.9	Refer to (1) (b) in this section and choose zeroing direction.
Dog input polarity	Parameter No.9	Refer to (1) (b) in this section and choose dog input polarity.
Zeroing speed	Parameter No.11	Set speed until detection of dog.
Creep speed	Parameter No.12	Set speed after detection of dog.
Zero shift distance	Parameter No.13	Set when shifting the home position starting at the first Z-phase signal after passage of proximity dog rear end.
Zeroing acceleration/deceleration time constants	Speed block No.1	Use the acceleration/deceleration time constants of speed block No.1.
Zeroing position data	Parameter No.10	Address reached by zeroing is stored automatically.

(b) Length of proximity dog

To ensure that the Z-phase signal of the servo motor is generated during detection of the dog signal, the proximity dog should have the length which satisfies formulas (3.2) and (3.3):

$$L1 \geq \frac{V}{60} \bullet \frac{td}{2} \quad \cdots\cdots (3.2)$$

L1 : Proximity dog length [mm]

V : Zeroing speed [mm/min]

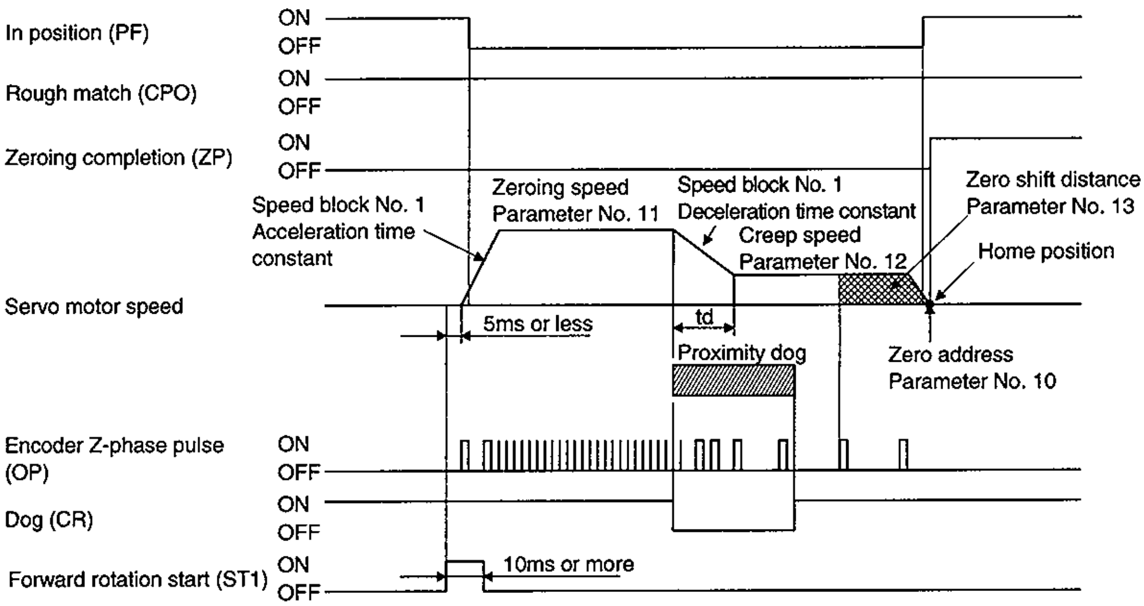
td : Deceleration time [s]

$$L2 = 2 \bullet \Delta S \quad \cdots\cdots (3.3)$$

L2 : Proximity dog length [mm]

ΔS : Moving distance per servo motor revolution [mm]

(c) Timing chart



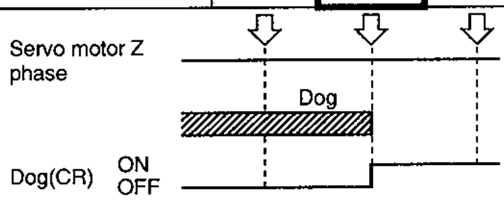
The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

(d) Adjustment

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

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

Servo motor	Within one-revolution position		
HC-MF· HA-FF· HC-UF 3000 r/min	0	4096	0
HC-SF· RF· UF 2000 r/min	0	8192	0



(3) Count type zeroing

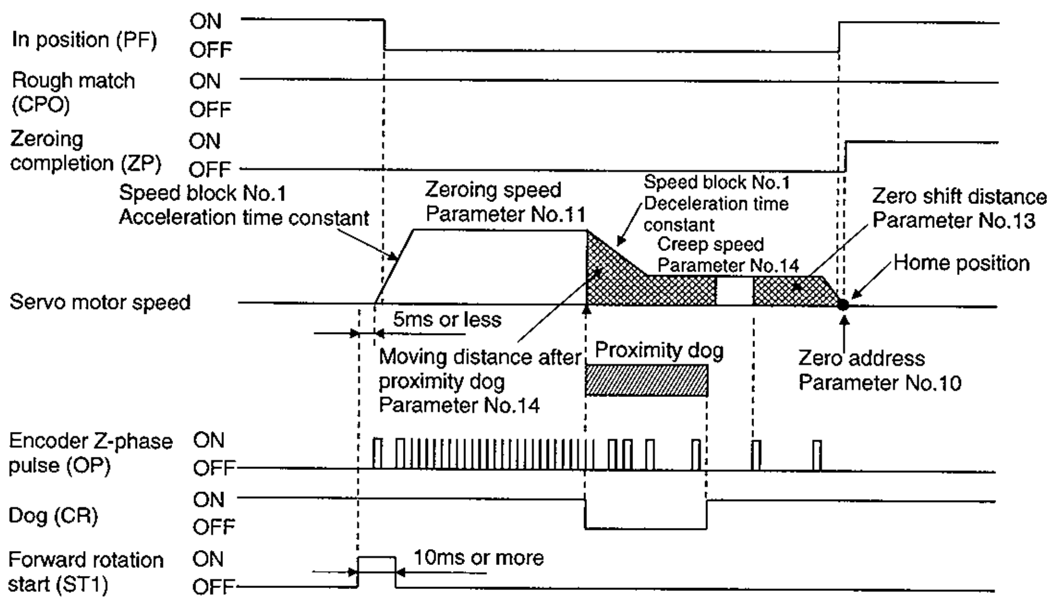
In count type zeroing, a motion is made over the distance set in parameter No.14 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the dog signal (CR) is 10ms or longer, there is no restriction on the dog length. This zeroing method is used when the required proximity dog length cannot be reserved to use dog type zeroing or when the dog signal is entered electrically from a controller or the like.

(a) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (DI0)	Open DI0-SG (OFF).
	Zeroing (DI2)	Short DI2-SG (ON).
Count type zeroing	Parameter No.9	□□□1: Count type zeroing is selected.
Zeroing direction	Parameter No.9	Refer to (1) (b) in this section and choose zeroing direction.
Dog input polarity	Parameter No.9	Refer to (1) (b) in this section and choose dog input polarity.
Zeroing speed	Parameter No.11	Set speed until detection of dog.
Creep speed	Parameter No.12	Set speed after detection of dog.
Zero shift distance	Parameter No.13	Set when shifting the home position, starting at the first Z-phase signal given after passage of the proximity dog front end and movement over the moving distance.
Moving distance after proximity dog	Parameter No.14	Set the moving distance after passage of proximity dog front end.
Zeroing acceleration/deceleration time constants	Speed block No.1	Use the acceleration/deceleration time constants of speed block No.1.
Zeroing position data	Parameter No.10	Address reached by zeroing is stored automatically.

(b) Timing chart



The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

(4) Data setting type zeroing

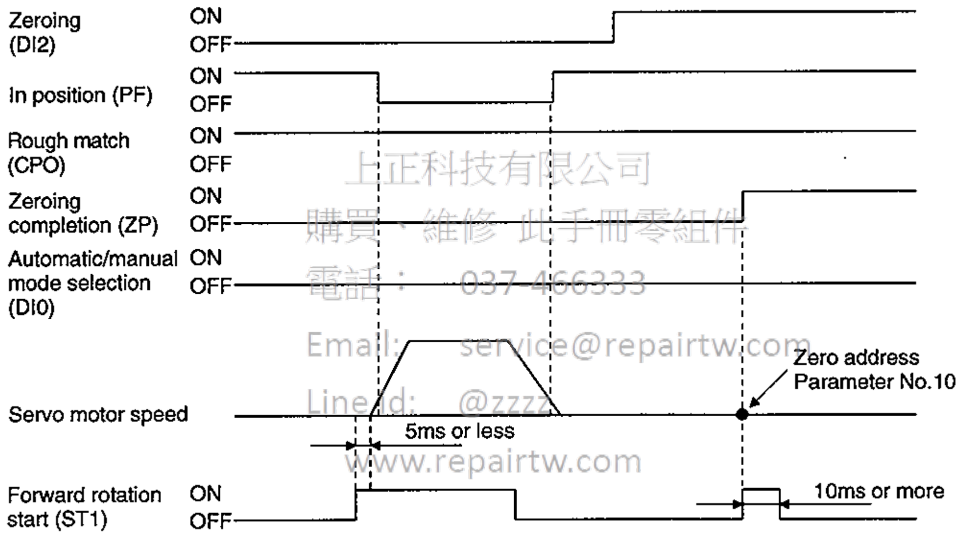
In data setting type zeroing, a motion is made to any position by jog operation, manual pulse generator operation or the like to make a home position return, and the position reached is defined as a home position.

(a) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (DI0)	Open DI0-SG (OFF).
	Zeroing (DI2)	Short DI2-SG (ON).
Data setting type zeroing	Parameter No.9	□□□2: Data setting type zeroing is selected.
Zeroing position data	Parameter No.10	Address reached by zeroing is stored automatically.

(b) Timing chart



The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

(5) Stopper type zeroing

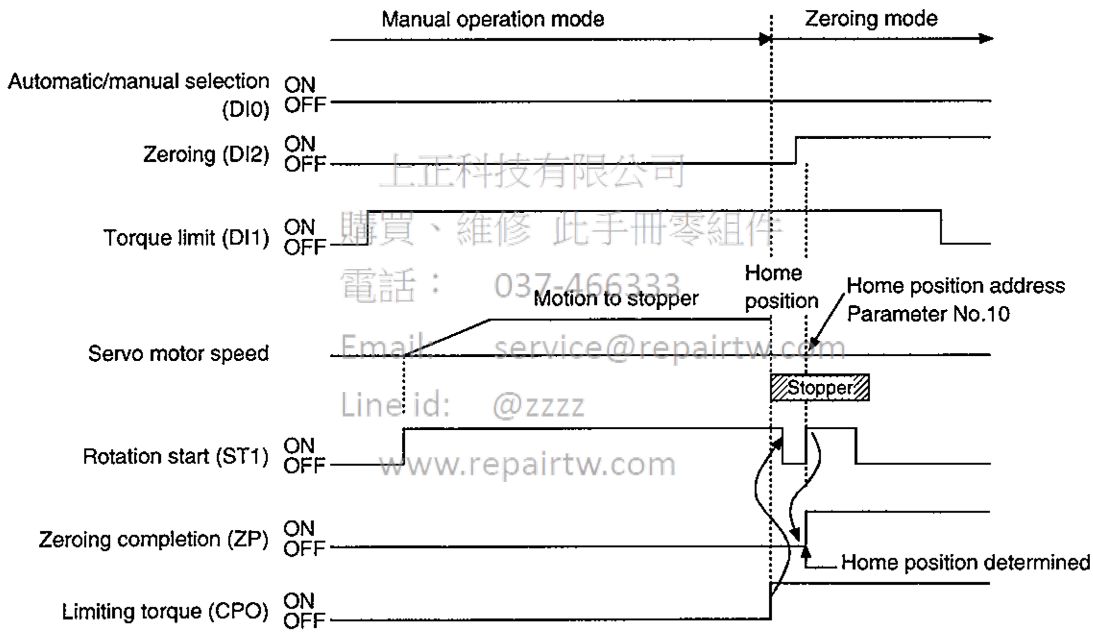
In stopper type zeroing, a machine part is pressed against a stopper or the like by jog operation, manual pulse generator operation or the like to make a home position return and that position is defined as a home position.

(a) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter Used	Description
Manual zeroing mode selection	Automatic/manual selection signal (DI0)	Open DI0-SG (OFF).
	Zeroing (DI2)	Short DI2-SG (ON).
Stopper type zeroing	Parameter No.9	□□□3: Stopper type zeroing is selected.
Zeroing position data	Parameter No.10	Address reached by zeroing is stored automatically.

(b) Timing chart

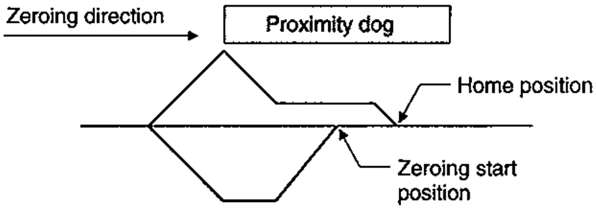


The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

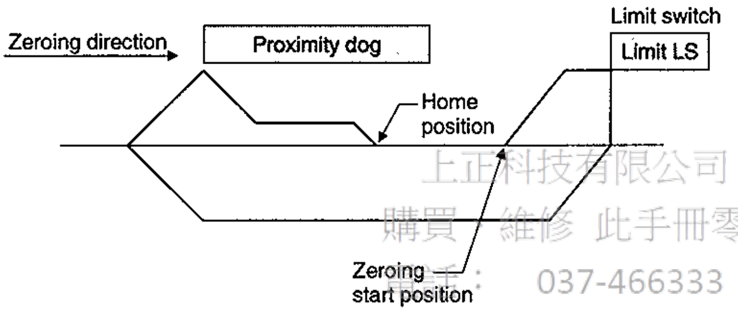
(6) Automatic zeroing return function

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

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



At a start, a motion is made in the zeroing direction and an automatic return is made on detection of the limit switch. The motion stops past the front end of the proximity dog, and zeroing is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the opposite limit switch and AL 90 occurs.



3.4.6 Automatic zeroing

To define a home position (parameter No.10) by manual zeroing after power-on and then return to the home position, use of automatic zeroing enables an automatic return to the home position at high speed. In an absolute position system, manual zeroing is not required after power-on. Also, a second home position can be set in parameter No.15.

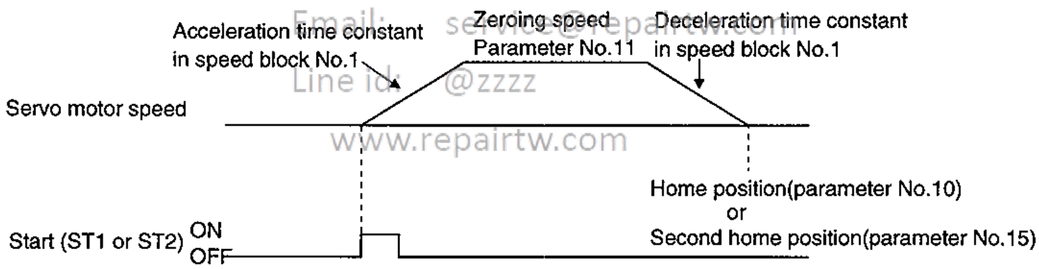
After power-on, execute manual zeroing in advance.
Set the operation mode selection signals (DI0, DI2) as indicated below:

Operation Mode Select Signal	ON/OFF
DI0	ON
DI2	ON

Use parameter No.11 to set the zeroing speed for automatic zeroing. Use the data of speed block No.1 in the point table to set the acceleration and deceleration time constants. Switching the forward rotation signal (ST1) on starts a high-speed automatic return to the home position.

Parameter No.	Description	Setting Range
11	Zeroing speed	0 to max. speed (r/min)

A second home position can be set and an automatic return to that position performed.
Set the position address of the second home position in parameter No. 15. Switch the reverse rotation start signal (ST2) on to start a high-speed automatic return to the second home position.



3.5 Absolute position detection system

An absolute position detection system can be configured up by merely loading an absolute position data back-up battery and setting parameter values.
You only have to make home position setting once and need not perform zeroing at every power-on.

(1) Restrictions

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

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

(2) Specifications

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

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

(3) Structure

Component		Description
Controller		Use standard models.
Servo motor	HA-LH	Use a servo motor equipped with absolute position encoder (-Y).
	HC-MF · HA-FF HC-SF · HC-RF HC-UF	Use standard models.
Battery		MR-BAT or A6BAT
Encoder cable		Use a standard model. When fabricating, refer to, Section 15.1.6

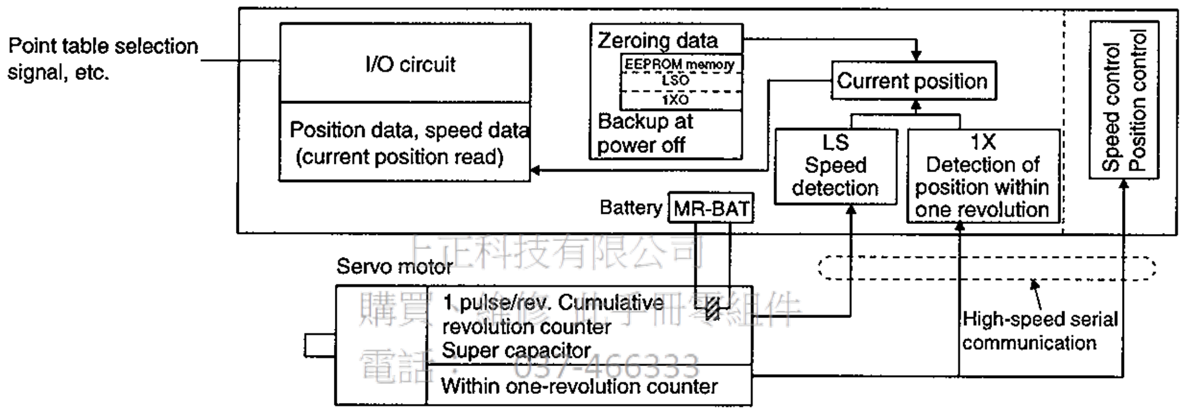
(4) Outline of absolute position detection data communication

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

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose programming controller power is on or off. Therefore, once the home position is defined at the time of machine installation, zeroing is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.

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



(5) Battery installation procedure

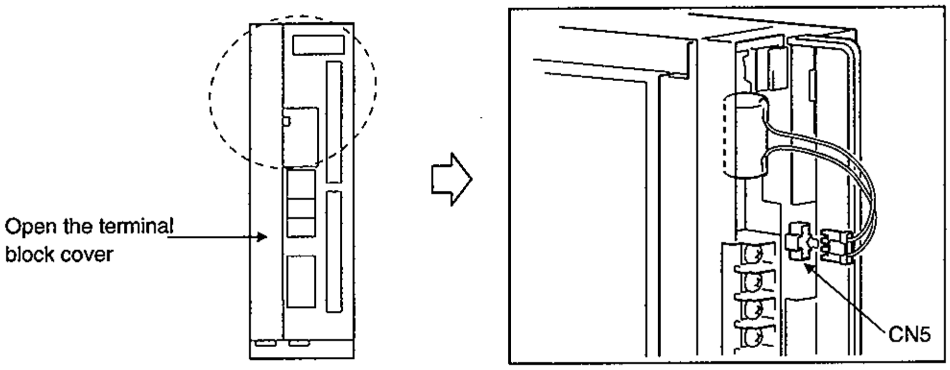
⚠ WARNING	• Before starting battery installation procedure, make sure that the charge lamp is off more than 10 minutes after power-off. Then confirm that voltage safe in the tester or the like. Otherwise, you may get an electric shock.

POINT

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

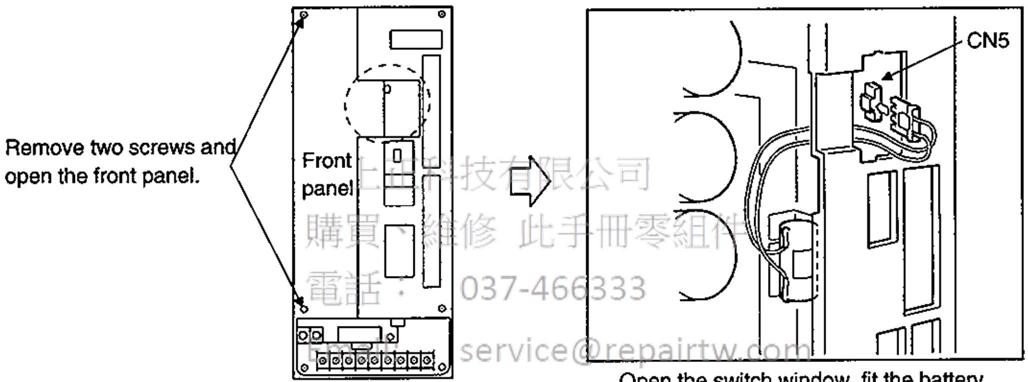
1) Open the terminal block cover and switch window. (When the model used is the MR-H500ACN or more, also remove the front panel.)
2) Install the battery in the battery holder.
3) Install the battery connector into CN5 unit it clicks.

(a) MR-H10ACN to MR-H350ACN



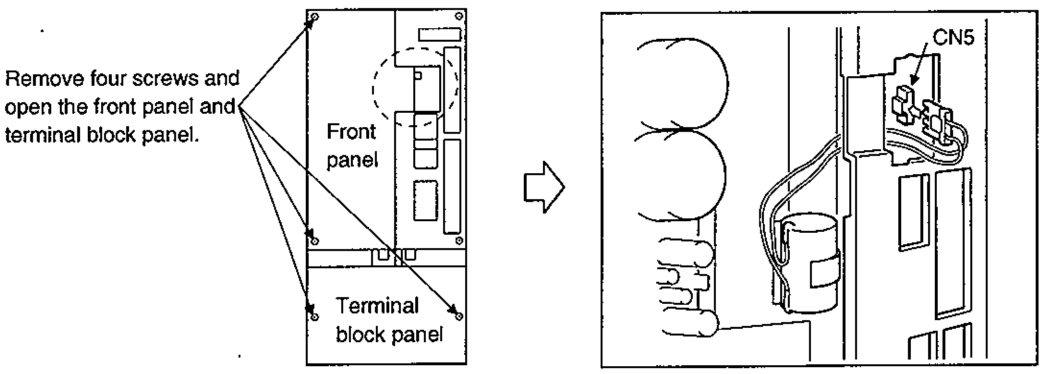
Open the switch window, fit the battery, and insert the plug into CN5.

(b) MR-H500ACN,MR-H700ACN



Open the switch window, fit the battery, and insert the plug into CN5.

(c) MR-H11KACN to MR-H22KACN



Open the switch window, fit the battery, and insert the plug into CN5.

(6) Parameter setting

Set parameter No. 3 as indicated below to make the absolute position detection system valid.

Parameter No.3

| 1 | - | - | - |

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

3.6 Point Table Data Setting Procedures

(1) Position block data

(a) Position block data input

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA] (call the data setting mode screen). Press [▲]/[▼] to select the block to be set (select the position block). Press [↵] to define the block to be set (select the position block).	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [^{E}8] and [^{B}5] on the ten-key pad to specify the position block number to be set (for 85). Press [↵] to define the position block number to be set.	<Pos. set> Block No. 85 Read:↵
3)	Press [▲]/[▼] to specify the position block number to be set (for 85). Press [↵] to define the position block number to be set.	85→12345.0 ▲ 86 78901.2 87 34567.8 88 90123.4 ▼
4)	On the data list screen, press [▲]/[▼] to select the data field into which data is to be input (select the position). Press [↵] to define the data field into which data is to be input (define the position).	85 Pos.Bloc ▲ →Pos 12345.6 M Code 68 Speed No 5 ▼
5)	On the input screen, press [^{D}7], [^{E}8], [^{1STEP}•] and [^{F}9] on the ten-key pad to enter position data (for 78.9). Press [↵] to write the position data and press [CAN] to proceed to step 6).	85 Position ▲ 12345.6 78.9 Write:↵ mm ▼
6)	On the data list screen, press [▲]/[▼] to select the data field into which data is to be input (select the M code). Press [↵] to define the data field into which data is to be input (define the M code).	85 Pos.Bloc ▲ Pos 78.9 →M code 68 Speed No 5 ▼
7)	On the input screen, press [^{B}5] and [0] on the ten-key pad to enter the M code (for 50). Press [↵] to write the M code and press [CAN] to proceed to step 8).	85 M code ▲ 68 50 Write:↵ ▼
8)	On the data list screen, press [▲]/[▼] to select the data field into which data is to be input (select the speed number). Press [↵] to define the data field into which data is to be input (define the speed number).	85 Pos. Bloc ▲ Pos 78.9 M code 50 →Speed No 5 ▼
9)	On the input screen, press [2] on the ten-key pad to enter the speed number (for 2). Press [↵] to write the speed number. Position block input complete Press [CAN] twice to return to step 6).	85 Speed No ▲ 5 2 Write:↵ ▼
10)	If the key pressed is wrong, press [STOP/RESET] to return to the input screen, or press [CAN] to return to the data list screen.	85 Speed No ▲ 5 9 Error:RST ▼

(b) Speed block reference

The speed block settings can be referred to during position block input, but cannot be input.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	On the position block screen Press [SHIFT] and [3] to move to the speed block reference screen. Press [▲]/[▼] to select the block to be set (select the position block).	5 Speed Block ▲ Speed 2000.0 Acc 20000 Dec 20000 ▼
2)	Press [CAN] to move to the position block data input selection screen.	85 Pos.Bloc ▲ →Pos 12345.6 M code 68 Speed No 5 ▼

(c) Teaching

Teaching can be used for absolute command positioning.

Switch the automatic/manual operation mode signal (DI0) off and the zeroing signal (DI2) off to select the manual operation mode, and use the parameter unit to perform teaching in the following procedure:

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA] (call the data setting mode screen). Press [▲]/[▼] to select the position block. Press [↵] to define the position block.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [^{E}8] and [^{B}5] on the ten-key pad to specify the position block number to be set (for 85). Press [↵] to define the position block number to be set.	<Pos. set> Block No. 85 Read:↵
3)	If the key pressed is wrong, press [STOP/RESET] to return to step 2).	<Pos. set> Block No. 300 Error:RST
4)	Press [▲]/[▼] to specify the position block number to be set (for 85). Press [↵] to define the position block number to be set.	85→12345.0 ▲ 86 78901.2 87 34567.8 88 90123.4 ▼
5)	Press [SHIFT] and [1] to switch to the teaching screen. Press [▲]/[▼] to select the position block number in which teaching is to be performed.	85 Teach ▲ Pos 12345.6 (1000.0) Write:↵ mm ▼
6)	Manual operation By jogging (use ST1, ST2) or using the manual pulse generator, move the machine to the target position. Press [↵] to define the position data to be set (define 8570.0). Write complete Press [SHIFT] and [3] to return to step 5).	85 Teach ▲ Pos 12345.6 (8570.0) Write:↵ mm ▼
7)	If the key pressed is wrong, press [STOP/RESET] to return to step 6).	85 Teach ▲ Pos 8570.0 (-305.3) Pr02 Mis.Set ▼ 85 Teach ▲ Pos 8570.0 (1.8) OT Er.:RST ▼

(2) Speed block data input

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA] (call the data setting screen). Press [▲]/[▼] to select the block to be set (select the speed block). Press [↵] to define the block to be set.	<Set mode> ▲ Pos. Block →Speed Block Edit :HELP ▼
2)	Press [^{B}5] on the ten-key pad to specify the speed block number to be set (for 5). Press [↵] to define the speed block number to be set.	<Speed set> Block No. 5 Read: ↵
3)	If the key pressed is wrong, press [STOP/RESET] to return to step 2).	<Speed set> Block No. 9 Error:RST
4)	Press [▲]/[▼] to specify the speed block number to be set (for 5). Press [↵] to define the speed block number to be set.	<Speed set> ▲ 5 → 2000.0 6 1000.0 7 3000.0 ▼
5)	On the data list screen, press [▲]/[▼] to select the data field into which data is to be input (select the speed). Press [↵] to define the data field into which data is to be input (define the speed).	5 SpeedBlock ▲ →Speed 2000.0 Acc 10000 Dec 10000 ▼
6)	On the input screen, press [3] [0] [0] [0] on the ten-key pad to enter the speed (for 3000r/min). Press [↵] to write the speed and press [CAN] to proceed to step 7).	5 Ref.Speed ▲ 2000.0 3000.0 Write :↵ r/min ▼
7)	On the data list screen, press [▲]/[▼] to select the data field into which data is to be input (select the acceleration time constant). Press [↵] to define the data field into which data is to be input (define the acceleration time constant).	5 SpeedBlolck ▲ Speed 3000.0 →Acc 20000 Dec 20000 ▼
8)	On the input screen, press [1] [^{A}4] [^{B}5] [^{C}6] [^{D}7] on the ten-key pad to enter the acceleration time constant (for 14567msec). Press [↵] to write the acceleration time constant and press [CAN] to proceed to step 9).	5 Acc time ▲ 20000 14567 Write:↵ msec ▼
9)	On the data list screen, press[▲]/[▼] to select the data field into which data is to be input (select the deceleration time constant). Press [↵] to define the data field into which data is to be input (define the deceleration time constant).	5 SpeedBlock ▲ Speed 3000.0 Acc 14567 →Dec 20000 ▼
10)	On the input screen, press [1] [^{A}4] [^{B}5] [^{C}6] [^{D}7] on the ten-key pad to enter the deceleration time constant (for 14567msec). Press [↵] to write the deceleration time constant. Speed block input complete Press [CAN] twice to return to step 4).	5 Dec time ▲ 20000 14567 Write:↵ msec ▼
11)	If the key pressed is wrong, press [STOP/RESET] to return to the input screen, or press [CAN] to return to the data list screen.	5 Dec time ▲ 20000 99999 Error :RST ▼

(3) Data copy

This function reads the point table data (position blocks, speed blocks) of the MR-H-ACN to the parameter unit and writes them from the parameter unit. By using this function, data can be read once to the parameter unit and then copied to the other MR-H-ACN.

(a) Data read

Reads data from the MR-H-ACN to the parameter unit.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify). Press [↵] to define the mode. If the key press is wrong, press [STOP/RESET] or [CAN] to return to step 1).	<DATA COPY> ▲ →READ WRITE COMPARE ▼ <DATA COPY> Read ? Yes: ↵ No:RST
3)	Read complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE Mode sel.:CAN

(b) Data verify

Verifies the data in the parameter unit with that in the MR-H-ACN.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify). Press [↵] to define the mode.	<DATA COPY> ▲ →READ WRITE COMPARE ▼ <DATA COPY> Comparing Not Power Off
3)	Verify complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE Mode sel.:CAN
4)	When incorrect data exists in the data verified Press [SHIFT] to check incorrect data numbers. When incorrect data overflows a single screen, press [▲]/[▼] to switch to the preceding/next screen. Press [CAN] to return to step 1). [SHIFT]	<DATA COPY> Compare Er. Error No.:SFT Mode sel.:CAN Er.Data No. ▲ P010P P010S P050M P185M P185S S002V ▼

Error number make-up

□□□□□

- Data block identification
  P: Position block
  S: Speed block
- Block number
- Data item

Position Block		Speed Block	
P	Position	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(c) Data write

Writes the data in the parameter unit to the MR-H-ACN.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT][3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify). Press [↵] to define the mode.	<DATA COPY> ▲ →READ WRITE COMPARE ▼
3)	When write is inhibited Press [CAN] to return to step 1).	<DATA COPY> Write Inhibit SON ALM Press "CAN"
4)	Press [↵] to execute write. Press [STOP/RESET] to stop write and return to step 1).	<DATA COPY> Write ? Yes:↵ No:RST <DATA COPY> Writeing Not Power Off
5)	Write complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE →Power Off
6)	When incorrect data exists in the data written 1. Press [↵] to write only the correct data. 2. Press [STOP/RESET] to stop write and return to step 1). 3. Press [SHIFT] to check incorrect data numbers. When incorrect data overflows a single screen, press [▲]/[▼] to switch to the preceding/next screen. [SHIFT]	ErrorNo.:SFT Right Data Write Yes:↵ No:RST Wrong Data ▲ P000P P001P S001V S001A S101D S002V ▼

Error number make-up

□□□□□

- Data item
- Block number
- Data block identification
  - P: Position block
  - S: Speed block

Position Block		Speed Block	
P	Psition	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(4) Point table data edition

(a) Position block data insertion

Inserts data into the specified position block on a block basis.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [HELP] (position block edition initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify). Press [↵] to define the mode (define).	<Pos. Edit> ▲ →INSERT DELETE ▼
3)	Press [2] [5] [0] on the ten-key pad to specify the block number into which data is to be inserted (for No.250). Press [↵] to execute insertion.	<Block Ins.> Block No. 250 Yes:↵ No:RST
4)	During insertion Data in block No.250 is shifted to No.1 and No.250 is vacated. On completion of insertion, the positioning address list screen is displayed.	<Block Ins.> Inserting Not Power Off 250→ 0.0 ▲ 251 78901.2 252 34567.8 253 90123.4 ▼
5)	When insertion cannot be performed (outside the block number setting range) Press [STOP/RESET] to return to step 3).	<Block Ins.> Block No. 300 Error:RST
6)	When the data of the last block will be deleted by executing insertion Press [↵] to return to step 3). Press [STOP/RESET] to execute insertion.	<Block Ins.> No. 255 Delete Yes:↵ No:RST

Concept of data insertion

When inserting data, data in and after the block where data is to be inserted is shifted to the following blocks. When any unused blocks exist in block No.s 0 through 255, the data of the first unused block is deleted and data is shifted to that block. The data of the following unused blocks and subsequent used blocks are not shifted. When data exists in all blocks, block No.255 is deleted.

Example: When inserting the following data into block No.002

Position Data	M code	Speed Block No.
1150.0	00	05

Before insertion

Position Block No.	Position Data	M Code	Speed Block No.
000	1000.0	00	01
001	1100.0	00	01
002	1200.0	00	02
003	1300.0	00	03
004	1400.0	00	04
005	1500.0	00	02
006	0.0	00	00
007	0.0	00	00
008	0.0	00	00
009	2000.0	00	01
010	2100.0	00	01
011	2200.0	00	02
⋮	⋮	⋮	⋮
255	2200.0	00	02

Unused blocks

Data inserted

After insertion

Position Block No.	Position Data	M Code	Speed Block No.
000	1000.0	00	01
001	1100.0	00	01
002	1150.0	00	05
003	1200.0	00	02
004	1300.0	00	03
005	1400.0	00	04
006	1500.0	00	02
007	0.0	00	00
008	0.0	00	00
009	2000.0	00	01
010	2100.0	00	01
011	2200.0	00	02
⋮	⋮	⋮	⋮
255	2200.0	00	02

Unused blocks

Data is shifted down to position block No.007 and one unused position block is deleted.

Data in and after position block No.007 remain unchanged.

(b) Position block data deletion

Deletes the position data of the specified position block number.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [HELP] (position block edition initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify). Press [↵] to define the mode (define).	<Pos. Edit> ▲ INSERT →DELETE ▼
3)	Press [2] [5] [0] on the ten-key pad to specify the block number from which data is to be deleted (for No.250). Press [↵] to execute deletion.	<Block Del.> Block No. 250 Yes:↵ No:RST
4)	During deletion The data of block No. 250 is deleted, the data from No. 251 on are shifted up one place, and No. 255 is vacated. On completion of deletion, the positioning address list screen is displayed.	<Block Del.> Deleting Not Power Off 250→ 3000.0 ▲ 251 4000.0 252 5000.0 253 6000.0 ▼
5)	When deletion cannot be performed (outside the block number setting range) Press [STOP/RESET] to return to step 3)	<Block Del.> Block No. 300 Error:RST

Concept of data deletion

When deleting data, data in and after the block where data is deleted is shifted to the preceding blocks. When any unused blocks exist in block No.s 0 through 255, an unused block is added and data before that additional unused block is shifted.

The data of the unused blocks and subsequent used blocks are not shifted.

When data exists in all blocks, an unused block is added to block No.255.

Example: When deleting the data of block No.002

Before deletion

Data to be deleted: 002

Unused blocks: 007, 008

Position Block No.	Position Data	M Code	Speed Block No.
000	1000.0	00	01
001	1100.0	00	01
002	1150.0	00	05
003	1200.0	00	02
004	1300.0	00	03
005	1400.0	00	04
006	1500.0	00	02
007	0.0	00	00
008	0.0	00	00
009	2000.0	00	01
010	2100.0	00	01
011	2200.0	00	02
⋮	⋮	⋮	⋮
255	2200.0	00	02

After deletion

Unused blocks: 006, 007, 008

Position Block No.	Position Data	M Code	Speed Block No.
000	1000.0	00	01
001	1100.0	00	01
002	1200.0	00	02
003	1300.0	00	03
004	1400.0	00	04
005	1500.0	00	02
006	0.0	00	00
007	0.0	00	00
008	0.0	00	00
009	2000.0	00	01
010	2100.0	00	01
011	2200.0	00	02
⋮	⋮	⋮	⋮
255	2200.0	00	02

One unused position block (No.006) is added.

Data in and after position block No.007 remain unchanged.

4. ROLL FEEDING SYSTEM

4.1 Roll Feeding System Specifications

Item			Specifications
Command system	Point table number input	Operational specifications	Position block number is specified for positioning.
		Position command input	• Using the contact input, positions are selected from those in 2 position blocks. • Feed length setting range for 1 position: ±1μm to ±999.999m
		Speed command input	• The contact input allows speeds and acceleration/deceleration times to be selected from those in 2 speed blocks as standard or from those in 8 speed blocks when the option card (MR-H-D01) is used.
		System	Incremental command
	Position data input (D01 card required)	Operational specifications	Digital switch or contact data input is used for positioning.
		Position command input	• 6-digit BCD (unsigned) digital switch (MR-SD60) or contact input • Feed length input setting range:1 ±μm to ±999.999m
		Speed command input	Using the contact input, speeds and acceleration/deceleration times are selected from those in 2 speed blocks as standard or from those in 8 speed blocks when the option card (MR-H-D01) is used.
		System	Incremental command
Operation mode	Automatic mode		Positioning operation is performed once under the speed/position commands.
	Manual mode	Jog	Jog operation is performed by the parameter unit or contact input under the speed command.
		Manual pulse generator (MR-HDP01)	Manual pulse generator (MR-HDP01) is used for manual feed. • Input pulse specifications: 2-phase pulse train with 90°phase difference (A phase, B phase) ･･････multiplied by 4 • Input pulse form: open collector input • Max. Input pulse frequency: open collector input 200kepps 120000r/min for MR-HDP01 • Command pulse magnification: any of ×1, ×10 and ×100 is selected using the internal parameter. The option card (MR-H-D01) may be used to select the above externally.
Functions of positioning control			• Acceleration/deceleration method setting (S-shaped acceleration/deceleration, separate settings for acceleration and deceleration) • Backlash compensation • Alarm code is output using the option card (MR-H-D01) • Input contact assignment changed by internal parameter

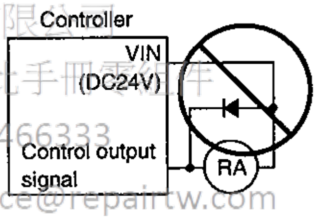
4.2 Standard Connection Example

⚠ WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before starting wiring, make sure that the charge lamp is off more than 10 minutes after power-off, and then confirm that the voltage across terminals P-N is safe with a tester or similar device. A failure to do so can cause an electric shock.
- Do not attempt to wire the controller 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

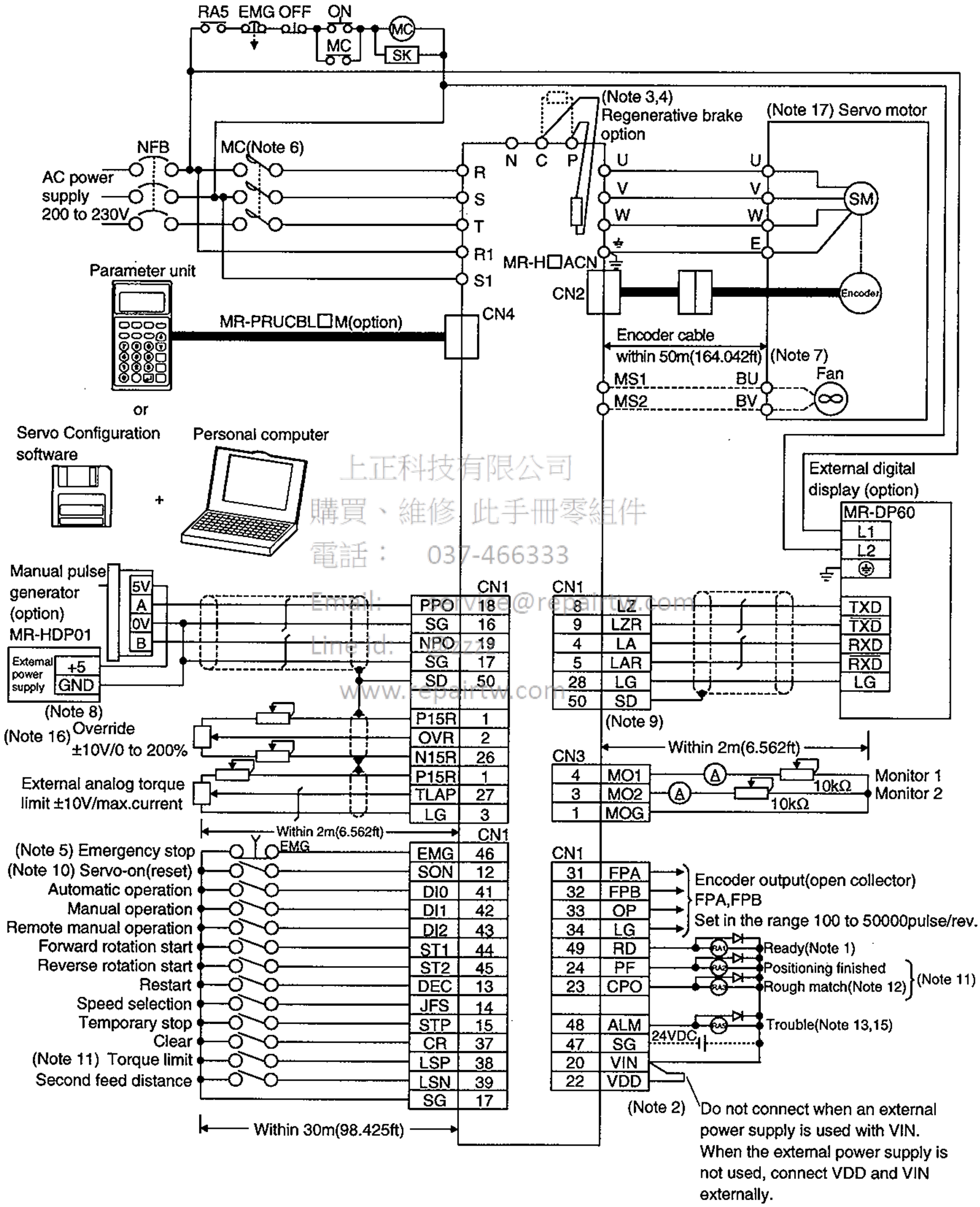
- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, fault, etc. may occur.
- The surge absorbing diode installed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



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

4.2.1 Standard configuration (without the MR-H-D01 option card)

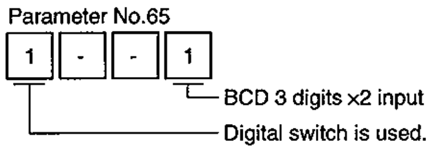
Roll feeding operation according to 2-position point table

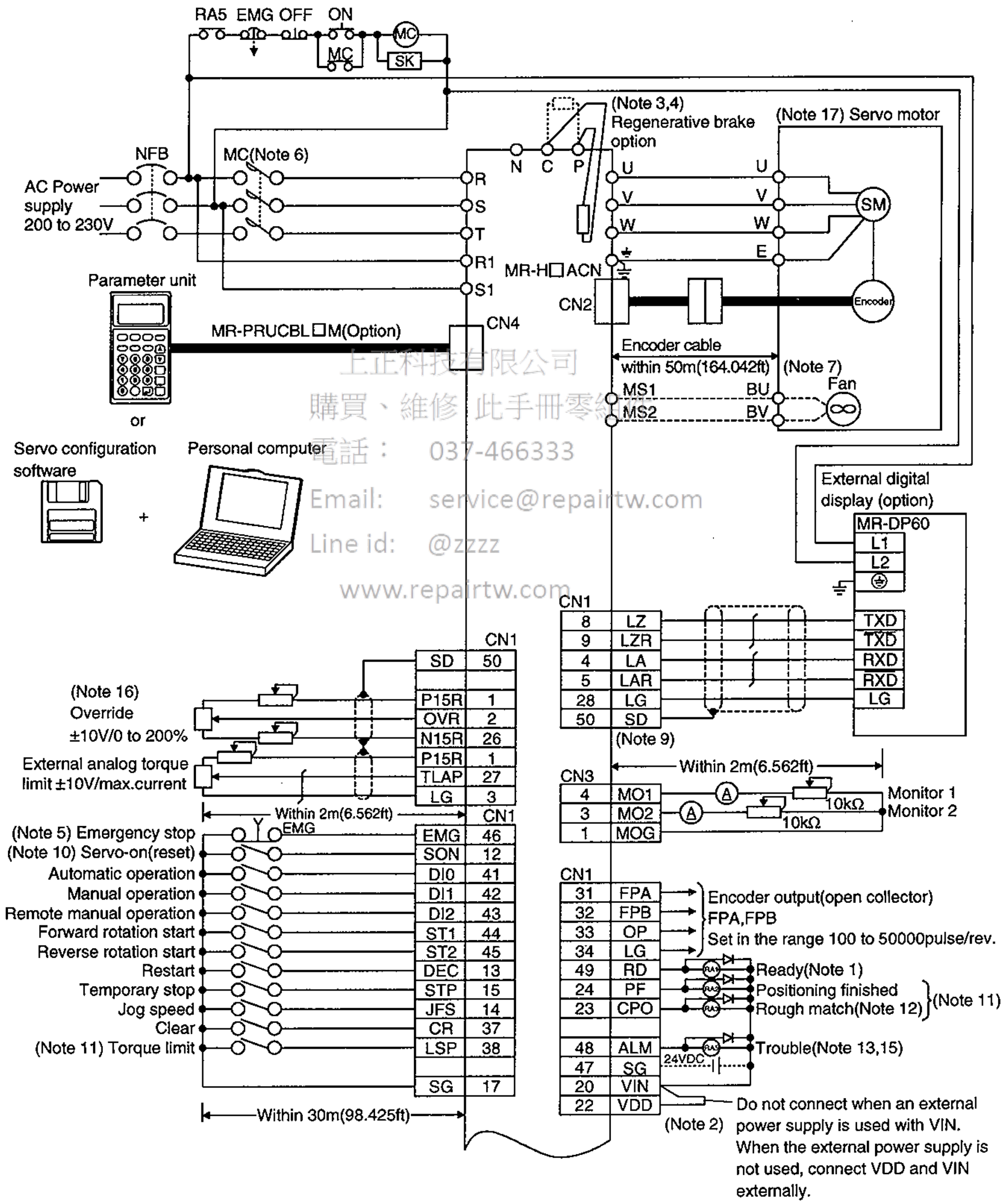


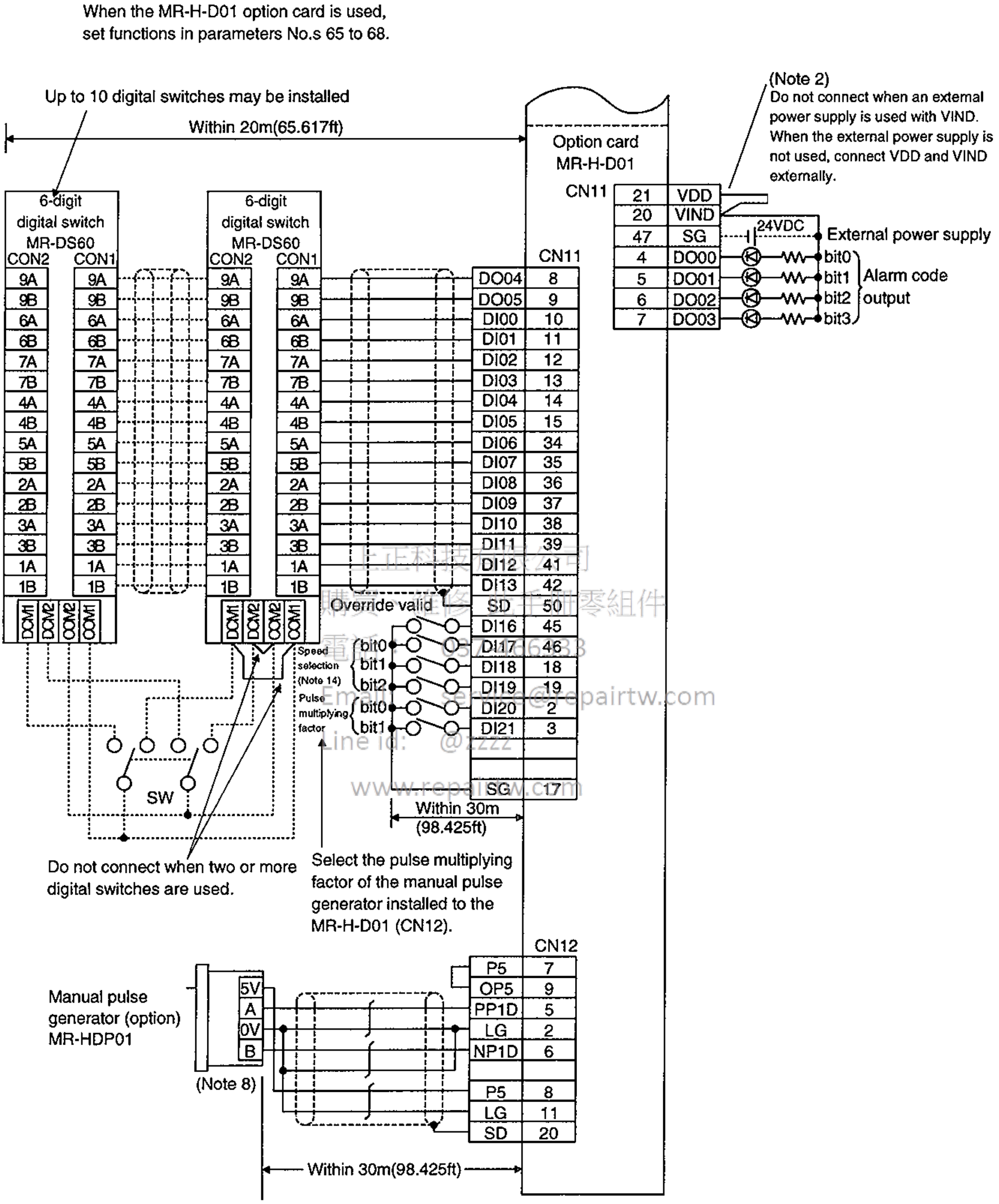
For notes, refer to page 4-8.

4.2.2 Extension configuration 1 (with the MR-H-D01 option card)

Roll feeding operation under digital switch (MR-DS60) position data command.
The digital switch used must be the optional MR-DS60.
Set 1□□1 in parameter No.65.



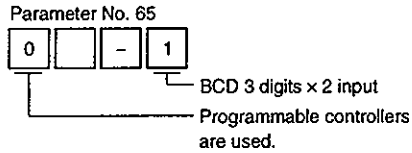


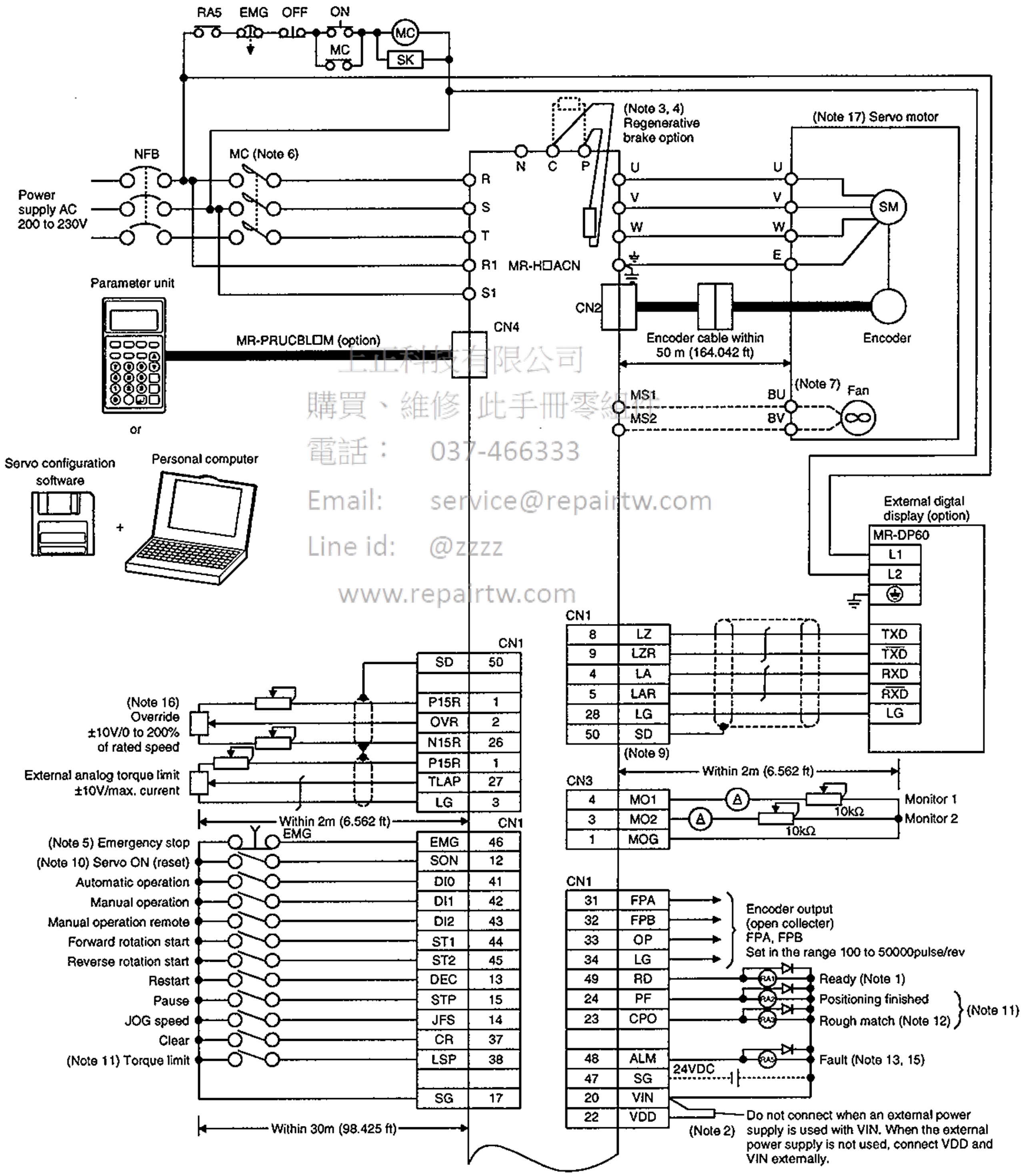


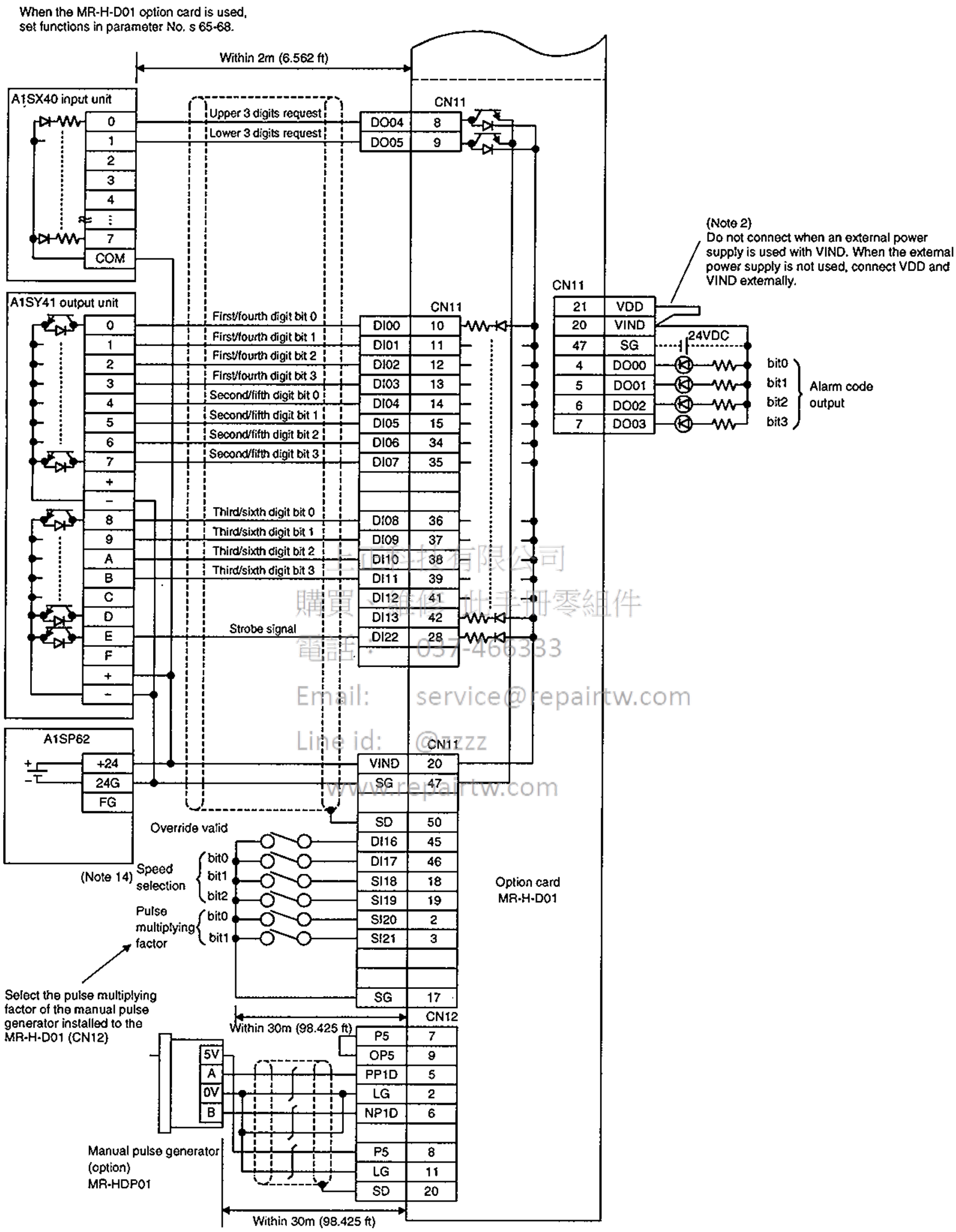
For notes, refer to page 4-8.

4.2.3 Extension configuration 2 (with the MR-H-D01 option card)

Roll feeding operation under programmable controller position data command
The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controllers are used.
Set 0□□1 in parameter No.65.







For notes, refer to page 4-8.

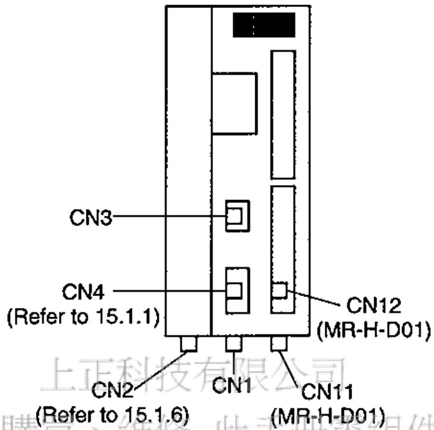
Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.
2. The sum total of currents flowing in the external relays should be 200mA max. If 200mA is exceeded, supply external power to the interface.
3. The controller of 11kW or more does not contain the regenerative brake resistor. Connect the supplied external regenerative brake resistor.
4. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C.
5. The emergency stop switch must be installed.
6. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
7. For the HA-LH series servo motors of 11kW or more, supply power to the fan terminals. For 11kW or more, connect the fan terminals to the MS1 and MS terminals of the controller. Refer to Section 5.4.4 for connection with the servo motor.
8. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
9. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
10. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
11. Change the setting of parameter No.41 to 11□□ to use LSP as a forward rotation stroke end signal and LSN as a reverse rotation stroke end signal.
12. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
13. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
14. Speed selection is made valid by setting □□1□ in parameter No.65.
When the initial value (□□0□) is used, speed block No.1 is selected.
15. The trouble (ALM) signal is on under normal conditions.
16. The upper limit of the overriding speed is the permissible speed.

4.3 I/O Connectors

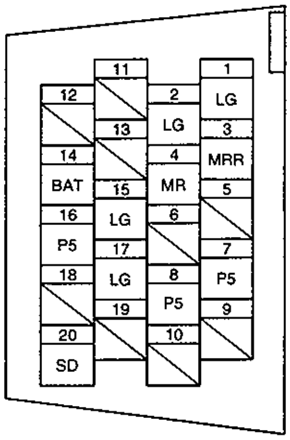
4.3.1 Connector signal layouts

POINT
• The signal layouts of the connectors are views from the wiring section of the cable connectors.

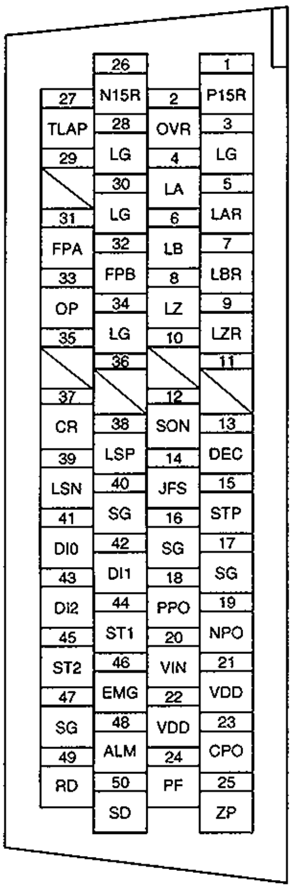
MR-H-ACN



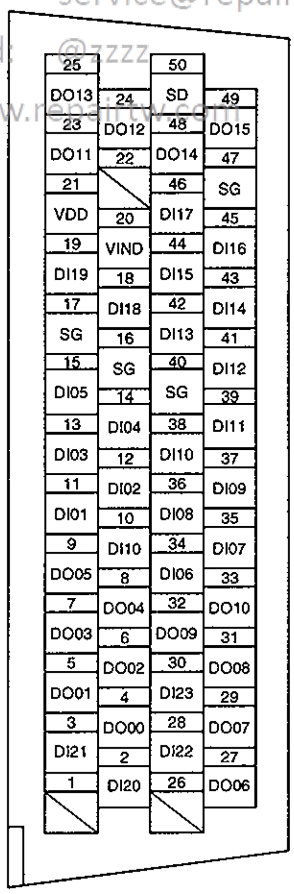
CN2 (for encoder signals)
Model PCR-S20FS (Honda Tsushin make)



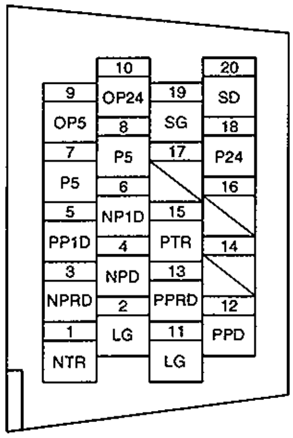
CN1
Model PCR-S50FS (Honda Tsushin make)



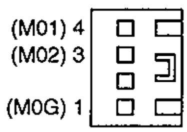
CN11
Model PCR-S50FS (Honda Tsushin make)



CN12
Model PCR-S20FS (Honda Tsushin make)



CN3
Model 171822-4 (AMP make)



4.3.2 Signal explanations

Refer to Section 5.2.2 for the I/O interfaces (symbols in the I/O column of the table).

(1) CN1

Signal Name	Symbol	Pin No.	Description	I/O Division
Digital I/F power supply input	VIN	20	Driver power supply input terminal for digital interface Input 24VDC ±10% for input interface. When using an external power supply, connect a 24VDC power supply of 200mA or more to this terminal. When using the internal power supply (VDD) as the interface power supply, always connect VDD.	
Driver power supply	VDD	21,22	+24V ±10% is output across VDD-SG. Connect with VIN when using this power supply for the digital interface. Permissible current: 200mA	
Open collector power input	OPC	11	When using a manual pulse generator, supply 24VDC to this terminal.	
24V common	SG	16,17 40,47	Common terminals for VDD and VIN. Isolated from LG.	
DC power supply	P15R	1	+15VDC is output across P15R-LG. Use as a power supply for OVR/TLAP. Permissible current: 30mA	
	P15N	26	−15VDC is output across P15N-LG. Use as a power supply for OVR/TLAP. Permissible current: 30mA	
Control common	LG	3,28 30,34	Common terminals for OVR, TLAP, LA, LAR, LB, LBR, LZ, LZR, FPA, FPB and OP.	
Shield	SD	50	Connect the servo amplifier end of the shield cable.	
Servo on	SON	12	Operation-ready signal input terminal. Short SON-SG to switch the base circuit on, making the servo amplifier ready to operate. Open them to shut off the base circuit, coasting the servo motor.	DI-1
Reset			Alarm reset signal input terminal. When using the reset signal, set □□□1 in parameter No. 41. At this time, the servo on signal is "automatically turned on internally". Short SON-SG for longer than 20ms to reset the alarm. While SON-SG are shorted, the base circuit is shut off. However, regenerative alarm (AL30), overload 1 (AL50) and overload 2 (AL51) cannot be reset until the regenerative brake resistor and power transistor temperatures reduce. The following alarms can be reset.	DI-1

Display	Function Name	Display	Function Name
AL10	Under voltage	AL45	Main circuit device overheat
AL24	Ground fault	AL46	Servo motor overheat
AL31	Over speed	AL52	Error excessive
AL32	Over current	AL73	Auxiliary pulse frequency alarm 1
AL33	Over voltage	AL75	Option memory alarm 2
AL35	command pulse frequency alarm	AL8E	RS-232C alarm
AL42	Feedback alarm	AL8F	RS-422 alarm

<table>
<tr><th>Signal Name</th><th>Symbol</th><th>Pin No.</th><th>Description</th><th>I/O Division</th></tr>
<tr><td>Torque limit</td><td>LSP</td><td>38</td><td>Torque limit signal input terminal.
When using the torque limit signal, set □0□□ in parameter No. 41. At this time, the forward rotation stroke end signal is made invalid.
Short LSP-SG to limit the generated torque according to the voltage of the torque limit command (TLAP).
Open LSP-SG to make the parameter No. 40 setting valid.</td><td>DI-1</td></tr>
<tr><td>Second feed distance</td><td>LSN</td><td>39</td><td>Second feed distance selection signal input terminal.
Used to choose the position block No. to be executed.
Open LSN-SG to choose position block No. 0. Short LSN-SG to choose position block No. 1.</td><td></td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>38</td><td rowspan="2">Stroke end signal input terminals.
When using the forward/reverse rotation stroke end signal, make them valid in parameter No.41.
At this time, the torque limit signal/second feed distance selection signal is made invalid.
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.
When these signals are not used, you can specify "automatically turned on internally" in parameter No. 42.
<table>
<tr><th colspan="2">(Note) External 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>DI-1</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>39</td><td>DI-1</td></tr>
<tr><td>Clear</td><td>CR</td><td>37</td><td>Clear signal input terminal.
Short CR-SG for longer than 5ms to clear the droop pulses.
Using parameter No. 42, you can make selection between "cleared when signal is switched from off to on" and "always cleared while signal is on".</td><td>DI-1</td></tr>
<tr><td>Speed selection</td><td>JFS</td><td>14</td><td>Speed selection signal input terminal.
Used to choose the speed block No. to be executed.
Open JFS-SG to choose speed block No. 1. Short JFS-SG to choose speed block No. 2.</td><td>DI-1</td></tr>
<tr><td>Temporary stop</td><td>STP</td><td>15</td><td>Temporary stop signal input terminal
Short STP-SG which are open to stop operation. Turn on the restart signal (DEC) which is off to resume operation from where it had stopped.
Reserve the pulse width of 5ms or longer.</td><td>DI-1</td></tr>
<tr><td>Restart</td><td>DEC</td><td>13</td><td>Restart signal input terminal
Short DEC-SG which are open to resume operation from where it had stopped.
Reserve the pulse width of 5ms or longer.</td><td>DI-1</td></tr>
<tr><td rowspan="2">Reverse rotation start</td><td rowspan="2">ST2</td><td rowspan="2">45</td><td rowspan="2">In the manual remote mode, short ST1-SG to rotate the servo motor in the CCW direction. Short ST2-SG to rotate it in the CW direction.
<table>
<tr><th colspan="2">(Note) External Input Signals</th><th rowspan="2">Rotation Direction</th></tr>
<tr><th>ST2</th><th>ST1</th></tr>
<tr><td>1</td><td>1</td><td>(Stop) Servo lock</td></tr>
<tr><td>0</td><td>1</td><td>CCW</td></tr>
<tr><td>1</td><td>0</td><td>CW</td></tr>
<tr><td>0</td><td>0</td><td>(Stop) Servo lock</td></tr>
</table>
Note. 0: LSP/LSN-SG off (open)
1: LSP/LSN-SG on (short)</td><td>DI-1</td></tr>
<tr><td>DI-1</td></tr>
</table>

Signal Name	Symbol	Pin No.	Description	I/O Division
Automatic operation selection	DIO	41	Operation mode selection signal input terminal. Used to choose the operation mode. Refer to Section 4.3.3.	DI-1
Manual operation selection	DI1	42		DI-1
Remote manual operation selection	DI2	43		DI-1
Manual pulse generator signal	PPO NPO	18 19	Connect the manual pulse generator (MR-HDP01). Refer to Section 15.1.12 for details.	DI-2
Emergency stop	EMG	46	Emergency stop signal input terminal Opening EMG-SG puts the motor in an emergency stop status, in which the servo is switched off, the dynamic brake is operated, and the motor comes to a sudden stop. Short EMG-SG in the emergency stop status to exit from the emergency stop status.	DI-1
Trouble	ALM	48	Trouble signal output terminal. ALM-SG is disconnected when the protective circuit is activated to shut off the base circuit at power-off. They are connected in a normal status at power-off.	DO-1
Rough match	CPO	23	Rough match signal output terminal. CPO-SG are connected when the command remaining distance is less than the rough match output range set in the parameter. Not output while the base circuit is off.	DO-1
Limiting torque			Limiting torque signal output terminal. When using the limiting torque signal, make it valid in parameter No. 44. At this time, the rough match/electromagnetic brake interlock signal is made invalid. CPO-SG are connected when the internally or externally set torque limit value is reached.	DO-1
Electromagnetic brake interlock			Electromagnetic brake interlock output signal terminal. When using the electromagnetic brake interlock signal, make it valid in parameter No. 3. At this time, the rough match/limiting torque signal is made invalid. The electromagnetic brake interlock signal is output. CPO-SG are disconnected at servo off or alarm.	DO-1
In position	PF	24	In-position signal output terminal. PF-SG are connected when the droop pulse value is less than the in-position range set in the parameter. Not output while the base circuit is off.	DO-1
Ready	RD	49	Ready output terminal. After servo on, RD-SG are connected in a trouble-free ready status.	DO-1
Encoder pulse (open collector)	FPA FPB	31 32	In CCW rotation of the servo motor, FPA leads FPB by $\pi/2$. Pulses are output in the range 100 to 5000 pulses/rev according to the parameter No. 39 setting.	DO-2
Encoder Z-phase pulse (differential line driver)	OP	33	Z-phase pulse signal output terminal. Output the zero-point signal of the servo motor encoder. OP-SG are connected in the zero-point position. The minimum pulse width is approx. 1.77 ms.	DO-2
External digital display signal	LA LAR LZ LZR	4 5 8 9	External digital display signal output terminal. When using the MR-DP60 external digital display, connect it to this terminal.	DO-2
Encoder pulse (differential line driver)	LA LAR LA LAR	4 5 6 7	When using the encoder output signal (differential line driver system), make it valid in parameter No. 52.	DO-2
Override	OVR	2	Apply −10 to +10V across OVR-LG to limit the servo motor speed. 0[%] for −10[V], 100[%] for 0[V], 200[%] for 10[V].	Analog input
External analog torque limit	TLAP	27	Apply 0 to +10V across TLAP-LG to limit the servo motor-generated torque. Zero torque for 0[V], max. torque for 10[V].	Analog input

(2) CN11 (MR-H-D01)

Symbol	Pin No.	Functions and Applications	I/O (Note)
D004	8	Position data common 1 terminal (sign, 6th digit, 5th digit, 4th digit)	
D005	9	Position data common 2 terminal (3rd digit, 2nd digit, 1st digit)	
DI00	10	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 0)	DI-1
DI01	11	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 1)	DI-1
DI02	12	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 2)	DI-1
DI03	13	Position data input terminal (1st digit, 4th digit, 4-bit binary bit 3)	DI-1
DI04	14	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 0)	DI-1
DI05	15	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 1)	DI-1
DI06	34	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 2)	DI-1
DI07	35	Position data input terminal (2nd digit, 5th digit, 4-bit binary bit 3)	DI-1
DI08	36	Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 0)	DI-1
DI09	37	Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 1)	DI-1
DI10	38	Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 2)	DI-1
DI11	39	Position data input terminal (3rd digit, 6th digit, 4-bit binary bit 3)	DI-1
DI16	45	Override selection input terminal	DI-1
DI17	46	Speed selection input terminal, 3-bit binary bit 0	DI-1
DI18	18	Speed selection input terminal, 3-bit binary bit 1	DI-1
DI19	19	Speed selection input terminal, 3-bit binary bit 2	DI-1
DI20	2	Manual pulse generator magnification selection input terminal, 2-bit binary bit 0	DI-1
DI21	3	Manual pulse generator magnification selection input terminal, 2-bit binary bit 1	DI-1
DI22	28	Strobe input terminal (not required when the 6-digit digital switch is used)	DI-1
D000	4	Alarm code output terminal, 4-bit binary bit 0	DO-2
D001	5	Alarm code output terminal, 4-bit binary bit 1	DO-2
D002	6	Alarm code output terminal, 4-bit binary bit 2	DO-2
D003	7	Alarm code output terminal, 4-bit binary bit 3	
VDD	21	24VDC output terminal	
VIND	20	Connect with VDD or connect an external power supply.	
SG	16,17 40,47	Common terminal for 24VDC except position data	
SD	50	Shielding terminal	

(3) CN12(MR-H-D01/connector for connection of manual pulse generator)

Symbol	Pin No.	Functions and Applications	I/O (Note)
PP1D	5	Open collector forward rotation pulse input terminal	DI-2
PN1D	6	Open collector reverse rotation pulse input terminal	DI-2
P5	7,8	5VDC output terminal	
OP5	9	Connect with P5 or connect an external power supply.	
LG	2,11	5VDC common terminal	
SD	20	Shielding terminal	

4.3.3 Control input/output signals

(1) Start signals and operation mode select signals

The start signals change as indicated below depending on the operation mode selection conditions. Indicates that the signal is made valid when it is switched from off to on, and is invalid if switched on during operation. Indicates that the signal is valid while it is on, and is made invalid when switched off.

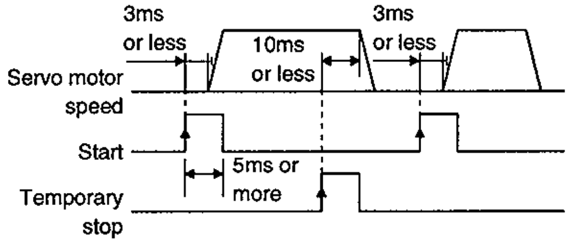
	Signal		Automatic	Manual	Remote Manual
(Note)CN1	Automatic operation	DI0	ON	OFF	OFF
(Note)CN1	Manual operation	DI1	OFF	ON	ON
(Note)CN1	Remote manual operation	DI2	OFF	OFF	ON
(Note)CN1	Forward rotation start	ST1	(Forward rotation start)		(Forward rotation jog)
(Note)CN1	Reverse rotation start	ST2	(Reverse rotation start)		(Reverse rotation jog)
(Note)CN1	Temporary stop	STP	(Temporary stop)	(Temporary stop)	
Parameter unit	JOG	FWD REV		(Forward/reverse rotation jog)	
Parameter unit	1STEP	1STEP		(1-step feed)	
Manual pulse generator					

Note: If you turn on-off DI0/DI1/DI2 during operation in the automatic operation mode, the operation mode cannot be changed. The operation mode is switched to the one specified by DI0, DI1 and DI2 after completion of positioning to the target position.

(2) Start and stop signals

a) Make up the sequence so that the start signal is switched on after the main circuit has been set up. The start signal is invalid if it is switched on before the main circuit is set up.
Normally, interlock is provided between the start signal and ready signal (RD).

b) The controller is started when the external start signal is switched from off to on. The internal processing of the controller delays 3ms maximum. The other signal delays 10ms maximum. (As shown below on the left)

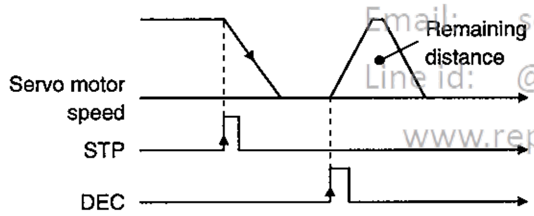


c) When the programmable controller is used, the start/stop signal ON time should be 5ms or more to prevent a malfunction.

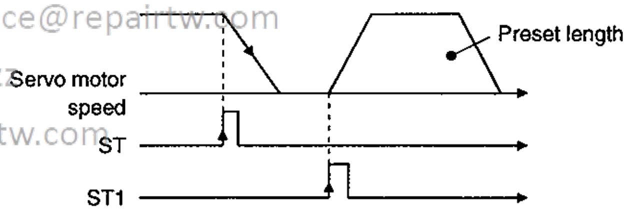
d) The start signal (ST1/ST2) is not accepted during operation. The next operation must be started after the rough match signal has been output with the rough match output range set to zero, or after the in-position signal has been output.

(3) Restart (DEC)

Turning on the temporary stop (STP) signal to make a stop and then turning on the restart (DEC) signal executes the operation of the remaining feed length.



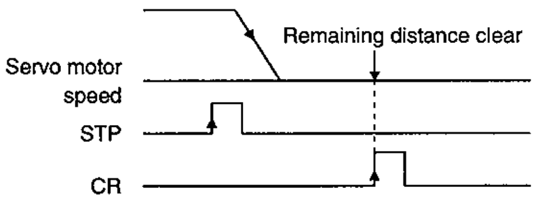
(a) Use of restart signal (DEC)



(b) Use of forward rotation start signal (ST1)

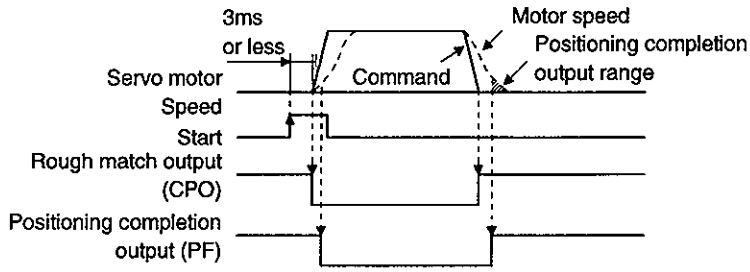
(4) Clear

Switch this signal on after a temporary stop to clear the remaining distance. Switch this signal on during operation to clear the feed command and droop and bring the servo motor to a sudden stop. Do not switch this signal on during high-speed operation, because it will bring the servo motor to a sudden stop, increasing the shock and vibration given to the machine.



(5) Positioning completion signal (PF)

Switched on when the droop of the deviation counter falls within the preset positioning completion range (parameter No.16). When operation is performed at low speed, the low droop may keep the PF signal on if the positioning completion range (parameter No.16)setting is large.



(6) Rough match (CPO)

Switched on when the command remaining distance falls within the rough match output range (parameter No.17).

(7) Override

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

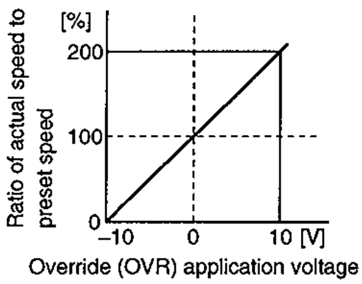
Item	Name	Remarks
Analog input signal	Override (OVR)	
Contact input signal	Override selection (DI16)	MR-H-D01 option card used
Parameter	No.24 function selection 5	□□□1: Override used
	No.47 override offset	−9999 to 9999mV

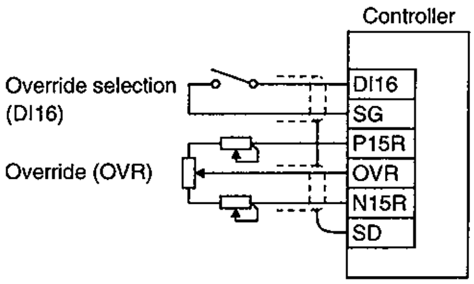
To use override, make it available by setting □□□1 in parameter No. 24.

(a)Override (OVR)

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

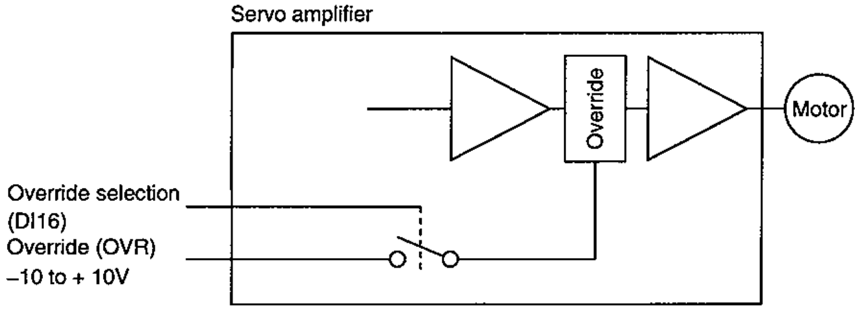
Refer to the following diagram when using the 15V power output (P15R, N15R) of the controller.





(b)Override selection (DI16)

Select between making override (OVR) Valid and invalid. The MR-H-D01 option card is required to use this signal. Set □□□1 in parameter No.66 to make override selection valid.



Using the override selection (DI16), choose a change value as follows:

Across DI16-SG	Speed Change Value
Open	No change
Short	Override (OVR) setting is made valid.

(c) Override offset (parameter No.47)

Using parameter No.47, the offset voltage can be set relative to the input voltage for the override (OVR). The setting is between –9999 to 9999mV.

(8) Torque limit

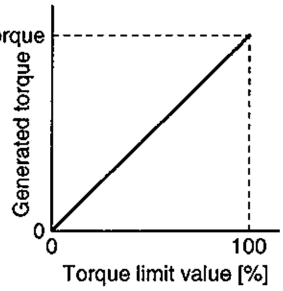
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLAP)	
Contact input signals	Torque limit selection(LSP)	Set □0□□ (initial value) in parameter No.41
Contact output signal	Limiting torque (CPO)	
Parameters	No.40 internal torque limit	0 to 100%
	No.54 internal torque limit2	0 to 100%
	No.48 torque limit offset	–9999 to 9999mV
	No.41 input signal selection	Selection of the rotation direction in which torque limit is executed

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

(a) Internal torque limits (Parameter No.40, 54)

Use parameter No.40 and 54 to set the internal torque limit values. The following graph shows the generated torque relative to the setting.

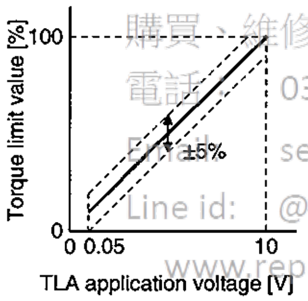


(b) External torque limit (TLAP)

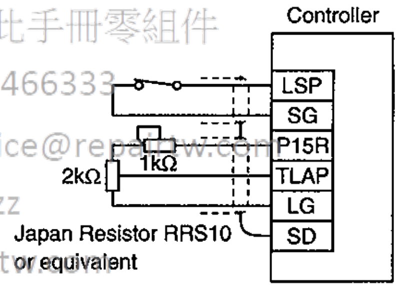
By applying a voltage (0 to 10V) to the external torque limit (TLAP) terminal, limit values can be set from outside consecutively. The following graph shows the relationship between input voltage and limit value.

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

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



TLA Application Voltage vs. Torque Limit Value



Connection Example

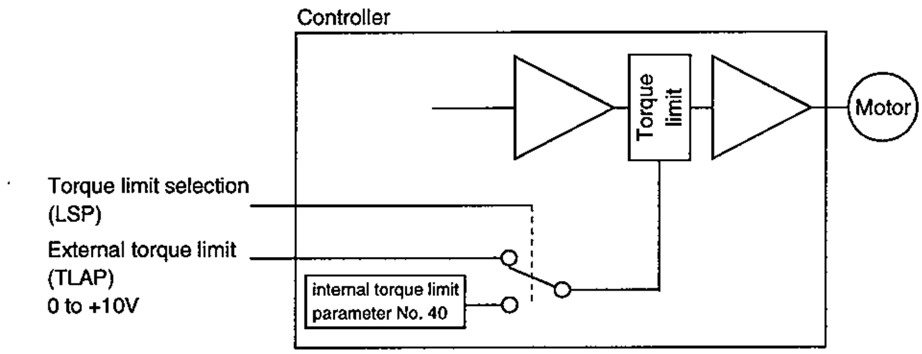
(c) Torque limit selection (LSP)

To use torque limit selection (LSP), set □0□□ in parameter No. 41.

This input signal can be used to choose the torque limit value made valid. When not using torque limit selection (LSP), set □1□□ in parameter No. 41. At this time, the internal torque limit (parameter No. 40) setting is always made valid.

1) When □□0□ (initial value) is set in parameter No. 41

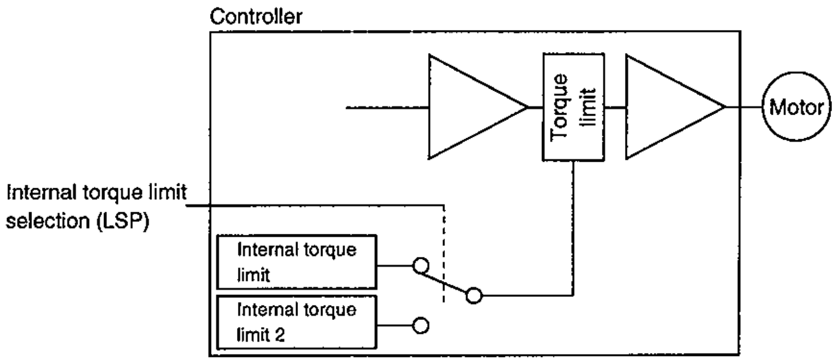
Switched between external torque limit (TLAP) and internal torque limit (parameter No. 40).



Using the internal torque limit selection (LSP), choose the limit value as follows. When LSD-SG are shorted, the smaller value of the external torque limit and internal torque limit is chosen:

Across LSP-Se	Torque Limit Value
Open	External torque limit (TLAP) if External torque limit (TLAP) < internal torque limit
	Internal torque limit if External torque limit (TLAP) > internal torque limit
Short	Internal torque limit

2) When □□1□ is set in parameter No. 41
Switched between internal torque limit (parameter No. 40) and internal torque limit 2 (parameter No. 54).



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

Across TL2-SG	Torque Limit Value
Open	Internal torque limit
Short	Internal torque limit if internal torque limit < internal torque limit 2
	Internal torque limit 2 if internal torque limit > internal torque limit 2

(9) Stroke ends (LSP,LSN)
Set 11□□ in parameter No.41 to make these signals valid. Use limit switches or the like with LSP and LSN to connect with SG. On a machine which does not have stroke ends, connect LSP and LSN with SG. If they are not connected, the servo motor will not rotate.
Disconnection of LSP or LSN from SG during rotation of the servo motor (LSP during CCW rotation, LSN during CW rotation) causes the servo motor to be brought to a sudden stop and servo-locked. At this time, the deviation counter is cleared.

(10) Manual pulse generator pulse magnification selection (DI20, DI21)
Use the option card (MR-H-D01)
Set □4□□ in parameter No.65 to make this signal valid.
Select the pulse magnification across DI20, DI21-SG as indicated in the following table.

Pulse Magnification	DI21	DI20
1 time	OFF	OFF
10 time	OFF	ON
100 time	ON	OFF

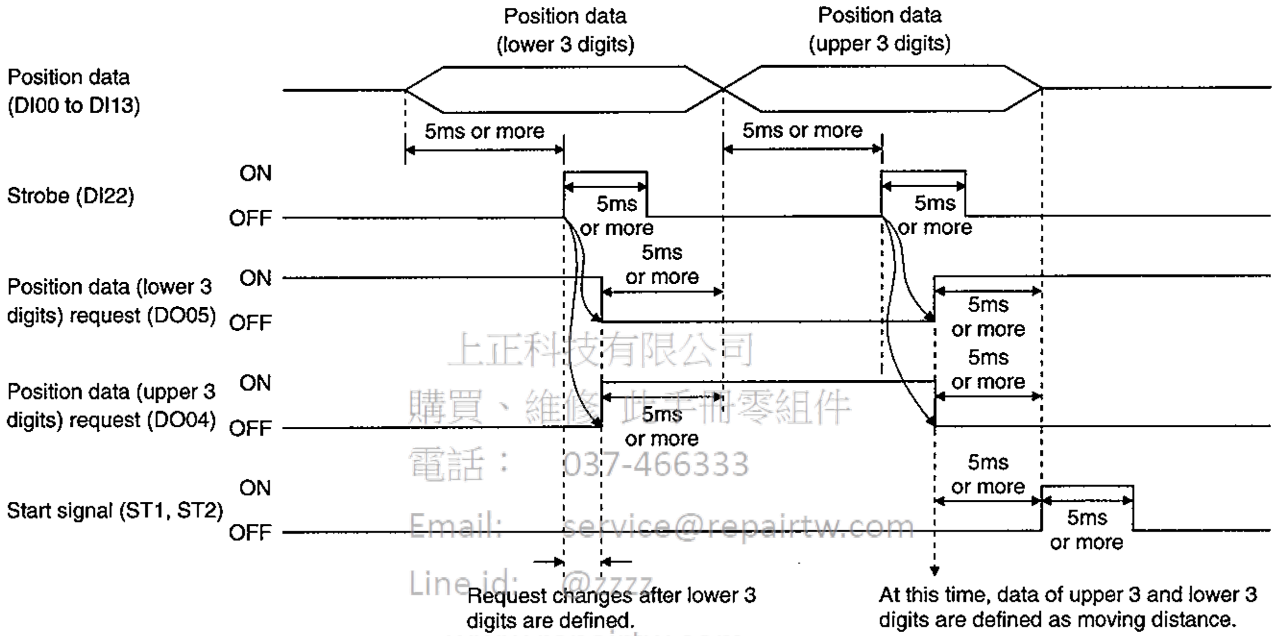
(11) Alarm code output (DO00, DO01, DO02, DO03)
Use the option card (MR-H-D01)
Set 1 in parameter No.67 to make this signal valid. The alarm type is output in 4-bit code.
For more information, refer to Section 12.2.

(12) Strobe signal (DI22)

Use the option card (MR-H-D01)

When the programmable controller is used, this signal controls the read timing of position data. Position data is read in two parts separately: lower 3 digits; and upper 3 digits. Hence, the strobe signal must be switched on twice. Provide position data and switch the strobe signal on with a delay of 5ms or more. Keep the strobe signal on for 5ms or more and keep the data unchanged during this period.

The relationship between the position data and start signal (ST1,ST2) should be as shown in the following timing chart. Two or more pieces of position data cannot be read. After one piece of data has been read, switch on the start signal.



(13) Speed select signal (DI17, DI18, DI19)

Use the option card (MR-H-D01)

3-bit binary signal used to select the speed block number (No.1 to 8).

Speed Block No.	DI19 bit2 (MSB)	DI18 bit1	DI17 bit0 (LSB)
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

3-bit binary, 0:OFF 1:ON

4.4 OPERATION

4.4.1 When Switching Power On for the First Time

(1) Pre-operation checks

Before starting operation, check the following:

(a) Wiring

1) A correct power supply is connected to the power input terminals (R, S, T) of the controller.
2) The servo motor power supply terminals (U, V, W) of the controller match in phase with the power input terminals (U, V, W) of the servo motor.
3) The servo motor power supply terminals (U, V, W) of the servo amplifier are not shorted to the power input terminals (R, S, T).
4) The controller and servo motor are grounded securely.
5) When using the regenerative brake option, twisted cables are used and the lead of the built-in regenerative brake resistor has been removed.
6) When stroke end limit switches are used, the signals across LSP-SG and LSN-SG are on during operation.
7) 24VDC or higher voltages are not applied to the pins of connectors CN1.
8) SD and SG of connectors CN1 are not shorted.
9) The wiring cables are free from excessive force.

(b) Environment

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

(c) Machine

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

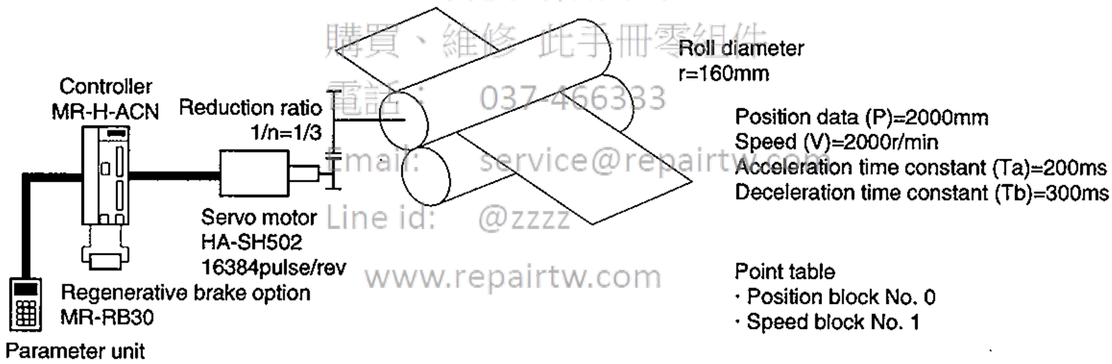
4.4.2 Startup

⚠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 are exposed and you may get an electric shock. • During power-on or operation, do not open the front cover. You may get an electric shock.

⚠CAUTION	• Before starting operation, check the parameters. Some machines may perform unexpected operation. • During power-on or soon after power-off, do not touch the servo amplifier heat sink, regenerative brake resistor, servo motor, etc. as they may be at high temperatures. You may get burnt.

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

(1) Machine conditions



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

$$\frac{\text{CMX (pulse)}}{\text{CDV } (\mu\text{m})} = \frac{16384}{\frac{1}{n}\cdot r\cdot\pi\cdot 1000} = \frac{16384}{\frac{1}{3}\cdot 160\cdot\pi\cdot 1000} \cong \frac{4096}{41888} = \frac{2048}{20944} \quad\cdots\cdots\cdots\cdots\cdots\cdots (4.1)$$

CMX=2048
CDV=20944

5) Position block No.1 is used to execute automatic operation once.

(2) Startup procedure

(a) Power on

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

2) When main circuit power/control circuit power is switched on, "Position" appears on the parameter unit display.

(b) Test operation 1

Using jog operation in the "test operation mode" of the Servo Configuration Software, make sure that the servo motor operates. (Refer to Section7.2.)

(c) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to Chapter 6 for the parameter definitions and to Sections 7.2 for the setting method.

Parameter	Name	Setting	Description
No.0	Motor series	0	HA-SH series servo motor used
No.1	Motor type	502	HA-SH502 used
No.2	Feeding system	□8□0 └ Roll feeding system └ MR-RB032 regenerative brake option is used.	
No.3	Function selection 1	0□□0 └ Linear acceleration/deceleration system └ Used in incremental system.	
No.4	Function selection 2	□001 └ As command resolution is 10μm, feed length multiplying factor of 10 times is chosen. └ Position data unit [mm] is selected. └ Digital display, automatic decimal point setting selection.	
No.5	Electronic gear numerator (CMX)	2048	From calculation result of formula (4.1)
No.6	Electronic gear denominator (CDV)	20944	From calculation result of formula (4.1)

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

(d) Position block setting

Set the position block according to the operation pattern. Refer to Section 4.4.4 for the position block details and to Section 4.5 for the setting method.

Setting of position block No. 0

Position data [×10^{STM}μm]	(Note) M code	Speed block No.
20000		1

Note: Enter no value.

Setting of speed block No. 1

Servo Motor Speed [r/min]	Acceleration Time constant [ms]	Deceleration Time constant [ms]
2000	200	300

(e) Servo on

Switch the servo on in the following procedure:

1) Switch on main circuit/control power.

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

When placed in the servo-on status, the servo amplifier is ready to operate and the servo motor is locked.

(f) Automatic operation

Set the input signals as listed below and switch on the forward rotation start (ST1) or reverse rotation start (ST2) to execute automatic operation in accordance with point table No. 0.

Signal	Name	ON/OFF	Description
Automatic/manual selection	DI0	ON	Automatic operation selected
Manual operation	DI1	OFF	
Remote manual operation	DI2	OFF	
Servo on	SON	ON	Servo-on status is reached.
Second feed distance	LSN	OFF	Position block No. 0 selected.

(g) Stop

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

1) Servo on (SON) OFF

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

2) Alarm occurrence

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

3) Emergency stop (EMG) OFF

The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. Alarm A.E6 occurs.

4.4.3 Manual operation remote mode

For manual operation, set the operation mode selection signals (DI0, DI1, DI2) as listed below:

Operation Mode Selection Signal	ON/OFF
DI0	OFF
DI1	ON
DI2	ON

(1) Jog operation

(a) Speed setting

Using parameter No. 8 "jog speed 1" and parameter No. 9 "jog speed 2", set the servo motor speeds for jog operation.

Parameter No.	Setting
8	0 to max. speed (r/min)
9	

Choose the jog operation speed with the speed selection signal (JFS). The acceleration/deceleration time constants for jog operation are those of speed block No. 1.

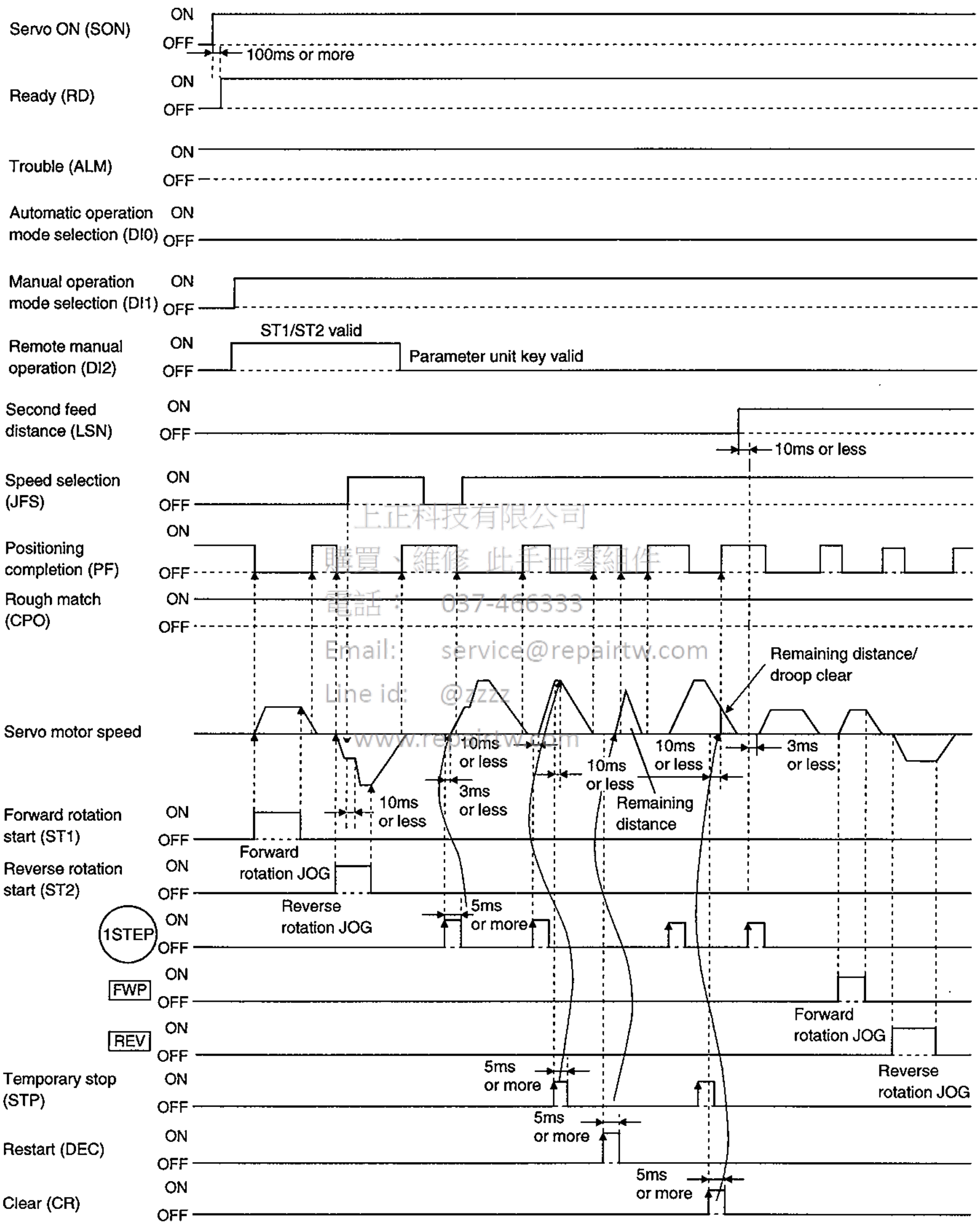
JFS	Setting
OFF	Jog speed 1
ON	Jog speed 2

(b) Start

When using the start signal (ST1, ST2), keep the forward rotation start (ST1) or reverse rotation start (ST2) signal on to rotate the servo motor. At this time, the rotation direction is as listed below:

Start Signal	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
ST1	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
ST2	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)

(c) Timing chart



(2) Manual pulse generator operation

(a) When option card (MR-H-D01) is not used

Set parameter No. 30 as indicated below to make operation from the manual pulse generator valid. Choose the pulse multiplying factor of the manual pulse generator at this time.

Parameter No. 30

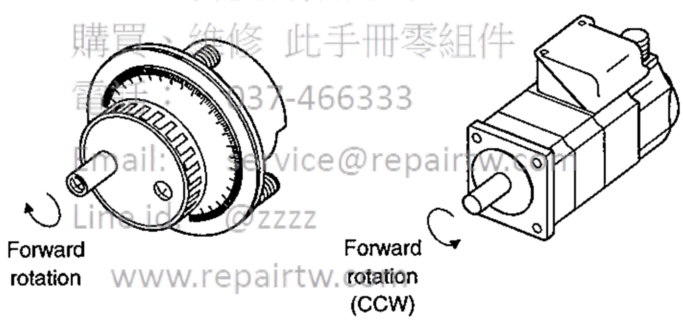
- - - □

*Machine feedrate per revolution of manual pulse generator in metric system

Setting	Manual Pulse Generator	*Feed Distance/Revolution
0	Not used	
1	Used/pulse 1-time multiplication selected	100μm
2	Used/pulse 10-time multiplication selected	1mm
3	Used/pulse 100-time multiplication selected	10mm

Turn the manual pulse generator (MR-HDP01) to rotate the servo motor. The turning direction of the manual pulse generator corresponds to the rotation direction of the servo motor as listed below:

Turning Direction of Manual Pulse Generator	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
Forward rotation	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
Reverse rotation	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)



(b) When option card (MR-H-D01) is used

The pulse multiplying factor of the manual pulse generator can be changed by using pulse multiplying factor selection in parameter No. 65 and the pulse multiplying factor selection signals (DI20, DI21) of the MR-H-D01. Set parameter No. 65 as listed below to make operation from the manual pulse generator valid.

Parameter No. 65

- □ - -

*Machine feedrate per revolution of manual pulse generator in metric system

Setting	Manual Pulse Generator	*Feed Distance/Revolution
0	Not used	
1	Used/pulse 1-time multiplication selected	100μm
2	Used/pulse 10-time multiplication selected	1mm
3	Used/pulse 100-time multiplication selected	10mm
4	Used/pulse multiplication selected externally	

Set □4□□ in parameter No. 65 to set the pulse multiplying factor externally. Relationships between the multiplying factors and pulse multiplying factor selection signals are listed below:

Multiplying Factor	Pulse Multiplying Factor Selection Signals	
	DI21	DI20
1 times	OFF	OFF
10 times	OFF	ON
100 times	ON	OFF

4.4.4 Manual Operation Mode

For manual operation, set the operation mode selection signals (DI0, DI1, DI2) as listed below:

Operation Mode Selection Signal	ON/OFF
DI0	OFF
DI1	ON
DI2	OFF

(1) Jog operation

(a) Speed setting

Using parameter No. 8 "jog speed 1" and parameter No. 9 "jog speed 2", set the servo motor speeds for jog operation.

Parameter No.	Setting
8	0 to max. speed (r/min)
9	

Choose the jog operation speed with the speed selection signal (JFS). The acceleration/deceleration time constants for jog operation are those of speed block No. 1.

JFS	Setting
OFF	Jog speed 1
ON	Jog speed 2

(b) Start

When using the parameter unit, hold down the FWD or REV key of the parameter unit to rotate the servo motor. At this time, the rotation direction is as listed below:

Parameter Unit Key	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
FWD	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
REV	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)

(c) Timing chart

Refer to Section 4.4.3 (1)(c).

(2) Stepped operation

Use the second feed distance signal (LSN) to choose the position block No. Press the [1STEP] key of the parameter unit to perform the operation of the position block No. currently being selected.

Position Block No.	Second Feed Distance (LSN)
0	OFF
1	ON

(3) Manual pulse generator operation

As in Section 3.4.3 (2).

4.4.5 Automatic Operation Mode

Set the operation mode select signals (DI0, DI1,DI2) as listed on the right.

Operation Mode Select Signal	ON/OFF
DI0	ON
DI1	OFF
DI2	OFF

(1) Roll feeding operation according to point table

(a) Setting of position block data

The number of data that may be set is 2 (position block No. s 0 to 1) as standard. Using the second feed distance signal (LSN), select position block No.1.

2-position point data

Position Block No.	Second Feed Distance (LSN)
0	OFF
1	ON

Using the parameter unit, set the position data (increment) in the position block of the position table data. At this time, do not enter any values into the M code and speed block No. items as they are invalid. For the position block setting procedure, refer to Section 3-5.

Position Block No.	Position Data	M Code	Speed Block No.
0	20000		
1	15000		

Position data: Increment of the servo motor

The unit ([mm], [inch]) and input range of the position data (increment) can be changed by setting parameter No.4.

Parameter No. 4

- - □ □

Set Value (STM)	Input Range (mm or Inch)
0	0 to +999.999
1	0 to +9999.99
2	0 to +99999.9
3	0 to +999999

Set Value	Unit
0	mm
1	inch

(b) Setting of speed block data

By setting parameter No.3, either linear or S-shaped acceleration/deceleration pattern can be selected. The number of speed blocks that may be set is 2 (speed block numbers 1, 2) as standard or 8 (speed block numbers 1 to 8) when the option card (MR-H-D01) is used.

Parameter No. 03

- - - □

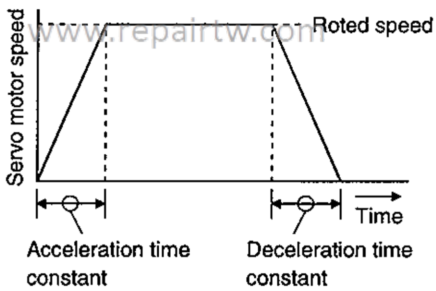
Set Value	Acceleration/Deceleration Pattern
0	Linear acceleration/deceleration
1	S-shaped acceleration/deceleration

For linear acceleration/deceleration pattern, to select the liner acceleration/deceleration pattern, set □□□0 in parameter No.3.

Speed Block No.	speed (r/min)	Acceleration Time Constant (ms)	Deceleration Time constant (ms)
1	2000	220	20
2	500	100	50
(3)	(1200)	(50)	(55)
⋮	⋮	⋮	⋮
(8)	(1500)	(20)	(30)

For the speed block setting method, refer to Section 4.5.4

Item	Description
Speed	0 to max. speed r/min
Acceleration/Deceleration Time constant	0 to 200000ms The acceleration and deceleration time constants set should be the lengths of time (ms) required for the servo motor to rise to and fall from the rated speed, respectively. (Refer to the chart on the right.)

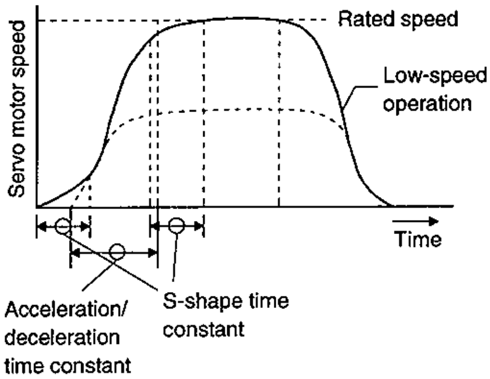


For S-shaped acceleration/deceleration pattern, smooths the rise and fall of servo motor rotation. Set □□□1 in parameter No.3.

Using the parameter unit, set the servo motor speed, acceleration/deceleration time constant and S-shape time constant in the speed block. The acceleration time constant is equal to the deceleration time constant.

Speed Block No.	Speed (r/min)	Acceleration/Deceleration Time Constant (ms)	S-Shape time constant (ms)
1	2000	1000	100
2	500	1500	200
(3)	(1200)	(1200)	(100)
⋮	⋮	⋮	⋮
(8)	(1500)	(2000)	(200)

Item	Description
Speed	0 to max. speed r/min
Acceleration/deceleration time constant	0 to 20000ms
S-shape time	100 to 450ms Set the S-shape time constant to 10-20% of the acceleration/deceleration time constant.



(c) Operation of the servo motor

When the setting of each point table is complete, select the position block number using the second feed distance signal (LSN). The relationship between the second feed distance signal and position block No.s are listed below:

2-position point data

Position Block No.	Second Feed Distance (LSN)
0	OFF
1	ON

Using the speed select signal, select the speed block number.

Standard (2 speed blocks)

Speed Block No.	Speed Selection (JFS)
1	ON
2	OFF

The relationships between the speed selection signal and speed block No.s are listed below:

MR-H-D01 used (8 speed blocks)

Speed Block No.	DI19	DI18	DI17
	bit2 (MSB)	bit1	bit0 (LSB)
1	0	0	0
2	0	0	1
3	0	1	0
⋮	⋮	⋮	⋮
8	1	1	1

3-bit binary, 0: OFF, 1: ON

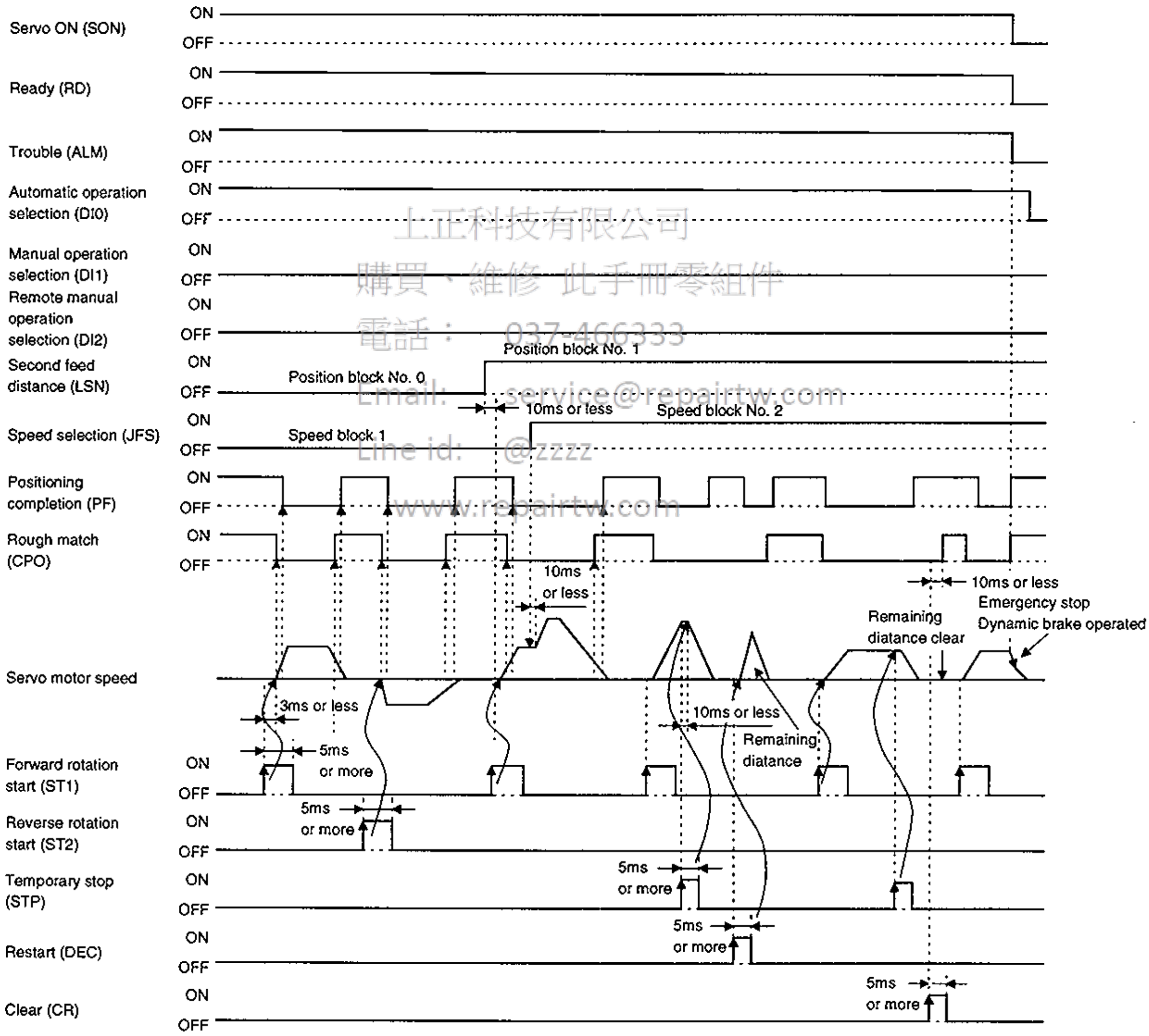
Switch on the forward rotation start (ST1) or reverse rotation start (ST2) to rotate the servo motor to the preset position. The rotation direction of the servo motor depends on the setting of parameter No.2. The relationship between the set value and servo motor rotation is as listed below:

Parameter No. 2

-	-		-

Set Value	Servo Motor Rotation Direction	
	ST1:ON	ST2:ON
0	CCW rotation (Current value increase)	CW rotation (Current value decrease)
1	CW rotation (Current value increase)	CCW rotation (Current value decrease)
2	CCW rotation (Current value decrease)	CW rotation (Current value increase)
3	CW rotation (Current value decrease)	CCW rotation (Current value increase)

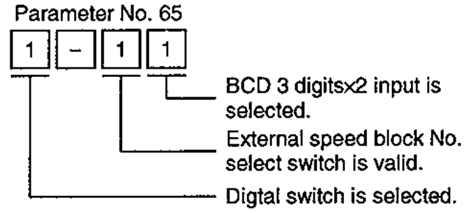
- The following is the timing chart after servo-on.



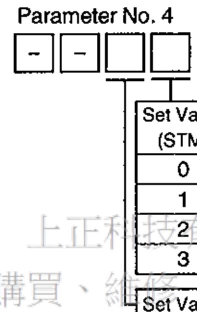
(2) Roll feeding operation under digital switch position command

This operation requires the option card (MR-H-D01) and digital switch (MR-DS60). For wiring, refer to Section 4.2.2

Set 1□11 in parameter No.65.



Using the digital switch (MR-DS60), set the position data (increment). The unit ([mm], [[inch]) and input range of the position data (increment) can be changed by setting parameter No.4.

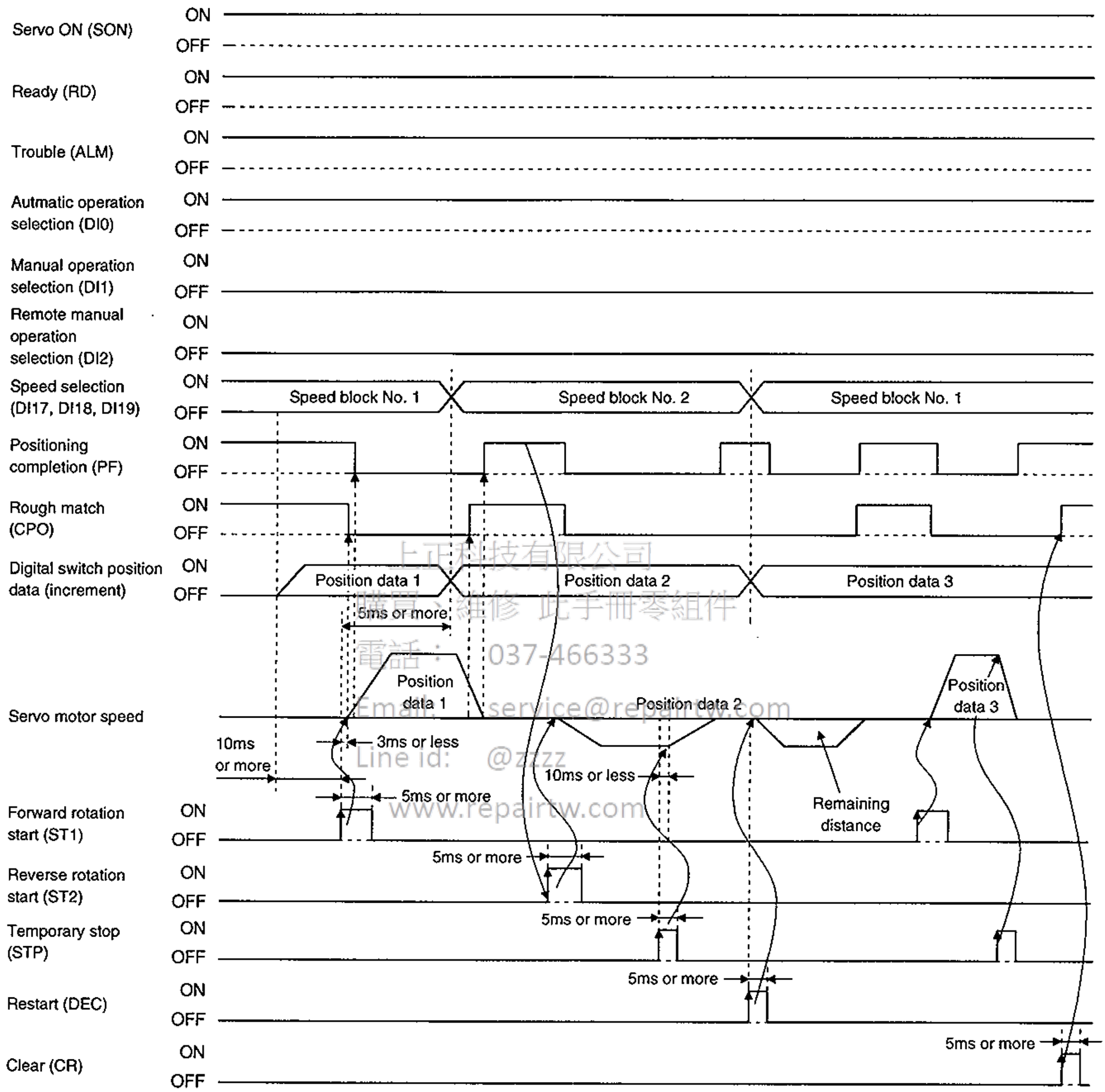


Set Value (STM)	Input Range (mm or inch)
0	0 to +999.999
1	0 to +9999.99
2	0 to +99999.9
3	0 to +999999

Set Value	Unit
0	mm
1	inch

Switch on the forward rotation start (ST1) or reverse rotation start (ST2) to rotate the servo motor to the preset position. Select the speed block as in the above-mentioned absolute command. The rotation direction of the servo motor depends on the setting of parameter No.2, as in (1), this Section.

• The following is the timing chart after servo-on.

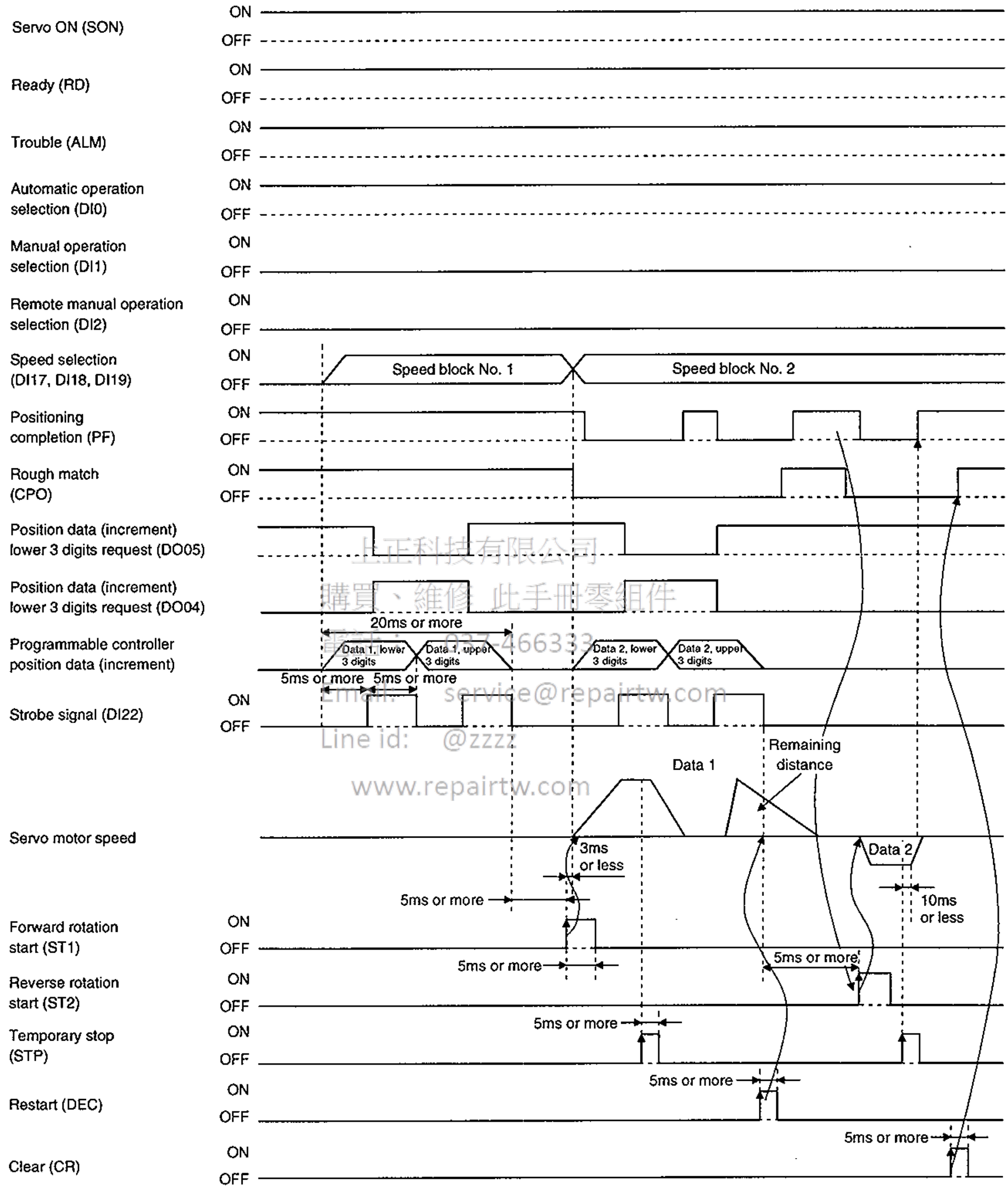


(3) Roll feeding operation under programmable controller position command

This operation requires the option card (MR-H-D01). For wiring, refer to Section 3.2.3. The relationship between the position data and strobe signal is as in (13), Section 3.3.3.

Set 0011 in parameter No.65.
Select the input range and speed block number of the position data as in "2) Positioning operation under digital switch position command."
Switch the forward rotation start (ST1) or reverse rotation start (ST2) on to rotate the servo motor to the preset position. For the rotation direction of the servo motor, refer to "c. Operation of the servo motor "in "1) (1), this Section"

• The following is the timing chart after servo-on.



4.5 Point Table Date Setting Procedures

(1) Position block data input

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA] (call the data setting mode screen). Press [▲] / [▼] to select the block to be set (select the position block). Press [↵] to define the block to be set (define the position block).	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	press [0] on the ten-key pad to specify the position block number to be set (for 0). Press [↵] to define the position block number to be set.	<Pos. set> Block No. 0 Read:↵
3)	If the key press is wrong, press [STOP/RESET] to return to step 2).	<Pos. set> Block No. 300 Error :RST
4)	press [▲] / [▼] to specify the position block number to be set (for 0). Press [↵] to define the position block number to be set.	0→ 12345.0 1→ 78901.2
5)	Press [▲]/ [▼]to select the data field into which data is to be input (select the position data). Press [↵] to define the data field into which data is to be input (define the position data).	0 Pos.Bloc ▲ →Pos. 12345.6 M code Speed No ▼
6)	Press [D7], [E8], [STEP ·] and [F9] on the ten-key pad to enter position data (for 78.9). Press [↵] to write the position data and press [CAN] to return to step 1). Position block input complete press [CAN] twice to return to step 4).	0 Position ▲ 12345.6 78.9 Write: ↵ mm ▼
7)	If the key pressed is wrong, press [STOP/RESET] to return to step 6), or press [CAN] to return to step 5).	0 Position ▲ 12345.6 Error :RST ▼

(2) Speed block data input

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA] (call the data setting screen). Press [▲] / [▼] to select the block to be set (select the speed block). Press [↵] to define the block to be set.	<Set mode> ▲ Pos. Block →Speed Block Edit :HELP ▼
2)	Press [1] on the ten-key pad to specify the speed block number to be set (for 1). Press [↵] to define the speed block number to be set.	<Speed. set> Block No. 1 Read:↵
3)	If the key pressed is wrong, press [STOP/RESET] to return to step 2).	<Speed. set> Block No. 9 Error :RST
4)	Press [▲] / [▼] to specify the speed block number to be set (for 1). Press [↵] to define the speed block number to be set.	1→ 2000.0 ▲ 2→ 1000.0 3→ 3000.0 4→ 0.0 ▼
5)	On the data list screen, press [▲] / [▼] to select the data field into which data is to be input (select the speed). Press [↵] to define the data field into which data is to be input (define the speed).	1 SpeedBlock ▲ →Speed 2000.0 Acc 20000 Dec 20000 ▼
6)	On the input screen, press [3] [0] [0] [0] on the ten-key pad to enter the speed (for 3000r/min). Press [↵] to write the speed and press [CAN] to proceed to step 7).	1 Ref.Speed ▲ 2000.0 3000.0 Write:↵ r/min ▼
7)	On the data list screen, press [▲] / [▼] to select the data field into which data is to be input (select the acceleration time constant). Press [↵] to define the data field into which data is to be input (define the acceleration time constant).	1 SpeedBlock ▲ Speed 3000.0 →Acc 20000 Dec 20000 ▼
8)	On the input screen, press [1] [^{A}4] [^{B}5] [^{C}6] [^{D}7] on the ten-key pad to enter the acceleration time constant (for 14567m). Press [↵] to write the acceleration time constant and press [CAN] to proceed to step 9).	1 Acc time ▲ 20000 14567 Write:↵ msec ▼
9)	On the data list screen, press [▲] / [▼] to select the data field into which data is to be input (select the deceleration time constant). Press [↵] to define the data field into which data is to be input (define the deceleration time constant).	1 SpeedBlock ▲ Speed 3000.0 Acc 14567 →Dec 10000 ▼
10)	On the input screen, press [1] [^{A}4] [^{B}5] [^{C}6] [^{D}7] on the ten-key pad to enter the deceleration time constant (for 14567m). Press [↵] to write the deceleration time constant. Speed block input complete. Press [CAN] twice to return to step 4).	1 Dec time ▲ 10000 14567 Write:↵ msec ▼
11)	If the key pressed is wrong, press [STOP/RESET] to return to the input screen, or press [CAN] to return to the data list screen.	1 Dec time ▲ 20000 99999 Error :RST ▼

(3) Data copy

This function reads the point table data (position blocks, speed blocks) of the MR-H-ACN to the parameter unit and writes them from the parameter unit. By using this function, data can be read once to the parameter unit and then copied to the other MR-H-ACN.

(a) Data read

Reads data from the MR-H-ACN to the parameter unit.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲] / [▼] to specify the mode (specify). Press [↵] to define the mode. If the key press is wrong, press [STOP/RESET] or [CAN] to return to step 1).	<DATA COPY> ▲ →READ WRITE COMPARE ▼ <DATA COPY> Read ? Yes: ↵ No:RST
3)	Read complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE Mode sel.:CAN

(b) Data verify

Verifies the data in the parameter unit with that in the MR-H-ACN.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲] / [▼] to specify the mode (specify). Press [↵] to define the mode.	<DATA COPY> ▲ →READ WRITE COMPARE ▼ <DATA COPY> Comparing Not Power Off
3)	Verify complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE Mode sel.:CAN
4)	When incorrect data exists in the data verified Press [SHIFT] to check incorrect data numbers. When incorrect data overflows a single screen, press [▲] / [▼] to switch to the preceding/next screen. Press [CAN] to return to step 1). [SHIFT]	<DATA COPY> Compare Er. Error No.:SFT Mode sel.:CAN Er.Data No. ▲ P010P P010S P050M P185M P185S S002V ▼

Error number make-up

□ □□ □□

Data item

Block number

Data block identification
P: Position block
S: Speed block

Position Block		Speed Block	
P	Position	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(c) Data write

Writes the data in the parameter unit to the MR-H-ACN.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲] / [▼] to specify the mode (specify). Press [↲] to define the mode.	<DATA COPY> ▲ →READ WRITE COMPARE ▼
3)	When write is inhibited Press [CAN] to return to step 1).	<DATA COPY> Write Inhibit SON ALM Press "CAN"
4)	Press [↲] to execute write. Press [STOP/RESET] to step write and return to step 1).	<DATA COPY> Write ? Yes:↲ No:RST <DATA COPY> Writeing Not Power Off
5)	Write complete Press [CAN] to return to step 1).	<DATA COPY> COMPLETE →Power Off
6)	When incorrect data exists in the data written 1. Press [↲] to write only the correct data. 2. Press [STOP/RESET] to stop write and return to step 1). 3. Press [SHIFT] to check incorrect data numbers. When incorrect data overflows a single screen, press [▲] / [▼] to switch to the preceding/next screen. [SHIFT]	ErrorNo.:SFT Right Data Write Yes:↲ No:RST Wrong Data ▲ P000P P001P S001V S001A S101D S002V ▼

Error number make-up

□□□□□

- Data block identification
  P: Position block
  S: Speed block
- Block number
- Data item

Position Block		Speed Block	
P	Psition	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(4) Point table data edition

(a) Position block data insertion

Inserts data into the specified position block on a block basis.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [HELP] (position block edition initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲] / [▼] to specify the mode (specify). Press [↵] to define the mode (define).	<Pos. Edit> ▲ →INSERT DELETE ▼
3)	Press [0] on the ten-key pad to specify the block number into which data is to be inserted (for No.0). Press [↵] to execute insertion.	<Block Ins.> Block No. 0 Yes:↵ No:RST
4)	During insertion Data in block No.0 is shifted to No1 and No.0 is vacated. On completion of insertion, the positioning address list screen is displayed.	<Block Ins.> Inserting Not Power Off 0→ 0.0 ▲ 1 78901.2 ▼
5)	When insertion cannot be performed (outside the block number setting range) Press [STOP/RESET] to return to step 3).	<Block Ins.> Block No. 2 Error:RST
6)	When the data of the last block will be deleted by executing insertion Press [STOP/RESET] to return to step 3. Press [↵] to execute insertion.	<Block Ins.> No. 1 Delete Yes:↵ No:RST

(b) Position block data deletion

Deletes the position data of the specified position block number.

Step	Parameter Unit Operation	Parameter Unit Screen
1)	Press [PARAM/DATA]. Press [HELP] (position block edition initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲] / [▼] to specify the mode (specify). Press [↵] to define the mode (define).	<Pos. Edit> ▲ INSERT →DELETE ▼
3)	Press [0] on the ten-key pad to specify the block number from which data is to be deleted (for No.0). Press [↵] to execute deletion	<Block Del.> Block No. 0 Yes:↵ No:RST
4)	During deletion Data in block No.0 is deleted, the data in No.1 is shifted to No.0, and No.1 is vacated. On completion of deletion, the positioning address list screen is displayed.	<Block Del.> Deleting Not Power Off 0→ 3000.0 ▲ 1 0.0 ▼
5)	When deletion cannot be performed (outside the block number setting range) Press [STOP/RESET] to return to step 3).	<Block Del.> Block No. 2 Error:RST

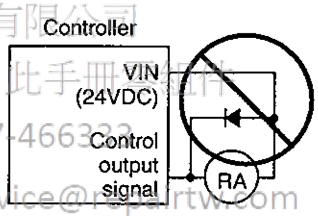
5. SIGNALS AND WIRINGS

⚠ 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 controller and the servo motor securely.
- Do not attempt to wire the controller 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.

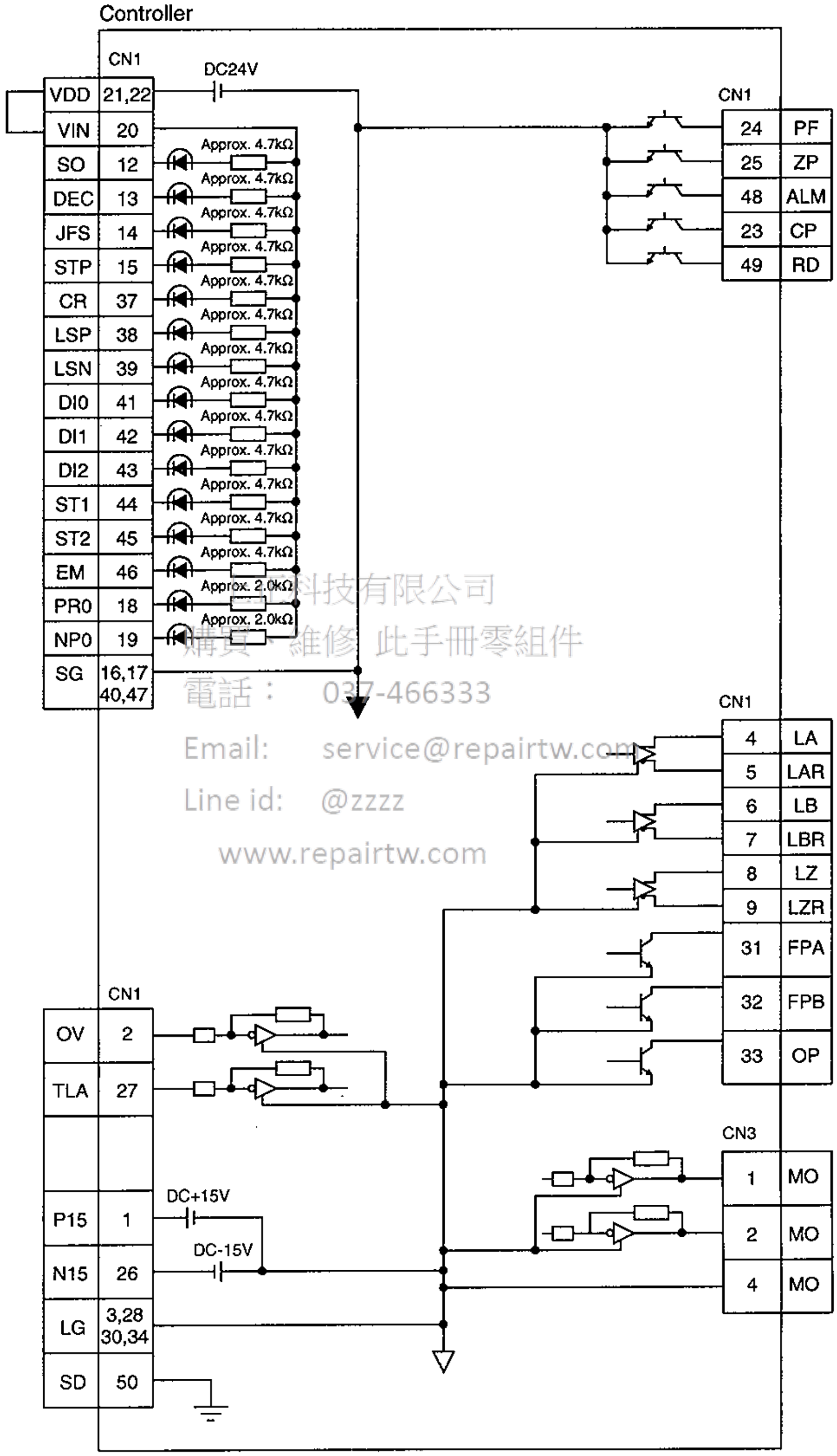
⚠ CAUTION

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



- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the controller.
- 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.

5.1 Internal Connection Diagram of Servo Amplifier

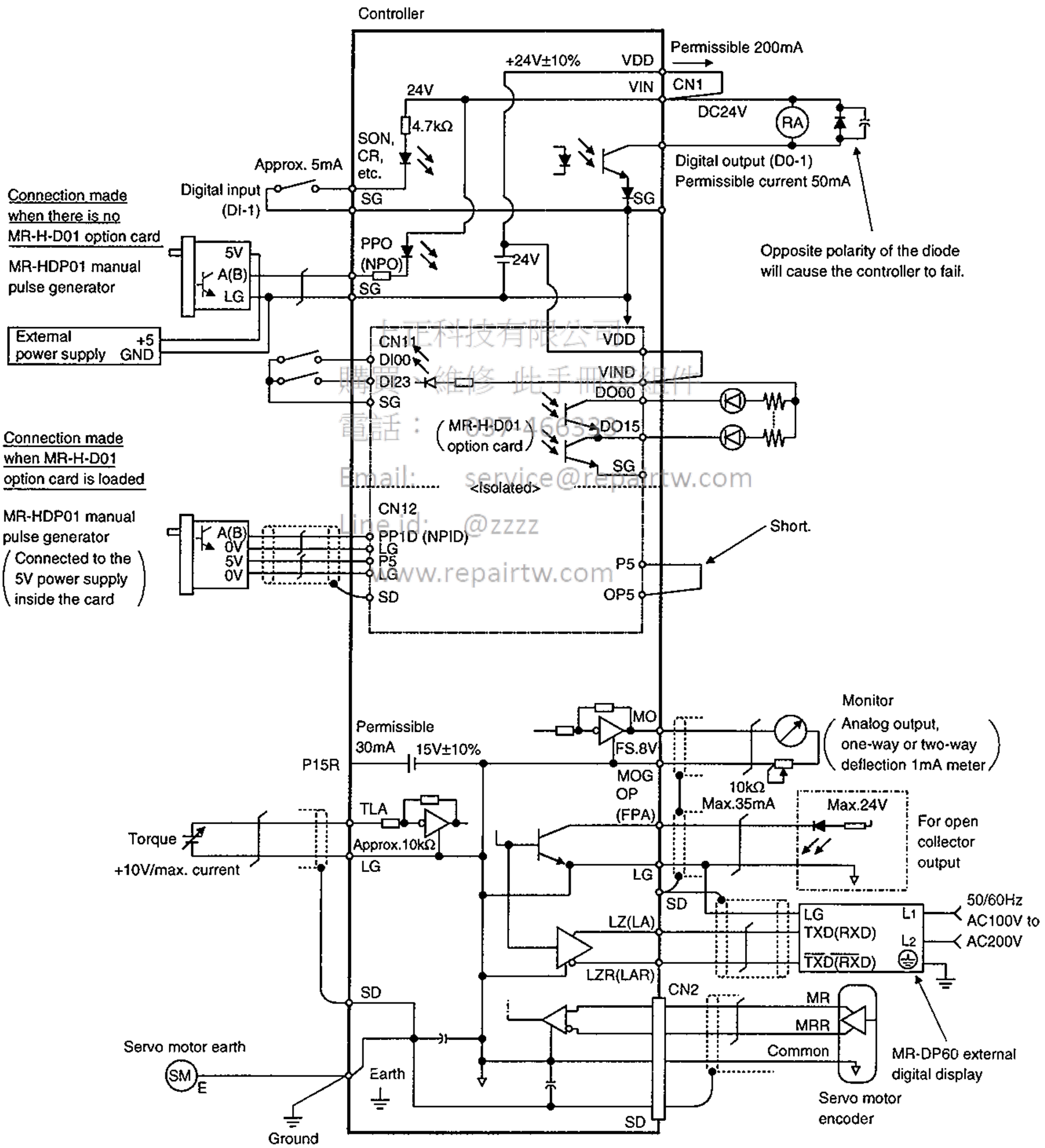


5.2 Interfaces

5.2.1 Common line

POINT
• Do not connect SG, LG and SD externally.

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

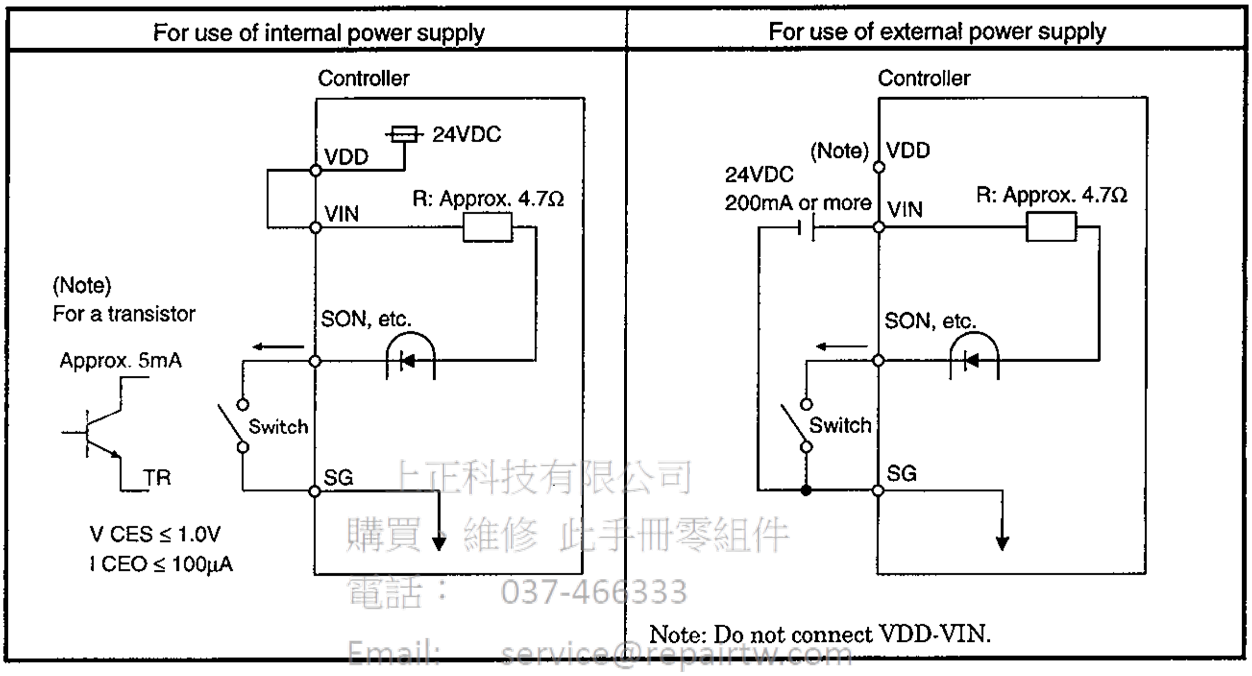


5.2.2 Detailed description of the interfaces

This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in Sections 3.3.2 or Sections 4.3.2.
Refer to this section and connect the interfaces with the external equipment.

(1) Digital input interface DI-1

Give a signal with a relay or open collector transistor.

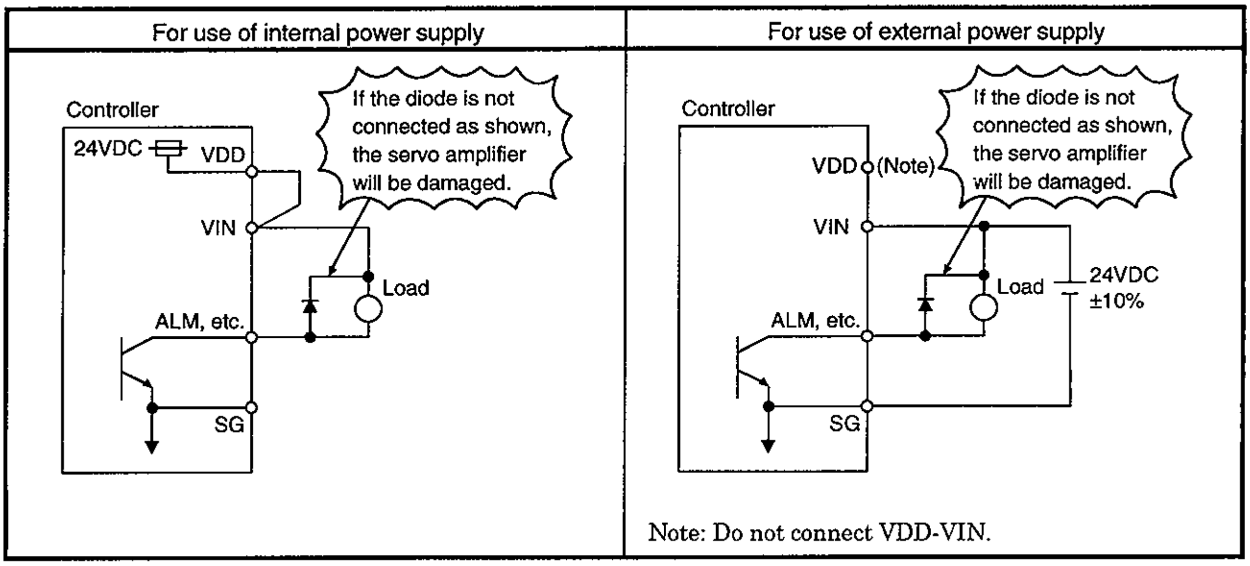


Note: This also applies to the use of the external power supply.

(2) Digital output interface DO-1

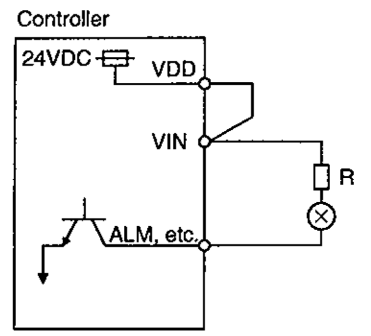
A lamp, relay or photocoupler can be driven. Provide a diode (D) for an inductive load, or an inrush current suppressing resister (R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less)

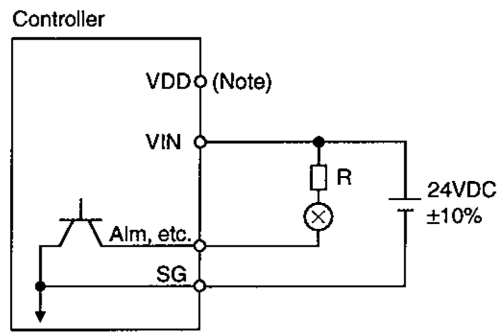
1) Inductive load



2) Lamp load

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





Note: Do not connect VDD-VIN.

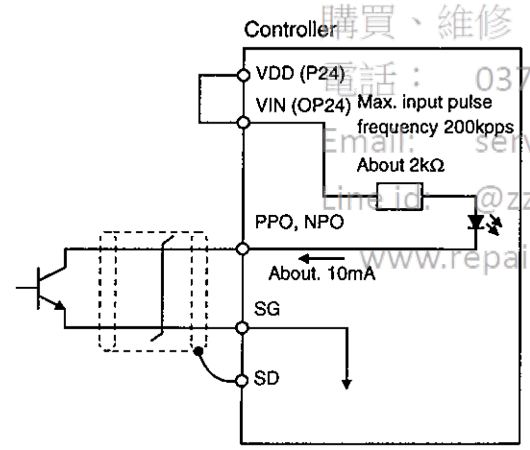
(3) Manual pulse generator input interface DI-2

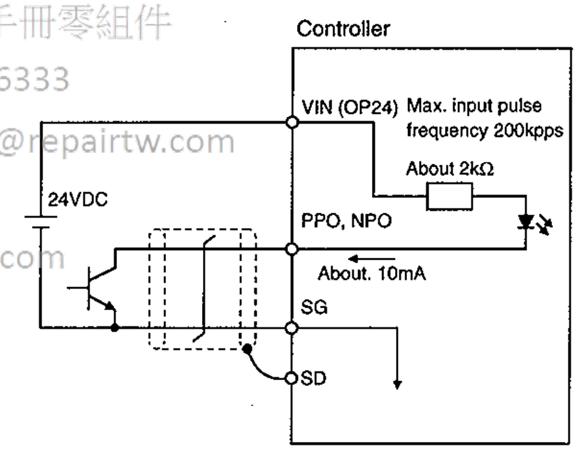
Provide a pulse train signal in the open collector system.

(a) Open collector system

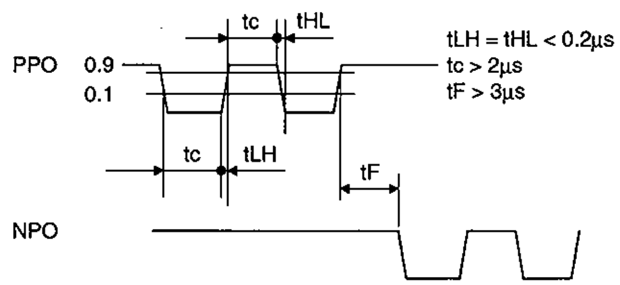
1) Interface

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





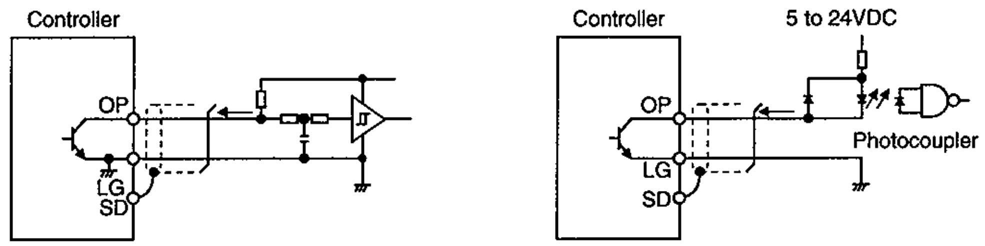
2) Conditions of the input pulse



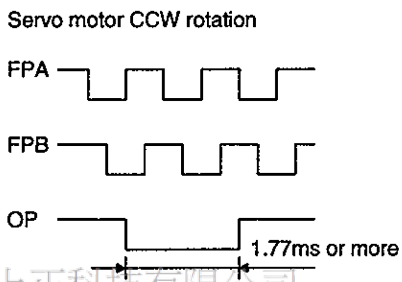
(4) Encoder pulse output DO-2

(a) Open collector system

1) Interface



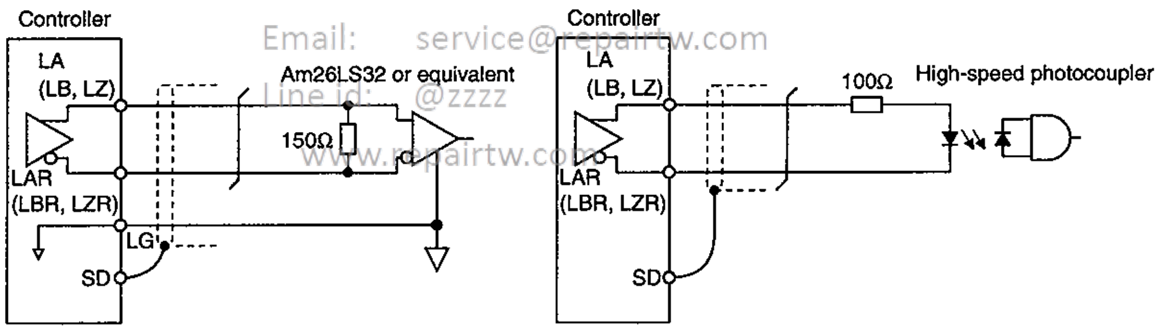
2) Output pulse



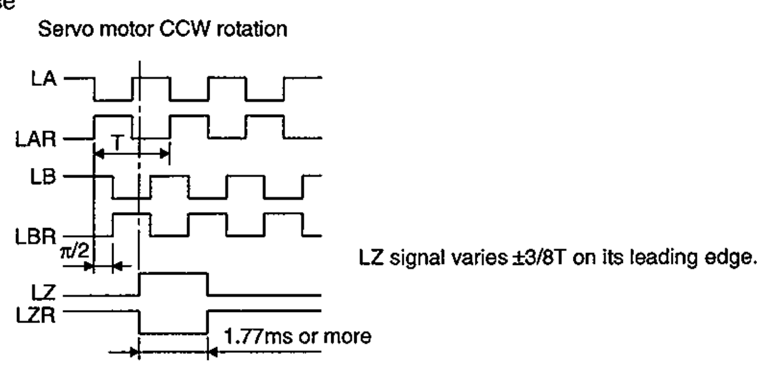
(b) Differential line driver system

1) Interface

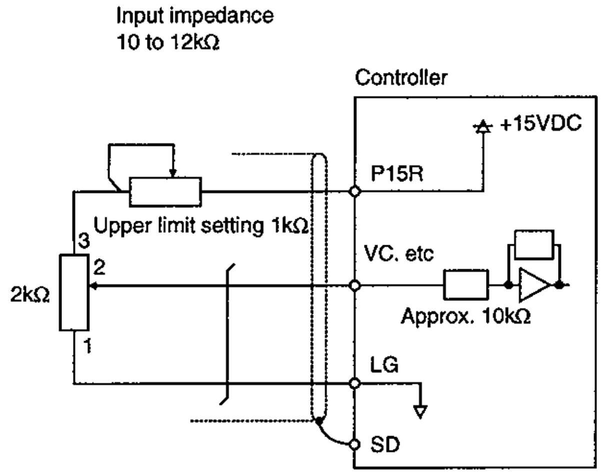
Max. output current: 35mA



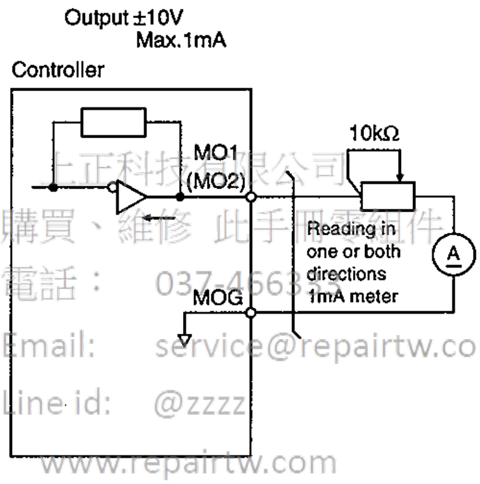
2) Output pulse



(5) Analog input



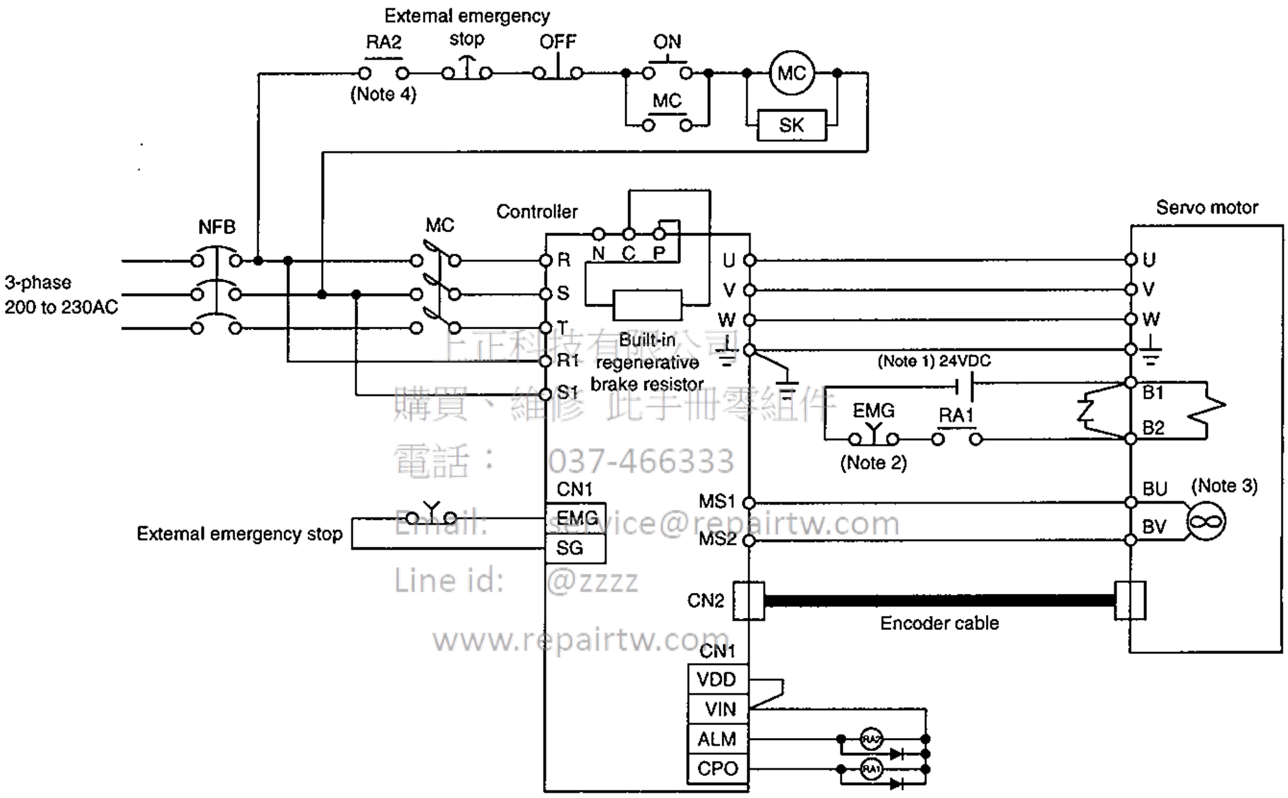
(6) Analog output



5.3 Power Line Circuit

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

5.3.1 Connection example



Note: 1. The interface 24VDC power supply (VDD) of the servo amplifier cannot be used. Always prepare a power supply dedicated to electromagnetic brake. The power supply connected to the lead (blue) of the electromagnetic brake should be wired independently of polarity.
2. When the usage is as described in Section 5.5.2 (2), do not connect the EMG switch.
3. For HA-LH11K2 or more.
4. Configure up a power circuit which will switch off the magnetic contactor after detection of an alarm.

5.3.2 Terminal

The arrangement and signal layout of the terminal block change with the controller capacity. Refer to Section 13.2.1.

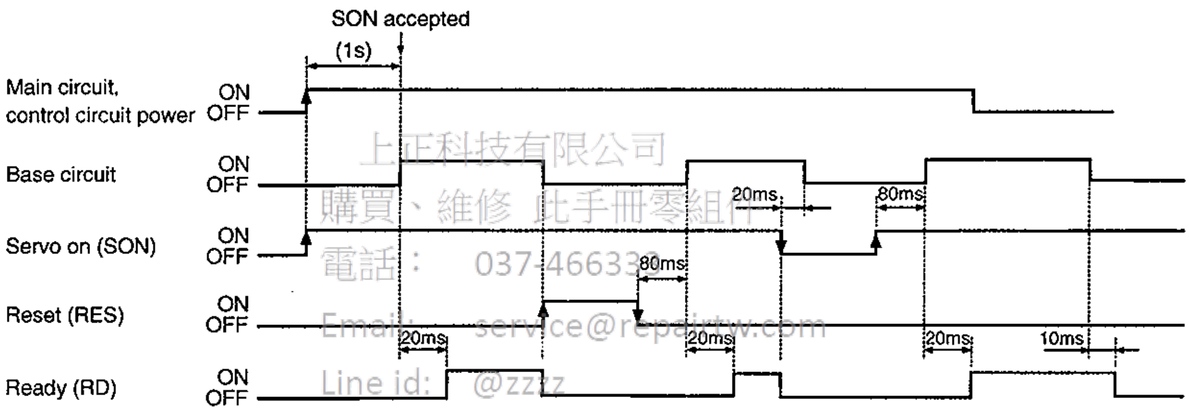
Symbol	Signal	Description
R · S · T	Main circuit power supply	Main circuit power input terminals Connect a three-phase 200 to 230VAC, 50/60Hz power supply to R, S, T. For MR-H700ACN-UE or more, the voltage of 50Hz power is 200 to 220V.
U, V, W	Servo motor output	Servo motor power output terminals Connect to the servo motor power supply terminals (U, V, W).
$R_1 \cdot S_1$	Control circuit power supply	Control circuit power input terminals L11 and L21 should be in phase with L1 and L2, respectively. Connect a single-phase 200 to 230VAC, 50/60Hz power supply. For MR-H700ACN or more, the voltage of 50Hz power is 200 to 220V.
P, C, D	Regenerative brake	Regenerative brake option connection terminals The MR-H400ACN to MR-H700ACN are factory-connected with a built-in regenerative brake resistor. When using the regenerative brake option, brake unit or power return converter, always connect it after removing the wiring of the built-in regenerative brake resistor connected across P-C. For MR-H11KACN or more, always connect the supplied regenerative brake resistor across P-C.
MS1 · MS2	Servo motor fan	Servo motor fan power supply terminals Connect to the cooling fan which is built in the HA-LH11K2 to HA-LH22K2 servo motors. Provided for the controllers of MR-H11KACN or more.
⏚	Grounding	Ground terminal Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.

5.3.3 Power-on sequence

(1) Power-on procedure

1) Always wire the power supply as shown in above Section 5.3.1 using the magnetic contactor with the main circuit power supply. Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.
2) Switch on the control circuit power supply L11, L21 simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the controller will operate properly.
3) The controller can accept the servo-on signal (SON) about 1 second after the main circuit power supply is switched on. Therefore, when SON is switched on simultaneously with the three-phase power supply, the base circuit will switch on in about 1 second, and the ready signal (RD) will switch on in further about 20ms, making the controller ready to operate.

(2) Timing chart

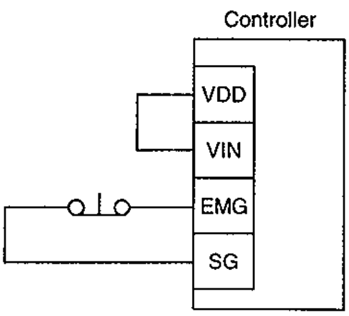


(3) Emergency stop

⚠ CAUTION	• To stop operation and switch power off immediately, provide an external emergency stop circuit.

Make up a circuit which shuts off main circuit power as soon as EMG-SG are opened at an emergency stop. To ensure safety, always install an external emergency stop switch across EMG-SG. By disconnecting EMG-SG, the dynamic brake is operated to bring the servo motor to a sudden stop. At this time, the display shows the servo emergency stop warning (ALE6).

During ordinary operation, do not use the external emergency stop signal to alternate stop and run. For the MR-H-ACN, if the start signal is on or a pulse train is input during an emergency stop, the servo motor will rotate as soon as the warning is reset. During an emergency stop, always shut off the run command.



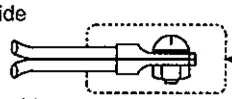
5.4 Connection of Controller and Servo Motor

5.4.1 Connection instructions

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

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

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



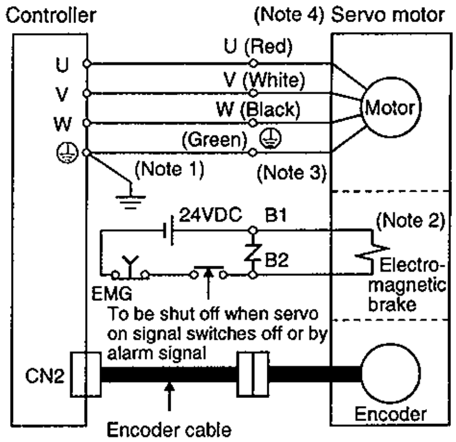
(2) For grounding, connect the earth cable of the servo motor to the ground terminal of the controller and connect the ground cable of the controller to the earth via earth plate of the control box.

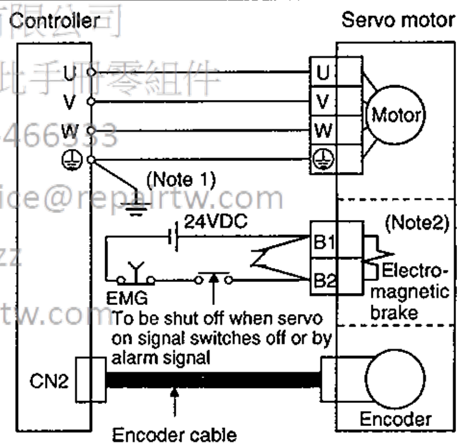
(3) Supply exclusive 24VDC power to the brake lead of the servo motor with electromagnetic brake.

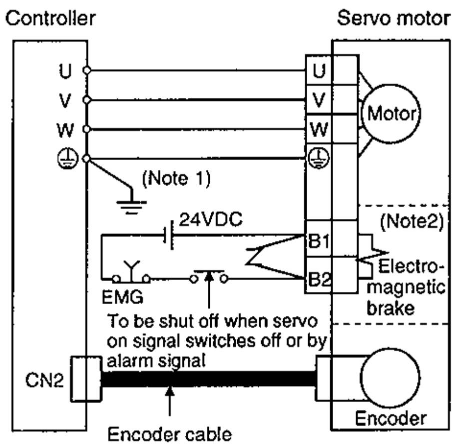
The connection method differs according to the series and capacity of the servo motor and whether or not the servo motor has the electromagnetic brake. Perform wiring in accordance with this section.

5.4.2 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 15.2.1. For encoder cable connection, refer to Section 15.1.6.
For the signal layouts of the connectors, refer to Section 5.2.2.

<table>
<tr><th>Servo Motor</th><th>Connection Diagram</th></tr>
<tr><td>HA-LH11K2 to HA-LH22K
HC-MF053 (B) (-UE) to
HC-MF73 (B) (-UE)
HA-FF053 (B) to HA-FF63 (B)
HC-UF13 (B) to HC-UF73 (B)</td><td>


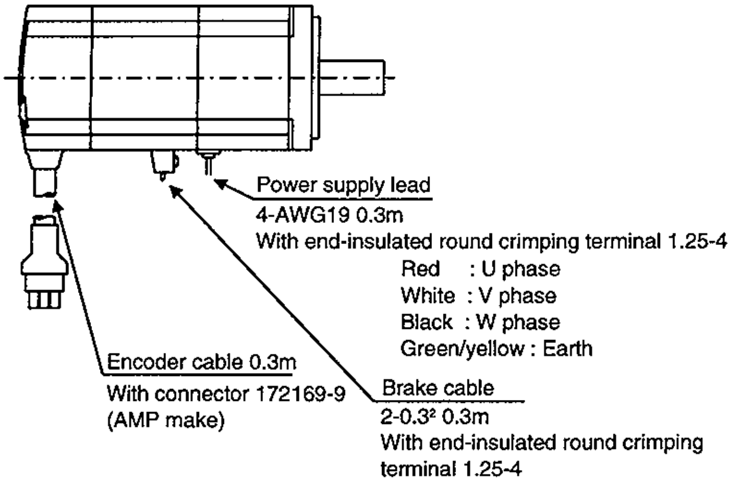
Note 1. To prevent an electric shock, always connect the earth terminal of the controller to the earth of the control box.
2. This circuit applies to the servo motor with electromagnetic brake.
3. For the HA-FF series, connect the ground cable to the earth terminal of the servo motor.
4. The HA-LH11K2 to HA-LH22K2 are equipped with a cooling fan. For wiring, refer to Section 5.4.4.
</td></tr>
<tr><td>HA-FF053 (B)-UE to HA-FF63C (B)-UE
HC-SF121 (B) to HC-SF301 (B)
HC-SF202 (B) to HC-SF702 (B)
HC-SF203 (B) · HC-SF353 (B)
HC-UF202 (B) to HC-CF502(B)</td><td>


Note 1. To prevent an electric shock, always connect the earth terminal of the controller to the earth of the control box.
2. This circuit applies to the servo motor with electromagnetic brake.
</td></tr>
<tr><td>HC-SF52 (B) to HC-SF152 (B)
HC-RF103 (B) to HC-RF503 (B)
HC-UF72 (B) · HC-UF152 (B)</td><td>


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

5.4.3 Details of the servo motor side

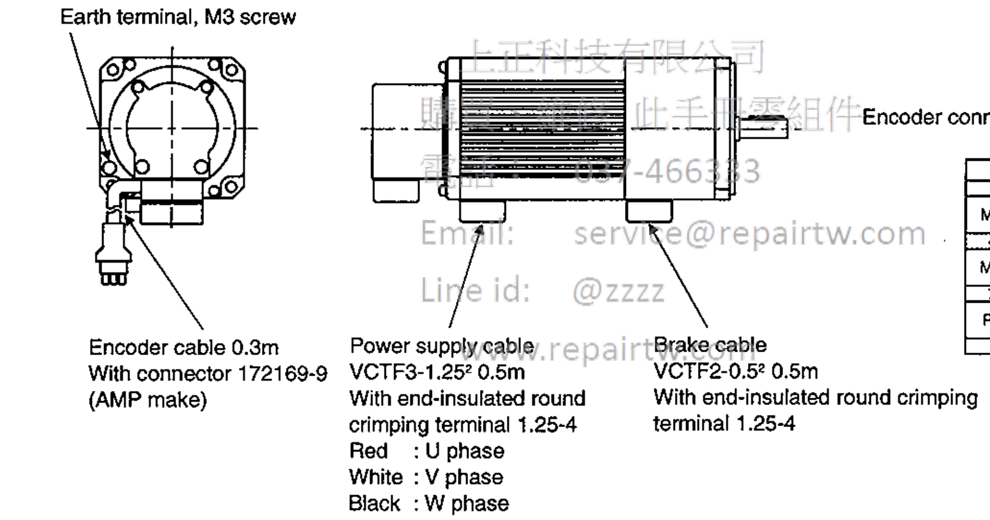
(1) HC-MF(-UE) series



Encoder connector signal arrangement

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

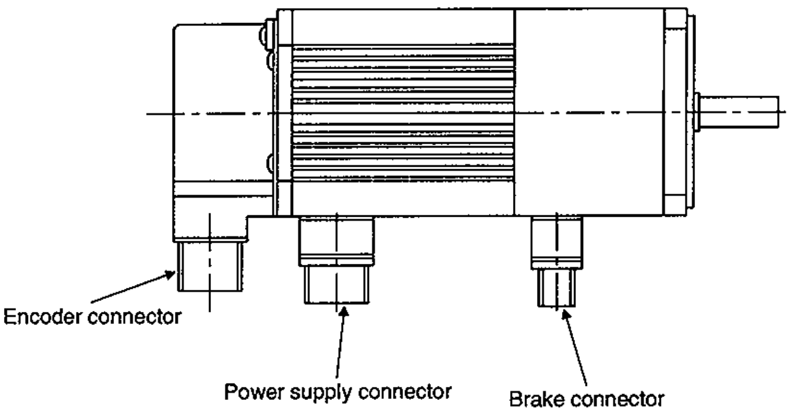
(2) HA-FF series



Encoder connector signal arrangement

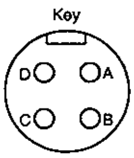
1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	CNT
7	8	9
P5	LG	SHD

(3) HA-FF□C(B)−UE series



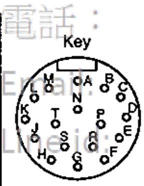
Servo Motor	Connector		
	For Power Supply	For Encoder	For Brake
HA-FF053C(B)-UE to HA-FF63C(B)-UE	CE05-2A14S-2PD-B	MS3102A20-29	MS3102E10SL-4P

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



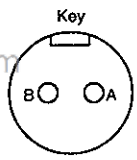
Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

Encoder connector signal arrangement
MS3102A20-29P



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

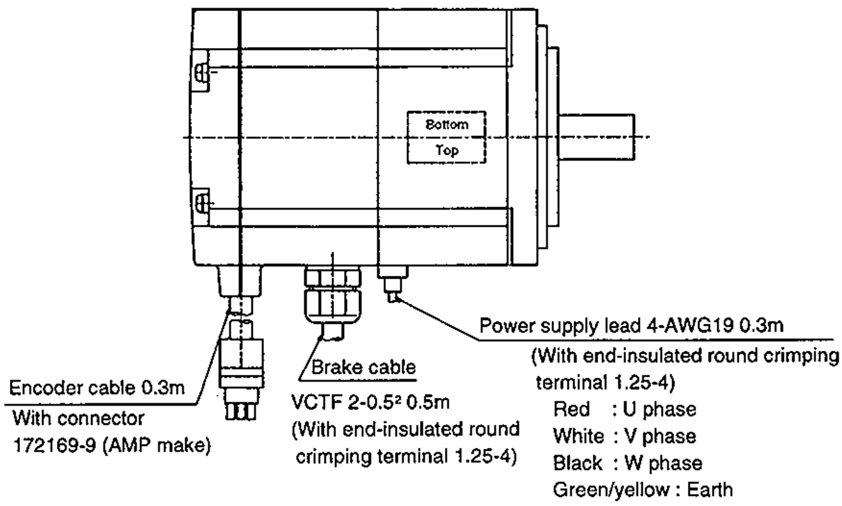
Brake connector signal arrangement
MS3102E10SL-4P



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

Note: 24VDC without polarity.

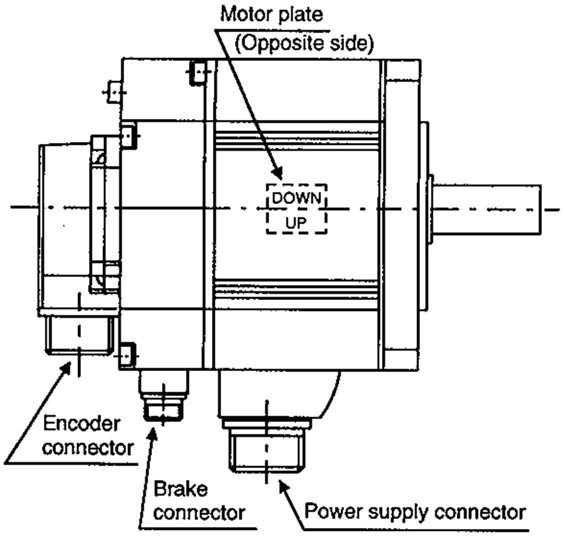
(4) HC-UF(B) 3000r/min series



Encoder connector signal arrangement

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

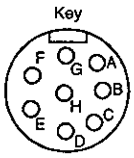
(5) HC-SF□(B) · HC-RF□(B) · HC-U□(B)F2000 r/min series



Servo Motor	Servo Motor Side Connectors		
	For Power Supply	For Encoder	Electromagnetic Brake Connector
HC-SF81(B) HC-SF52(B) to 152(B) HC-SF53(B) to 153(B)	CE05-2A22-23PD-B	MS3102A20-29P	Also used by power supply
HC-SF121(B) to 301(B) HC-SF202(B) to 502(B) HC-SF203(B)·353(B)	CE05-2A24-10PD-B		MS3102A10SL-4P
HC-SF702(B)	CE05-2A32-17PD-B		Also used by power supply
HC-RF103(B) to 203(B)	CE05-2A22-23PD-B		
HC-RF353(B)·503(B)	CE05-2A24-10PD-B		
HC-UF72(B)·152(B)	CE05-2A22-23PD-B		
HC-UF202(B) to 502(B)	CE05-2A24-10PD-B		MS3102A10SL-4P

Power supply connector signal arrangement

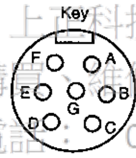
CE05-2A22-23PD-B



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

Note: 24VDC, without polarity

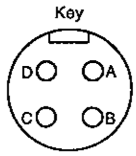
CE05-2A24-10PD-B



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

Note: 24VDC, without polarity

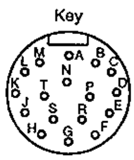
CE05-2A32-17PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

Encoder connector signal arrangement

MS3102A20-29P

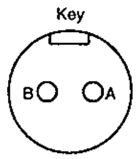


Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAD
G	LG
H	
J	

Pin	Signal
K	
L	
M	CNT
N	SHD
P	
R	LG
S	P5
T	

Electromagnetic brake connector signal pin-outs

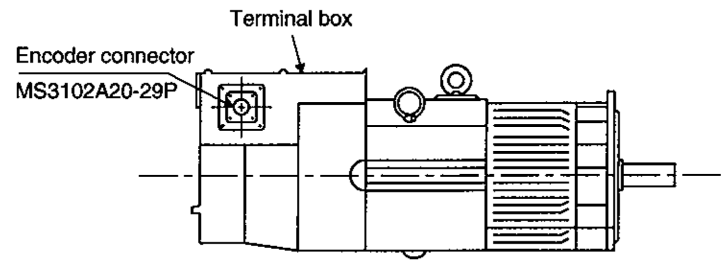
MS3102E10SL-4P



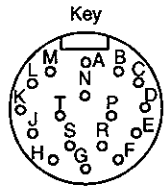
Pin	Signal
A	(Note) B1
B	(Note) B2

Note: 24VDC without polarity

(6) HA-LH11K2(-EC) to HA-LH22K2(-EC)



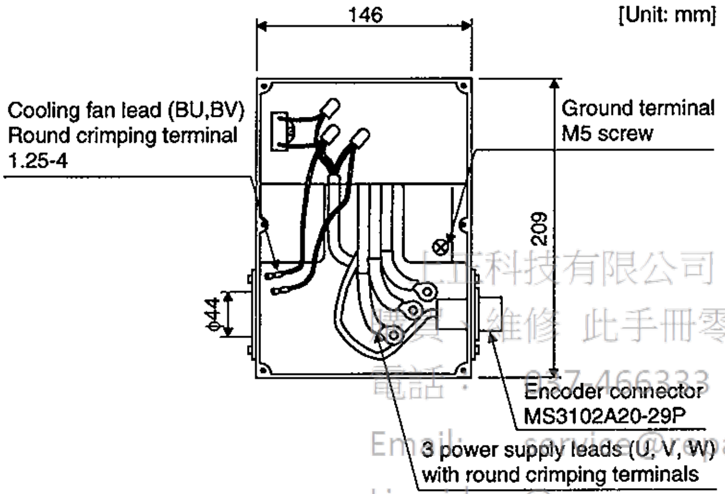
Encoder connector signal arrangement
MS3102A-29P



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

Pin	Signal
K	
L	
M	CNT
N	SHD
P	
R	LG
S	P5
T	

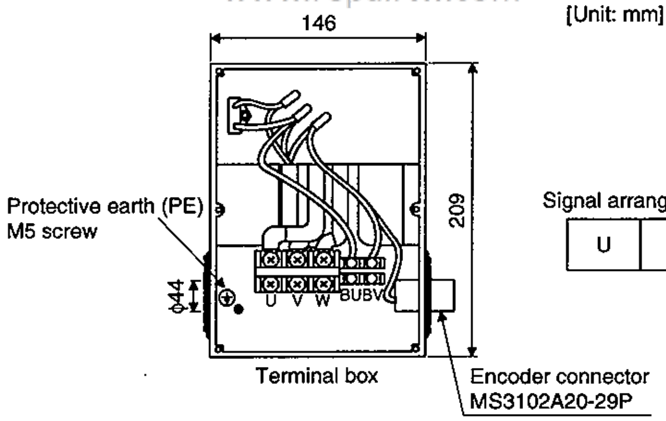
(a) Terminal box of HA-LH11K2 to HA-LH22K2



Power supply connection screw size

Servo Motor	Power Supply Connection Screw Size
HA-LH11K2	8-6
HA-LH15K2 · 22K2	14-6

(b) Terminal box of HA-LH11K2-EC to HA-LH22K2-EC Protective earth (PE)



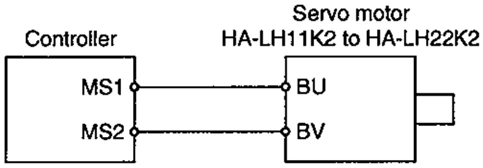
Signal arrangement of terminal block

U	V	W	BU	BV

Servo Motor	Power Supply Connection Screw Size	Fan Connection Screw Size
HA-LH11K2-EC	M6	M4
HA-LH15K2-EC · LH22K2-EC	M8	M4

5.4.4 Servo motor fan (HA-LH11K2 to HA-LH22K2)

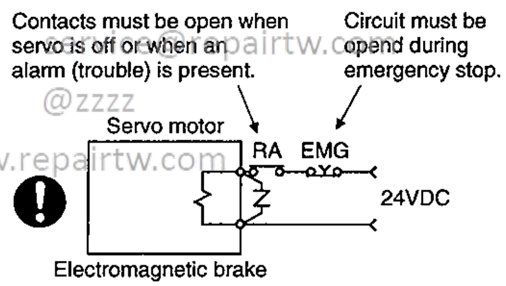
The 11kW or more of the HA-LH series are of totally-enclosed, force-cooled type. When performing operation, supply power to the cooling fan terminals (BU, BV) to operate the cooling fan. (Single-phase 200V, 35W)
Connect the fan terminals (BU, BV) of the servo motor to the cooling fan power terminals MS1, MS2 of the controller.



5.5 Servo Motor with Electromagnetic Brake

CAUTION

- The electromagnetic brake 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.
- Configure the electromagnetic brake operation circuit so that it is activated not only by the controller signals but also by an external emergency stop signal.



Use a servo motor with electromagnetic brake which is designed to prevent a load drop on a vertical shaft or which ensures double safety at an emergency stop. When using the servo motor with electromagnetic brake, set □□□1 in parameter No. 3 to make the electromagnetic brake interlock signal available. When this signal is used, the zero speed detection signal is made unavailable.
Refer to the connection diagram in Section 5.3.1 and make connection.

5.5.1 Wiring instructions

1) Do not share the 24VDC interface power supply between the interface and electromagnetic brake. Always use the power supply designed exclusively for the electromagnetic brake.
2) The brake will operate when the power (24VDC) switches off.
3) The electromagnetic brake has no polarity. When connecting the power supply, wire it independently of polarity.

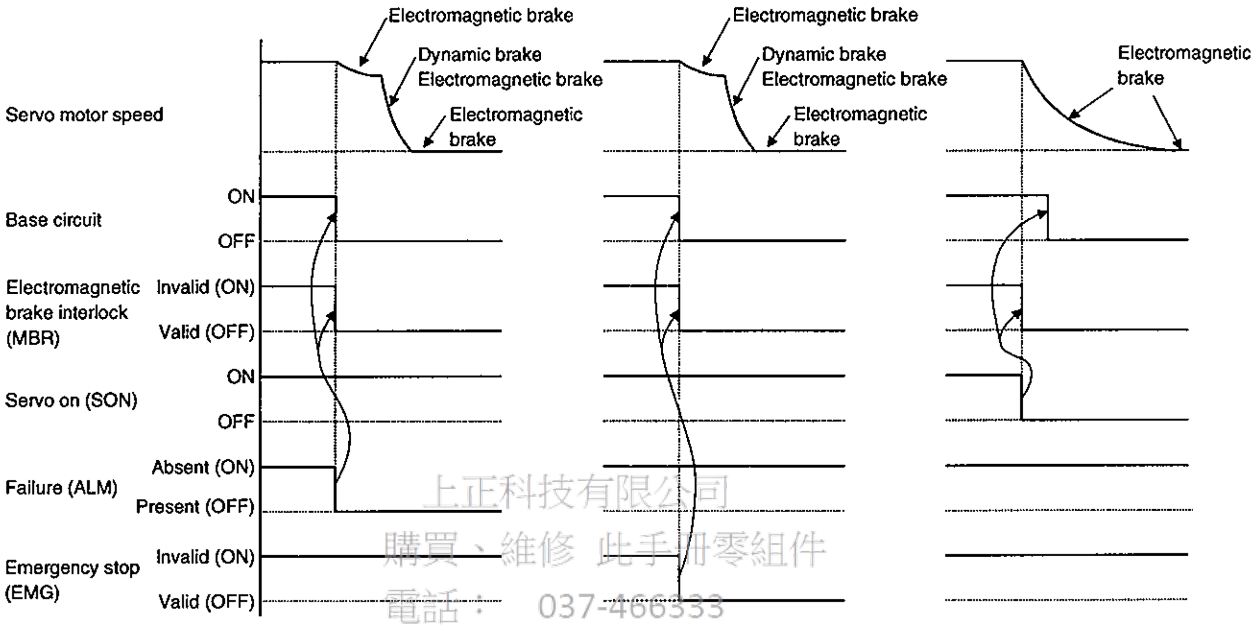
5.5.2 Operation of electromagnetic brake

(1) Electromagnetic brake operates when alarm occurs, emergency stop is valid, or SON signal is off

(a) Setting

Set □0□□ (initial value) in parameter No. 44.

(b) Timing chart



(a) When alarm occurs (b) When emergency stop is valid (c) When SON signal is off (servo off)

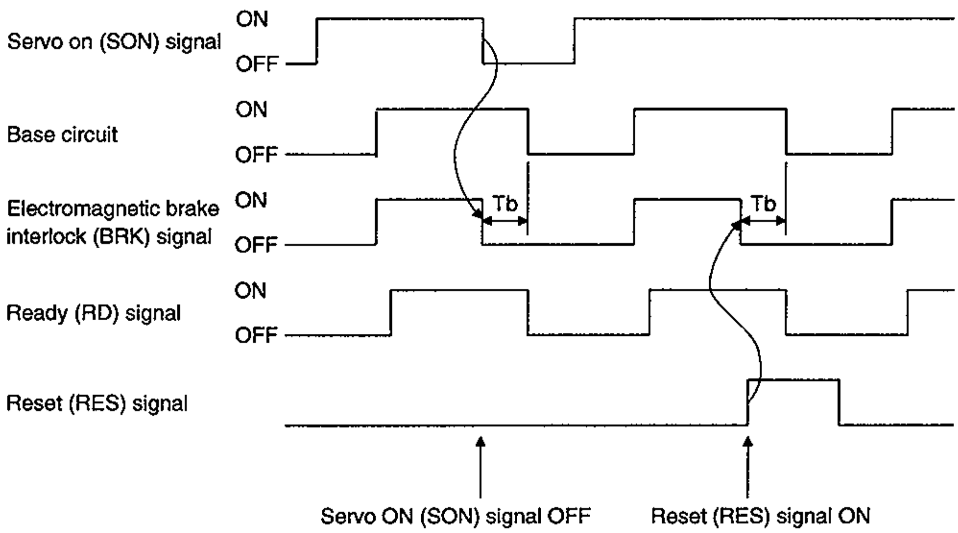
(2) Electromagnetic brake operates under the condition in (2) (b) of this section and at zero speed

(a) Setting

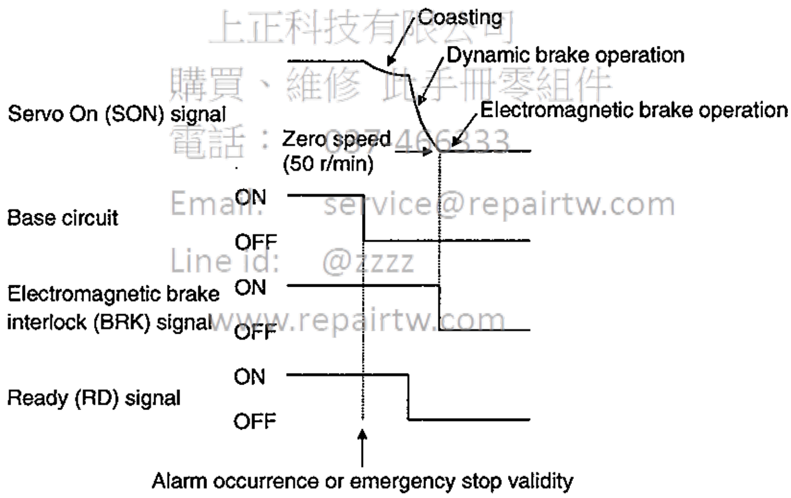
1) Set □1□□ in parameter No. 44.
2) Using parameter No.3 (feed system),set the function of CN! Pin 23 (COP) to make the electromagnetic brake interlock output signal (BRK) valid.
3) In parameter No. 53, set a time delay (Tb) between electromagnetic brake operation and base circuit shut-off.
4) In this usage, do not install the EMG switch in Note 2 in the connection diagram of Section 5.3.1.

(b) Timing chart

1) Servo ON, reset timing chart.



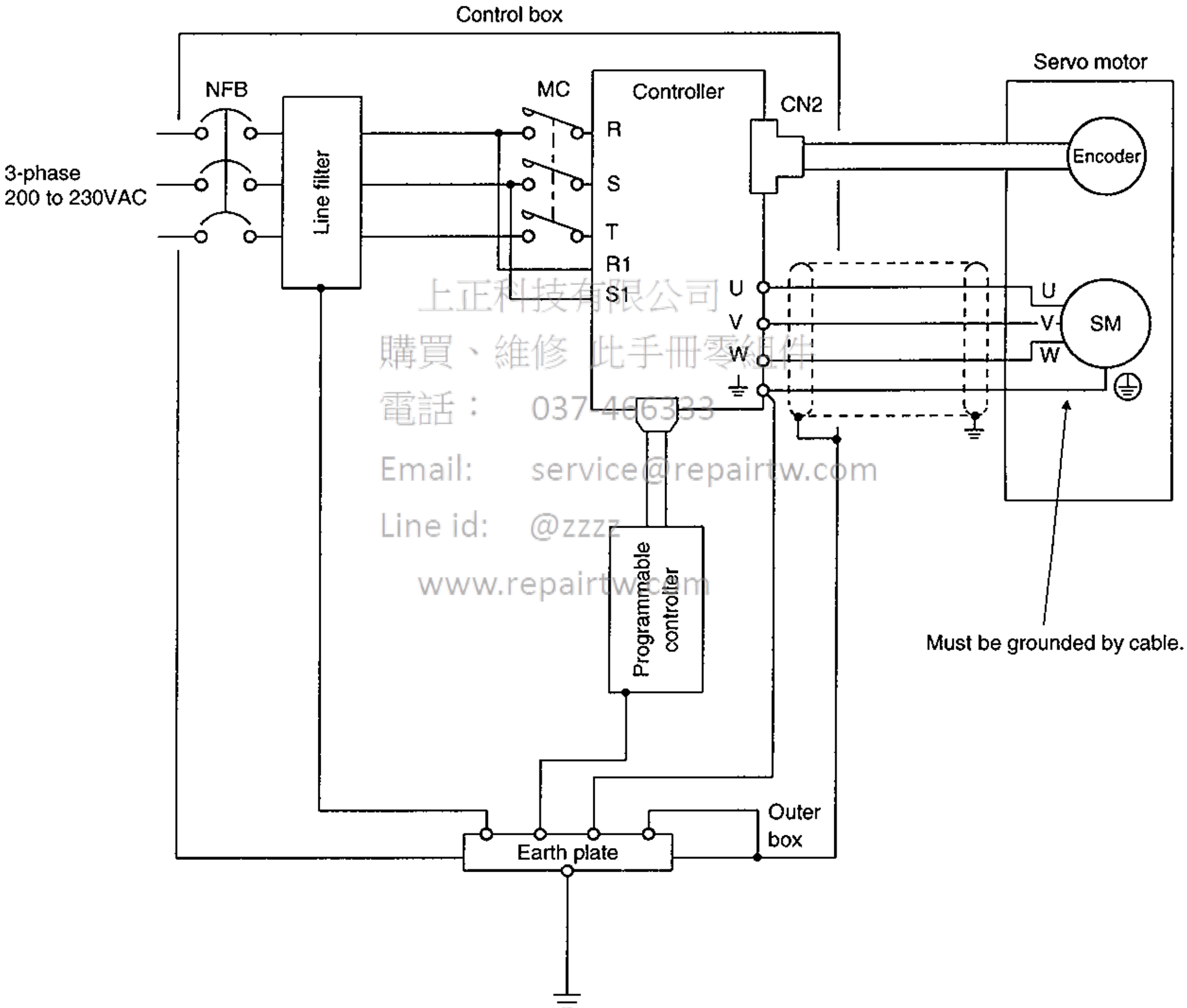
2) Alarm occurrence or emergency stop validity timing chart.



5.6 Grounding

⚠ WARNING	• Ground the controller and servo motor securely.

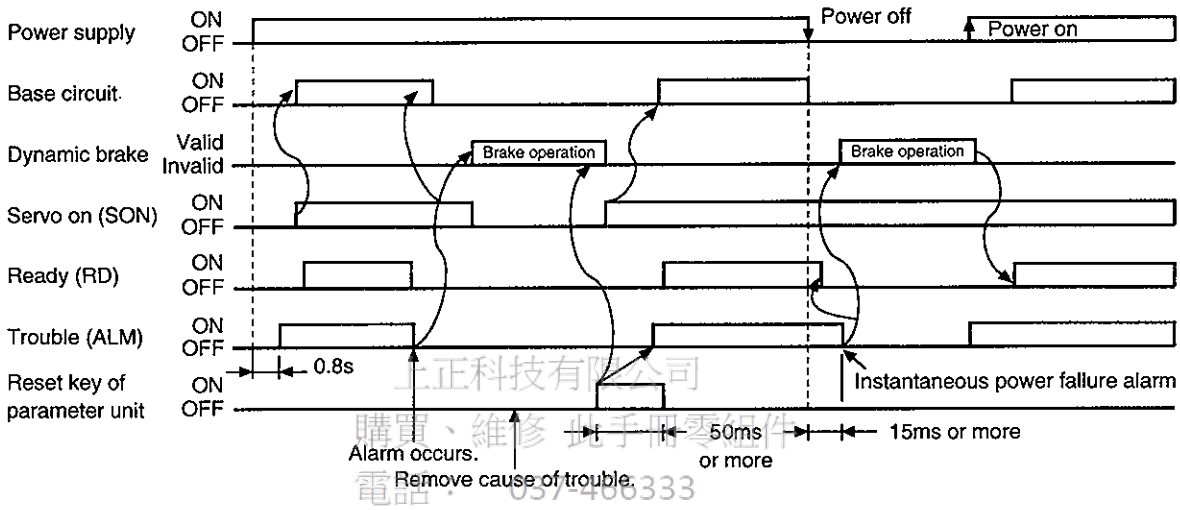
The controller switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cablerouting, the controller may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and use a flat mesh copper cable, which is as large as possible (3.5mm^2 or larger is desirable), for grounding.
To conform to the EMC Directive, refer to the EMC INSTALLATION GUIDELINES (IB(NA)67310).



5.7 Alarm Occurrence Timing Chart

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

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



Precautions for alarm occurrence

1) Overcurrent, overload 1 or overload 2
   If operation is repeated by switching control circuit power off, then on to reset the overcurrent (AL32), overload 1 (AL50) or overload 2 (AL51) alarm after its occurrence, without removing its cause, the controller 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 (AL30) alarm after its occurrence, the external regenerative brake resistor will generate heat, resulting in an accident.
3) Instantaneous power failure
   If a power failure continues 15ms or longer, the undervoltage (AL10) alarm will occur. If the power failure still persists for 20ms or longer, the control circuit is switched off. When the power failure is reset in this state, the alarm is reset and the servo motor will start suddenly if the servo-on signal (SON) is on. To prevent hazard, make up a sequence which will switch off the servo-on signal (SON) if an alarm occurs.
4) Incremental system
   When an alarm occurs, the home position is lost. When resuming operation after deactivating the alarm, make a return to home position.

6. PARAMETERS

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

6.1 Parameter List

6.1.1 Parameter write inhibit

In the MR-H-ACN single-axis amplifier built-in controller, its parameters are classified into the basic parameters (No.0 to 20) and expansion parameters (No.21 to 64) and option parameters according to their safety aspects and frequencies of use. In the factory setting condition, the customer can change the basic parameter values but cannot change the expansion parameter values. When fine adjustment, e.g. gain adjustment, is required, change the parameter No.20 setting to make the expansion parameters write-enabled.
Parameter No.20 is made valid by setting its value and then switching power off, then on.

Parameter No.20 Setting	Operation	Parameters No.0 to No.20	Parameters No.21 to No.79
□□□0 (initial value)	Reference	○	
	Write	○	
□□□A	Reference	No.20 only	
	Write	No.20 only	
□□□C	Reference	○	○
	Write	○	○
□□□E	Reference	○	○
	Write	○	○

When using the MR-H-D01 option card, the write-enabled range changes as follows:

Parameter No.20 Setting	Operation	Parameters No.0 to No.20	Parameters No.21 to No.64	Parameters No.65 to No.79
□□□0 (initial value)	Reference	○		○
	Write	○		○
□□□A	Reference	No.20 only		
	Write	No.20 only		
□□□C	Reference	○	○	○
	Write	○		
□□□E	Reference	○	○	○
	Write	○	○	○

6.1.2 Lists

> **POINT**
>
> - For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch on again to make that parameter setting valid.
> - When using the HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor, the values of parameters No. 0 and 1 need not be set. They are automatically judged by simply connecting the servo motor. At this time, the settings of these parameters are ignored.

For details of the parameters, refer to the corresponding items.
The symbols in the Feeding System column of the table denote the following:
P: Positioning system
R: Roll feeding system

(1) Item list

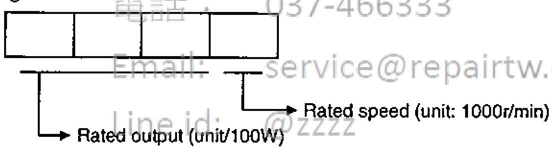
classif-ication	No.	Code	Name	Parameter Unit Screen Display	Feeding system	Initial value	Unit	Customer Setting
Basic parameters	0	*MSR	Motor series	0 MTR ser.	P, R	——		
	1	*MTY	Motor type	1 MTR type		——		
	2	*FTY	Feeding system, regenerative brake option selection	2 Feed mode		0001		
	3	*ST1	Function selection 1	3 Function 1		0000		
	4	*ST2	Function selection 2	4 Function 2		0000		
	5	*CMX	Electronic gear numerator	5 E-gear-N		1		
	6	*CDV	Electronic gear denominator	6 E-gear-D		1		
	7	PG1	Position control gain 1	7 Pos. gain 1		70	rad/s	
	8	JG1	Jog speed 1	8 JOGspeed1		100	r/min	
	9	JG2	Jog speed 2	9 JOGspeed2	R	1000	r/min	
		*ZTY	Zeroing type	9 ORG type	P	0010		
	10		Space	10 blank	R			
		ZSP	Zeroing position data	10 ORG Add	P	0	Command unit × 10^{STM} × 10^{-3}	
	11		Space	11 blank	R			
		ZRF	Zeroing speed	11 ORG Speed	P	500	r/min	
	12		Space	12 blank	R			
		CRF	Creep speed	12 ORG Creep	P	10	r/min	
	13		Space	13 blank	R			
		ZST	Zero shift distance	13 ORG shift	P	0	Command unit	
	14		Space	14 blank	R			
		DCT	Moving distance after proximity dog signal ON	14 Near Dog	P	1000	Command unit × 10^{STM} × 10^{-3}	
	15		Space	15 blank	R			
			Second home position data	15 ORG Add. 2	P	100	Command unit × 10^{STM} × 10^{-3}	
	16	INP	In-position range	16 IPN zone	P, R	25	Command unit × 10^{STM} × 10^{-3}	
	17	CRP	Rough match output range	17 CRP zone		0		
	18	MOD	Analog monitor output	18 Moni. sel.		0001		
	19	DMD	Status display selection	19 Disp. sel.		0000		

classif-ication	No.	Code	Name	Parameter Unit Screen Display	Feeding system	Initial value	Unit	Customer Setting
Expansion parameters	20	*BLK	Parameter/point table write inhibit	20 Pr. block		0000		
	21	AUT	Auto tuning	21 AT tuning		0001		
	22	*OP1	Function selection 3	22 Function3		0000		
	23	*OP2	Function selection 4	23 Function4		0000		
	24	*OP3	Function selection 5	24 Function5	P, R	0000		
	25	BKC	Backlash compensation	25 Backlash		0	pulse	
	26	FFC	Feed forward gain	26 FF gain		0	%	
	27	ERZ	Excessive error alarm level	27 AL52level		80	K pulse	
	28	INT	In-position output time	28 INP time		0	ms	
	29	*RMX	For manufacturer setting	29 PulsFunc1		0120		
	30	RM2	Pulse input function 2	30 PulsFunc2		0000		
	31	*DSP	Current position display function selection	31 Pos Disply	R	0000		
			Spare	31 blank	P			
	32		Spare	32 blank				
	33		Spare	33 blank				
	34		Spare	34 blank				
	35		Spare	35 blank				
	36		Spare	36 blank				
	37		Spare	37 blank				
	38		Spare	38 blank				
	39	*ENR	Encoder output pulse	39 PLG pulse		2048	pulse	
	40	TL	Internal torque limit 1	40 TQ limit1		100		
	41	*IP1	Input signal selection 1	41 DI sel. 1		P:0100 R:0000		
	42	*IP2	Input signal selection 2	42 DI sel. 2		0000		
	43		Spare	43 blank				
	44	*OPC	Output signal selection	44 DO sel.		0000		
	45		Spare	45 blank				
	46	*MOA	Pre-alarm data selection	46 ALM memo		0001		
	47	VOC	VC offset	47 VC offset		0	mV	
	48	TPO	TLAP offset	48 TLAP ofset		0	mV	
	49		Spare	49 blank				
	50	MO1	MO1 offset	50 MO1offset	P, R	0	mV	
	51	MO2	MO2 offset	51 MO2offset		0	mV	
	52	*SIO	External digital display selection	52 SIO sel.		0101		
	53	MBR	Electromagnetic brake sequence output	53 BRKtiming		100	ms	
	54	TL2	Internal torque limit value 2	54 TQ limit2		100	%	
	55		Spare	55 blank		0		
	56		Spare	56 blank		0		
	57		Spare	57 PID droop		0		
	58	DG2	Ratio of load inertia moment to servo motor inertia moment	58 Inertia		2.0		
	59	NCH	Machine resonance control filter	59 M-filter		0		
	60	PG2	Position control gain 2	60 Pos.gain2		25	rad/s	
	61	VG1	Speed control gain 1	61 V-gain 1		1200	rad/s	
	62	VG2	Speed control gain 2	62 V-gain 2		600	rad/s	
	63	VIC	Speed integral compensation	63 V-int com		20	ms	
	64	VDC	Speed differential compensation	64 V-dif com		980		

Parameter List for Use When the MR-H-D01 Option Card Is Loaded

classif-ication	No.	Code	Name	Parameter Unit Screen Display	Feeding system	Initial value	Unit	Customer Setting
Optional parameters	65	*DI1	D-1 extension function selection 1	65 OP. DI1	P, R	1000		
	66	*DI2	Extension function selection 2	66 OP. DI2		0000		
	67	*DOS	Extension function selection	67 OP.DO		0000		
	68	*APS	For manufacturer setting	68 OP.pulse		0120		
	69		Spare	69 blank				
	70		Spare	70 blank				
	71		Spare	71 blank				
	72		Spare	72 blank				
	73		Spare	73 blank				
	74		Spare	74 blank				
	75		Spare	75 blank				
	76		Spare	76 blank				
	77		Spare	77 blank				
	78		Spare	78 blank				
	79		Spare	79 blank				

(2) Detail List

<table>
<tr><th>classif-
ication</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="2">Basic parameters</td><td>0</td><td>*MSR</td><td>Motor series
Used to select the series of the servo motor.
When using the HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor, the value of this parameter need not be set since it is automatically judged by simply connecting the servo motor encoder and controller. At this time, the value of this parameter remains unchanged but use it as it is.
<table>
<tr><th>Set Value</th><th>Servo Motor Series</th></tr>
<tr><td>0000</td><td>HA-SH</td></tr>
<tr><td>0001</td><td>HA-LH</td></tr>
<tr><td>0002</td><td>HA-UH</td></tr>
<tr><td>0003</td><td>HA-FH</td></tr>
<tr><td>0005</td><td>HA-MH</td></tr>
</table></td><td></td><td></td><td></td><td>0000
to
0005</td></tr>
<tr><td>1</td><td>*MTY</td><td>Motor type
Set the parameter (servo motor capacity) according to the servo motor used.
When using the HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor, the value of this parameter need not be set since it is automatically judged by simply connecting the servo motor encoder and controller. At this time, the value of this parameter remains unchanged but use it as it is.


Indicated on the next page</td><td></td><td></td><td></td><td></td></tr>
</table>

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Basic parameters	1	*MTY	(see table below)		As given in the Left table		As given in the Left table

	Servo motor	Capacity (W)	Controller MR-H□ACN 10	20	40	60	100	200	350	500	700	11K	15K	22K
Ultracompact	HA-MH053	50		053										
	HA-MH13	100		13										
	HA-MH23	200			23									
	HA-MH43	400				43								
	HA-MH73	750					73							
Small capacity	HA-FH053	50	$\boxed{053}$											
	HA-FH13	100	13											
	HA-FH23	200		$\boxed{23}$										
	HA-FH33	300			$\boxed{33}$									
	HA-FH43	400			43									
	HA-FH63	600				63								
1000r/min	HA-SH81	850					81							
	HA-SH121	1200						121						
	HA-SH201	2000						201						
	HA-SH301	3000							301					
2000r/min	HA-SH52	500				$\boxed{52}$								
	HA-SH102	1000					$\boxed{102}$							
	HA-SH152	1500						$\boxed{152}$						
	HA-SH202	2000						202						
	HA-SH352	3500							$\boxed{352}$					
	HA-SH502	5000								$\boxed{502}$				
	HA-SH702	7000									$\boxed{702}$			
3000r/min	HA-SH53	500				53								
	HA-SH103	1000					103							
	HA-SH153	1500						153						
	HA-SH203	2000						203						
	HA-SH353	3500							353					
Low inertia	HA-LH52	500				$\boxed{52}$								
	HA-LH102	1000						102						
	HA-LH152	1500						$\boxed{152}$						
	HA-LH202	2000							202					
	HA-LH302	3000								302				
	HA-LH502	5000								$\boxed{502}$				
	HA-LH702	7000									$\boxed{702}$			
Large capacity	HA-LH11K2	11000										$\boxed{1102}$		
	HA-LH15K2	15000											$\boxed{1502}$	
	HA-LH22K2	22000												$\boxed{2202}$
Pancake	HA-UH32	300			32									
	HA-UH52	500				$\boxed{52}$								
	HA-UH102	1000						102						
	HA-UH152	1500						$\boxed{152}$						
	HA-UH222	2200							222					
	HA-UH352	3500								352				
	HA-UH452	4500								452				

The values enclosed by □ are factory-set values.

⚠CAUTION

- The parameter values given in the following table indicate that the corresponding controllers and servo motors may be used together. If the other value is set, a fire may take place.

classification	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Basic parameters	2	*FTY	Feeding system, regenerative brake option selection Used to select the feeding system and regenerative brake option. 0 □ □ □ → Feed command system 0: Roll feeding (R) 1: Positioning incremental command system } (P) 2: Positioning absolute command system } → ST1 coordinate system selection....Title 0: CCW rotation (address increase) 1: CW rotation (address increase) 2: CCW rotation (address decrease) 3: CW rotation (address decrease) → Select the regenerative brake option. 0: Set 0 when the servo amplifier of 7kW or less capacity has no external option or when the servo amplifier of 11kW or more uses the supplied regenerative brake resistor or regenerative brake option without a fan. 1: FR-RC, FR-BU brake unit 2: MR-RB013 3: MR-RB033 5: MR-RB32 6: MR-RB34 7: MR-RB54 8: MR-RB30 9: MR-RB50 B: MR-RB31 C: MR-RB51 E: When the servo amplifier is 11kW or more and the supplied regenerative brake resistor or regenerative brake option is cooled by a fan to increase its capability. (If the regenerative brake option selected cannot be used with the MR-H-ACN, the corresponding parameter error occurs.)	P, R	0001		0000 to 0E33
	3	*ST1	Function selection 1 Used to choose the optional functions. □ □ □ □ → Acceleration/deceleration pattern 0: Linear acceleration/deceleration 1: S-shaped acceleration/deceleration → Select the electromagnetic brake interlock signal or rough match signal. (Connector CPO (pin 23) is changed in function) 0: Rough match signal valid 1: Electromagnetic brake interlock signal valid → Select the external dynamic brake. 0: Without the external dynamic brake 1: With the external dynamic brake → Absolute position detection system selection 0: Invalid (when using the controller in incremental system) 1: Valid (when using the controller in absolute position detection system)	P, R P	0000		0000 to 1111h

<table>
<tr><th>classif-
ication</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="3">Basic parameters</td><td>4</td><td>*ST2</td><td>Function selection 2
Used to choose the optional functions.

0 □ □ □

(last digit) The magnification (STM) can be set to position data set in the position block number or by the digital switch. Refer to the follwing table.
<table>
<tr><th>Set Value (STM)</th><th>Magnification</th></tr>
<tr><td>0</td><td>1 time</td></tr>
<tr><td>1</td><td>10 times</td></tr>
<tr><td>2</td><td>100 times</td></tr>
<tr><td>3</td><td>1000 times</td></tr>
</table>
(2nd digit) Unit of position data
0: Metric system
1: Inch system
(The unit on the machine speed screen is:
mm: mm/m
inch: inch/m)

(3rd digit) Decimal point position setting
The decimal point position can be moved as desired on the monitor screen.
Note that the actual moving distance depends on STM. Refer to the following table.
0: Automatic setting
1: 1st digit
2: 2nd digit
3: 3rd digit
4: 4th digit

Relationship between STM, decimal point position setting and monitor display
<table>
<tr><th rowspan="2">STM Set Value</th><th rowspan="2">Actual Moving Distance (μm)</th><th colspan="5">3rd Digit Set Value (Decimal point position setting)</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>0</td><td>Position data × 1</td><td>999.999</td><td rowspan="4">999999</td><td rowspan="4">99999.9</td><td rowspan="4">9999.99</td><td rowspan="4">999.999</td></tr>
<tr><td>1</td><td>Position data × 10</td><td>9999.99</td></tr>
<tr><td>2</td><td>Position data × 100</td><td>99999.9</td></tr>
<tr><td>3</td><td>Position data ×1000</td><td>999999</td></tr>
</table>
</td><td>P, R</td><td>0000</td><td></td><td>0000
to
0413h</td></tr>
<tr><td>5</td><td>*CMX</td><td>Electronic gear numerator
set in the range $\frac{1}{50} < \frac{CMX}{CDV} < 50$.</td><td>P, R</td><td>1</td><td>Pulse</td><td>1
to
50000</td></tr>
<tr><td>6</td><td>*CDV</td><td>Electronic gear denominator
Setting example
Roll diameter : 50mm
Reduction ratio : 1/n = 3/7
Number of pulses : 16384 pulse/rev (for HA-SH motor)

$$\frac{\text{Number of pulses (CMX)}}{\text{Moving distance (CDV)}} = \frac{16384}{50 \times \pi \times 3/7 \times 1000} = \frac{7168}{9375\pi} \fallingdotseq \frac{7168}{29452}$$
Hence, set CMX to 7168 and CDV to 29452.

When a fraction is produced, carry within the setting range and round that fraction off.</td><td>P, R</td><td>1</td><td>Com-
mand
unit</td><td>1
to
50000</td></tr>
</table>

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Basic parameters	7	PG1	Position control gain 1 Used to set the gain of the position loop. Increase the gain to raise tracking performance in response to the position command.	P, R	70	rad/s	10 to 1000
	8	JG1	JOG speed 1 Used to set speed 1 of the jog speed command. The acceleration and deceleration time constants used are those of speed block No. 1	P, R	100	r/min	0 to max. speed
	9	*ZTY	Zeroing type Select the home position setting method, zeroing direction and proximity dog signal input polarity. 0 □ □ □ Home position setting type 0: Dog type (rear end detection) 1: Count type (front end detection) 2: Data setting type 3: Stopper type 4: Servo on position home position (home position ignored) Zeroing direction 0: Address increasing direction 1: Address decreasing direction Dog signal input polarity 0: Dog signal ON when open 1: Dog signal ON when closed	P	0010		0000 to 0114h
		JG2	JOG speed 2 Used to set speed 2 of the jog speed command.	R	1000	r/min	0 to max. speed
	10	ZPS	Zeroing position data Used to set the current position reached on completion of zeroing. The actual zeroing position data is 10STM times greater that the set value.	P	0	Com-mand unit × 10^{STM} × 10^{-3}	−32765 to 32767
	11	ZRF	Zeroing speed Used to set the servo motor speed for zeroing.	P	500	r/min	0 to max. speed
	12	CRF	Creep speed Used to set the creep speed after proximity dog detection.	P	10	r/min	0 to max. speed
	13	ZST	Zero shift distance Used to set the shifting distance from the Z-phase pulse detection position in the encoder.	P	0	Com-mand unit	0 to 65535
	14	DCT	Moving distance after proximity dog signal ON Used to set the moving distance after detection of the proximity dog for count type zeroing. Set the value not less than the distance required to decelerate from the zeroing speed.	P	1000	Com-mand unit × 10^{STM} × 10^{-3}	0 to 65535
	15	STN	Second home position data Used to set the current position reached when automatic zeroing is performed to return to the second home position. The actual second home position data is 10STM times greater that the set value.	P	0	Com-mand unit × 10^{STM} × 10^{-3}	−32768 to 32767
	16	INP	In-position range Used to set the droop pulse range when the in-position signal is output.	P, R	25	pulse	0 to 50000

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Basic parameters	17	CRP	Rough match output range Used to set the command distance range in which the rough match output is provided.	P, R	0	Com-mand unit × 10^{STM} × 10^{-3}	0 to 50000
	18	MOD	Analog monitor output Used to set the signal provided to the analog monitor output. (Refer to Section 6.2.3.) [0] [ ] [0] [ ] Monitor 2 output selection 0: Motor speed (±8V/maximum speed) 1: Torque (±8V/maximum torque) (Note) 2: motor speed (+8V/maximum speed) 3: Torque (+8V/maximum torque) (Note) 4: Current command output 5: Command pulse frequency (±8V/400kpps) 6: Droop pulse value 1/1 (±11.6V/2048 pulses) 7: Droop pulse value 1/4 (±11.6V/8192 pulses) 8: Droop pulse value 1/16 (±11.6V/32768 pulses) 9: Droop pulse value 1/32 (±11.6V/65536 pulses) A: Droop pulse value 1/64 (±11.6V/131072 pulses) Monitor 1 out put selection Items are the same as in monitor 2 output selection. Note: Torque limit mode (8V is output at the maximum torque). In the torque control mode, the maximum output (8V) changes according to the setting of parameter No.40.	P, R	0001		0000 to 0909h
	19	DMD	Status display selection Used to choose the status display provided at power-on. [0] [0] [ ] [ ] Controller display/external display (valid when rotary switch CS1 is 0) The items are the same as in parameter unit status display at power-on. However, you cannot set F (bus voltage). The display is overridden by the setting of the rotary switch on the controller. When the rotary switch setting is "0", parameter No. 19 is made valid. (Refer to Section 7.5.) Parameter unit status display at power-on 0: Current position 1: Command position 2: Command remaining distance 3: Override 4: Position block number 5: Feedback pulse value 6: Machine speed 7: Droop pulse 8: Torque limit command voltage 9: Regenerative load factor A: Effective load factor B: Peak load factor C: Within-1-revolution position D: ABS counter E: Servo motor speed F: Bus voltage	P, R	0000		0000 to 00FEh

classification	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Basic parameters	20	*BLK	Parameter/point table write inhibit Used to limit write of the parameter values and point table data.	P, R	0000		0000 to 0E0Eh

Parameter/point table write inhibit

Used to limit write of the parameter values and point table data.

0		0	

→ Parameter write is limited.

Set value	Operation	Parameters No.0 to No.20	Parameters No.21 to No.79
0	Reference	○	\
	Write	○	\
A	Reference	No.20 only	\
	Write	No.20 only	\
C	Reference	○	○
	Write	○	\
E	Reference	○	○
	Write	○	○

When using the MR-H-D01 option card, the write-enabled range changes as follows:

Set value	Operation	Parameters No.0 to No.20	Parameters No.21 to No.64	Parameters No.65 to No.79
0	Reference	○	\	○
	Write	○	\	○
A	Reference	No.20 only	\	\
	Write	No.20 only	\	\
C	Reference	○	○	○
	Write	○	\	\
E	Reference	○	○	○
	Write	○	○	○

→ When using the large setting/display unit (MR-PRU02) in the roll feeding system, the point table data is protected. (Feeding system: R)

Set value	Data Setting: Position data	Data Setting: Speed	Data Setting: Acceleration/deceleration time constant
0	○	○	○
A	\	\	\
B	○	○	○
C	\	\	○
D	\	○	\
E	○	\	\

Note: ○: Can be set. \: Cannot be set.

(2) Extension parameters

<table>
<tr><th>classification</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="2">Extension parameters</td><td>21</td><td>AUT</td><td>Auto tuning
Used to set the response, etc. for execution of the auto tuning function.

| 0 | | 0 | |

Auto tuning selection (last digit)
0: Auto tuning selected for use of interpolation axis control, etc. In position control (valid)
1: Auto tuning for ordinary operation (valid)
2: No auto tuning (invalid)

Response setting (when auto tuning is valid) (second digit)
Optimum response can be selected according to the rigidity of the machine. As the machine has higher rigidity, faster response can be set to improve tracking performance in response to a command and to reduce setting time.

<table>
<tr><th rowspan="2">Machine Type</th><th rowspan="2">Setting</th><th colspan="3">Description</th><th rowspan="2">Guideline for Position Setting Time GDL²/GDM² guideline = within 5 times</th></tr>
<tr><th>Response</th><th>Guideline for corresponding machine rigidity</th><th>GDL²/GDM² guideline for load inertia</th></tr>
<tr><td>Initial value</td><td>0</td><td>Low response</td><td>Low to high rigidity</td><td>1 to 5 times</td><td></td></tr>
<tr><td rowspan="5">Normal</td><td>1</td><td rowspan="5">Low response
to
Middle response
to
High response</td><td rowspan="5">Low rigidity
to
Middle rigidity
to
High rigidity</td><td rowspan="10">1 to 10 times</td><td>50 to 300ms</td></tr>
<tr><td>2</td><td rowspan="2">10 to 70ms</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td rowspan="2">10 to 30ms</td></tr>
<tr><td>5</td></tr>
<tr><td rowspan="5">Large friction</td><td>8</td><td rowspan="5">Low response
Middle response
High response</td><td rowspan="5">Low rigidity
to
Middle rigidity
to
High rigidity</td><td>70 to 400ms</td></tr>
<tr><td>9</td><td rowspan="2">10 to 100ms</td></tr>
<tr><td>A</td></tr>
<tr><td>B</td><td rowspan="2">10 to 50ms</td></tr>
<tr><td>C</td></tr>
</table>

When changing the set value, look at the vibration and setting of the servo motor and machine immediately before they stop and during their stop and always increase the set value in sequence, beginning with the slower response.</td><td>P, R</td><td>0001</td><td></td><td>0000
to
0C02h</td></tr>
<tr><td>22</td><td>*OP1</td><td>Function selection 3
Used to select the optional function.

| 0 | 0 | 0 | |

Low acoustic-noise mode selection
By selecting the low acoustic-noise mode, electromagnetic noise generated by the servo motor can be reduced approx. 20dB. (Refer to Section 6.2.6.)
At this time, the continuous output of the servo motor reduces. (Refer to Section 13.1.)
0: Non-low acoustic-noise
3: Low acoustic-noise mode is selected.</td><td>P, R</td><td>0000</td><td></td><td>0000
to
0003h</td></tr>
</table>

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Extension parameters	23	*OP2	Function selection 4 Used to choose the stop processing to be performed when LSP · LSN signal turns off. 0 0 □ 0 Stopping pattern when LSP/LSN is swiched off (made valid) 0: Sudden stop 1: Slow stop	P, R	0000		0000 to 1011h
	24	*OP3	Function selection 5 Used to choose the input filter and override. 0 □ □ 0 Override 0: Invalid 1: Valid External input signal filter 0: Without filter 1: 3.55 [msec] 2: 7.11 [msec] Used to protect the external relay contact input from chattering, noise entry, etc.	P, R	0000		0000 to 1211h
	25	BKC	Backlash compensation Used to set the backlash compensated for when the command direction is reversed.	P, R	0	pulse	0 to 10000
	26	FFC	Feed forward gain Used to set the feed forward gain for position control. Set 100% to zero the droop pulse value when operation is performed at constant speed. Note that sudden acceleration/deceleration will increase overshoot. (As a guideline, acceleration/deceleration time up to the rated speed is 1S or longer at the FFC of 100.) When this parameter is set, parameter No.21 must be set to disable auto tuning.	P, R	0	%	0 to 100
	27	ERZ	Excessive error alarm level Used to set the range in which the excessive droop alarm is provided.	P, R	80	kpulse	1 to 1000
	28	INT	In-position output time Set the length of time when the in-position signal is kept output. Set "0" to keep outputting the signal during positioning.	P, R	0	ms	0 to 50000
	29	*RMX	For manufacturer setting		0120		
	30	RM2	Pulse input function 2 Used to set the pulse magnification of the manual pulse generator (MR-HDP01). 0 0 0 □ Manual pulse generator input selection 0: Manual pulse generator input invalid 1: 1-time pulses 2: 10-time pulses 3: 100-time pulses	P, R	0000		0000 to 0003h

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Extension parameters	31	*DSP	Display function selection Used to choose the display function of the current position. 0 0 0 ☐ Current position display function selection 0: Cumulative display 1: Fixed dimension display	R	0000		0000 to 0001
	32 33 34 35 36 37 38		Spare				
	39	*ENR	Encoder output pulse Used to set the encoder output pulse (A-phase/B-phase) per servo motor revolution. The value (pulses/rev) set in this parameter is output independently of the motor type. The setting is a value derived by multiplying the A-phase/B-phase pulses by 4.	P, R	2048	pulse /rev	0 to 50000
	40	TL1	Internal torque limit value 1 Set to define the maximum torque as 100%. When the external analog torque limit is valid, torque is limited at the lower level value of the external and internal torque limit values. When torque monitoring has been selected for monitor output, this set level is 8[V]. The monitored torque of the analog monitor output is 8[V] at max. torque.	P, R	100	%	0 to 100

<table>
<tr><th>classif-ication</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="2">Extension parameters</td><td rowspan="2">41</td><td rowspan="2">*IP1</td><td>Input signal selection 1
Used to select the functions of the input signals.

0 □ □ □

→ SON signal function selection
0: Servo ON
1: Reset
(SON is automatically switched on internally)

→ Torque limit (DI1) switching function selection
0: ON – The external analog torque limit command is valid. However, the internal torque limit value is valid when the internal torque limit value (parameter No.40) is less than the external torque limit.
OFF – The internal torque limit value is valid.
1: ON – The internal torque limit value (parameter No.40) is valid. However, the internal torque limit value 2 is always valid when the internal torque limit value 2 is less than the internal torque limit.
OFF – The internal torque limit value 2 (parameter No.54) is valid.

→ DI1 signal function selection
0: Torque limit
1: Temporary stop (torque limit 1 (parameter No.40) is always valid)</td><td>P</td><td>0100</td><td></td><td>0000 to 0111h</td></tr>
<tr><td>□ □ □ □

→ SON signal function selection
0: Servo ON
1: Reset
(SON is automatically switched on internally)

→ Torque limit (LSP) switching function selection
0: ON – The external analog torque limit command is valid. However, the internal torque limit value is valid when the internal torque limit value (parameter No.40) is less than the external torque limit.
OFF – The internal torque limit value is valid.
1: ON – The internal torque limit value (parameter No.40) is valid. However, the internal torque limit value 2 is always valid when the internal torque limit value 2 is less than the internal torque limit.
OFF – The internal torque limit value 2 (parameter No.54) is valid.

→ LSN signal function selection
0: Torque limit (reverse stroke end is switched on internally)
1: Forward stroke end
(torque limit 1 (parameter No.40) is always valid)

→ LSN signal function selection
0: Second feed distance (reverse stroke end is switched on internally)
1: Reverse stroke end (for the feed distance, select position block No.0)</td><td>R</td><td>0000</td><td></td><td>0000 to 0011h</td></tr>
</table>

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Extension parameters	42	*IP2	Input signal selection 2 Used to select the functions of the input signals. 0 0 □ □ → LSP signal automatic ON 0: External (depending on the LSP contact) 1: Internal (always ON) → Clear signal function selection (CR) 0: Cleared when the terminal disconnected is connected. 1: Kept cleared while the terminal is connected. → LSP signal automatic ON 0: External (depending on the LSP contact) 1: Internal (always ON)	P R P	0000		0000 to 0011h
	43		Spare				
	44	*OPC	Output signal selection Used to select the functions of the output signals. □ □ □ □ → M code 2-bit output selection (PF and CPO are changed in function) 0: Invaild (PF and CPO are vaild.) 1: "After output" vaild Output after position data is output. → Alarm/pre-alarm output selection 0: ALM signal is used as alarm output. (Output at alarm occurrence) 1: ALM signal is used as prealarm (warning) output. (Output at warning occurrence) → Torque limit-in-progress (CPO) output 0: Torque limit-in-progress is not output. 1: Torque limit-in-progress is output (Alarm AL37 is output if limiting torque output and M code 2-bit output are chosen at the same time.) → Electromagnetic brake interlock output timing 0: Output in any of the following statuses independently of the servo motor speed: 1) Servo off 2) Alarm (ALM) occurred 3) Emergency stop signal (EM1) turned off (valid) 1: Output in any of the above 1) to 3) statuses when the motor speed is at or less than the zero speed (50r/min). The time from when the electromagnetic brake interlock signal is output until when the base circuit is shut off can be set in parameter No. 53.	P P, R P, R P, R	0000		0000 to 1111h
	45		Spare				

classification	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Extension parameters	46	*MOA	Pre-alarm data selection Used to choose the pre-alarm data to be output. [0] [ ] [ ] [ ] → Data selection 2 0: Servo motor speed (±output) 1: Torque (±output) 2: Servo motor speed (+output) 3: Torque (+output) 4: Current command output (±output) 5: Command pulse frequency 6: Droop pulse value 1/1 (±output) 7: Droop pulse value 1/4 (±output) 8: Droop pulse value 1/16 (±output) 9: Droop pulse value 1/32 (±output) A: Droop pulse value 1/64 (±output) → Data selection 1 Items are the same as in data sekection 2 → Alarm data sampling time selection 0: 3.55 [msec] 1: 7.11 [msec] 2: 14.2 [msec] 3: 28.4 [msec]	P, R	0001		0000 to 03AAh
	47	VCO	OVR offset Used to set the offset in response to the override command.	P, R	0	mv	-9999 to 9999
	48	TPO	TLAP offset Used to set the offset in response to the torque limit analog command.	P, R	0	mv	-9999 to 9999
	49		Spare				
	50	MO1	MO1 offset Used to set the offset value for the monitor output.	P, R	0	mv	-9999 to 9999
	51	MO2	MO2 offset Used to set the offset value for the monitor output.	P, R	0	mv	-9999 to 9999
	52	*SIO	External digital display (MR-DP60) selection Set this parameter when using the external digital display. [0] [1] [0] [ ] → External display selection 0: Encoder pulses (value set in parameter No. 39) are output. (Differential driver) 1: External display is used.	P, R	0101		0000 to 3101
	53	MBR	Electromagnetic brake sequence output Used to set a time delay between magnetic brake operation and base circuit shut-off.	P, R	100	ms	0 to 1000
	54	TL2	Internal torque limit value 2 Set to define the maximum torque as 100%. Set 0010 in parameter No.41 and switch on the external torque limit signal (P: DI1, R: LSP) to control torque at the value of this parameter. The set value of this parameter should be larger than the internal torque control value in parameter No.40. If smaller, this parameter is made valid Independently of the switching of DI1/LSP.	P, R	100	%	0 to 100
	55 56 57		Spare				

<table>
<tr><th>classif-ication</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting Range</th></tr>
<tr><td rowspan="7">Extension parameters</td><td>58</td><td>DG2</td><td>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 is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>2.0</td><td></td><td>0.0 to 100.0</td></tr>
<tr><td>59</td><td>NCH</td><td>Machine resonance control filter
Used to set the frequency to match the resonance frequency of the mechanical system.
<table><tr><th>Set Value</th><th>Machine Resonance Frequency [Hz]</th></tr><tr><td>0</td><td>Not used</td></tr><tr><td>1</td><td>1125</td></tr><tr><td>2</td><td>563</td></tr><tr><td>3</td><td>375</td></tr><tr><td>4</td><td>282</td></tr><tr><td>5</td><td>225</td></tr><tr><td>6</td><td>188</td></tr><tr><td>7</td><td>161</td></tr></table></td><td>P, R</td><td>0</td><td></td><td>0 to 7</td></tr>
<tr><td>60</td><td>PG2</td><td>Position control gain 2
Used to set the gain of the position loop.
Set this parameter to increase the position response level to load disturbance.
Higher setting increase the response level but is liable to generate vibration and/or noise.
When auto tuning is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>25</td><td>rad/s</td><td>1 to 500</td></tr>
<tr><td>61</td><td>VG1</td><td>Speed control gain 1
Normally this parameter setting need not be changed.
Higher setting increases the response level but is liable to generate vibration and/or noise.
When auto tuning is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>1200</td><td>rad/s</td><td>2 to 5000</td></tr>
<tr><td>62</td><td>VG2</td><td>Speed control gain 2
Set the parameter when vibration occurs on machines of low rigidity or large backlash.
Higher setting increases the response level but is liable to generate vibration and/or noise.
When auto tuning is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>600</td><td>rad/s</td><td>2 to 5000</td></tr>
<tr><td>63</td><td>VIC</td><td>Speed integral compensation
Used to set the integral time constant of the speed loop.
When auto tuning is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>20</td><td>ms</td><td>1 to 1000</td></tr>
<tr><td>64</td><td>VDC</td><td>Speed differential compensation
Used to set the time constant of differential compensation.
When auto tuning is selected, the result of auto tuning is automatically set.</td><td>P, R</td><td>980</td><td></td><td>0 to 1000</td></tr>
</table>

(3) Parameters used when the option card (MR-H-D01) is loaded

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
Optional parameters	65	*DI1	Extension function selection 1 This parameter must be set when the option card (MR-H-D01) is used. □□□□ → Feed distance 0: Option card is not used. 1: BCD 3-digits×2 input 3: 256 position blocks selected. Feed distance 0: Option card is not used. 1: BCD 3-digits×2 Input → External setting of speed selection 0: invalid 1: valid → Manual pulse generator magnification selection 0: Manual pulse generator is not used. 1: 1-time pulse 2: 10-time pulse 3: 100-time pulse 4: External setting of pulse magnification (DI20, DI21 used) → Data setup condition selection 0: Strobe signal valid (programmable controller used) 1: Strobe signal invalid (when the digital switch or 256 position blocks are selected)	P R P R	1000		0000 to 1413h
	66	*DI2	Extension function selection 2 Set this parameter when using override. 0 0 0 □ → Override selection (DI16) is selected 0: invalid (Not used.) 1: valid (Used.)	P, R	0000		0000 to 0001h
	67	*DOS	Extension function selection Set this parameter when outputting the alarm code and M code. 0 0 □ □ → Alarm code output selection 0: Not output. 1: Output. → M code output selection 0: Not output. 1: Output. (After mode) Output after position data is output.	P, R P	0000		0000 to 0011h

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting Range
	68	*APS	For manufacturer setting	P, R	0120		
	69		Spare				
	70						
	71						
	72						
	73						
	74						
	75						
	76						
	77						
	78						
	79						

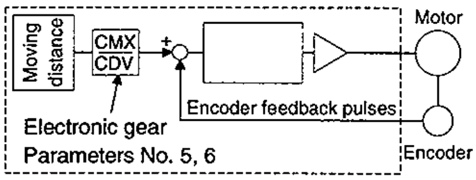
6.2 Detailed Explanation

6.2.1 Electronic gear

POINT
• The electronic gear setting range is $\frac{1}{50} < \frac{CMX}{CDV} < 50$.
• If the setting is outside this range, operation may not be performed at the preset speed and/or acceleration/deceleration time constants.

Use the electronic gear (parameters No.5, 6) to make adjustment so that the controller setting matches the moving distance of the machine. Also, by changing the electronic gear value, the machine can be moved at any multiplication ratio to the moving distance on the controller.

$$\frac{CMX}{CDV} = \frac{\text{Parameter No.5}}{\text{Parameter No.6}}$$



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

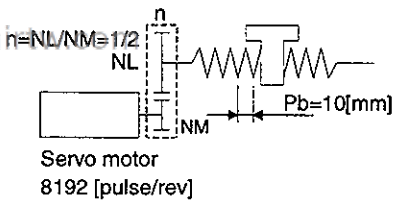
(1) Ballscrew setting example

Machine specifications

Ballscrew lead : Pb = 10 [mm]

Reduction ratio : n = 1/2

Servo motor resolution : Pt = 8192 [pulse/rev]



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

Hence, set 1024 to CMX and 625 to CDV.

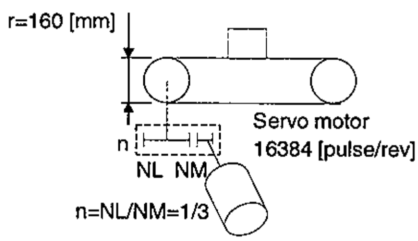
(2) Conveyor setting example

Machine specifications

Pulley diameter : r = 10 [mm]

Reduction ratio : n = 1/3

Servo motor resolution : Pt = 16384 [pulse/rev]



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

Reduce CDV to 50000 or less and round off the first decimal place.

Hence, set 2048 to CMX and 20944 to CDV.

6.2.2 Changing the status display screen

By changing the parameter No.19 value, you can change the status display item of the controller display section or MR-DP60 with CS1 = 0 and that of the parameter unit at power-on. In the initial status, each display shows the current position.
For display details, refer to Section 7.3.

Parameter No. 19

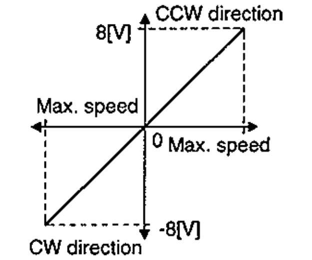
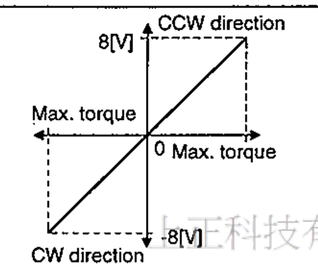
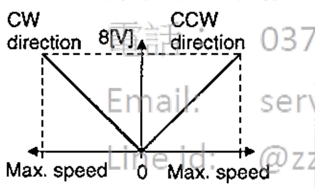
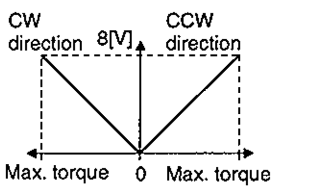
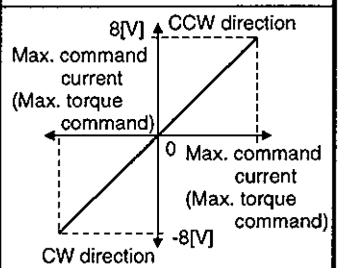
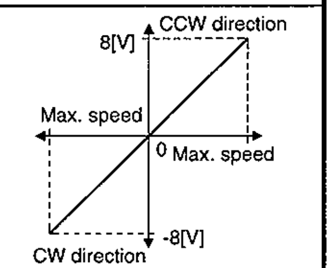
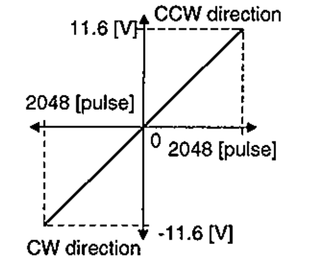
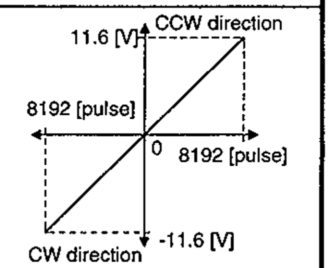
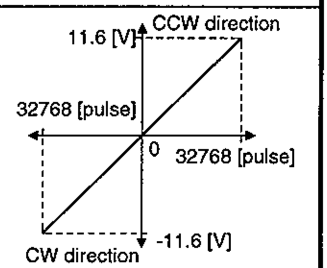
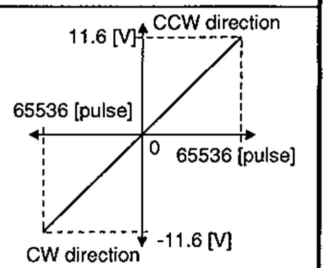
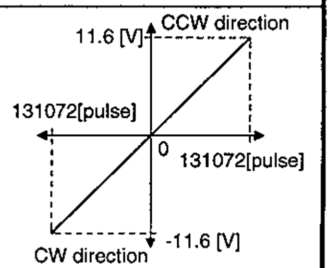
–	–		

Status display of controller display section or external digital display at power-on with CS1 = 0 (last digit)
0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Override
4: Position block number
5: Feedback pulse value
6: Machine speed
7: Droop pulse
8: Torque limit command voltage
9: Regenerative load factor
A: Effective load factor
B: Peak load factor
C: Within-1-revolution position
D: ABS counter
E: Servo motor speed
F: Bus voltage

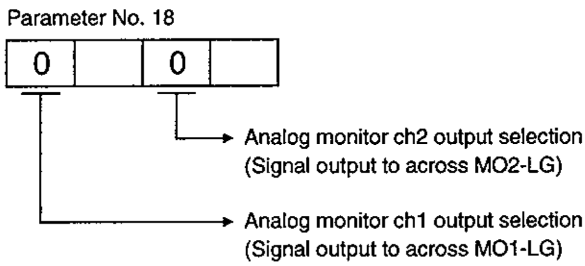
Status display of parameter unit at power-on (third digit)
0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Override
4: Position block number
5: Feedback pulse value
6: Machine speed
7: Droop pulse
8: Torque limit command voltage
9: Regenerative load factor
A: Effective load factor
B: Peak load factor
C: Within-1-revolution position
D: ABS counter
E: Servo motor speed
F: Bus voltage

6.2.3 Analog output

The servo status can be output to two channels in terms of voltage. Use this function when using an ammeter to monitor the servo status or synchronizing the torque/speed with the other servo.
The servo amplifier is factory-set to output the motor speed to CH1 and the generated torque to CH2. The setting can be changed as listed below by changing the parameter No.18 value:

Setting	Output Item	Description
0	Motor speed	
1	Generated torque	
2	Motor speed	
3	Generated torque	
4	Current command (Torque command)	
5	Command speed	
6	Droop pulses 1/1 (2048pulse)	
7	Droop pulses 1/4 (8192pulse)	
8	Droop pulses 1/16 (32768pulse)	
9	Droop pulses 1/32 (65536pulse)	
A	Droop pulses 1/64 (131072pulse)	

Change the following digits of parameter No.18:



Parameters No.50 and 51 can be used to set the offset voltages to the analog output voltages. The setting range is between −9999 to 9999mV.

Parameter	Description	Setting Range [mV]
Parameter No.50	Used to set the offset voltage for the analog monitor CH1 output.	−9999 to 9999
Parameter No.51	Used to set the offset voltage for the analog monitor CH2 output.	

6.2.4 Changing the stopping pattern at the forward/reverse stroke end

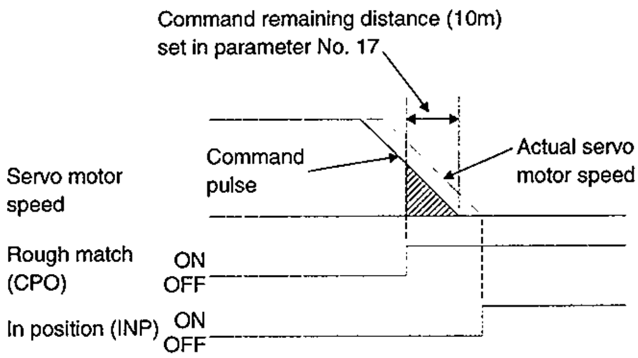
The motor stops when LSP-SG are opened during forward rotation. It may be run in the reverse rotation direction. The motor stops when LSN-SG are opened during reverse rotation. It may be run in the forward rotation direction.

The stopping method can be changed by changing the parameter No.23 value as indicated below:

Parameter No. 23 Setting	Stopping Method
□□0□ (initial value)	Sudden stop Droop pulse value is reset to make a stop.
□□1□	Slow stop Droop pulses are issued to make a slow stop.

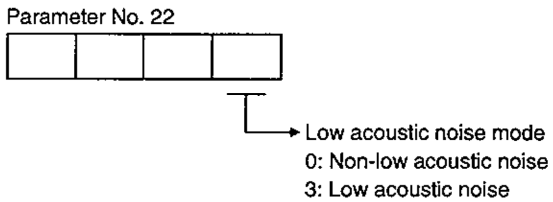
6.2.5 Rough match output

Rough match (CPO) is output when the command remaining distance reaches the value set in parameter No.17. The set remaining distance is 0 to 50000 [×10^{STM}mm].

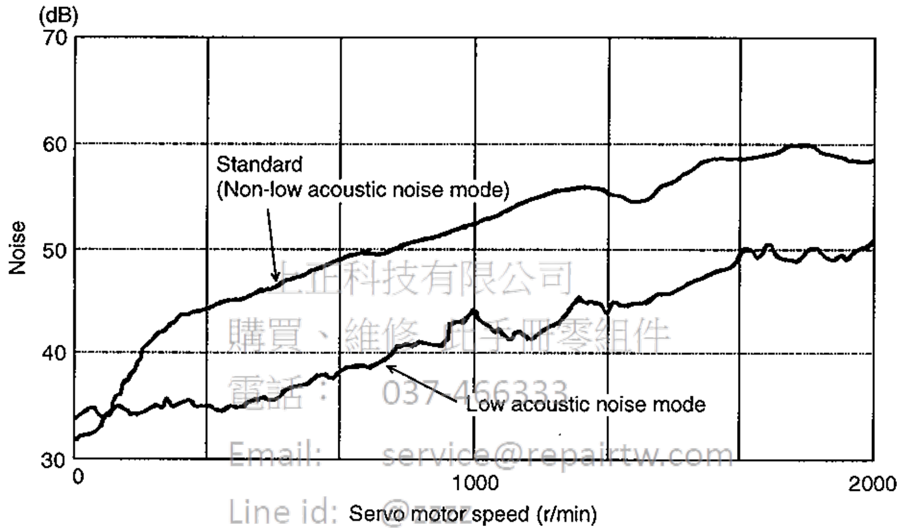


6.2.6 Low acoustic noise mode

By selecting the low acoustic noise mode in parameter No.22, audible-frequency magnetic noise generated by the servo motor can be improved about 20dB.



For HC-SF152



CONTENTS

7. PARAMETER UNIT AND DISPLAY SECTION

7.1 Parameter Unit Keys

The MR-PRU01A parameter unit is used to set data, perform test operation, set parameters, monitor the operating status, and display alarm definition.

MR-PRU01A Structure

Mode keys···Used to switch between modes displayed on the screen

- MONI-TOR : Monitoring mode select key
  - Used to change the screen display to the monitoring mode.
- ALM/DGN : Alarm/diagnostic mode select key
  - Used to change the screen display to the alarm/diagnostic mode.
- PARAM DATA : (1) Parameter mode select key
  - Used to change the screen display to the parameter mode.

  (2) Data setting mode select key
  - Used to change the screen display to the data setting mode.
- TEST : Test mode select key
  - Used to change the screen mode to the test mode.

Display···Liquid crystal screen (13 characters by 4 digits)

- Interactive parameter setting
- Help function, troubleshooting guidance
- Monitoring

Operation keys

- HELP : Help mode select key
  Used to set the monitor or parameter in a list.
- SHIFT : Shift key
  - Used to make the typing of the corresponding shift character (e.g.D of [D7]) valid.
  - Used to switch the screen. Example: Used to alternate between the current alarm and the concurrent alarm.
- CAN : Cancel key
  - Used to return to the previous screen.
- ▼ ▲ : Scroll keys
  - Used to scroll the screen.
  - Hold down the key for more than 1 second to increase the scroll speed.
  - Used to move the cursor on the screen.

Numeral keys

- 0 to F9 : Numerals (0 to F)
  - Used to enter the set value of the parameter. To type F, press [F9] after pressing the [SHIFT] key.
- STEP : (1) Decimal point

  (2) I step feed key
  - Press this key to perform positioning one step.

Definition key

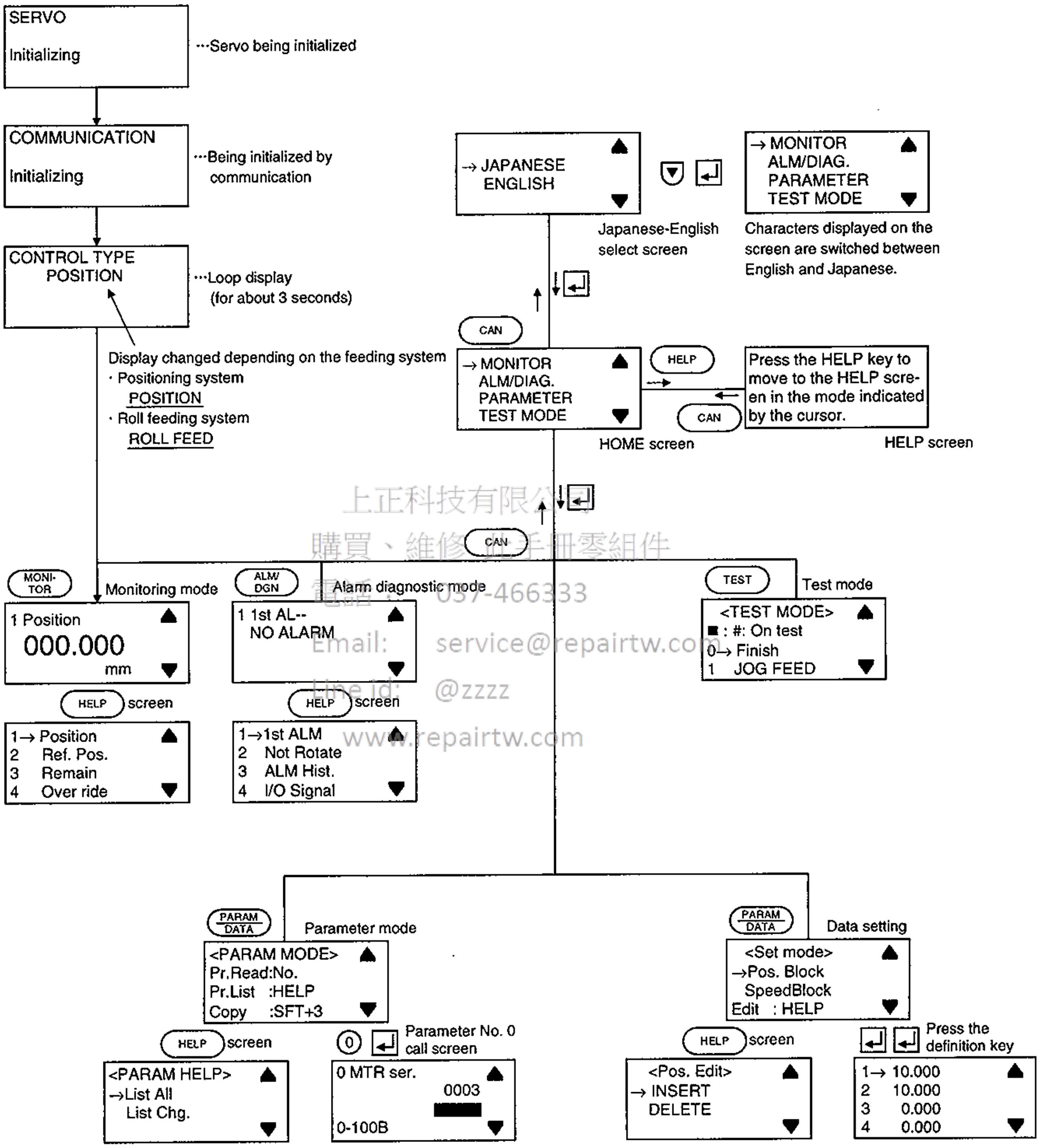
- ↵ : Definition key
  - Used to define the parameter data after it is entered.
  - Used to choose the necessary operation on the corresponding function menu screen.

Test run keys

- FWD : Forward rotation start key
  - Used to start forward rotation in the test run mode.
- —/REV : –/Reverse rotation start key
  - Used to enter the – (negative) sign.
  - Used to start reverse rotation in the test run mode.
- STOP RESET : Stop/reset key
  - Used to stop the test run temporarily.
  - Used to reset an alarm or clear date entered.

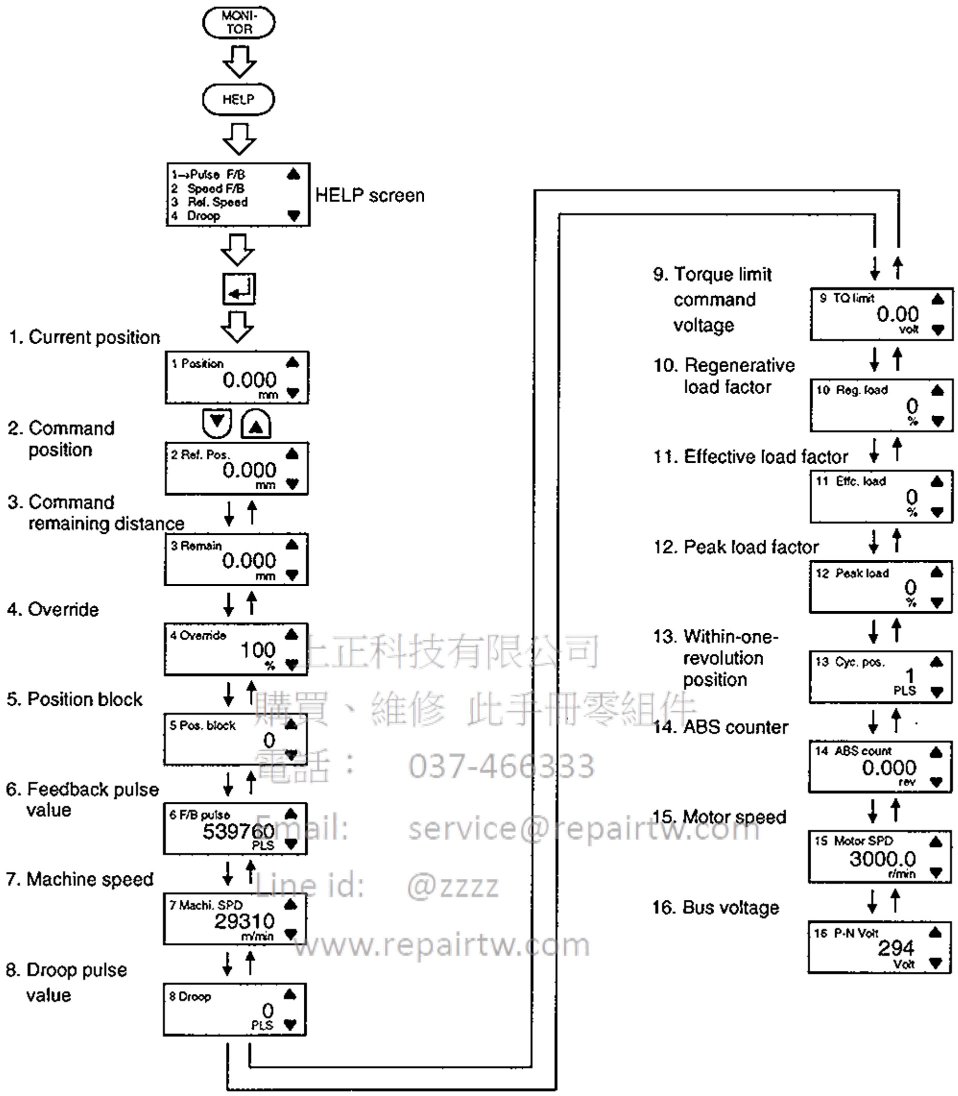
7.2 Operation of the Parameter Unit

(1) Outline of display sequence

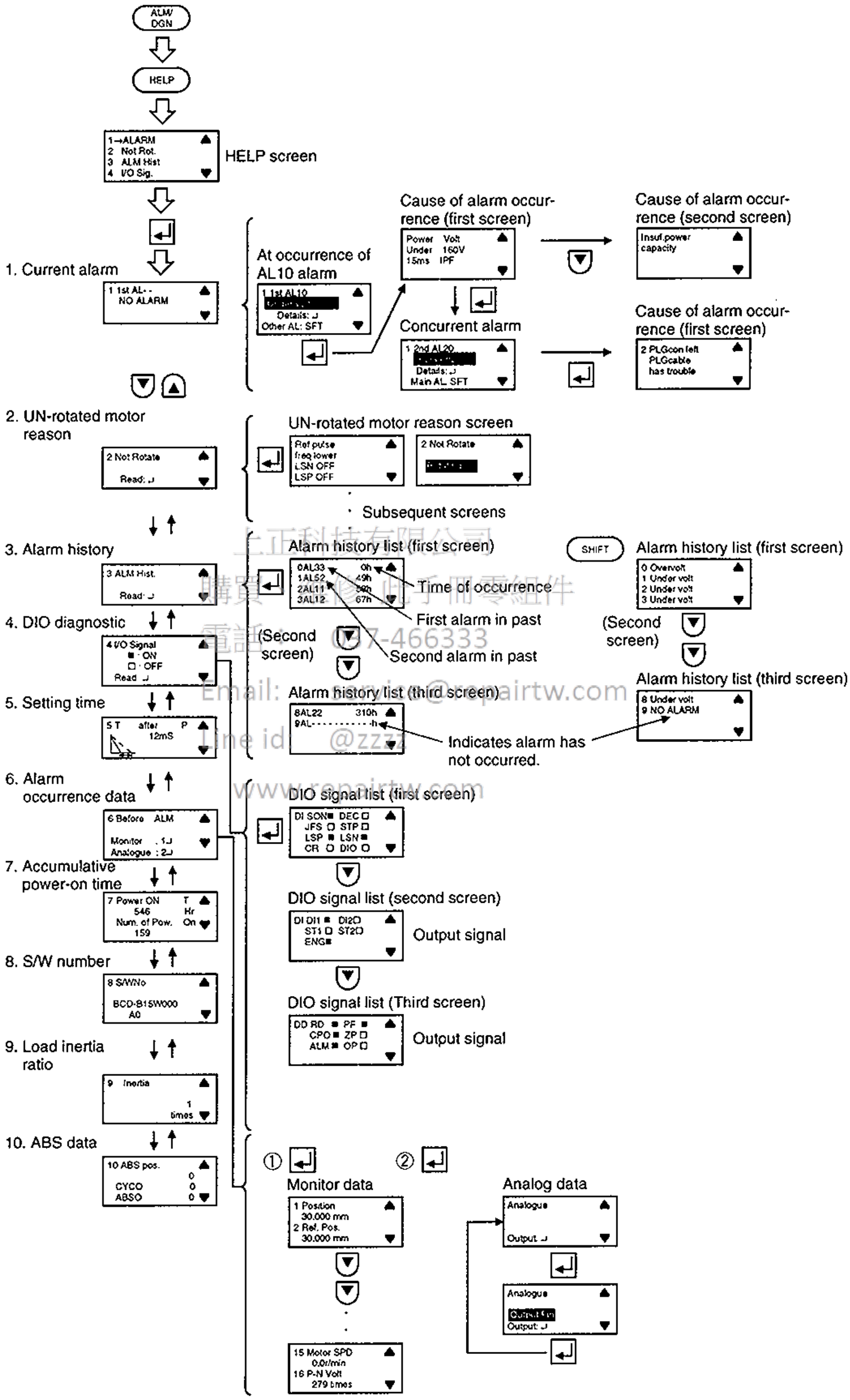


The displays and operation procedure in each mode are given on the following pages. Refer to them.

(2) Monitoring mode

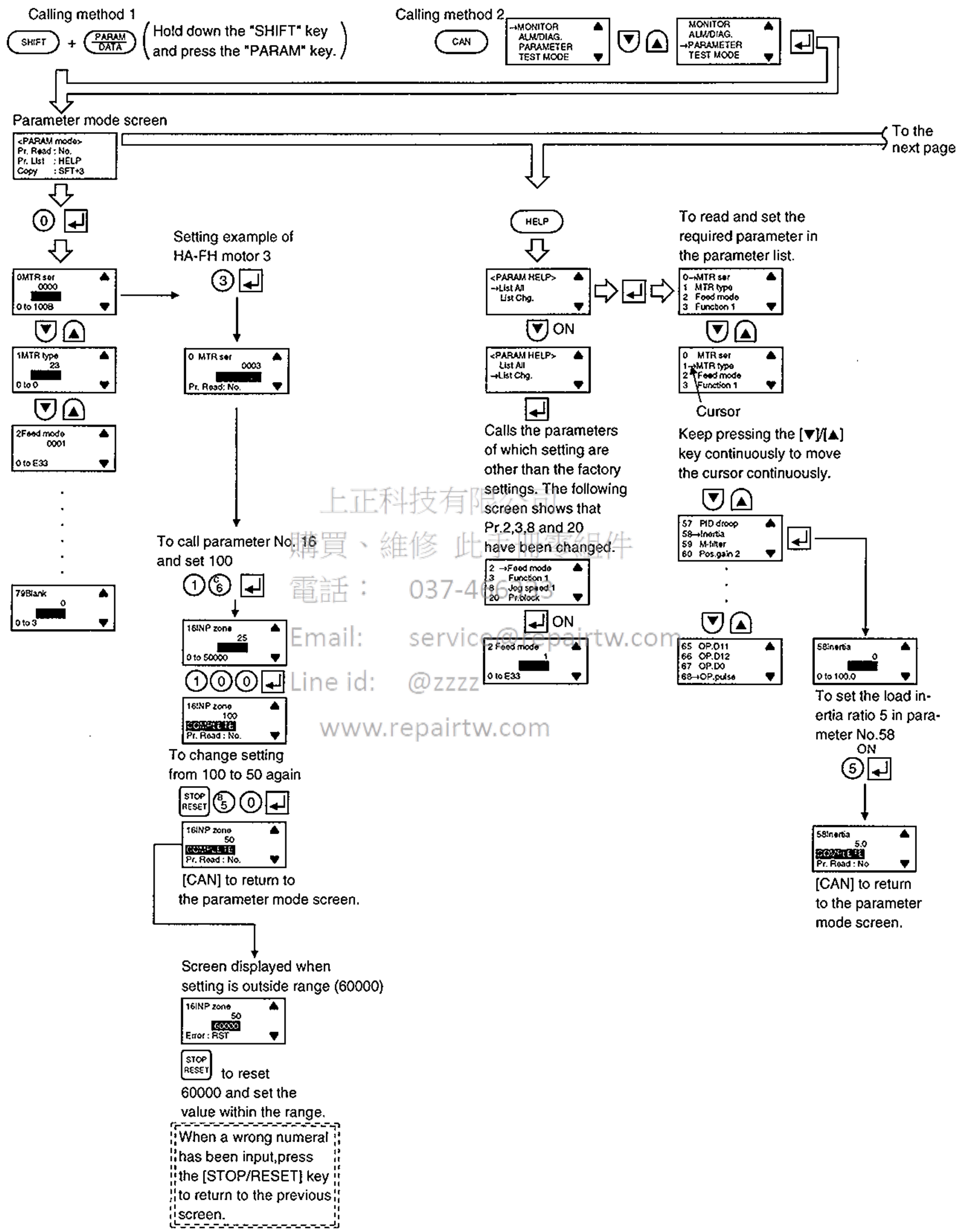


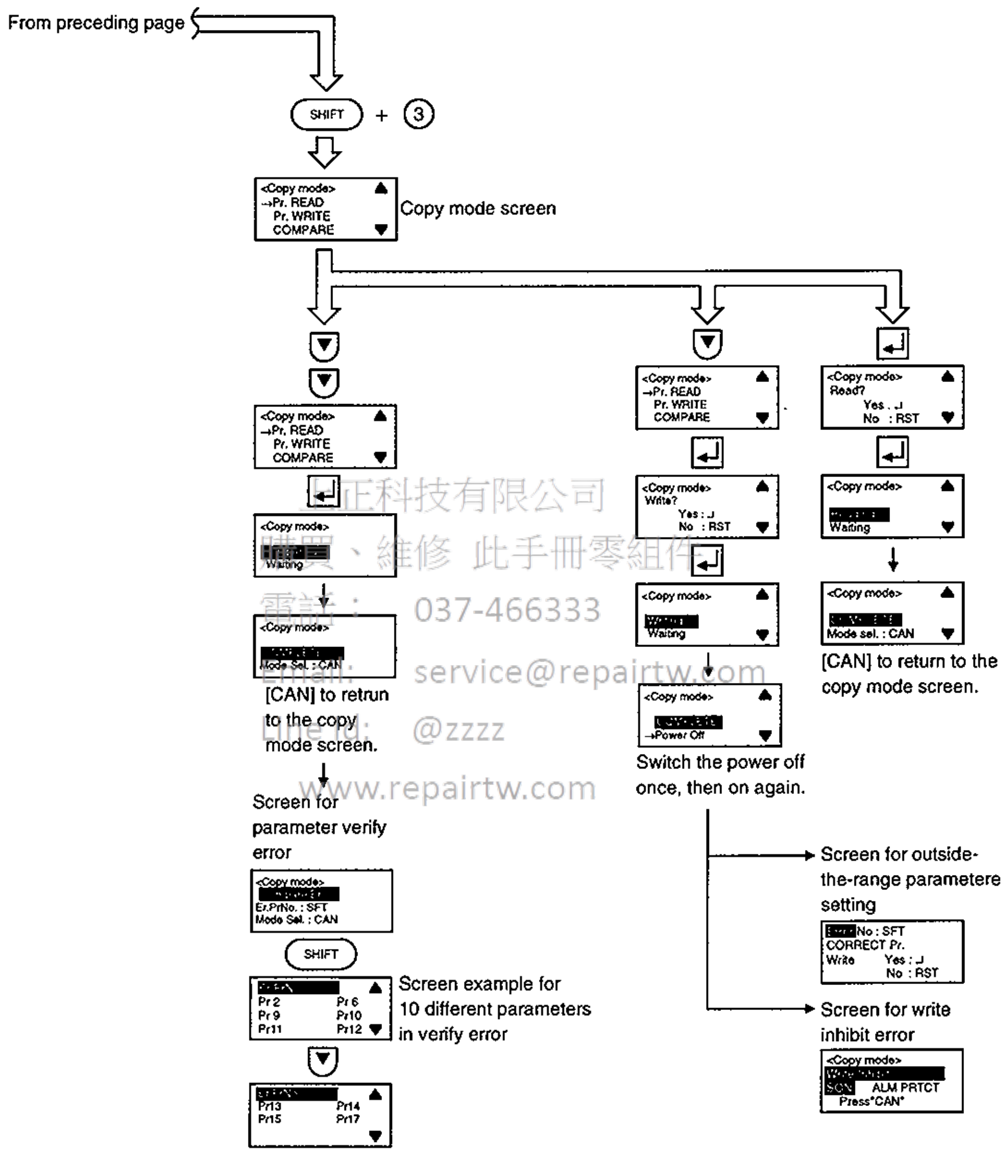
(3) Alarm mode



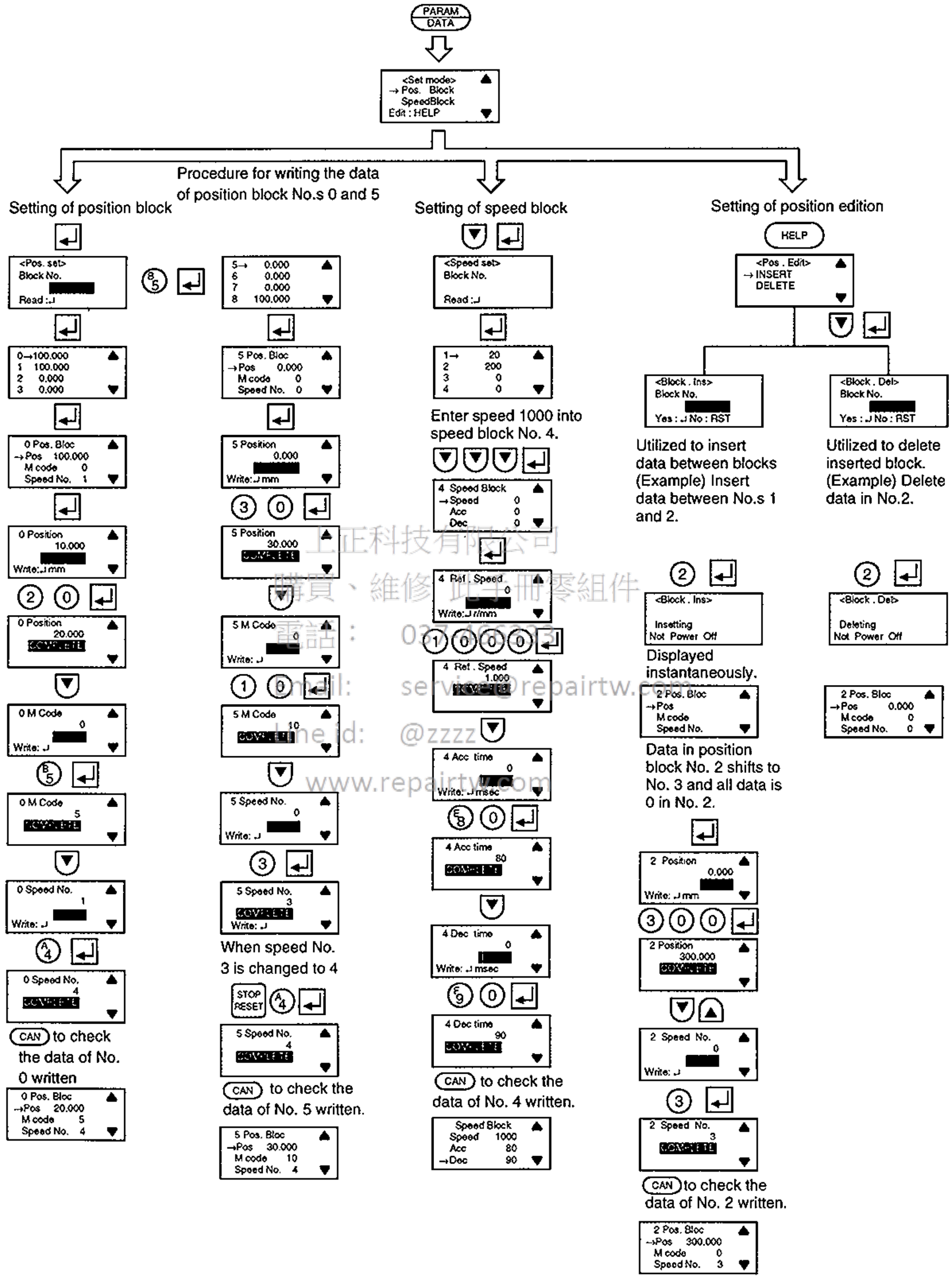
For details of the monitor screens, refer to Section 7.4.

(4) Parameter mode

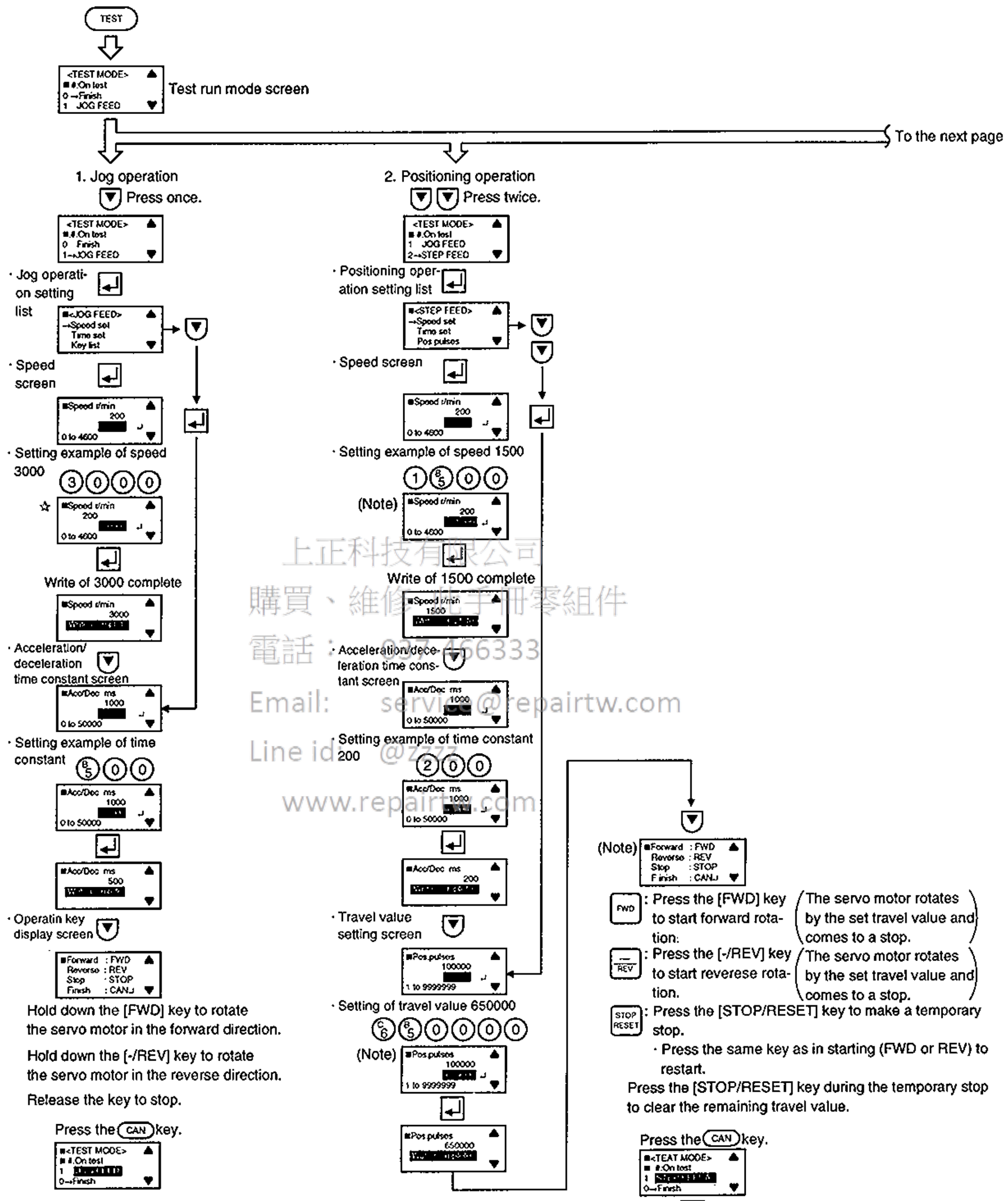



From preceding page
SHIFT
3
<Copy mode>
→Pr. READ
Pr. WRITE
COMPARE
Copy mode screen
Waiting
Mode Sel. : CAN
[CAN] to retrun to the copy mode screen.
Screen for parameter verify error
Er.PrNo. : SFT
Mode Sel. : CAN
SHIFT
Pr 2
Pr 6
Pr 9
Pr10
Pr11
Pr12
Screen example for 10 different parameters in verify error
Pr13
Pr14
Pr15
Pr17
Write?
Yes : ↵
No : RST
→Power Off
Switch the power off once, then on again.
Read?
Mode sel. : CAN
[CAN] to return to the copy mode screen.
Screen for outside-the-range parametere setting
No : SFT
CORRECT Pr.
Write
Screen for write inhibit error
ALM PRTCT
Press"CAN"

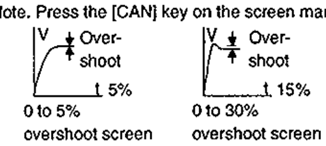
(5) Point table setting mode



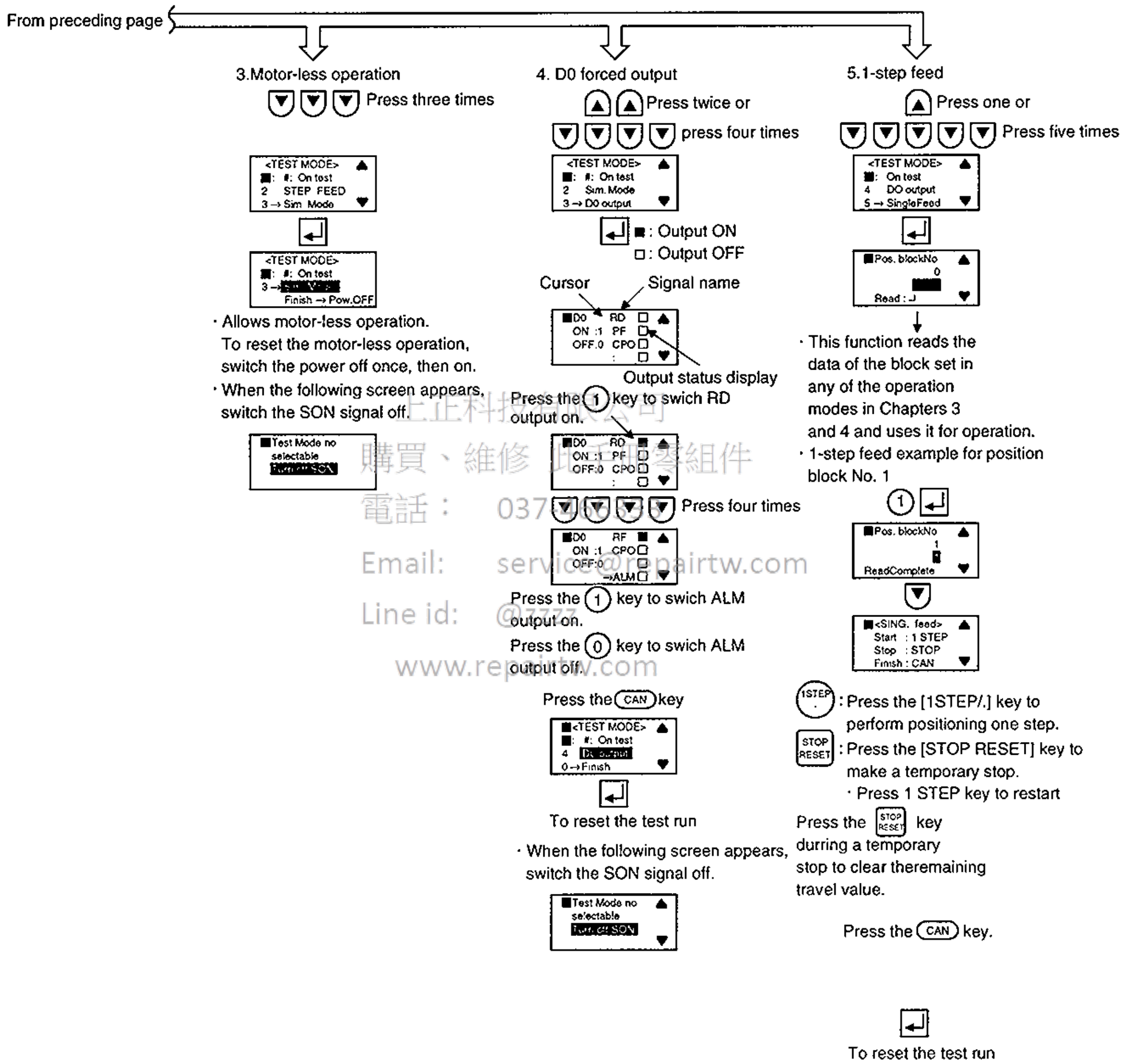
(6) Test run mode



Note. Press the [CAN] key on the screen marked ☆ to call the overshoot diagnostic screen.



The value shown at power-on or no operation is "--%".


From preceding page
3.Motor-less operation
Press three times
<TEST MODE>
#: On test
2 STEP FEED
3 → Sim Mode
Finish → Pow.OFF
· Allows motor-less operation.
To reset the motor-less operation, switch the power off once, then on.
· When the following screen appears, switch the SON signal off.
Test Mode no selectable
4. D0 forced output
Press twice or
press four times
<TEST MODE>
#: On test
2 Sim.Mode
3 → D0 output
■ : Output ON
□ : Output OFF
Cursor
Signal name
DO RD
ON :1 PF
OFF:0 CPO
Output status display
Press the 1 key to swich RD output on.
Press four times
DO RF
ON :1 CPO
OFF:0 →ALM
Press the 1 key to swich ALM output on.
Press the 0 key to swich ALM output off.
Press the CAN key
<TEST MODE>
#: On test
0 → Finish
To reset the test run
· When the following screen appears, switch the SON signal off.
Test Mode no selectable
5.1-step feed
Press one or
Press five times
<TEST MODE>
On test
4 DO output
5 → SingleFeed
Pos. blockNo
0
Read : ↵
· This function reads the data of the block set in any of the operation modes in Chapters 3 and 4 and uses it for operation.
· 1-step feed example for position block No. 1
Pos. blockNo
1
ReadComplete
<SING. feed>
Start : 1 STEP
Stop : STOP
Finish : CAN
1STEP : Press the [1STEP/.] key to perform positioning one step.
STOP RESET : Press the [STOP RESET] key to make a temporary stop.
· Press 1 STEP key to restart
Press the STOP RESET key durring a temporary stop to clear theremaining travel value.
Press the CAN key.
To reset the test run

7.3 Status Display

The running servo status can be shown on the parameter unit display and controller display.
In addition, the status can be displayed in up to six digits by use of the optional external digital display (MR-DP60). For the usage and parameter setting method, refer to Section 7.5.

Status Display	Parameter Unit Indication	Unit	Description	Indication Range	
				Controller display	Parameter Unit
Current position	Position	$\times10^{STM}$mm $\times10^{STM}$inch	Positioning system: The current position from the machine home position of 0 is displayed. Roll feeding system: 0 appears at power-on, counting starts when the start signal turns on, and the current position appears.	−9999 to 9999	−999999 to 999999
Command position	Ref.Pos.	$\times10^{STM}$mm $\times10^{STM}$inch	The position data or preset command position in the position block is displayed.	−9999 to 9999	−999999 to 999999
Command remaining distance	Remain	$\times10^{STM}$mm $\times10^{STM}$inch	During operation, the remaining distance between current position and command position is displayed. During a stop, the next feed distance is displayed.	−9999 to 9999	−999999 to 999999
Override	Over ride	%	The set value of override is displayed. 100% appears when override is invalid.	0 to 200	0 to 200
Position block	Pos. block		The position block number being executed is displayed.	0 to 255	0 to 255
Feedback pulse value	F/B Pulse	pulse	Feedback pulses from the servo motor encoder are counted and displayed. When the value exceeds ±9999999, it starts with 0. Press "RESET" to reset the value to "0".	−9999 to 9999	−9999999 to 9999999
Machine speed	Machi. SPD	mm/min m/s	Speed multiplied by the electronic gear is displayed. The unit can be changed with parameter No. 4.	0 to 9.999	0 to 999.999
Droop pulse value	Droop	pulse	The pulse value of the deviation counter is displayed. Reverse rotation pulse value is indicated by "-".	−9999 to 9999	−9999999 to 9999999
Torque limit command voltage	TQ limit	V	The voltage of the torque limit command (TLAP) is displayed.	0.00 to 10.00	0.00 to 10.00
Regenerative load factor	Reg. load	%	The percentage of regenerative power to the permissible regenerative value is displayed.	0 to 100	0 to 100
Effective load factor	Effc. load	%	Continuous effective load torque is displayed. The effective value is displayed relative to the rated torque of 100%..	0 to 320	0 to 320
Peak load factor	Peak load	%	Maximum generated torque is displayed. The peak value for the past 15 seconds is displayed relative to the rated torque of 100%.	0 to 320	0 to 320

Status Display	Parameter Unit Indication	Unit	Description	Indication Range	
				Controller Display	Parameter Unit
Within one-revolution position	Cyc. pos	pulse	The position within one revolution is displayed in terms of encoder pulses. The value returns to 0 when it exceeds the maximum number of pulses. As the controller display shows data in four digits, it shows the four lower digits of the actual position within one revolution.	Servo motor with resolution of 8192 pulses: 0 to 8191 Servo motor with resolution of 16384 pulses: 0 to 16383	Servo motor with resolution of 8192 pulses: 0 to 8191 Servo motor with resolution of 16384 pulses: 0 to 16383
ABS counter	ABS Count	rev	Moving distance from the home position in the absolute position detection system is displayed in the counter value of the absolute position encoder. As the controller display shows data in four digits, it shows the four lower digits of the actual counter value.	−32768 to 32767	−32768 to 32767
Servo motor speed	Motor SPD	r/min	The speed of the servo motor is displayed. Reverse rotation is indicated by "-".	−4600 to 4600	−4600.0 to 4600.0
Bus voltage	P/N Volt	V	The voltage (across P-N) of the main circuit converter is displayed.	0 to 400	0 to 400

7.4 Alarm/Diagnosis

The servo motor failing to rotate or any abnormality occurring during operation is indicated by the corresponding alarm code. The alarm may also be confirmed on the controller display, parameter unit or digital display.

(1) Controller display

When abnormality occurs, its definition is indicated by the corresponding number. For definitions, refer to Section 11.2.

(2) Parameter unit

When abnormality occurs, its definition can be confirmed as listed below.

a) Alarm/diagnosis list

No.	Name	Parameter Unit Display	Description
1	Current alarm	1stAL	The currently occurring alarm number, concurrent alarm, cause of alarm occurrence, etc. are displayed. When alarm occurs, the current alarm overrides the others in any display mode.
2	Unrotated motor reason	Not Rotate	When the servo motor does not rotate, the reason why it does not operate can be displayed.
3	Alarm history	ALM Hist.	The history of alarms from the most recent one to 9th preceding one is displayed with alarm numbers and energization time up to alarm occurrence. All past alarms can be cleared. (For full information, refer to Chapter 12.3)
4	DIO signal	I/O Sig.	The ON-OFF states of the external input signals are displayed.
5	Setting time	T after P	The time from when the position command becomes 0 to when the in-position signal is output is displayed.
6	Alarm occurrence data	Before ALM	The status at alarm occurrence (16 types) is displayed.
7	Accumulative power-on time	Power ON T.	Accumulative power-on time after shipment from our factory is displayed.
8	S/W number	S/W No.	For management by the manufacturer.
9	Ratio of load inertia moment to motor inertia moment	Inertia	The ratio of load inertia converted into the equivalent value at the servo motor shaft to the rotor inertia of the servo motor itself is estimated and displayed.
10	ABS data	ABS data	Absolute position data (ABC in-position) ······ Present position relative to the home position of 0 1-revolution data (CYSO) ······ Position within 1 revolution Multi-revolution data (ABS0) ······ Home position in multi-revolution data

b) Unrotated motor reason

O: Relevant, ×: Irrelevant

No.	Parameter Unit Display	Description	Feeding System: Positioning	Feeding System: Roll feeding
1	SON off	Servo on (SON) signal is off.	O	O
2	Alarm	Alarm has occurred.	O	O
3	RES on	Reset (RES) signal is on.	O	O
4	EMG off	Emergency stop (EMG) signal is off.	O	O
5	LSP on	Forward rotation stroke end (LSP) signal is off.	O	O
6	LSN off	Reverse rotation stroke end (LSN) signal is off.	O	O
7	ST1,ST2 on	· Both the forward rotation start (ST1) and reverse rotation start (ST2) are on. · The start signal is on in the positioning or zeroing mode.	O	O
8	ST1,ST2 off	Both the forward rotation start (ST1) and reverse rotation start (ST2) are off.	O	O
9	ST1 off	· The start (ST1) signal switches off when the absolute position command is given. · The start (ST1) signal switches off in the dog type zeroing mode.	O	×
10	Ext. torque limit low	The servo motor speed is 5r/min of less when the torque limit signal is switched on.	O	O
11	Int. torque limit low	The servo motor speed is 5r/min of less when the torque limit signal is switched on.	O	O
12	Over ride lower	The servo motor speed, which is preset to higher than 1r/min, is restricted to not higher than 1r/min by override.	O	O
13	Speed □- lower □ = 1 to 8 (speed block No.)	In positioning operation, the servo motor speed is preset to not higher than 1r/min, independently of whether override is valid or invalid.	O	O
14	Test mode	The motor does not operate because the FWD (forward rotation), REV (reverse rotation) or 1STEP (1-step feed) key of the parameter unit is not pressed in test operation.	O	O
15	Feed ref. lower	In positioning operation, the command remaining distance is less than the rough match output range.	O	O
16	JOG speed lower	In jog feed, the jog speed is preset to not higher than 1r/min, independently of whether override is valid or invalid.	O	O
17	ORG Speed lower	The zeroing speed or creep speed in the zeroing mode is preset to not higher than 1r/min, independently of whether override is valid or invalid.	O	O
18	Drive Mode Missetting	The operation mode has not been selected in the roll feeding system.	O	O
19	Speed No.0 Selected	Speed block No. 0 has been selected. Set any of speed blocks No. 1 to 8.	O	O
20	Once stop	During temporary stop.	O	O

POINT

- When the roll feeding operation, automatic positioning operation or zeroing (dog type) mode has been set, a start is made when the start signal (ST1, ST2) turns from OFF to ON. After a start, therefore, return ST1 or ST2 to OFF. Operation cannot be performed if ST1 or ST2 remains ON.
- Check the unrotated motor reasons No. 13 to 20 after clearing the No. 1 to 12 reasons.

7.5 Servo Amplifier Display

The status display and alarm can also be shown on the servo amplifier display.

7.5.1 Display examples

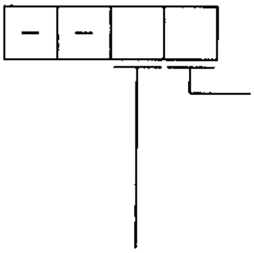
The controller display shows the four lower digits of the data to be displayed.

Item	4-Digit Display of controller		Display of Digital Display
Indication of current position (for -654.321) Motor speed (during reverse rotation at 3000r/min)	4. 3. 2. 1 Off 3. 0. 0. 0	The decimal points are lit as shown on the left to indicate the value of negative polarity. At this time, the actual decimal point is turned off.	- 6 5 4. 3 2 1 - 3 0 0 0
Indication of alarm or warning occurrence (Indication of overcurrent alarm occurrence) (Indication of watchdog alarm)	A L 3 2	If a warning has occurred, the original status display is restored by removing its cause. If an alarm has occurred, its indication is held until the alarm is reset or power is switched off once. The decimal points in all four digits are lit to indicate the watchdog alarm.	Not indicated in the controller display. However, the error related to MR-DP60 is displayed. · CPU error A L C P U · Communication error A L C 0
Indication during test operation		The decimal point in the lowest digit of the display flickers.	The parameter No. 19 setting or controller's CS1 setting (table below) status is displayed.
Indication given for 2 seconds after power-on or CS1 change-over (CS1: Current position abbreviation indication when set)	P P		P P

7.5.2 Selection of display data

The status display data can be selected by setting parameter No. 19 and rotary switch CS1.

(1) Parameter setting



Status indication of controller display and digital display (MR-DP60)
When the setting of the rotary switch CS1 is "0", the setting is the same as in the second digit. When the CS1 setting is other than "0", the CS1 setting has priority.

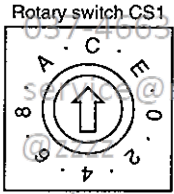
Status indication of parameter unit at power-on

0: Current position	8: Torque limit command voltage
1: Command position	9: Regenerative load factor
2: Command remaining distance	A: Effective load factor
3: Override	B: Peak load factor
4: Position block	C: Within-one-revolution position
5: Feedback pulse value	D: ABC counter
6: Machine speed	E: Servo motor speed
7: Droop pulse value	F: Bus voltage

(2) Setting of rotary switch CS1

You can select the status display by setting the rotary switch CS1 of the controller. Setting of "0" shows the status set in the first digit of parameter No. 19.

Rotary switch CS1



CS1 Setting	Status Display
0	Parameter No. 18 setting
1	Command position
2	Command remaining distance
3	Override
4	Position block
5	Feedback pulse value
6	Machine speed

CS1 Setting	Status Display
7	Droop pulse value
8	Torque limit command voltage
9	Regenerative load factor
A	Effective load factor
B	Peak load factor
C	Within-one-revolution position
D	Servo motor speed

7.6 Test Operation Mode

CAUTION	
	• The test operation mode is designed to confirm servo operation. It is not designed to confirm machine operation. Do not use this mode with the machine. • If an operation fault occurs, use emergency stop (EMG) to make a stop.

The parameter unit can be used to run the servo motor. For the way of operating the parameter unit, refer to Section 7.2 (6).
When a servo motor with electromagnetic brake is used with the machine to prevent the servo motor from starting in a brake operating status, always make up a sequence circuit which will operate the brake with the electromagnetic brake signal (ZSP) of the controller.

7.6.1 Jog operation

Jog operation can be performed with no command given from the external command device.

(1) Operation
Connect EMG-SG to perform jog operation, and connect VDD-VIN to use the internal power supply.
Hold down the "FWD" or "REV" key to rotate the servo motor. Release it to stop. The operating conditions can be changed with the parameter unit. The initial conditions and setting ranges of operation are listed below:

Item	Initial Value	Setting Range
Speed [r/min]	200	0 to instantaneous permissible speed
(Note) Acceleration/deceleration time constant [ms]	1000	0 to 50000

Note: The acceleration time constant indicates the time required for the servo motor to attain the rated speed from a stop (0r/min), and the deceleration time constant indicates the time required for the servo motor to stop from the rated speed.

How to use the keys is listed below:

Key	Description
"FWD"	Press to start CCW rotation. Release to stop.
"REV"	Press to start CW rotation. Release to stop.

If the parameter unit cable is disconnected during jog operation, the servo motor is decelerated to a stop.

(2) Status display
The status display can be monitored during jog operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

7.6.2 Positioning operation

Positioning operation can be performed once, with no command given from the external command device.

(1) Operation

Connect EMG-SG to perform positioning operation, and connect VDD-VIN to use the internal power supply.

By pressing the "FWD" or "REV" key, the servo motor rotates and the machine moves the preset distance and stops. The operating conditions can be changed with the parameter unit. The initial conditions and setting ranges of operation are listed below:

Item	Initial Value	Setting Range
Moving distance [pulse]	100000	0 to 9999999
Speed [r/min]	200	0 to instantaneous permissible speed
(Note) Acceleration/deceleration time constant [ms]	1000	0 to 50000

Note: The acceleration time constant indicates the time required for the servo motor to attain the rated speed from a stop (0r/min), and the deceleration time constant indicates the time required for the servo motor to stop from the rated speed.

How to use the keys is listed below:

Key	Description
"FWD"	Press to start positioning operation in the CCW direction.
"REV"	Press to start positioning operation in the CW direction.
"STOP"	Press during operation to make a temporary stop. Press the "STOP" key again to erase the remaining distance. To resume operation, press the key that was used to start operation.

If the parameter unit cable is disconnected during positioning operation, the servo motor is decelerated to a stop.

(2) Status display

The status display can be monitored during positioning operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

7.6.3 1-step feed operation

When there is no command given from the external command unit, you can perform positioning operation once in accordance with the point table.

(1) Operation

Connect EMG-SG to perform 1-step feed operation, and connect VDD-VIN to use the internal power supply.

Choose the position block No. and press the "1STEP" key to rotate the servo motor and perform operation in accordance with the settings of the selected position block. The position block No. selected can be changed from the parameter unit. The initial condition and setting range of the operation are listed below:

Item	Initial Setting	Setting Range
Position block No.	0	Standard: 0 to 7 When MR-H-D01 is used: 0 to 255

The keys are explained in the following table:

Key	Description
"1STEP"	Pressing this key starts positioning operation in accordance with the settings of the selected position block.
"STOP"	Pressing this key during operation stops the operation temporarily. Pressing the "STOP" key again erases the remaining distance. To resume operation, press the "1STEP" key.

If the parameter unit cable is disconnected during positioning operation, the servo motor decelerates to a stop.

(2) Status display

The status display can be monitored during positioning operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

7.6.4 Motorless operation

Without the servo motor being connected, the output signals can be provided and the status display monitored in response to external input signals as if the servo motor is actually running. This function can be used for the sequence check of the host programmable controller or the like.

(1) Operation

After turning off SON-SG, choose motorless operation. Then, perform external operation as in ordinary operation.

(2) Status display

The status display can be monitored during motorless operation.

(3) Termination of motorless operation

Switch power off to end motorless operation.

7.6.5 DO forced output

Each output signal can be turned on/off independently of the input signals and servo status. This function can be used for servo wiring check, etc.

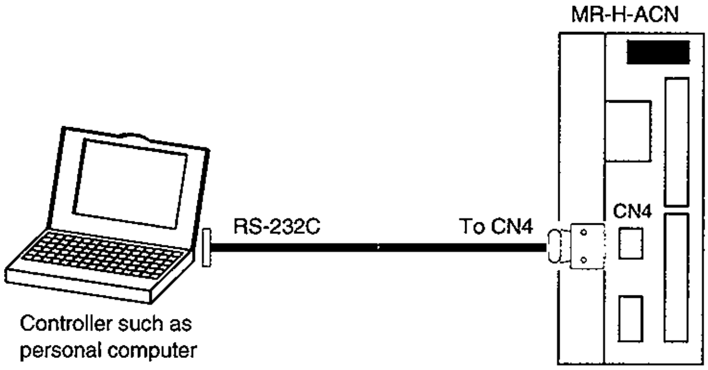
8. RS-232C COMMUNICATION FUNCTIONS

The MR-H-ACN has the RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.

8.1 Configuration

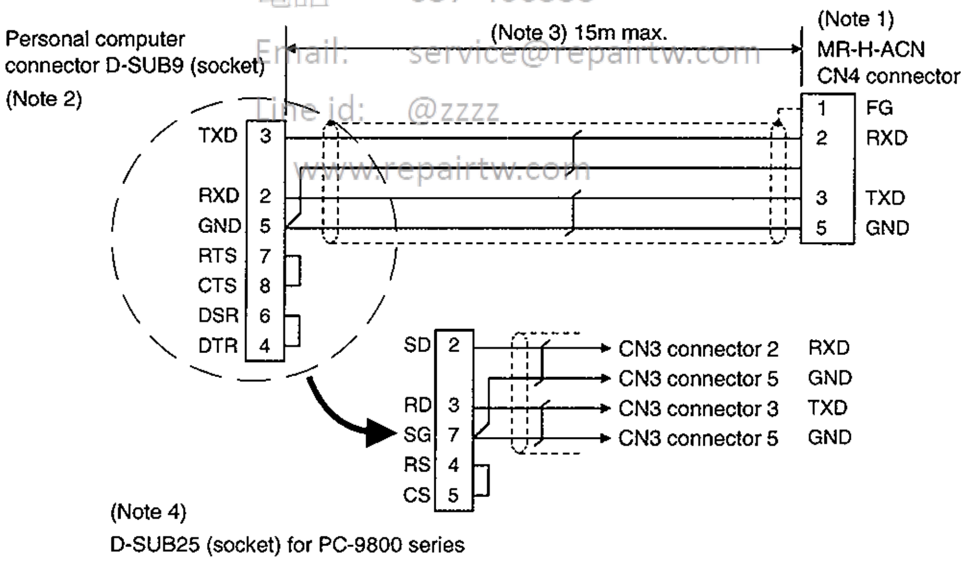
(1) Outline

A single axis of controller is operated.



(2) Cable connection diagram

Wire as shown below. The communication cable for connection with the personal computer (MR-HPCATCBL3M · MR-HPC98CBL3M) is available. (Refer to Section 15.1.6.)

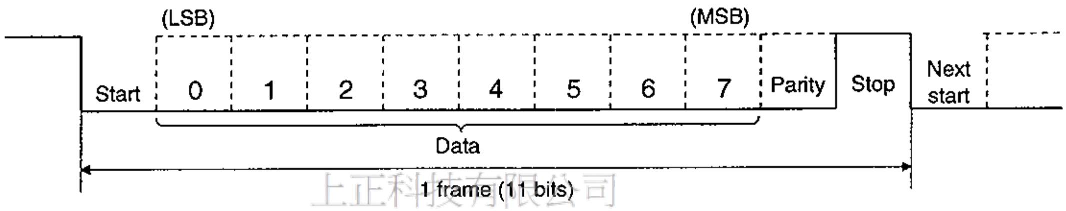


Note: 1. Honda Tsushin's CN3 connector
Connector: DE-9PF-N
Shell kit: DE-C1-J6-S6
2. For the PC-AT compatible controller series.
3. 15m max. in environment of little noise.
4. The PC-9800 series also has the half-pitch type.

8.2 Communication Specifications

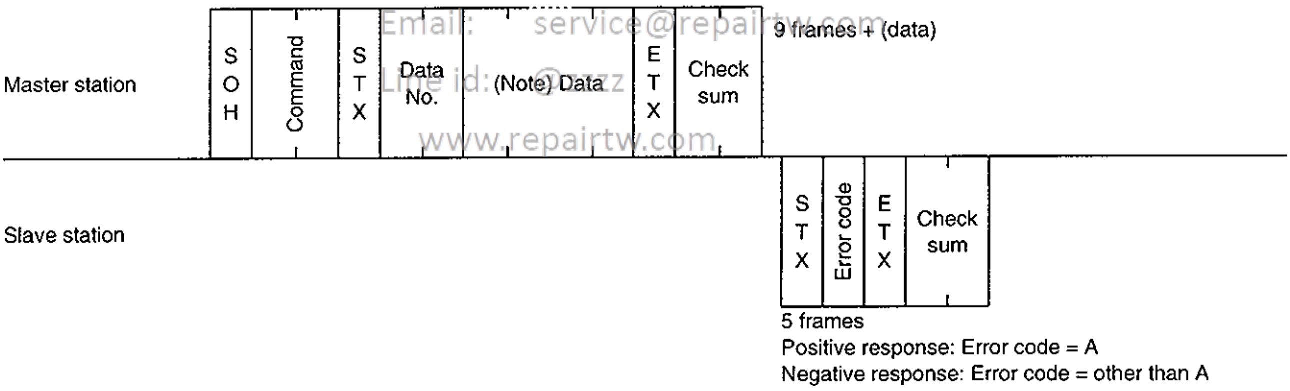
Servo Amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (Servo Amplifier) is called a master station and the device which sends a reply in response to the instruction (Servo Amplifier) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Description
Baudrate	4800/9600/19200 asynchronous system
Transfer code	Start bit : 1 bit Data bit : 8 bits Parity bit : 1 bit (even) Stop bit : 1 bit
Transfer protocol	Character system, half-duplex communication system



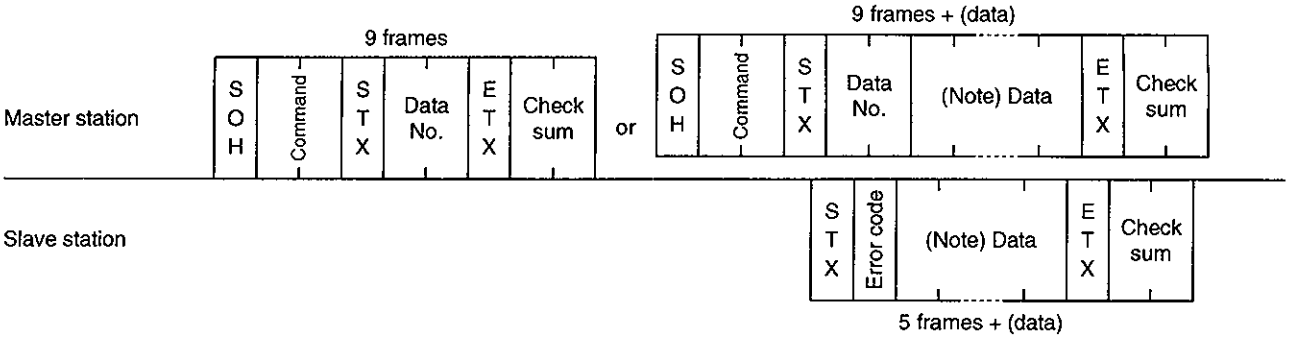
8.3 Protocol

(1) Transmission of data from master station to slave station



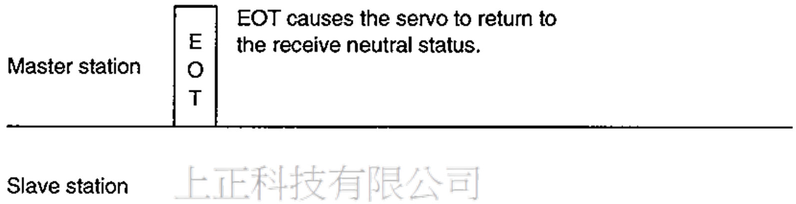
Note: Refer to (4) in this section for the number of data frames.

(2) Transmission of data request from master station to slave station



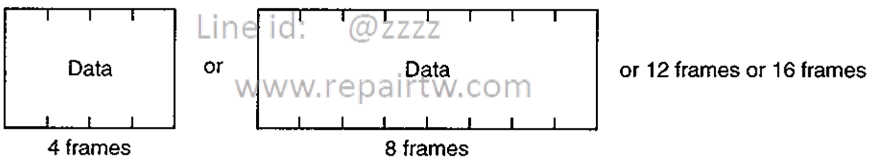
Note: Refer to (4) in this section for the number of data frames.

(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



8.4 Character Codes

(1) Control codes

Code Name	Hexadecimal (ASCII code)	Description	Personal Computer Terminal Key Operation (General)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

JIS8 unit codes are used.

b_8	0	0	0	0	0	0	0	0
b_7	0	0	0	0	1	1	1	1
b_6	0	0	1	1	0	0	1	1
b_5	0	1	0	1	0	1	0	1

b_8~b_5	b_4	b_3	b_2	b_1	R \ C	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

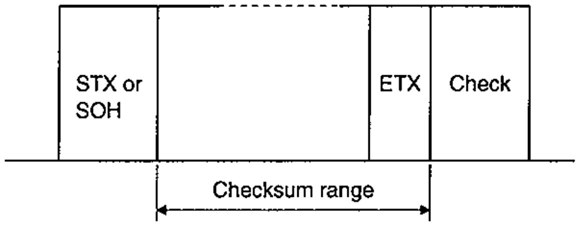
8.5 Error Codes

Error codes are used in the following cases and an error code of single-code length is transmitted.
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.

Error Code		Error Name	Description	Remarks
Servo normal	Servo alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	Character not existing in the specifications was transmitted.	
[E]	[e]	Command error	Command not existing in the specifications was transmitted.	
[F]	[f]	Data No. error	Data No. not existing in the specifications was transmitted.	
[J]	[j]	External reset ON	Reset (RES) turned on.	Special response

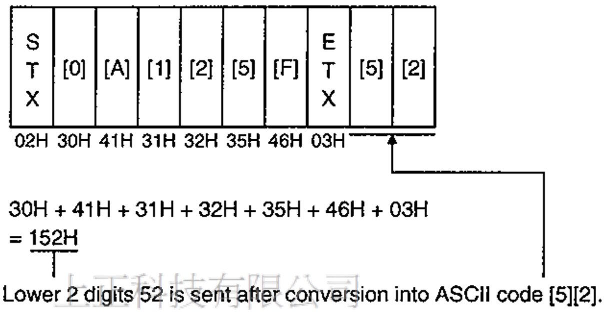
8.6 Checksum

Checksum range



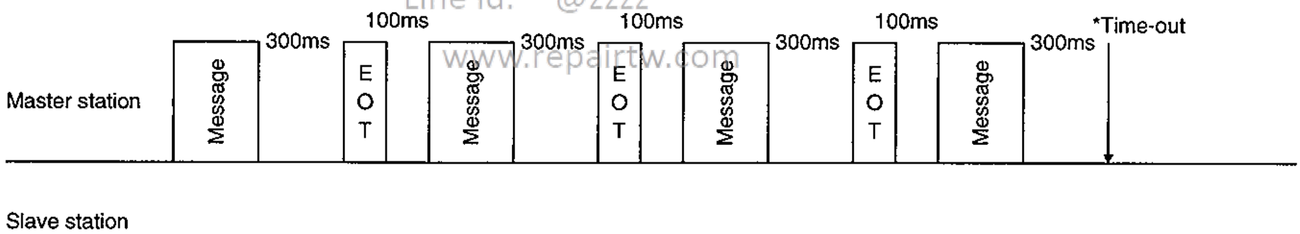
The checksum is sent as a JIS8-coded hexadecimal code representing the lower two digits of the sum of JIS8-coded hexadecimal values up to ETX, with the exception of the first control code (STX or SOH).

(Example)



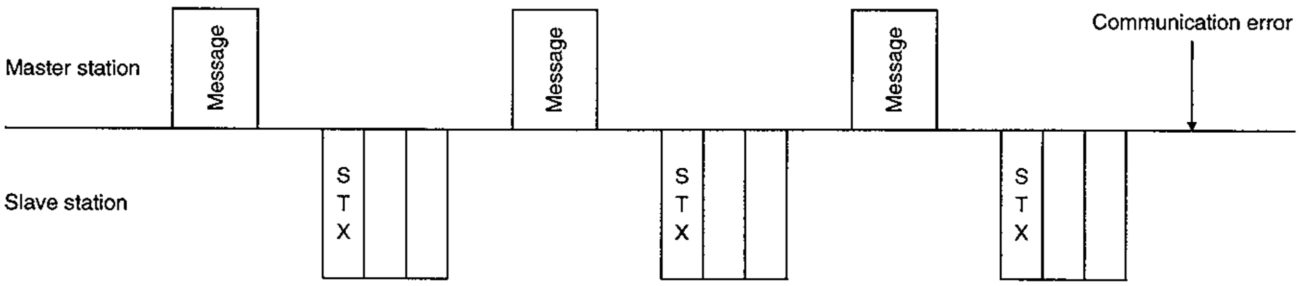
8.7 Time-Out Operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300[ms] after the master station has ended communication operation. 100[ms] after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above operation three times. (Communication error)



8.8 Retry Operation

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [I], [b] to [i]). In this case, the master station retransmits the message which was sent at the occurrence of the fault (Retry operation). A communication error occurs if the above operation is repeated and results in the error three or more consecutive times.



Similarly, when the master station detects a fault (e.g. checksum, parity) in the response data from the slave station, the master station retransmits the message which was sent at the occurrence of the fault. A communication error occurs if the retry operation is performed three times.

8.9 Initialization

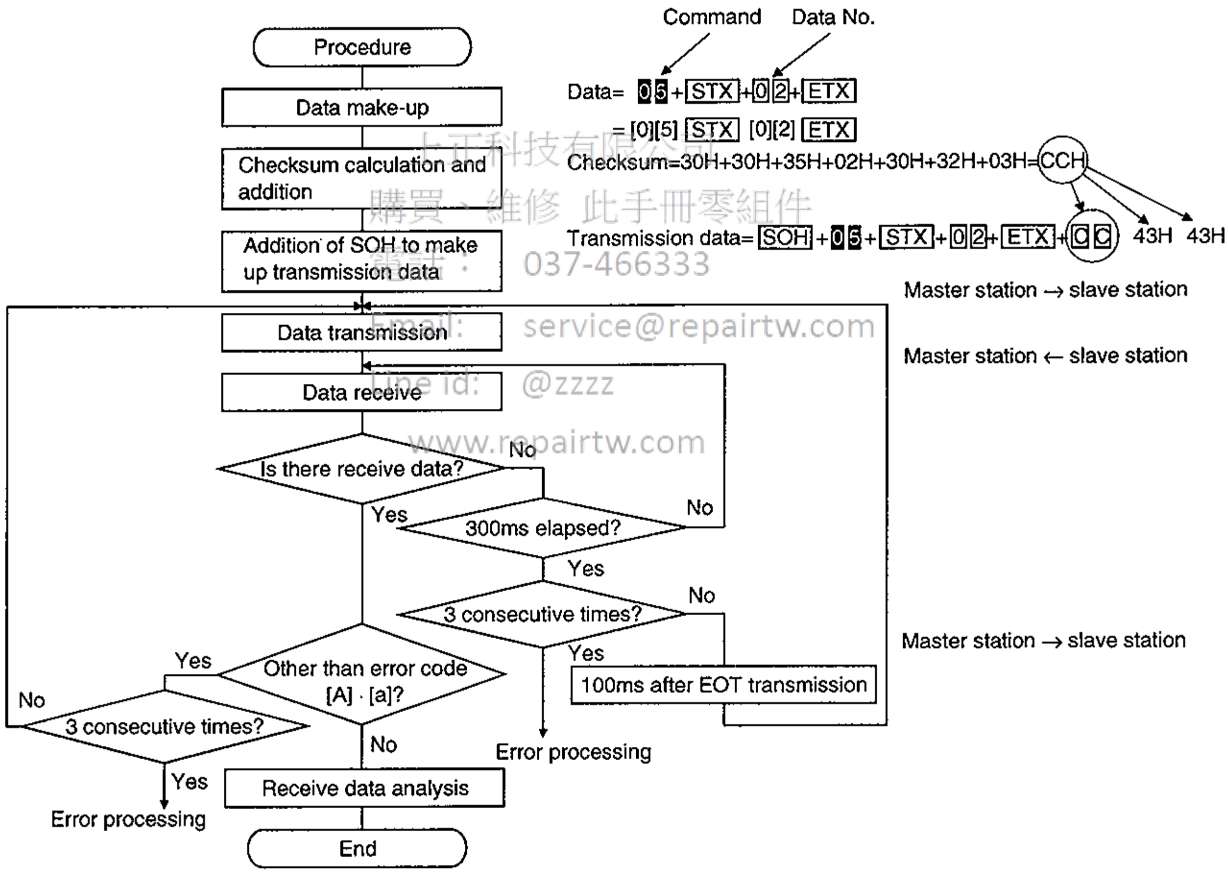
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

1) 1s or more time has elapsed after the slave station is switched on; and
2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

8.10 Communication Procedure Example

The following example reads the setting of parameter No. 2:

Data Item	Value	Description
Command	05	Read command
Data No.	02	Parameter No.2



8.11 Command and Data No. List

8.11.1 Read commands

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

Command	Data No.	Description	Display Item	Frame Length
[0][1]	[0][0]	Status display name and unit	Current position	16
[0][1]	[0][1]		Command position	16
[0][1]	[0][2]		Command remaining distance	16
[0][1]	[0][3]		Override	16
[0][1]	[0][4]		Position block	16
[0][1]	[0][5]		Command pulse value	16
[0][1]	[0][6]		Machine speed	16
[0][1]	[0][7]		Droop pulse	16
[0][1]	[8][8]		Torque limit command voltage	16
[0][1]	[0[9]		Regenerative load ratio	16
[0][1]	[0][A]		Effective load factor	16
[0][1]	[0][B]		Peak load ratio	16
[0][1]	[0][C]		Within one-revolution position	16
[0][1]	[0][D]		ABS counter	16
[0][1]	[0][E]		Servo motor speed	16
[0][1]	[0][F]		Bus voltage	16
[0][1]	[8][0]	Status display data value and processing information	Current position	12
[0][1]	[8][1]		Command position	12
[0][1]	[8][2]		Command remaining distance	12
[0][1]	[8][3]		Override	12
[0][1]	[8][4]		Position block	12
[0][1]	[8][5]		Command pulse value	12
[0][1]	[8][6]		Machine speed	12
[0][1]	[8][7]		Droop pulse	12
[0][1]	[8][8]		Torque limit command voltage	12
[0][1]	[8][9]		Regenerative load ratio	12
[0][1]	[8][A]		Effective load factor	12
[0][1]	[8][B]		Peak load ratio	12
[0][1]	[8][C]		Within one-revolution position	12
[0][1]	[8][D]		ABS counter	12
[0][1]	[8][E]		Servo motor speed	12
[0][1]	[8][F]		Bus voltage	12

(2) Parameter (Command [0][5] to [0][8])

Command	Data No.	Description	Frame Length
[0][5]	[0][0]~ [4][F]	Present value of the corresponding parameter (The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)	8
[0][6]	[0][0]~ [4][F]	Upper limit value of the corresponding parameter setting range (The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)	8
[0][7]	[0][0]~ [4][F]	Lower limit value of the corresponding parameter setting range (The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)	8
[0][8]	[0][0]~ [4][F]	Name of the corresponding parameter (The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)	12

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

Command	Data No.	Description	Alarm Occurrence Sequence	Frame Length
[3][3]	[1][0]	Alarm number in alarm history	most recent alarm	4
[3][3]	[1][1]		first alarm in past	4
[3][3]	[1][2]		second alarm in past	4
[3][3]	[1][3]		third alarm in past	4
[3][3]	[1][4]		fourth alarm in past	4
[3][3]	[1][5]		fifth alarm in past	4
[3][3]	[1][6]		sixth alarm in past	4
[3][3]	[1][7]		seventh alarm in past	4
[3][3]	[1][8]		eighth alarm in past	4
[3][3]	[1][9]		ninth alarm in past	4
[3][3]	[2][0]	Alarm occurrence time in alarm history	most recent alarm	8
[3][3]	[2][1]		first alarm in past	8
[3][3]	[2][2]		second alarm in past	8
[3][3]	[2][3]		third alarm in past	8
[3][3]	[2][4]		fourth alarm in past	8
[3][3]	[2][5]		fifth alarm in past	8
[3][3]	[2][6]		sixth alarm in past	8
[3][3]	[2][7]		seventh alarm in past	8
[3][3]	[2][8]		eighth alarm in past	8
[3][3]	[2][9]		ninth alarm in past	8
[3][3]	[3][0]	Alarm occurrence name	most recent alarm	12
[3][3]	[3][1]		first alarm in past	12
[3][3]	[3][2]		second alarm in past	12
[3][3]	[3][3]		third alarm in past	12
[3][3]	[3][4]		fourth alarm in past	12
[3][3]	[3][5]		fifth alarm in past	12
[3][3]	[3][6]		sixth alarm in past	12
[3][3]	[3][7]		seventh alarm in past	12
[3][3]	[3][8]		eighth alarm in past	12
[3][3]	[3][9]		ninth alarm in past	12

(4) Current alarm (Command [0][2] · [3][5])

Command	Data No.	Description	Frame Length
[0][2]	[0][0]	Current alarm number	4
[0][2]	[0][1]	Current alarm name	12
[0][2]	[0][8]	Concurrent alarm number	4
[0][2]	[0][9]	Concurrent alarm name	12

Command	Data No.	Description	Status Display Item	Frame Length
[3][5]	[0][0]	Status display name and unit at alarm occurrence	Current position	16
[3][5]	[0][1]		Command position	16
[3][5]	[0][2]		Command remaining distance	16
[3][5]	[0][3]		Override	16
[3][5]	[0][4]		Position block	16
[3][5]	[0][5]		Command pulse value	16
[3][5]	[0][6]		Machine speed	16
[3][5]	[0][7]		Droop pulse	16
[3][5]	[0][8]		Torque limit command voltage	16
[3][5]	[0][9]		Regenerative load ratio	16
[3][5]	[0][A]		Effective load factor	16
[3][5]	[0][B]		Peak load ratio	16
[3][5]	[0][C]		Within one-revolution position	16
[3][5]	[0][D]		ABS counter	16
[3][5]	[0][E]		Servo motor speed	16
[3][5]	[0][F]		Bus voltage	16
[3][5]	[8][0]	Status display data value and processing information at alarm occurrence	Current position	12
[3][5]	[8][1]		Command position	12
[3][5]	[8][2]		Command remaining distance	12
[3][5]	[8][3]		Override	12
[3][5]	[8][4]		Position block	12
[3][5]	[8][5]		Command pulse value	12
[3][5]	[8][6]		Machine speed	12
[3][5]	[8][7]		Droop pulse	12
[3][5]	[8][8]		Torque limit command voltage	12
[3][5]	[8][9]		Regenerative load ratio	12
[3][5]	[8][A]		Effective load factor	12
[3][5]	[8][B]		Peak load ratio	12
[3][5]	[8][C]		Within one-revolution position	12
[3][5]	[8][D]		ABS counter	12
[3][5]	[8][E]		Servo motor speed	12
[3][5]	[8][F]		Bus voltage	12

(5) External I/O signals (command [3][4])

Command	Data No.	Description	Signal	Frame Length
[3][4]	[1][1]	External input signal ON/OFF status	SON	4
[3][4]	[1][2]		DEC	4
[3][4]	[1][3]		JFS	4
[3][4]	[1][4]		STP	4
[3][4]	[1][5]		LSP	4
[3][4]	[1][6]		LSN	4
[3][4]	[1][7]		CR	4
[3][4]	[1][8]		DI0	4
[3][4]	[1][9]		DI1	4
[3][4]	[1][A]		DI2	4
[3][4]	[1][B]		ST1	4
[3][4]	[1][C]		ST2	4
[3][4]	[9][1]	External output signal ON/OFF status	RD	4
[3][4]	[9][2]		PF	4
[3][4]	[9][3]		COP	4
[3][4]	[9][4]		ZP	4
[3][4]	[9][5]		ALM	4
[3][4]	[9][6]		OP	4

(6) Position block

(a) Position data (command [4][0] to [4][3])

Command	Data No.	Description	Frame Length
[4][0]	[0][0] to [F][F]	Data form and data of position data (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][1]	[0][0] to [F][F]	Setting range of position data (upper limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][2]	[0][0] to [F][F]	Setting range of position data (lower limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][3]	[2][0]	Display unit of position data	8

(b) M code (command [4][5] to [4][8])

Command	Data No.	Description	Frame Length
[4][5]	[0][0] to [F][F]	Data form and data of M code (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][6]	[0][0] to [F][F]	Setting range of M code (upper limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][7]	[0][0] to [F][F]	Setting range of M code (lower limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][8]	[2][0]	Display unit of M code	8

(c) Speed block No. (command [4][A] to [4][D])

Command	Data No.	Description	Frame Length
[4][A]	[0][0] to [F][F]	Data form and data of speed block No. (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][B]	[0][0] to [F][F]	Setting range of speed block No. (upper limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][C]	[0][0] to [F][F]	Setting range of speed block No. (lower limit value) (The decimal equivalent of the data No. corresponds to the position block No.)	8
[4][D]	[2][0]	Display unit of speed block No.	8

(7) Speed block

(a) Speed (commands [5][0] to [5][3])

Command	Data No.	Description	Frame Length
[5][0]	[0][1] to [0][8]	Data form and data of speed (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][1]	[0][1] to [0][8]	Setting range of speed (upper limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][2]	[0][0] to [0][8]	Setting range of speed (lower limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][3]	[2][0]	Display unit of speed	8

(b) Acceleration time constant (commands [5][4] to [5][7])

Command	Data No.	Description	Frame Length
[5][4]	[0][1] to [0][8]	Data form and data of acceleration time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][5]	[0][1] to [0][8]	Setting range of acceleration time constant (upper limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][6]	[0][0] to [0][8]	Setting range of acceleration time constant (lower limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][7]	[2][0]	Display unit of acceleration time constant	8

(c) Deceleration time constant (commands [5][8] to [5][B])

Command	Data No.	Description	Frame Length
[5][8]	[0][1] to [0][8]	Data form and data of deceleration time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][9]	[0][1] to [0][8]	Setting range of deceleration time constant (upper limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][A]	[0][0] to [0][8]	Setting range of deceleration time constant (lower limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][B]	[2][0]	Display unit of deceleration time constant	8

(d) S-pattern time constant (commands [5][C] to [5][F])

Command	Data No.	Description	Frame Length
[5][C]	[0][1] to [0][8]	Data form and data of S-pattern time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][D]	[0][1] to [0][8]	Setting range of S-pattern time constant (upper limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][E]	[0][0] to [0][8]	Setting range of S-pattern time constant (lower limit value) (The decimal equivalent of the data No. corresponds to the speed block No.)	8
[5][F]	[2][0]	Display unit of S-pattern time constant	8

8.11.2 Write commands

(1) Japanese-English switch-over (command [8][0])

Command	Data No.	Description	Setting Range	Frame Length
[8][0]	[0][0]	Japanese-English switch-over 0000: Japanese 0001: English	0000 · 0001	4

(2) Status display (command [8][1])

Command	Data No.	Description	Setting Range	Frame Length
[8][1]	[0][0]	Status display data clear	1EA5	4

(3) Manual operation of roll feeding system (command [8][1])

Command	Data No.	Description	Setting Range	Frame Length
[8][1]	[2][0]	FWD key of parameter unit in manual operation mode of roll feeding system 1EA5: Forward rotation JOG start 5AE1: Forward rotation JOG end	1EA5 · 5AE1	4
[8][1]	[2][1]	REV key of parameter unit in manual operation mode of roll feeding system 1EA5: Reverse rotation JOG start 5AE1: Reverse rotation JOG end	1EA5 · 5AE1	4
[8][1]	[2][2]	1STEP key of parameter unit in manual operation mode of roll feeding system 1-step operation start	1EA5	4

(4) Alarm (command [8][2])

Command	Data No.	Description	Setting Range	Frame Length
[8][2]	[0][0]	Alarm clear	1EA5	4
[8][2]	[2][0]	Alarm history clear	1EA5	4
[8][2]	[5][0]	Analog output of data before alarm occurrence	1EA5	4

(5) Parameter (command [8][4])

Command	Data No.	Description	Setting Range	Frame Length
[8][4]	[0][0] to [4][F]	Each parameter write (The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.)	Depends on the parameter.	8

(6) Operation mode selection (command [8][B])

Command	Data No.	Description	Setting Range	Frame Length
[8][B]	[0][0]	Operation mode changing 0000: Exit from test operation mode 0001: Jog operation 0002: Positioning operation 0003: Motor-less operation 0004: DO forced output (output signal forced output) 0005: 1 step feed operation	0000 to 0004	4

(7) DO forced output (command [8][B])

Command	Data No.	Description	Signal	Setting Range	Frame Length
[8][B]	[8][1]	DO forced output 0000:OFF 0001:ON	RD	0000 · 0001	4
[8][B]	[8][2]		PF	0000 · 0001	4
[8][B]	[8][3]		COP	0000 · 0001	4
[8][B]	[8][4]		ZP	0000 · 0001	4
[8][B]	[8][5]		ALM	0000 · 0001	4
[8][B]	[8][6]		OP	0000 · 0001	4

(8) External input signal disable (command [9][0])

Command	Data No.	Description	Setting Range	Frame Length
[9][0]	[0][0]	Turns off the external input signals (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN, independently of the external ON/OFF statuses.	1EA5	4
[9][0]	[0][1]	Disables only the external input signals (DI) with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[0][2]	Disables only the external analog input signals.	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 analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][1]	Enables the disabled external input signals (DI) with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][2]	Enables the disabled external analog input signals.	1EA5	4
[9][0]	[1][3]	Enables the disabled external output signals (DO).	1EA5	4

(9) Forced ON/OFF of external I/O signals (DIO) [A][0])

Command	Data No.	Description	Setting Range	Frame Length
[A][0]	[0][0]	Forces the external output signals (DO) to turn on/off.	00000000 to FFFFFFFF	8
[A][0]	[0][1]	Forces the external input signals (DI) to turn on/off with the exception of EMG, LSP and LSN.	00000000 to FFFFFFFF	8

(10) Data for test operation mode (command [A][0])

Command	Data No.	Description	Setting Range	Frame Length
[A][0]	[1][0]	Writes the speed of the test operation mode (jog operation, positioning operation).	0000 to 7FFF	4
[A][0]	[1][1]	Writes the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	00000000 to 7FFFFFFF	8
[A][0]	[1][2]	Clears the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation).	1EA5	4
[A][0]	[1][3]	Writes the moving distance (in pulses) of the test operation mode (jog operation, positioning operation).	80000000 to 7FFFFFFF	8
[A][0]	[1][5]	Temporary stop command of the test operation mode (jog operation, positioning operation)	1EA5	4
[A][0]	[1][A]	Writes the position block No. of the test operation mode (1 step feed operation).	80000000 to 7FFFFFFF	8
[A][0]	[1][B]	"1 STEP" key of test operation mode (1-step feed operation)	1EA5	4

(11) Position block data (commands [C][0], [C][2], [C][4])

Command	Data No.	Description	Setting Range	Frame Length
[C][0]	[0][0] to [F][F]	Position data (The decimal equivalent of the data No. corresponds to the position block No.)	According to commands [4][1] and [4][2]	8
[C][2]	[0][0] to [F][F]	M code (The decimal equivalent of the data No. corresponds to the position block No.)	According to commands [4][6] and [4][7]	8
[C][4]	[0][0] to [F][F]	Speed block No. (The decimal equivalent of the data No. corresponds to the position block No.)	According to commands [4][B] and [4][C]	8

(12) Speed block data (commands [C][6] to [C][9])

Command	Data No.	Description	Setting Range	Frame Length
[C][6]	[0][1] to [0][7]	Speed (The decimal equivalent of the data No. corresponds to the speed block No.)	According to commands [5][1] and [5][2]	8
[C][7]	[0][1] to [0][7]	Acceleration time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	According to commands [5][5] and [5][6]	8
[C][8]	[0][1] to [0][7]	Deceleration time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	According to commands [5][9] and [5][A]	8
[C][9]	[0][1] to [0][7]	S-pattern time constant (The decimal equivalent of the data No. corresponds to the speed block No.)	According to commands [5][D] and [5][E]	8

8.12 Detailed Explanations of Commands

8.12.1 Data processing

When the master station transmits a command + data No. or a command + data No. + data to a slave station, the servo amplifier returns a reply or data according to the purpose.
When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.
Therefore, data must be processed according to the application.
Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.
The following methods are how to process send and receive data when reading and writing data.

(1) Processing the read data

When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.
When the display type is 1, the eight-character data is used unchanged.

The following example indicates how to process the receive data "003000000929" given to show.
The receive data is as follows.

0	0	3	0	0	0	0	0	0	9	2	9

Data 32-bit length (hexadecimal representation)
(Data conversion is required as indicated in the display type)

Display type
[0]: Data must be converted into decimal.
[1]: Data is used unchanged in hexadecimal.

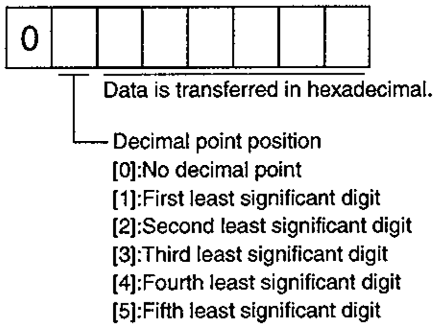
Decimal point position
[0]:No decimal point
[1]:First least significant digit (normally not used)
[2]:Second least significant digit
[3]:Third least significant digit
[4]:Fourth least significant digit
[5]:Fifth least significant digit
[6]:Sixth least significant digit

Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
00000929H→2345
As the decimal point position is "3", a decimal point is placed in the third least significant digit.
Hence, "23.45" is displayed.

(2) Writing the processed data

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

The data to be sent is the following value.



By way of example, here is described how to process the set data when a value of "15.5" is sent.
Since the decimal point position is the second digit, the decimal point position data is "2".
As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.
155→9B
Hence, "0200009B" is transmitted.

8.12.2 Status display

(1) Reading the status display name and unit

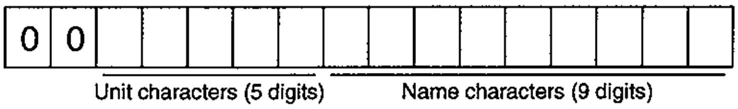
Read the status display name and unit.

(a) Transmission

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

(b) Reply

The slave station sends back the status display name and unit requested.



(2) Status display data read

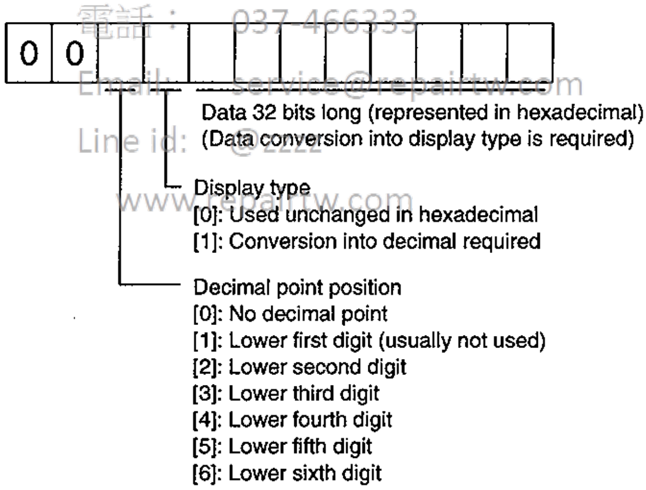
Read the status display data and processing information.

(a) Transmission

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

(b) Reply

The slave station sends back the status display data requested.



(3) Status display data clear

The cumulative feedback pulse data of the status display is cleared. Send this command immediately after reading the status display item. The data of the status display item transmitted is cleared to zero.

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

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

8.12.3 Parameters

(1) Reading the name

Read the parameter name.

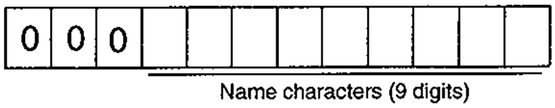
(a) Transmission

Transmit command [0][8] and the data No. corresponding to the parameter No., [0][0] to [4][F]. (Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the name of the parameter No. requested.



(2) Reading the setting

Read the parameter setting.

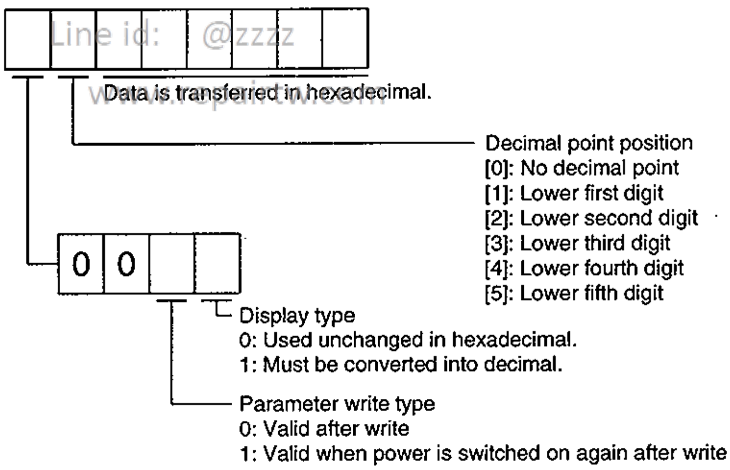
(a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No., [0][0] to [4][F]. (Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



For example, data "1200270F" means 999.9 (decimal display format) and data "0003ABC" means 3ABC (hexadecimal display format).

When the display type is "0" (hexadecimal) and the decimal point position is other than 0, the display type is a special hexadecimal display format and "F" of the data value is handled as a blank. Data "01FFF053" means 053 (special hexadecimal display format).

"000000" is transferred when the parameter that was read is the one inaccessible for write/reference in the parameter write disable setting of parameter No. 20.

(3) Reading the setting range

Read the parameter setting range.

(a) Transmission

When reading the upper limit value, transmit command [0][6] and the data No. corresponding to the parameter No., [0][0] to [6][3]. When reading the lower limit value, transmit command [0][7] and the data No. corresponding to the parameter No., [0][0] to [6][3]. (Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to he parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.

0	0						

Data is transferred in hexadecimal.

For example, data"10FFFFEC" means -20.

(4) Parameter write

Write the parameter setting into EEP-ROM of the controller.

Parameter settings may be written up to 100,000 times. Write the value within the setting enabled range. For the setting enabled range, refer to Section 6.1 or read the setting range by performing operation in (3) of this section.

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

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to he parameter number.

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

Write the data after making sure that it is within the upper/lower limit value range.

Read the parameter data to be written, confirm the decimal point position, and create transmission data to prevent error occurrence. On completion of write, read the same parameter data to verify that data has been written correctly.

Command	Data No.	Set Data
[8][4]	[0][0] to [3][5]	See below.

0							

Data is transferred in hexadecimal.

Decimal point position
[0]: No decimal point
[1]: Lower first digit
[2]: Lower second digit
[3]: Lower third digit
[4]: Lower fourth digit
[5]: Lower fifth digit

8.12.4 External I/O signal status (DIO diagnosis)

(1) Reading the external input signal ON/OFF status

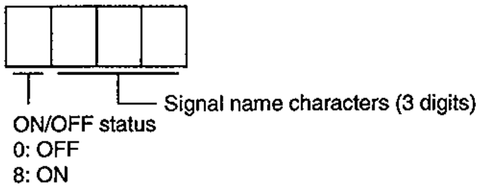
Read the ON/OFF status of the external input signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

(a) Transmission

Transmit command [3][4] and the data No. corresponding to the input signal to be read. (Refer to Section 8.11.1.)

(b) Reply

The slave station sends back the ON/OFF status of the input signal requested.



(2) Reading the external output signal ON/OFF status

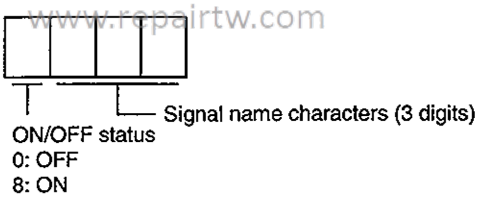
Read the ON/OFF status of the external output signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

(a) Transmission

Transmit command [3][4] and the data No. corresponding to the output signal to be read. (Refer to Section 8.11.1.)

(b) Reply

The slave station sends back the ON/OFF status of the output signal requested.



8.12.5 External output signal ON/OFF (DO forced output)

In the test operation mode, any output signal can be turned on/off independently of its 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.

0	0	0	4

Selection of test operation mode
4: DO forced output (output signal forced output)

(2) External output signal ON/OFF

(a) Turning the output signal ON/OFF signal-by-signal

Transmit command [8][B] + data No. corresponding to the output signal, [8][1] to [6][8], and the data which means ON/OFF.

0	0	0	

ON/OFF command
0: OFF
1: ON

(b) Turning all output signals ON/OFF at once

Transmit the following communication commands:

Command	Data No.	Setting Data
[A][0]	[0][1]	See below.

b31 -- b1 b0

1:ON
0:OFF

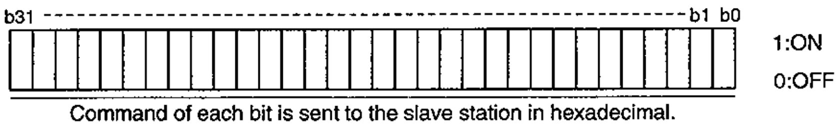
Command of each bit is sent to the slave station in hexadecimal.

bit	Signal Name	bit	Signal Name	bit	Signal Name
0	RD	11		22	
1	PF	12		23	
2	CPO	13		24	
3	ZP	14		25	
4	ALM	15		26	
5	OP	16		27	
6		17		28	
7		18		29	
8		19		30	
9		20		31	
10		21			

8.12.6 External input signal ON/OFF

With the exception of EMG, LSP and LSN, the input signals can be turned on/off independently of their statuses. Using command [9][0], disable the external input signals in advance.When you want to keep the signals on, turn them on every time data is transmitted.

Command	Data No.	Setting Data
[A][0]	[0][0]	See below.



bit	Signal Name	bit	Signal Name	bit	Signal Name
0	SON	11	ST2	22	
1	DEC	12		23	
2	JFS	13		24	
3	STP	14		25	
4		15		26	
5		16		27	
6	CR	17		28	
7	DI0	18		29	
8	DI1	19		30	
9	DI2	20		31	
10	ST1	21			

8.12.7 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, EMG, LSP and LSN cannot be disabled.

Signal	Status
External input signals (DI)	OFF
External analog input signals	0V
Pulse train inputs	None

(1) Disabling/enabling the external input signals (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][0]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Disabling/enabling only the external input signals (DI) with the exception of EMG, LSP and LSN.
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][1]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][1]	1EA5

(3) Disabling/enabling only the external analog input signals.
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][2]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][2]	1EA5

(4) Disabling/enabling the external output signals (DO)
Transmit the following communication commands:
(a) Disable

Command	Data No.	Data
[9][0]	[0][3]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][3]	1EA5

8.12.8 Test operation mode

(1) Instructions for test operation mode

The test operation mode must be executed in the following procedure. If communication is interrupted for longer than 0.5s during test operation, the MR-H-ACN 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.

1) Turn off all external input signals.

2) Disable the external input signals.

Command	Data No.	Data
[9][0]	[0][0]	1EA5

3) Choose the test operation mode.

Command	Data No.	Transmission Data	Selection of Test Operation Mode
[8][B]	[0][0]	0000	Test operation mode cancel
[8][B]	[0][0]	0001	Jog operation
[8][B]	[0][0]	0002	Positioning operation
[8][B]	[0][0]	0003	Motor-less operation
[8][B]	[0][0]	0004	DO forced output
[8][B]	[0][0]	0005	1 step feed operation

4) Set the data needed for test operation.

5) Start.

6) Continue communication using the status display or other command.

To terminate the test operation mode, complete the corresponding operation and:

1) Clear the test operation acceleration/deceleration time constant.

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

2) Cancel the test operation mode.

Command	Data No.	Data
[8][B]	[0][0]	0000

3) Enable the disabled external input signals.

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Jog operation

Transmit the following communication commands:

(a) Setting of jog operation data

Item	Command	Data No.	Data
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.
Acceleration/deceleration time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.

(b) Start

Turn on the external I/O signals SON and DI3/DI4 by using command [A][0] + data No. [0][0] or command [A][0] + data No. [0][1].

Item	Command	Data No.	Data
Forward rotation start	[A][0]	[0][0]	00000401: Turns on SON and ST1.
Reverse rotation start	[A][0]	[0][0]	00000801: Turns on SON and ST2.

(3) Positioning operation

Transmit the following communication commands:

(a) Setting of positioning operation data

Item	Command	Data No.	Data
Speed	[A][0]	[1][0]	Write the speed [r/min] in hexadecimal.
Acceleration/deceleration time constant	[A][0]	[1][1]	Write the acceleration/deceleration time constant [ms] in hexadecimal.
Moving distance	[A][0]	[1][3]	Write the moving distance [pulse] in hexadecimal.

(b) Start

Turn on the external I/O signals SON and DI3/DI4 by using command [A][0] + data No. [0][0].

Item	Command	Data No.	Data
Forward rotation start	[A][0]	[0][0]	00000401: Turns on SON and ST1.
Reverse rotation start	[A][0]	[0][0]	00000801: Turns on SON and ST2.

(c) Temporary stop

A temporary stop can be made during positioning operation.

Command	Data No.	Data
[A][0]	[1][5]	1EA5

Retransmit the same communication commands as at the start time to resume operation.

To stop positioning operation after a temporary stop, retransmit the temporary stop communication command. The remaining moving distance is then cleared.

(4) 1-step feed operation

Transmit the following communication commands:

(a) Setting of the position data No. to be executed

Item	Command	Data No.	Data
Position block No.	[A][0]	[1][0]	According to the following figure

0	0	0	0	0	0		

Data 8-bit length
Displayed in hexadecimal

(b) Start

Item	Command	Data No.	Data
1-step feed	[A][0]	[1][B]	1E5A

Using command [A][0] + data No. [0][0], switch on SON of the external I/O signals.

Item	Command	Data No.	Data
Servo on	[A][0]	[0][0]	00000001 : on SON

Item	Command	Data No.	Data
1-step feed	[A][0]	[1][B]	1E5A

(c) Temporary stop

You can make a temporary stop during 1-step feed operation.

Command	Data No.	Data
[A][0]	[1][5]	1E5A

Transmitting the 1-step feed communication command again resumes operation. At this time, SON need not be switched on again.

To stop the 1-step feed operation after a temporary stop, transmit the temporary stop communication command again. This clears the remaining moving distance.

8.12.9 Alarm history

The alarm numbers, occurrence times and name of No.0 (last alarm) to No.9 (ten alarm in the past) are read.

(1) Alarm No. read

Read the alarm No. which occurred in the past.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][9]. Refer to Section 8.11.1.

(b) Reply

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

0	0		

Alarm No. is transferred in decimal.

For example, "0032" means AL32 and "000F" means AL_(no alarm).

(2) Alarm occurrence time read

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

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

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][9].

Refer to Section 8.11.1.

(b) Reply

Alarm occurrence time is transferred in hexadecimal.
Hexadecimal must be converted into decimal.

Foe example, data "01F5" means that the alarm occurred 501 hours after start of operation.

(3) Reading the alarm name

Read the name of the past alarm.

(a) Transmission

Transmit command [3][3] + data No. [3][0] to [3][9]. (Refer to Section 8.11.1.)

(b) Reply

The slave station sends back the alarm name corresponding to the data No.

0											

Name characters (11 digits)

(4) Alarm history clear

Erase the alarm history. Transmit the following communication command:

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

8.12.10 Current alarm

(1) Current alarm No. read

Read the alarm No. which is occurring currently.

(a) Transmission

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

(b) Reply

The slave station sends back the alarm currently occurring.

0	0		

Alarm No. is transferred in decimal.

For example, "0032" means AL32 and "000F" means AL_(no alarm).

(2) Reading the concurrent alarm No.

Read the concurrent alarm No.

(a) Transmission

Transmit command [0][2] + data No. [0][8].

(b) Reply

The slave station sends back the concurrent alarm.

0	0		

Alarm No. is transferred in decimal.

(3) Reading the current alarm name

Read the name of the current alarm.

(a) Transmission

Transmit command [0][2] + data No. [0][0].

(b) Reply

The slave station sends back the current alarm.

0	0										

Name characters (10 digits)

(4) Reading the concurrent alarm name

Read the concurrent alarm name.

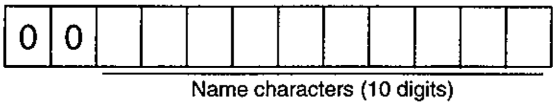
(a) Transmission

Transmit command [0][2] + data No. [0][9].

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

(b) Reply

The slave station sends back the concurrent alarm.



(5) Read of the status display at alarm occurrence

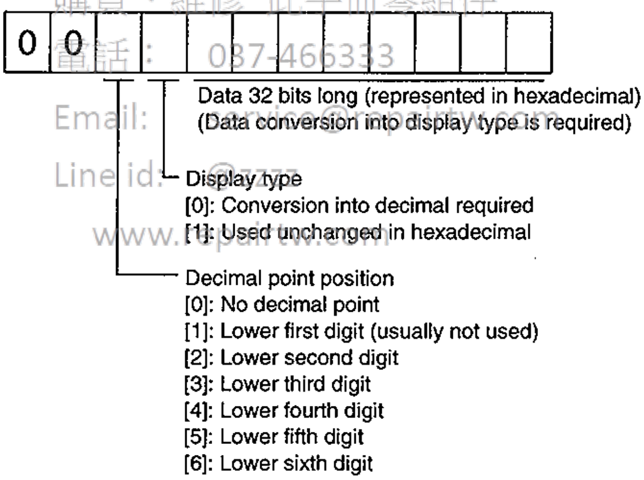
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

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

(b) Reply

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



(6) Current alarm clear

As by the entry of the RES signal, reset the controller alarm to make the MR-H-ACN ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

Transmission

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

(7) Analog output of data before alarm occurrence

The status display at the time of alarm occurrence is output to pins 4, 3 of CN3 as an analog signal. Use parameter No. 46 to set the output item.

Transmit the following communication command:

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

8.12.11 Position block

(1) Reading of the settings

Read the position data, M code and speed block No.

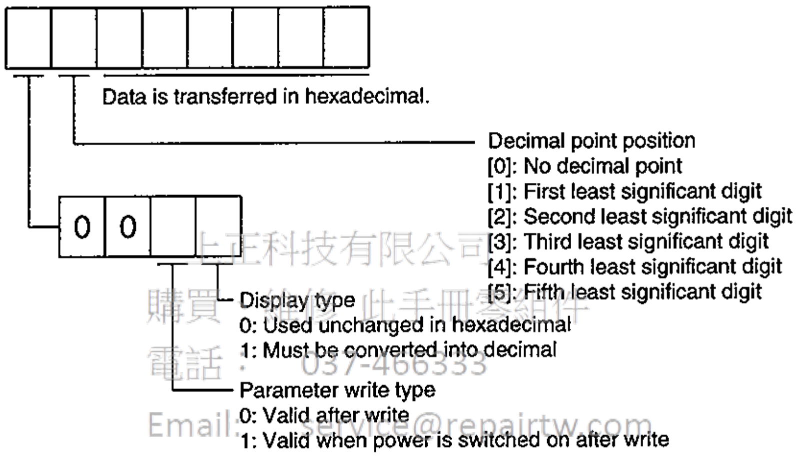
(a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

Item	Command	Data No.
Position data	[4][0]	[0][0] to [F][F]
M code	[4][5]	[0][0] to [F][F]
Speed block No.	[4][A]	[0][0] to [F][F]

(b) Reply

The slave station returns the settings of the requested position block No.



For example, the received data of the respective items have the following meanings:

- Data "13F0BDC1" of position data indicates -9999.99
- Data "100000063" of M code indicates 99
- Data "10000005" of speed block No. indicates 5

(2) Reading of the position data unit

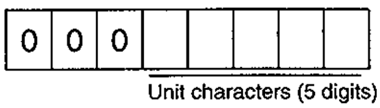
Read the unit of the position data.

(a) Transmission

Transmit command [4][3] + data No. [0][0].

(b) Reply

The slave station returns the unit of the position data.



(3) Reading of the setting ranges (upper and lower limit values)

Read the setting ranges of the position data, M code and speed block No.

(a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

Item	Command	Data No.
Position data setting range (upper limit value)	[4][1]	[0][0] to [F][F]
Position data setting range (lower limit value)	[4][2]	[0][0] to [F][F]
M code setting range (upper limit value)	[4][6]	[0][0] to [F][F]
M code setting range (lower limit value)	[4][7]	[0][0] to [F][F]
Speed block No. setting range (upper limit value)	[4][B]	[0][0] to [F][F]
Speed block No. setting range (lower limit value)	[4][C]	[0][0] to [F][F]

(b) Reply

The slave station returns the setting ranges in the requested position block No.

0	0						

Data is transferred in hexadecimal.

(4) Writing of the settings

Write the position data, M code and speed block No. to the EEP-ROM of the MR-H-ACN.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 8.11.2):

Item	Command	Data No.	Data
Position data	[C][0]	[0][0] to [F][F]	According to the following figure
M code	[C][2]	[0][0] to [F][F]	
Speed block No.	[C][4]	[0][0] to [F][F]	

0							

Hexadecimal data

Decimal point position
0: No decimal point
1: First least significant digit
2: Second least significant digit
3: Third least significant digit
4: Fourth least significant digit
5: Fifth least significant digit

Make the decimal point position equal to the feed length multiplying factor (STM) set in parameter No. 4.
The slavestation will not accept the decimal point position if the position specified is different from the STM setting.

8.12.12 Speed block

(1) Reading of the settings

Read the speed, acceleration time constant, deceleration time constant and S-pattern time constant.

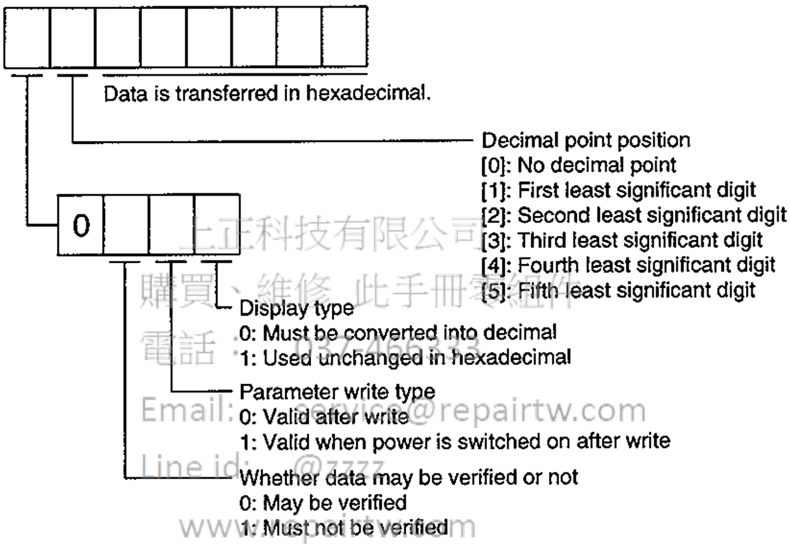
(a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

Item	Command	Data No.
Speed	[5][0]	[0][1] to [0][8]
Acceleration time constant	[5][4]	[0][1] to [0][8]
Deceleration time constant	[5][8]	[0][1] to [0][8]
S-pattern time constant	[5][C]	[0][1] to [0][8]

(b) Reply

The slave station returns the settings of the requested speed block No.



(2) Reading of the speed unit

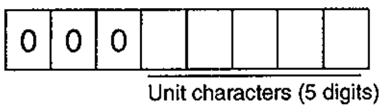
Read the unit of the speed.

(a) Transmission

Transmit command [5][3] + data No. [2][0].

(b) Reply

The slave station returns the unit of the speed.



(3) Reading of the setting ranges (upper and lower limit values)

Read the setting ranges of the speed, acceleration time constant, deceleration time constant and S-pattern time constant.

(a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

Item	Command	Data No.
Speed (upper limit value)	[5][1]	[0][1] to [0][8]
Speed (lower limit value)	[5][2]	[0][1] to [0][8]
Acceleration time constant (upper limit value)	[5][5]	[0][1] to [0][8]
Acceleration time constant (lower limit value	[5][6]	[0][1] to [0][8]
Deceleration time constant (upper limit value)	[5][8]	[0][1] to [0][8]
Deceleration time constant (lower limit value)	[5][9]	[0][1] to [0][8]
S-pattern time constant (upper limit value)	[5][D]	[0][1] to [0][8]
S-pattern time constant (lower limit value)	[5][E]	[0][1] to [0][8]

(b) Reply

The slave station returns the setting ranges in the requested speed block No.

0	0						

Data is transferred in hexadecimal.

(4) Writing of the settings

Write the speed, acceleration time constant, deceleration time constant and S-pattern time constant to the EEP-ROM of the MR-H-ACN.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 8.11.2):

Item	Command	Data No.	Data
Speed	[C][6]	[0][1] to [0][8]	According to the following figure
Acceleration time constant	[C][7]	[0][1] to [0][8]	
Deceleration time constant	[C][8]	[0][1] to [0][8]	
S-pattern time constant	[C][9]	[0][1] to [0][8]	

0							

Hexadecimal data

Decimal point position
0: No decimal point
1: First least significant digit
2: Second least significant digit
3: Third least significant digit
4: Fourth least significant digit
5: Fifth least significant digit

Make the decimal point position equal to the feed length multiplying factor (STM) set in parameter No. 4.
The slave station will not accept the decimal point position if the position specified is different from the STM setting.

8.12.13 Selection between Japanese and English

The characters representing the names of the status displays, parameters, etc. may be displayed in either Japanese or English.
Transmit the following communication command:

Command	Data No.	Data
[8][0]	[0][0]	0000: Japanese 0001: English

9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

9.1 Compliance With EC Directives

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

9.1.2 For compliance

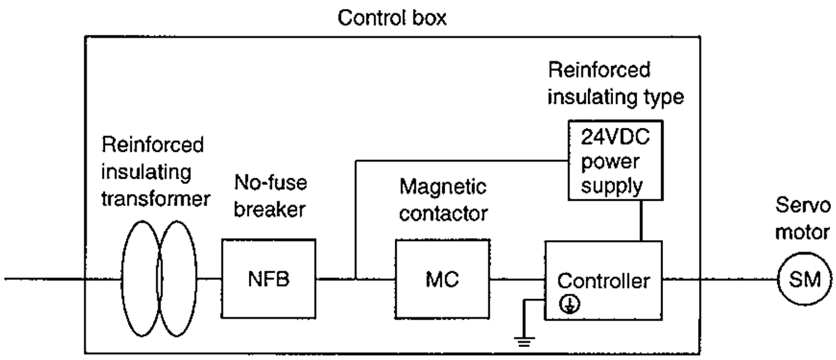
(1) Controllers and servo motors used

Use the controllers and servo motors which comply with the EN Standard.

Controller series	:	MR-H10ACN-UE to MR-H22KACN-UE
Servo motor series	:	HA-LH□-EC
		HC-MF□-UE
		HA-FF□C-UE
		HC-SF□
		HC-RF□
		HC-UF□

The handling, performance, specifications and other information of the EN Standard-compliant models are the same as those of the standard models unless otherwise specified.

(2) Structure



(3) Environment

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

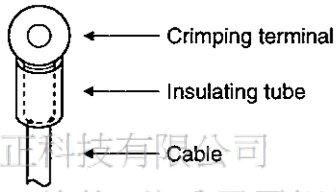
(4) Power supply

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

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

(5) Wiring

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



(b) Use a fixed terminal block to connect the power supply lead of the servo motor to the controller. Do not connect cables directly.

(c) Use the servo motor side power connector which complies with the EN Standard. The EN Standard-compliant power connector sets are available from us as options.

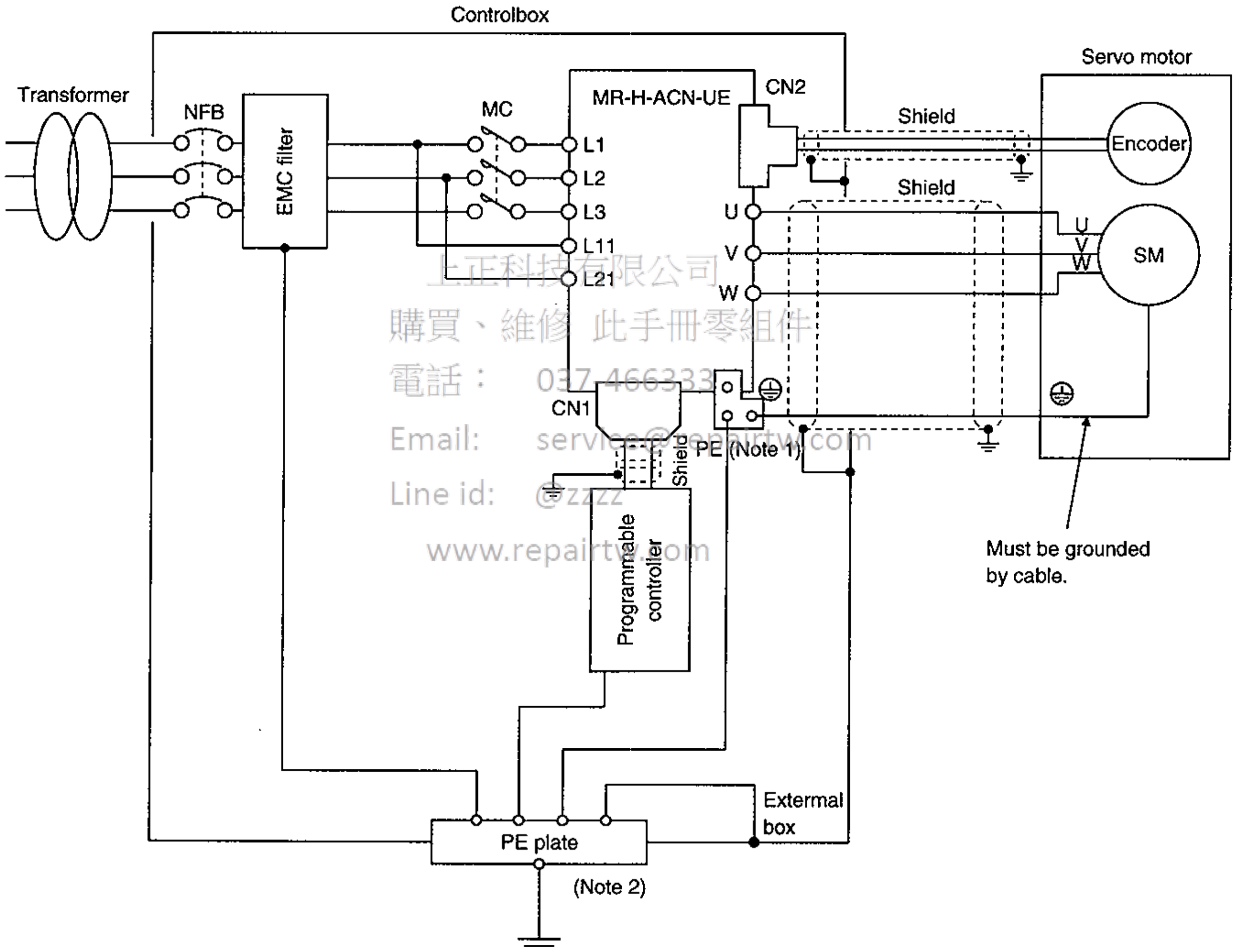
(6) Noise reduction techniques

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

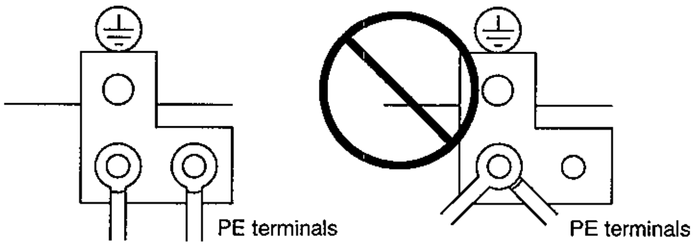
(7) Grounding

⚠ WARNING	• Securely ground the controller and servo motor. • To prevent an electric shock, the protective earth (PE) terminal (marked ⏚) of the controller must be connected to the protective earth (PE) of the control box.

The controller switches the power transistor to supply power to the servo motor. Depending on the routing of the wiring and ground cables, the controller may be affected by the switching noises (due to di/dt and dv/dt) of the transistor.
To prevent such a fault, refer to the following diagram and use the thickest possible ground cables (3.5mm^2 or larger preferable), such as flat mesh copper cables, to securely ground the controller and servo motor.
Even when a leakage current breaker is used, always earth the protective earth (PE) terminal of the controller to prevent an electric shock.



Note: 1. Do not connect two ground cables to the same protective earth (PE) terminal as shown at right below. Always connect cables to the terminals one-to-one as shown at left:



2. For the grounding of the control box, refer to EN60204.

(8) Cables, No-Fuse Breakers, Magnetic Contactors, Power Factor Improving Reactors

Always use the EN/IEC Standard compliant products specified in this section or their equivalent products compliant with the EN/IEC Standard.

Controller	(Note 4) No-Fuse Breaker	(Note 4) Magnetic Contactor	(Note 1) Cables [mm^2]					Power Factor Improving Reactor FR-BAL
			L1 · L2 · L3 ⏚	(Note 2) U · V · W ⏚	L11 · L21	(Note 3) P · C	Electro-magnetic Brake	
MR-H10ACN-UE	Type NF30 5A	S-N10	2	1.25	2	2	1.25	FR-BAL-0.4K
MR-H20ACN-UE	Type NF30 10A	S-N10	2	1.25	2	2		FR-BAL-0.4K
MR-H40ACN-UE	Type NF30 10A	S-N10	2	1.25	2	2		FR-BAL-0.75K
MR-H60ACN-UE	Type NF30 10A	S-N10	2	1.25	2	2		FR-BAL-1.5K
MR-H100ACN-UE	Type NF30 15A	S-N10	2	2	2	2		FR-BAL-2.2K
MR-H200ACN-UE	Type NF30 20A	S-N18	3.5	3.5	2	2		FR-BAL-3.7K
MR-H350ACN-UE	Type NF50 30A	S-N25	5.5	(Note 5)5.5	2	2		FR-BAL-7.5K
MR-H500ACN-UE	Type NF50 50A	S-N35	5.5	5.5	2	2		FR-BAL-11K
MR-H700ACN-UE	Type NF100 75A	S-K50	8	8	2	3.5		FR-BAL-15K
MR-H11KACN-UE	Type NF100 100A	S-K65	14	22	2	5.5		FR-BAL-15K
MR-H15KACN-UE	Type NF225 125A	S-K95	22	30	2	5.5		FR-BAL-22K
MR-H22KACN-UE	Type NF225 175A	S-K125	50	60	2	5.5		FR-BAL-30K

Note: 1. Cables are based on the 600V vinyl cables.

The cable sizes listed above conform to EN60204 under the following conditions:

- Ambient temperature 40°C
- PVC (polyvinyl chloride) sheath
- Run on wall surface or in open cable tray

When the cables in compliance with EN60204 are to be used under the conditions other than the above, refer to Table 5 and Appendix C in EN60204.

2. The values assume that the distance between the servo motor and controller is 30m max.
3. The cables for connection of the regenerative brake option (P · C) should be twisted for wiring.
4. Use the no-fuse breaker, magnetic contactor or equivalent which conforms to the EN/IEC Standards.
5. 3.5mm^2 for use of the HC-RF203 servo motor.

(9) Performing EMC tests

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

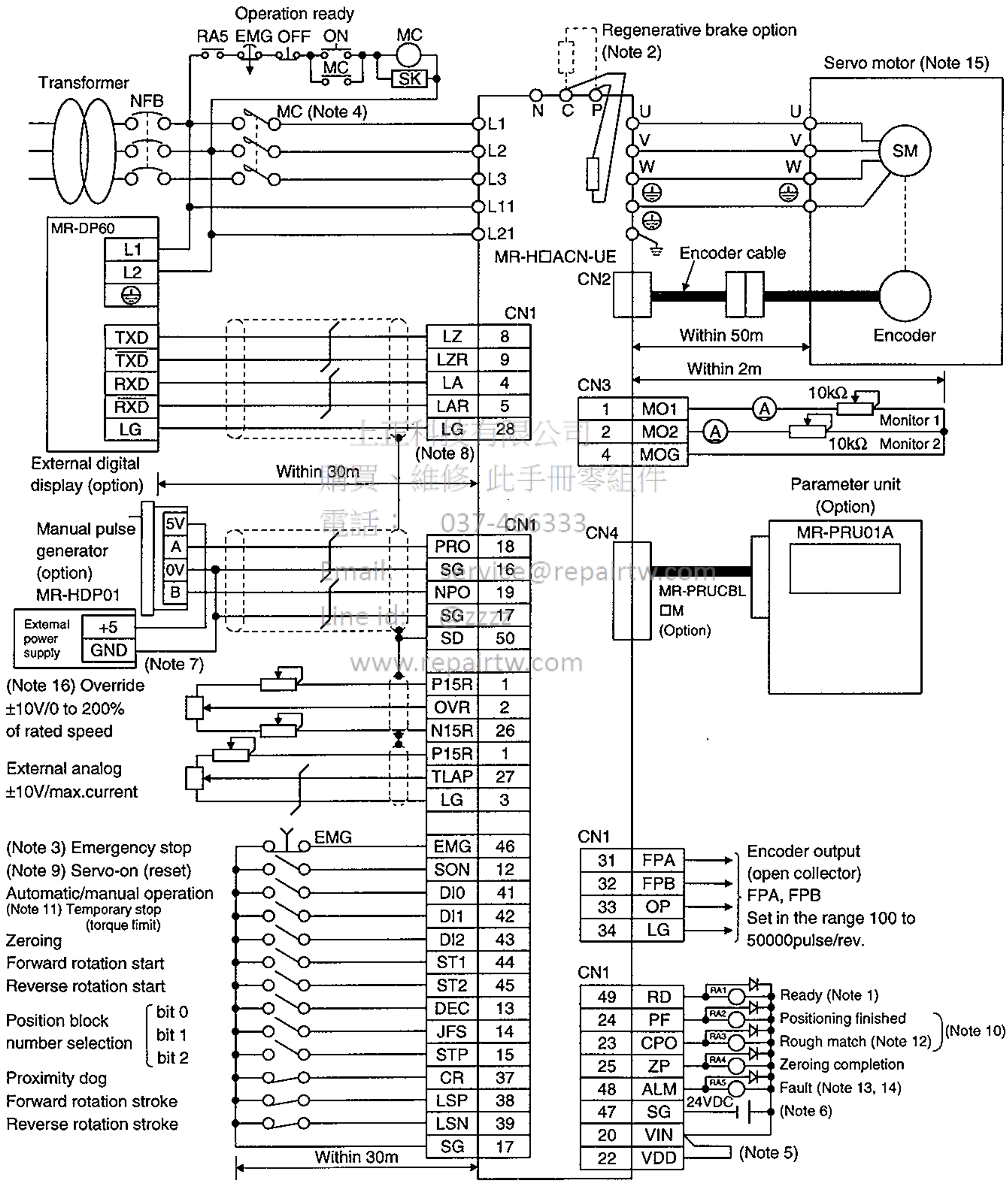
For the way of dealing with the EMC Directive on servo amplifiers, refer to the "EMC INSTALLATION GUIDELINES".

9.1.3 Standard connection examples

(1) Positioning system

(a) Standard configuration (without the MR-H-D01 option card)

Positioning operation according to 8-position point table.



For the notes, refer to page 9-12

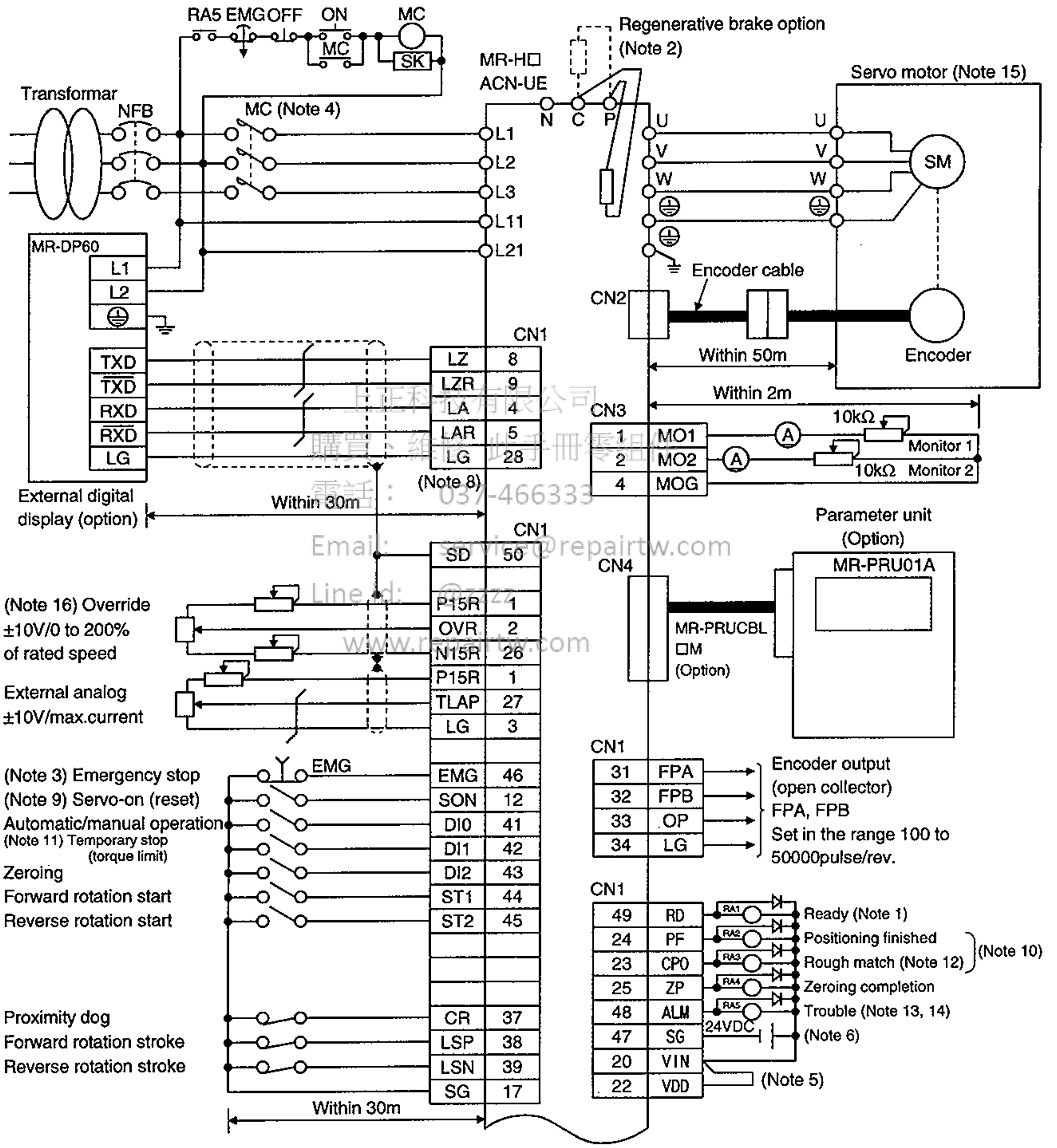
(b) Extension configuration 1 (with the MR-H-D01 option card)

Positioning operation according to 256-position point table. Set 1□□3 in parameter No.65.

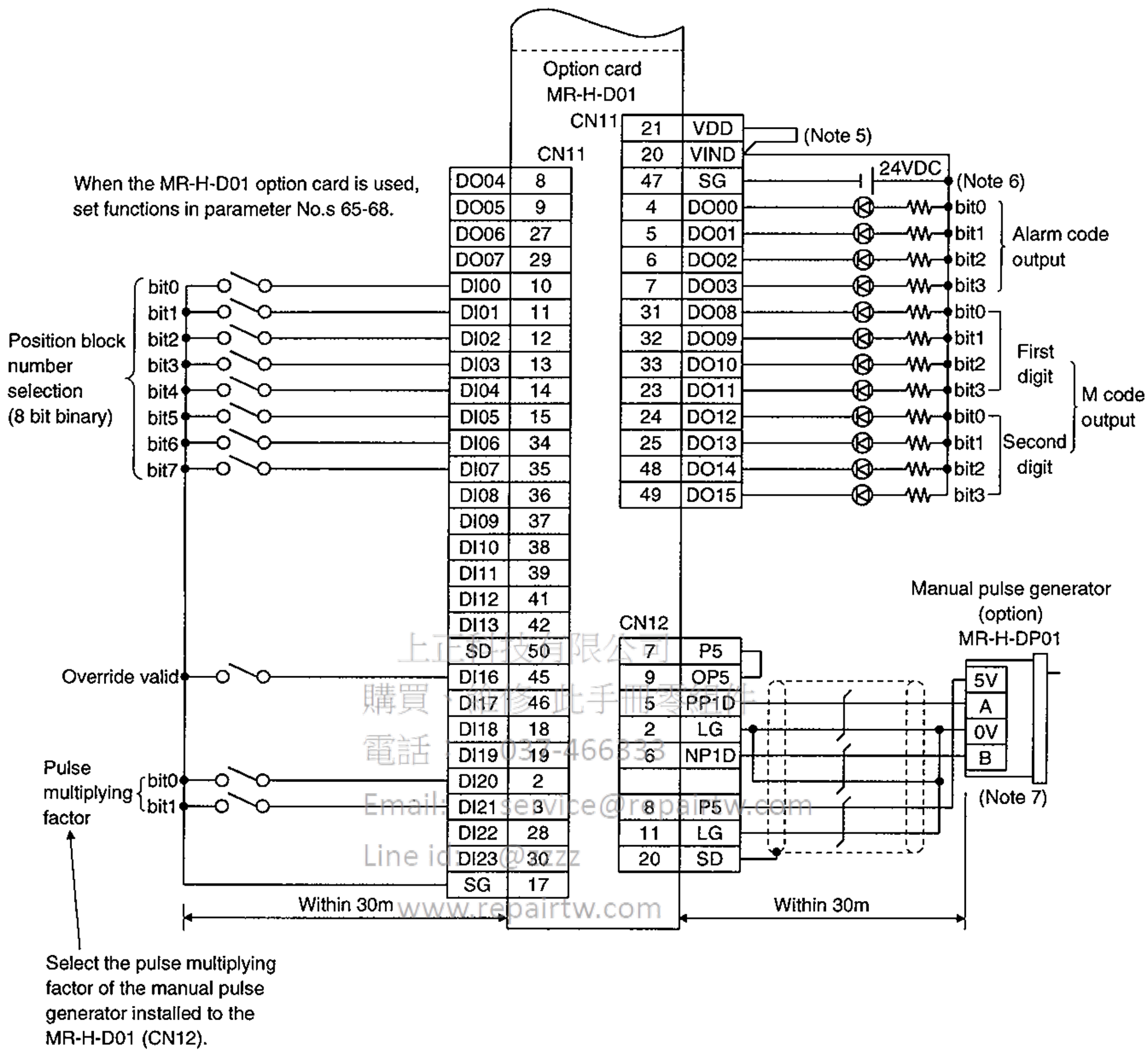
Parameter No. 65

1	-	-	3

256 position blocks



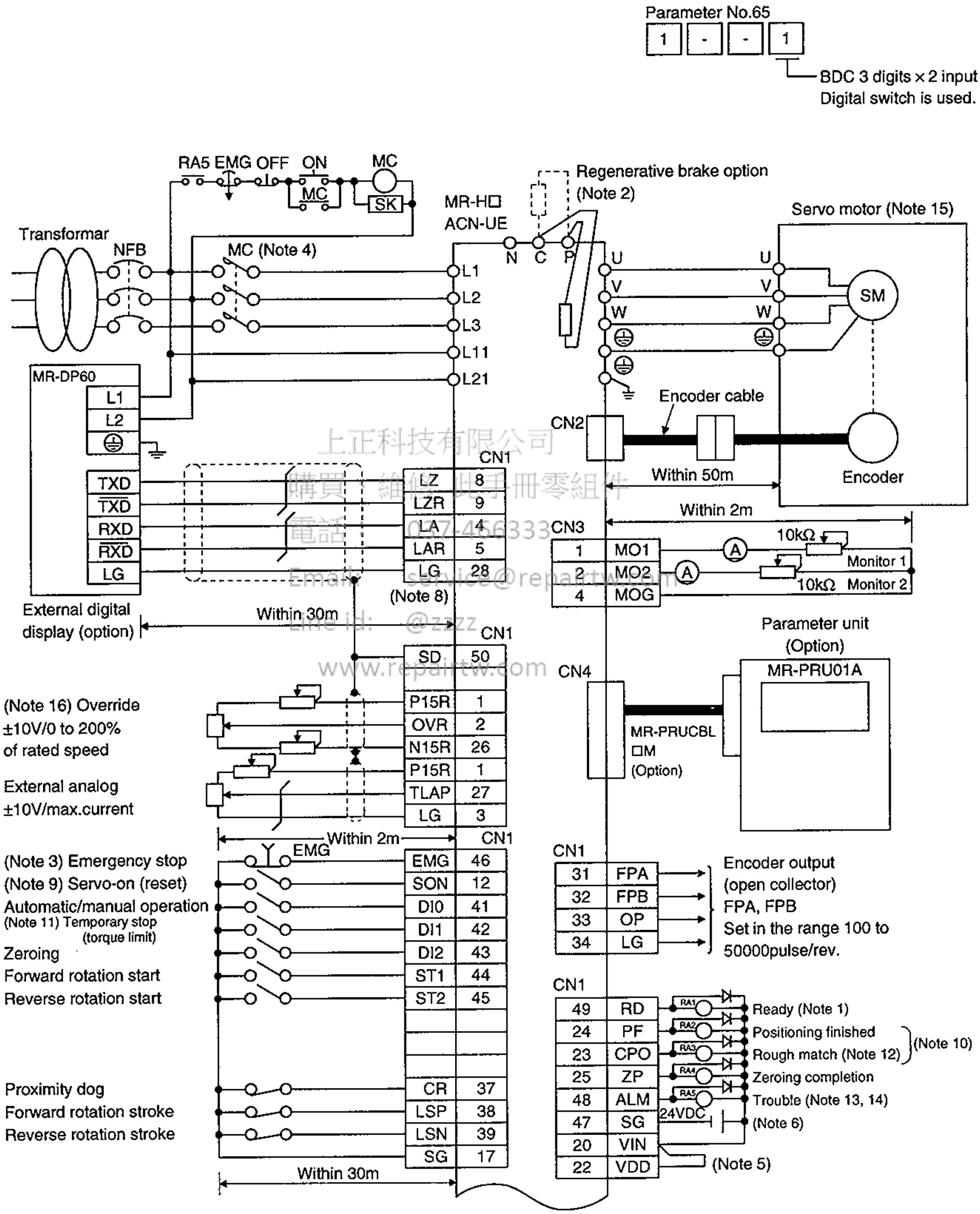
For the notes, refer to page 9-12



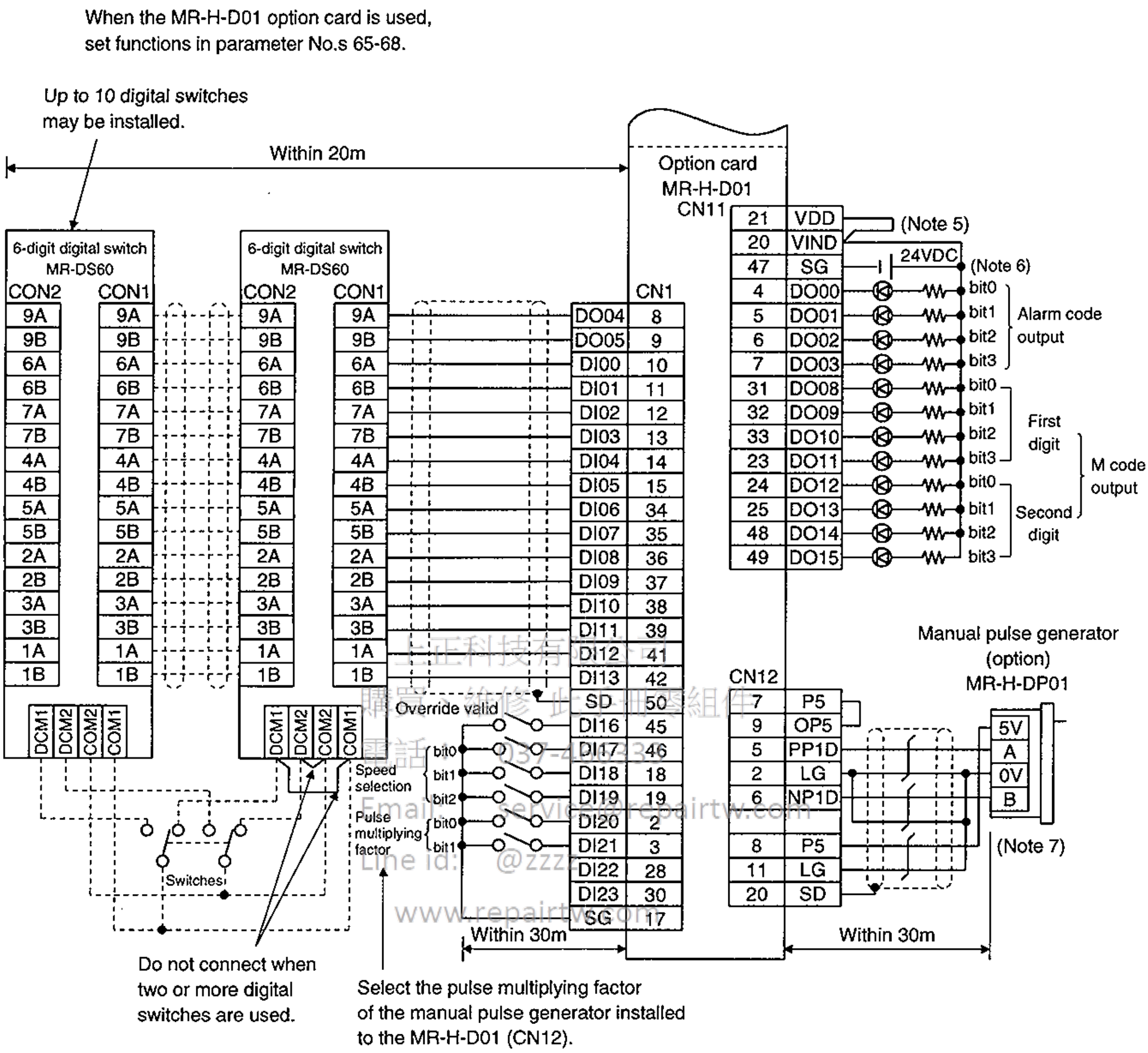
For the notes, refer to page 9-12

(c) Extension configuration 2 (with the MR-H-D01 option card)

Positioning operation under digital switch (MR-DS60) position data command. The digital switch used must be the optional MR-DS60. Set 1□□1 in parameter No.65.



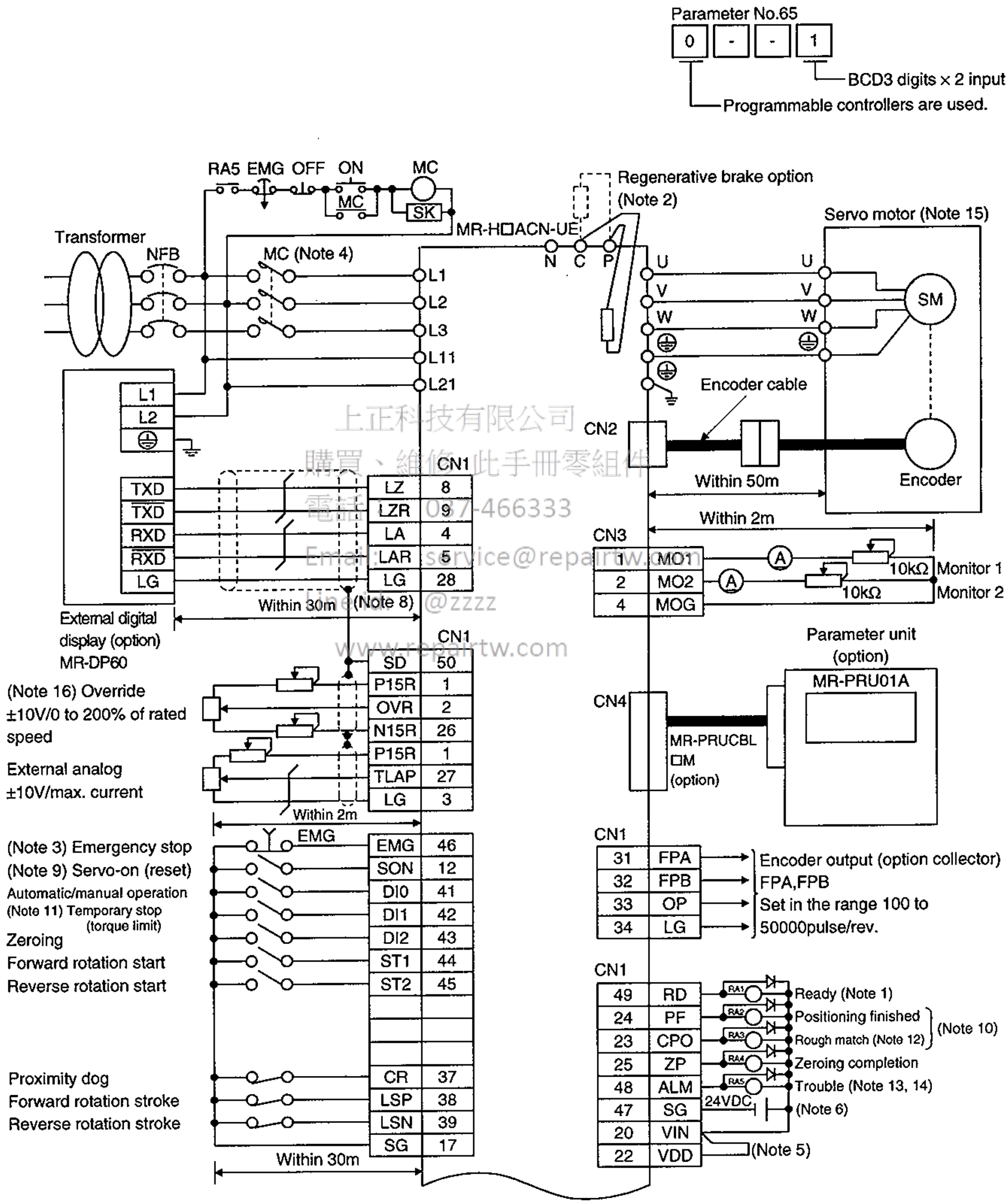
For the notes, refer to page 9-12



For the notes, refer to page 9-12

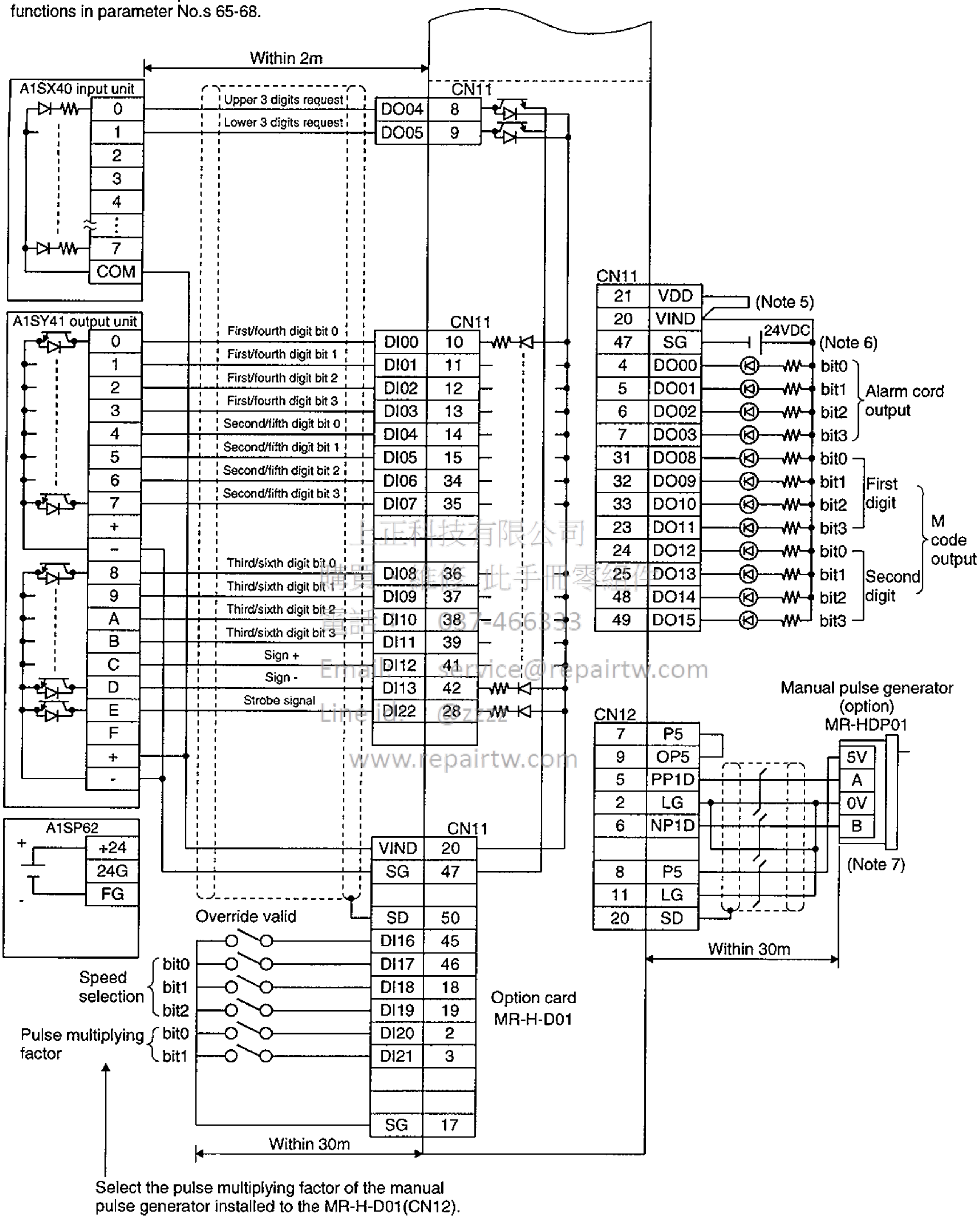
(d) Extension configuration 3 (with the MR-H-D01 option card)

Positioning operation under programmable controller position data command. The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controllers are used. Set 1□□1 in parameter No.65.



For the notes, refer to page 9-12

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



For the notes, refer to page 9-12

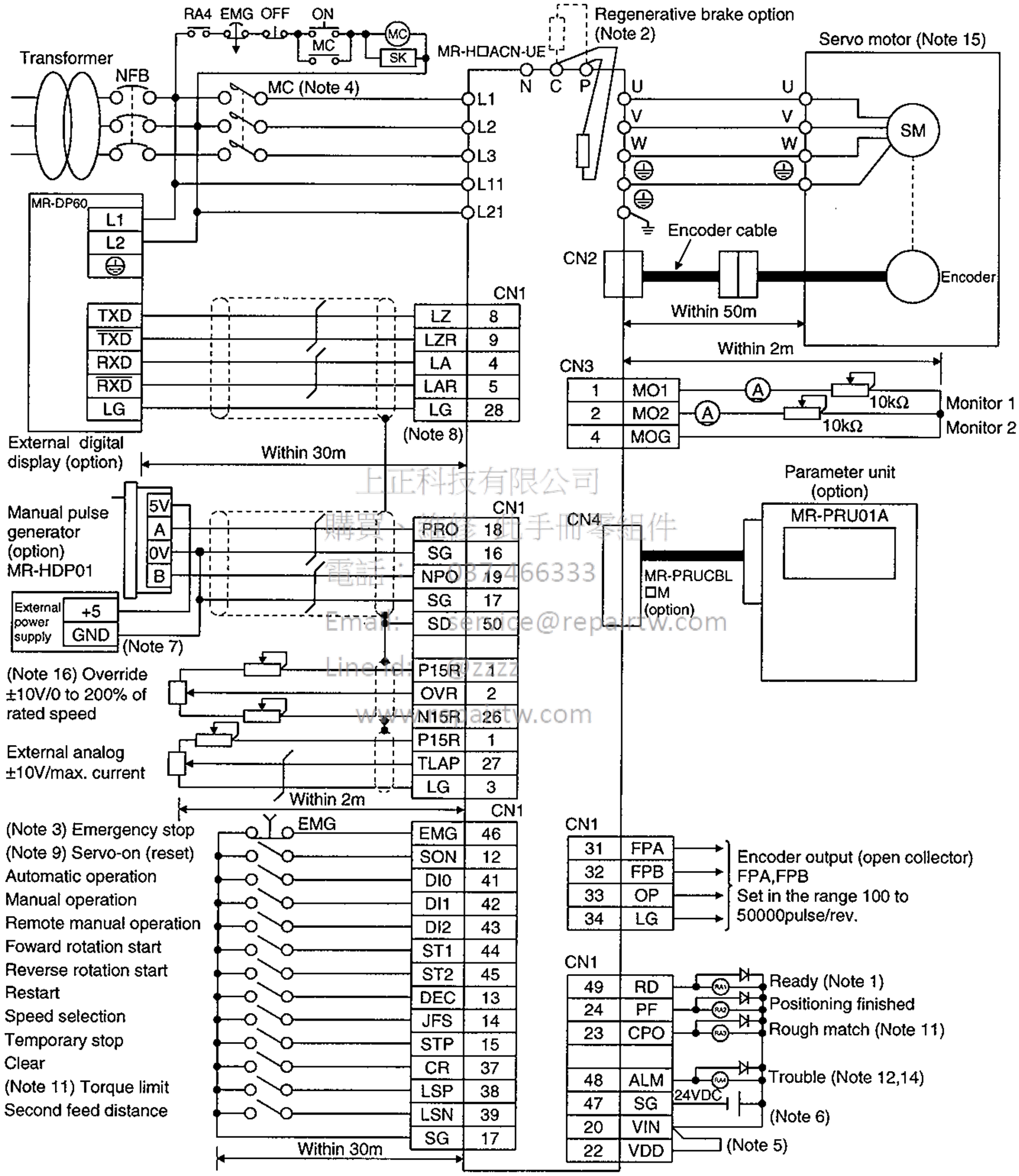
Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.

2. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C
3. The emergency stop switch must be installed.
4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
5. The MR-H□ACN-UE does not contain an internal power supply for interface power supply. Always connect an external power supply across VIN-SG. At this time, also connect VDD-VIN.
6. Use a 24VDC power supply which has been insulation-reinforced in I/O.
7. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
8. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
9. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
10. Change the setting of parameter No.44 to □□□1 to use PF and CPO as an M code.
11. Change the setting of parameter No.41 to □0□□ to use DI1 as a torque limit signal.
12. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
13. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
14. The trouble (ALM) signal is on under normal conditions.
15. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Chapter 5.
16. The upper limit of the overriding speed is the permissible speed.

(2) Roll feeding system

(a) Standard configuration (without the MR-H-D01 option card)

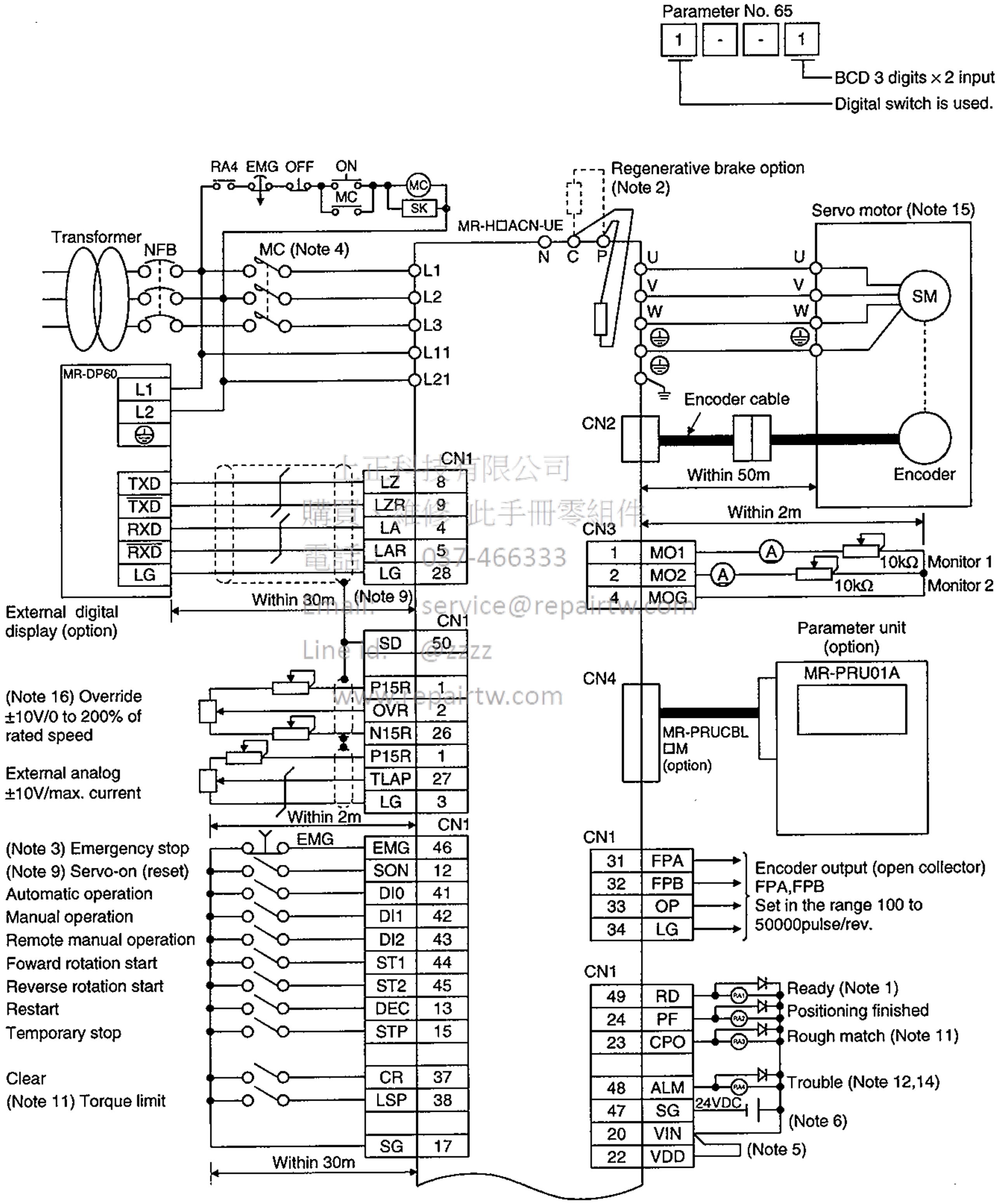
Roll feeding operation according to 2-position point table.



For the notes, refer to page 9-18

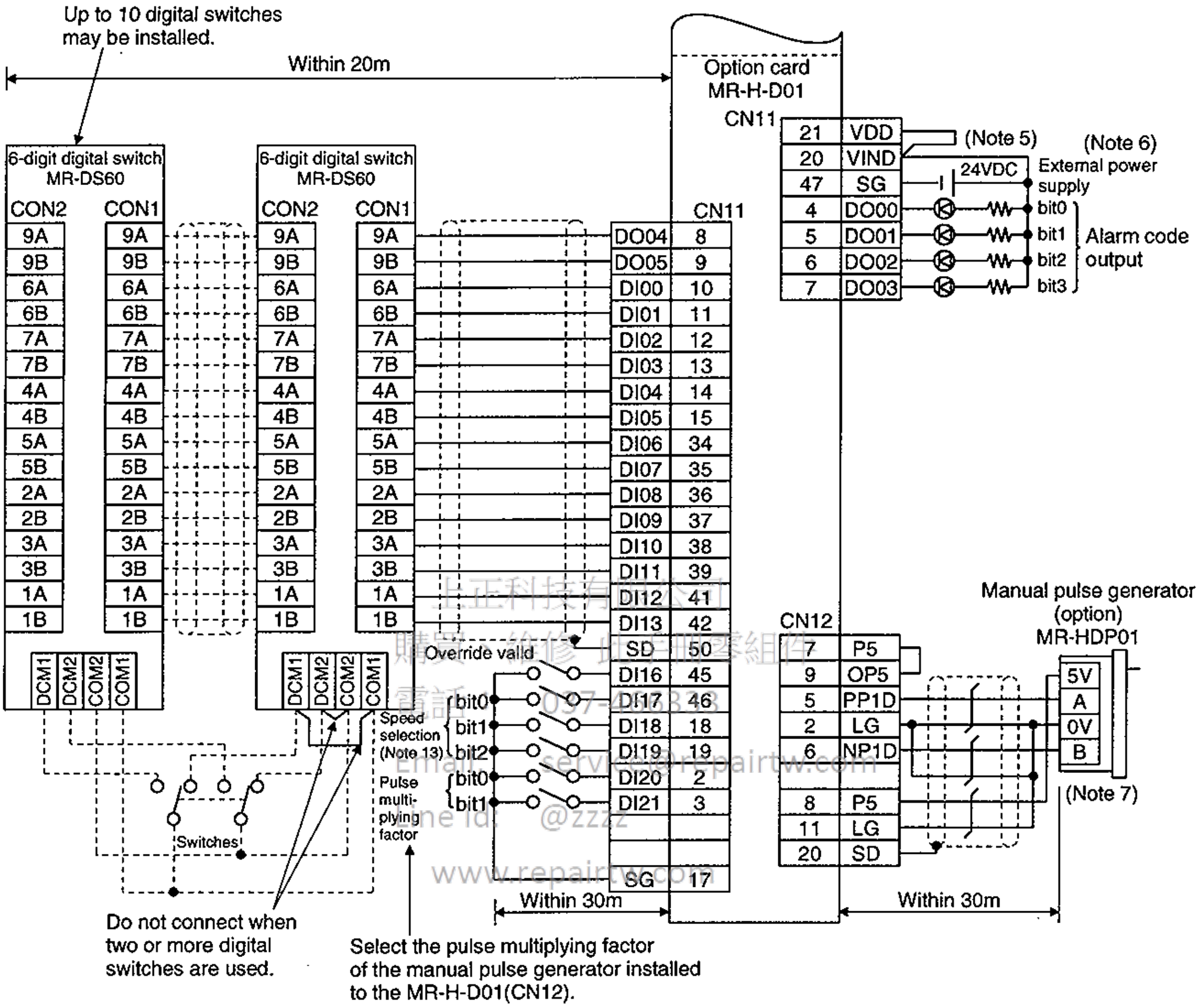
(b) Extension configuration 1 (with the MR-H-D01 option card)

Roll feeding operation under digital switch (MR-DS60) position data command. The digital switch used must be the optional MR-DS60. Set 1□□1 in parameter No.65.



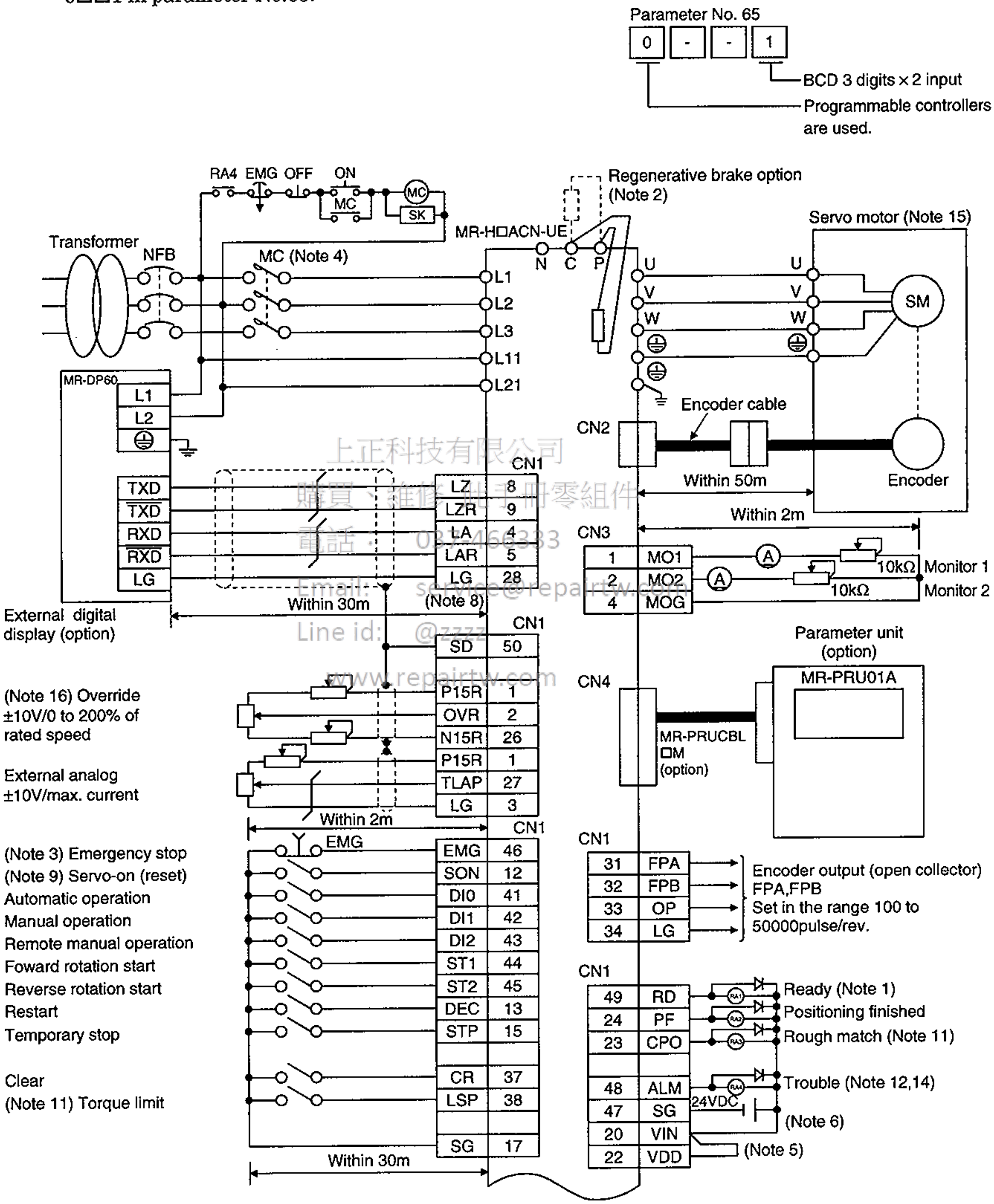
For the notes, refer to page 9-18

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



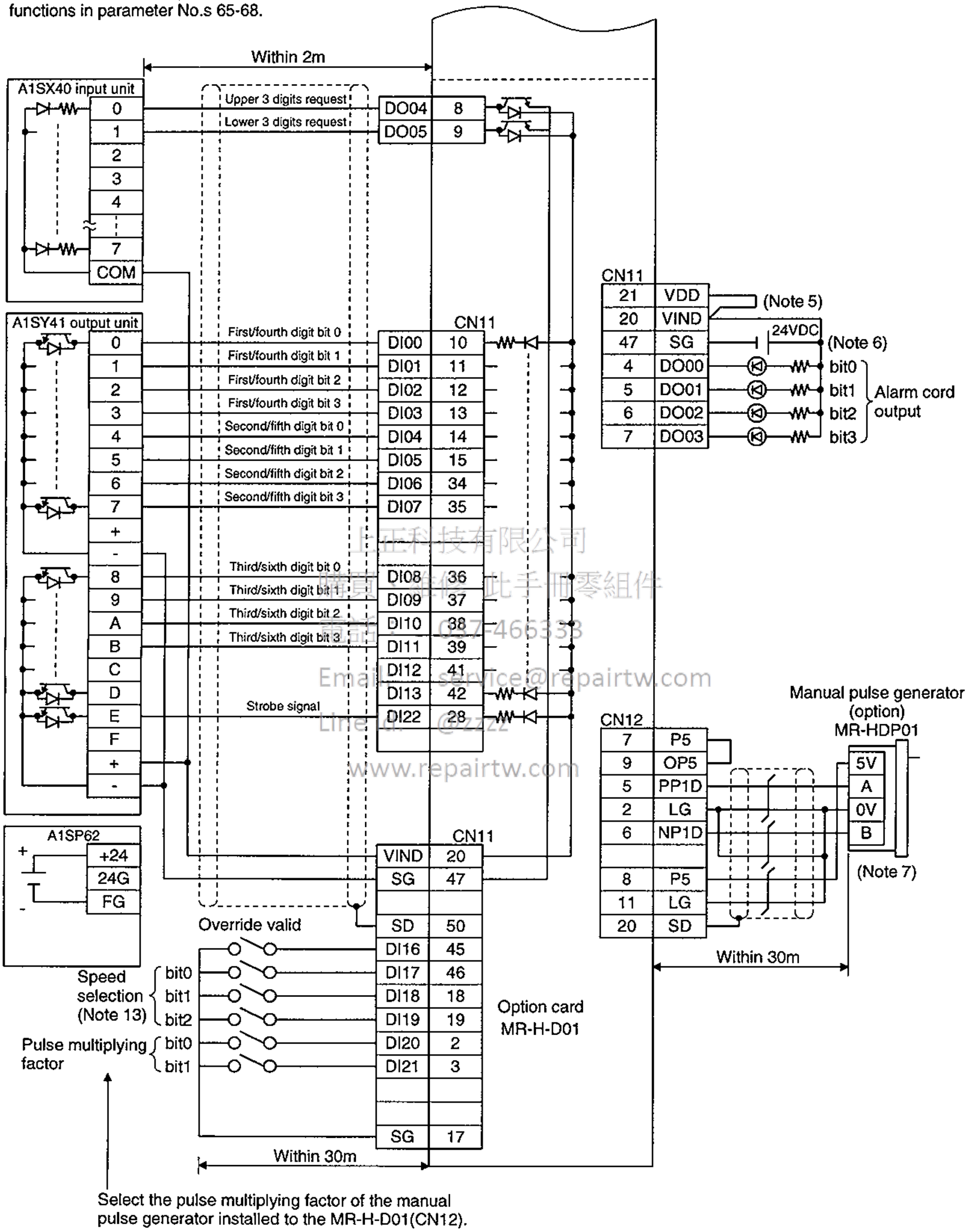
For the notes, refer to page 9-18

(c) Extension configuration 2 (with the MR-H-D01 option card)
Roll feeding operation under programmable controller position data command. The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controllers are used. Set 0□□1 in parameter No.65.



For the notes, refer to page 9-18

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



For the notes, refer to page 9-18

Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.

2. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C.
3. The emergency stop switch must be installed.
4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
5. The MR-H□ACN-UE does not contain an internal power supply for interface power supply. Always connect an external power supply across VIN-SG. At this time, also connect VDD-VIN.
6. Use a 24VDC power supply which has been insulation-reinforced in I/O.
7. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
8. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
9. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
10. Change the setting of parameter No.41 to 11□□ to use LSP as a forward rotation stroke end signal and LSN as a reverse rotation stroke end signal.
11. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
12. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
13. Speed selection is made valid by setting □□1□ in parameter No.65.
When the initial value (□□0□) is used, speed block No.1 is selected.
14. The trouble (ALM) signal is on under normal conditions.
15. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Chapter 5.
16. The upper limit of the overriding speed is the permissible speed.

9.2 Conformance With UL/C-UL Standard

9.2.1 Controller and servo motor used

Use the UL/C-UL Standard-compliant model of controller and servo motor. The 11kW and higher controllers will be certified by the UL/C-UL Standard soon, and the UL/C-UL Standard-compliant models of the HA-LH702 to HA-LH22K2 will be released soon.

Controller series : MR-H10ACN-UE to MR-H700ACN-UE
Servo motor series : HC-MF□-UE
HA-FF□C-UE
HC-SF□
HC-RF□
HC-UF□

Unless otherwise specified, the handling, performance, specifications, etc. of the UL/C-UL Standard-compliant models are the same as those of the standard models.
When using the options and auxiliary equipment, use those which conform to the UL/C-UL Standard.
To comply with the UL/C-UL Standard, strictly observe the following:

9.2.2 Installation

Install a fan of 100CFM air flow 10.16[cm] (4[in]) above the controller or provide cooling of at least equivalent capability to ensure that the ambient temperature conforms to the environment conditions.

9.2.3 Power supply

(1) Short circuit rating
Having been subjected to UL tests in the alternating-current circuit whose peak current is limited to 5000A or less, this servo amplifier conforms to this circuit.

(2) Capacitor discharge time
The capacitor discharge time exceeds 1 minute. To ensure safety, do not touch the charging section for 10 minutes after power-off.

9.2.4 Wires

Always use the wires specified in this section.

Controller	(Note 1) Wire[mm^2]				
	L1 · L2 · L3	(Note 2) U · V · W · ⏚	L11 · L21	(Note 3) P · C	Electromagnetic Brake
MR-H10ACN-UE	2(AWG 14)	1.25(AWG 16)	2(AWG 14)	2(AWG 14)	
MR-H20ACN-UE	2(AWG 14)	1.25(AWG 16)	2(AWG 14)	2(AWG 14)	
MR-H40ACN-UE	2(AWG 14)	1.25(AWG 16)	2(AWG 14)	2(AWG 14)	
MR-H60ACN-UE	2(AWG 14)	1.25(AWG 16)	2(AWG 14)	2(AWG 14)	
MR-H100ACN-UE	2(AWG 14)	2(AWG 14)	2(AWG 14)	2(AWG 14)	1.25(AWG 16)
MR-H200ACN-UE	3.5(AWG 12)	3.5(AWG 12)	2(AWG 14)	2(AWG 14)	
MR-H350ACN-UE	5.5(AWG 10)	(Note 4)5.5(AWG 10)	2(AWG 14)	2(AWG 14)	
MR-H500ACN-UE	5.5(AWG 10)	5.5(AWG 10)	2(AWG 14)	2(AWG 14)	
MR-H700ACN-UE	8(AWG 8)	8(AWG 8)	2(AWG 14)	3.5(AWG 12)	

Note: 1. The wires are based on 600V vinyl cables.
2. The values assume that the distance between the servo motor and controller is 30m max.
3. Twist the regenerative brake option (P · C) cables.
4. $3.5mm^2$ (AWG12) for use of the HC-RF203 servo motor.

9.2.5 Crimping terminals and crimping tools

When connecting the wires to the terminal block, always use AMP's crimping terminals specified in this section or UL Standard-compliant products.
For symbols a to e in the list, refer to the table at right.

Controller	Crimping Terminals, Crimping Tools			
	L1 · L2 · L3	U · V · W · ⏚	L11 · L21	P · C
MR-H10ACN-UE	a	a	a	a
MR-H20ACN-UE	a	a	a	a
MR-H40ACN-UE	a	a	a	a
MR-H60ACN-UE	a	a	a	a
MR-H100ACN-UE	a	a	a	a
MR-H200ACN-UE	b	b	a	a
MR-H350ACN-UE	b	b	a	a
MR-H500ACN-UE	b	b	c	a
MR-H700ACN-UE	e	e	d	d

Symbol	(Note) Type	
	Crimping Terminals	Crimping Tools
a	32959	47387
b	32968	59239
c	32957	47387
d	171517-1	59239
e	322128	59974-1 (body) 48752-0 (dies)
f	52042	69040 (body) 69066 (head) 48859 (dies)
g	322153	59974-1 (body) 48753-0 (dies)

Note: AMP make

9.2.6 Fuses

When using a fuse, it must be the one specified in this section or its equivalent compliant with the UL/C-UL Standard.

Controller	Fuse			
	Type (Maker)	Class	Current [A]	Voltage
MR-H10ACN-UE	NON-10(Buss) or OT10(Gould)	K5	10	250VAC
MR-H20ACN-UE	NON-10(Buss) or OT10(Gould)	K5	10	
MR-H40ACN-UE	NON-15(Buss) or OT15(Gould)	K5	15	
MR-H60ACN-UE	NON-20(Buss) or OT20(Gould)	K5	20	
MR-H100ACN-UE	NON-25(Buss) or OT25(Gould)	K5	25	
MR-H200ACN-UE	NON-40(Buss) or OT40(Gould)	K5	40	
MR-H350ACN-UE	NON-70(Buss) or OT70(Gould)	K5 or H	70	
MR-H500ACN-UE	NON-125(Buss) or OT125(Gould)	K5 or H	125	
MR-H700ACN-UE	NON-150(Buss) or OT150(Gould)	K5 or H	150	

9.2.7 Terminal block tightening torque

The following torques are recommended to tighten screws to the terminal blocks. For the screw size of each terminal block, refer to Section 13.2.

Screw size		M3.5	M4	M5	M6
Recommended tightening torque value	[N·cm]	0.8	1.2	2.0	2.5
	[lb·in]	8	11	20	24

9.2.8 Standard connection example

Same as in Section 9.1.3.

9.3 Signals

9.3.1 Main circuit terminal block

Note that the power supply symbols of the MR-H□ACN-UE given on the terminal block are different from those of the standard models. What the symbols R, S, T, R1 and S1 used in other than this chapter indicate are the same as what L1, L2, L3, L11 and L21 indicate.

Signal Name	Power Supply Symbols	
	MR-H□ACN	MR-H□ACN-UE
Main circuit power supply	R · S · T	L1 · L2 · L3
Control circuit power supply	R1 · S1	L11 · L21

The position and signal arrangement of the terminal block depend on the controller capacity. Refer to Section 13.2.1.

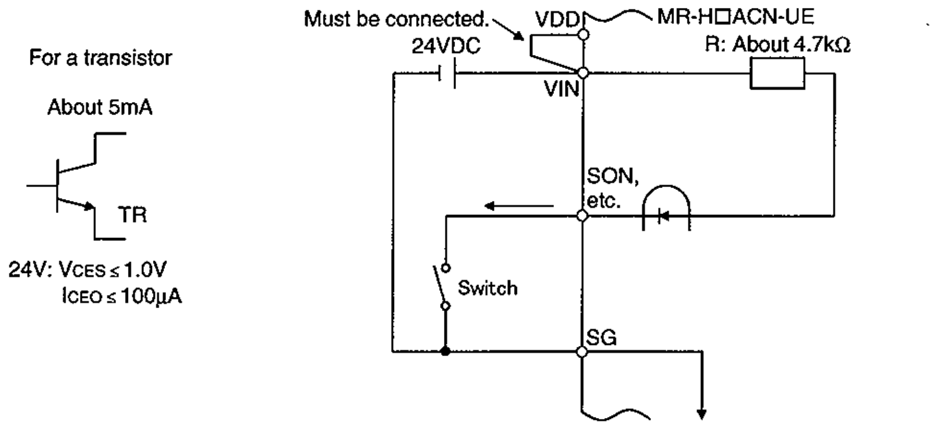
Symbol	Signal	Description
L1, L2, L3	Main circuit power supply	Main circuit power input terminals Connect a three-phase 200 to 230VAC, 50/60Hz power supply to L1, L2, L3. For MR-H700□ACN-UE or more, the voltage of 50Hz power is 200 to 220V.
U, V, W	Servo motor output	Servo motor power output terminals Connect to the servo motor power supply terminals (U, V, W).
L11, L21	Control circuit power supply	Control circuit power input terminals L11 and L21 should be in phase with L1 and L2, respectively. Connect a single-phase 200 to 230VAC, 50/60Hz power supply. For MR-H700□ACN-UE or more, the voltage of 50Hz power is 200 to 220V.
P, C, D	Regenerative brake	Regenerative brake option connection terminals In the MR-H-400ACN-UE to MR-H700ACN-UE, the built-in regenerative brake resistor is factory-connected across P-C. When using the regenerative brake option, brake unit or power return converter, always connect it after removing the wiring of the built-in regenerative brake resistor connected across P-C. For MR-H11KACN-UE or more, always connect the supplied regenerative brake resistor across P-C.
MS1 · MS2	Servo motor fan	Servo motor fan power supply terminals Connect to the cooling fan which is built in the HA-LH11K2-EC to HA-LH22K2-EC servo motors. Provided for the controllers of MR-H11KACN-UE or more.
⏚	Grounding	Ground terminal Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.

9.3.2 Interfaces

(1) Digital input interface DI-1

Always use an external power supply.

Provide a signal using a relay or open collector transistor.

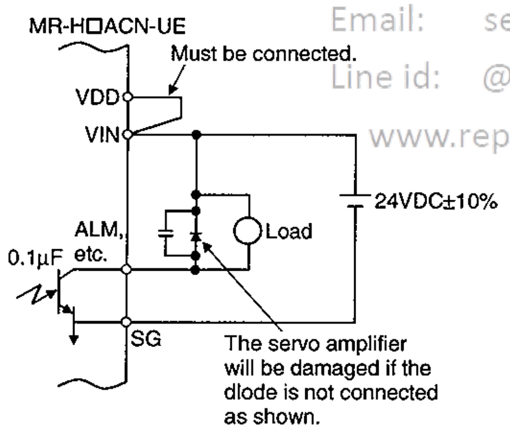


(2) Digital output interface DO-1

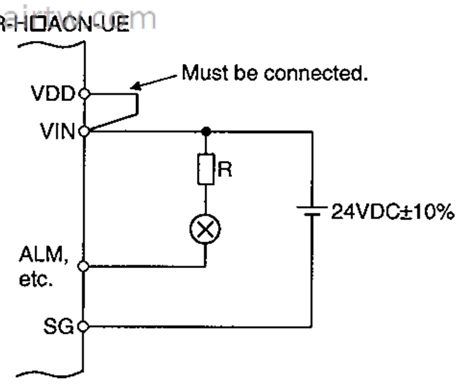
Always use an external power supply.

Can drive a lamp, relay or photocoupler. Provide absorbers (D, C) for an inductive load or an inrush current suppressing resister (R) for a lamp load. (Permissible current: 50mA or less, inrush current: 100mA or less)

· Inductive load



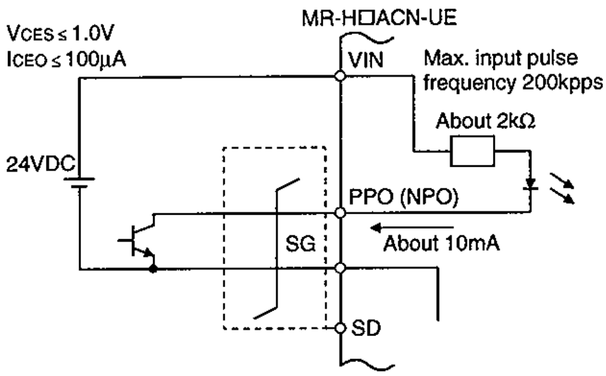
· Lamp load



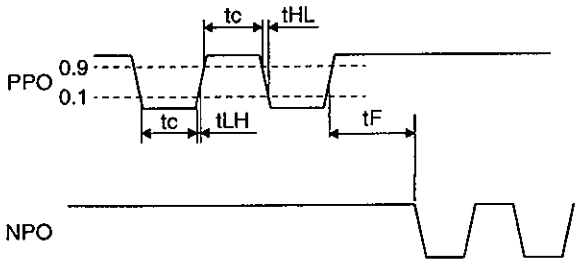
(3) Pulse train input interface DI-2

(a) Open collector system

· Interface example



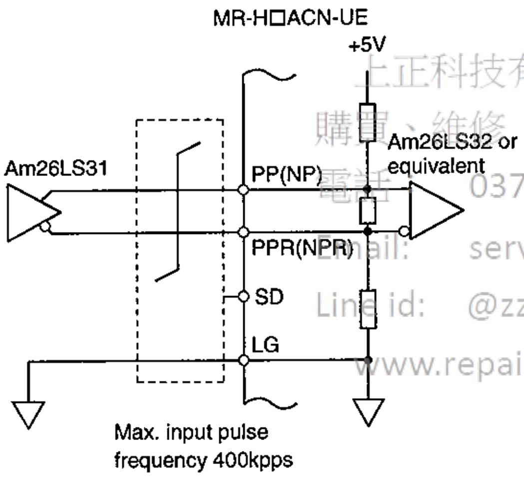
· Input pulse conditions



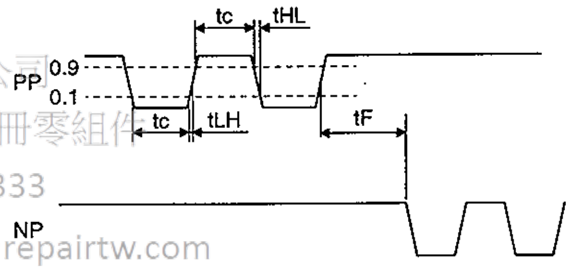
$t_{LH} = t_{HL} < 0.2\mu s$
$t_c > 2\mu s$
$t_F < 3\mu s$

(b) Differential line driver system

· Interface example



· Input pulse conditions



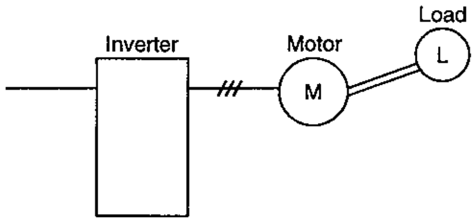
$t_{LH} = t_{HL} < 0.1\mu s$
$t_c > 1\mu s$
$t_F < 3\mu s$

10. ADJUSTMENT

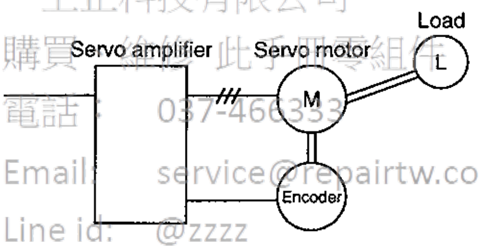
10.1 What Is Gain Adjustment?

10.1.1 Difference between servo amplifier and other drives

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

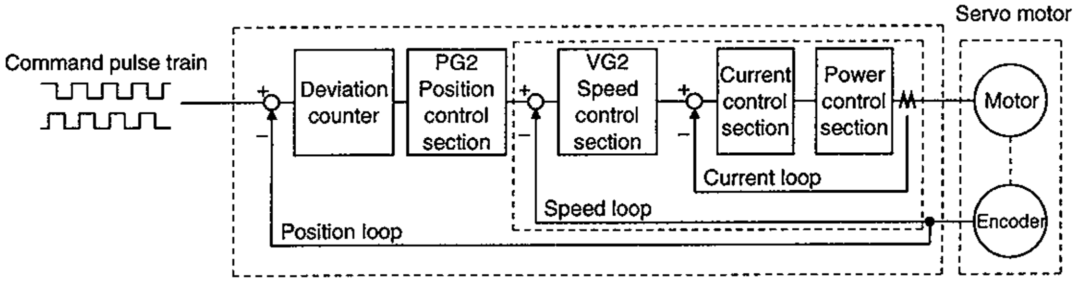


On the other hand, the servo amplifier always detects the positions and speeds of the motor and machine using the servo motor encoder, and exercises control to match the position and speed commands with the actual motor (machine) position and speed. In the servo system, adjustment is needed because:



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

10.1.2 Basics of the servo system



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

(1) Current loop

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

(2) Speed loop

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

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

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

J_L = load inertia moment

J_M = servo motor shaft inertia moment

(3) Position loop

The response level will not vary according to machine conditions.

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

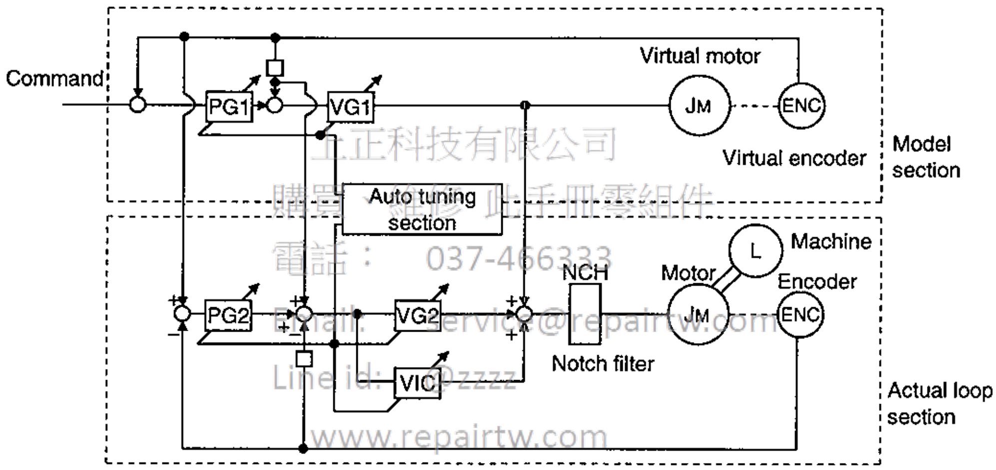
When the motor is installed to the machine, the gain must be adjusted to satisfy f_v = 4 to 6f_p according to the load inertia moment ratio m.

10.2 Gain adjustment

10.2.1 Parameters required for gain adjustment

Parameter No.	Symbol	Name
No.21	AUT	Function selection (Auto tuning)
No.7	PG1	Position loop gain 1
No.59	NCH	Machine resonance suppression filter.
No.58	GD2	Ratio of load inertia moment to motor inertia moment
No.60	PG2	Position loop gain 2
No.61	VG1	Speed loop gain 1
No.62	VG2	Speed loop gain 2
No.63	VIC	Speed integral compensation

10.2.2 Block diagram



The block diagram of the MR-H-ACN servo control section is shown above. (The current loop is omitted.)

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

(2) Model section
Acts to provide the ideal operation values to the current loop in response to the command.

(3) Auto tuning section
Judges the load inertia moment of the machine fitted with the actual motor from the operation error of the motor to change each control gain in real time.
The gains changed by auto tuning are PG1, VG1, PG2, VG2 and VIC.

10.2.3 What is auto tuning?

The load inertia moment is estimated from the angular speed (ω) and torque (T) are estimated in accordance with the equation of motion (10.1) used for motor acceleration/deceleration. In actuality, the acceleration/deceleration characteristics of the model and those of the actual motor are compared to estimate the inertia moment of the load in real time.

$$J\frac{d\omega}{dt}=T \cdots\cdots\cdots\cdots\cdots\cdots (10.1)$$

J : Inertia moment
ω : Angular speed
T : Torque

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

(1) When the motor makes acceleration/deceleration, load inertia moment JL is estimated in the above method to calculate the load inertia moment ratio (GD2).

(2) Each gain (PG1, VG1, PG2, VG2, VIC) to the calculated load inertia moment ratio (GD2) is changed according to the response level set in parameter No.21. Note that these gains have been patterned beforehand to satisfy the aforementioned stabilization condition.

10.3 Gain Adjustment by Auto Tuning

10.3.1 Adjustment method

The MR-H-ACN is factory-set to make auto tuning valid (parameter No.21: □0□1).
In the factory setting of the controller, auto tuning is valid and the response setting is "2".
The initial settings provide sufficient tuning for general machines. Higher-level tuning can be provided by adjusting the response setting (third digit of parameter No.21) according to machine rigidity.
The following table lists guidelines for response setting to drive systems. Choose slow response when using a reduction gear having backlash:

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

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

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

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

10.3.2 Valid conditions

POINT

- If the acceleration/deceleration time is long or the motor speed used is only low speed, the valid conditions of auto tuning are not satisfied. Therefore, it may result in false tuning.
  In this case, after performing operation which satisfies the auto tuning conditions, set parameter No. 21 to "auto tuning not executed".

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

(1) Set the acceleration time (time until the preset speed is reached) to 5s or less and the acceleration/deceleration current to 50% or more.

(2) Perform operation several times until the cumulative acceleration/deceleration time is 1s or more.

(3) Set the servo motor speed to 500r/min or more.

10.4 Manual Gain Adjustment

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

10.4.1 When machine rigidity is low

(1) Machine condition

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

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

(2) Adjustment procedure

Adjustment 1

a) Execute auto tuning with the response setting of the level at which machine will not vibrate. Set 0101 in parameter No.21.

b) Set "Not executed" auto tuning in parameter No.21.

c) Gradually decrease the speed integral compensation VIC (parameter No.63) setting.

Adjustment 2

a) Perform auto tuning with the response setting of slow response. Set 0101 in parameter No.21.

b) Set the machine resonance suppression filter (parameter No.59) in order from higher to lower frequencies.

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

d) If the machine condition does not become excellent after the above adjustment, reduce the setting of speed integral compensation as in Adjustment 1.

10.4.2 When the machine vibrates due to machine resonance frequency

(1) Machine condition

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

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

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

(2) Adjustment procedure

(a) Adjustment 1

1) Perform auto tuning with the response setting of slow response.
   Set 0101 in parameter No.21.
2) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.59).
3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) Increase the machine resonance suppression filter value gradually and repeat step 3).
   The optimum value is provided at the point just before vibration increases.
5) To further shorten the settling time, gradually increase the response setting in parameter No.21 and repeat steps 1) to 4).

(b) Adjustment 2

1) Choose the response setting of slow response.
   Set 0101 in parameter No.21.
2) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).
   If an exact machine inertia moment ratio is unknown, enter an approximate value.
   When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

Parameter No.	Symbol	Name
No.7	PG1	Position loop gain 1
No.60	PG2	Position loop gain 2
No.61	VG1	Speed loop gain 1
No.62	VG2	Speed loop gain 2
No.63	VIC	Speed integral compensation

3) Set parameter No. 21 to □□□2 (auto tuning not executed).
4) Decrease the speed control gain (parameter No. 62) to a value about 100 to 200 smaller than the automatically set value.
5) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.59).
6) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
7) Decrease the machine resonance suppression filter gradually and repeat step 6).
   The optimum value is provided at the point where vibration is minimum.
8) When there is no machine resonance, check the operating status and gradually increase the speed loop gain 2 (parameter No.62) and repeat steps 5) to 7) in Adjustment 1.
   Set the value about 50 to 100 smaller than the value at which gear sound begins to be generated.
   Make this gain a little smaller if there is variation in the machine because a timing belt or the like is used.
9) To further shorten the settling time, gradually increase the response setting of parameter No.21 and repeat steps 1) to 8).

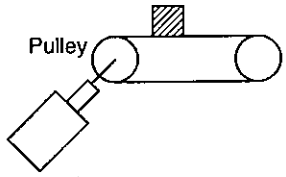
10.4.3 Load inertia moment is 20 or more times

(1) Machine condition

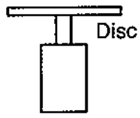
The machine inertia moment is 20 times or more and the servo motor oscillates at low frequency (5Hz or more). At this time, servo motor shaft vibration can be confirmed visually.

This adjustment method is valid for the following machines:

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



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



3) Machine of which ballscrew lead is long

(2) Adjustment procedure

1) Choose the response setting of slow response.
   Set 0101 in parameter No.21.
2) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).
   If an exact machine inertia moment ratio is unknown, enter an approximate value.
   When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

Parameter No.	Symbol	Name
No.7	PG1	Position loop gain 1
No.60	PG2	Position loop gain 2
No.61	VG1	Speed loop gain 1
No.62	VG2	Speed loop gain 2
No.63	VIC	Speed integral compensation

3) Set parameter No. 21 to □□□2 (auto tuning not executed).
4) Alternate a start and a stop several times, and check whether the machine does not vibrate.
5) If vibration still persists, repeat steps 1) and 4).
6) If vibration still persists, make (a) Adjustment 1 and (b) Adjustment 2 in paragraph (2) of Section 10.4.2.
7) If you want to further increase the response, set parameter No. 21 to "auto tuning executed" (third digit) with operation at a stop, and increase the response setting (first digit). After that, set the parameter to "auto tuning not executed" (third digit).
   For example, after setting parameter No. 21 to "□2□1", set it to "□2□2".
8) Reducing the speed loop's integral time constant (parameter No. 63) may improve the performance. However, making it too small may generate vibration.

10.4.4 When shortening the settling time

(1) Machine condition

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

(2) Adjustment procedure

a) Choose the response setting of slow response.
Set 0101 in parameter No.21.

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

c) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).
If an exact machine inertia moment ratio is unknown, enter an approximate value.
When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

Parameter No.	Symbol	Name
No.7	PG1	Position loop gain 1
No.60	PG2	Position loop gain 2
No.61	VG1	Speed loop gain 1
No.62	VG2	Speed loop gain 2
No.63	VIC	Speed integral compensation

d) Set □□□2 in parameter No.21 to make auto tuning invalid.
Make the parameter No.7, 60 to 63 settings manually adjustable.

e) Check the operating status and adjust the following parameter values:

Parameter No.	Symbol	Name	Description
No.7	PG1	Position loop gain 1	Higher setting shortens the settling time but is liable to cause overshooting.
No.60	PG2	Position loop gain 2	
No.61	VG1	Speed loop gain 1	Higher setting improves the servo response level but is liable to cause vibration.
No.62	VG2	Speed loop gain 2	
No.63	VIC	Speed integral compensation	Lower setting keeps the speed constant to load disturbance and increases holding force at a stop (servo rigidity) but is liable to cause overshooting.

Make adjustment by gradually increasing the parameter No.7, 60 to 62 settings at the same ratio and reducing the speed integral compensation (parameter No.63). The optimum value is provided at the point just before vibration increases. Use of the machine resonance filter (parameter No.59) may increase the limit point.

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

(1) Machine condition

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

(2) Adjustment procedure

a) To adjust the gains of each axis, adjust the gains of all axes in the adjustment procedures in Sections 10.4.1 to 10.4.5.

b) Set □□□0 or □□□2 in parameter No.21.

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

Parameter No.	Symbol	Name
No.7	PG1	Position loop gain 1
No.60	PG2	Position loop gain 2
No.63	VIC	Speed integral compensation

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

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

11. INSPECTION

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

POINT

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

11.1 Inspection

It is recommended to make the following checks periodically:

1) Check for loose terminal block screws. Retighten any loose screws.
2) Check the servo motor bearings, brake section, etc. for unusual noise.
3) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.
4) Check the servo motor shaft and coupling for misalignment.

11.2 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.
Also when using the servo motor in the atmosphere having much oil mist, dust, etc., clean and inspect every three months. For parts replacement, please contact your sales representative.

Part Name		Life Guideline
Controller	Smoothing capacitor	10 years
	Relay	10.000times
	Cooling fan	10,000 to 30,000 hours (2 to 3 years)
	Absolute position battery	10,000 hours
Servo motor	Bearings	20,000 to 30,000 hours
	Encoder	20,000 to 30,000 hours
	Oil seal, V ring	5,000 hours
	Cooling fan	20,000 hours

(1) 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.

(2) Relays
Their contacts will wear due to switching currents and contact faults occur. Relays reach the end of their life at cumulative 100,000 switching times (switching life), which depends on the power supply capacity.

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

(4) Servo motor bearings
When the servo motor is run at rated speed under rated load, change the bearings in 20,000 to 30,000 hours as a guideline. This differs on the operating conditions. The bearings must also be changed if unusual noise or vibration is found during inspection.

(5) Servo motor oil seal, V ring
Must be changed in 5,000 hours of operation at rated speed as a guideline. This differs on the operating conditions. These parts must also be changed if oil leakage, etc. is found during inspection.

(6) Servo motor cooling fan (HA-LH11K2 or more)
The design life of the cooling fan is 20,000 hours. Change the cooling fan periodically.

12. TROUBLESHOOTING

12.1 Trouble at Start-Up

⚠CAUTION	• Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

POINT

- If the servo motor is inoperative, refer to the "unrotated motor reason" screen (Section 7.4 (2)) and take corrective action.

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

No.	Start-Up Sequence	Fault	Investigation	Possible Cause	Refer To
1	Power on	· LED is not lit. · LED flickers.	Not improved if connectors CN1, CN2, CN3,CN4,CN11 andCN12 are disconnected.	1) Power supply voltage fault 2) Servo amplifier is faulty.	
			Improved when connectors CN1 and CN11 are disconnected.	Power supply of CN1 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1) Power supply of encoder cabling is shorted. 2) Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply is shorted.	
		Alarm occurs.	Refer to Section 12.2 and remove cause.		Section 12.2
2	Switch on servo-on signal.	Alarm occurs.	Refer to Section 12.2 and remove cause.		Section 12.2
		Servo motor shaft is not servo-locked (is free).	Check the display to see if the controller is ready to operate.	1) Servo on signal is not input. (Wiring mistake) 2) 24VDC power is not supplied to COM.	Section 7.3
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure: 1) Increase the auto tuning response level. 2) Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 10
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	Make gain adjustment in the following procedure: If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 10
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	

12.2 When Alarm or Warning Has Occurred

12.2.1 Alarms and Warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to Section 12.2.2 or 12.2.3 and take the appropriate action.
You can use the MR-H-D01 option card to output the alarm code. Set □□□1 in parameter No. 67.

	Indication	(Note1) MR-H-D01 Alarm Code				Function Name	Parameter Unit Screen Display	Alarm Deactivation		
		DO03	DO02	DO01	DO00			Power OFF→ON	Parameter unit "RES"	Alarm reset (RES) signal
Alarm codes	AL10	0	0	1	0	Under voltage	Under volt	○	○	○
	AL12	0	0	0	0	Memory alarm 1	Memory er 1	○		
	AL13	0	0	0	0	Clock alarm	OSC err	○		
	AL14	0	0	0	0	Watchdog	Watch dog	○		
	AL15	0	0	0	0	Memory alarm 2	Memory er 2	○		
	AL16	0	1	1	0	Encoder alarm 1	PLG err 1	○		
	AL17	0	0	0	0	Board alarm	Board err	○		
	AL19	0	0	0	0	Memory alarm 3	Memory er 3	○		
	AL1A	0	1	1	0	Motor combination error	Motor err.	○		
	AL20	0	1	1	0	Encoder alarm 2	PLG err 2	○		
	AL24	1	1	0	0	Ground fault	Grounded	○	○	○
	AL25	1	1	1	0	Absolute position erase	ABS lost	○		
	AL30	0	0	0	1	Regenerative alarm	Reg. err	○		
	AL31	0	1	0	1	Over speed	Over speed	○	○	○
	AL32	0	1	0	0	Over current	Over curr	○	○	○
	AL33	1	0	0	1	Over voltage	Over volt	○	○	○
	AL35	1	1	0	1	Command pulse frequency alarm	Ref. f err	○	○	○
	AL37	1	0	0	0	Parameter alarm	Pr. err	○		
	AL42	0	1	1	0	Feedback alarm	Pos. err	○	○	○
	AL45	0	0	1	1	Main circuit device overheat	Fin heat	○	○	○
	AL46	0	0	1	1	Servo motor overheat	Motor heat	○	○	○
	AL50	0	0	1	1	Over load 1	Over load 1	○ (Note2)	○ (Note2)	○ (Note2)
	AL51	0	0	1	1	Over load 2	Over load 2	○ (Note2)	○ (Note2)	○ (Note2)
	AL52	0	1	0	1	Error excessive	Over droop	○	○	○
	AL73	1	1	0	1	Auxiliary pulse frequency alarm	OpRef. f er	○	○	○
	AL74	1	1	1	1	Option memory alarm 1	OpMemo. er 1	○		
	AL75	1	1	1	1	Option memory alarm 2	OpMemo. er 2	○	○	○
	AL8E	0	0	0	0	RS-232C alarm	RS232 err	○	○	○
	AL8F	1	0	0	0	RS-422 alarm	RS422 err	○	○	○
Warning codes	AL90					Zeroing incomplete	ORG error	Removing the cause of occurrence deactivates the alarm automatically.		
	AL92					Open battery cable warning	BTT cable			
	AL96					Zero setting error	ZERO set er			
	AL9A					Digital switch warning	Dig.SW err			
	AL9F					Battery warning	BTT volt			
	ALE0					Excessive regenerative load warning	OR warning			
	ALE1					Over load warning	OL warning			
	ALE3					Absolute position counter warning	ABS warning			
	ALE6					Servo emergency stop	EMG stop			
	ALE9					Main circuit off warning	Main P-off			

Note 1. 0: Any terminal-SG OFF (open)
1: Any terminal-SG ON (short)
2. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

12.2.2 Remedies for alarms

⚠CAUTION	• When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.

POINT

- When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the controller, servo motor and regenerative brake option may become faulty.
  - · Regenerative alarm (AL30)
  - · Overload 1 (AL50)
  - · Overload 2 (AL51)
- The alarms can be deactivated by switching power off, then on, by pressing the "RES" key of the parameter unit or by turning on the reset signal (RES). Refer to Section 12.2.1 for details.
- When □□□1 is set in parameter No. 41 to make reset (SON) valid, reset (SON) can be used to deactivate the alarm.

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

Indication	Name	Definition	Parameter Unit Screen Display		Cause	Action
			Current Alarm (name and definition)	Alarm Occurrence Factor		
AL10	Undervoltage	Power supply voltage dropped. 160V or less	Under volt	Power Volt under 160V	1. Power supply voltage is low.	Review the power supply.
				15ms IPF	2. Power failed instantaneously. In case of MR-H700ACN or less : 15ms or less In case of MR-H11KACN or more : 10ms or less	
				Insuf. Power capacity	3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
					4. Power switched on within 5s after it had switched off.	
					5. Faulty parts in the controller Checking method: Alarm (AL 10) occurs if power is switched on after all connectors are disconnected.	Change the Servo amplifier.
AL12	Memory alarm 1	RAM, ROM memory fault	Memory er 1	Board error	Faulty parts in the controller Checking method: Alarm (any of AL 12 to 15) occurs if power is switched on after all connectors are disconnected.	Change the Servo amplifier.
AL13	Clock alarm	Printed board fault	OSC err			
AL14	Watch dog	CPU fault	Watch dog			
AL15	Memory alarm 2	EEPROM fault	Memory er 2			
AL16	Encoder alarm	Communication error occurred between encoder and controller.	PLG err 1	PLG con. left	1. Encoder connector disconnected.	Connect correctly.
				PLG trouble	2. Encoder faulty.	Change the servo motor.
				PLG cable has trouble	3. Encoder cable faulty (wire breakage or short)	Repair or change the cable.

Indication	Name	Definition	Parameter Unit Screen Display: Current Alarm (name and definition)	Parameter Unit Screen Display: Alarm Occurrence Factor	Cause	Action
AL17	Board alarm	CPU/parts fault	Board err	Board error	Faulty parts in the controller Checking method Alarm (AL 17 or AL 19) occurs if power is switched on after all connectors have been disconnected.	Change the controller.
AL19	Memory alarm 3	Flash ROM fault	Memory alarm 3	Board error		
AL1A	Motor combination erase	Motor combination error	Motor err.	Motor err.	When using HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor, improper motor was connected with controller.	Use correct combination.
AL20	Encoder alarm 2	Communication error occurred between encoder and controller.	PLG err 2	PLG con. left	1. Encoder connector disconnected.	Connect correctly.
				PLG cable has trouble	2. Encoder cable faulty (wire breakage or short)	Repair or change the cable.
AL24	Ground fault	Ground fault occurred at the servo motor outputs (U,V and W phases) of the servo amplififer.	Grounded	UVW ground fault	1. Power input cable and servo motor output cable are making contact at the main circuit terminal block (TE1).	Connect correctly.
					2. Servo motor power cable insulation deteriorated.	Change the cable.
AL25	Absolute position erase	Absolute position data in error	ABS lost	Power trset after 2-3 min. pow. on	1. Reduced voltage of super capacitor in encoder	After alarm has occurred, hold power on for a few minutes, and switch it off once, then on again. Make home position return again.
				BTT life time over	2. Battery voltage low	Change battery. Make home position return again.
				BTT cable has trouble	3. Battery cable or battery is faulty.	
AL30	Regenerative alarm	Permissible regenerative power of the built-in regenerative brake resistor or regenerative brake option is exceeded.	Reg. err	Pr. 2 missetting	1. Wrong setting of parameter No. 2	Set correctly.
				Reg. Resist. Missing	2. Built-in regenerative brake resistor or regenerative brake option is not connected.	connect correctly.
				Reg. Load exceeded	3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative brake option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative brake option of larger capacity. 3. Reduce the load.
					Power supply voltage is abnormal. 260V or more	Review power supply
		Regenerative transistor fault		Reg. Tr. damaged	5. Regenerative transistor faulty. Checking method 1) The regenerative brake option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative brake resistor or regenerative brake option.	Change the controller.
				Reg. Resist. has trouble	6. Built-in regenerative brake resistor or regenerative brake option faulty.	Change controller or regene-rative brake option.
		Cooling fan stop			7. Unusual overheat due to cooling fan stop	1. Change the controller or cooling fan. 2. Reduce ambient temperature.

Indication	Name	Definition	Parameter Unit Screen Display: Current Alarm (name and definition)	Parameter Unit Screen Display: Alarm Occurrence Factor	Cause	Action
AL31	Over speed	Speed has exceeded the instantaneous permissible speed.	Over speed	Acc. time-C shortage	1. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.
				Overshoot by unstable	2. Servo system is instable to cause overshoot.	1. Re-set servo gain to proper value. 2 If servo gain cannot be set to proper value: 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
				Pr. 1 missetting	3. Parameter No. 1 setting error.	Set correctly.
				PLG trouble	4. Encoder faulty.	Change the servo motor.
AL32	Over current	Current that flew is higher than the permissible current of the controller.	Over curr.	UVW short circuit	1. Short occurred in controller output phases U, V and W.	Correct the wiring.
				IPM dameged	2. Transistor (IPM) of the controller faulty. Checking method Alarm (AL 32) occurs if power is switched on after U, V and W are disconnected.	Change the controller
				UVW fault	3. Ground fault occurred in controller output phases U, V and W.	Correct the wiring.
				Ext. noise	4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
AL33	Over voltage	Converter bus voltage exceeded 400V.	Over volt.	Reg. resist. Missing	1. Lead of built-in regenerative brake resistor or regenerative brake option is open or disconnected.	1. Change lead. 2. Connect correctly.
				Reg. Tr. damaged	2. Regenerative transistor faulty.	
				Reg. Resist. has trouble	3. Wire breakage of built-in regenerative brake resistor or regenerative brake option	1. For wire breakage of built-in regenerative brake resistor, change controller. 2. For wire breakage of regenerative brake option, change regenerative brake option.
				Power volt exceeded	4. Capacity of built-in regenerative brake resistor or regenerative brake option is insufficient.	Add regenerative brake option or increase capacity.
					5. Power supply voltage high.	Review the power supply.
AL35	Command pulse frequency alarm	Input pulse frequency of the manual pulse generator is too high.	Ref. f err	Ref. pulse f exceeded	1. Command pulse frequency too high.	Change the command pulse frequency to a proper value.
				Ref. pulse has noise	2. Noise entered the command pulse.	Take action against noise.
					3. Manual pulse generator faulty.	Change the manual pulse generator.

Indication	Name	Definition	Parameter Unit Screen Display		Cause	Action
			Current Alarm (name and definition)	Alarm Occurrence Factor		
AL37	Parameter alarm	Parameter setting is wrong.	Pr. err	Pr. data destroyed	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the controller.
				Pr. □□ err.	2. Parameter data mis-setting	Set parameter correctly.
				Ps. □□ err.	3. Position block data mis-setting	
				Spd. □□ err.	4. Speed block data mis-setting	
AL42	Feedback alarm	Encoder signal is faulty.	Pos. err	PLG trouble	Encoder faulty.	Change the servo motor.
AL45	Main circuit device overheat	Main circuit device overheat	Fin heat	Overload	1. Servo amplifier faulty.	Change the controller.
				Amb. temp. over 55°c	2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
				Amp. Cooling trouble	3. Air cooling fan of controller stops.	The cooling method is reviewed.
AL46	Servo motor overheat	Servo motor temperature rise actuated the thermal protector.	Motor overheat	Motor amb. over 40°C	1. Ambient temperature of servo motor is over 40℃.	Review environment so that ambient temperature is 0 to 40°C.
				Overload	2. Servo motor is overloaded.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
				PLG-TH trouble	3. Thermal protector in encoder is faulty.	Change servo motor.
				Motor cool trouble	4. Air cooling fan of the servo motor stops.	Change servo motor.
AL50	Over load 1	Load exceeded overload protection characteristic of controller. Load ratio 300%: 2.5s or more Load ratio 200%: 100s or more	Over load 1	E-thermal tripped	1. Servo amplifier is used in excess of its continuous output current.	1. Reduce load. 2. Review operation pattern. 3. Use servo motor that provides larger output.
				Mot. Vibrat. by unstabl	2. Servo system is instable and hunting.	1. Repeat acceleration/ deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
				Machine locked	3. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
				UVW miswire	4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
				PLG trouble	5. Encoder faulty. Checking method When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	Change the servo motor.

Indication	Name	Definition	Parameter Unit Screen Display: Current Alarm (name and definition)	Parameter Unit Screen Display: Alarm Occurrence Factor	Cause	Action
AL51	Over load 2	Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked: 1s or more	Over load 2	Machine locked	1. Machine struck something.	1. Review operation pattern. 2. Install limit switches.
				UVW miswire	2. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
				Mot. Vibrat. by unstabl	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.
				Dc-bus low	4. The bus voltage of the unit has decreased.	Change the controller.
				PLG trouble	5. Encoder faulty. Checking method When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.	Change the servo motor.
AL52	Error excessive	Droop pulse value of the deviation counter exceeded 80k pulses.	Error excessive	Acc. time-c shortage	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
				Start torque missing	2. Torque limit value (parameter No.40) 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.
				Pr. 7 shortage	4. Position control gain 1 (parameter No.7) value is small.	Increase set value and adjust to ensure proper operation.
				Machine locked	5. The bus voltage of the unit due to the breakdown.	Change controller.
				Rotated by ext. force	6. 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.
				DC-bus low	7. Machine struck something.	1. Review operation pattern. 2. install limit switches.
				PLG trouble	8. Encoder faulty.	Change the servo motor
					9. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.

Indication	Name	Definition	Parameter Unit Screen Display: Current Alarm (name and definition)	Parameter Unit Screen Display: Alarm Occurrence Factor	Cause	Action
AL73	Auxiliary pulse frequency alarm	Input pulse frequency of manual pulse generator connected to option card is too high.	OpRef. fer	Op. board AUX pulse exceeded	Pulse input command frequency exceeded 600kpps.	Use at 600keeps or less.
AL74	Option memory alarm 1	Option card RAM fault	OpMemo. er 1	Op. board error	MR-H-D01 option card faulty.	Change the option card.
AL75	Option memory alarm 2	Option card EEP-ROM fault	OpMemo. er 1	Op. board error		
AL8E	RS-232C alarm	Serial communication error occurred between controller and communication device (parameter unit, personal computer or similar device).	RS232 err	RS232 comm. error	1. Encoder cable faulty. (write breakage or short) 2. Telecommunications equipment faulty.	Repair or change the cable. Change the telecommunication equipment.
AL8F	RS-422 alarm	Serial communication error occurred between controller and communication device (parameter unit, personal computer or similar device).	RS422 err	RS422 comm. error	1. The connection is defective with the external digital display. 2. External digital display faulty.	Wiring is repaired. Change the external digital display.

12.2.3 Remedies for warnings

If the warning that occurred is other than AL E6, and AL E9, operation can be continued but proper operation may not be performed. Occurrence of any other warning will result in a servo off status. Eliminate the cause of the warning according to this section. Use the operation parameter unit to refer to the cause of warning.

Indication	Name	Definition	Parameter Unit Screen Display		Cause	Action
			Current Alarm (name and definition)	Alarm Occurrence Factor		
AL90	Zero setting error	In incremental system: 1. Positioning operation was performed without zeroing. 2. Zeroing ended abnormally.	ZERO set er	ORG return missetting	1. Positioning operation was performed without zeroing. 2. Zeroing speed could not be reduced to creep speed. 3. Limit switch was actuated due to zeroing made from other than the position beyond the dog.	1. Perform zeroing. 2. Reconsider zeroing speed/creep speed.
		In absolute position detection system 1. Positioning operation was performed without home position setting. 2. Home position setting ended abnormally.			1. Positioning operation was performed without home position setting. 2. Home position setting speed could not be reduced to creep speed. 3. Limit switch was actuated due to home position setting made from other than the position beyond the dog.	1. Make home position setting. 2. Reconsider home position setting speed/creep speed.
AL96	Zero setting error	1. In incremental system: Zeroing could not be made. 2. In absolute position detection system: Zero setting could not be made.	ZERO set er	Ref. P input after CR on Out of inposition	Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence
AL9A	Digital switch warning	Setting is defective of the clock. digital switch MR-DS60.	Dig.SW err	Dig. SW minus feed	1.Minus setting was entered for an incremental command. 2.+ and - sign commands were entered at the same time.	Set parameter correctly.
AL9F	Battery warning	Voltage of battery for absolute position detection system reduced.	BTT volt	BTT voltage low	Battery voltage fell to 3.2V or less.	Change the battery.

Indication	Name	Definition	Parameter Unit Screen Display		Cause	Action
			Current Alarm (name and definition)	Alarm Occurrence Factor		
ALE0	Excessive regenerative load warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative brake resistor or regenerative brake option.	OR warning	Reg. Load over 85% of alarm	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative brake resistor or regenerative brake option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change regenerative brake option for the one with larger capacity. 3. Reduce load.
ALE1	Over load warning	There is a possibility that overload alarm 1 or 2 may occur.	OL warning	Load over 85% of alarm	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to AL 50, 51.	Refer to AL 50, AL 51.
ALE3	Absolute position counter warning	Absolute position encoder pulses faulty.	ABS warning	PLG trouble by noise	1. Noise entered the encoder.	Take noise suppression measures.
					2. Encoder faulty.	Change servo motor.
ALE6	Servo emergency stop	EMG-SG are open.	EMG stop	EMG off	External emergency stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate emergency stop.
ALE9	Main circuit off warning	Servo was switched on with main circuit power off.	Main P-off	Main power down while SON-on		Switch on main circuit power.

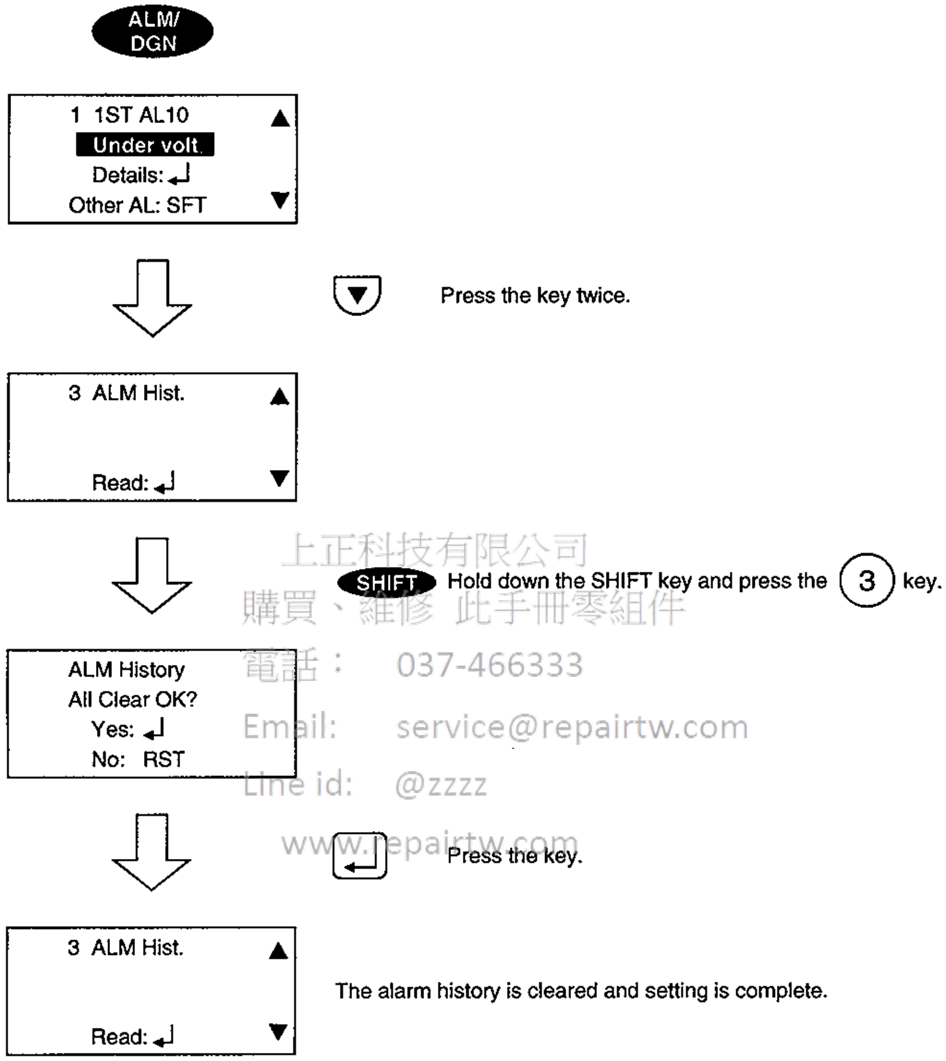
12.2.4 RS-232C communication error

When a communication fault occurs between the controller and parameter unit, any of the following errors is displayed on the screen of the parameter unit. In this case, switch the power off, take the corresponding action, and switch the power on.

Screen display	Error Definition	Cause	Corrective Action
COMMUNICATION ERROR	A fault occurred in communication between the controller and parameter unit during servo operation.	1. Parameter unit cable or communication cable connection fault 2. Parameter unit cable or communication cable open 3. Servo amplifier faulty. 4. Parameter unit faulty.	1. Connect properly. 2. Change the cable. 3. Change the controller. 4. Change the parameter unit.
SERVO CPU ERROR	Communication cannot be made at power-on between the controller and parameter unit.		
PRU MEMORY ERROR	Parameters cannot be copied from the controller to the parameter unit.	Memory (EEPROM) in the parameter unit faulty.	Change the parameter unit.

12.3 Clearing the Alarm History

The parameter unit can be used to confirm an alarm history. The controller stores one current alarm and nine past alarms which occurred since it had been switched on first. Before starting operation, clear the alarm history so that you can control alarms which may occur during the operation.



13. SPECIFICATIONS

13.1 Standard specifications

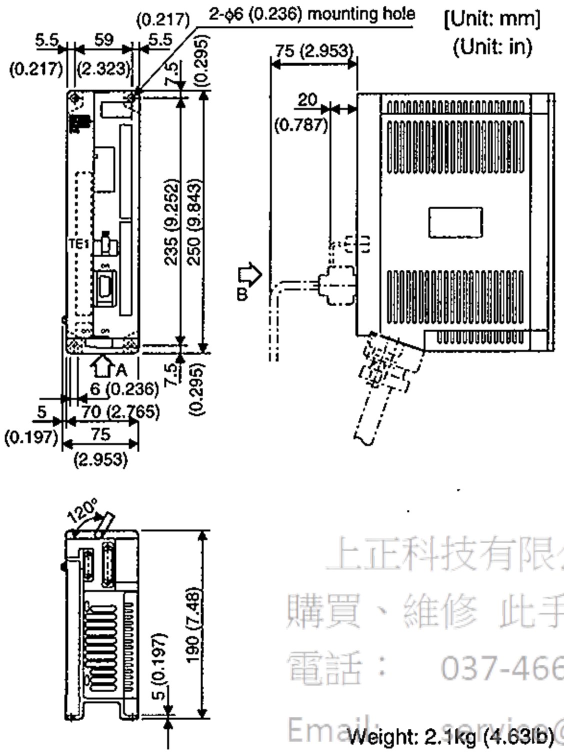
(1) Controller

Item	Controller MR-H□ACN	10	20	40	60	100	200	350	500	700	11K	15K	22K
Power supply	Voltage/frequency	3-phase 200 to 230VAC, 50/60Hz								3-phase 200 to 220VAC, 50Hz 3-phase 200 to 230VAC, 60Hz			
	Permissible voltage fluctuation	3-phase 170 to 253VAC, 50/60Hz								3-phase 170 to 242VAC, 50Hz 3-phase 170 to 253VAC, 60Hz			
	Permissible frequency fluctuation	Within ±5%											
	Power supply capacity	Given in Section 14.2											
System		Sine-wave PWM control, current control system											
Dynamic brake		Built-in									Option		
Protective functions		Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder fault protection, regenerative fault protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection											
Speed frequency response		250Hz or more											
Torque limit input		0 to ±10VDC/max. current (individual commands for forward rotation and reverse rotation, input impedance 10 to 12kΩ)											
Electronic gear		A/B times A · B:1 to 50000 1/50<A/B<50											
Error excessive		±80k pulse											
Positioning system specifications		Given in Section 3.1											
Roll Feeding system specifications		Given in Section 4.1											
Absolute position detection specifications		Given in Section 3.5											
Structure		Open (IP00)											
Environ ment	Ambient temperature	0 to +55 [°C] (non-freezing) 32 to +131 [°F] (non-freezing)											
	Ambient humidity	90%RH or less (non-condensing)											
	storage temperature	−20 to +65 [°C] (non-freezing) −4 to +149 [°F] (non-freezing)											
	storage humidity	90%RH or less (non-condensing)											
	Ambient	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt											
	Altitud	Max. 1000m (3280ft) above sea level											
	Vibration	5.9 [m/s^2] {0.6G} or less 19.4 [ft/s^2] or less											
Weight	[kg]	2.1	2.1	2.1	2.1	2.4	4.4	4.4	7.0	12.0	21	27	30
	[lb]	4.63	4.63	4.63	4.63	5.291	9.7	9.7	15.432	26.455	46.297	59.525	66.139

13.2 Outline Dimensional Drawings

13.2.1 Controllers

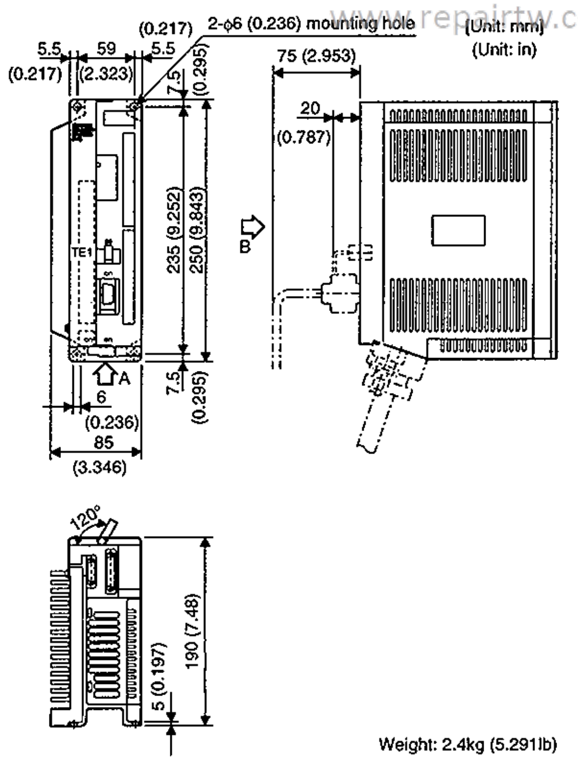
MR-H10ACN(-UE) to MR-H60ACN(-UE)



Weight: 2.1kg (4.63lb)

Terminal block TE1	
MR-H□ACN	MR-H□ACN-UE
Terminal screw: M4	Terminal screw: M4
P, C, N, R, S, T, R1, S1, U, V, W, ⏚	P, C, N, L1, L2, L3, L11, L21, U, V, W, (Note) Chassis ◎⏚ ◎
	Note: Keep it open.

MR-H100ACN(-UE)

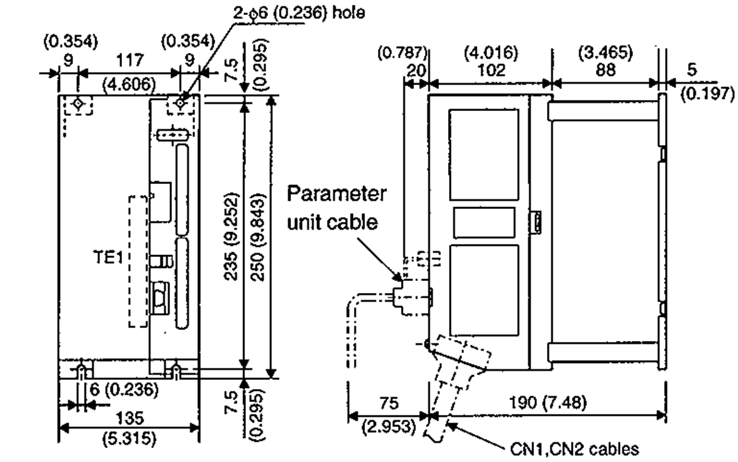


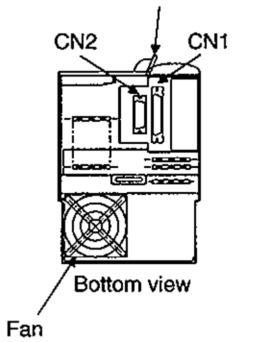
Weight: 2.4kg (5.291lb)

Terminal block TE1	
MR-H□ACN	MR-H□ACN-UE
Terminal screw: M4	Terminal screw: M4
P, C, N, R, S, T, R1, S1, U, V, W, ⏚	P, C, N, L1, L2, L3, L11, L21, U, V, W, (Note) Chassis ◎⏚ ◎
	Note: Keep it open.

MR-H200ACN(-UE) · MR-H350ACN(-UE)

[Unit: mm]
(Unit: in)



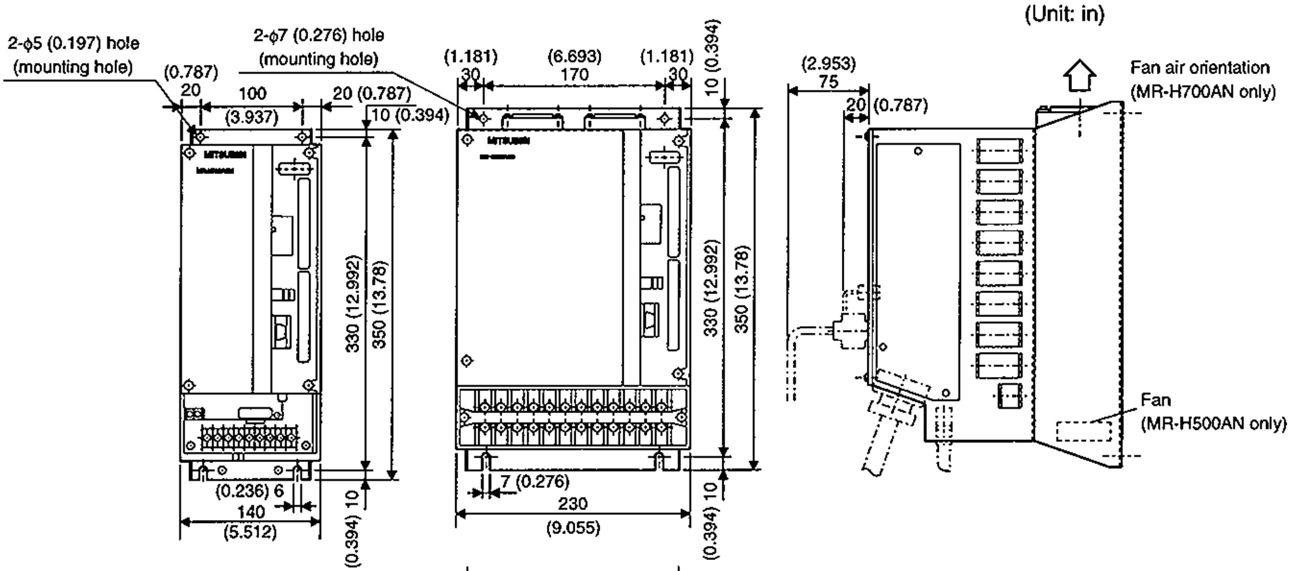


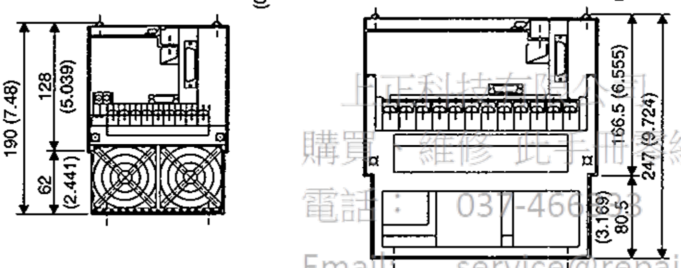
Terminal block TE1	
MR-H□ACN	MR-H□ACN-UE
Terminal screw: M4	Terminal screw: M4
P	P
C	C
N	N
R	L1
S	L2
T	L3
R1	L11
S1	L21
U	U
V	V
W	W
⏚	(Note)
	Chassis
	Note: Keep it open.

Weight: 4.4kg (9.7lb)

MR-H500ACN(-UE) · MR-H700ACN(-UE)

[Unit: mm]
(Unit: in)





MR-H500AN(-UE)

MR-H700AN(-UE)

Model	Weight [kg (lb)]
MR-H500AN(-UE)	7 (15.432)
MR-H700AN(-UE)	12 (22.455)

Terminal block signal arrangement

- MR-H500ACN

TE2

R1	S1

Terminal screw: M3.5

GND

◎

Terminal screw: M4

TE1

P	C	N	R	S	T	U	V	W

Terminal screw: M4

- MR-H700ACN

TE1

P	C	N	R	S	T	R1	S1	U	V	W	⏚

Terminal screw: M5

- MR-H500ACN-UE

TE2

L11	L21

PE

Terminal screw: M4

TE1

P	C	N	L1	L2	L3	U	V	W

Terminal screw: M4

- MR-H700ACN-UE

TE1

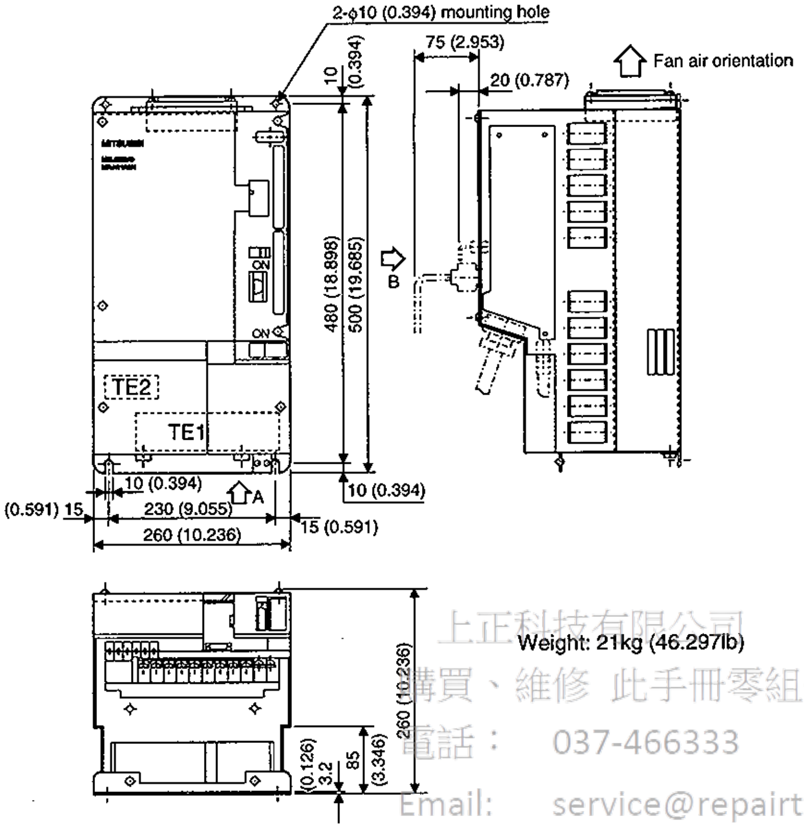
P	C	N	L1	L2	L3	L11	L21	U	V	W	◎

Terminal screw: M5

PE

MR-H11KACN(-UE)

[Unit: mm]
(Unit: in)



Weight: 21kg (46.297lb)

Terminal block signal arrangement

- MR-H11KACN

TE2

R1	S1		MS1	MS2	

Terminal screw: M4

TE1

R	S	T	U	V	W	P	C	N	⏚

Terminal screw: M5

- MR-H11KACN-UE

TE2

L11	L21		MS1	MS2	

Terminal screw: M4

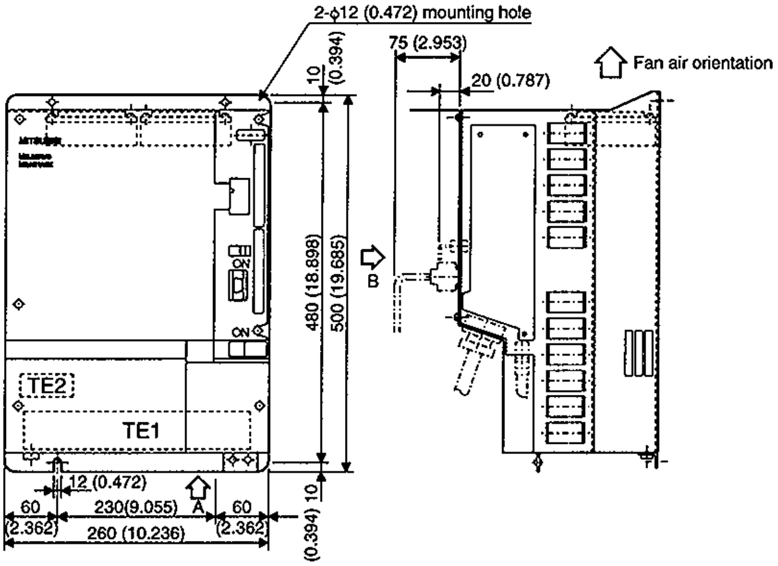
TE1

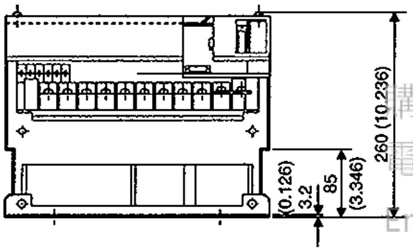
L1	L2	L3	U	V	W	P	C	N	PE

Terminal screw: M5

MR-H15KACN(-UE) · MR-H22KACN(-UE)

[Unit: mm]
(Unit: in)





Model	Weight [kg (lb)]
MR-H15KACN(-UE)	27 (59.525)
MR-H22KACN(-UE)	30 (66.139)

Terminal block signal arrangement

- MR-H15KACN · MR-H22KACN

TE2

R1	S1		MS1	MS2	

Terminal screw: M4

TE1

R	S	T	U	V	W	P	C	N	⏚

Terminal screw: M6(MR-H15KAN)
M8(MR-H22KAN)

- MR-H15KACN-UE · MR-H22KACN-UE

TE2

L11	L21		MS1	MS2	

Terminal screw: M4

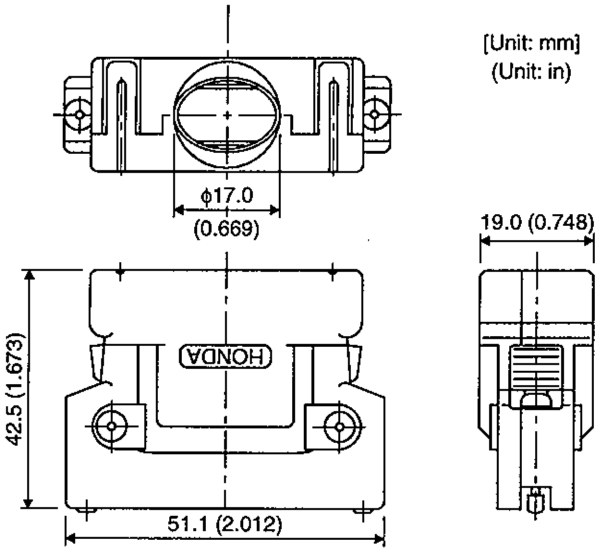
TE1

L1	L2	L3	U	V	W	P	C	N	PE

Terminal screw: M6(MR-H15KAN)
M8(MR-H22KAN)

13.2.2 Connectors

(1) Controller side connector
<Honda Tsushin Kogyo make>

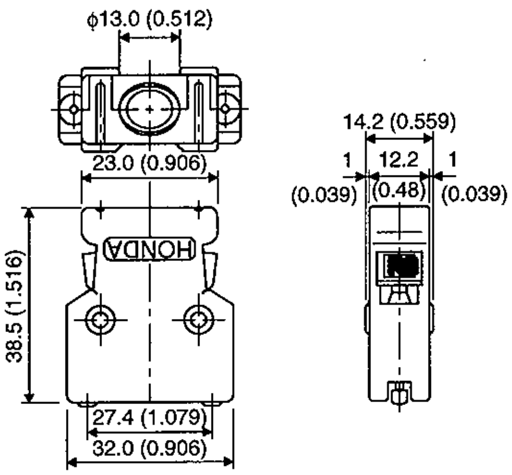


Number of Pins	Model	
	Connector	Case
50	PCR-S50FS (soldering type)	PCR-LS50LA1
	PCR-S50F (insulation displacement type)	

Crimping terminal: FHAT-002A

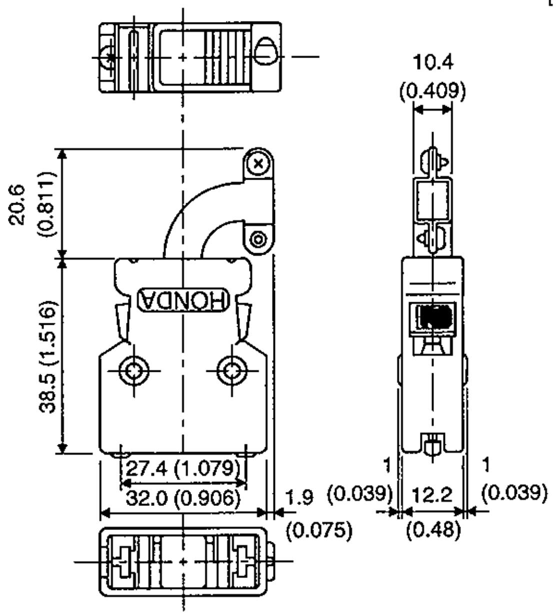
Note: PCR-S50F is not an option and is to be supplied by the customer.

PCR-LS20LA1



PCR-LS20LA1W

[Unit: mm]
(Unit: in)



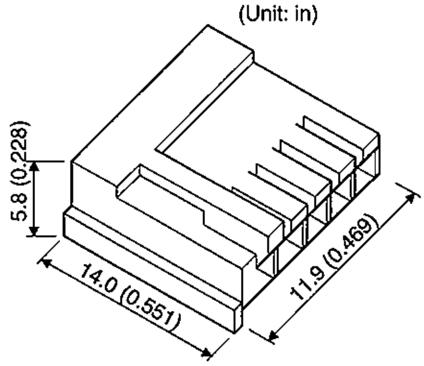
Number of Pins	Model	
	Connector	Case
50	PCR-S20FS (soldering type)	PCR-LS20LA1
	PCR-S20F (insulation displacement type)	PCR-LS20LA1W

Crimping terminal: FHAT-002A

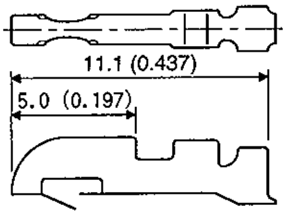
Note: PCR-S20F and PCR-LS20LA1W are not options and are to be supplied by the customer.

<Nippon AMP make>

· Housing Model: 171822-4
[Unit: mm]
(Unit: in)



· Contactor Model: 170262-2 (chain type)
170204-2 (loose type)
[Unit: mm]
(Unit: in)

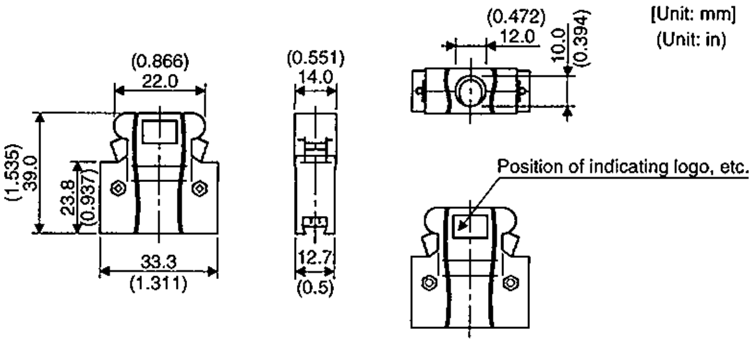


Applicable wire range
AWG: 30-26
(0.05 to 0.15mm^2)
Contactor caulking hand tool
Model: 722561-1

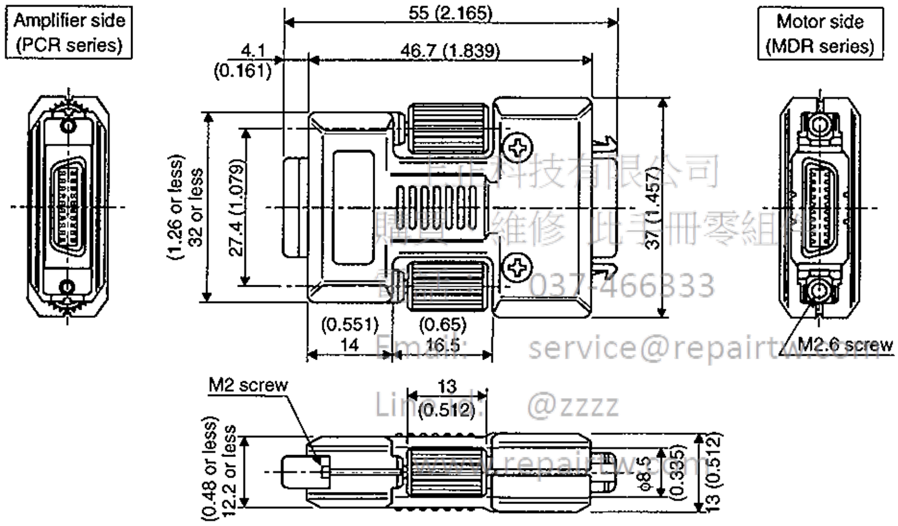
(2) Connector for conversion connector

Signal connector

<Sumitomo Three M make>



(3) MR-HCN2 conversion connector



14. CHARACTERISTICS

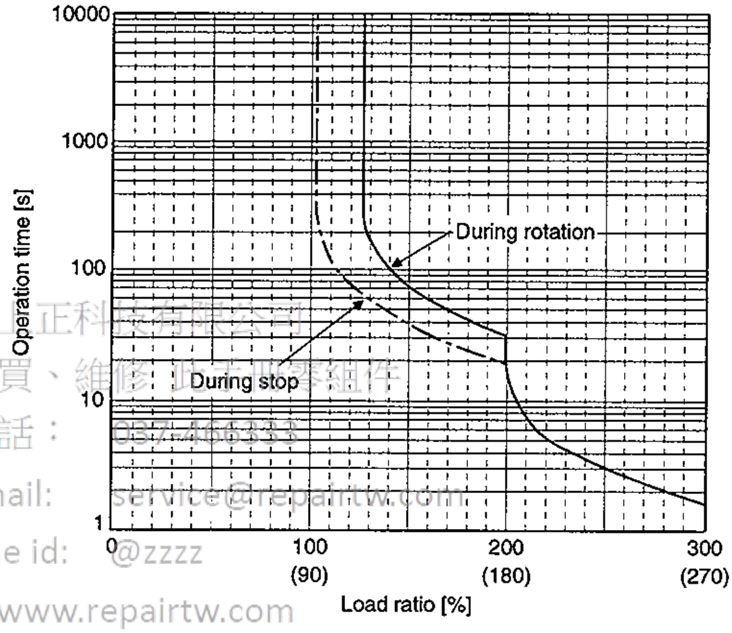
14.1 Overload Protection Characteristics

An electronic thermal relay is built in the controller to protect the servo motor and controller from overloads. The operation characteristics of the electronic thermal relay are shown below. Overload 1 alarm (AL50) occurs if overload operation performed is above the electronic thermal relay protection curve shown below. Overload 2 alarm (AL51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

If load is applied at a stop (during servo lock), 70% of the rated torque must not be exceeded.

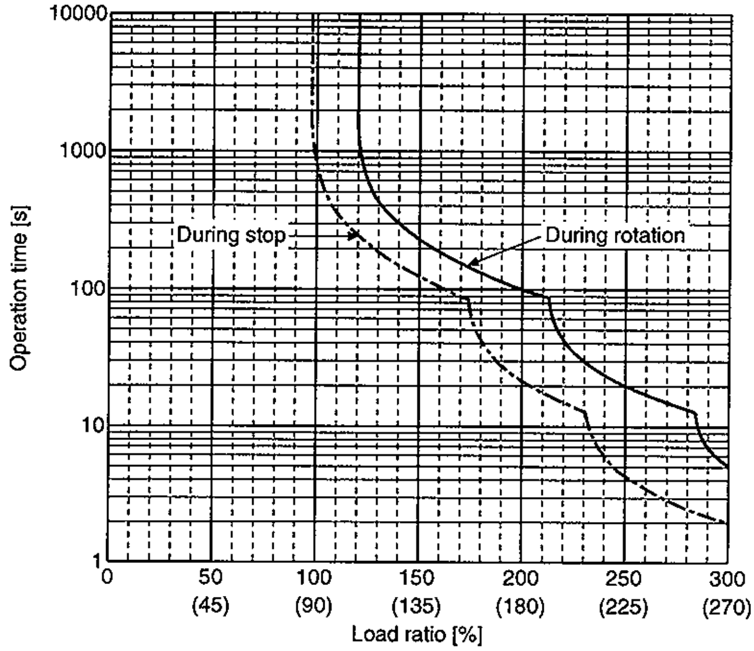
HA-LH serise
(11kW or more)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



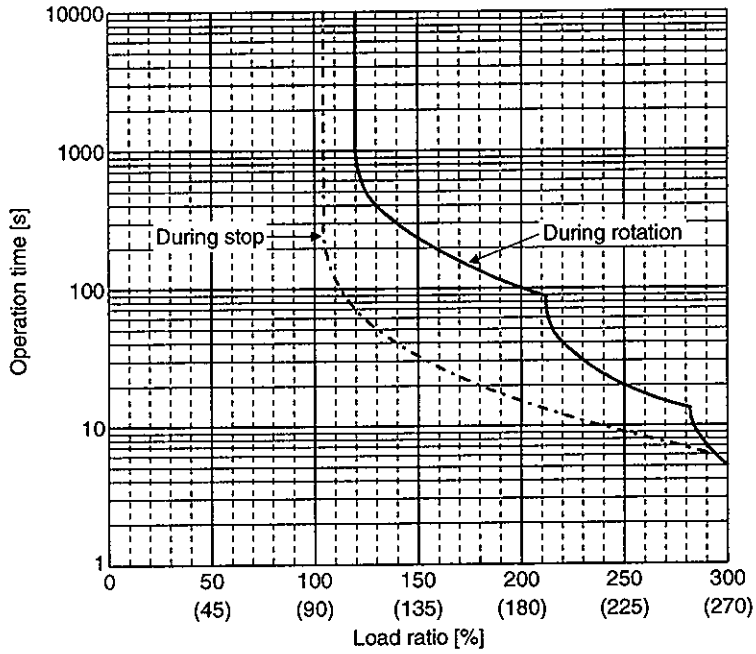
HC-MF serise
HC-SF serise
HC-RF serise
HC-UF serise

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



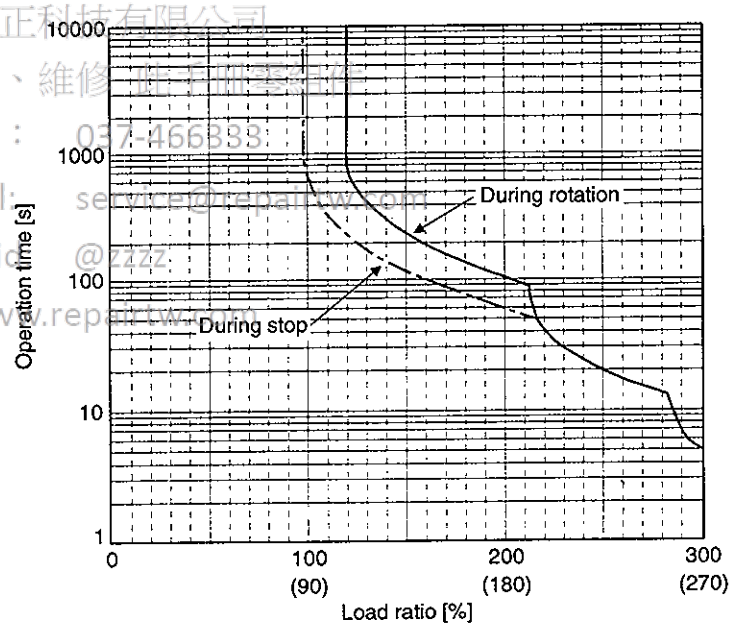
HC-FF serise
(200W or less)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



HC-FF serise
(300W or more)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



14.2 Power Supply Equipment Capacity and Generated Loss

(1) Amount of heat generated by the controller

Table 14.1 indicates controllers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 14.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and zero torque according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the controller's generated heat will not change.

Table 14.1 Power Supply Capacity and Generated Heat Per Controller at Rated Output

Controller	Servo Motor	Power Supply Capacity [kVA]	Controller-Generated Heat [W]		Area Required for Heat Dissipation	
			At rated torque	With servo off	[m^2]	[ft^2]
MR-H10ACN	HA-FF053 · 13	0.3	40	30	0.8	8.6
	HC-UF13	0.3	40	30	0.8	8.6
MR-H20ACN	HC-MF053 · 13	0.3	40	30	0.8	8.6
	HA-FF23	0.5	40	30	0.8	8.6
MR-H40ACN	HC-MF23	0.5	40	30	0.8	8.6
	HA-FF33	0.7	50	30	0.9	9.7
	HA-FF43	0.9	50	30	0.9	9.7
	HC-UF23	0.5	40	30	0.8	8.6
MR-H60ACN	HC-MF43	0.9	55	30	1.0	10.8
	HA-FF63	1.1	55	30	1.0	10.8
	HA-SF52 · 53	1.0	55	30	1.0	10.8
	HC-UF43	0.9	55	30	1.0	10.8
MR-H100ACN	HC-MF73	1.3	65	30	1.2	12.9
	HC-SF81	1.5	65	30	1.2	12.9
	HC-SF102 · 103	1.7	65	30	1.2	12.9
	HC-UF72 · 73	1.3	65	30	1.2	12.9
MR-H200ACN	HC-SF121	2.1	105	35	2.0	21.5
	HC-SF152 · 153	2.5	105	35	2.0	21.5
	HC-SF201 · 202 · 203	3.5	105	35	2.0	21.5
	HC-RF103	1.7	105	35	2.0	21.5
	HC-RF153	2.5	105	35	2.0	21.5
	HC-UF152	2.5	105	35	2.0	21.5
MR-H350ACN	HC-SF301	4.8	145	35	2.7	29.1
	HC-SF352 · 353	5.5	145	35	2.7	29.1
	HC-RF203	3.5	135	35	2.5	26.9
	HC-UF202	3.5	145	35	2.7	29.1
MR-H500ACN	HC-SF502	7.5	210	40	4.0	43.1
	HC-RF353	5.5	145	35	2.7	29.1
	HC-RF503	7.5	210	40	4.0	43.1
	HC-UF352	5.5	210	40	4.0	43.1
	HC-UF502	7.5	210	40	4.0	43.1
MR-H700ACN	HC-SF702	10.0	320	45	6.0	64.6
MR-H11KACN	HA-LH11K2	16	540	57	10.0	107.6
MR-H15KACN	HA-LH15K2	22	660	68	13.0	139.9
MR-H22KACN	HA-LH22K2	33	870	82	16.0	172.2

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

2. Refer to Table for the current capacity of the power supply.
3. When using multi-axes, add the power capacity per axis.
4. Heat generated during regeneration is not included in the controller-generated heat. To calculate heat generated by the regenerative brake option, use Equation 15.1 in Section 15.1.2.

(2) Heat dissipation area for enclosed controller

An enclosure or control box for the controller should be designed to operate at the ambient temperature of 40°C (104°F) within a temperature rise of 10°C (50°F). (With a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 14.1:

$$A = \frac{P}{K \cdot \Delta T} \quad \cdots\cdots\cdots\cdots \quad (14.1)$$

where, A : Heat dissipation area [m²]

P : Loss generated in the control box [W]

ΔT : Difference between internal and ambient temperatures [°C]

K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 14.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 14.1 for heat generated by the controller. "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 14.1 lists the enclosure dissipation area for each controller when the controller is operated at the ambient temperature of 40°C (104°F) under rated load.

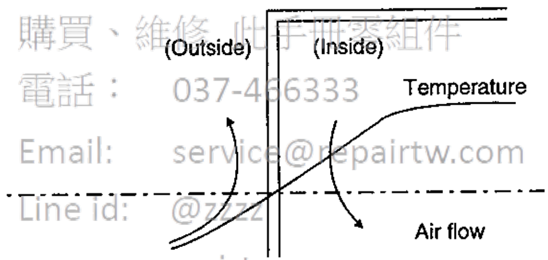


Fig. 14.1 Temperature Distribution in Enclosure

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.

(3) Fitting of the controller (MR-H200ACN or more)

When mounted with the heat sink outside mounting attachment (option), the controller can dissipate generated loss directly to the outside of a control box. This method can reduce the heat dissipation area of the control box since 45 to 55% of the generated loss given in Table 14.1 is dissipated to the outside of the enclosure. For details of the heat sink outside mounting attachment, refer to Section 15.1.9.

14.3 Dynamic Brake Characteristics

When an alarm, emergency stop or power failure occurs, the dynamic brake is operated to bring the servo motor to a sudden stop. Fig. 14.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 14.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant t varies with the servo motor and machine operation speeds. (Refer to Fig. 14.3 and Table 14.5.)

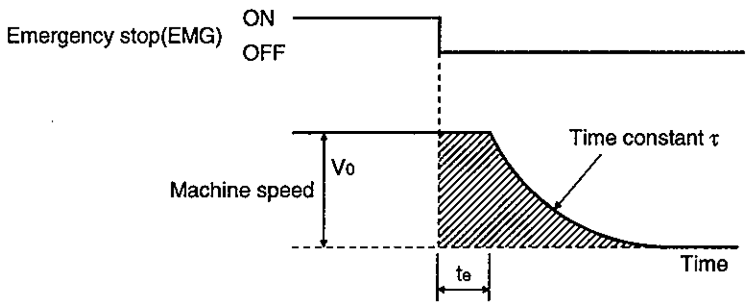
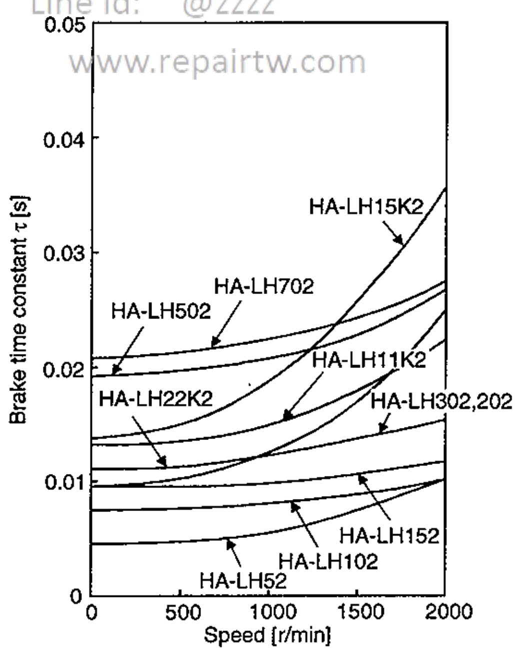


Fig. 14.2 Dynamic Brake Operation Diagram

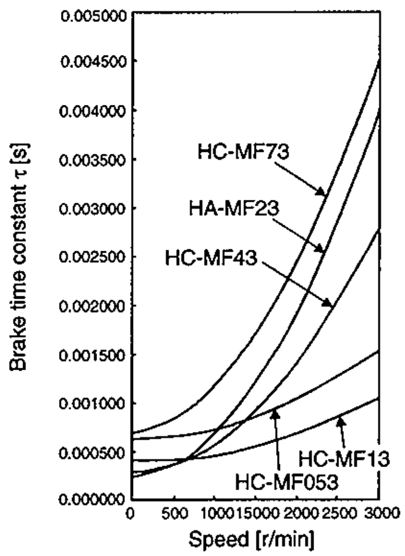
$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left[1 + \frac{J_L}{J_M} \right] \right\} \quad \cdots (14.2)$$

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 (Fig. 14.3 · Table 14.4) ········ [s]
t_e : Delay time of control section (Fig. 14.2) ········ [s]
(There is internal relay delay time of about 30ms.)

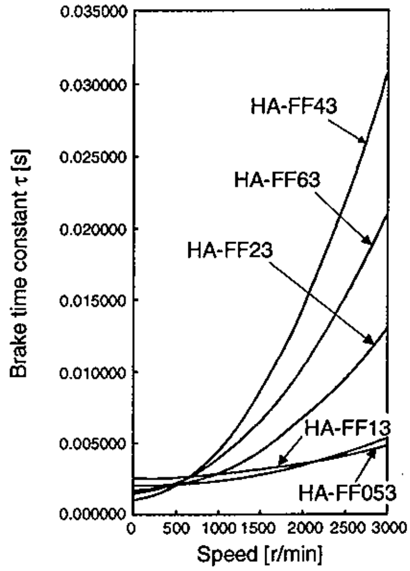


a. HA-LH Series

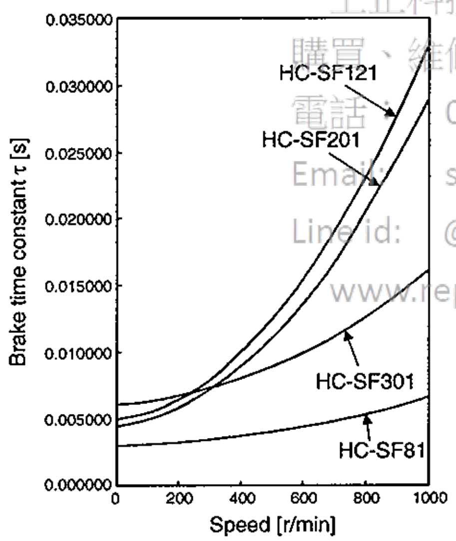
Fig. 14.3 Dynamic Brake Time Constant 1



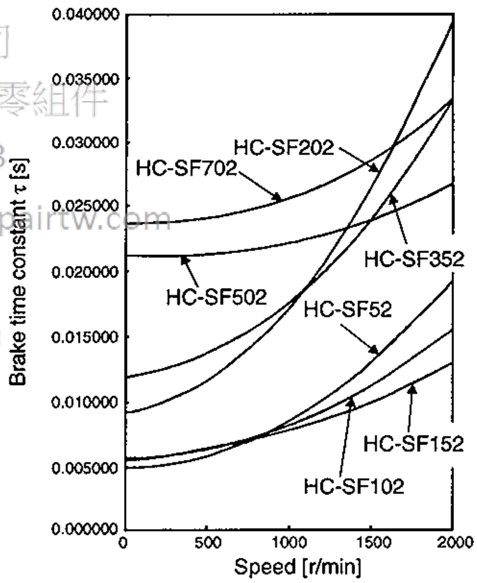
b. HC-MF Series



c. HA-FF Series

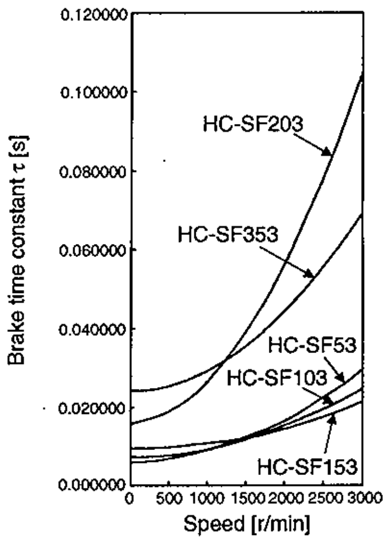


d. HC-SF1000r/min Series

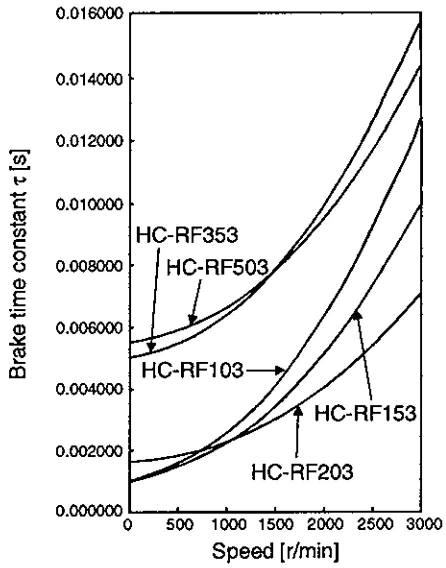


e. HC-SF2000r/min Series

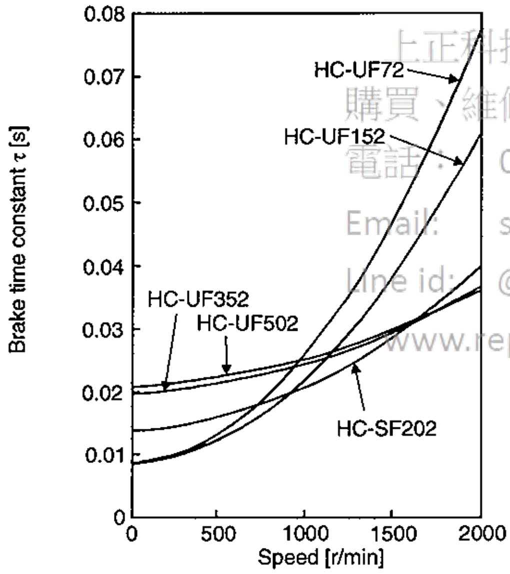
Fig. 14.4 Dynamic Brake Time Constant 2



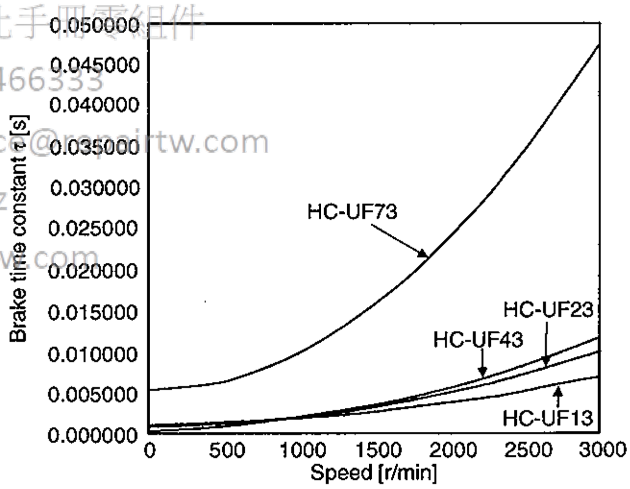
f. HC-SF3000r/min Series



g. HC-RF Series



h. HC-UF2000r/min Series



i. HC-UF3000r/min Series

Fig. 14.5 Dynamic Brake Time Constant 3

[Dynamic brake's permissible load inertia moment]

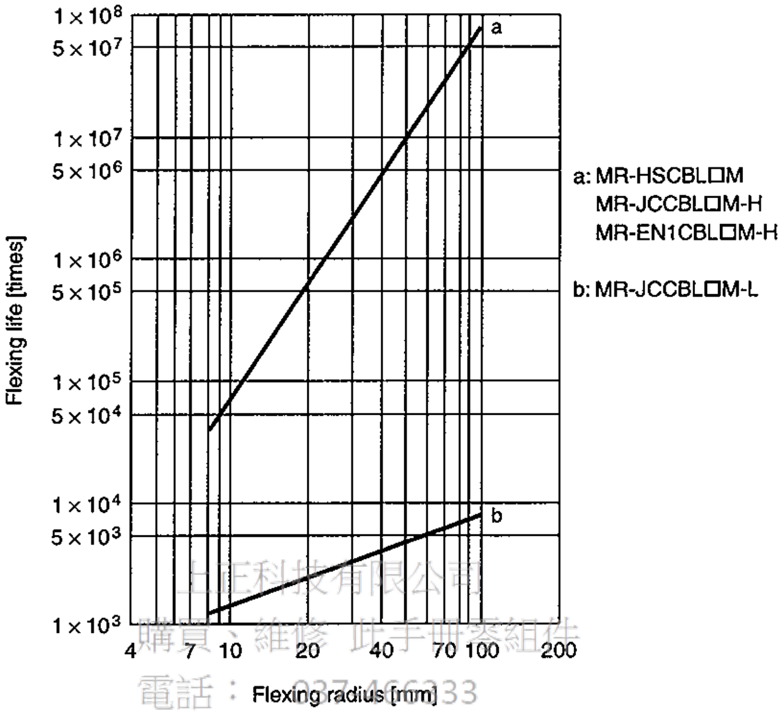
If the dynamic brake is operated at the load inertia moment above the corresponding value indicated in the following list, the brake resistor in the controller (external brake resistor for 11kW or more) may burn out. If the value is exceeded, contact us.

Controller	JL/JM
MR-H10ACN to MR-H100ACN	30 times
MR-H200ACN	20 times
MR-H350ACN to MR-H700ACN	10 times (Note)
MR-H11KACN to MR-H22KACN	30 times

Note: 15 times for the HC-SF series.

14.4 Encoder Cable Flexing Life

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



15. OPTIONS AND AUXILIARY EQUIPMENT

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

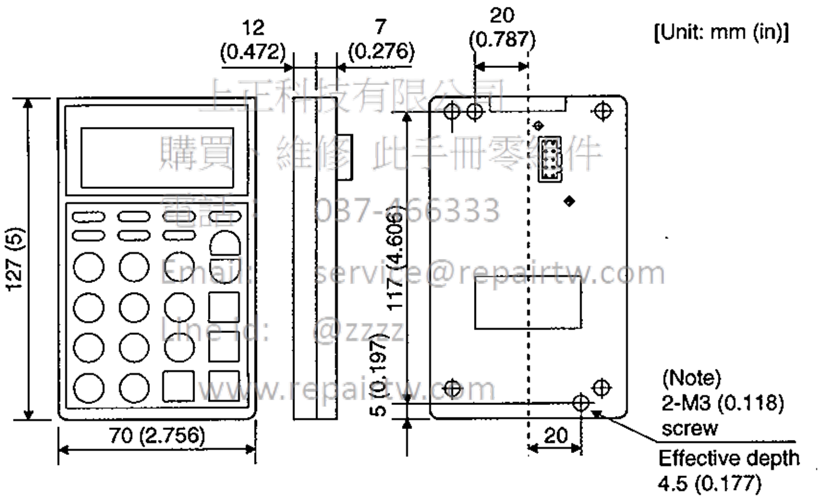
⚠CAUTION	• Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

15.1 Options

15.1.1 Parameter unit

One parameter unit (MR-PRU01A) is required to use the MR-H-ACN. It displays parameter settings, test operation and alarms. Use it with the parameter unit cable (MR-PRUCBL□M).

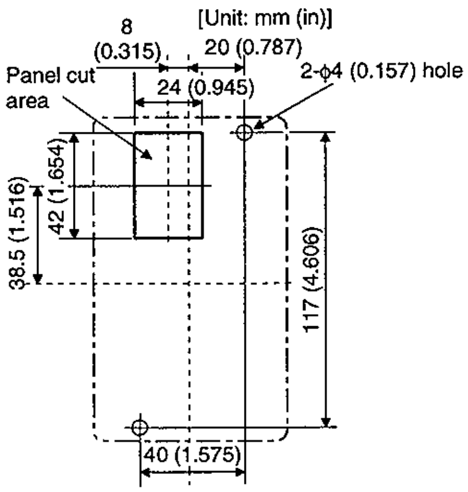
(1) Outline drawing



Note: The length of the mounting screw selected should not exceed the effective depth of the parameter unit mounting screw.

(2) Panel cutting dimensions

The following dimensions assume that the parameter unit is installed on a panel or the like.



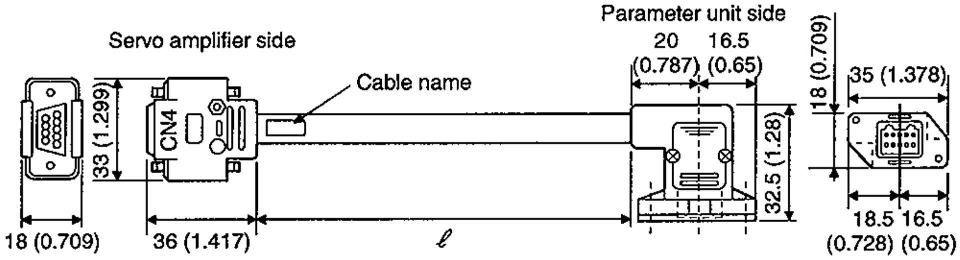
(3) Parameter unit cable

Used for connection of the parameter unit and MR-H-ACN.

Model: MR-PRUCBL□M

Symbol	Cable Length [m (ft)]
1	1 (3.281)
3	3 (9.843)
5	5 (16.404)

[Unit: mm (in)]



15.1.2 Regenerative brake options

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

(1) Combination and regenerative power

The regenerative power values listed below are not the permissible power values of the resistors.

Controller	Regenerative Power [W]					
	Built-in Regenerative Brake Resistor	MR-RB013 [52Ω]	MR-RB033 [52Ω]	MR-RB32 [40Ω]	MR-RB34 [26Ω]	(Note) MR-RB54 [26Ω]
MR-H10ACN	None	10	30			
MR-H20ACN	None	10	30			
MR-H40ACN	50			300		
MR-H60ACN	50			300		
MR-H100ACN	80			300		
MR-H200ACN	80				300	500

Note: Always install a cooling fan.

Controller	Regenerative Power [W]				
	Built-in Regenerative Brake Resistor	MR-RB30 [13Ω]	MR-RB31 [6.7Ω]	MR-RB50 [13Ω]	(Note) MR-RB51 [6.7Ω]
MR-H350ACN	130	300		500	
MR-H500ACN	130	300		500	
MR-H700ACN	170		300		500

Note: Always install a cooling fan.

Controller	Regenerative Power [W]			
	(Note) External Regenerative Brake Resistor (Accessory)	MR-RB65 [8Ω]	MR-RB66 [5Ω]	MR-RB67 [4Ω]
MR-H11KACN	500 (800)	500 (800)		
MR-H15KACN	850 (1300)		850 (1300)	
MR-H22KACN	850 (1300)			850 (1300)

Note: Values in parentheses assume the installation of a cooling fan.

(2) Selection of the regenerative brake option

(a) Simple selection method

In horizontal motion applications, select the regenerative brake option as described below:
When the servo motor is run without load in the regenerative mode from the running speed to a stop, the permissible duty is as indicated in Section 5.1 of the separately available Servo Motor Instruction Manual.For the servo motor with a load, the permissible duty changes according to the inertia moment of the load and can be calculated by the following formula:

$$\text{Permissible duty} = \frac{\text{permissible duty for servo motor with no load (value indicated in Section 5.1 of the Servo Motor Instruction Manual)}}{(m+1)} \times \left(\frac{\text{ratedspeed}}{\text{running speed}}\right)^2 \text{ [times/min]}$$

where m = load inertia moment/servo motor inertia moment

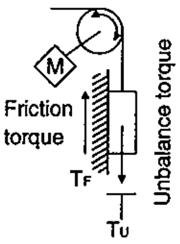
From the permissible duty, find whether the regenerative brake option is required or not.
Permissible duty < number of positioning times [times/min]
Select the regenerative brake option out of the combinations in (1) in this section.

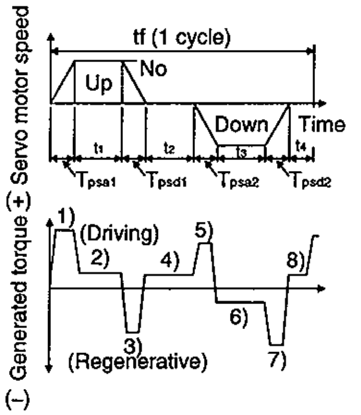
(b) To make selection according to regenerative energy

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)	$T_7 = \frac{(J_L + J_M) \cdot No}{9.55 \times 10^4} \cdot \frac{1}{T_{Psd2}} - T_U + T_F$	$E7 = \frac{0.1047}{2} \cdot No \cdot T_7 \cdot T_{Psd2}$
Sum total of regenerative energies		Sum total of negative energies in 1) to 8)

2) Losses of servo motor and controller in regenerative mode

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

Controller	Inverse Efficiency [%]	Capacitor Charging [J]
MR-H10ACN	55	9
MR-H20ACN	70	9
MR-H40ACN	85	9
MR-H60ACN	85	9
MR-H100ACN	80	15
MR-H200ACN	85	25

Controller	Inverse Efficiency [%]	Capacitor Charging [J]
MR-H350ACN	90	30
MR-H500ACN	90	45
MR-H700ACN	90	70
MR-H11KACN	90	120
MR-H15KACN	90	180
MR-H22KACN	90	250

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

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

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

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

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

$$PR\ [W] = ER/tf \quad \cdots\cdots \quad (13.1)$$

(3) Parameter setting

When using the regenerative brake option, set parameter No.2 according to the regenerative brake option used.

Parameter No. 2

Regenerative brake option selection
- 0: Set 0 when the servo amplifier of less than 11kW capacity has no external option or when the servo amplifier of 11kW or more uses the supplied regenerative brake resistor or regenerative brake option
- 1:FR-RC,FR-BU model brake unit
- 2:MR-RB013
- 3:MR-RB033
- 5:MR-RB32
- 6:MR-RB34
- 7:MR-RB54
- 8:MR-RB30
- 9:MR-RB50
- B:MR-RB31
- C:MR-RB51
- E: When the servo amplifier is 11kW or more and the supplied regenerative brake resistor or regenerative brake option is cooled by a fan to increase its capability

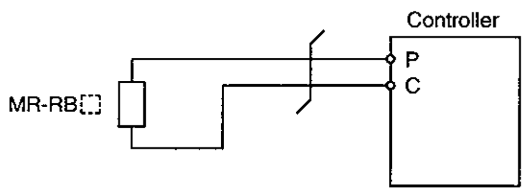
(4) Connection of the regenerative brake option

The regenerative brake option will generate heat of about 100°C. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use fire-retarding cables and keep them clear of the regenerative brake option body.

Always use twisted cables of max. 5m (16.404ft) length for connection with the controller.

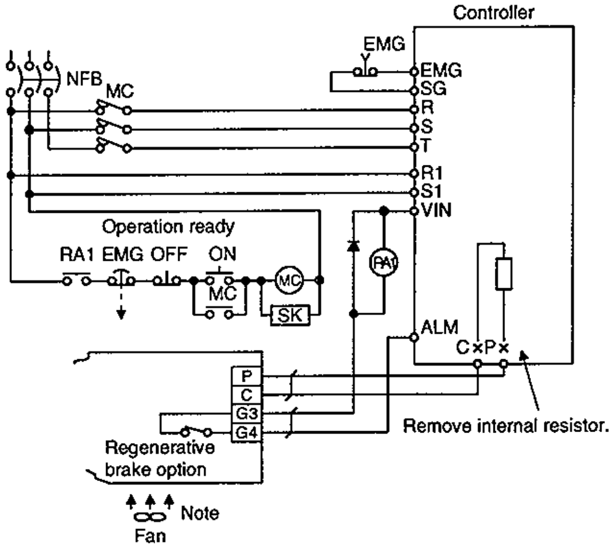
(a) MR-H10ACN · MR-H20ACN

This controller does not have the built-in regenerative brake resistor.



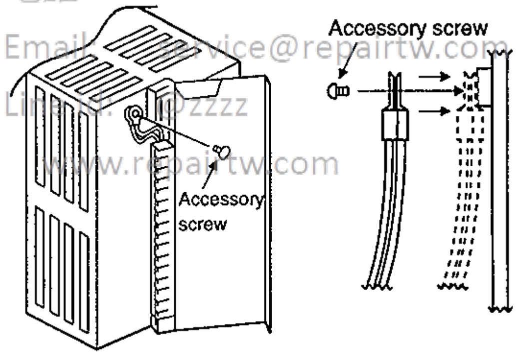
(b) MR-H40ACN to MR-H700ACN

When any of the MR-RB50 to MR-RB54 is used, the regenerative brake option must be forcibly cooled by the cooling fan.

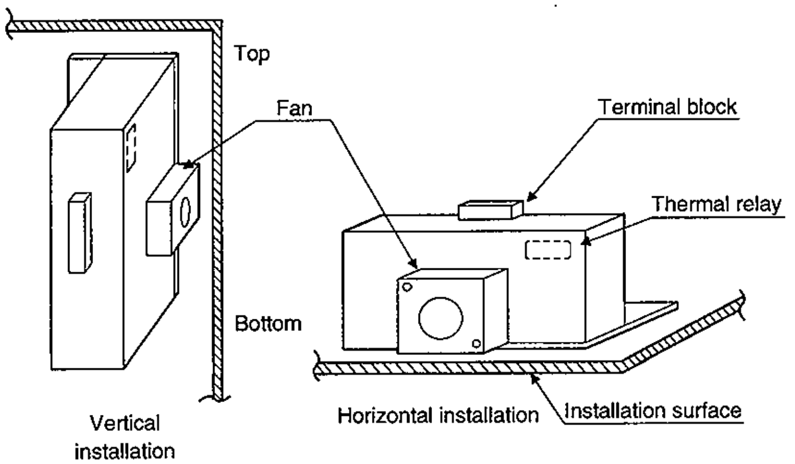


Note: When the MR-RB5□ is used, cool it forcibly by the cooling fan (1.0m²/min, about □92).

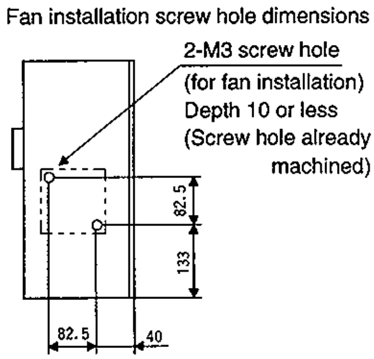
When the regenerative brake option is used, disconnect the cables from the regenerative brake resistor terminals (across C-P) in the controller and fix them to the area provided at the opposite side on the front cover as shown in the figure below.



For the MR-RB50, MR-RB51 or MR-RB54, install the cooling fan as shown.



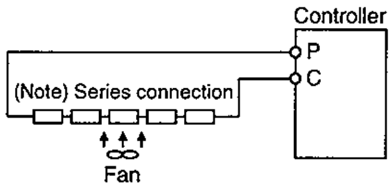
[Unit : mm(in)]



Recommended fan:
Toyo Denki's TL396A or equivalent

(C) MR-H11KACN to MR-H22KACN(when using the supplied regenerative brake resistor)

When using the regenerative brake resistors supplied to the controller, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the controller may become faulty and/or the regenerative brake resistors burn. Install the resistors at intervals of about 70mm. Cool the resistors with fans to increase the regenerative capability.

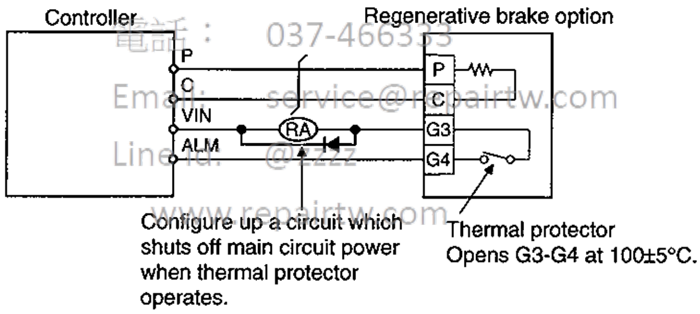


Note: The number of resistors connected in series depends on the resistor type.

Controller	Regenerative Brake Resistor	Regenerative Power (W)		Resistance (Ω)	Number Of Resistors
MR-H11KACN	GRZG400-2Ω	600	800	8	4
MR-H15KACN	GRZG400-1Ω	600	1300	5	5
MR-H22KACN	GRZG400-0.8Ω	600	1300	4	5

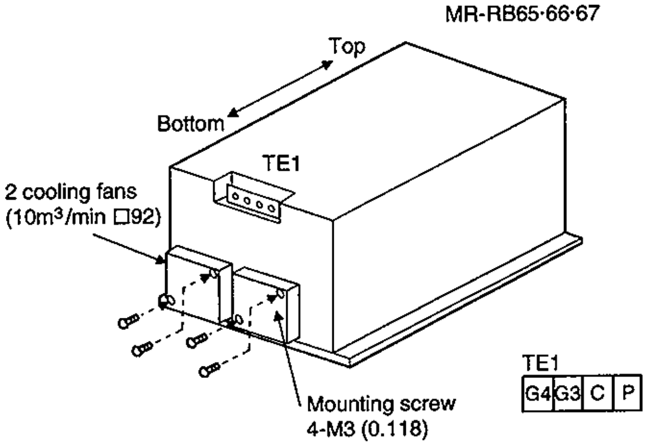
(D) MR-H11KACN-P90 to MR-H22KACN-P90 (when using the regenerative brake option)

Cooling the regenerative brake option with fans improves regenerative capability.



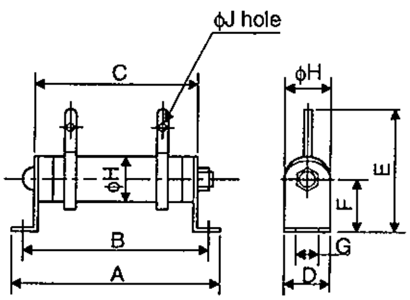
Controller	Regenerative Brake Option Model	Resistor (Ω)	(Note) Regenerative Power	
			Without Fans	With Fans
MR-H11KACN	MR-RB65	8	500	800
MR-H15KACN	MR-RB66	5	850	1300
MR-H22KACN	MR-RB67	4	850	1300

When using fans, install them using the mounting holes provided in the bottom of the regenerative brake option.


MR-RB65·66·67
Top
Bottom
TE1
2 cooling fans
(10m³/min □92)
Mounting screw
4-M3 (0.118)
TE1
G4 G3 C P

(5) Outline dimension drawings

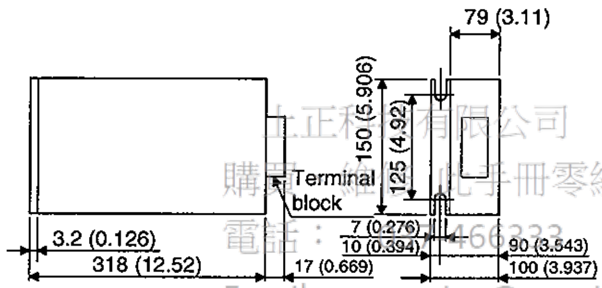
MR-RB013 · MR-RB033



Regenerative Brake Option	Variable Dimensions [mm(in)]									Weight [kg(lb)]
	A	B	C	D	E	F	G	H	J	
MR-RB013	110 (4.331)	101 (3.979)	85 (3.346)	18 (0.709)	35 (1.378)	16 (0.63)	4.5 (0.177)	18 (0.709)	3.2 (0.126)	0.1 (0.22)
MR-RB033	192 (7.559)	173 (6.811)	152 (5.984)	26 (1.024)	54 (2.126)	22 (0.866)	6 (0.236)	26 (1.024)	3.2 (0.126)	0.2 (0.441)

MR-RB30 · MR-RB31 · MR-RB32 · MR-RB34

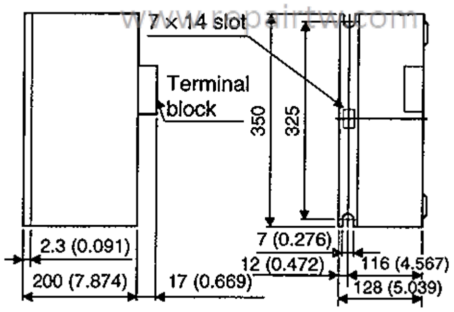
[Unit : mm(in)]



Regenerative Brake Option	Weight [kg(lb)]
MR-RB30	2.9 (6.393)
MR-RB31	
MR-RB32	
MR-RB34	

MR-RB50 · MR-RB51 · MR-RB54

[Unit : mm(in)]

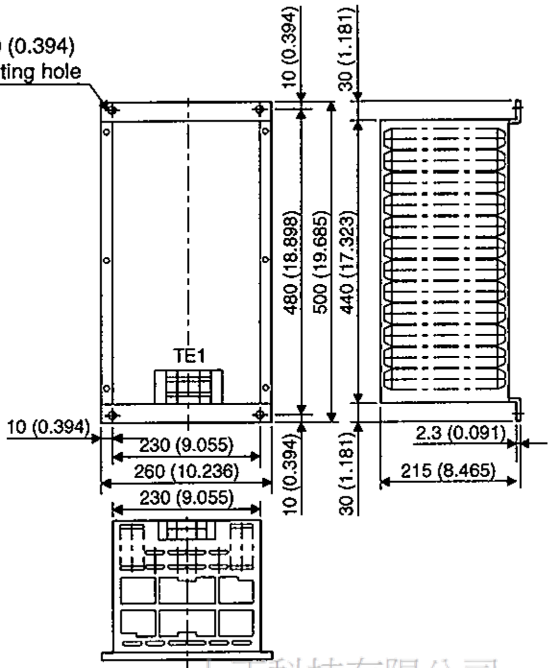


Regenerative Brake Option	Weight [kg(lb)]
MR-RB50	5.6 (12.346)
MR-RB51	
MR-RB54	

MR-RB65 · MR-RB66 · MR-RB67

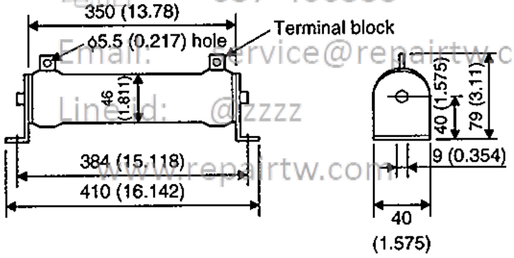
[Unit : mm(in)]

Regenerative Brake Option	Weight [kg(lb)]
MR-RB65	10(22.046)
MR-RB66	11(24.251)
MR-RB67	11(24.251)



GRZG400-2Ω · GRZG400-1Ω · GRZG400-0.8Ω (standard accessories)

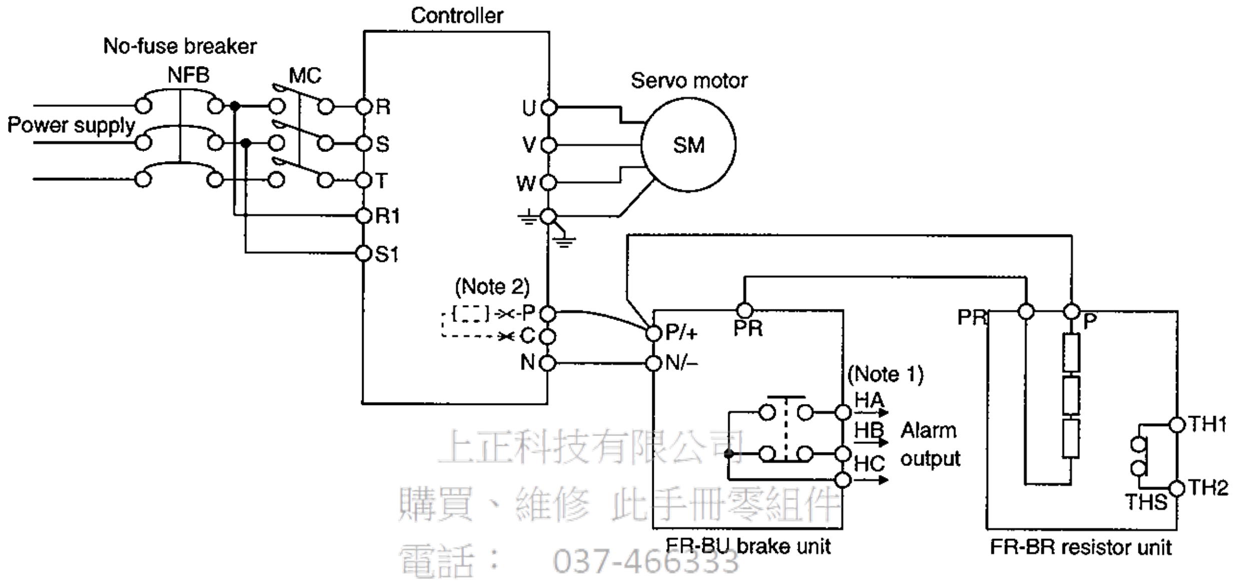
[Unit : mm(in)]



15.1.3 Brake unit

The brake unit is the integration of the regenerative control and resistor and is connected to the bus (across P-N) of the controller. As compared to the MR-RB regenerative brake option, the brake unit can return larger power. Hence, use the this brake unit when the MR-RB cannot provide sufficient regenerative brake capability.

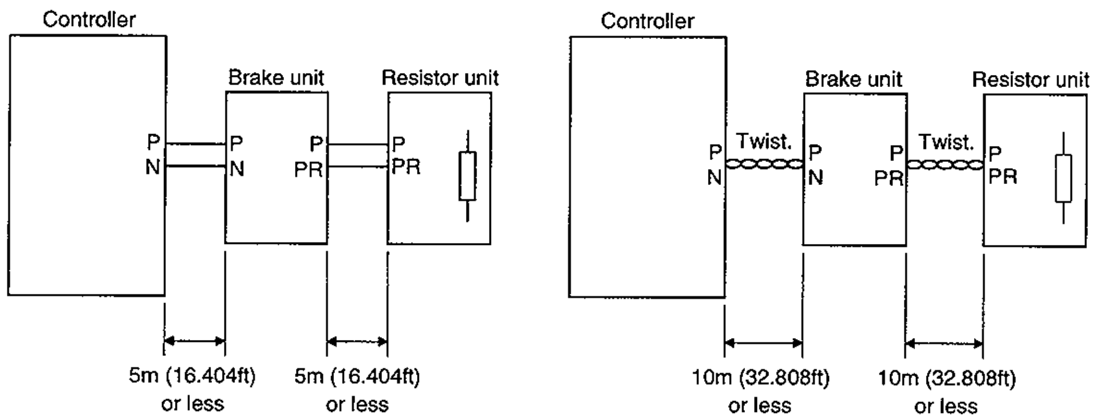
(1) Connection example for use of brake unit



Note: 1. Make up the external sequence to switch the power off when an alarm occurs or when the thermal relay is actuated.
2. The cables of the resistor in the controller across P-C must be disconnected.

The cables between the controller and brake unit and between the resistor unit and brake unit should be as short as possible. The cables longer than 5m should be twisted. (If twisted, the cables must not be longer than 10m.)

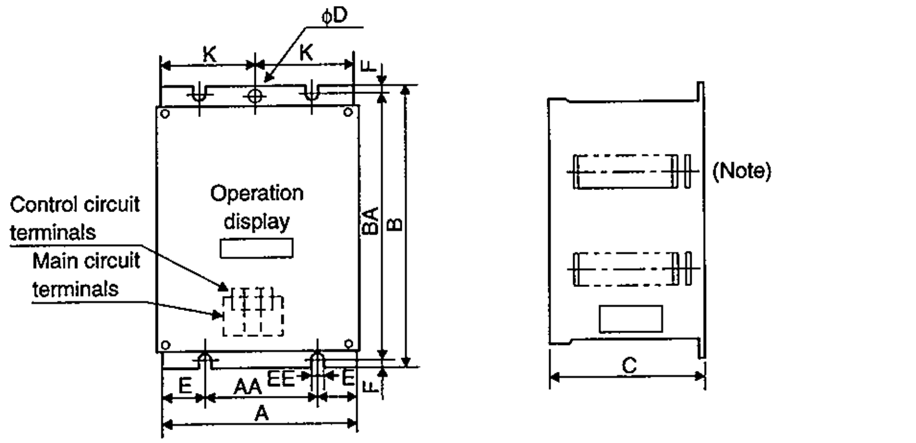
The cable size should be equal to or larger than the recommended size. See the brake unit instruction manual. You cannot connect one set of brake unit to two controllers or two sets of brake units to one controller.



(2) Outside dimensions

・Brake unit (FR-BU)

[Unit : mm(in)]

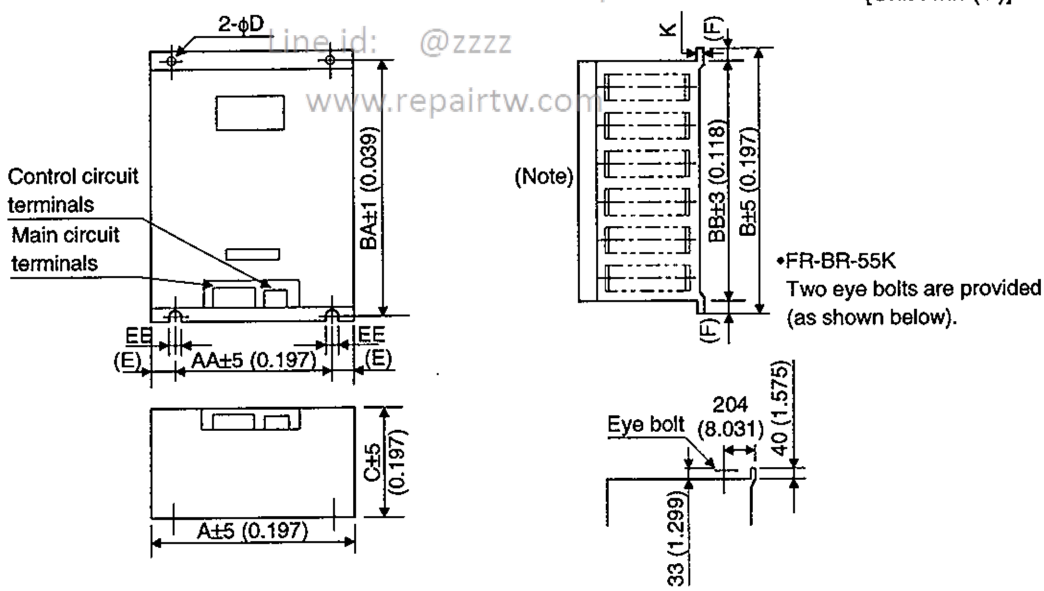


Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

Brake Unit Model	A	AA	B	BA	C	D	E	EE	K	F	Approx. Weight [kg(lb)]
FR-BU-15K	100 (3.937)	60 (2.362)	240 (9.446)	225 (10.039)	128 (5.039)	6 (0.236)	18.5 (0.728)	6 (0.236)	48.5 (1.909)	7.5 (0.295)	2.4 (5.291)
FR-BU-30K	160 (6.299)	90 (3.543)	240 (9.446)	225 (10.039)	128 (5.039)	6 (0.236)	33.5 (1.319)	6 (0.236)	78.5 (3.091)	7.5 (0.295)	3.2 (7.055)
FR-BU-55K	265 (10.433)	145 (5.709)	240 (9.446)	225 (10.039)	128 (5.039)		58.5 (2.303)	6 (0.236)		7.5 (0.295)	5.8 (12.787)

・Resistor unit (FR-BR)

[Unit : mm(in)]



Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

Resistor Unit Model	A	AA	B	BA	BB	C	D	E	EE	K	F	Approx. Weight [kg(lb)]
FR-BR-15K	170 (6.693)	100 (3.937)	450 (17.717)	432 (17.008)	410 (16.142)	220 (8.661)	6 (0.236)	35 (1.378)	6 (0.236)	1.6 (0.063)	20 (0.787)	15 (66.139)
FR-BR-30K	340 (11.389)	270 (10.63)	600 (23.622)	582 (22.913)	560 (22.047)	220 (8.661)	10 (0.394)	35 (1.378)	10 (0.394)	2 (0.079)	20 (0.787)	30 (33.069)
FR-BR-55K	480 (18.898)	410 (16.142)	700 (27.559)	670 (26.378)	620 (24.409)	450 (17.717)	12 (0.472)	35 (1.378)	12 (0.472)	3.2 (0.126)	40 (1.575)	70 (154.323)

POINT

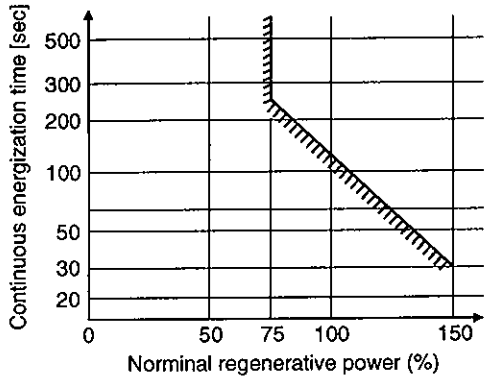
- The brake unit and resistor unit of other than 200V class are not applicable to the controller.
- The brake unit and resistor unit of the same capacity must be combined. The units of different capacities may result in damage.
- The brake unit and resistor unit must be installed on a vertical surface in the vertical direction. If they are installed in the horizontal direction or on a horizontal surface, a heat dissipation effect reduces.
- The temperature of the resistor unit casing rises to higher than 100°C. Do not cause cables and combustibles to make contact with the casing.

15.1.4 Power return converter

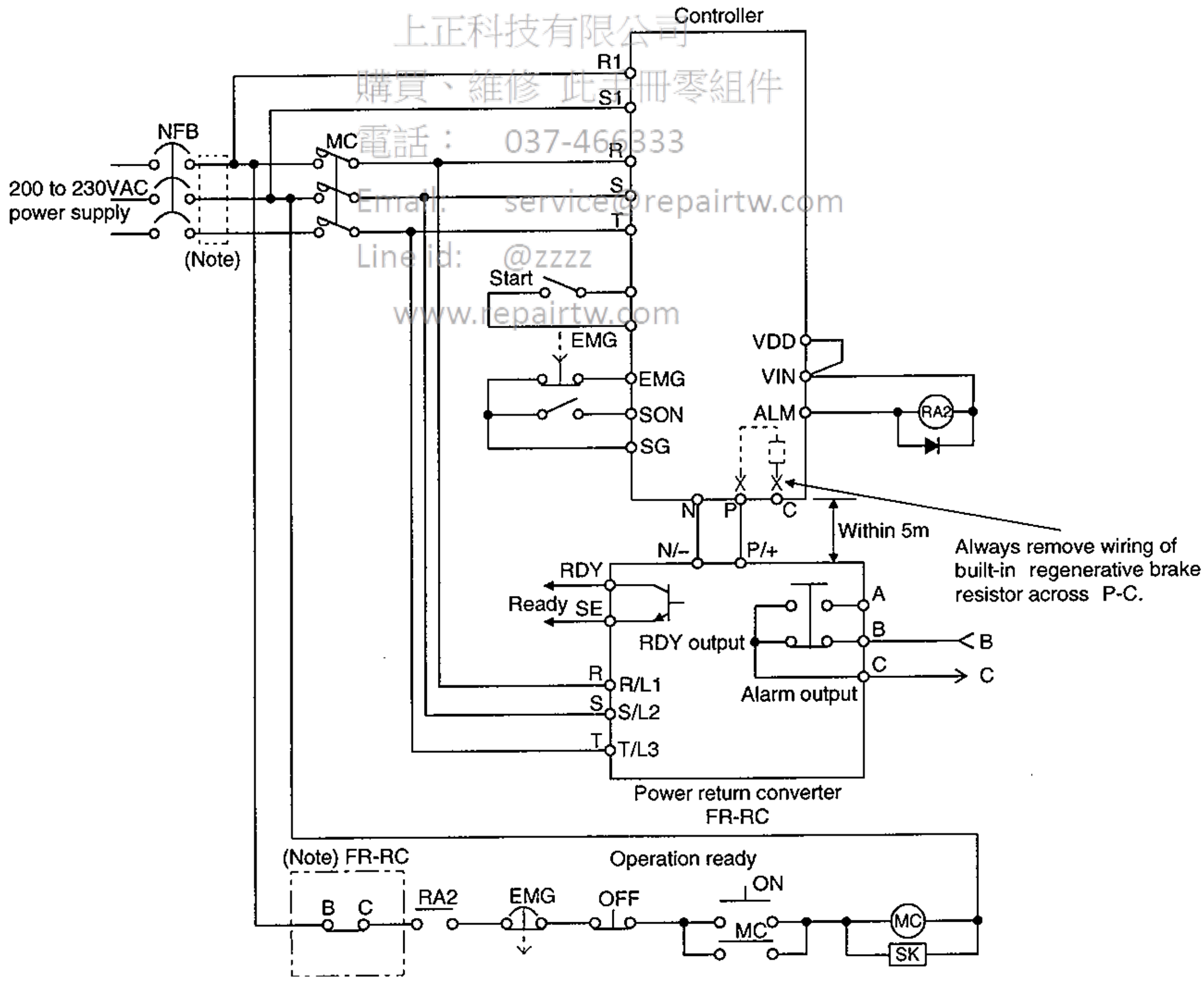
(1) Selection

The characteristics in the figure are common to all units of the FR-RC. The converters can continuously return 75% of the nominal regenerative power. They are applied to the controllers of the MR-H350ACN or more.

Model	Nominal Regenerative Power (kW)	Controller
FR-RC15	15	MR-H350ACN to MR-H700ACN
FR-RC30	30	MR-H11KACN MR-H15KACN
FR-RC55	55	MR-H22KACN



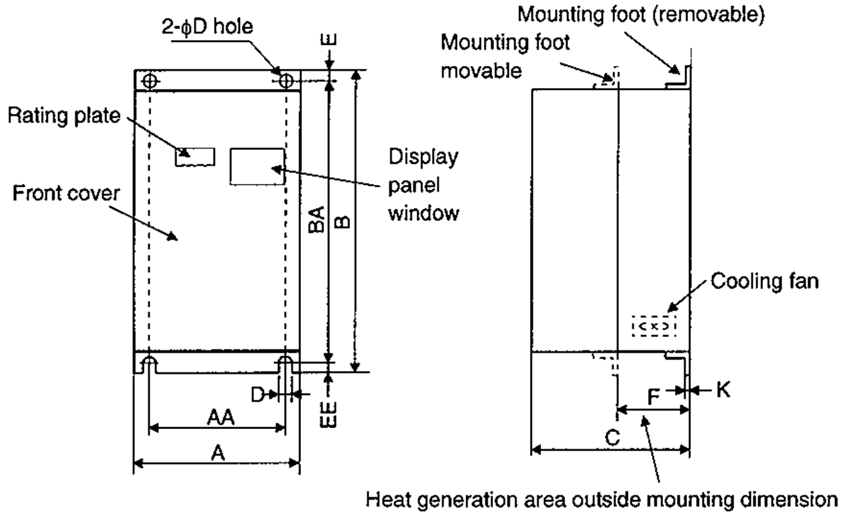
(2) Connection example



Note: To improve the input power factor or when connecting two or more FR-RC's to the same power transformer, install the power factor improving reactor (FR-BAL) in the dotted area.

(3) Outside dimensions of the power return converters

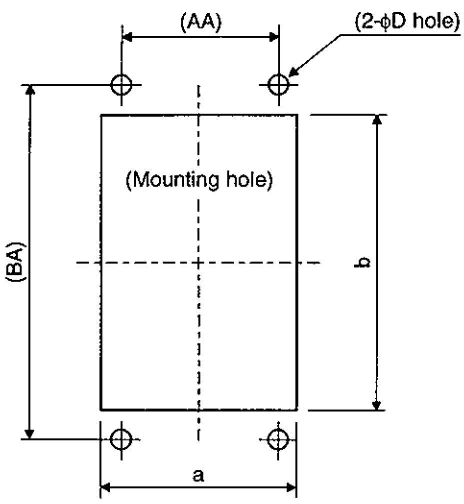
[Unit : mm(in)]



Model	A	AA	B	BA	C	D	E	EE	K	F	Approx. Weight [kg(lb)]
FR-RC-15K	270 (10.630)	200 (7.874)	450 (17.717)	432 (17.008)	195 (7.677)	10 (0.394)	10 (0.394)	8 (0.315)	3.2 (0.126)	87 (3.425)	19 (41.888)
FR-RC-30K	340 (13.386)	270 (10.630)	600 (23.622)	582 (22.913)	195 (7.677)	10 (0.394)	10 (0.394)	8 (0.315)	3.2 (0.126)	90 (3.543)	31 (68.343)
FR-RC-55K	480 (18.898)	410 (16.142)	700 (27.559)	670 (26.378)	250 (9.843)	12 (0.472)	15 (0.591)	15 (0.591)	3.2 (0.126)	135 (5.315)	55 (121.254)

(4) Mounting hole machining dimensions

When the power return converter is fitted to a totally enclosed type box, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole having the following dimensions is machined in the box.



[Unit : mm(in)]

Model	A	B	D
FR-RC-15K	260 (10.236)	412 (16.220)	10 (0.394)
FR-RC-30K	330 (12.992)	562 (22.126)	10 (0.394)
FR-RC-55K	470 (18.504)	662 (26.063)	12 (0.472)

15.1.5 External dynamic brake

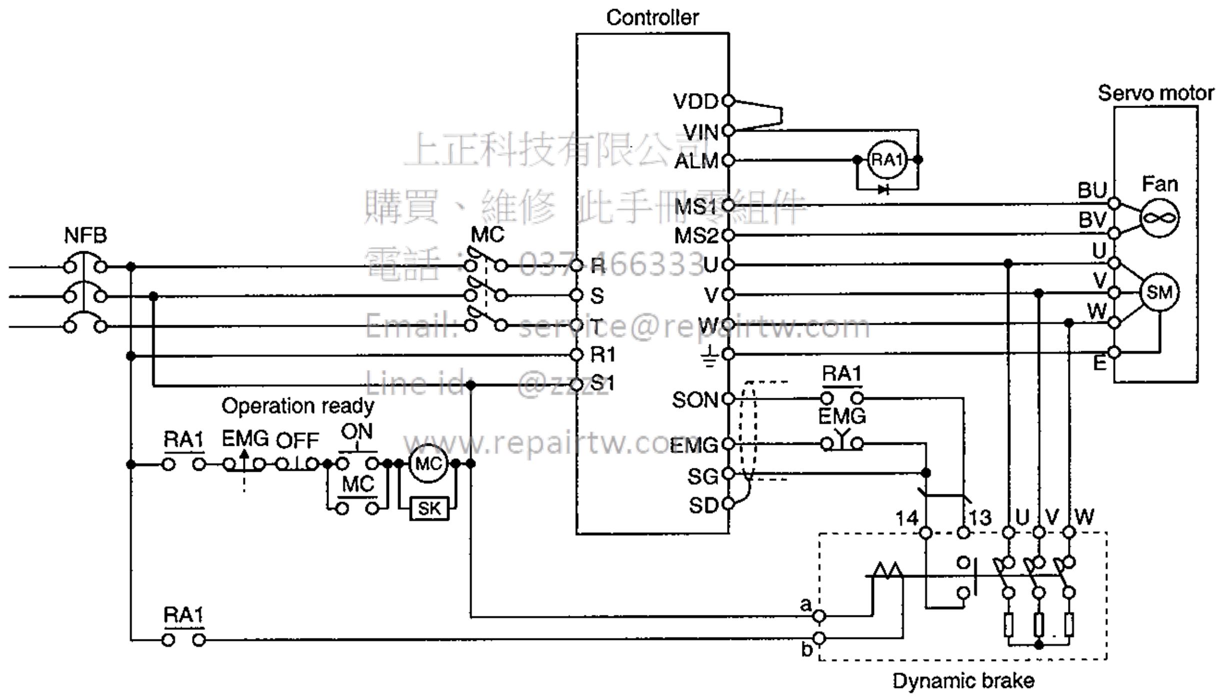
(1) Selection of dynamic brake

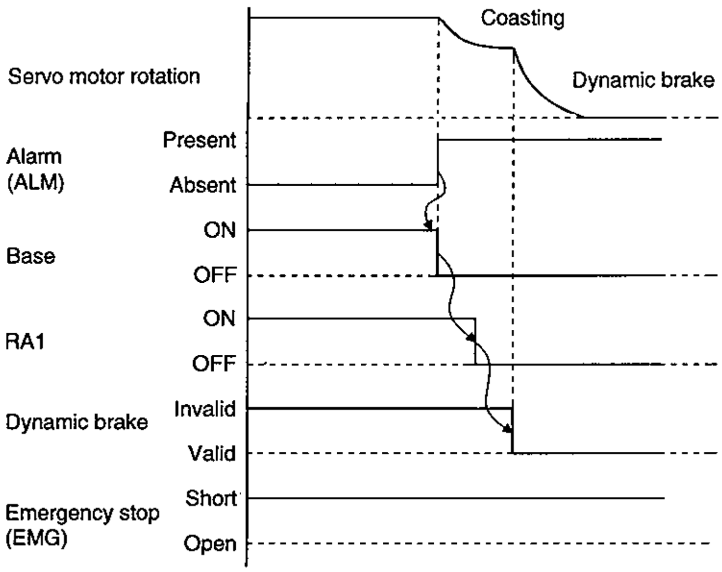
The dynamic brake is designed to bring the motor to a sudden stop when a power failure occurs or the protective circuit is activated. This brake is contained in the controller of 7kW or less but is not included in the controller of 11kW or more. When this brake is required, refer to the following table and place a purchase order Set □1□□ in parameter No.3.

Note that when the inertia moment of the load is large, the built-in brake in the controller of 7kWor less may be used. (Refer to Section 14.3)

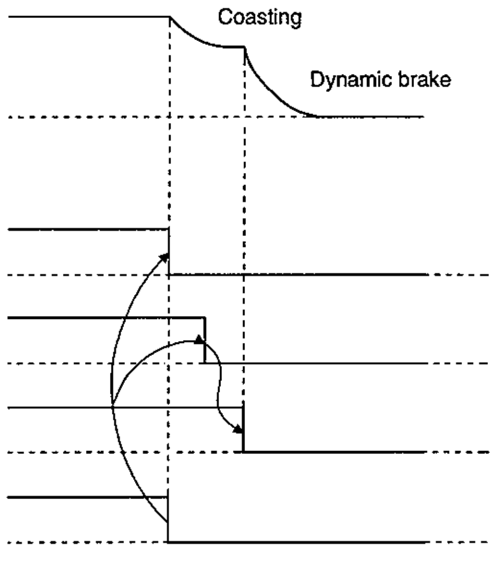
Controller	Dynamic Brake
MR-H11KACN	DBU-11K
MR-H15KACN	DBU-15K
MR-H22KACN	DBU-22K

(2) Connection example





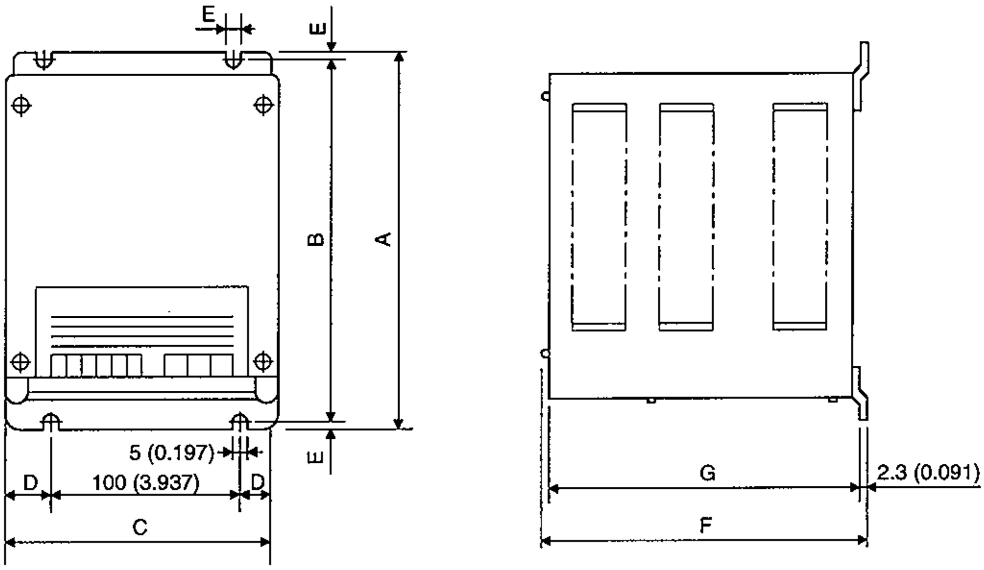
a. Timing chart at alarm (ALM) occurrence



b. Timing chart at emergency stop (EMG) validity

(3) Outline dimension drawing

[Unit: mm (in)]



Terminal block

E (GND)		a	b	13	14

Screw: M3.5

U	V	W

Screw: M4

Model	A	B	C	D	E	F	G	Approx. Weight [kg(lb)]	Connection Wire[mm^2]
DBU-11K	200 (7.874)	290 (11.417)	140 (5.512)	20 (0.787)	5 (0.197)	170 (6.693)	163.5 (6.437)	2 (4.409)	5.5 (AWG10)
DBU-15K DBU-22K	250 (9.843)	238 (9.370)	150 (5.906)	25 (0.984)	6 (0.236)	235 (9.252)	228 (8.976)	6 (13.228)	5.5 (AWG10)

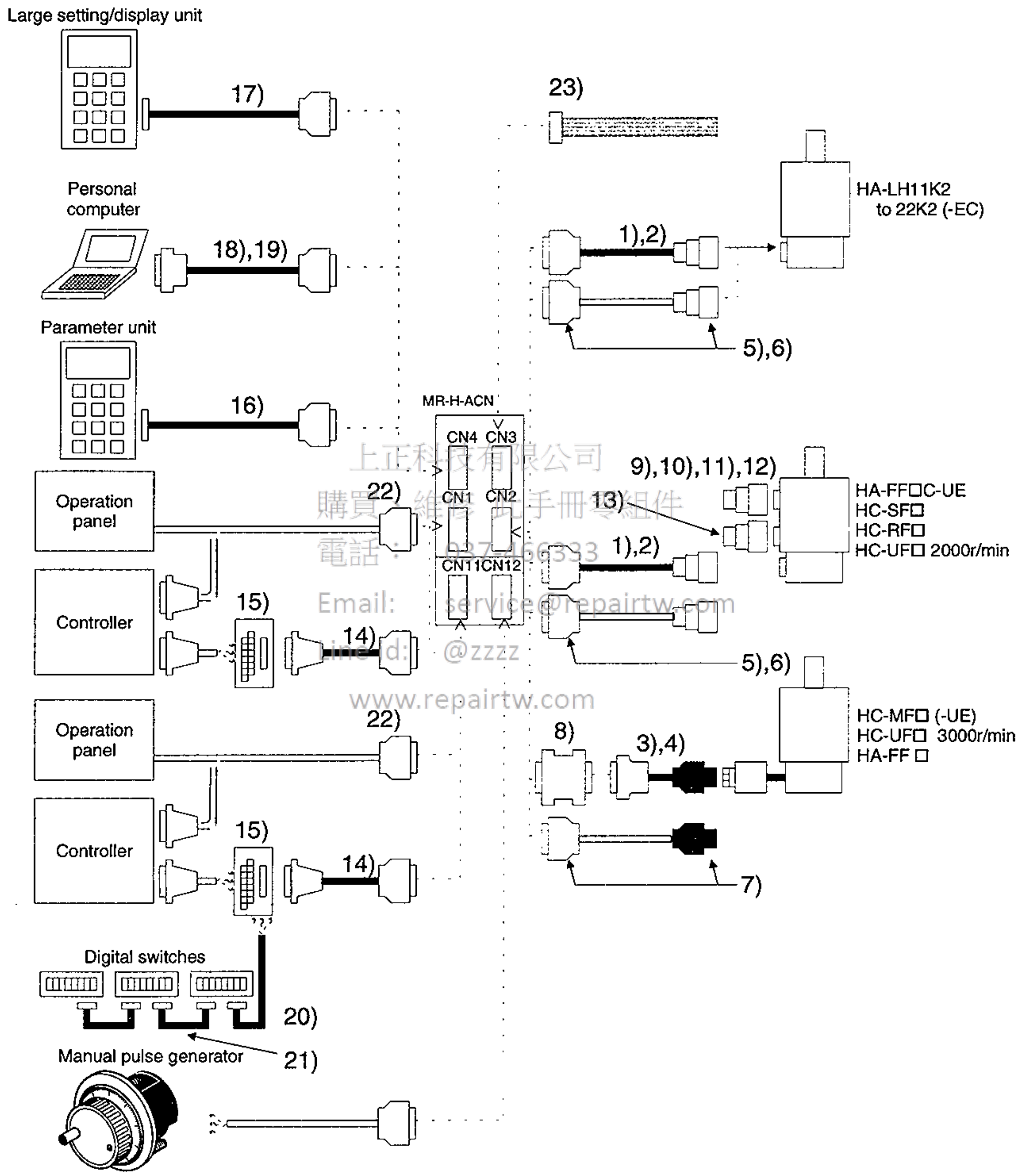
POINT

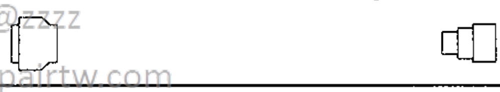
- Configure up a sequence which switches off the contact of the brake unit after (or as soon as) it has turned off the servo on signal at a power failure or failure.
- For the braking time taken when the dynamic brake is operated, refer to Section 14.3.
- The brake unit is rated for a short duration. Do not use it for high duty.

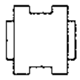
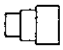
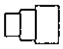
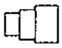
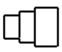
15.1.6 Cables and connectors

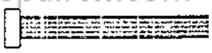
(1) Cable make-up

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



No.	Product Name	Model	Description		Application
1)	Encoder cable	MR-HSCBL□M Refer to (2) in this section.	Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 	Encoder side connector (Japan Aviation Electronics Industry make) Plug: MS3106B20-29S Cable clamp: MS-3057-12A	Long flexing life
2)	Encoder cable	MR-EN1CBL□M-H Refer to (2) in this section.	Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 	Encoder side connector (DDK make) Plug: MS3106A20-29S(D190) Cable clamp: CE3057-12A-3(D265) Back shell: CE02-20BS-S	Long flexing life IP65 compliant
3)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) in this section.	Controller side connector (3M make or equivalent) Connector: 10120-3000VE Shell kit: 10320-52F0-008	Encoder side connector (3M make or equivalent) Housing: 1-172161-9 Connector pin: 170359-1	Standard flexing life
4)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) in this section.			Long flexing life
5)	Encoder connector set	MR-JSCNS	Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 	Encoder side connector (Japan Aviation Electronics Industry make) Plug: MS3106B20-29S Cable clamp: MS3057-12A	
6)	Encoder connector set	MR-EN1CNS	Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 	Encoder side connector Plug: MS3106A20-29S(D190) Cable clamp: CE3057-12A-3(D265) Back shell: CE02-20BS-S	
7)	Encoder connector set	MR-HCNM	Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 	Encoder side connector (3M make or equivalent) Housing: 1-172161-9 Pin: 170359-1 Cable clamp: MTI-0002 (Toa Denki Kogyo make)	

No.	Product Name	Model	Description	Application
8)	Conversion connector	MR-HCN2	Controller side  Encoder cable side	
9)	Power connector set	MR-PWCNF	 Plug: CE05-6A14S-2SD-B (Daiichi Denshi Kogyo make) Cable connector: YS014-9 to 11 (Daiwa Dengyo make)	IP65 compliant Must be used for compliance with the EN Standard.
10)	Power connector set	MR-PWCNS1	 Daiichi Denshi Kogyo make Plug: CE05-6A22-23SD-B-BSS Cable clamp: CE3057-12A-2(D265)	
11)	Power connector set	MR-PWCNS2	 Daiichi Denshi Kogyo make Plug: CE05-6A22-10SD-B-BSS Cable clamp: CE3057-16A-2(D265)	
12)	Power connector set	MR-PWCNS3	 Daiichi Denshi Kogyo make Plug: CE05-6A32-17SD-B-BSS Cable clamp: CE3057-20A-1(D265)	
13)	Brake connector set	MR-BKCN	 Plug: MS3106A10SL-4S(D190) (Daiichi Denshi Kogyo make) Cable connector: YS010-5 to 8 (Daiwa Dengyo make)	
14)	Junction terminal block cable	MR-HTBL□M Refer to Section 15.1.7.	Junction terminal block side connector (Izumi Denki make) Connector: JE1S-501 / Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S50FS Cable: PCR-LS50LA 	
15)	Junction terminal block	MR-TB50	Refer to Section 15.1.7.	
16)	Parameter unit cable	MR-PRUCBL□M Refer to Section 15.1.1.		
17)	Large setting /display unit cable	MR-PRUBCBL□M Refer to Section 15.1.10.	Controller side connector (Japan Aviation Electronics Industry make) Connector: DE-9PF-N Case: DE-C1-J6-S6 / MR-PRU02 side connector (Japan Aviation Electronics Industry make) Connector: DE-9PF-N Case: DE-C1-J6-S6 	

No.	Product Name	Model	Description	Application
18)	Communication cable	MR-HPC98CBL3M Refer to (3) in this section.	Controller side connector (Japan Aviation Electronics Industry make) Connector: DE-9PF-N Case: DE-C1-J6-S6 Personal computer side connector (Japan Aviation Electronics Industry make) Connector: DE-25PF-N Case: DB-C2-J9 	For connection with PC-98 personal computer
19)	Communication cable	MR-HPCATCBL3M Refer to (3) in this section.	Controller side connector (Japan Aviation Electronics Industry make) Connector: DE-9PF-N Case: DE-C1-J6-S6 Personal computer side connector (Japan Aviation Electronics Industry make) Connector: DE-9SF-N Case: DE-C1-J6-S6 	For connection with PC-AT-compatible personal computer
20)	Digital switch cable	MR-DSCBL□M-G		
21)	Digital switch cable	MR-DSCBL□M		
22)	Connector set	MR-HCN1	 Controller side connector (Honda Tsushin Kogyo make) Connector: PCR-S50FS Cable: PCR-LS50LA	
23)	CN3 cable	MR-H3CBL1M	 Controller side connector (AMP make) Housing: 171822-4	

(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-proof.
- Refer to Section 14.4 for the flexing life of the encoder cables.

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

(a) Selection

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

Servo Motor Model	Standard Encoder Cable				Connector Set	
	(Note 1) Model	Use For EN/UL Standard	Long Flexing Life	IP65 Compliance	Model	IP65 Compliance
HA-LH HA-LH-EC HA-FF□C-UE (Note 2) HC-SF HC-RF HC-UF2000r/min	MR-HSCBL□M	○	○		MR-JSCNS	
	MR-EN1CBL□M-H	○	○	○	MR-EN1CNS	○
HC-MF HC-MF-UE HA-FF HC-UF3000r/min	MR-JCCBL□M-L	○			MR-J2CNM MR-HCNM	
	MR-JCCBL□M-H	○	○			

Note: 1 □ indicates the cable length: 2, 5, 10, 20, 30, 40, 50 (m).

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

3 Not oil-proof.

(b) MR-HSCBL□M (long flexing life product)

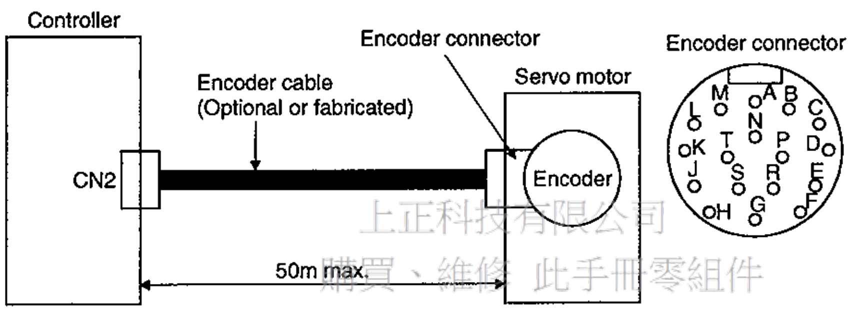
1) Explanation of model name

Model: MR-HSCBL□M

Symbol	Cable Length [m]
2	2
5	5
10	10
20	20
30	30
40	40
50	50

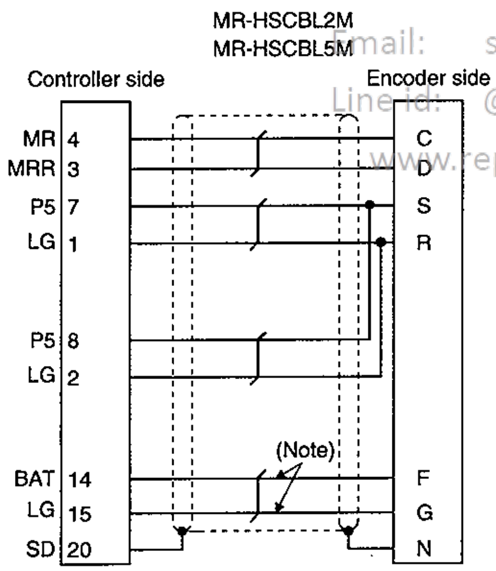
2) Connection diagram

Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.

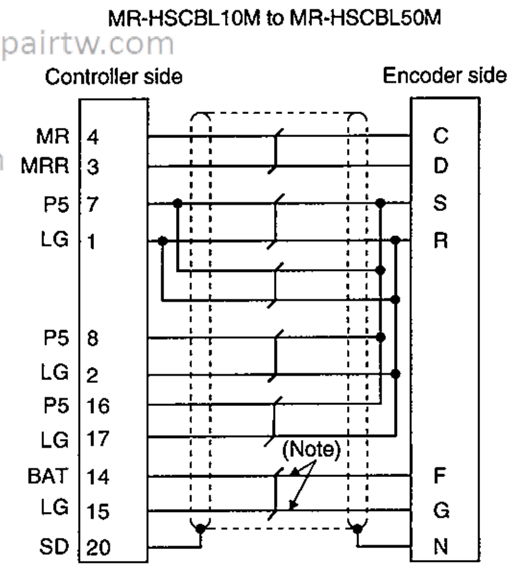


Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

Pin	Signal
K	
L	
M	CNT
N	SHD
P	
R	LG
S	P5
T	



(10m or less)



(10m to 50m)

Note: This wiring is required for use in the absolute position detection system.
This wiring is not needed for use in the incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 15.2.1 and the MR-JSCNS connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m length including the length of the encoder cable supplied to the servo motor.

(c) MR-EN1CBL□M-H (long flexing life product)

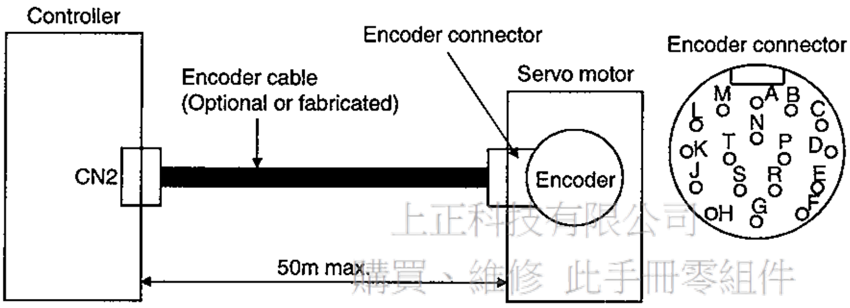
1) Explanation of model name

Model: MR-EN1CBL□M-H

Symbol	Cable Length [m]
2	2
5	5
10	10
20	20
30	30
40	40
50	50

2) Connection diagram

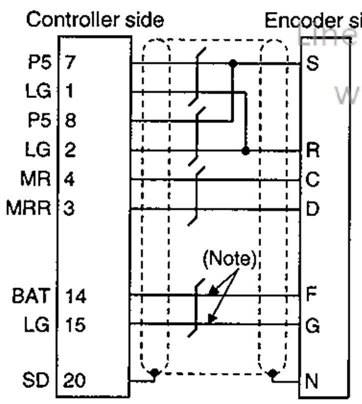
Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.



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

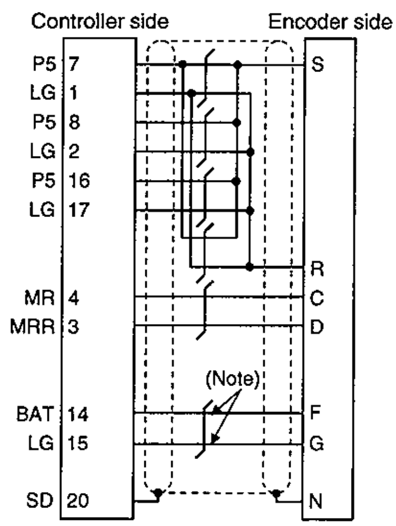
Pin	Signal
K	
L	
M	CNT
N	SHD
P	
R	LG
S	P5
T	

MR-EN1CBL2M-H
MR-EN1CBL5M-H



AWG24 used
(less than 10m)

MR-EN1CBL10M-H to MR-EN1CBL50M-H



AWG24 used
(10m to 50m)

Note: This wiring is required for use in the absolute position detection system.
This wiring is not needed for use in the incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 15.2.1 and the MR-ENICNS connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m length including the length of the encoder cable supplied to the servo motor.

(d) MR-JCCBL□M-L · MR-JCCBL□M-H

1) Explanation of model name

Model: MR-JCCBL□M-□

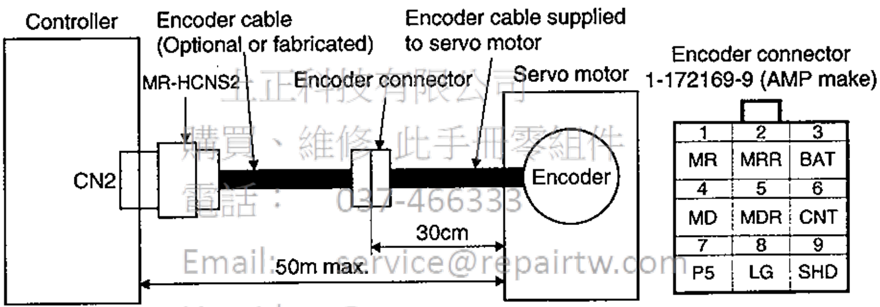
Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	(Note) Cable Length [m]
2	2
5	5
10	10
20	20
30	30
40	40
50	50

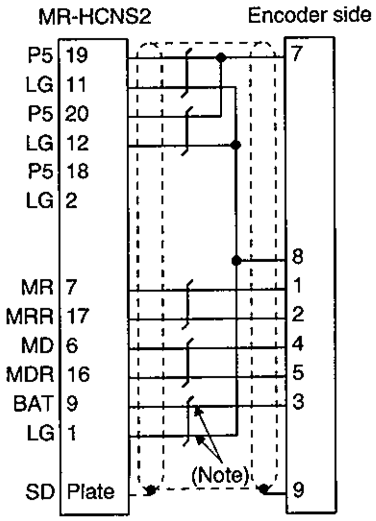
Note: MR-JCCBL□M-H has no 40 and 50m sizes.

2) Connection diagram

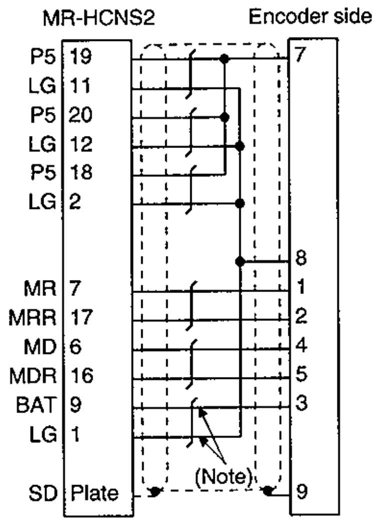
Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.



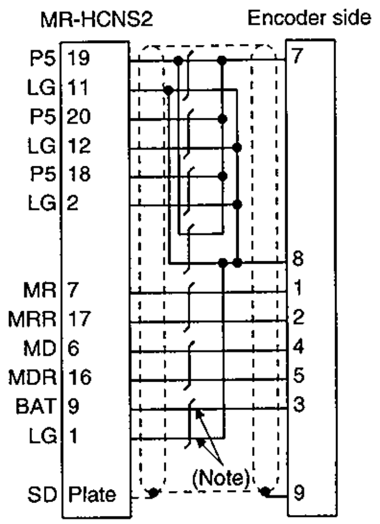
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L to MR-JCCBL30M-L



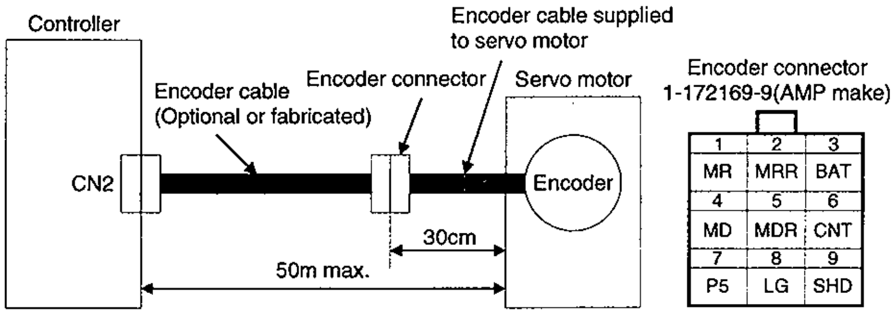
MR-JCCBL10M-H to MR-JCCBL50M-H

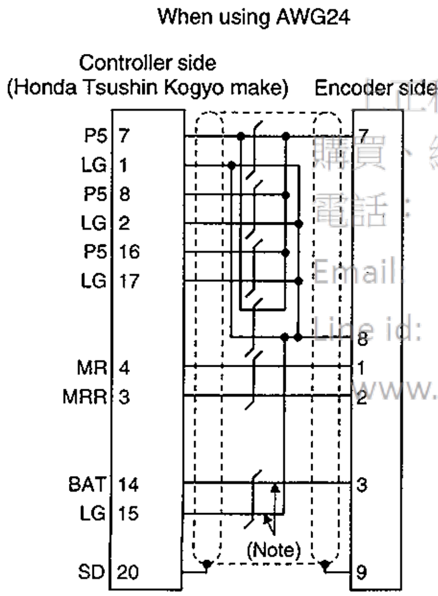


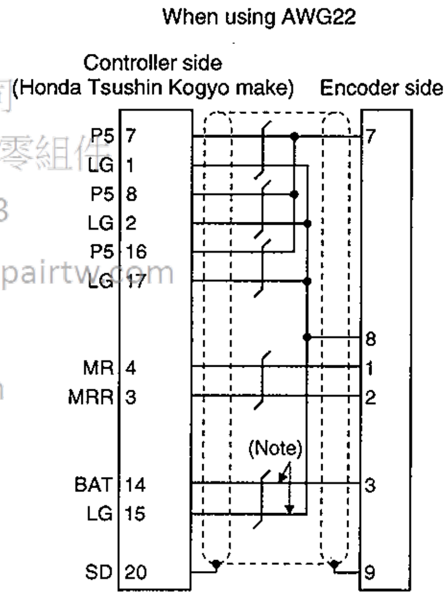
Note: This wiring is required for use in the absolute position detection system.
This wiring is not needed for use in the incremental system.

(e) When using MR-HCNM

Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment. Use the recommended wires given in Section 15.2.1 and fabricate the encoder cable in accordance with the connection diagram shown below. In this connection, an up to 50m long encoder cable including the encoder cable supplied to the servo motor can be fabricated.







Note: This wiring is required for use in the absolute position detection system.
This wiring is not needed for use in the incremental system.

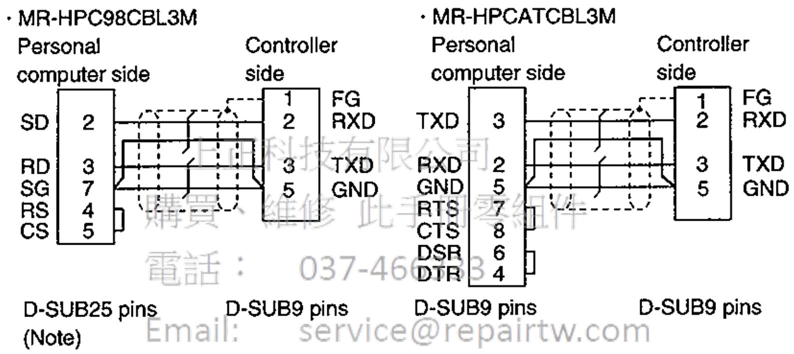
(3) Communication cable

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.

Select the communication cable according to the shape of the RS-232C connector of the personal computer used. When fabricating the cable, refer to the connection diagram in this section.
The following must be observed in fabrication:

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

Connection diagram

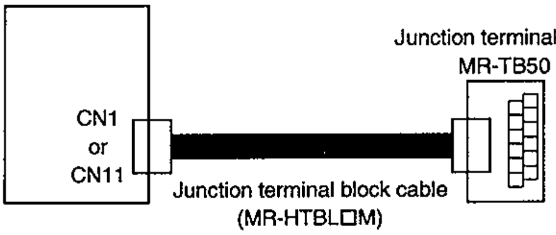


Note: The PC98 Notes having the connector of half-pitch 14 pins are also available.
Confirm the shape of the RS-232C connector of the personal computer used.

15.1.7 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-HTBL□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 (3), Section 15.2.6

(2) Terminal block labels

Use the following labels among the terminal block labels attached to the junction terminal block.

(a) For CN1

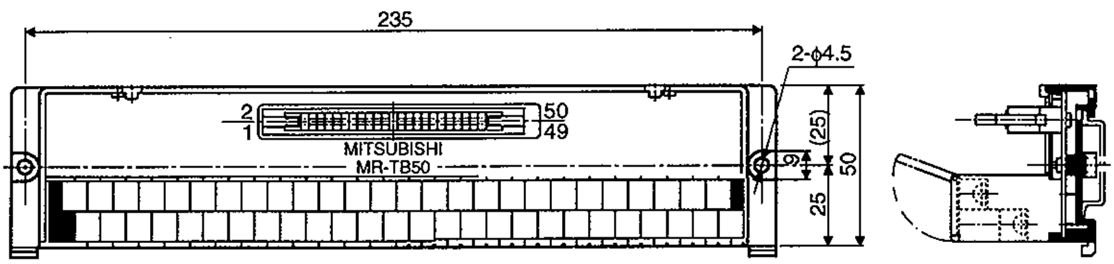
VDD	CR	PPO	NPO	SG	SG	JFS	LSP	DEC	PF	ALM	DI0	DI2	ST2	P15R	LA	LB	LZ	FPA	PPB	N15R	LG			
RD	SG	SG	VDD	VIN	SON	STP	LSN	CPO	ZP	EMG	DI1	ST1	LG	OP	LAR	LBR	LZR	LG	LG	OVR	TLAP			SD

(b) For CN11

	DI 9	DI 18	DI 19	SG	SG	DI 4	DI 10	DI 3	DO 12	DO 14	DI 12	DI 14	DI 16		DO 0	DO 2	DO 4	DO 8	DO 9		DI 21	DO 7	DI 1	DI 8
DO 15	SG	SG	VDD	VIN	DI 2	DI 5	DI 11	DO 11	DO 13	DI 17	DI 13	DI 15	DI 6	DO 10	DO 1	DO 3	DO 5	DI 22	DI 23	DI 20	DO 6	DI 0	DI 7	SD

(3) Outline drawing

[Unit: mm]



Terminal screw: M3.5
Applicable wire: 2mm²
Crimping terminal width: 7.2mm max.

(4) Junction terminal block cable (MR-HTBL□M)

(a) Explanation of model name

Model: MR-HTBL□M

Symbol	Cable Length [m]
05	0.5
1	1

(b) Connection diagram

PCR-S50FS (controller side) — JEIS-501 (junction terminal side)

Signal Name For CN11	Signal Name For CN1	Pin No. (PCR-S50FS)	Pin No. (JEIS-501)
	VDD	22	1
DO15	RD	49	2
DI09	CR	37	3
SG	SG	17	4
DI18	PPO	18	5
SG	SG	47	6
DI19	NPO	19	7
VDD	VDD	21	8
SG	SG	16	9
VIND	VIN	20	10
SG	SG	40	11
DI02	SON	12	12
DI04	JFS	14	13
DI05	STP	15	14
DI10	LSP	38	15
DI11	LSN	39	16
DI03	DEC	13	17
		Empty	Empty
DO11	CPO	23	18
		Empty	Empty
DO12	PF	24	19
		Empty	Empty
DO13	ZP	25	20
		Empty	Empty
DO14	ALM	48	21
		Empty	Empty
OD17	EMG	46	22
		Empty	Empty
DI12	DI0	41	23
DO12	DI1	42	24
DI14	DI2	43	25
DI15	ST1	44	26
DI16	ST2	45	27
		Empty	Empty
DI06	LG	34	28
	P15R	1	29
DO10	OP	33	30
DO00	LA	4	31
DO01	LAR	5	32
DO02	LB	6	33
DO03	LBR	7	34
DO04	LZ	8	35
DO05	LZR	9	36
DO08	FPA	31	37
DI22	LG	28	38
DO09	FPB	32	39
DI23	LG	30	40
	N15R	26	41
DI20	OVR	2	42
DI21	LG	3	43
DO06	TLAP	27	44
DO07		29	45
DI00		10	46
DI01		11	47
DI07		35	48
DI08		36	49
SD	SD	50	50

15.1.8 Servo Configuration Software

The Servo Configuration software uses the communication function of the controller 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	19200bps, 9600bps
Monitor	Batch display, high-speed display, graph display
Alarm	Alarm display, alarm history, data display at alarm occurrence
Diagnostic	External I/O signal display, function device display, cumulative power-on time display, software number display, tuning data display, ABS data display
Parameters	Data setting, list display, change list display, detailed information display
Test operation	Jog operation, positioning operation, motor-less operation, output signal forced output 1 step feed operation
Point data	Position block, speed block
File operation	Data read, save, print
Others	help display

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

(2) System configuration

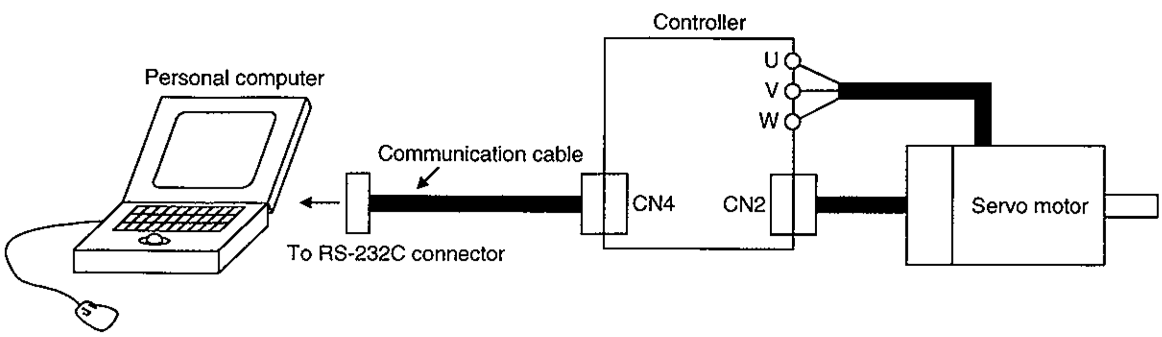
(a) Components

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

Model	Description
Personal computer	Which contains a 80386 or higher CPU and on which Windows 3.1· 95 runs (80486 or higher recommended).Memory: 8MB or more, hard disk: 1MB or more, serial port used.
OS	Windows 3.1· 95
Display	640×400 or more color or 16-scale monochrome display which can be used with Windows 3.1· 95.
Keyboard	Which can be connected to the personal computer.
Mouse	Which can be used with Windows 3.1· 95. Note that a serial mouse is not used.
Printer	Which can be used with Windows 3.1· 95.
Communication cable	MR-HPC98CBL3M·MR-HPCATCBL3M When these cannot be used, refer to Section 15.1.6(3) and fabricate.

Note: Windows is a registered trademark of Microsoft Corporation.

(b) Configuration diagram

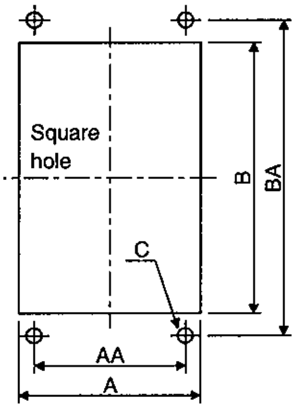


15.1.9 Heat sink outside mounting attachment (MR-ACN)

Use the heat sink outside mounting attachment to mount the heat generation area of the controller in the outside of the control box to dissipate controller-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed.
In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the controller with the fitting screws (4 screws supplied), and install the controller to the control box.
The environment outside the control box when using the heat sink outside mounting attachment should be within the range of the controller operating environment conditions.

(1) Panel cut dimensions

(a) MR-ACN350 to MR-ACN700

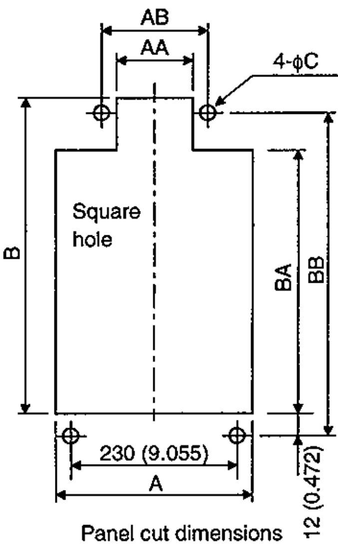


Panel cut dimensions

[Unit: mm (in)]

Model	AA	BA	A	B	C	Controller
MR-ACN350	117 (4.606)	280 (11.024)	131 (5.157)	265 (10.433)	4-5M	MR-H200ACN MR-H350ACN
MR-ACN500	100 (3.937)	370 (14.567)	134 (5.276)	355 (13.976)	4-5M	MR-H500ACN
MR-ACN700	170 (6.693)	380 (14.961)	222 (8.740)	360 (14.173)	4-5M	MR-H700ACN

(b) MR-ACN11K, MR-ACN22K



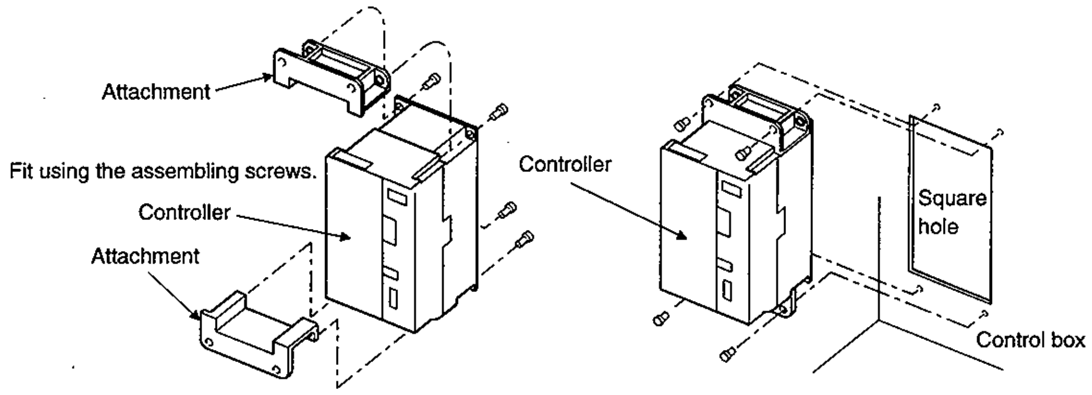
Panel cut dimensions

[Unit: mm (in)]

Model	A	AA	AB	B	BA	BB	C	Controller
MR-ACN11K	250 (9.843)	190 (7.480)	230 (9.055)	553 (21.772)	483 (19.016)	523 (20.591)	4-M8	MR-H11KACN
MR-ACN22K	340 (13.386)	284 (11.181)	308 (12.126)	556 (21.890)	483 (19.016)	483 (20.709)	4-M10	MR-H15KACN MR-H22KACN

(1) Fitting method

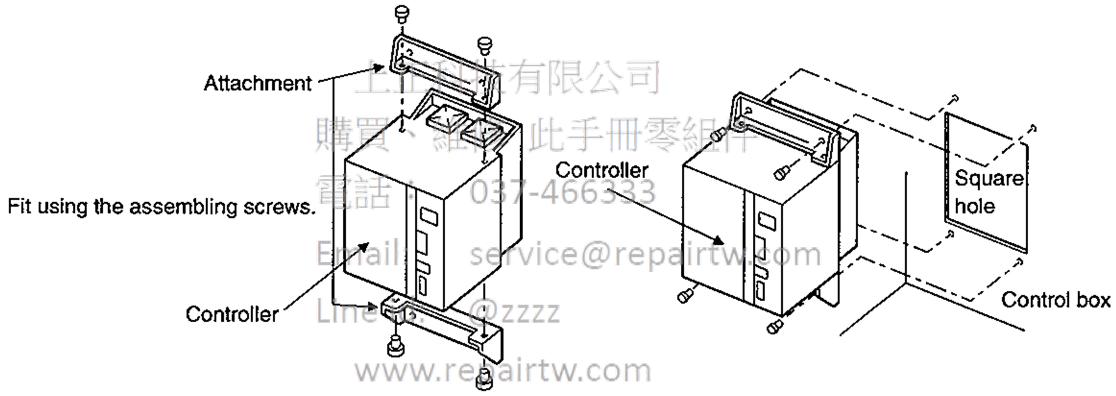
(a) MR-ACN350 (for MR-H200ACN, MR-H350ACN)



a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

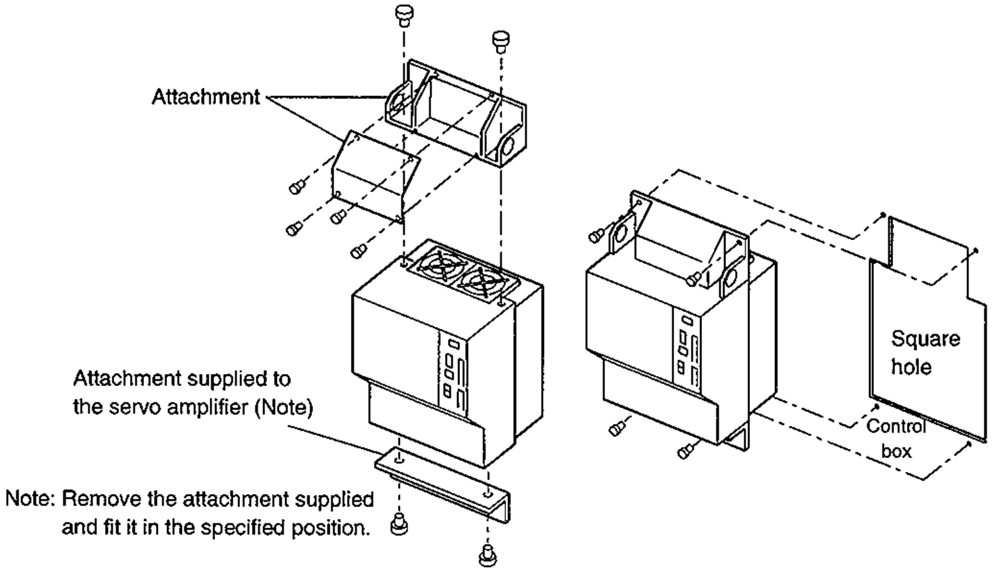
(b) MR-ACN500 (for MR-H500ACN), MR-ACN700 (for MR-H700ACN)



a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

(c) MR-ACN11K (for MR-H11KACN), MR-ACN22K (for MR-H15KACN, MR-H22KACN)



a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

15.1.10 Large setting/display unit (MR-PRU02)

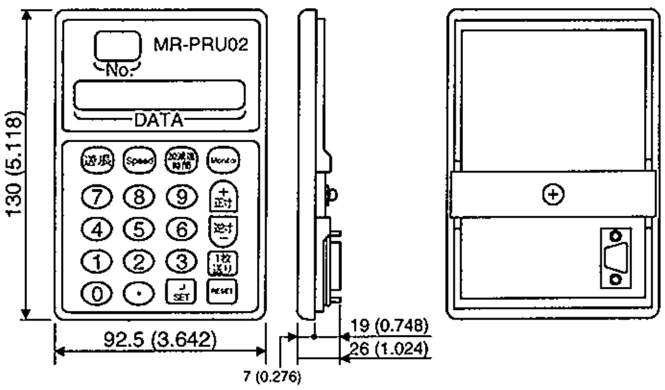
When using the MR-H-ACN in the roll feeding system, the MR-PRU02 allows status display, test operation, and reference to point table data. For details of its usage, refer to the installation guide of the MR-PRU02 large setting/display unit.
Use it with the large setting/display unit cable (MR-PRUBCBL□M).

(1) Specification

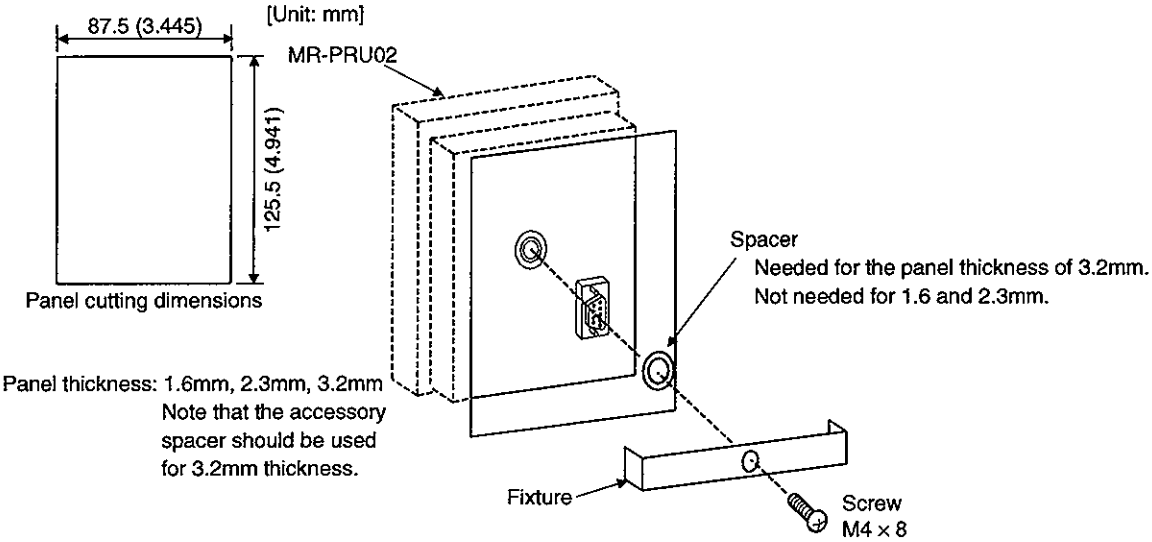
Item		Specification
Model		MR-PRU02
Function	Manual operation	Jog operation, 1 step feed operation
	Status display	Current position, Command position, Command remaining distance, Override, Position block, Command pulse value, Machine speed, Droop pulse, Torque limit command voltage, Regenerative load ratio, Effective load factor, Peak load ratio, Within one-revolution position, ABS counter, Servo motor speed, Bus voltage
	Point table data	Reference to position data speed and acceleration / deceleration time constant
Display		7 segment LED, 2 digits (code) and 7 digits (data)
Environment	Ambient temperature	0 to +55 [°C] (non-freezing)
		32 to +131 [°F] (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	storage temperature	−20 to +65 [°C] (non-freezing)
		−4 to +149 [°F] (non-freezing)
	storage humidity	90%RH or less (non-condensing)
	Ambient	Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt
	Altitude	Max. 1000m (3280ft) above sea level
	Vibration	5.9 [m/s^2] {0.6G} or less
		19.4 [ft/s^2] or less
Cooling method		Self-cooling
Installation panel thichness 〔mm(in)〕		1.6(0.063),2.3(0.091),3.2(0.126)
Weight 〔g(oz)〕		130(4.586)

(2) Outline drawing

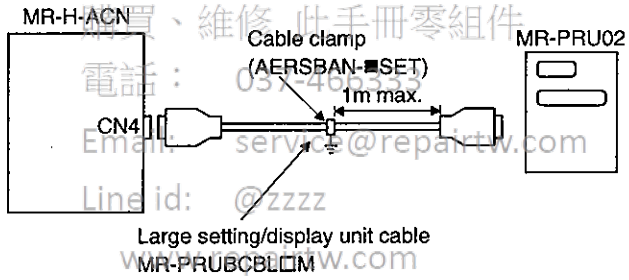
[Unit: mm (in)]



(3) Panel cutting/fitting method



(4) Makeup



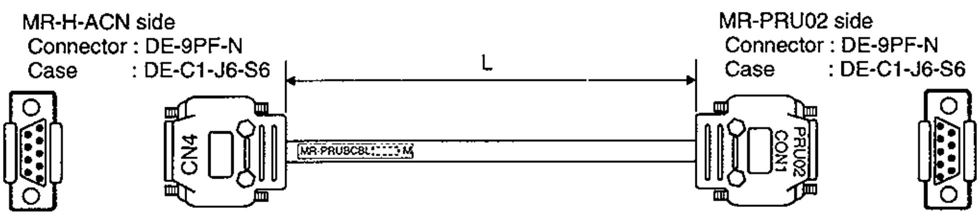
POINT
• If noise is generated to malfunction the equipment, use the cable clamp (AERSBAN-■SET) to suppress noise. Use the cable clamp fixture in accordance with Section 15.2.6, (3).

(5) Large setting/display unit cable

Used to connect the large setting/display unit and MR-H-ACN.

Model: MR-PRUBCBL□M

Symbol	Cable Length L [m (in)]
3	3 (9.843)
5	5 (16.404)

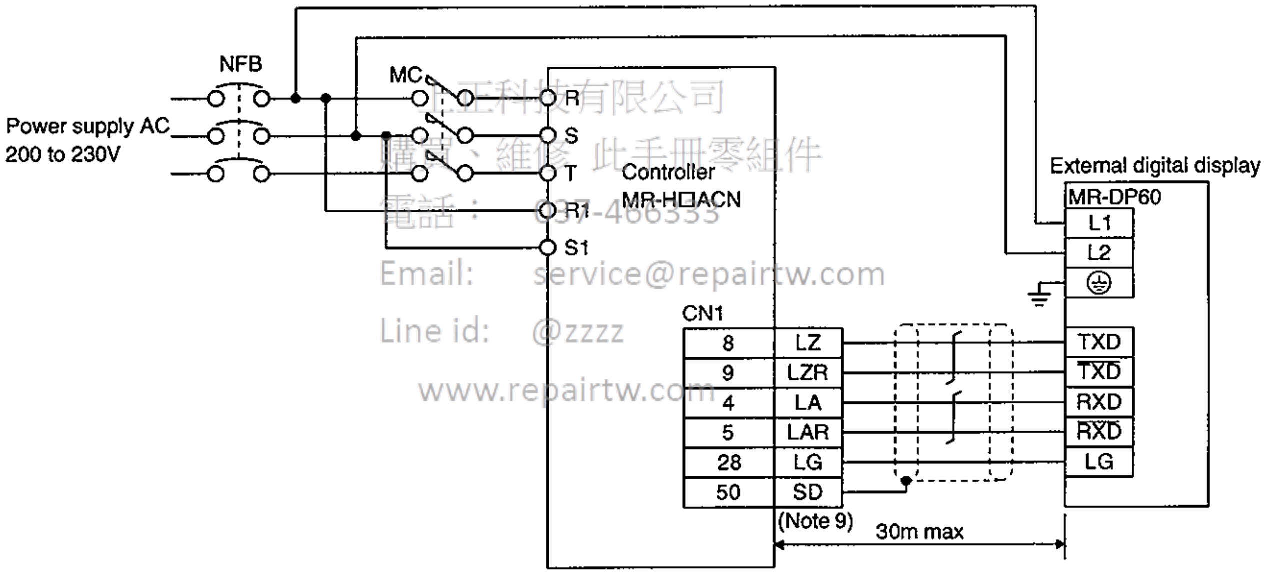


15.1.11 External Digital display (MR-DP60)

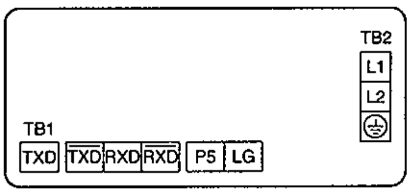
(1) Specifications

Item		Specifications
Display		Red 7-segment LED, signed 6 digits
Power supply	Permissible voltage fluctuation	Single phase, 85 to 253VAC
	Current consumption	Within 200mA
Communication	Interface	Conforming to RS-422A
	Baudrate	4800bps asynchronous
	Bit length	Start bit = 1, data bit = 8, parity bit = 1, stop bit = 1
	Protocol	MELSERVO-H protocol
	Communication commands	Commands dedicated to the MELSERVO-H
Operating temperature range		0°C to +60°C, 90%RH or less, non-condensing
Storage temperature range		-5°C to +70°C

(2) Connection example



(3) Terminal layout

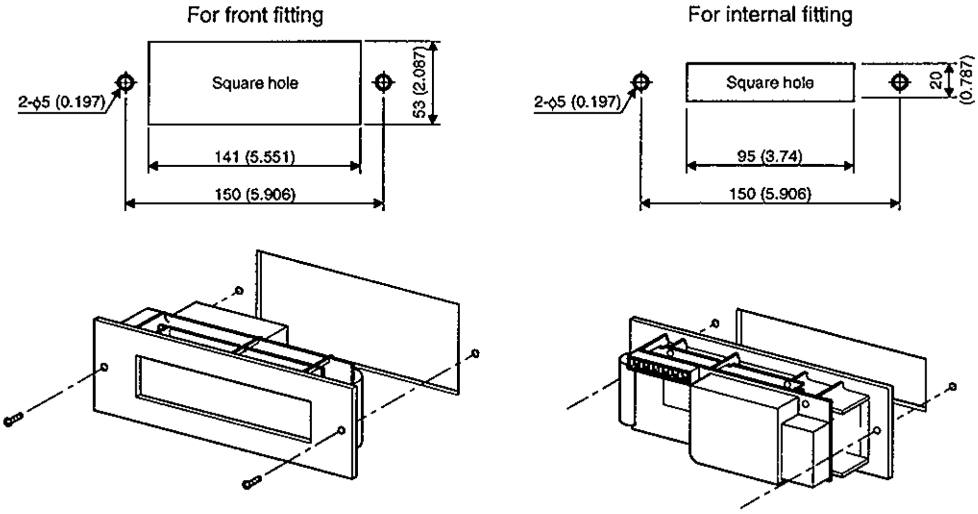


Signal	Description
R	Single-phase, 100 to 230VAC power input
S	
⏚	Earth
RXD	Receive signal input
$\overline{RXD}$	Inverse receive signal input
$\overline{TXD}$	Inverse transmission signal output
TXD	Transmission signal output
P5	5VDC output
LG	Control common

Note: The 5VDC output is used for the internal control circuit to check voltage, etc. Do not use this terminal to supply voltage to the other equipment.

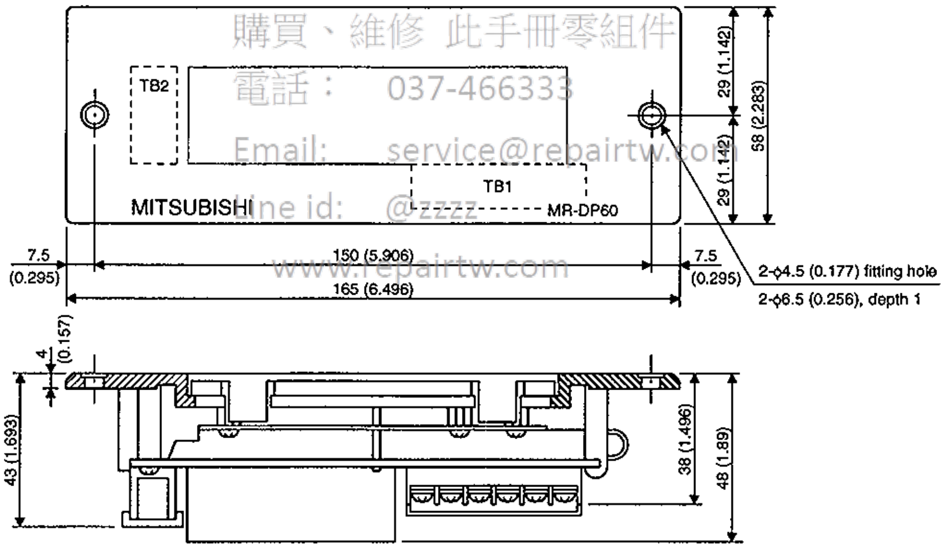
(4) Fitting

[Unit: mm (in)]



(5) Outline dimensional drawing

[Unit: mm (in)]



15.1.12 Manual Pulse Generator (MR-HDP01)

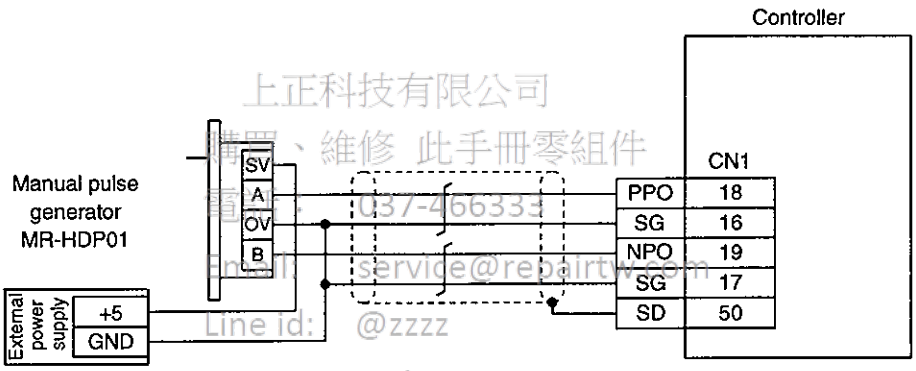
(1) Specifications

Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA or less
interface		Output current max. 20mA for open collector output
Pulse signal form		A phase, B phase, 2 signals of 90° phase difference
Pulse resolution		25P/rev (100P/rev after multiplied by 4 in the controller)
Max. speed		Max. 600r/min instaneously, 200r/min normally
Operating temperature range		-10°C to +60°C
Storage temperature range		-30°C to + 80°C

(2) Connection example

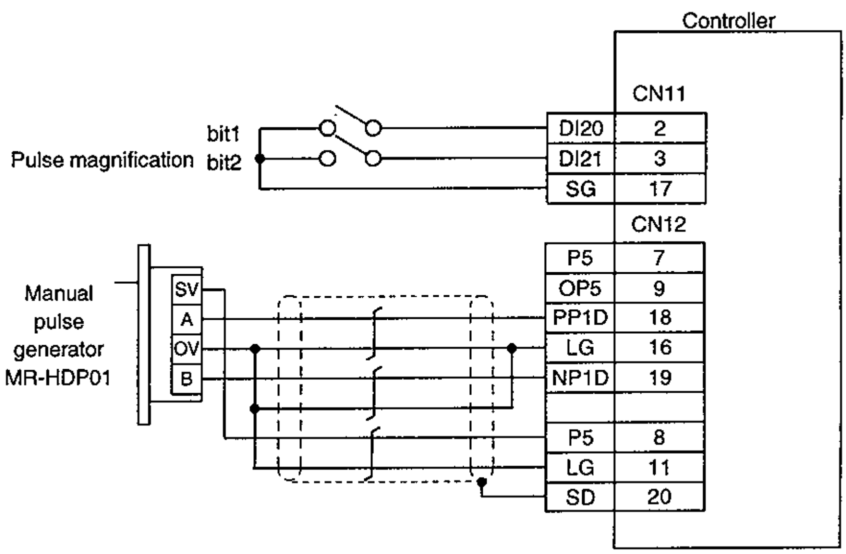
1) Standard configuration

Supply external power to the manual pulse generator.

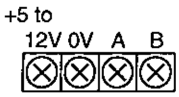


2) When the option card (MR-H-D01) is used

Supply power to the manual pulse from the MR-H-D01.

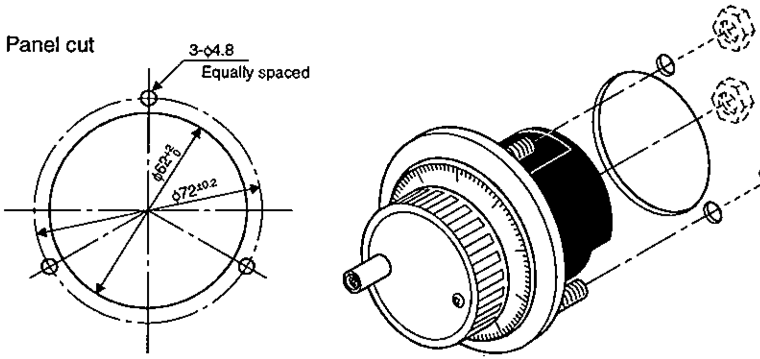


(3) Terminal layout

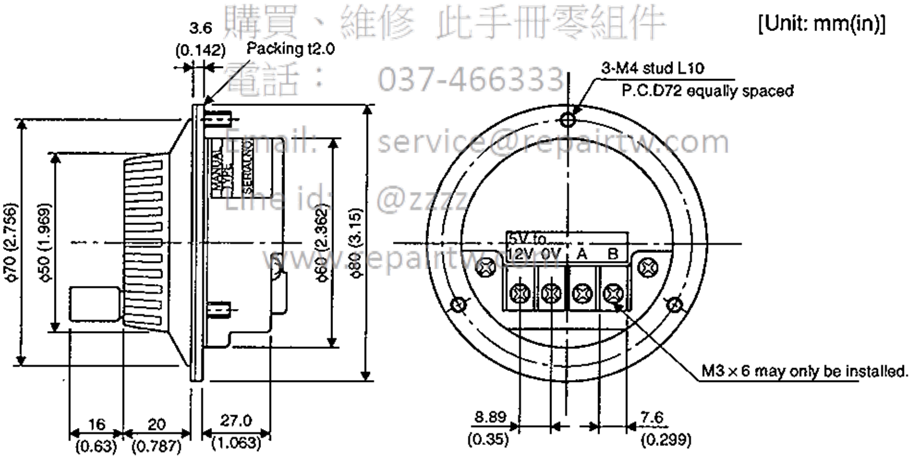


Signal	Description
+5 to 12V	Power input
0V	Common for power and signal
A	A-phase pulse output
B	B-phase pulse output

(4) Installation

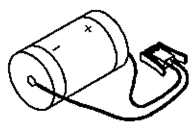


(5) Outline drawing



15.1.13 Battery (MR-BAT, A6BAT)

Used to configure up the absolute position detection system.

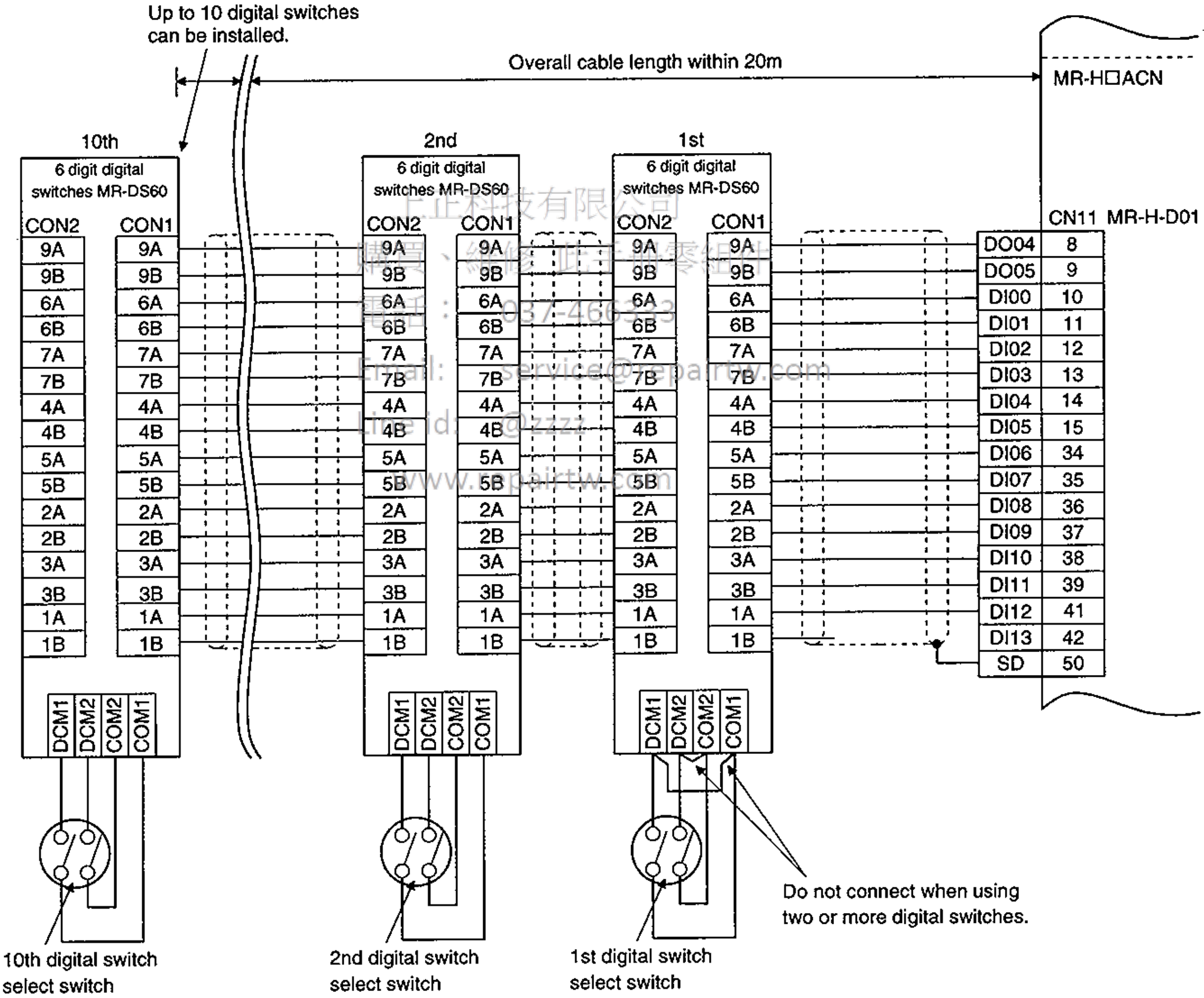


15.1.14 6-Digit Digital Switch (MR-DS60)

(1) Specifications

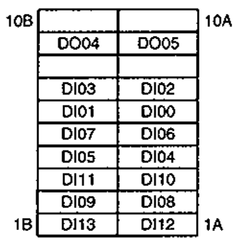
Item	Specifications
Type	MR-DS60A
Number of digits	Signal 6-digit BCD
Electrical characteristic	28VDC (0.5A)
Dielectric withstand voltage	500Vr.m.s
Contact resistance	100mΩ or less
Life	1,000,000 times
Operating temperature range	0°C to 60°C
Storage temperature range	-5°C to 70°C

(2) Connection example



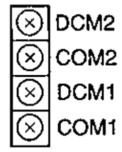
(3) Terminal layout

CON1,CON2



Signal	Pin No.	Description
DO04	9A	Common output 1, sign, ×1000,×10000, ×100000 side common output
DO05	9B	Common output 2, ×1, ×10, ×100 side common output
DI00	6A	×1, ×1000 bit 0
DI01	6B	×1, ×1000 bit 1
DI02	7A	×1, ×1000 bit 2
DI03	7B	×1, ×1000 bit 3
DI04	4A	×10, ×10000 bit 0
DI05	4B	×10, ×10000 bit 1
DI06	5A	×10, ×10000 bit 2
DI07	5B	×10, ×10000 bit 3
DI08	2A	×100, ×100000 bit 0
DI09	2B	×100, ×100000 bit 1
DI10	3A	×100, ×100000 bit 2
DI11	3B	×100, ×100000 bit 3
DI12	1A	Sign bit 0
DI13	1B	Sign bit 1

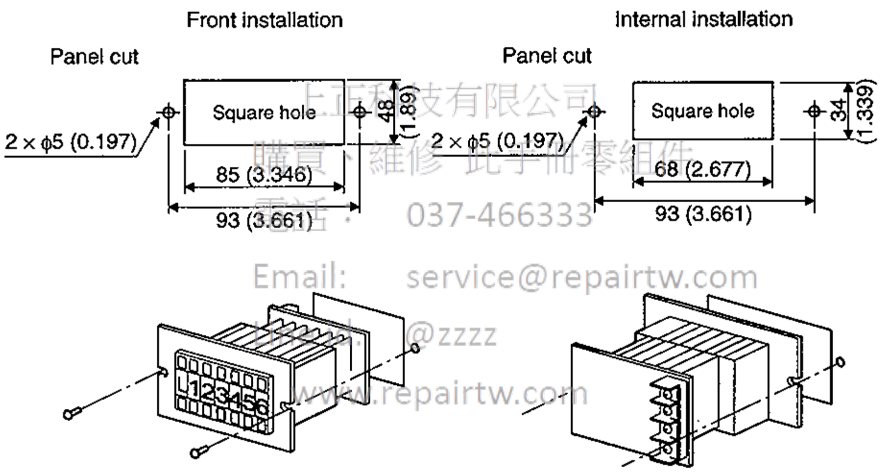
TB



Signal	Description
DCM2	Common input 2. Connect with COM2 when selecting a block.
COM2	Common output 2. Common 2 used for switch selection when two or more digital switches are used.
DCM1	Common input 1. Connect with selecting a block.
COM1	Common output 1. Common 1 used for switch selection when two or more sigital switches are used.

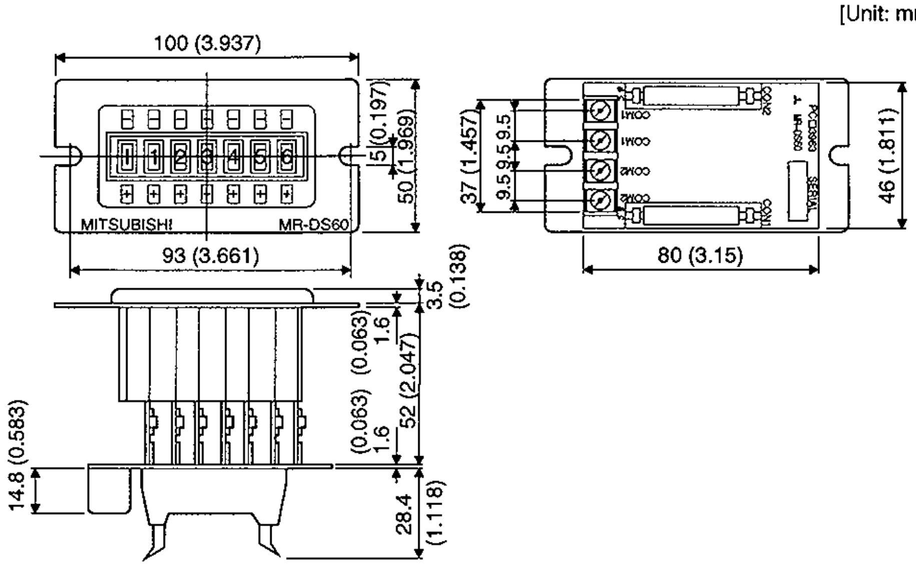
(4) Installation

[Unit: mm (in)]



(5) Outline drawing

[Unit: mm (in)]



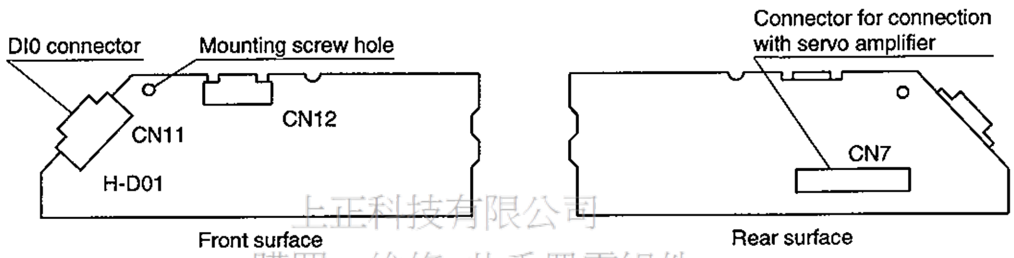
15.1.15 MR-H-D01 option card

Increase of point table and used for alarm code output, etc. See Chapter 3 or Chapter 4 for the connection and usage.

(1) Specifications

Item		Specifications
Function		Extra digital I/O, point table expansion memory
Digital input		24 points, photocoupler isolated, 24VDC, 5mA
Digital output		16 points, open collector, 24VDC, 50mA max.
Pulse train input	System	Forward/reverse rotation pulse train, 2-phase pulse train, signed pulse train
	Frequency	Differential 400kpps, open collector 200kpps

(2) Part names

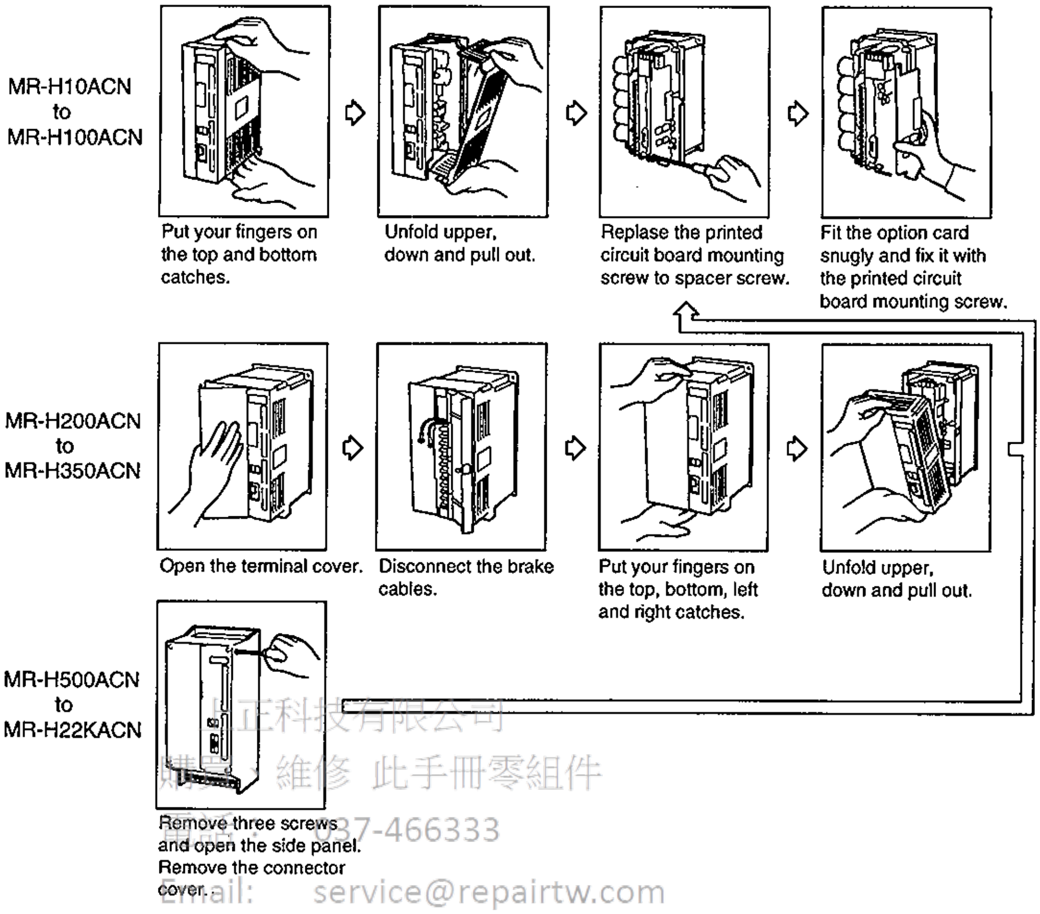


(3) Installation to controller

POINT

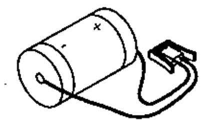
The internal circuits of the controller may be damaged by static electricity.
Always take the following precautions:

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



15.1.16 Battery (MR-BAT, A6BAT)

Use the battery to build an absolute position detection system.



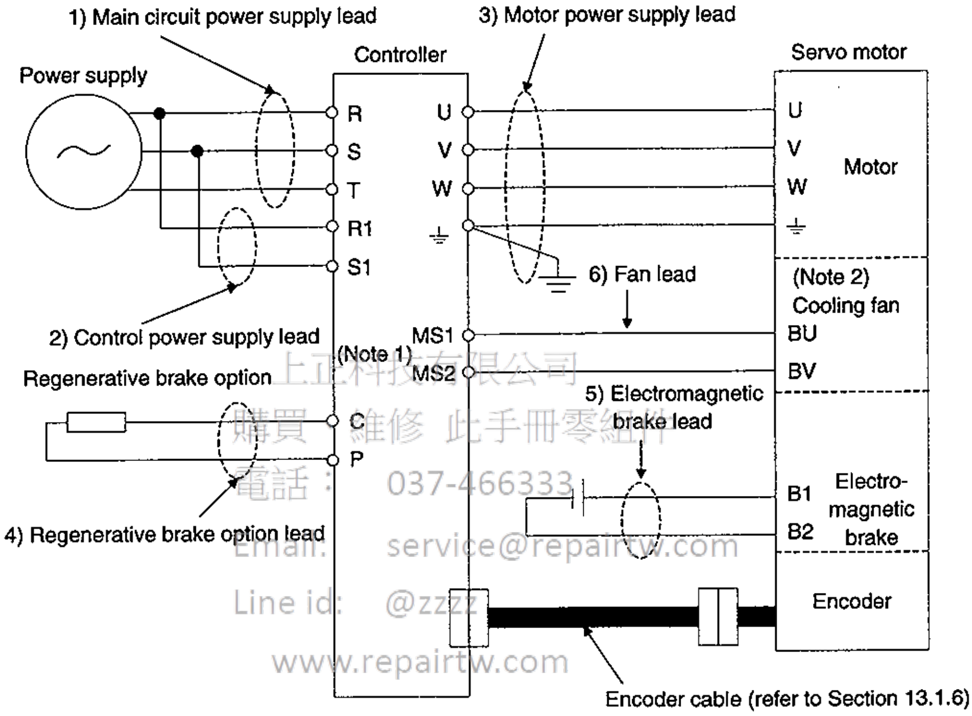
15.2 Auxiliary Equipment

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

15.2.1 Recommended wires

(1) Wires for power supply wiring

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



Note: 1. Provided for the 11kW and more controller.
2. Provided for the HA-LH11K2 to 22K2 servo motors.

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

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to Section 3.8.

The crimping terminals used with the U, V and W wires for MR-H11KACN should be those of Japan Crimping Terminal's 22-S5 or equivalent.

Tale 15.1 Recommended Wires

<table>
<tr><th rowspan="2">Controller</th><th colspan="6">Wires [mm²]</th></tr>
<tr><th>1) R · S · T</th><th>2) R1 · S1</th><th>3) U · V · W · ⏚</th><th>4) P · C</th><th>5) B1 · B2</th><th>6) BU · BV</th></tr>
<tr><td>MR-H10ACN</td><td rowspan="5">2</td><td rowspan="12">1.25</td><td rowspan="4">1.25</td><td rowspan="8">2</td><td rowspan="9">1.25</td><td rowspan="8"></td></tr>
<tr><td>MR-H20ACN</td></tr>
<tr><td>MR-H40ACN</td></tr>
<tr><td>MR-H60ACN</td></tr>
<tr><td>MR-H100ACN</td><td>2</td></tr>
<tr><td>MR-H200ACN</td><td>3.5</td><td>3.5</td></tr>
<tr><td>MR-H350ACN</td><td rowspan="2">5.5</td><td>(Note)5.5</td></tr>
<tr><td>MR-H500ACN</td><td>5.5</td></tr>
<tr><td>MR-H700ACN</td><td>8</td><td>8</td><td>3.5</td><td rowspan="4">2</td></tr>
<tr><td>MR-H11KACN</td><td>14</td><td>22</td><td rowspan="3">5.5</td><td rowspan="3"></td></tr>
<tr><td>MR-H15KACN</td><td>22</td><td>30</td></tr>
<tr><td>MR-H22KACN</td><td>50</td><td>60</td></tr>
</table>

Note:3.5mm² for use of the HC-RF203 servo motor.

Use the following wires to wire the brake unit (FR-BU) and power return converter (FR-RC):

Model	Wire [mm²]
FR-BU-15K	3.5
FR-BU-30K	5.5
FR-BU-55K	14
FR-RC-15K	14

(2) Wires for cables

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

Table 15.2 Wires for Standard Encoder cables

<table>
<tr><th>Wire Model</th><th>Core Size (mm²)</th><th>Number of Cores</th><th>Finishing OD [mm] (Note 1)</th><th>Core insulation Sheath Outline d (mm) (Note 2)</th><th>Cable Type</th><th>Cable Model</th></tr>
<tr><td rowspan="2">UL20276AWG28 7pair(BLAC)</td><td rowspan="2">0.08</td><td rowspan="2">14 (7 pairs)</td><td rowspan="2">5.6</td><td rowspan="2">0.9 to 1.27</td><td>Standard encoder cable</td><td>MR-JCCBL2M-L to MR-JCCBL10M-L</td></tr>
<tr><td>Communication cable</td><td>MR-HPC98CBL□M
MR-HPCATCBL□M</td></tr>
<tr><td>UL20276AWG22 6pair(BLAC)</td><td>0.3</td><td>14 (7 pairs)</td><td>8.2 (8.7)</td><td>0.9 to 1.27</td><td>Standard encoder cable</td><td>MR-JCCBL20M-L
MR-JCCBL30ML</td></tr>
</table>

Note 1: Value in parentheses is max. OD.
2: d is as shown below:

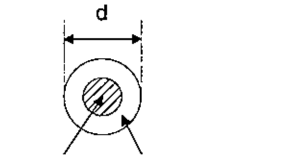


Table 15.3 Wires for Long Flexing Life Encoder Cables

(Note) Junkosha's Wire Model	Core Size [mm^2]	Number of Cores	Finishing OD [mm]	Characteristics of 1 Core		Cable Type	Cable Model
				Structure [Number of wires/mm]	Conductor resistance [Ω/km]		
A14B2339	0.2	8 (4 pairs)	7.2	40/0.08	105 min.	Long flexing life encoder cable	MR-HSCBL5M MR-JCCBL5M-H MR-JHSCBL5M-H
A14B2343	0.2	12 (6 pairs)	7.9	40/0.08	105 min..		MR-HSCBL10M or more MR-JCCBL10M-H or more MR-JHSCBL10M-H or more

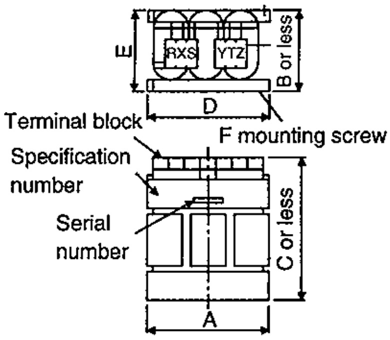
Note: purchase from Toa Electric industry

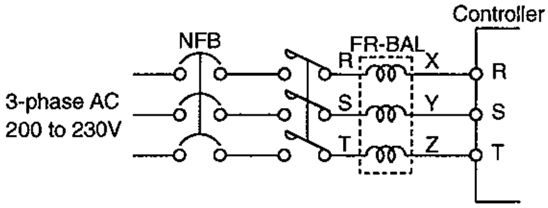
15.2.2 No-fuse breakers, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one controller.

Controller	No-Fuse Breaker	Magnetic Contactor
MR-H10ACN	Model NF30 5A	S-N10
MR-H20ACN	Model NF30 10A	S-N10
MR-H40ACN	Model NF30 10A	S-N10
MR-H60ACN	Model NF30 10A	S-N10
MR-H100ACN	Model NF30 15A	S-N10
MR-H200ACN	Model NF30 20A	S-N18
MR-H350ACN	Model NF50 30A	S-N25
MR-H500ACN	Model NF50 05A	S-N35
MR-H700ACN	Model NF100 75A	S-N50
MR-H11KACN	Model NF100 100A	S-N65
MR-H15KACN	Model NF225 125A	S-N95
MR-H22KACN	Model NF225 175A	S-N125

15.2.3 Power factor improving reactors





Controller	Model	dimensions [mm (in)]						Approx. Weight
		A	B	C	D	E	F	[kg (lb)]
MR-H10ACN MR-H20ACN	FR-BAL-0.4K	135 (5.315)	64 (2.520)	120 (4.724)	120 (4.724)	45 (1.772)	M4	2 (4.409)
MR-H40ACN	FR-BAL-0.75K	135 (5.315)	74 (2.913)	120 (4.724)	120 (4.724)	57 (2.244)	M4	3 (6.614)
MR-H60ACN	FR-BAL-1.5K	160 (6.299)	76 (2.992)	145 (5.709)	145 (5.709)	55 (2.165)	M4	4 (8.818)
MR-H100ACN	FR-BAL-2.2K	160 (6.299)	96 (3.780)	145 (5.709)	145 (5.709)	75 (2.953)	M4	6 (13.228)
MR-H200ACN	FR-BAL-3.7K	220 (8.661)	95 (3.740)	200 (7.874)	200 (7.874)	70 (2.756)	M5	8.5 (18.739)
MR-H350ACN	FR-BAL-7.5K	220 (8.661)	125 (4.921)	205 (8.071)	200 (7.874)	100 (3.937)	M5	14.5 (31.967)
MR-H500ACN	FR-BAL-11K	280 (11.024)	140 (5.512)	245 (9.646)	255 (10.039)	100 (3.937)	M6	19 (41.888)
MR-H700ACN MR-H11KACN	FR-BAL-15K	295 (11.614)	156 (6.142)	280 (11.024)	270 (10.630)	110 (4.331)	M6	27 (59.525)
MR-H15KACN	FR-BAL-20K	290 (11.417)	200 (7.874)	300 (11.811)	240 (9.449)	170 (6.693)	M8	35 (77.162)
MR-H22KACN	FR-BAL-30K	290 (11.417)	220 (8.661)	300 (11.811)	240 (9.449)	190 (7.480)	M8	43 (94.799)

15.2.4 Relays

The following relays should be used with the interfaces:

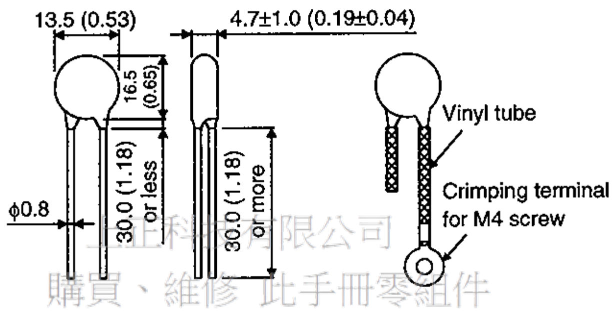
Interface	Selection Example
Relay used especially for switching on-off analog input command and input command (interface DI-1) signals	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) OMRON : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small relay with 12VDC or 24VDC of 40mA or less (Ex.) OMRON : type MY

15.2.5 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



15.2.6 Noise reduction techniques

Noises are classified into external noises which enter the controller to cause it to malfunction and those radiated by the controller to cause peripheral devices to malfunction. Since the controller is an electronic device which handles small signals, the following general noise reduction techniques are required.
Also, the controller 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 controller, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) General reduction techniques

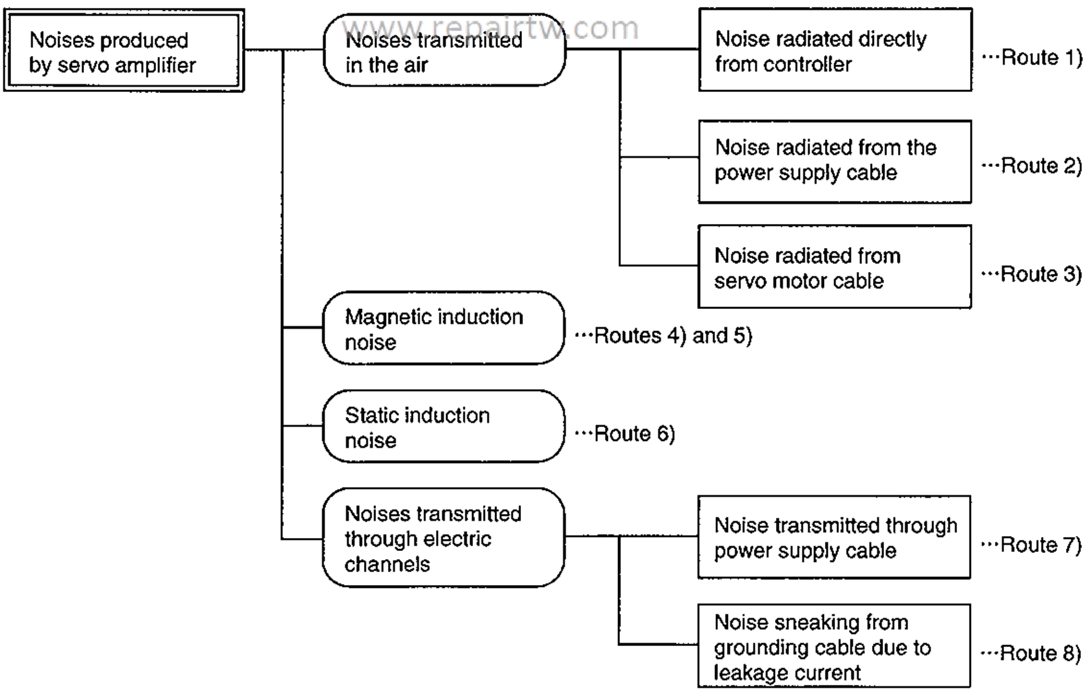
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the controller, servo motor, etc. together at one point (refer to Section 3.6).

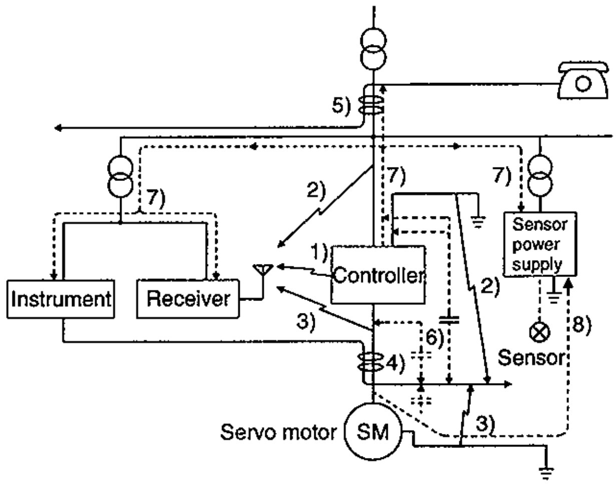
(2) Reduction techniques for external noises that cause the controller to malfunction

If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the controller and the controller 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.

(3) Techniques for noises radiated by the controller that cause peripheral devices to malfunction Noises produced by the controller are classified into those radiated from the cables connected to the controller 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 controller or run near the controller, such devices may malfunction due to noises transmitted through the air. The following techniques are required. (1) Provide maximum clearance between easily affected devices and the controller. (2) Provide maximum clearance between easily affected signal cables and the I/O cables of the controller. (3) Avoid laying the power lines (I/O cables of the controller) and signal cables side by side or bundling them together. (4) Insert a line noise filter to the I/O cables or a radio noise filter on the input line. (5) Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. (1) Provide maximum clearance between easily affected devices and the controller. (2) Provide maximum clearance between easily affected signal cables and the I/O cables of the controller. (3) Avoid laying the power lines (I/O cables of the controller) and signal cables side by side or bundling them together. (4) Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices is connected to the power supply of the controller system, noises produced by the controller 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 of the controller. (2) Insert the line noise filter (FR-BIF·FR-BLF01) on the power cables of the controller.
8)	When a closed loop circuit is formed by the ground cables of the peripheral device and controller, a leakage current may flow through to malfunction the device. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(1) Data line filter

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

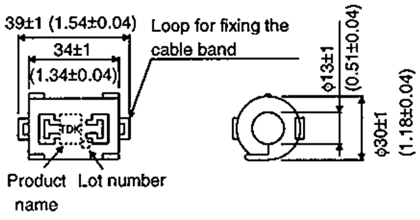
Example: Data line filter: ZCAT3035-1330 [TDK]
ESD-SR-25 [Tokin]

Impedance specifications (ZCAT3035-1330)

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

The above impedances are reference values and not guaranteed values.

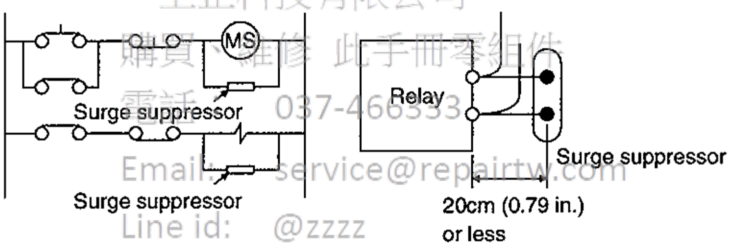
[Unit: mm (in)]



Outline drawing (ZCAT3035-1330)

(2) Surge suppressor

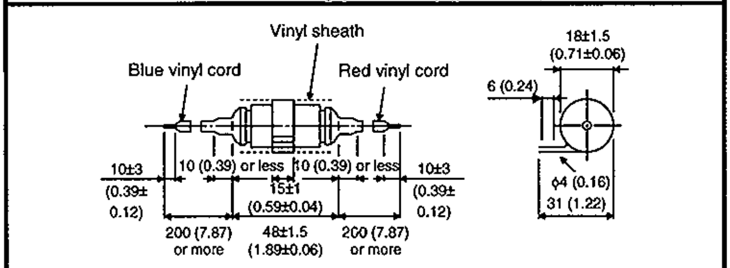
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the controller is shown below. Use this product or equivalent.



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

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

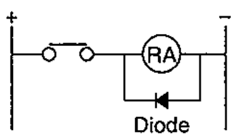
Outline Drawing [Unit: mm] ([Unit: in.])



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

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

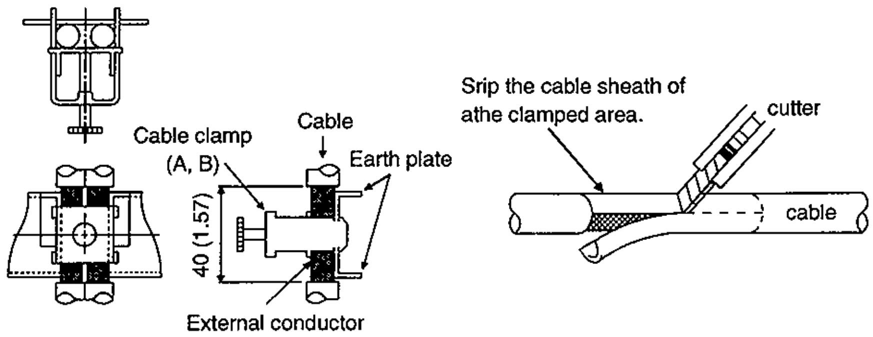
Maximum current: Not less than twice the drive current of the relay or the like



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

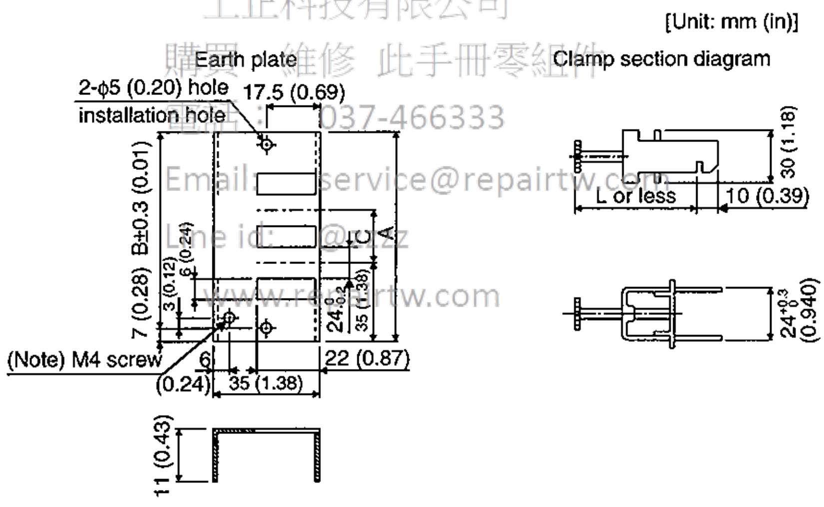
Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth plate near the controller for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



Clamp section diagram

· Outline drawing



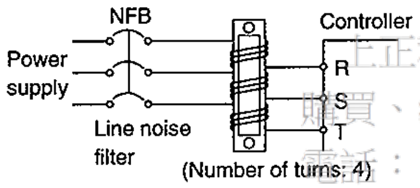
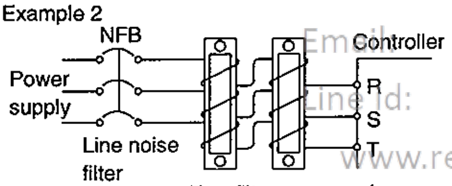
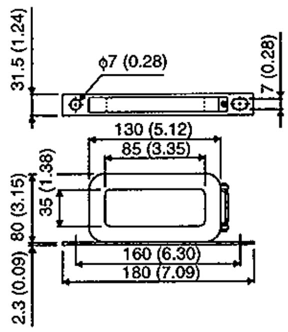
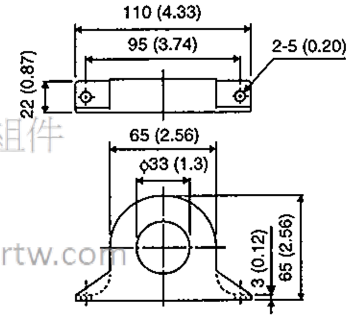
Note: Screw hole for grounding. Connect it to the earth plate of the control box.

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)

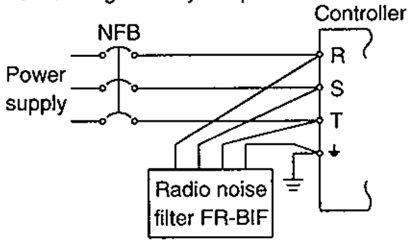
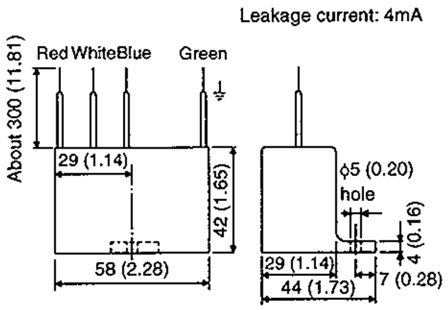
(4) Line noise filter (FR-BLF, FR-BSF01)

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

Connection Diagram	Outline Drawing [Unit: mm] ([Unit: in.])
· Wind the three-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the controller. · The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four. On the output side, the number of turns must be four or less. · Do not wind the grounding wire together with the three-phase wires. The filter effect will decrease. Use special caution when a four-core cable is used. Use a separate wire for grounding. · If the wires are too thick to be wound, use two or more filters and the number of turns should be as mentioned above. Example 1  Example 2  Two filters are used (Total number of turns: 4)	FR-BLF (MR-H350ACN or more)  FR-BSF01 (for MR-H200ACN or less) 

(5) Radio noise filter (FR-BIF)

This filter is effective in suppressing noises radiated from the power supply side of the controller 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.  	

15.2.7 Leakage current breaker

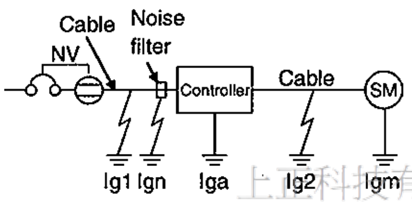
(1) Selection method

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 controller, servo motor, etc. securely.

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

Rated sensitivity current $\geq 10 \cdot \{Ig1+Ign+Iga+K \cdot (Ig2+Igm)\}$ [mA] $\cdots\cdots$ (15.2)



K: Constant considering the harmonic contents

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

Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the controller (Found from Fig. 15.1.)

Ig2: Leakage current on the electric channel from the output terminals of the controller to the servo motor (Found from Fig. 15.1.)

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

Iga: Leakage current of the controller (Found from Table 15.4.)

Igm: Leakage current of the servo motor (Found from Table 15.3.)

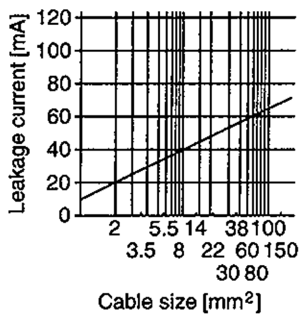


Fig.15.1 Leakage Current Example (Ig1,Ig2)for CV Cable Run in Metal Conduit

Table 15.4 Servo Motor's Leakage Current Example (Igm)

Servo Motor Output [kW]	Leakage Current [mA]
0.05 to 0.5	0.1
0.6 to 1.0	0.1
1.2 to 2.2	0.2
3 to 3.5	0.3
4.5	0.3
5	0.5
7	0.7
11	1.0
15	1.3
22	2.3

Table 15.5 Controller's Leakage Current Example (Iga)

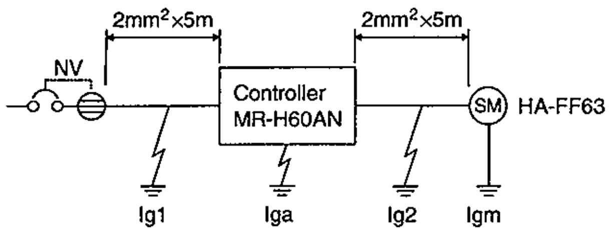
Controller Capacity [kW]	Leakage Current [mA]
All series	2

Table 15.6Leakage Circuit Breaker Selection Example

Controller	Rated Sensitivity Current of Leakage Circuit Breaker
MR-H10ACN to MR-H350ACN	15mA
MR-H500ACN	30mA
MR-H700ACN	50mA
MR-H11KACN to MR-H22KACN	100mA

(2) Selection example

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



Use a leakage current breaker generally available.

Find the terms of Equation (14.2) from the diagram:

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

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

$Ign = 0$ (not used)

$Iga = 0.1$ [mA]

$Igm = 0.1$ [mA]

Insert these values in Equation (15.2):

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

$$\geq 8.0 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 8.0[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-CA/CS/SS series.

15.2.8 Setting potentiometers for analog inputs

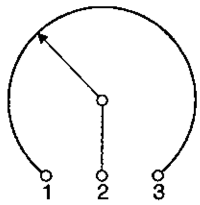
The following variable resistors are available for use with analog inputs such as override and analog torque commands:

(1) Single-revolution type

WA2WYA2SEBK2KΩ (Japan Resistor make)

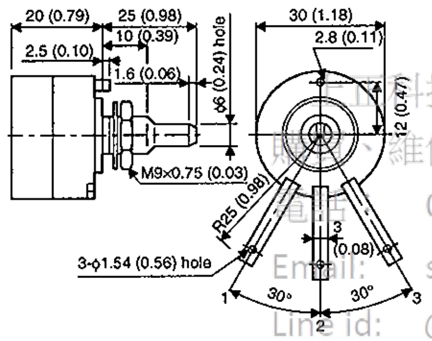
Rated Power	Resistance	Resistance Tolerance	dielectric Strength (for 1 minute)	Insulation Resistance	Mechanical Rotary Angle	Rotary Torque
2W	2kΩ	±10%	700V A.C	100MΩor more	300°±5°	10 to 100g-cm or less

connection diagram



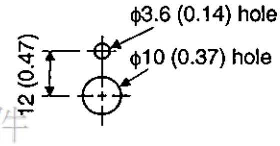
Outline dimension drawing

[Unit: mm (in)]



Panel hole machining diagram

[Unit: mm (in)]

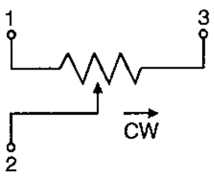


(2) Multi-revolution type

RRS10(M)2KΩ (Japan Resistor make)

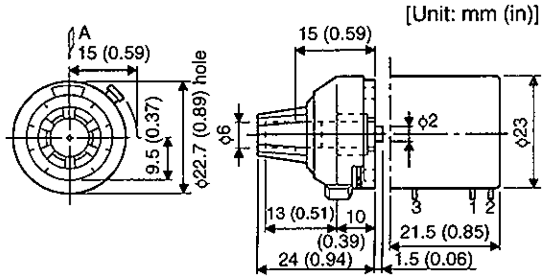
Rated Power	Resistance	Resistance Tolerance	dielectric Strength (for 1 minute)	Insulation Resistance	Mechanical Rotary Angle	Rotary Torque
1W	2kΩ	±10%	700V A.C	1000MΩ or more	$3600^{\circ}\ {}^{+10^{\circ}}_{-0^{\circ}}$	100g-cm or less

connection diagram



Outline dimension drawing

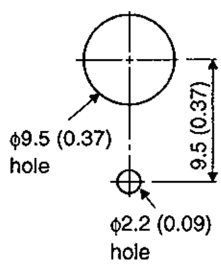
[Unit: mm (in)]



Panel hole machining diagram

[Unit: mm (in)]

Panel thickness: 2 to 6 (0.08 to 0.24)



POINT TABLE DATA RECORDING FORMS

(1) Position blocks

1) 256-positions (positioning)

(Position Block No.)	D107 bit7	D106 bit6	D105 bit5	D104 bit4	D103 bit3	D102 bit2	D101 bit1	D100 bit0	Position Data	M Code	Speed Block No.
0	0	0	0	0	0	0	0	0			
1	0	0	0	0	0	0	0	1			
2	0	0	0	0	0	0	1	0			
3	0	0	0	0	0	0	1	1			
4	0	0	0	0	0	1	0	0			
5	0	0	0	0	0	1	0	1			
6	0	0	0	0	0	1	1	0			
7	0	0	0	0	0	1	1	1			
8	0	0	0	0	1	0	0	0			
9	0	0	0	0	1	0	0	1			
10	0	0	0	0	1	0	1	0			
11	0	0	0	0	1	0	1	1			
12	0	0	0	0	1	1	0	0			
13	0	0	0	0	1	1	0	1			
14	0	0	0	0	1	1	1	0			
15	0	0	0	0	1	1	1	1			
16	0	0	0	1	0	0	0	0			
17	0	0	0	1	0	0	0	1			
18	0	0	0	1	0	0	1	0			
19	0	0	0	1	0	0	1	1			
20	0	0	0	1	0	1	0	0			
21	0	0	0	1	0	1	0	1			
22	0	0	0	1	0	1	1	0			
23	0	0	0	1	0	1	1	1			
24	0	0	0	1	1	0	0	0			
25	0	0	0	1	1	0	0	1			
26	0	0	0	1	1	0	1	0			
27	0	0	0	1	1	0	1	1			
28	0	0	0	1	1	1	0	0			
29	0	0	0	1	1	1	0	1			
30	0	0	0	1	1	1	1	0			
31	0	0	0	1	1	1	1	1			
32	0	0	1	0	0	0	0	0			
33	0	0	1	0	0	0	0	1			
34	0	0	1	0	0	0	1	0			
35	0	0	1	0	0	0	1	1			
36	0	0	1	0	0	1	0	0			
37	0	0	1	0	0	1	0	1			
38	0	0	1	0	0	1	1	0			
39	0	0	1	0	0	1	1	1			
40	0	0	1	0	1	0	0	0			
41	0	0	1	0	1	0	0	1			
42	0	0	1	0	1	0	1	0			
43	0	0	1	0	1	0	1	1			
44	0	0	1	0	1	1	0	0			
45	0	0	1	0	1	1	0	1			
46	0	0	1	0	1	1	1	0			
47	0	0	1	0	1	1	1	1			
48	0	0	1	1	0	0	0	0			
49	0	0	1	1	0	0	0	1			
50	0	0	1	1	0	0	1	0			
51	0	0	1	1	0	0	1	1			
52	0	0	1	1	0	1	0	0			
53	0	0	1	1	0	1	0	1			
54	0	0	1	1	0	1	1	0			
55	0	0	1	1	0	1	1	1			
56	0	0	1	1	1	0	0	0			
57	0	0	1	1	1	0	0	1			
58	0	0	1	1	1	0	1	0			
59	0	0	1	1	1	0	1	1			
60	0	0	1	1	1	1	0	0			
61	0	0	1	1	1	1	0	1			
62	0	0	1	1	1	1	1	0			
63	0	0	1	1	1	1	1	1			
64	0	1	0	0	0	0	0	0			
65	0	1	0	0	0	0	0	1			
66	0	1	0	0	0	0	1	0			
67	0	1	0	0	0	0	1	1			
68	0	1	0	0	0	1	0	0			
69	0	1	0	0	0	1	0	1			
70	0	1	0	0	0	1	1	0			
71	0	1	0	0	0	1	1	1			
72	0	1	0	0	1	0	0	0			
73	0	1	0	0	1	0	0	1			
74	0	1	0	0	1	0	1	0			
75	0	1	0	0	1	0	1	1			
76	0	1	0	0	1	1	0	0			
77	0	1	0	0	1	1	0	1			
78	0	1	0	0	1	1	1	0			
79	0	1	0	0	1	1	1	1			
80	0	1	0	1	0	0	0	0			
81	0	1	0	1	0	0	0	1			
82	0	1	0	1	0	0	1	0			
83	0	1	0	1	0	0	1	1			
84	0	1	0	1	0	1	0	0			
85	0	1	0	1	0	1	0	1			
86	0	1	0	1	0	1	1	0			
87	0	1	0	1	0	1	1	1			
88	0	1	0	1	1	0	0	0			
89	0	1	0	1	1	0	0	1			
90	0	1	0	1	1	0	1	0			
91	0	1	0	1	1	0	1	1			
92	0	1	0	1	1	1	0	0			
93	0	1	0	1	1	1	0	1			
94	0	1	0	1	1	1	1	0			
95	0	1	0	1	1	1	1	1			
96	0	1	1	0	0	0	0	0			
97	0	1	1	0	0	0	0	1			
98	0	1	1	0	0	0	1	0			
99	0	1	1	0	0	0	1	1			

(Position Block No.)	D107 bit7	D106 bit6	D105 bit5	D104 bit4	D103 bit3	D102 bit2	D101 bit1	D100 bit0	Position Data	M Code	Speed Block No.
100	0	1	1	0	0	1	0	0			
101	0	1	1	0	0	1	0	1			
102	0	1	1	0	0	1	1	0			
103	0	1	1	0	0	1	1	1			
104	0	1	1	0	1	0	0	0			
105	0	1	1	0	1	0	0	1			
106	0	1	1	0	1	0	1	0			
107	0	1	1	0	1	0	1	1			
108	0	1	1	0	1	1	0	0			
109	0	1	1	0	1	1	0	1			
110	0	1	1	0	1	1	1	0			
111	0	1	1	0	1	1	1	1			
112	0	1	1	1	0	0	0	0			
113	0	1	1	1	0	0	0	1			
114	0	1	1	1	0	0	1	0			
115	0	1	1	1	0	0	1	1			
116	0	1	1	1	0	1	0	0			
117	0	1	1	1	0	1	0	1			
118	0	1	1	1	0	1	1	0			
119	0	1	1	1	0	1	1	1			
120	0	1	1	1	1	0	0	0			
121	0	1	1	1	1	0	0	1			
122	0	1	1	1	1	0	1	0			
123	0	1	1	1	1	0	1	1			
124	0	1	1	1	1	1	0	0			
125	0	1	1	1	1	1	0	1			
126	0	1	1	1	1	1	1	0			
127	0	1	1	1	1	1	1	1			
128	1	0	0	0	0	0	0	0			
129	1	0	0	0	0	0	0	1			
130	1	0	0	0	0	0	1	0			
131	1	0	0	0	0	0	1	1			
132	1	0	0	0	0	1	0	0			
133	1	0	0	0	0	1	0	1			
134	1	0	0	0	0	1	1	0			
135	1	0	0	0	0	1	1	1			
136	1	0	0	0	1	0	0	0			
137	1	0	0	0	1	0	0	1			
138	1	0	0	0	1	0	1	0			
139	1	0	0	0	1	0	1	1			
140	1	0	0	0	1	1	0	0			
141	1	0	0	0	1	1	0	1			
142	1	0	0	0	1	1	1	0			
143	1	0	0	0	1	1	1	1			
144	1	0	0	1	0	0	0	0			
145	1	0	0	1	0	0	0	1			
146	1	0	0	1	0	0	1	0			
147	1	0	0	1	0	0	1	1			
148	1	0	0	1	0	1	0	0			
149	1	0	0	1	0	1	0	1			
150	1	0	0	1	0	1	1	0			
151	1	0	0	1	0	1	1	1			
152	1	0	0	1	1	0	0	0			
153	1	0	0	1	1	0	0	1			
154	1	0	0	1	1	0	1	0			

(Position Block No.)	D107 bit7	D106 bit6	D105 bit5	D104 bit4	D103 bit3	D102 bit2	D101 bit1	D100 bit0	Position Data	M Code	Speed Block No.
155	1	0	0	1	1	0	1	1			
156	1	0	0	1	1	1	0	0			
157	1	0	0	1	1	1	0	1			
158	1	0	0	1	1	1	1	0			
159	1	0	0	1	1	1	1	1			
160	1	0	1	0	0	0	0	0			
161	1	0	1	0	0	0	0	1			
162	1	0	1	0	0	0	1	0			
163	1	0	1	0	0	0	1	1			
164	1	0	1	0	0	1	0	0			
165	1	0	1	0	0	1	0	1			
166	1	0	1	0	0	1	1	0			
167	1	0	1	0	0	1	1	1			
168	1	0	1	0	1	0	0	0			
169	1	0	1	0	1	0	0	1			
170	1	0	1	0	1	0	1	0			
171	1	0	1	0	1	0	1	1			
172	1	0	1	0	1	1	0	0			
173	1	0	1	0	1	1	0	1			
174	1	0	1	0	1	1	1	0			
175	1	0	1	0	1	1	1	1			
176	1	0	1	1	0	0	0	0			
177	1	0	1	1	0	0	0	1			
178	1	0	1	1	0	0	1	0			
179	1	0	1	1	0	0	1	1			
180	1	0	1	1	0	1	0	0			
181	1	0	1	1	0	1	0	1			
182	1	0	1	1	0	1	1	0			
183	1	0	1	1	0	1	1	1			
184	1	0	1	1	1	0	0	0			
185	1	0	1	1	1	0	0	1			
186	1	0	1	1	1	0	1	0			
187	1	0	1	1	1	0	1	1			
188	1	0	1	1	1	1	0	0			
189	1	0	1	1	1	1	0	1			
190	1	0	1	1	1	1	1	0			
191	1	0	1	1	1	1	1	1			
192	1	1	0	0	0	0	0	0			
193	1	1	0	0	0	0	0	1			
194	1	1	0	0	0	0	1	0			
195	1	1	0	0	0	0	1	1			
196	1	1	0	0	0	1	0	0			
197	1	1	0	0	0	1	0	1			
198	1	1	0	0	0	1	1	0			
199	1	1	0	0	0	1	1	1			
200	1	1	0	0	1	0	0	0			
201	1	1	0	0	1	0	0	1			
202	1	1	0	0	1	0	1	0			
203	1	1	0	0	1	0	1	1			
204	1	1	0	0	1	1	0	0			
205	1	1	0	0	1	1	0	1			
206	1	1	0	0	1	1	1	0			
207	1	1	0	0	1	1	1	1			
208	1	1	0	1	0	0	0	0			
209	1	1	0	1	0	0	0	1			

(Position Block No.)	D107 bit7	D106 bit6	D105 bit5	D104 bit4	D103 bit3	D102 bit2	D101 bit1	D100 bit0	Position Data	M Code	Speed Block No.
210	1	1	0	1	0	0	1	0			
211	1	1	0	1	0	0	1	1			
212	1	1	0	1	0	1	0	0			
213	1	1	0	1	0	1	0	1			
214	1	1	0	1	0	1	1	0			
215	1	1	0	1	0	1	1	1			
216	1	1	0	1	1	0	0	0			
217	1	1	0	1	1	0	0	1			
218	1	1	0	1	1	0	1	0			
219	1	1	0	1	1	0	1	1			
220	1	1	0	1	1	1	0	0			
221	1	1	0	1	1	1	0	1			
222	1	1	0	1	1	1	1	0			
223	1	1	0	1	1	1	1	1			
224	1	1	1	0	0	0	0	0			
225	1	1	1	0	0	0	0	1			
226	1	1	1	0	0	0	1	0			
227	1	1	1	0	0	0	1	1			
228	1	1	1	0	0	1	0	0			
229	1	1	1	0	0	1	0	1			
230	1	1	1	0	0	1	1	0			
231	1	1	1	0	0	1	1	1			
232	1	1	1	0	1	0	0	0			
233	1	1	1	0	1	0	0	1			
234	1	1	1	0	1	0	1	0			
235	1	1	1	0	1	0	1	1			
236	1	1	1	0	1	1	0	0			
237	1	1	1	0	1	1	0	1			
238	1	1	1	0	1	1	1	0			
239	1	1	1	0	1	1	1	1			
240	1	1	1	1	0	0	0	0			
241	1	1	1	1	0	0	0	1			
242	1	1	1	1	0	0	1	0			
243	1	1	1	1	0	0	1	1			
244	1	1	1	1	0	1	0	0			
245	1	1	1	1	0	1	0	1			
246	1	1	1	1	0	1	1	0			
247	1	1	1	1	0	1	1	1			
248	1	1	1	1	1	0	0	0			
249	1	1	1	1	1	0	0	1			
250	1	1	1	1	1	0	1	0			
251	1	1	1	1	1	0	1	1			
252	1	1	1	1	1	1	0	0			
253	1	1	1	1	1	1	0	1			
254	1	1	1	1	1	1	1	0			
255	1	1	1	1	1	1	1	1			

2) 8-positions (positioning)

(Position Block No.)	DEC bit2	JFS bit1	STP bit0	Position Data	M Code	Speed Block No.
0	0	0	0			
1	0	0	1			
2	0	1	0			
3	0	1	1			
4	1	0	0			
5	1	0	1			
6	1	1	0			
7	1	1	1			

3) 2-positions (roll feeding)

(Position Block No.)	LSN	Position Data
0	0	
1	1	

(2) Speed blocks

1) 8 speeds (positioning・roll feeding)

Speed block No.	D119 bit2	D118 bit1	D117 bit0	Speed (r/min)	Acceleration Time Constant (ms) or Acceleration/ Deceleration Time Constant (ms)	Deceleration Time Constant (ms) or S-Shape Time Constant (ms)
1	0	0	0			
2	0	0	1			
3	0	1	0			
4	0	1	1			
5	1	0	0			
6	1	0	1			
7	1	1	0			
8	1	1	1			

2) 2 speeds (roll feeding)

Speed block No.	JFS	Speed (r/min)	Acceleration Time Constant (ms) or Acceleration/ Deceleration Time Constant (ms)	Deceleration Time Constant (ms) or S-Shape Time Constant (ms)
1	0			
2	1			

REVISIONS

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

Print Data	*Manual Number	Revision
Oct.,1998	SH(NA)3198-A	First edition
Sep.,1999	SH(NA)3198-B	Sentences of compliance with the European EC Directives changed.
		Section 1.1.2 (2) Part of the figure deleted.
		Section 1.2 (1) Rating plate changed.
		Section 2.4 (2) Sentence modified.
		Section 3.3.1 Sentence deleted, POINT added.
		Section 3.3.2 (1) Sentence added to Function/Application of Digital I/F power supply input. Description modified in Function/Application of Trouble. 6) to 9) deleted from Function/Application of Zeroing completion.
		Section 3.4.5 (4)(b) Automatic/manual mode selection (DI0) changed to Zeroing (DI2) in Timing chart. Automatic/manual mode selection (DI0) added.
		Section 4.3.1 Sentence deleted. POINT added.
		Section 4.3.2 (1) Sentence added to Function/Application of Digital I/F power supply input. In-position added.
		Section 4.3.3 (3) Sentence modified.
		Section 4.4.3 Manual operation remote mode added.
		Section 4.4.4 Manual operation mode added.
		Section 4.4.5 Automatic operation mode added.
		Section 5.1 Figure modified.
		Section 5.2.1 POINT added.
		Section 5.2.2 (4)(a) 1) Figure changed.
		Section 5.6 Partial sentence change.
		Section 6.1.1 Parameters No. 65 to No. 79 added to the table.
		Section 6.2.1 Partial sentence addition to POINT
		Section 6.2.1 (2) 32767 changed to 50000 in conveyor setting example.
		Section 7.3 Indication range of Effective load factor and Peak load factor changed to 320.
		Section 8.1 (2) CN3 changed to CN4 in cable connection diagram.
		Section 8.11.1 Partial table change.
		Section 8.11.2 (5) Data No. changed from [3][5] to [4][F].
		Section 8.11.2 (7) Partial table change.
		Section 8.12.3 (2) Partial sentence change.
		Section 8.12.3 (3) Partial sentence addition.
		Section 8.12.3 (4) Partial sentence addition.
		Section 8.12.6 Sentence added.
		Section 8.12.7 Sentence added.
		Section 8.12.9 (1)(2) Partial sentence change.
		Section 8.12.10 (1) Partial sentence change.
		Section 8.12.11 (1) Partial sentence change.
		Section 8.12.11 (4) Sentence added.
		Section 8.12.12 (4) Sentence added.
		Section 9.1.1 (8) Sentences added to Note 4 and 5.
		Section 9.1.3 (1) Operation-ready added. Sentence changed in Note 5.
		Section 9.1.3 (2) Sentence changed in Note 5.
		Section 9.2.3 (1) Sentence changed in Note 5.
		Section 9.2.3 Power supply capacity changed to Short-circuit rating. Sentence changed.
		Section 9.2.4 Sentence of Note 4 added.
		Section 9.2.7 Table change.
		Section 10.3.2 POINT addition.
		Section 10.4.1 (2) Partial sentence change.

		Section 10.4.2 (2)(b)	Addition of 5), 6), 7).
		Section 10.4.3 (2)	Addition of 7), 8).
		CHAPTER 11	CAUTION changed to WARNING.
		Section 11.2	CAUTION deleted.
		Section 11.2	Sentence added. Remarks in the table deleted.
		Section 12.2.1	Partial addition to alarm and warning lists.
		Section 12.2.2	Partial sentence addition.
		Section 12.2.2	AL 35 name changed to Command pulse frequency alarm. Part of AL 50 definition deleted. Servo motor locked: 1s or more added to AL51 definition.
		Section 12.2.3	Partial sentence change.
		Section 15.1.2 (2)(a)	Part of sentence changed to Section 5.1 of the separately available Servo Motor Instruction Manual.
		Section 15.1.6 (d) 2)	Encoder connector No. changed to 1-172169-9.
		Section 15.1.7 (2)	Terminal labels changed to Terminal block labels. Sentence changed.
		Section 15.2.2	No-fuse breaker Model NF30 30A changed to Model NF50 30A.
		Section 15.2.6	Changed to FR-BAL-22K.