MITSUBISHI

General-Purpose AC Servo

MELSERVO-H Series

Equivalatent to CC-Link
MR-H□TN
Servo Amplifier
Instruction Manual

MITSUBISHI
ELECTRIC

● Safety Instructions ●

(Always read these instructions before using the equipment.)

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

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

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

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

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

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

1. To prevent electric shock, note the following:

⚠ WARNING

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

2. To prevent fire, note the following:

⚠ CAUTION

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

3. To prevent injury, note the follow

⚠ CAUTION

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

4. Additional instructions

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

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their weights.
- 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 servo amplifier. The servo amplifier may drop.
- Install the servo amplifier in a load-bearing place in accordance with the Instruction Manual.
- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- The servo amplifier and servo motor must be installed in the specified direction.
- Leave specified clearances between the servo amplifier and control enclosure walls or other equipment.
- Do not install or operate the servo amplifier and servo motor which has been damaged or has any parts missing.
- 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 servo amplifier.
- Do not drop or strike servo amplifier or servo motor. Isolate from all impact loads.
- Use the servo amplifier and servo motor under the following environmental conditions:

Environment		Conditions		
		Servo amplifier	Servo motor	
Ambient temperature	[℃]	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	[℃]	−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/s^2]	5.9 {0.6G} or less	HC-MF Series HA-FF Series HC-UF 13 to 73	X・Y: 19.6
			HC-SF 81 HC-SF 52 to 152 HC-SF 53 to 153 HC-UF 72・152	X: 9.8 Y: 24.5
			HC-SF 121・201 HC-SF 202・352 HC-SF 203・353 HC-UF 202	X: 19.6 Y: 49
			HC-SF 301	X: 11.7 Y: 29.4
	[$ft./s^2$]	19.4 or less	HC-MF Series HA-FF Series HC-UF 13 to 73	X・Y: 64
			HC-SF 81 HC-SF 52 to 152 HC-SF 53 to 153 HC-UF 72・152	X: 32 Y: 80
			HC-SF 121・201 HC-SF 202・352 HC-SF 203・353 HC-UF 202	X: 64 Y: 161
			HC-SF 301	X: 38 Y: 96

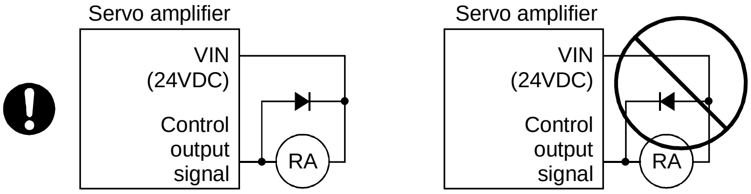
⚠ CAUTION

- 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 servo amplifier.
- Connect the output terminals (U, V, W) correctly. Otherwise, the servo motor will operate improperly.
- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay must be wired in the specified direction. Otherwise, the forced stop and other protective circuits may not operate.



(3) Test run adjustment

⚠ CAUTION

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

(4) Usage

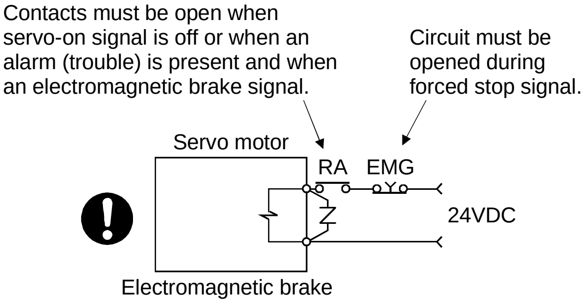
⚠ CAUTION

- Provide an external forced stop circuit to ensure that operation can be stopped and power switched off immediately.
- Any person who is involved in disassembly and repair should be fully competent to do the work.
- The STOP key of the parameter unit is only valid for test run. Provide a forced 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 servo amplifier.
- Use the servo amplifier with the specified servo motor.
- The electromagnetic brake on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- For such reasons as service life and mechanical structure (e.g. where a ballscrew and the servo motor are coupled via a timing belt), the electromagnetic brake may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

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

The EN Standard-compliant products are scheduled for release.

CONFORMANCE WITH UL/C-UL STANDARD

The UL/C-UL Standard-compliant products are scheduled for release.

About the Manuals

This Instruction Manual and the MELSERVO Servo Motor Instruction Manual are required if you use the CC-link Compatible AC servo MR-H-TN for the first time. Always purchase them and use the MR-H-TN 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

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Optional Servo Motor Instruction Manual CONTENTS

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

MEMO

1. FUNCTIONS AND CONFIGURATION

1.1 Overview

Based on the MR-H☐ACN servo amplifier having positioning functions, the MR-H☐TN CC-Link-compatible servo amplifier further includes CC-Link communication functions. Up to 42 axes of servo amplifiers can be controlled/monitored from the PLC side.
As a servo unit, this model has the same functions as those of the MR-H☐ACN servo amplifier having positioning functions. It allows you to perform positioning operation by merely setting the position data (target positions), motor speeds, acceleration/deceleration time constants, etc. in point tables (position blocks, speed blocks) like making parameter setting. It is the most appropriate for you to configure up a simple positioning system without programs or simplify your system.
The servo motors with absolute position encoders are available. By simply adding a battery to the servo amplifier, you can make up an absolute position detection system and you need not perform zeroing at power-on, alarm occurrence or the like.

1.1.1 Features

(1) Fast communication

Fast communication can be made by cyclic transmission of not only bit data but also word data.

(a) The highest communication speed is 10Mbps.

(b) The broadcast polling system ensures as high as 3.9ms to 6.7ms even at the maximum link scan (10Mbps).

(2) Variable communication speed/distance system

Selection of speed/distance allows use in a wide range of areas from a system requiring high speed to a system requiring long distance.

(3) System fault prevention (station separating function)

Because of connection in the bus system, any remote or local station that has become faulty due to power-off or the like does not affect communications with normal remote and local stations.
In addition, use of the two-piece terminal block allows the unit to be changed during data link.

(4) Factory Automation compatible

As the remote device stations of CC-Link, the servo amplifiers share a link system and can be controlled/monitored with PLC user programs.
From the PLC side, the running speed, acceleration/deceleration time constant and other settings of servo motors can be changed/checked and the servo motors started and stopped.

1.1.2 Features of the servo section

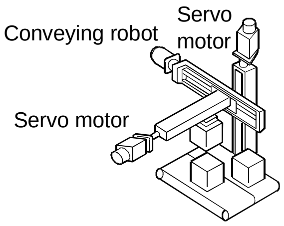
(1) Positioning system

(a) Main functions

1) Positioning for up to 256 positions using point table numbers. (When 1 station is occupied: 8 points, when 2 stations are occupied: 256 points)
2) Speed can be specified as desired from among up to 8 speeds.
3) Direct designation of position data can also be made externally (only when 2 stations are occupied).
4) Direct designation of speed data can also be made externally (only when 2 stations are occupied).
5) Easily compatible with an absolute position system.
6) 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

(b) 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

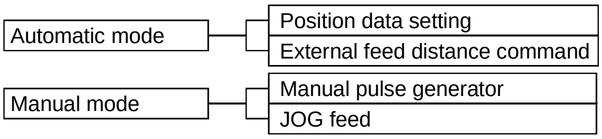
Speed Block

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

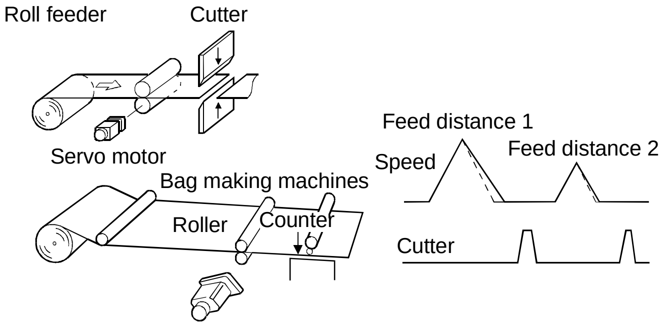
(2) Roll feeding system

(a) Main functions

1) Frequently repeated positioning
2) Two different feed distances can be specified externally as desired.
3) Direct designation of feed distance can also be made externally (when 2 stations are occupied).
4) Speed can be specified freely from among up to 8 speeds (when 1 station is occupied: 2 points, when 2 stations are occupied: 8 points).
5) Direct designation of speed can also be made externally (when 2 stations are occupied).

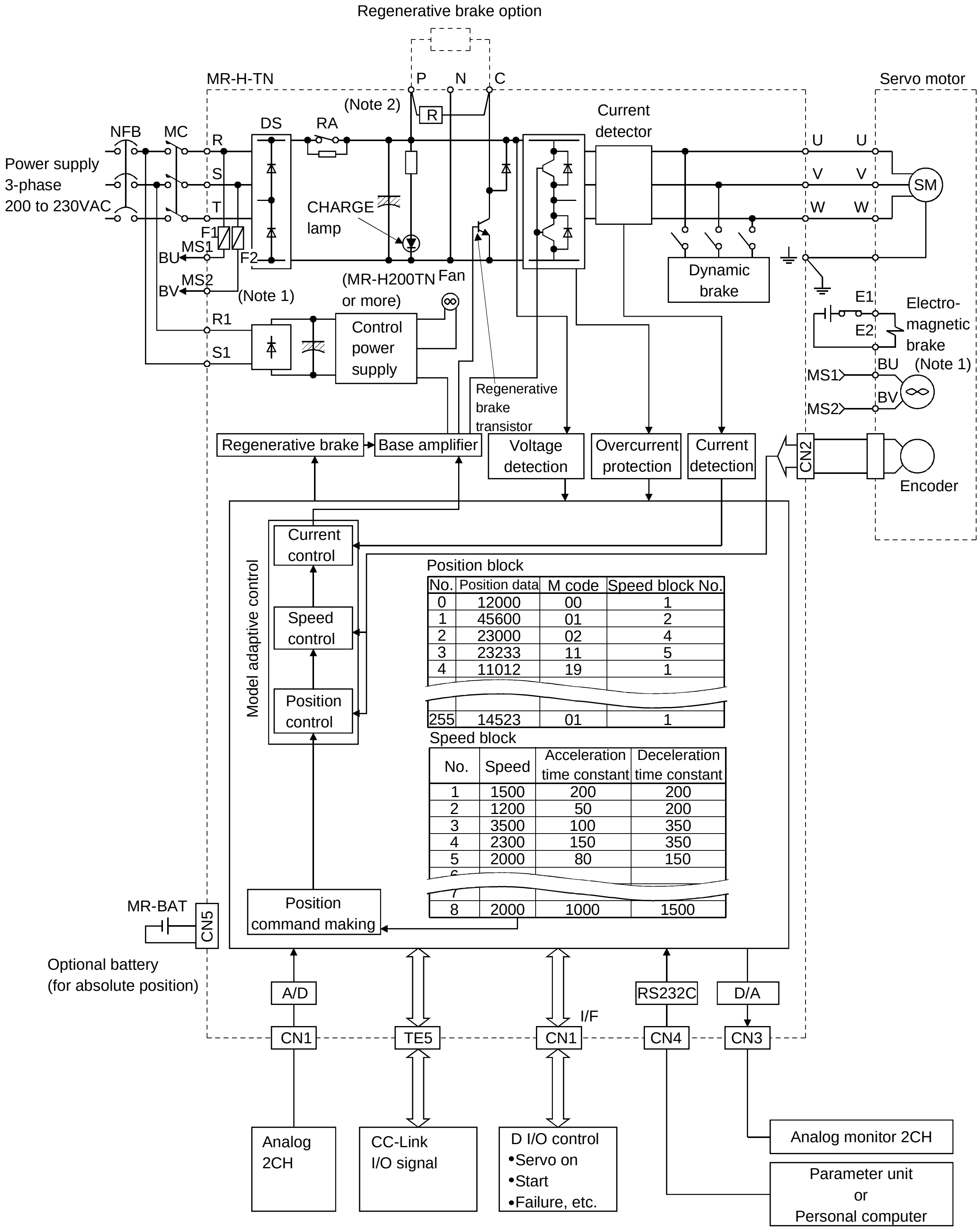


(b) Configuration example



1.1.3 Function block diagram

The function block diagram of this servo amplifier is shown on the next page.



Position block

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 block

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

Note1. For 11kw or more.

2. The built-in regenerative brake resistor is not provided for the MR-H20TN or less.

1.1.4 System configuration

This section provides operations using the MR-H□TN.
Use of CC-Link enables you to freely configure any system from a single-axis system to an up to 42-axis system. Further, you can assign external input signals to the pins of the connector CN by setting parameter No. 66. (Refer to Section 3.5.)
Data for operation are made up of the following point tables:

Position block

Item	Setting range	(Note1) Unit
Position data	−999999 to 999999	×0.001 [mm] ×0.01 [mm] ×0.1 [mm] ×1 [mm]
(Note3) M code	(Note4) 0 to 3	—
(Note3) Speed block No.	1 to 8	—

Speed block

Item	Setting range	(Note1) Unit
Motor speed	0 to max. speed	[r/min]
(Note2) Acceleration time constant	0 to 20000	[ms]
(Note 2) Deceleration time constant	0 to 20000	[ms]

Note1. Using parameter No. 4, the unit can be changed to [inch].
2. When S-pattern acceleration/deceleration is selected in parameter No. 3, the acceleration time constant in Item changes to the acceleration/deceleration time constant and the deceleration time constant changes to the S-pattern time constant.
3. Not provided for the roll feeding mode.
4. Any of 00 to 99 can be set for CC-Link operation when 2 stations are occupied.

The following table indicates the number of points that may be set in the position and speed blocks.

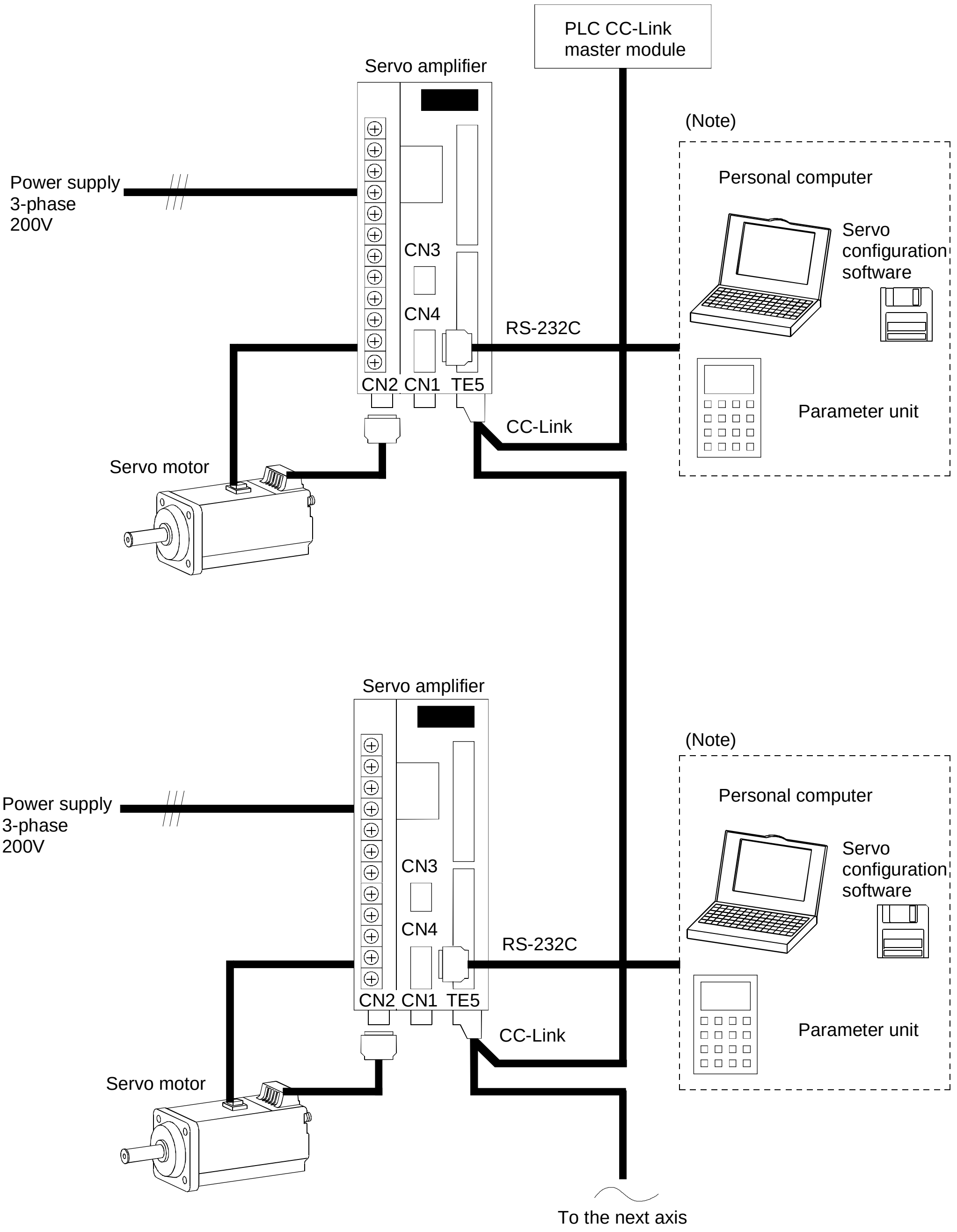
Point table	Number of points					
	Positioning system			Roll feeding system		
	When CN1 external input signals are used to specify	When CC-Link input signals are used to specify		When CN1 external input signals are used to specify	When CC-Link input signals are used to specify	
		1 station occupied	2 stations occupied		1 station occupied	2 stations occupied
Position block	8 (No.0 to 7)	8 (No.0 to 7)	256 (No.0 to 255)	2 (No.0 ▪ 1)	2 (No.0 ▪ 1)	2 (No.0 ▪ 1)
Speed block	8 (No.1 to 8)	8 (No.1 to 8)	8 (No.1 to 8)	2 (No.1 ▪ 2)	2 (No.1 ▪ 2)	8 (No.1 to 8)

(1) Operation using CC-Link communication functions

(a) Operation

All signals can be controlled by CC-Link communication. Also, each point table setting, point table selection, parameter value change, setting, monitor, servo motor operation and others can be performed.

(b) Configuration



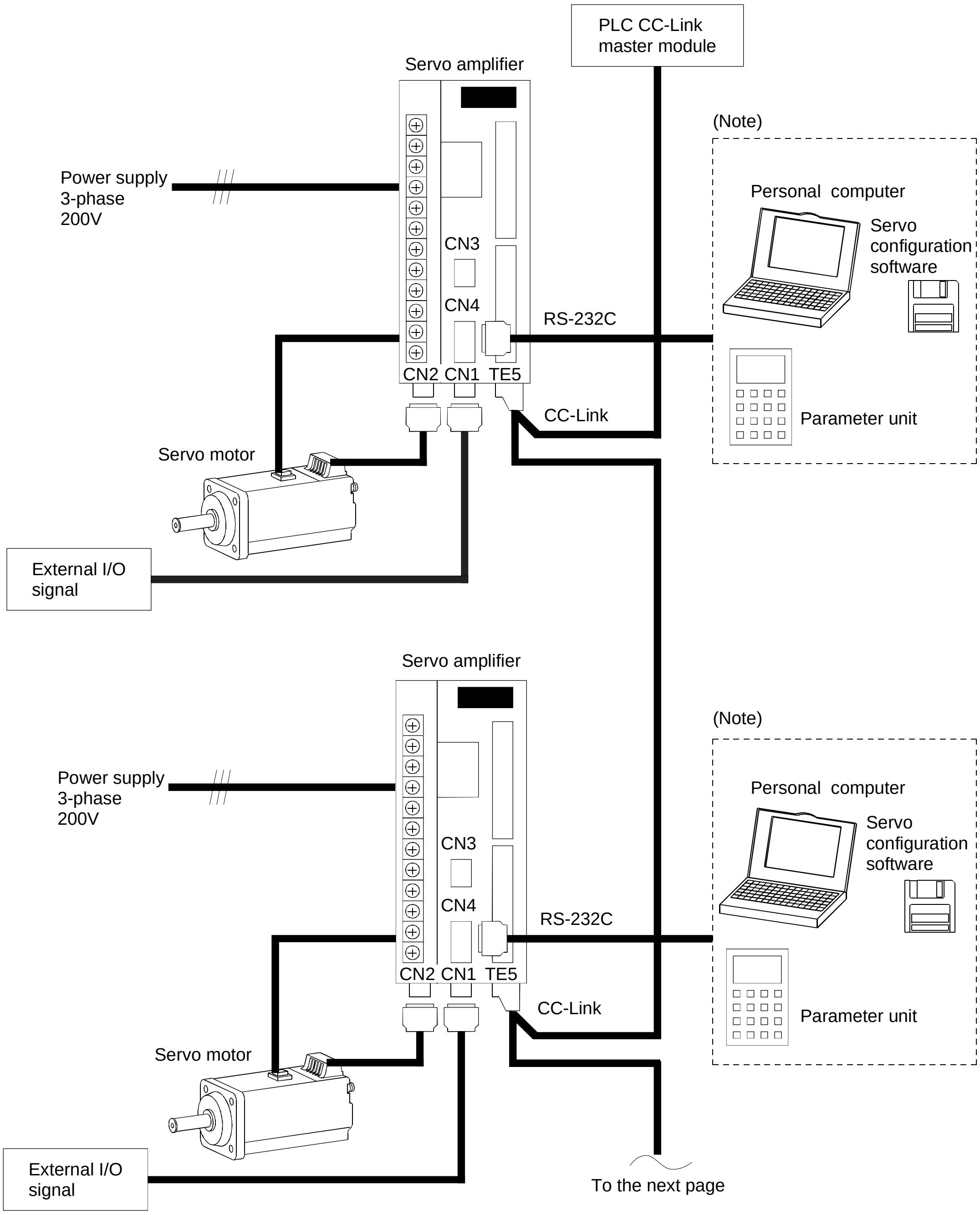
Note: Use as required.

(2) Operation using CN1 external input signals and CC-Link

(a) Operation

Using parameter No. 66, you can assign the input signals as CN1 external input signals. The signals assigned as the CN1 external input signals cannot be used with the CC-Link communication functions. The output signals can be used with both the CN1 connector and CC-Link communication functions.

(b) Configuration



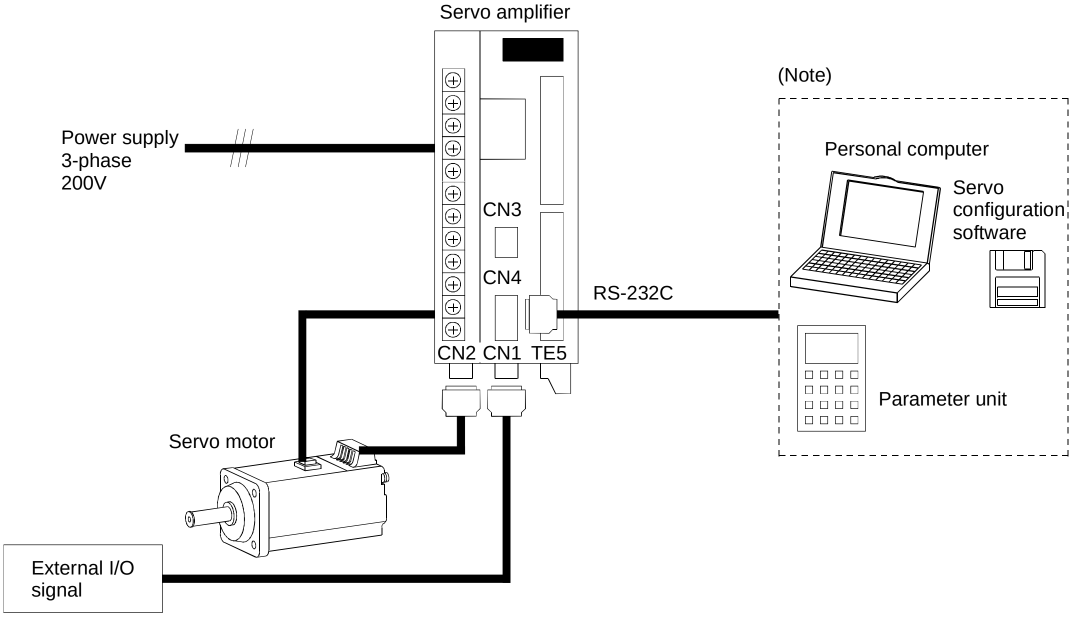
Note: Use as required.

(3) Operation not using CC-Link communication functions

(a) Operation

The following configuration example uses all signals as the CN1 external input signals and does not use the CC-Link communication functions. Using parameter No. 66, assign the signals as CN1 external input signals.

(b) Configuration



Note: Use as required.

1.2 Standard specifications

Item	Servo amplifier MR-H□TN	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 13.2											
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											
CC-Link communication function		Given in Section 3.1											
Positioning system specifications		Given in Section 4.1											
Roll Feeding system specifications		Given in Section 5.1											
Absolute position detection specifications		Given in Section 4.9											
Structure		Open (IP00)											
Environment	Ambient temperature	0 to +55 [℃] (non-freezing)											
		32 to +131 [°F] (non-freezing)											
	Ambient humidity	90%RH or less (non-condensing)											
	storage temperature	−20 to +65 [℃] (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] 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

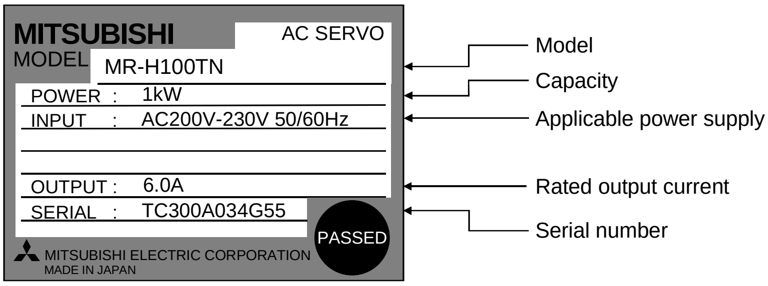
1.3 Function list

The functions of the servo amplifier are listed below. For more information on each function, refer to the corresponding chapter or section given in Detailed Explanation.

Function	Description	Refer to
Positioning by automatic operation	Operation is performed according to the values preset to the selected position blocks (travels, M codes, speed block Nos.) and speed blocks (speeds, acceleration time constants, deceleration time constants). Select the position blocks from the PLC link or external DI signals. When 1 station is occupied: 8 position blocks, 8 speed blocks When 2 stations are occupied: 256 position blocks, 8 speed blocks	Chapter 4
Roll feeding by automatic operation	Operation is performed according to the values preset to the selected position blocks (travels) and speed blocks (speeds, acceleration time constants, deceleration time constants). Select the position blocks from the PLC link or external DI signals. When 1 station is occupied: 2 position blocks, 2 speed blocks When 2 stations are occupied: 2 position blocks, 8 speed blocks	Chapter 5
Manual zeroing	Dog type, count type, data setting type, stopper type, home position ignored	Section 4.7
Automatic positioning to home position	Automatic return to home position.	Section 4.8
CC-Link operation	CC-Link communication functions allow up to 48 axes of MR-H-TN to be controlled simultaneously.	Chapter 3
Absolute position detection system	Zeroing per power-on is not needed by merely setting the home position once.	Section 4.9
Electronic gear	The electronic gear is used to make adjustment until the servo amplifier setting matches the machine travel. Also, changing the electronic gear setting allows the machine to be moved at any multiplying factor to the travel in the servo amplifier.	Parameter No. 5, 6
Real-time auto tuning	Automatic adjustment is made to set the optimum servo gains every time a start/stop is made.	Section 9.3
Manual gain adjustment	Gains can be adjusted manually if real-time auto tuning failed to provide the ideal gains.	Section 9.4
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Section 4.6 Section 5.6
Analog monitor output	The servo status is output in terms of voltage in real time.	Section 6.2.3
Alarm history	Using the parameter unit or Servo Configuration software, the alarm Nos. of the currently occurring alarm and 10 past alarms are stored and displayed.	Section 7.4
I/O signal selection	Parameter setting enables the signals used in PLC link to be assigned to the connector pins as I/O signals.	Section 3.5.6
Torque limit	The torque generated by the servo motor is limited. Parameter × 2 limit values Analog input × 1 limit value	Section 3.3.3 Section 4.3.3
Override (speed limit)	The servo motor speed is limited by analog input. Speed can be changed at the ratio of 0 to 200% to the preset speed.	Section 3.3.3 Section 4.3.3
Status display	The servo status is displayed. Up to 16 different statuses can be shown on the servo amplifier display and parameter unit.	Section 8.3
Test operation mode	JOG operation, positioning operation, motor-less operation, DO forced output, 1-step feed	Section 8.6
Limit switch	The forward rotation stroke end (RY4)/reverse rotation stroke end (RY5) can be used to set the moving region of the servo motor.	Section 7.2.4

1.4 Model name make-up

(1) Name plate



(2) Model

MR-H□ TN □□

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 servo amplifier 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.

Equivalent to CC-Link

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

1.5 Combination with servo motor

The following table lists combinations of servo amplifier 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).

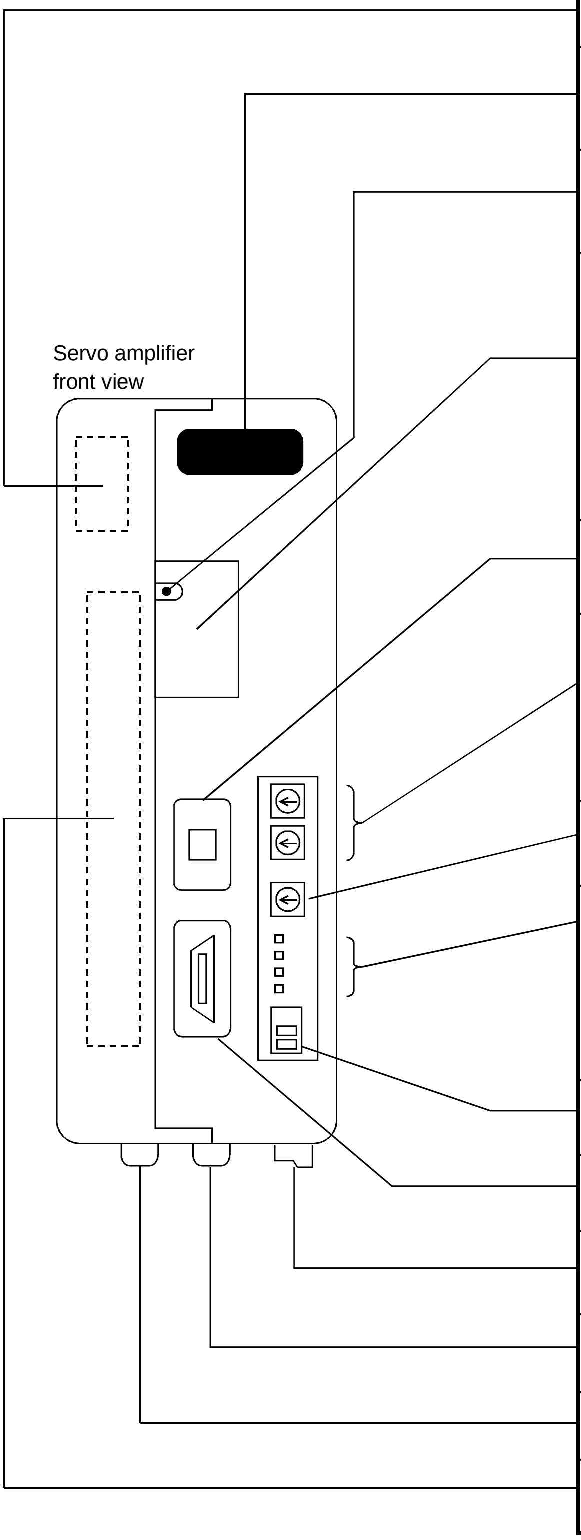
Servo amplifier	Servo motor					
	(Note) HC-KF□	HC-MF□	HA-FF□	HC-SF□		
				1000r/min	2000r/min	3000r/min
MR-H10TN	053 ▪ 13		053 ▪ 13			
MR-H20TN	23	053 ▪ 13	23			
MR-H40TN	43	23	33 ▪ 43			
MR-H60TN		43	63		52	53
MR-H100TN		73		81	102	103
MR-H200TN				121 ▪ 201	152 ▪ 202	153 ▪ 203
MR-H350TN				301	352	353
MR-H500TN					502	
MR-H700TN					702	

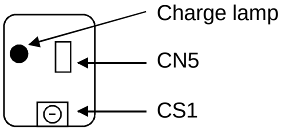
Note. When using the HC-KF series servo motor, contact us because the servo amplifier used is a special product.

Servo amplifier	Servo motor			
	HC-RF□	HC-UF□		HC-LH□
		2000r/min	3000r/min	
MR-H10TN			13	
MR-H20TN				
MR-H40TN			23	
MR-H60TN			43	52
MR-H100TN		72	73	
MR-H200TN	103 ▪ 153	152		102 ▪ 152
MR-H350TN	203	202		202
MR-H500TN	353 ▪ 503	352 ▪ 502		302 ▪ 502
MR-H700TN				702
MR-H11KTN				11K2
MR-H15KTN				15K2
MR-H22KTN				22K2

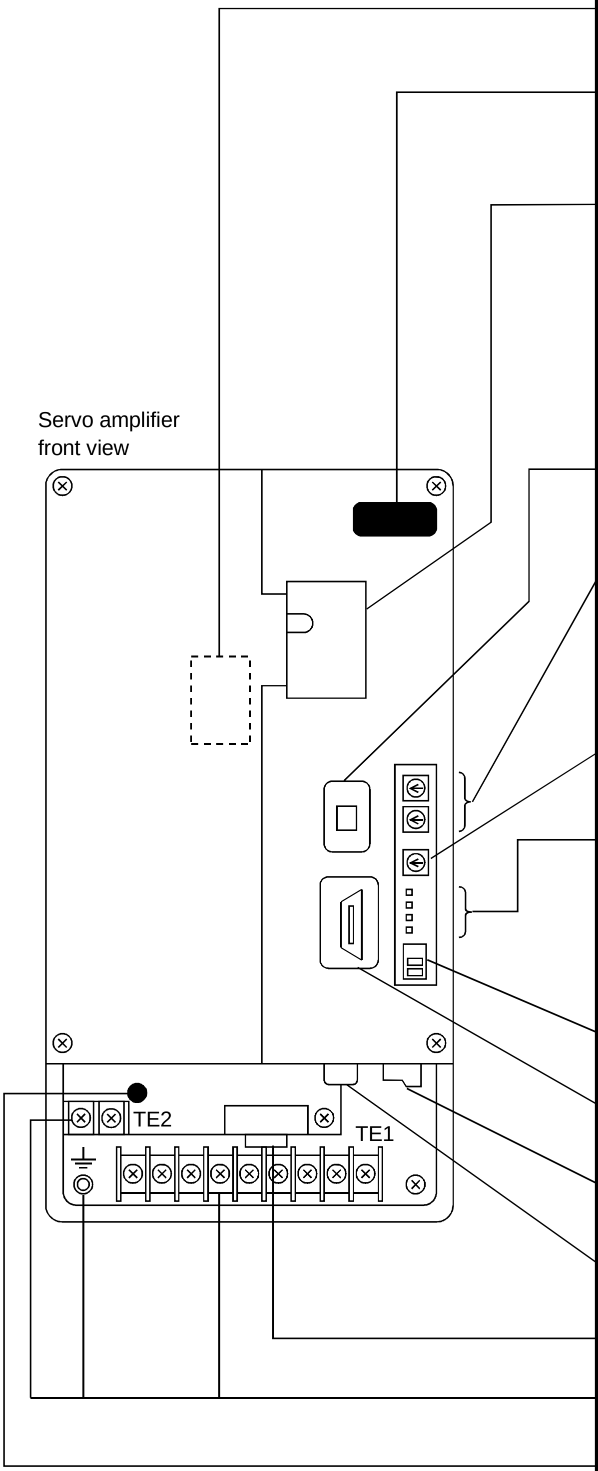
1.6 Parts identification

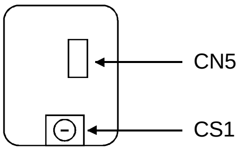
1.6.1 MR-H350TN or less



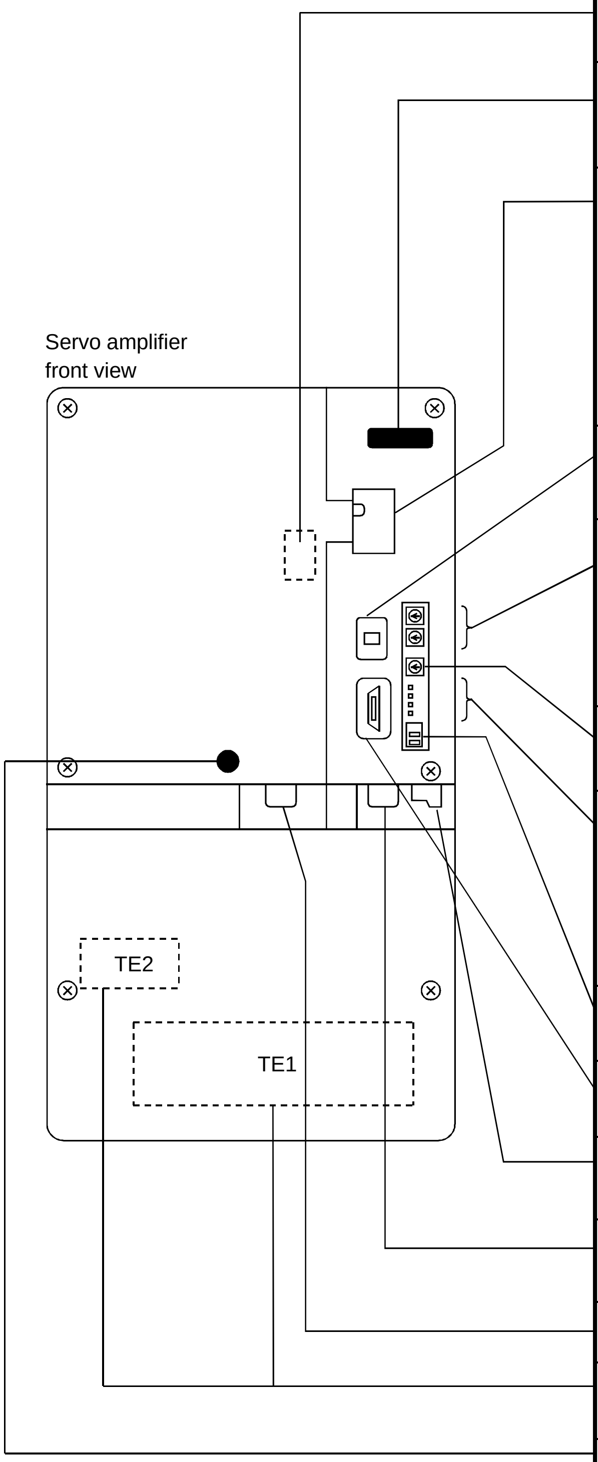
Name/Application	Refer to
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Section 8.3 Section 8.5
Charge lamp Lit to indicate that the main circuit is charged. while this lamp is lit, do not reconnect the cables.	
Switch window • CN5: Connector for connection of the battery for absolute position detection • CS1: Status indication select switch 	Section 4.9 Section 8.5
Analog monitor output connector (CN3) Used to output an analog monitor signal.	Section 5.1.1 Section 7.2.3
Station number switches (SW3,SW4) Used to set the station number of the servo amplifier. SW4: Used to set the second digit. (X10) SW3: Used to set the first digit. (X1)	Section 3.2.3
Baudrate switch (SW2) Used to chose the CC-Link communication baudrate.	Section 3.2.4
Communication alarm display Shows the alarm in CC-Link communication. ☐ RD ☐ SD ☐ L.ERR ☐ L.RUN	Section 11.3
Occupied station count switch (SW1) Used to set the number of occupied stations.	Section 3.2.5
Communication connector (CN4) Used for connection with the MR-PRU01A/personal computer.	Section 14.1.1 Chapter 15
CC-Link terminal block (TE5) Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN1) Used to connect digital I/O signal.	Section 4.3 Section 5.3
Encoder connector (CN2) Connector for connection of the servo motor encoder.	Section 14.1.6
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 6.3.2

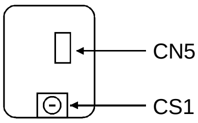
1.6.2 MR-H500TN to MR-H700TN



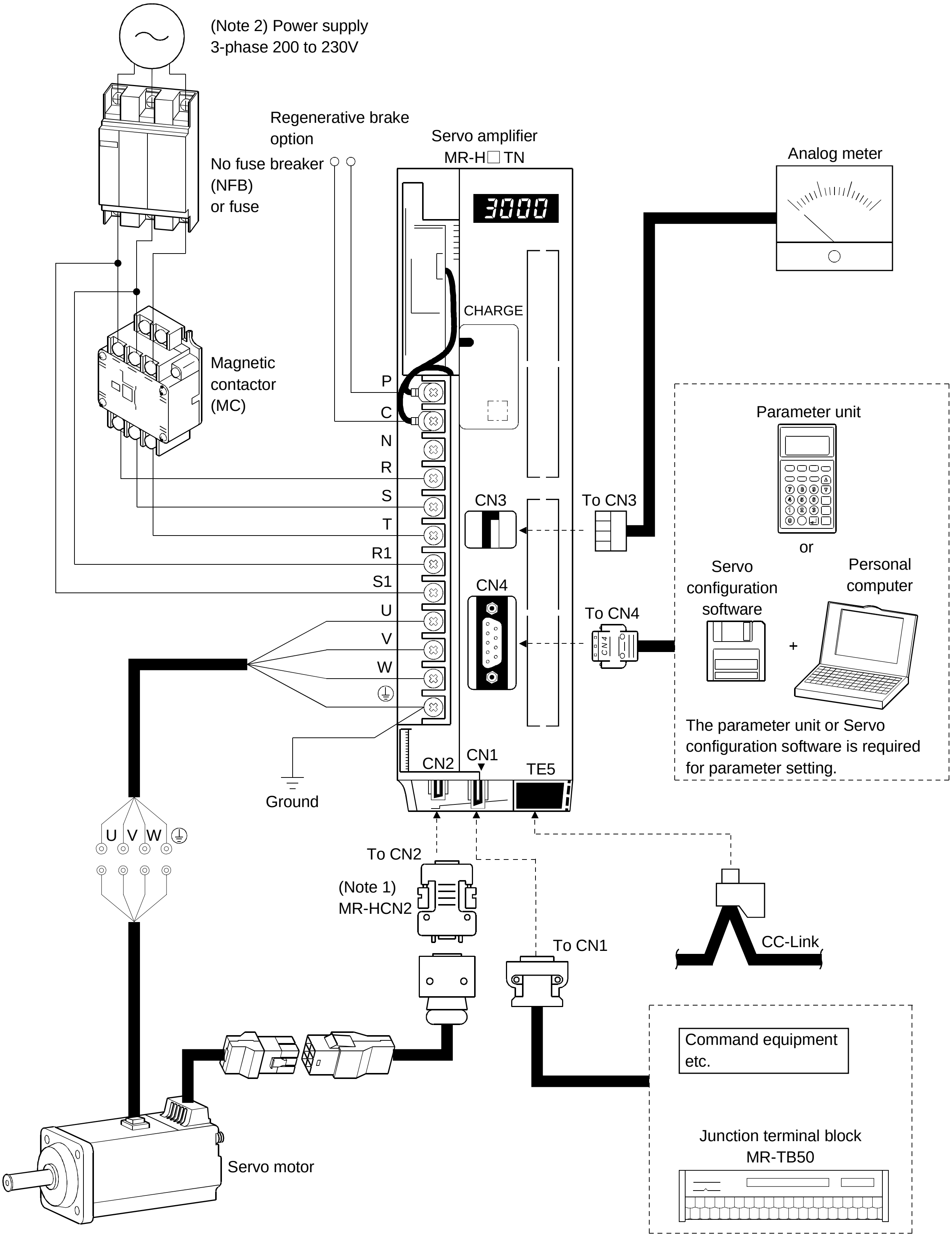
Name/Application	Refer to
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Section 8.3 Section 8.5
Switch window • CN5: Connector for connection of the battery for absolute position detection. • CS1: Status indication select switch. 	Section 4.9 Section 8.5
Analog monitor output connector (CN3) Used to output an analog monitor signal.	Section 5.1.1 Section 7.2.3
Station number switches Used to set the station number of the servo amplifier. SW4: Used to set the second digit. (X10) SW3: Used to set the first digit. (X1)	Section 3.2.3
Baudrate switch (SW2) Used to chose the CC-Link communication baudrate.	Section 3.2.4
Communication alarm display Shows the alarm in CC-Link communication. ☐ RD ☐ SD ☐ L.ERR ☐ L.RUN	Section 11.3
Occupied station count switch (SW1) Used to set the number of occupied stations.	Section 3.2.5
Communication connector (CN4) Used for connection with the MR-PRU01A/ personal computer.	Section 14.1.1 Chapter 15
CC-Link terminal block Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN1) Used to connect digital I/O signals.	Section 4.3 Section 5.3
Encoder connector (CN2) Connector for connection of the servo motor encoder	Section 14.1.6
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 6.3.2
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cable.	

1.6.3 MR-H11KTN or more



Name/Application	Refer to
Battery holder Contains the battery for absolute position data backup.	Section 4.9
Display The four-digit, seven-segment LED shows the servo status and alarm number.	Section 8.3 Section 8.5
Switch window • CN5: Connector for connection of the battery for absolute position detection • CS1: Status indication select switch 	Section 4.9 Section 8.5
Analog monitor output connector (CN3) Used to output an analog monitor signal.	Section 5.1.1 Section 7.2.3
Station number switches Used to set the station number of the servo amplifier. SW4: Used to set the second digit. (X10) SW3: Used to set the first digit. (X1)	Section 3.2.3
Baudrate switch (SW2) Used to chose the CC-Link communication baudrate.	Section 3.2.4
Communication alarm display Shows the alarm in CC-Link communication. ☐ RD ☐ SD ☐ L.ERR ☐ L.RUN	Section 11.3
Occupied station count switch (SW1) Used to set the number of occupied stations.	Section 3.2.5
Communication connector (CN4) Used for connection with MR-PRU01A/personal computer.	Section 14.1.1 Chapter 15
CC-Link terminal block Wire the CC-Link cable.	Section 3.2.2
I/O signal connector (CN1) Used to connect digital I/O signals.	Section 4.3 Section 5.3
Encoder connector (CN2) Connector for connection of the servo motor encoder.	Section 14.1.6
Main circuit terminal block (TE1) Used to connect the input power supply and servo motor.	Section 6.3.2
Charge lamp (in the front panel) Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	

1.7 Servo system with auxiliary equipment



Note: 1. Required when using the HC-FF or HC-UF 3000r/min servo motor.

2. Depends on the servo amplifier capacity. Refer to Section 12.1.

2. INSTALLATION

⚠ CAUTION

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

2.1 Environmental conditions

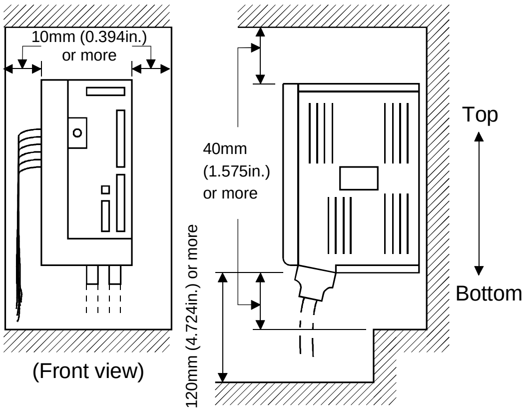
Environment	Conditions
Ambient temperature	0 to +55 [℃] (non-freezing)
	32 to +131 [℉] (non-freezing)
Ambient humidity	90%RH or less (non-condensing)
Storage temperature	−20 to +65 [℃] (non-freezing)
	−4 to +149 [℉] (non-freezing)
Storage humidity	90%RH or less (non-condensing)
Ambient	Indoors (no direct 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] or less
	19.4 [$ft./s^2$] or less

2.2 Installation direction and clearances

⚠ CAUTION

- Do not hold the front cover to transport the servo amplifier. You may drop the servo amplifier and get injured.
- The equipment must be installed in the specified direction. Otherwise, a fault may occur.
- Leave specified clearances between the servo amplifier and control box inside walls or other equipment. Otherwise, a fault may occur.

(1) Installation of one servo amplifier



(Front view)

(2) Installation of two or more servo amplifiers

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

Reserve an at least 10mm (0.394 in.) clearance between the servo amplifiers. For the MR-H10TN to MR-H60TN, 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 servo amplifier is not affected.

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

2.3 Keep out foreign materials

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

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

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

2.4 Cable stress

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

(2) In any application where the servo motor moves, the cables should be free from excessive stress. For use in any application where the servo moves, run the cables so that their flexing portions fall within the optional encoder cable range. Fix the encoder cable and power cable of the servo motor.

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

(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 13.4 for the flexing life.

MEMO

3. CC-LINK COMMUNICATION FUNCTIONS

3.1 Communication specifications

POINT

- The MR-H□TN servo amplifier is equivalent to a remote device station.

For details of the PLC side specifications, refer to the CC-Link system master module manual.

Item				Specifications
PLC side master station	Applicable CPU card			QnA(H), QnAS(H), A1S, A1SH, AnUS(H), AnN, AnA, AnU(H)
	Communication speed			10M/5M/2.5M/625k/156kbps
	Communication system			Broadcast polling system
	Synchronization system			Frame synchronization system
	Transmission path format			Bus format (conforming to EIA RS485)
	Transmission format			Conforming to HDLC
	Remote station number			1 to 64
	(Note) Max. transmission distance	Communication speed		156k to 10Mbps
		Overall distance		1200 to 50m (3934.426 to 163.934ft.)
		Interstation distance	Between master/local station and preceding/ subsequent station	2m (6.557ft.) or more
			Between remote I/O stations/ remote device stations	30cm (0.984ft.) or more (depends on communication speed)
	Error control system			CRC
	Connection cable			Twisted pair cable (3-wire type)
Number of servo amplifiers connected				Max. 42 (see Section 3.2.3)

Note. Depends on the cable used. For more information, refer to the CC-Link system master/local module user's manual.

3.2 System configuration

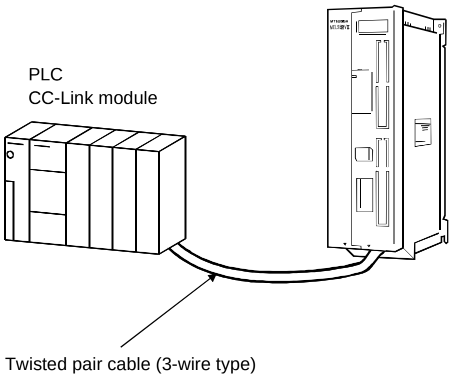
3.2.1 Configuration example

(1) PLC side

Fit “Type AJ61BT11”, “Type A1SJ61BT”, “Type AJ61QBT11” or “Type A1SJ61QBT” “Control & Communication Link system master/local module” to the main or extension base unit which is loaded with the PLC CPU used as the master station.

(2) Wiring

Connect the PLC CC-Link module master station and servo amplifier by a twisted pair cable (3-wire type).



(3) For the CPU having the automatic refresh function (Example: QnA series CPU)

Transfer of data to/from the corresponding devices is performed from a sequence ladder and the devices are automatically refreshed by the refresh buffer of the master station at the END instruction to make communications with the remote devices.

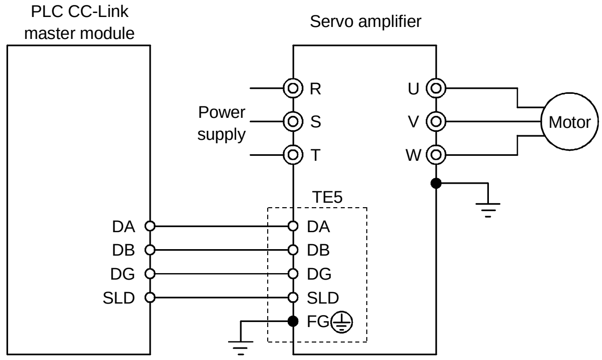
(4) For the CPU having no automatic refresh function (Example: AnA series CPU)

Transfer of data to/from the refresh buffer of the master station is performed directly from a sequence ladder to make communications with the remote devices.

3.2.2 Wiring method

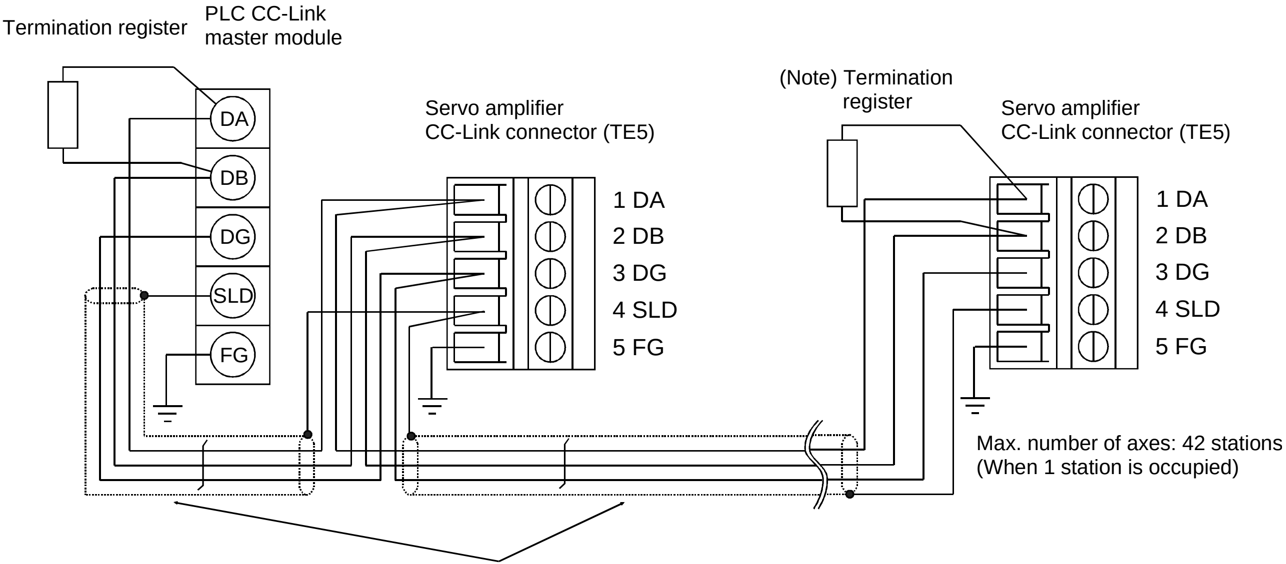
(1) Connection example

The servo amplifier and PLC CC-Link master module are wired as shown below. Refer to Section 14.2.1 (3) for the twisted pair cable used for connection.



(2) Example of connecting multiple servo units

As the remote I/O stations of CC-Link, servo amplifiers share the link system and can be controlled/monitored using PLC user programs.



(Note 2) Shielded twisted cable (3-wire type)

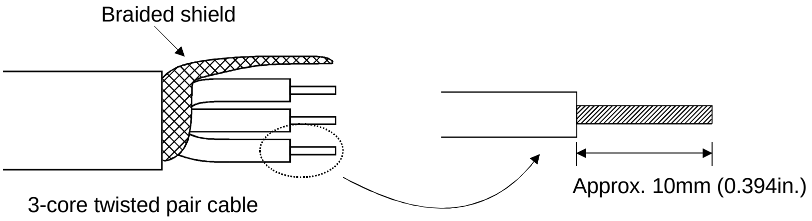
Note 1. Use the termination resistor supplied with the PLC. The resistance of the termination resistor depends on the cable used. For details, refer to the open field network CC-Link catalog (L(NA)74108143).

2. Refer to this section (4).

(3) How to wire the CC-Link terminal block (TE5)

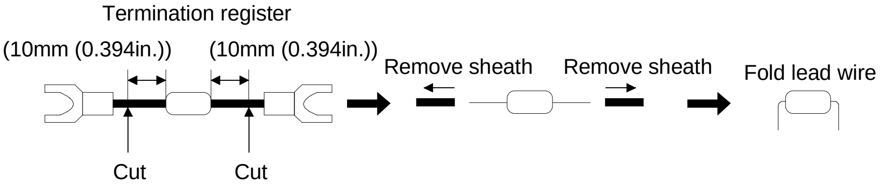
(a) Strip the sheath of the cable and separate the internal wires and braided shield.

(b) Strip the sheaths of the braided shield and internal wires and twist the cores.

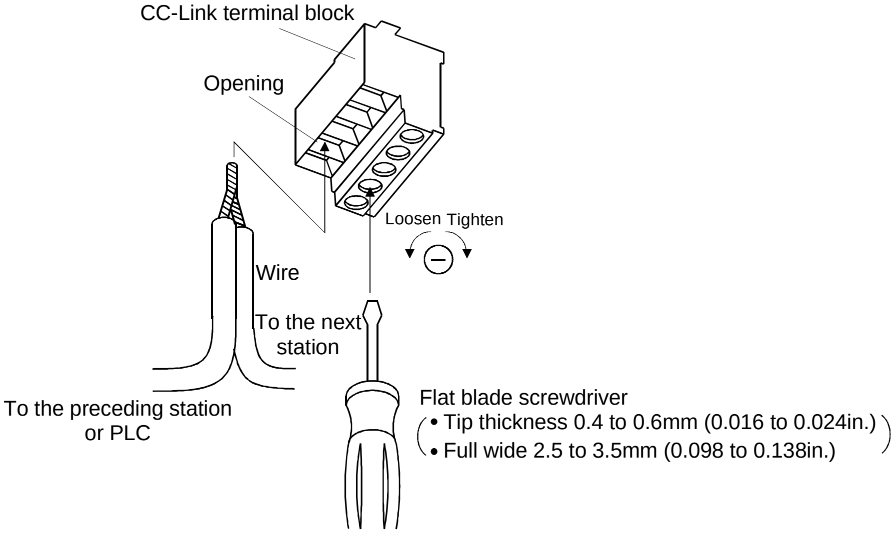


(c) Match and twist the wires and braided shield of the cable connected to the preceding axis or PLC and the corresponding wires and braided shield of the cable connected to the subsequent axis.

(d) For the last axis, work the termination resistor supplied to the CC-Link module as shown below.



(e) Insert the core of the cable into the opening and tighten it with a flat-blade screwdriver so that it will not come off. (Tightening torque: 0.5 to 0.6N・m) When inserting the wire into the opening, make sure that the terminal screw is fully loose.



POINT

・Do not solder the cores as it may cause a contact fault.

3.2.3 Station number setting

(1) How to number the stations

Set the servo station numbers before powering on the servo amplifiers. Note the following points when setting the station numbers:

(a) Station numbers may be set within the range 1 to 64.

(b) One servo amplifier occupies 1 or 2 stations. (One station of PLC remote device station)

(c) Max. number of connected units: 42

Note that the following conditions must be satisfied:

$\{(1\times a) + (2\times B) + (3\times d) + (4\times d)\} \leq 64$

a: Number of 1-station occupying units

b: Number of 2-station occupying units

c: Number of 3-station occupying units (not available for MR-H-TN)

d: Number of 4-station occupying units (not available for MR-H-TN)

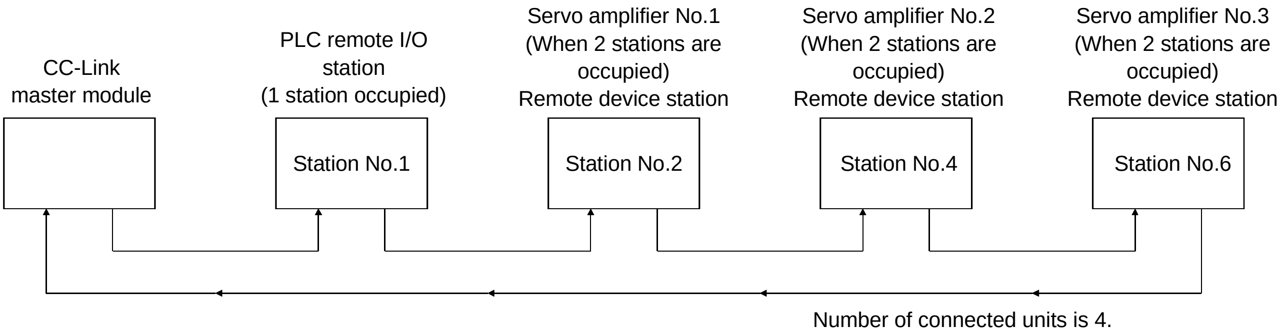
$\{(16\times A) + (54\times B) + (88\times C)\} \leq 2304$

A: Number of remote I/O stations ≤ 64

B: Number of remote device stations ≤ 42

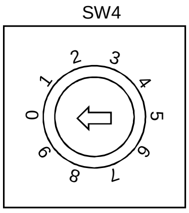
C: Number of local stations ≤ 26

(d) When the number of units connected is 4, station numbers can be set as shown below:

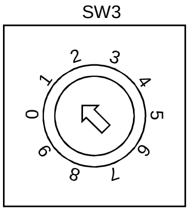


(2) Station number setting method

Set the station number with the station number switches (SW3, SW4) on the server amplifier front. The station number that may be set is any of 1 to 64 in decimal. In the initial status, the station number is set to station 1.



Set the tens. (initial value: 0)

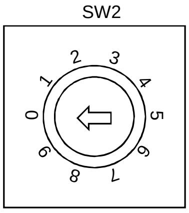


Set the units. (initial value: 1)

3.2.4 Communication baudrate setting

Set the transfer baudrate of CC-Link with the transfer baudrate switch (SW2) on the servo amplifier front. The initial value is set to 156kbps.

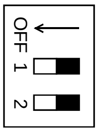
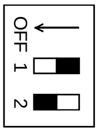
The overall distance of the system changes with the transfer speed setting. For details, refer to the CC-Link system master/local module user's manual.



No.	Baudrate
0 (initial value)	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps
5 to 9	Not used

3.2.5 Occupied station count setting

Set the number of occupied stations with the occupied station count switch (SW1) on the servo amplifier front. The usable I/O signals and the number of connectable units change with the set number of occupied stations. Refer to Section 3.5 and Section 3.2.3. In the initial status, the number of stations occupied is set to 1.

SW1 setting	Number of occupied stations
 OFF OFF (Initial value)	1 station occupied
 OFF ON	2 stations occupied

3.3 Functions

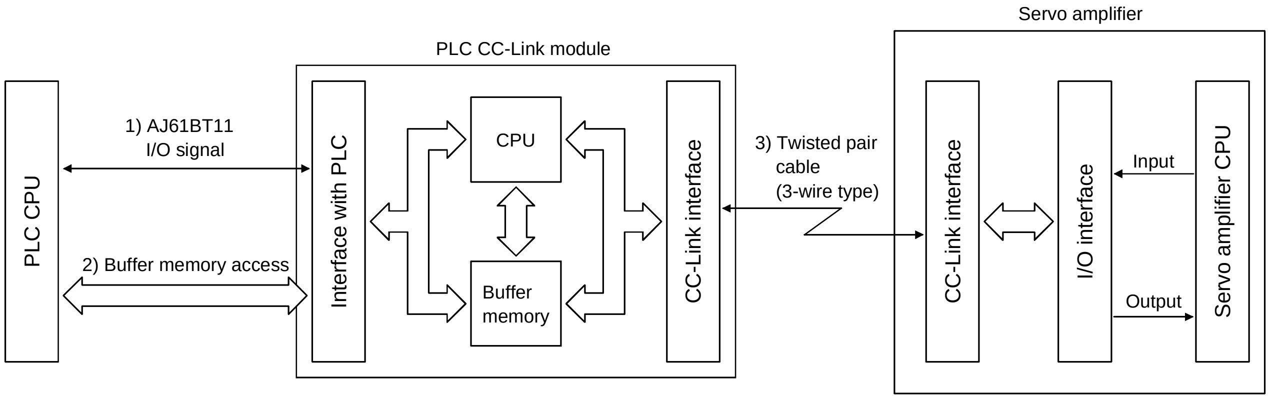
3.3.1 Function block diagram

This section explains the transfer of I/O data to/from the servo amplifier in PLC link, using function blocks.

(1) Between the master station and servo amplifier in the CC-Link system, link refresh is normally performed at intervals of 3.5 to 18ms (512 points). The link scan time of link refresh changes with the communication speed. For details, refer to the CC-Link system master/local module user's manual.

(2) The I/O refresh and master station sequence program are executed asynchronously. Some PLCs allow link scans to be synchronized with PLC scans.

(3) The FROM instruction from the buffer memory of the CC-Link system master/local module is used to read data from the servo amplifier, and the TO instruction is used to write data. Some PLCs allow automatic refresh to be set to omit the FROM and TO instructions.



3.3.2 Functions

The following table lists the functions that may be performed from the PLC in the CC-Link system in the CC-Link operation mode or parameter unit test operation mode.

Item	Operation mode	
	CC-Link operation mode	Parameter unit test operation mode
Monitor	○	○
Operation	○	
Parameter write	○	○
Parameter read	○	○
Position block data write	○	○
Position block data read	○	○
Speed block data write	○	○
Speed block data read	○	○
Alarm deactivation	(Note 1) ○	(Note 2)

Note 1. CC-Link-related alarm cannot be deactivated.

2. Occurrence of an alarm automatically causes the servo amplifier to leave the test operation mode and therefore the alarm cannot be deactivated in the CC-Link system.

3.4 Servo amplifier setting

3.4.1 Servo amplifier side operation modes

The MR-H-TN servo amplifier has the following operation modes:

Operation mode	Description
CC-Link operation mode	CC-Link communication functions are used to operate the servo with the PLC programs.
Parameter unit test operation mode	The parameter unit (MR-PRU01A) keys are operated to test-run the servo.

3.4.2 Operation mode changing

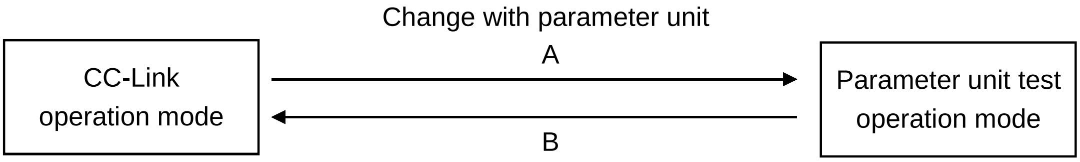
(1) Operation mode changing conditions

Change the operation mode after making sure that:

(a) The servo motor is at a stop.

(b) The forward rotation start (RYA) or reverse rotation start (RYB) is “0” (OFF).

(2) Operation mode changing method



Symbol	Changing	Description
A	CC-Link operation mode ↓ Parameter unit test operation mode	Select the test operation mode with the parameter unit.
B	Parameter unit test operation mode ↓ CC-Link operation mode	Deselect the test operation mode with the parameter unit.

3.5 I/O Signals transferred to/from the PLC CPU

3.5.1 I/O signals

(1) Positioning system

The input signals may be used as either the CC-Link or CN1 external input signals. Make selection in parameter No. 66. The output signals can be used as both the CC-Link and CN1 external input signals.

POINT

- In the factory-shipped status, the forward rotation stroke end (LSP), reverse rotation stroke end (LSN) and proximity dog (DOG) are valid as the CN1 external input signals.

(a) When 1 station is occupied

RX/RY: 32 points each, RW$_{R/W}$: 4 points each

PLC → Servo amplifier (RY)			
Device No.	Signal name	Signal abbreviation	External input CN1
RY0	Servo on	SON	12
RY1	Position block number selection bit0	DI0	13
RY2	Position block number selection bit1	DI1	14
RY3	Position block number selection bit2	DI2	15
RY4	Forward rotation stroke end	LSP	38
RY5	Reverse rotation stroke end	LSN	39
RY6	Proximity dog	DOG	37
RY7	Automatic operation/ manual drive mode	MD0	41
RY8	Temporary stop	STP	42
RY9	Zeroing	ORG	43
RYA	Forward rotation start	ST1	44
RYB	Reverse rotation start	ST2	45
RYC	Monitor output execution demand	MOR	
RYD	Instruction code execution demand	COR	
RYE	Torque limit selection	TL	
RYF to RY19			
RY1A	Reset	RES	
RY1B to RY1F			

Servo amplifier → PLC (RX)			
Device No.	Signal name	Signal abbreviation	External input CN1
RX0	Ready	RD	49
RX1	In position	INP	24
RX2	Rough match	CPO	23
RX3	Zeroing completion	ZP	25
RX4	M code bit0	MCO	(Note1) 23
RX5	M code bit1	MC1	(Note1) 24
RX6	Alarm code bit0	AC0	
RX7	Alarm code bit1	AC1	
RX8	Alarm code bit2	AC2	
RX9	Alarm code bit3	AC3	
RXA	Limiting torque	TLC	(Note2) 23
RXB	Electromagnetic brake inter lock	MBR	(Note3) 23
RXC	Monitoring	MOF	
RXD	Instruction code execution completion	COF	
RXE	Warning	WNG	
RXF to RX19			
RX1A	Trouble	ALM	48
RX1B	Remote bureau communication ready	CRD	
RX1C to RX1F			

Note 1. When using this signal as an external output signal, make M code valid in the setting of parameter No. 44.

2. When using this signal as an external output signal, make Limiting torque valid in the setting of parameter No. 44.

3. When using this signal as an external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.

PLC → Servo amplifier (RWw)	
Address No.	Signal name
RWw0	Monitor 1
RWw1	Monitor 2
RWw2	Instruction code
RWw3	Writing data

Servo amplifier → PLC (RWr)	
Address No.	Signal name
RWr0	Monitor 1 data
RWr1	Monitor 2 data
RWr2	Answer code
RWr3	Reading data

(b) When 2 stations are occupied

RX/RY: 32 points each (possible to extend to 64 points), RWr/w: 8 points each

PLC → Servo amplifier (RY)			
Device No.	Signal name	Signal abbreviation	External input CN1
RY0	Servo on	SON	12
RY1	Position block number selection bit0	DI0	13
RY2	Position block number selection bit1	DI1	14
RY3	Position block number selection bit2	DI2	15
RY4	Forward rotation stroke end	LSP	38
RY5	Reverse rotation stroke end	LSN	39
RY6	Proximity dog	DOG	37
RY7	Automatic operation/ manual drive mode	MD0	41
RY8	Temporary stop	STP	42
RY9	Zeroing	ORG	43
RYA	Forward rotation start	ST1	44
RYB	Reverse rotation start	ST2	45
RYC	Monitor output execution demand	MOR	
RYD	Instruction code execution demand	COR	
RYE	Torque limit selection	TL	
RYF			
RY10	Position instruction demand	PSR	
RY11	Speed instruction demand	SPR	
RY12	Override selection	OVR	
RY13	Manual pulse generator magnification selection bit0	HP0	
RY14	Manual pulse generator magnification selection bit1	HP1	
RY15 to RY39			
RY3A	Reset	RES	
RY19 to RY3F			

Servo amplifier → PLC (RX)			
Device No.	Signal name	Signal abbreviation	External input CN1
RX0	Ready	RD	49
RX1	In position	INP	24
RX2	Rough match	CPO	23
RX3	Zeroing completion	ZP	25
RX4			
RX5			
RX6	Alarm code bit0	AC0	
RX7	Alarm code bit1	AC1	
RX8	Alarm code bit2	AC2	
RX9	Alarm code bit3	AC3	
RXA	Limiting torque	TLC	(Note1) 23
RXB	Electromagnetic brake inter lock	MBR	(Note2) 23
RXC	Monitoring	MOF	
RXD	Instruction code execution completion	COF	
RXE	Warning	WNG	
RXF			
RX10	Position instruction execution completion	PSF	
RX11	Speed instruction execution completion	SPF	
RX12 to RX39			
RX3A	Trouble	ALM	48
RX3B	Remote bureau communication ready	CRD	
RX12 to RX3F			

Note 1. When using this signal as an external output signal, make Limiting torque valid in the setting of parameter No. 44.
2. When using this signal as an external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.

PLC → Servo amplifier (RWw)	
Address No.	Signal name
RWw0	Monitor 1
RWw1	Monitor 2
RWw2	Instruction code
RWw3	Writing data
RWw4	Position block No./Position instruction data under 16bit
RWw5	Position instruction data upper 16bit
RWw6	Speed block No./Speed instruction data
RWw7	

Servo amplifier → PLC (RWr)	
Address No.	Signal name
RWr0	Monitor 1 data under 16bit
RWr1	Monitor 1 data upper 16bit
RWr2	Answer code
RWr3	Reading data
RWr4	M code output
RWr5	Monitor 2 data under 16bit
RWr6	Monitor 2 data upper 16bit
RWr7	

(1) Roll feeding system

The input signals may be used as either the CC-Link or CN1 external input signals. Make selection in parameter No. 66. The output signals can be used as both the CC-Link and CN1 external input signals.

(a) When 1 station is occupied

RX/RY: 32 points each, RWr/w: 4 points each

PLC → Servo amplifier (RY)			
Device No.	Signal name	Signal abbreviation	External input CN1
RY0	Servo on	SON	12
RY1	Restart	DEC	13
RY2	Speed selection	JFS	14
RY3	Temporary stop	STP	15
RY4	Torque limit selection	TL	38
RY5	Second feed distance	PS2	39
RY6	Clear	CR	37
RY7	Automatic operation selection	MD0	41
RY8	Manual operation selection	MD1	42
RY9	Remote manual operation selection	MD2	43
RYA	Forward rotation start	ST1	44
RYB	Reverse rotation start	ST2	45
RYC	Monitor output execution demand	MOR	
RYD	Instruction code execution demand	COR	
RYE			
RYF to RY19			
RY1A	Reset	RES	
RY1B to RY1F			

Servo amplifier → PLC (RX)			
Device No.	Signal name	Signal abbreviation	External input CN1
RX0	Ready	RD	49
RX1	In position	INP	24
RX2	Rough match	CPO	23
RX3			
RX4			
RX5			
RX6	Alarm code bit0	AC0	
RX7	Alarm code bit1	AC1	
RX8	Alarm code bit2	AC2	
RX9	Alarm code bit3	AC3	
RXA	Limiting torque	TLC	(Note1) 23
RXB	Electromagnetic brake inter lock	MBR	(Note2) 23
RXC	Monitoring	MOF	
RXD	Instruction code execution completion	COF	
RXE	Warning	WNG	
RXF to RX19			
RX1A	Trouble	ALM	48
RX1B	Remote bureau communication ready	CRD	
RX1C to RX1F			

Note 1. When using this signal as an external output signal, make Limiting torque valid in the setting of parameter No. 44.

2. When using this signal as an external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.

PLC → Servo amplifier (RWw)	
Address No.	Signal name
RWw0	Monitor 1
RWw1	Monitor 2
RWw2	Instruction code
RWw3	Writing data

Servo amplifier → PLC (RWr)	
Address No.	Signal name
RWr0	Monitor 1 data
RWr1	Monitor 2 data
RWr2	Answer code
RWr3	Reading data

(b) When 2 stations are occupied

RX/RY: 32 points each (possible to extend to 64 points), RWr/w: 8 points each

PLC → Servo amplifier (RY)			
Device No.	Signal name	Signal abbreviation	External input CN1
RY0	Servo on	SON	12
RY1	Restart	DEC	13
RY2	Speed selection	JFS	14
RY3	Temporary stop	STP	15
RY4	Torque limit selection	TL	38
RY5	Second feed distance	PS2	39
RY6	Clear	CR	37
RY7	Automatic operation selection	MD0	41
RY8	Manual operation selection	MD1	42
RY9	Remote manual operation selection	MD2	43
RYA	Forward rotation start	ST1	44
RYB	Reverse rotation start	ST2	45
RYC	Monitor output execution demand	MOR	
RYD	Instruction code execution demand	COR	
RYE			
RYF			
RY10			
RY11	Speed instruction demand	SPR	
RY12	Override selection	OVR	
RY13	Manual pulse generator magnification selection bit0	HP0	
RY14	Manual pulse generator magnification selection bit1	HP1	
RY15 to RY39			
RY3A	Reset	RES	
RY3B to RY3F			

Servo amplifier → PLC (RX)			
Device No.	Signal name	Signal abbreviation	External input CN1
RX0	Ready	RD	49
RX1	In position	INP	24
RX2	Rough match	CPO	23
RX3			
RX4			
RX5			
RX6	Alarm code bit0	AC0	
RX7	Alarm code bit1	AC1	
RX8	Alarm code bit2	AC2	
RX9	Alarm code bit3	AC3	
RXA	Limiting torque	TLC	(Note1) 23
RXB	Electromagnetic brake inter lock	MBR	(Note2) 23
RXC	Monitoring	MOF	
RXD	Instruction code execution completion	COF	
RXE	Warning	WNG	
RXF			
RX10			
RX11	Speed instruction execution completion	SPF	
RX12 to RX39			
RX3A	Trouble	ALM	48
RX3B	Remote bureau communication ready	CRD	
RX3C to RX3F			

Note 1. When using this signal as an external output signal, make Limiting torque valid in the setting of parameter No. 44.
2. When using this signal as an external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.

PLC → Servo amplifier (RWw)	
Address No.	Signal name
RWw0	Monitor 1
RWw1	Monitor 2
RWw2	Instruction code
RWw3	Writing data
RWw4	Position instruction data under 16bit
RWw5	Position instruction data upper 16bit
RWw6	Speed block No./Speed instruction data
RWw7	

Servo amplifier → PLC (RWR)	
Address No.	Signal name
RWR0	Monitor 1 data under 16bit
RWR1	Monitor 1 data upper 16bit
RWR2	Answer code
RWR3	Reading data
RWR4	
RWR5	Monitor 2 data under 16bit
RWR6	Monitor 2 data upper 16bit
RWR7	

3.5.2 Detailed explanation of I/O signals

> **POINT**
>
> - ON/OFF in the explanation of the signals indicates the status when the I/O signals are used as the CN1 external signals. ON of the input signal indicates that the corresponding pin and SG are shorted, and OFF indicates that they are opened. ON of the output signal indicates that the corresponding pin and SG conduct and OFF indicates that they do not conduct.

(1) Positioning system

(a) Input signals

The I/O Input CN1 field indicates the pin number that may be assigned to the CN1 connector when the signal is used as the CN1 external input signal. The signal whose Device No. field has an oblique line cannot be used in CC-Link.

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Servo on</td><td>Turning RY0 to “1” (ON) powers on the base circuit, making operation ready to start.
Turning it to “0” (OFF) powers off the base circuit, coasting the servo motor.</td><td>RY0</td><td>RY0</td><td>12</td></tr>
<tr><td>Position block number selection bit0</td><td rowspan="3">RY1, RY2 and RY3 are combined to choose the position block No.
<table>
<tr><th colspan="3">(Note) Input signal</th><th rowspan="2">Position block No.</th></tr>
<tr><th>RY3</th><th>RY2</th><th>RY1</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>5</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>7</td></tr>
</table>
Note. 0: OFF 1: ON</td><td>RY1</td><td></td><td>13</td></tr>
<tr><td>Position block number selection bit1</td><td>RY2</td><td></td><td>14</td></tr>
<tr><td>Position block number selection bit2</td><td>RY3</td><td></td><td>15</td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Forward rotation stroke end</td><td rowspan="2">In the factory-shipped status, the forward rotation stroke end is valid as the external input signal (CN1-38) and the reverse rotation stroke end is valid as the external input signal (CN1-39).
When starting operation, short CN1-38 - SG and CN1-39 - SG. Opening them causes a sudden stop, resulting in servo lock.
For use in CC-Link, make it usable in parameter No. 66.
When starting operation, turn RY4/RY5 to “1” (ON). Turning it to “0” (OFF) causes a sudden stop, resulting in servo lock.
When not using the forward/reverse rotation stroke end, set “Automatic ON internally” in parameter No. 42.
<table>
<tr><th colspan="2">(Note) Input signal</th><th colspan="2">Operation</th></tr>
<tr><th>RY4</th><th>RY5</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: OFF 1: ON</td><td>RY4</td><td>RY4</td><td>38</td></tr>
<tr><td>Reverse rotation stroke end</td><td>RY5</td><td>RY5</td><td>39</td></tr>
<tr><td>Proximity dog</td><td>In the factory-shipped status, the proximity dog is valid as the external input signal (CN1-37). For use in CC-Link, make it usable in parameter No. 66.
<table>
<tr><th>Parameter No.9</th><th>(Note) Polarity of proximity dog detection</th></tr>
<tr><td>□0□□</td><td>0</td></tr>
<tr><td>□1□□ (Initial value)</td><td>1</td></tr>
</table>
Note. 0: OFF 1: ON</td><td>RY6</td><td>RY6</td><td>37</td></tr>
<tr><td>Automatic operation/manual drive mode</td><td>RY7 and RY9 are combined to choose the operation mode.
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Operation mode</th></tr>
<tr><th>RY7</th><th>RY9</th></tr>
<tr><td>1</td><td>0</td><td>Automatic operation mode</td></tr>
<tr><td>0</td><td>0</td><td>Automatic operation mode</td></tr>
<tr><td>0</td><td>1</td><td>Zeroing mode</td></tr>
<tr><td>1</td><td>1</td><td>Automatic positioning mode to home position</td></tr>
</table>
Note. 0: OFF 1: ON</td><td>RY7</td><td>RY7</td><td>41</td></tr>
<tr><td>Temporary stop</td><td>Turning RY8 from “0” (OFF) to “1” (ON) and keeping it in that status for longer than 5ms suspends operation. Turning the start signal RYA or RYB from “0” (OFF) to “1” (ON) again resumes operation from where it stopped.</td><td>RY8</td><td>RY8</td><td>42</td></tr>
<tr><td>Zeroing</td><td>Turn RY9 to “1” (ON) to choose the zeroing mode, or to “0” (OFF) to choose the automatic or manual operation mode. (Refer to RY7.)</td><td>RY9</td><td>RY9</td><td>43</td></tr>
</table>

Signal name	Description	Device No.		I/O input CN1
		1 station occupied	2 stations occupied	
Forward rotation start	In incremental value command system Turning this signal to “1” (ON) in the automatic operation mode starts forward rotation. Turning this signal to “1” (ON) in the zeroing mode starts zeroing. Turning this signal to “1” (ON) in the JOG operation mode performs forward rotation while it is shorted. Turning this signal from “0” (OFF) to “1” (ON) during a temporary stop resumes operation over the remaining distance. Forward rotation indicates the address increasing direction.	RYA	RYA	44
	In absolute value command system Turning this signal to “1” (ON) in the automatic operation mode starts operation. Turning this signal to “1” (ON) in the zeroing mode starts zeroing. Turning this signal to “1” (ON) in the JOG operation mode performs forward rotation while it is shorted. Turning this signal from “0” (OFF) to “1” (ON) during a temporary stop resumes operation over the remaining distance. Forward rotation indicates the address increasing direction.			
Reverse rotation start	This signal is used with the incremental value command only. It is not used with the absolute value command. Turning this signal to “1” (ON) in the automatic operation mode starts reverse rotation. Turning this signal to “1” (ON) in the JOG operation mode performs reverse rotation while it is shorted. Turning this signal from “0” (OFF) to “1” (ON) during a temporary stop resumes operation over the remaining distance. Reverse rotation indicates the address decreasing direction.	RYB	RYB	45
Monitor output execution demand	Turning RYC to “1” (ON) sets the following data/signals. At the same time, RXC turns to “1” (ON). While RYC is “1” (ON), the monitor values are always updated. 1) When 1 station is occupied Remote register RW_{R0}: Data requested by monitor 1 (RW_{W0}) Remote register RW_{R1}: Data requested by monitor 2 (RW_{W1}) Remote register RW_{R2}: Normal or error answer code 2) When 2 stations are occupied Remote register RW_{R0}: Lower 16 bits of data requested by monitor 1 (RW_{W0}) Remote register RW_{R1}: Upper 16 bits of data requested by monitor 1 (RW_{W0}) Remote register RW_{R5}: Lower 16 bits of data requested by monitor 2 (RW_{W2}) Remote register RW_{R6}: Upper 16 bits of data requested by monitor 2 (RW_{W2}) Remote register RW_{R2}: Normal or error answer code Refer to Section 3.6.1 for details.	RYC	RYC	

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Instruction code execution demand</td><td>Turning RYD to “1” (ON) executes the processing corresponding to the instruction code set to the remote register RW_{W2}.
After completion of instruction code execution, a normal or error answer code is set to RW_{R2}. At the same time, RXD turns to “1” (ON).
Refer to Section 3.6.2 for details.</td><td>RYD</td><td>RYD</td><td></td></tr>
<tr><td>Torque limit selection</td><td>Turning RYE to “1” (ON) limits the generated torque according to the voltage of the torque limit command (TLAP).
Turning it to “0” (OFF) makes the parameter No. 40 setting valid.</td><td>RYE</td><td>RYE</td><td></td></tr>
<tr><td>Position instruction demand</td><td>Turning RY10 to “1” (ON) sets the position block No. or position command data set to the remote register RW_{W4}/RW_{W5}.
When it is set to the servo amplifier, the normal or error answer code is set to RW_{R2}. At the same time, RX10 turns to “1” (ON).
Refer to Section 3.6.3 for details.</td><td></td><td>RY10</td><td></td></tr>
<tr><td>Speed instruction demand</td><td>Turning RY11 to “1” (ON) sets the speed block No. or speed command data set to the remote register RW_{W6}.
When it is set to the servo amplifier, the normal or error answer code is set to RW_{R2}. At the same time, RX11 turns to “1” (ON).
Refer to Section 3.6.3 for details.</td><td></td><td>RY11</td><td></td></tr>
<tr><td>Override selection</td><td>Used to select whether the override (OVR) analog input signal is made valid or invalid.
<table>
<tr><th>(Note) RY12</th><th>Speed change value</th></tr>
<tr><td>0</td><td>No change</td></tr>
<tr><td>1</td><td>Override (OVR) setting is valid.</td></tr>
</table>
Note. 0: OFF 1: ON</td><td></td><td>RY12</td><td></td></tr>
<tr><td>Manual pulse generator magnification selection bit0</td><td rowspan="2">When using this signal, set “□□□4” in parameter No. 30 to make the manual pulse generator multiplying factor selection signal valid.
Turning RY13 and RY14 to “1” (ON)/“0” (OFF) changes the multiplying factor of the manual pulse generator.
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Multiplying factor</th></tr>
<tr><th>RY14</th><th>RY13</th></tr>
<tr><td>0</td><td>0</td><td>×1</td></tr>
<tr><td>0</td><td>1</td><td>×10</td></tr>
<tr><td>1</td><td>0</td><td>×100</td></tr>
</table>
Note. 0: OFF 1: ON</td><td></td><td>RY13</td><td></td></tr>
<tr><td>Manual pulse generator magnification selection bit1</td><td></td><td>RY14</td><td></td></tr>
<tr><td>Reset</td><td>Keeping this signal “1” (ON) for longer than 20ms deactivates any of the following alarms. The base circuit is off while the signal is “1” (ON).
<table>
<tr><th>Indication</th><th>Name</th><th>Indication</th><th>Name</th></tr>
<tr><td>AL.10</td><td>Under voltage</td><td rowspan="2">AL.45</td><td rowspan="2">Main circuit device overheat</td></tr>
<tr><td>AL.24</td><td>Ground fault</td></tr>
<tr><td>AL.31</td><td>Over speed</td><td rowspan="2">AL.46</td><td rowspan="2">Servo motor overheat</td></tr>
<tr><td>AL.32</td><td>Over current</td></tr>
<tr><td>AL.33</td><td>Over voltage</td><td>AL.52</td><td>Error excessive</td></tr>
<tr><td rowspan="2">AL.35</td><td rowspan="2">Command pulse frequency alarm</td><td>AL.8D</td><td>CC-Link alarm</td></tr>
<tr><td>AL.8E</td><td>RS-232C alarm</td></tr>
<tr><td>AL.42</td><td>Feedback alarm</td><td>AL.8F</td><td>RS-422 alarm</td></tr>
</table></td><td>RY1A</td><td>RY3A</td><td></td></tr>
</table>

Signal name	Description	Device No.		I/O input CN1
		1 station occupied	2 stations occupied	
Forced stop	This signal may be used as the external input signal only. It cannot be used in CC-Link. Opening CN1-46 and SG places the servo amplifier in a forced stop status, causing servo off and operating the dynamic brake to make a sudden stop. Shorting CN1-46 and SG causes the servo amplifier to leave the forced stop status.			46

(b) Output signals

The I/O Input CN1 field indicates the pin number that may be assigned to the CN1 connector when the signal is used as the CN1 external output signal. The device number whose Device No. field has an oblique line cannot be used in CC-Link.

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Ready</td><td>This signal turns to “1” (ON) when the servo amplifier is ready to operate without any failure after servo-on.</td><td>RX0</td><td>RX0</td><td>49</td></tr>
<tr><td>In position</td><td>This signal turns to “1” (ON) when the droop pulse value has become less than the in-position range set in the parameter.
This signal is not output while the base circuit is off.</td><td>RX1</td><td>RX1</td><td>24</td></tr>
<tr><td>Rough match</td><td>This signal turns to “1” (ON) when the command remaining distance has become less than the rough match output range set in the parameter.
This signal is not output while the base circuit is off.</td><td>RX2</td><td>RX2</td><td>23</td></tr>
<tr><td>Zeroing completion</td><td>This signal turns to “1” (ON) on completion of zeroing.
In the absolute position system, this signal turns to “1” (ON) when operation is ready to start, but it turns to “0” (OFF) if:
1) Servo on (RY0) is turned to “0” (OFF);
2) Forced stop (CN1-46) is made valid;
3) Reset (RY1A or RY3A) is turned to “1” (ON);
4) Alarm occurs; or
5) Forward rotation stroke end (RY4) ▪ reverse rotation stroke end (RY5) is turned to “0” (OFF).</td><td>RX3</td><td>RX3</td><td>25</td></tr>
<tr><td>M code bit0</td><td rowspan="2">The M code is output to RX4 and RX5 in 2-bit binary.
<table>
<tr><th rowspan="2">M code</th><th colspan="2">(Note) Output signal</th></tr>
<tr><th>RX5</th><th>RX4</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: OFF 1: ON
When using these signals as the external output signals, make the M code valid in the setting of parameter No. 44.</td><td>RX4</td><td></td><td>23</td></tr>
<tr><td>M code bit1</td><td>RX5</td><td></td><td>24</td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Alarm code bit0</td><td rowspan="4">The alarm code is output to RX6, RX7, RX8 and RX9 in 4-bit binary.
Refer to Section 11.4.1.</td><td>RX6</td><td>RX6</td><td></td></tr>
<tr><td>Alarm code bit1</td><td>RX7</td><td>RX7</td><td></td></tr>
<tr><td>Alarm code bit2</td><td>RX8</td><td>RX8</td><td></td></tr>
<tr><td>Alarm code bit3</td><td>RX9</td><td>RX9</td><td></td></tr>
<tr><td>Limiting torque</td><td>This signal turns to “1” (ON) when the torque limit value set internally or externally is reached.
When using this signal as the external output signal, make Limiting torque valid in the setting of parameter No. 44.</td><td>RXA</td><td>RXA</td><td>23</td></tr>
<tr><td>Electromagnetic brake inter lock</td><td>The electromagnetic brake interlock signal is output.
RXB turns to “0” (OFF) at servo-off or alarm occurrence.
When using this signal as the external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.</td><td>RXB</td><td>RXB</td><td>23</td></tr>
<tr><td>Monitoring</td><td>Refer to Monitor output execution demand.</td><td>RXC</td><td>RXC</td><td></td></tr>
<tr><td>Instruction code execution completion</td><td>Refer to Instruction code execution demand.</td><td>RXD</td><td>RXD</td><td></td></tr>
<tr><td>Warning</td><td>RXE turns to “1” (ON) if a warning occurs in the servo amplifier. The outputs corresponding to the servo statuses are indicated below.
<table>
<tr><th>Servo status</th><th>(Note) RXE</th></tr>
<tr><td>Normal status</td><td>1</td></tr>
<tr><td>Power off</td><td>1</td></tr>
<tr><td>Warning occurrence</td><td>0</td></tr>
<tr><td>Failure occurrence</td><td>1</td></tr>
<tr><td>Servo off</td><td>1</td></tr>
<tr><td>Forced stop valid</td><td>0</td></tr>
</table>
Note. 0: OFF 1: ON</td><td>RXE</td><td>RXE</td><td></td></tr>
<tr><td>Position instruction execution completion</td><td>Refer to Position instruction execution demand (RY10).</td><td></td><td>RX10</td><td></td></tr>
<tr><td>Speed instruction execution completion</td><td>Refer to Speed instruction execution demand (RY11).</td><td></td><td>RX11</td><td></td></tr>
<tr><td>Trouble</td><td>When the trouble signal is used in CC-Link, it turns to “1” (ON) at alarm occurrence or the like. Since the external dynamic brake is used, setting “□ 1 □ □” in parameter No. 3 changes the output signal corresponding to the servo status.
<table>
<tr><th rowspan="4">Servo status</th><th colspan="3">RX1A or RX3A</th></tr>
<tr><th colspan="3">Parameter setting</th></tr>
<tr><th colspan="2">No.3</th><th>No.44</th></tr>
<tr><th>□0□□</th><th>(Note)□1□□</th><th>(Note)□□1□</th></tr>
<tr><td>Normal status</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Power off</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Warning occurrence</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Failure occurrence</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Servo off</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Forced stop valid</td><td>0</td><td>1</td><td>1</td></tr>
</table>
Note. Cannot be set simultaneously. Simultaneous setting results in alarm (AL.37).</td><td>RX1A</td><td>RX3A</td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Trouble</td><td>When the trouble signal is used as the CN1 external output signal, it turns OFF at alarm occurrence or the like. Since the external dynamic brake is used, setting "□ 1 □ □" in parameter No. 3 changes the output signal corresponding to the servo status.
<table>
<tr><th rowspan="4">Servo status</th><th colspan="3">CN1-48</th></tr>
<tr><th colspan="3">Parameter setting</th></tr>
<tr><th colspan="2">No.3</th><th>No.44</th></tr>
<tr><th>□0□□</th><th>(Note)□1□□</th><th>(Note)□□1□</th></tr>
<tr><td>Normal status</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Power off</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Warning occurrence</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>Failure occurrence</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Servo off</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Forced stop valid</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
</table>
Note. 1. ON: 48-SG conducting, OFF: 48-SG not conducting
2. Cannot be set simultaneously. Simultaneous setting results in alarm (AL.37).</td><td></td><td></td><td>48</td></tr>
<tr><td>Remote bureau communication ready</td><td>This signal turns to "1" (ON) at power-on or to "0" (OFF) in either of the following statuses:
<table>
<tr><th>Servo status</th><th>(Note1) RX1B or RX3B</th></tr>
<tr><td>Failure occurrence</td><td>0</td></tr>
<tr><td>(Note2) Reset ON status</td><td>0</td></tr>
</table>
Note1. 0: OFF 1: ON
2. When 1 station is occupied: RY1A,
When 2 stations are occupied: RY3A</td><td>RX1B</td><td>RX3B</td><td></td></tr>
</table>

(c) Remote registers

The signal whose Remote Register field has an oblique line cannot be used.

1) Input (PLC → servo amplifier)

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RW_{W0}	RW_{W0}	Monitor 1	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied Setting the code of the status indication item to be monitored to RW_{W0} and turning RYC to "1" (ON) sets data to RW_{R0}. 2) When 2 stations are occupied Setting the code of the status indication item to be monitored to RW_{W0} and turning RYC to "1" (ON) sets data to RW_{R0}. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYC to "1" (ON) sets the lower 16-bit data to RW_{R0} and the upper 16-bit data to RW_{R1}. Refer to Section 3.5.3 for the status indication item.	0000 to 001A

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RW_{w1}	RW_{w1}	Monitor 2	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied Setting the code of the status indication item to be monitored to RW_{w1} and turning RYC to "1" (ON) sets data to RW_{R1}. 2) When 2 stations are occupied When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYC to "1" (ON) sets the lower 16-bit data to RW_{R5} and the upper 16-bit data to RW_{R6}. Refer to Section 3.5.3 for the status indication item.	0000 to 001A
RW_{w2}	RW_{w2}	Instruction code	Sets the instruction code used to perform parameter or point table data read, alarm reference or the like. Setting the instruction code to RW_{w2} and turning RYD to "1" (ON) executes the instruction. RXD turns to "1" (ON) on completion of instruction execution. Refer to Section 3.5.4 for instruction code definitions.	Refer to Section 3.5.4 (1).
RW_{w3}	RW_{w3}	Writing data	Sets the written data used to perform parameter or point table data write, alarm history clear or the like. Setting the written data to RW_{w3} and turning RYD to "1" (ON) writes the data to the servo amplifier. RXD turns to "1" (ON) on completion of write. Refer to Section 3.5.4 (2) for written data definitions.	Write instruction code: Refer to Section 3.5.4 (2). Parameter: Refer to Section 7.6. Point table: Refer to Section 4.4.4 (1).
	RW_{w4}	Position block No./ Position instruction data under 16bit	Sets the position block No. to be executed in the automatic operation mode when 2 stations are occupied. Setting the position block No. to RW_{w4} and turning RY10 to "1" (ON) sets the position block No. to the servo amplifier. RX10 turns to "1" (ON) on completion of setting. When the point table is not used, set the position command data. Setting the lower 16 bits to RW_{w4} and the upper 16 bits to RW_{w5} and turning RY10 to "1" (ON) writes the upper and lower 16-bit position command data. RX10 turns to "1" (ON) on completion of write. Use parameter No. 65 to set the position block No. and position command data. Refer to Section 3.6.3 for details of the position block No./position command data.	Position block No.: 0 to 255 Position command data: 0 to 999999
	RW_{w5}	Position instruction data upper 16bit		

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
	RW$_{w6}$	Speed block No./ Speed instruction data	When the point table is not used, set the speed block No. to be executed or the speed command data (motor speed [r/min]). Setting the position block No. to RW$_{w5}$ and turning RY11 to "1" (ON) writes the speed block No. or speed command data to the servo amplifier. RX11 turns to "1" (ON) on completion of setting. Use parameter No. 65 to set the speed block No. and speed command data. Refer to Section 3.6.3 for details of the speed block No./speed command data.	Speed block No.: 1 to 8 Speed command data: 0 to permissible speed

2) Output (Servo amplifier → PLC)

Note that the data set to RW$_{R0}$ and RW$_{R1}$ depends on whether 1 station or 2 stations are occupied.

If you set inappropriate code No. or data to the remote register input, the error code is set to Answer code (RW$_{R2}$). Refer to Section 3.5.5 for the error code.

When 1 station is occupied

Remote register	Signal name	Description
RW$_{R0}$	Monitor 1 data	The data of the status indication item set to RW$_{w0}$ is set.
RW$_{R1}$	Monitor 2 data	The data of the status indication item set to RW$_{w1}$ is set.
RW$_{R2}$	Answer code	"0000" is set when the codes set to RW$_{w0}$～RW$_{w3}$ are executed normally.
RW$_{R3}$	Reading data	Data corresponding to the read code set to RW$_{w2}$ is set.

When 2 stations are occupied

Remote register	Signal name	Description
RW$_{R0}$	Monitor 1 data under 16bit	The lower 16 bits of the data of the status indication item set to RW$_{w0}$ are set.
RW$_{R1}$	Monitor 1 data upper 16bit	The upper 16 bits of the data of the status indication item set to RW$_{w0}$ are set. A sign is set if there are no data in the upper 16 bits.
RW$_{R2}$	Answer code	"0000" is set when the codes set to RW$_{w0}$～RW$_{w6}$ are executed normally.
RW$_{R3}$	Reading data	Data corresponding to the read code set to RW$_{w2}$ is set.
RW$_{R4}$	M code output	The executed M code is set.
RW$_{R5}$	Monitor 2 data under 16bit	The lower 16 bits of the data of the status indication item set to RW$_{w1}$ are set.
RW$_{R6}$	Monitor 2 data upper 16bit	The upper 16 bits of the data of the status indication item set to RW$_{w1}$ are set. A sign is set if there are no data in the upper 16 bits.

(2) Roll feeding system

(a) Input signals

The I/O Input CN1 field indicates the pin number that may be assigned to the CN1 connector when the signal is used as the CN1 external input signal. The signal whose Device No. field has an oblique line cannot be used in CC-Link.

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Servo on</td><td>Turning RY0 to “1” (ON) powers on the base circuit, making operation ready to start.
Turning it to “0” (OFF) powers off the base circuit, coasting the servo motor.</td><td>RY0</td><td>RY0</td><td>12</td></tr>
<tr><td>Restart</td><td>After turning RY3 to “1” (ON) to stop operation temporarily, keep RY1 “1” (ON) for longer than 5ms to resume operation from where it stopped.</td><td>RY1</td><td>RY1</td><td>13</td></tr>
<tr><td>Speed selection</td><td>Used to select the speed block No. to be executed.
Turn RY2 to “0” (OFF) to choose the speed block No. 1, or to “1” (ON) to choose the speed block No. 2.</td><td>RY2</td><td>RY2</td><td>14</td></tr>
<tr><td>Temporary stop</td><td>Keeping RY3 “1” (ON) for longer than 5ms during operation suspends and stops operation. Turn RY1 to “1” (ON) to make a restart.</td><td>RY3</td><td>RY3</td><td>15</td></tr>
<tr><td>Torque limit selection</td><td>Turning RY4 to “1” (ON) limits the generated torque according to the voltage of the torque limit command (TLAP). Turning it to “0” (OFF) makes the parameter No. 40 setting valid.</td><td>RY4</td><td></td><td>38</td></tr>
<tr><td>Second feed distance</td><td>Used to select the position block No. to be executed.
Turning RY5 to “0” (OFF) chooses the position block No. 0. Turning it to “1” (ON) chooses the position block No. 1.</td><td>RY5</td><td></td><td>39</td></tr>
<tr><td>Clear</td><td>Keeping RY6 “1” (ON) for longer than 5ms clears the droop pulses. Turning it to “1” (ON) during operation causes a sudden stop and clears the remaining distance.
Using parameter No. 42, you can select “Clear at OFF to ON” or “Always cleared during ON”.</td><td>RY6</td><td>RY6</td><td>37</td></tr>
<tr><td>Automatic operation selection</td><td rowspan="3">RY7, RY8 and RY9 are combined to select the operation mode.
<table>
<tr><th colspan="3">(Note) Input signal</th><th rowspan="2">Operation mode</th></tr>
<tr><th>RY9</th><th>RY8</th><th>RY7</th></tr>
<tr><td>1</td><td>0</td><td>0</td><td>Automatic operation</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Manual operation</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Remote manual operation</td></tr>
</table>
Note. 0: OFF 1: ON</td><td>RY7</td><td>RY7</td><td>41</td></tr>
<tr><td>Manual operation selection</td><td>RY8</td><td>RY8</td><td>42</td></tr>
<tr><td>Remote manual operation selection</td><td>RY9</td><td>RY9</td><td>43</td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Forward rotation start</td><td rowspan="2">In the automatic operation mode, the servo motor starts as indicated below:
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Rotation direction</th></tr>
<tr><th>RYB</th><th>RYA</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: OFF 1: ON
In the remote manual operation mode, the servo motor rotates while the signal is “1” (ON).
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Rotation direction</th></tr>
<tr><th>RYB</th><th>RYA</th></tr>
<tr><td>0</td><td>1</td><td>CCW</td></tr>
<tr><td>1</td><td>0</td><td>CW</td></tr>
</table>
Note. 0: OFF 1: ON
The direction of rotation started by turning the signal on can be changed by setting parameter No. 2.</td><td>RYA</td><td>RYA</td><td>44</td></tr>
<tr><td>Reverse rotation start</td><td>RYB</td><td>RYB</td><td>45</td></tr>
<tr><td>Monitor output execution demand</td><td>Turning RYC to “1” (ON) sets the following data/signals. At the same time, RXC turns to “1” (ON). While RYC is “1” (ON), the monitor values are always updated.
1) When 1 station is occupied
Remote register RW_{R0}: Data requested by monitor 1 (RW_{W0})
Remote register RW_{R1}: Data requested by monitor 2 (RW_{W1})
Remote register RW_{R2}: Normal or error answer code
2) When 2 stations are occupied
Remote register RW_{R0}: Lower 16 bits of data requested by monitor 1 (RW_{W0})
Remote register RW_{R1}: Upper 16 bits of data requested by monitor 1 (RW_{W0})
Remote register RW_{R5}: Lower 16 bits of data requested by monitor 2 (RW_{W5})
Remote register RW_{R6}: Upper 16 bits of data requested by monitor 2 (RW_{W5})
Remote register RW_{R2}: Normal or error answer code
Refer to Section 3.6.1 for details.</td><td>RYC</td><td>RYC</td><td></td></tr>
<tr><td>Instruction code execution demand</td><td>Turning RYD to “1” (ON) executes the processing corresponding to the instruction code set to the remote register RW_{W2}.
After completion of instruction code execution, a normal or error answer code is set to RW_{R2}. At the same time, RXD turns to “1” (ON).
Refer to Section 3.6.2 for details.</td><td>RYD</td><td>RYD</td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Position instruction demand</td><td>Turning RY10 to “1” (ON) sets the position block No. or position command data set to the remote register RW$_{W4}$ ▪ RW$_{W5}$.
When it is set to the servo amplifier, the normal or error answer code is set to RW$_{R2}$. At the same time, RX10 turns to “1” (ON).
Refer to Section 3.6.3 for details.</td><td></td><td>RY10</td><td></td></tr>
<tr><td>Speed instruction demand</td><td>Turning RY11 to “1” (ON) sets the speed block No. or speed command data set to the remote register RW$_{W6}$.
When it is set to the servo amplifier, the normal or error answer code is set to RW$_{R2}$. At the same time, RX11 turns to “1” (ON).
Refer to Section 3.6.3 for details.</td><td></td><td>RY11</td><td></td></tr>
<tr><td>Override selection</td><td>Used to select whether the override (OVR) analog input signal is made valid or invalid.
<table>
<tr><th>(Note) RY12</th><th>Speed change value</th></tr>
<tr><td>0</td><td>No change</td></tr>
<tr><td>1</td><td>Override (OVR) setting is valid.</td></tr>
</table>
Note. 0: OFF 1: ON</td><td></td><td>RY12</td><td></td></tr>
<tr><td>Manual pulse generator magnification selection bit0</td><td rowspan="2">When using this signal, set “□□□4” in parameter No. 60 to make the manual pulse generator multiplying factor selection signal valid. Turning RY13 and RY14 to “1” (ON)/ “0” (OFF) changes the multiplying factor of the manual pulse generator.
<table>
<tr><th colspan="2">(Note) Input signal</th><th rowspan="2">Multiplying factor</th></tr>
<tr><th>RY14</th><th>RY13</th></tr>
<tr><td>0</td><td>0</td><td>×1</td></tr>
<tr><td>0</td><td>1</td><td>×10</td></tr>
<tr><td>1</td><td>0</td><td>×100</td></tr>
</table>
Note. 0: OFF 1: ON</td><td></td><td>RY13</td><td></td></tr>
<tr><td>Manual pulse generator magnification selection bit1</td><td></td><td>RY14</td><td></td></tr>
<tr><td>Reset</td><td>Keeping this signal “1” (ON) for longer than 20ms deactivates any of the following alarms. The base circuit is off while the signal is “1” (ON).
<table>
<tr><th>Indication</th><th>Name</th></tr>
<tr><td>AL.10</td><td>Under voltage</td></tr>
<tr><td>AL.24</td><td>Ground fault</td></tr>
<tr><td>AL.31</td><td>Over speed</td></tr>
<tr><td>AL.32</td><td>Over current</td></tr>
<tr><td>AL.33</td><td>Over voltage</td></tr>
<tr><td>AL.35</td><td>Command pulse frequency alarm</td></tr>
<tr><td>AL.42</td><td>Feedback alarm</td></tr>
</table>
<table>
<tr><th>Indication</th><th>Name</th></tr>
<tr><td>AL.45</td><td>Main circuit device overheat</td></tr>
<tr><td>AL.46</td><td>Servo motor overheat</td></tr>
<tr><td>AL.52</td><td>Error excessive</td></tr>
<tr><td>AL.8D</td><td>CC-Link alarm</td></tr>
<tr><td>AL.8E</td><td>RS-232C alarm</td></tr>
<tr><td>AL.8F</td><td>RS-422 alarm</td></tr>
</table></td><td>RY1A</td><td>RY3A</td><td></td></tr>
<tr><td>Forced stop</td><td>This signal may be used as the external input signal only. It cannot be used in CC-Link.
Opening CN1-46 and SG places the servo amplifier in a forced stop status, causing servo off and operating the dynamic brake to make a sudden stop.
Shorting CN1-46 and SG causes the servo amplifier to leave the forced stop status.</td><td></td><td></td><td>46</td></tr>
</table>

(b) Output signals

The I/O Input CN1 field indicates the pin number that may be assigned to the CN1 connector when the signal is used as the CN1 external output signal. The signal whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name	Description	Device No.		I/O input CN1
		1 station occupied	2 stations occupied	
Ready	This signal turns to "1" (ON) when the servo amplifier is ready to operate without any failure after servo-on.	RX0	RX0	49
Positioning completion	This signal turns to "1" (ON) when the droop pulse value has become less than the in-position range set in the parameter. This signal is not output while the base circuit is off.	RX1	RX1	24
Rough match	This signal turns to "1" (ON) when the command remaining distance has become less than the rough match output range set in the parameter. This signal is not output while the base circuit is off.	RX3	RX3	23
Alarm code bit0	The alarm code is output to RX6, RX7, RX8 and RX9 in 4-bit binary. Refer to Section 11.4.1.	RX6	RX6	
Alarm code bit1		RX7	RX7	
Alarm code bit2		RX8	RX8	
Alarm code bit3		RX9	RX9	
Limiting torque	This signal turns to "1" (ON) when the torque limit value set internally or externally is reached. When using this signal as the external output signal, make Limiting torque valid in the setting of parameter No. 44.	RXA	RXA	23
Electromagnetic brake inter lock	The electromagnetic brake interlock signal is output. RXB turns to "0" (OFF) at servo-off or alarm occurrence. When using this signal as the external output signal, make Electromagnetic brake interlock valid in the setting of parameter No. 3.	RXB	RXB	23
Monitoring	Refer to Monitor output execution demand.	RXC	RXC	
Instruction code execution completion	Refer to Instruction code execution demand.	RXD	RXD	
Warning	RXE turns to "1" (ON) if a warning occurs in the servo amplifier. The outputs corresponding to the servo statuses are indicated below.	RXE	RXE	

Servo status	(Note) RXE
Normal status	0
Power off	1
Warning occurrence	1
Failure occurrence	0
Servo off	0
Forced stop valid	0

Note. 0: OFF 1: ON

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">I/O input CN1</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Position instruction execution completion</td><td>Refer to Position instruction execution demand (RY10).</td><td></td><td>RX10</td><td></td></tr>
<tr><td>Speed instruction execution completion</td><td>Refer to Speed instruction execution demand (RY11).</td><td></td><td>RX11</td><td></td></tr>
<tr><td rowspan="2">Trouble</td><td>When the trouble signal is used in CC-Link, RXF turns to “1” (ON) at alarm occurrence or the like.
Since the external dynamic brake is used, setting “□ 1 □ □” in parameter No. 3 changes the output signal corresponding to the servo status.
<table>
<tr><th rowspan="4">Servo status</th><th colspan="3">RX1A or RX3A</th></tr>
<tr><th colspan="3">Parameter setting</th></tr>
<tr><th colspan="2">No.3</th><th>No.44</th></tr>
<tr><th>□0□□</th><th>(Note)□1□□</th><th>(Note)□□1□</th></tr>
<tr><td>Normal status</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Power off</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Warning occurrence</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>Failure occurrence</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Servo off</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Forced stop valid</td><td>0</td><td>1</td><td>0</td></tr>
</table>
Note. Cannot be set simultaneously. Simultaneous setting results in alarm (AL.37).</td><td>RX1A</td><td>RX3A</td><td></td></tr>
<tr><td>When the trouble signal is used as the CN1 external output signal, RXF turns OFF at alarm occurrence or the like.
Since the external dynamic brake is used, setting “□ 1 □ □” in parameter No. 3 changes the output signal corresponding to the servo status.
<table>
<tr><th rowspan="4">Servo status</th><th colspan="3">(Note1) Output signal</th></tr>
<tr><th colspan="3">Parameter setting</th></tr>
<tr><th colspan="2">No.3</th><th>No.44</th></tr>
<tr><th>□0□□</th><th>(Note)□1□□</th><th>(Note)□□1□</th></tr>
<tr><td>Normal status</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Power off</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Warning occurrence</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>Failure occurrence</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Servo off</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>Forced stop valid</td><td>ON</td><td>OFF</td><td>ON</td></tr>
</table>
Note. 1. ON: 48-SG conducting, OFF: 48-SG not conducting
2. Cannot be set simultaneously. Simultaneous setting results in alarm (AL.37).</td><td></td><td></td><td>48</td></tr>
<tr><td>Remote bureau communication ready</td><td>This signal turns to “1” (ON) at power-on or to “0” (OFF) in either of the following statuses:
<table>
<tr><th>Servo status</th><th>(Note1) RX1B or RX3B</th></tr>
<tr><td>Failure occurrence</td><td>0</td></tr>
<tr><td>(Note2) Reset ON status</td><td>0</td></tr>
</table>
Note1. 0: OFF 1: ON
2. When 1 station is occupied: RY1A,
When 2 stations are occupied: RY3A</td><td>RX1B</td><td>RX3B</td><td></td></tr>
</table>

(c) Remote registers

The signal whose Remote Register field has an oblique line cannot be used.

1) Input (PLC → servo amplifier)

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RW_{W0}	RW_{W0}	Monitor 1	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied Setting the code of the status indication item to be monitored to RW_{W0} and turning RYC to “1” (ON) sets data to RW_{R0}. 2) When 2 stations are occupied Setting the code of the status indication item to be monitored to RW_{W0} and turning RYC to “1” (ON) sets data to RW_{R0}. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYC to “1” (ON) sets the lower 16-bit data to RW_{R0} and the upper 16-bit data to RW_{R1}. Refer to Section 3.5.3 for the status indication item.	0000 to 001A
RW_{W1}	RW_{W1}	Monitor 2	Demands the status indication data of the servo amplifier. 1) When 1 station is occupied Setting the code of the status indication item to be monitored to RW_{W1} and turning RYC to “1” (ON) sets data to RW_{R1}. 2) When 2 stations are occupied When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYC to “1” (ON) sets the lower 16-bit data to RW_{R5} and the upper 16-bit data to RW_{R6}. Refer to Section 3.5.3 for the status indication item.	0000 to 001A
RW_{W2}	RW_{W2}	Instruction code	Sets the instruction code used to perform parameter or point table data read, alarm reference or the like. Setting the instruction code to RW_{W2} and turning RYD to “1” (ON) executes the instruction. RXD turns to “1” (ON) on completion of instruction execution. Refer to Section 3.5.4 for instruction code definitions.	Refer to Section 3.5.4 (1).
RW_{W3}	RW_{W3}	Writing data	Sets the written data used to perform parameter or point table data write, alarm history clear or the like. Setting the written data to RW_{W3} and turning RYD to “1” (ON) writes the data to the servo amplifier. RXD turns to “1” (ON) on completion of write. Refer to Section 3.5.4 (2) for written data definitions.	Write instruction code: Refer to Section 3.5.4 (2). Parameter: Refer to Section 7.6. Point table: Refer to Section 5.4.4 (1).

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
	RW_{W4}	Position instruction data under 16bit	When the point table is not used, set the position command data. Setting the lower 16 bits to RW_{W4} and the upper 16 bits to RW_{W5} and turning RY10 to "1" (ON) writes the upper and lower 16-bit position command data. RX10 turns to "1" (ON) on completion of write. Use parameter No. 65 to set the position block No. and position command data. Refer to Section 3.6.3 for details of the position block No./position command data.	0 to 999999
	RW_{W5}	Position instruction data upper 16bit		
	RW_{W6}	Speed instruction data	When the point table is not used, set the speed block No. to be executed or the speed command data (motor speed [r/min]). Setting the position block No. to RW_{W5} and turning RY11 to "1" (ON) writes the speed block No. or speed command data to the servo amplifier. RX11 turns to "1" (ON) on completion of setting. Use parameter No. 65 to set the speed block No. and speed command data. Refer to Section 3.6.3 for details of the speed block No./speed command data.	Speed command data: 0 to permissible speed

2) Output (Servo amplifier → PLC)

Note that the data set to RW_{R0} and RW_{R1} depends on whether 1 station or 2 stations are occupied.

If you set inappropriate code No. or data to the remote register input, the error code is set to Answer code (RW_{R2}). Refer to Section 3.5.5 for the error code.

When 1 station is occupied

Remote register	Signal name	Description
RW_{R0}	Monitor 1 data	The data of the status indication item set to RW_{W0} is set.
RW_{R1}	Monitor 2 data	The data of the status indication item set to RW_{W1} is set.
RW_{R2}	Answer code	"0000" is set when the codes set to RW_{W0}～RW_{W3} are executed normally.
RW_{R3}	Reading data	Data corresponding to the read code set to RW_{W2} is set.

When 2 stations are occupied

Remote register	Signal name	Description
RW_{R0}	Monitor 1 data under 16bit	The lower 16 bits of the data of the status indication item set to RW_{W0} are set.
RW_{R1}	Monitor 1 data upper 16bit	The upper 16 bits of the data of the status indication item set to RW_{W0} are set. A sign is set if there are no data in the upper 16 bits.
RW_{R2}	Answer code	"0000" is set when the codes set to RW_{W0}～RW_{W3}, RW_{W5} and RW_{W6} are executed normally.
RW_{R3}	Reading data	Data corresponding to the read code set to RW_{W2} is set.
RW_{R5}	Monitor 2 data under 16bit	The lower 16 bits of the data of the status indication item set to RW_{W1} are set.
RW_{R6}	Monitor 2 data upper 16bit	The upper 16 bits of the data of the status indication item set to RW_{W1} are set. A sign is set if there are no data in the upper 16 bits.

3.5.3 Monitor codes

To demand 32-bit data when 2 stations are occupied, specify the lower 16-bit code No. Use any of the instruction codes 0101 to 011C to read the decimal point position (multiplying factor) of the status indication.

Setting any code No. that is not given in this section will set the error code (☐ ☐ 1 ☐) to Answer code (RWR2). At this time, "0000" is set to RWR0, RWR1, RWR5 and RWR6.

For monitor data, refer to Section 8.3.

Code No.		Monitored item	Answer data (Servo amplifier → PLC)	
1 station occupied	2 stations occupied		Data length	Unit
0000	0000	Not monitored.	0000	
0001	0001	Current position under 16bit	16bit	(Note2) $\times 10^{STM}$[mm] or $\times 10^{STM}$[inch]
0002		Current position upper 16bit	16bit	
0003	0003	Command position under 16bit	16bit	
0004		Command position upper 16bit	16bit	
0005	0005	Command remaining distance under 16bit	16bit	
0006		Command remaining distance upper 16bit	16bit	
0007	0007	Override	16bit	[%]
0008	0008	Position block	16bit	[No.]
0009	0009	Speed block	16bit	[No.]
000A	000A	Feedback pulse value under 16bit	16bit	[pulse]
000B		Feedback pulse value upper 16bit	16bit	[pulse]
000C	000C	Machine speed under 16bit	16bit	[mm/min] or [inch/min]
000D		Machine speed upper 16bit	16bit	
000E	000E	Droop pulse value under 16bit	16bit	[pulse]
000F		Droop pulse value upper 16bit	16bit	[pulse]
0010	0010	Torque limit command voltage	16bit	×0.01[V]
0011	0011	Regenerative load factor	16bit	[%]
0012	0012	Effective load factor	16bit	[%]
0013	0013	Peak load factor	16bit	[%]
0014	0014	Within one-revolution position	16bit	[pulse]
0015	0015	ABS counter	16bit	[rev]
0016	0016	Motor speed under 16bit	16bit	×0.1[rev/min]
0017		Motor speed upper 16bit	16bit	×0.1[rev/min]
0018	0018	Bus voltage	16bit	[V]
0019	0019	(Note1) ABS position reading under 16bit	16bit	[pulse]
001A		(Note1) ABS position reading upper 16bit	16bit	[pulse]

Note 1. For the data, refer to "ABS data" in Section 8.4.

2. The decimal point position changes with the parameter No. 4 setting.

3.5.4 Instruction codes (RW_{W2} · RW_{W3})

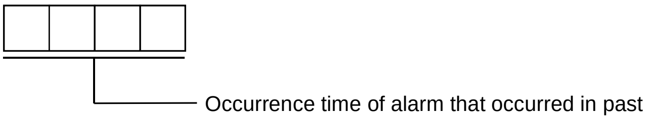
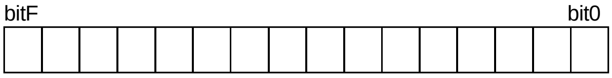
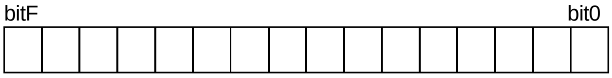
Refer to Section 3.6.2 for the instruction code timing charts.

(1) Read instruction codes

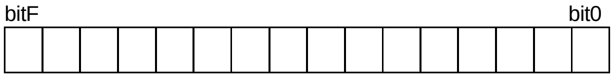
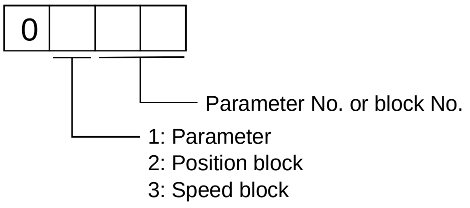
Set the code No. corresponding to the item to RW_{W2}. The codes and answer data are all 4-digit hexadecimal numbers.

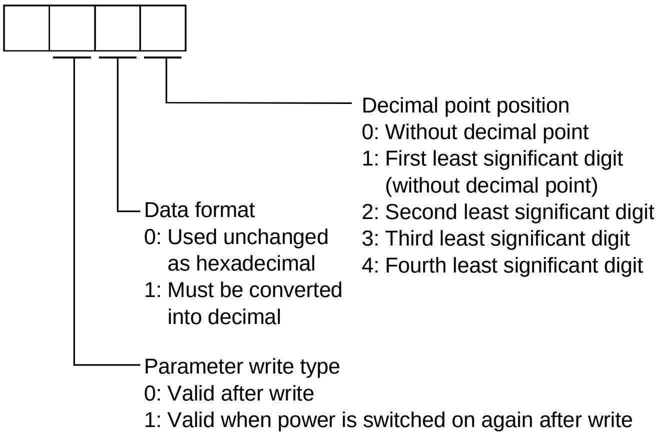
Setting any code No. that is not given in this section will set the error code (□ □ 1 □) to Answer code (RW_{R2}). At this time, "0000" is set to Reading data (RW_{R3}).

Code No.	Item/Function	Reading data (RW_{R3}) contents (Servo amplifier → PLC)
0000	Operation mode Reads the operation mode.	0000: CC-Link operation mode 0001: Parameter unit test operation mode
0002	Travel multiplying factor Reads the multiplying factor of the position data in the position block set in parameter No. 3.	0300: ×1000 0200: ×100 0100: ×10 0000: ×1 0001: ×1/10 (×0.1) 0002: ×1/100 (×0.01) 0003: ×1/1000 (×0.001)
0010	Current alarm (warning) reading Reads the alarm No. or warning No. occurring currently.	0 0 □ □ Occurring alarm No./warning No.
0011	Reading the current alarm (warning) reading Reads the alarm No. or warning No. occurring concurrently.	0 0 □ □ Concurrently occurring alarm No./warning No.
0020	Alarm number in alarm history (most recent alarm)	0 0 □ □ Alarm No. that occurred in past
0021	Alarm number in alarm history (first recent alarm)	
0022	Alarm number in alarm history (second recent alarm)	
0023	Alarm number in alarm history (third recent alarm)	
0024	Alarm number in alarm history (fourth recent alarm)	
0025	Alarm number in alarm history (fifth recent alarm)	
0026	Alarm number in alarm history (sixth recent alarm)	
0027	Alarm number in alarm history (seventh recent alarm)	
0028	Alarm number in alarm history (eighth recent alarm)	
0029	Alarm number in alarm history (ninth recent alarm)	

Code No.	Item/Function	Reading data (RW_{R3}) contents (Servo amplifier → PLC)
0030	Alarm occurrence time in alarm history (most recent alarm)	
0031	Alarm occurrence time in alarm history (first recent alarm)	
0032	Alarm occurrence time in alarm history (second recent alarm)	
0033	Alarm occurrence time in alarm history (third recent alarm)	
0034	Alarm occurrence time in alarm history (fourth recent alarm)	
0035	Alarm occurrence time in alarm history (fifth recent alarm)	
0036	Alarm occurrence time in alarm history (sixth recent alarm)	
0037	Alarm occurrence time in alarm history (seventh recent alarm)	
0038	Alarm occurrence time in alarm history (eighth recent alarm)	
0039	Alarm occurrence time in alarm history (ninth recent alarm)	
0040	Input signal status 0 Reads the statuses (0 or 1) of the input signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding input signals. Refer to Section 3.5.1 for the meanings of the abbreviations.  1) Positioning system When 2 stations are occupied, DI0, DI1 and DI2 do not function and therefore they are always "0". bit0: SON bit4: LSP bit8: STP bitC: MOR bit1: DI0 bit5: LSN bit9: ORG bitD: COR bit2: DI1 bit6: DOG bitA: ST1 bitE: TL bit3: DI2 bit7: MD0 bitB: ST2 bitF: ——— 2) Roll feeding system bit0: SON bit4: TL bit8: MO1 bitC: MOR bit1: DEC bit5: PS2 bit9: MO2 bitD: COR bit2: JFS bit6: CR bitA: ST1 bitE: ——— bit3: STP bit7: MO0 bitB: ST2 bitF: ———
0041	Input signal status 1 Reads the statuses (0 or 1) of the input signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding input signals. Refer to Section 3.5.1 for the meanings of the abbreviations.  1) Positioning system bit0: PSR bit4: TP1 bit8: ——— bitC: ——— bit1: SPR bit5: ——— bit9: ——— bitD: ——— bit2: OVR bit6: ——— bitA: ——— bitE: ——— bit3: TP0 bit7: ——— bitB: ——— bitF: ——— 2) Roll feeding system bit0: PSR bit4: TP1 bit8: ——— bitC: ——— bit1: SPR bit5: ——— bit9: ——— bitD: ——— bit2: OVR bit6: ——— bitA: ——— bitE: ——— bit3: TP0 bit7: ——— bitB: ——— bitF: ———

Code No.	Item/Function	Reading data (RW$_{R3}$) contents (Servo amplifier → PLC)
0042	Input signal status 2 Reads the statuses (0 or 1) of the input signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding input signals. Refer to Section 3.5.1 for the meanings of the abbreviations. bitF bit0 1) Positioning system bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: RES bitE: ――― bit3: ――― bit7: ――― bitB: ――― bitF: ――― 2) Roll feeding system bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: RES bitE: ――― bit3: ――― bit7: ――― bitB: ――― bitF: ―――
0050	Output signal status 0 Reads the statuses (0 or 1) of the Output signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding output signals. Refer to Section 3.5.1 for the meanings of the abbreviations. bitF bit0 1) Positioning system When 2 stations are occupied, MC0 and MC1 do not function and therefore they are always “0”. bit0: RD bit4: MC0 bit8: AC2 bitC: MOF bit1: INP bit5: MC1 bit9: AC3 bitD: COF bit2: CPO bit6: AC0 bitA: TLC bitE: WNG bit3: ZP bit7: AC1 bitB: MBR bitF: ――― 2) Roll feeding system bit0: RD bit4: ――― bit8: AC2 bitC: MOF bit1: INP bit5: ――― bit9: AC3 bitD: COF bit2: CPO bit6: AC0 bitA: TLC bitE: WNG bit3: ――― bit7: AC1 bitB: MBR bitF: ―――
0051	Output signal status 1 Reads the statuses (0 or 1) of the Output signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding output signals. Refer to Section 3.5.1 for the meanings of the abbreviations. bitF bit0 1) Positioning system When 2 stations are occupied, MC0 and MC1 do not function and therefore they are always “0”. bit0: PSF bit4: ――― bit8: ――― bitC: ――― bit1: SPF bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: ――― bitE: ――― bit3: ――― bit7: ――― bitB: ――― bitF: ――― 2) Roll feeding system bit0: PSF bit4: ――― bit8: ――― bitC: ――― bit1: SPF bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: ――― bitE: ――― bit3: ――― bit7: ――― bitB: ――― bitF: ―――

Code No.	Item/Function	Reading data (RW$_{R3}$) contents (Servo amplifier → PLC)
0052	Output signal status 2 Reads the statuses (0 or 1) of the Output signals.	bit 0 to bit F indicate the statuses (0 or 1) of the corresponding output signals. Refer to Section 3.5.1 for the meanings of the abbreviations.  1) Positioning system When 2 stations are occupied, MC0 and MC1 do not function and therefore they are always "0". bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: ALM bitE: ――― bit3: ――― bit7: ――― bitB: CRD bitF: ――― 2) Roll feeding system bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: ALM bitE: ――― bit3: ――― bit7: ――― bitB: CRD bitF: ―――
0080	Setting time Reads the setting time.	Returns the setting time [ms].
0081	Energization time Reads the energization time from shipment.	Returns the energization time [h].
0082	Power ON frequency Reads the number of power-on times from shipment.	Returns the number of power-on times.
00A0	Ratio load inertia Reads the estimated ratio of load inertia moment to servo motor shaft inertia moment.	Returns the estimated ratio of load inertia moment to servo motor shaft inertia moment [times].
00B0	Within-1-revolution position data (CYC0) Cycle counter value of absolute home position	Return unit [pulses]
00B1	Multi-revolution data (ABS0) Multi-revolution counter value of absolute home position	Return unit [rev]
00C0 to 00CF	Error parameter No./Point data No. reading Reads up to 16 parameter, position block and speed block numbers in error using the 00C0 to 00CF codes.	
0200 to 024F	Parameter setting Reads the values set in parameter No. 0 to 79. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No.	The setting of the requested parameter No. is returned. For parameter No. 1, "F" enters the blank digits. For example, setting of "13" will be "FF13". For other parameters, make setting as indicated in Section 7.2.

Code No.	Item/Function	Reading data (RW_{R3}) contents (Servo amplifier → PLC)
0300 to 034F	Data form of parameter setting Reads the data format of the values set in parameter No. 0 to 79. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No.	The setting of the requested parameter No. is returned.  Decimal point position 0: Without decimal point 1: First least significant digit (without decimal point) 2: Second least significant digit 3: Third least significant digit 4: Fourth least significant digit Data format 0: Used unchanged as hexadecimal 1: Must be converted into decimal Parameter write type 0: Valid after write 1: Valid when power is switched on again after write
0400 to 05FF	Position data of position block Reads the position data of position block No. 0 to 255. The usable position block Nos. depend on the feeding system and the number of occupied stations. The lower 16 bits are read in even code and the upper 16 bits in odd code. Example Instruction code 043A: Lower 16 bits of position block No. 58 Instruction code 053A: Upper 16 bits of position block No. 58 When 1 station is occupied, sending the code No. of position block No. 8 or larger will return the error code.	The position data (upper 16 bits or lower 16 bits) set in the requested position block No. is returned.
0600 to 06FF	M code of position block Reads the M codes of position block No. 0 to 255. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	The M code set to the requested position block No. is returned.
0700 to 07FF	Speed block No. of position block Reads the speed block Nos. of position block No. 0 to 255. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	The speed block No. set to the requested position block No. is returned.

Code No.	Item/Function	Reading data (RW_{R3}) contents (Servo amplifier → PLC)
0801 to 0808	Rotational speed of speed block Reads the speeds of speed block No. 1 to 8. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	The speed set to the requested speed block No. is returned.
0901 to 0908	Acceleration time constant of speed block Reads the acceleration time constants of speed block No. 1 to 8. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	The acceleration time constant set to the requested speed block No. is returned.
0A01 to 0A08	Deceleration time constant of speed block Reads the deceleration time constants of speed block No. 1 to 8. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	The deceleration time constant set to the requested speed block No. is returned.
0B01 to 0B08	Acceleration/deceleration time constant of speed block Reads the acceleration/deceleration time constants of speed block No. 1 to 8. The usable speed block Nos. depend on the feeding system and the number of occupied stations. These code Nos. are used when S-pattern acceleration/deceleration is selected. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	The acceleration/deceleration time constant set to the requested speed block No. is returned.
0C01 to 0C08	S-pattern time constant of speed block Reads the S-pattern time constants of speed block No. 1 to 8. The usable speed block Nos. depend on the feeding system and the number of occupied stations. These code Nos. are used when S-pattern acceleration/deceleration is selected. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	The S-pattern time constant set to the requested speed block No. is returned.

(2) Write instruction codes

Set the code No. corresponding to the item to Instruction code (RW_{W2}) and the written data to Writing data (RW_{W3}). The codes and answer data are all 4-digit hexadecimal numbers.

Setting any code No. that is not given in this section will set the error code (☐☐1☐) to Answer code (RW_{R2}).

Code No.	Item	Writing data (RW_{W3}) contents (PLC → Servo amplifier)
8000 to 800F	Empty	
8010	Alarm reset command Deactivates the alarm that occurred. This function is the same as that of the input signal of device No. RY1A or RY3A.	1EA5
8100	Current position display data is clear Resets the display data of the status indication “current position” to 0.	1EA5
8101	Feedback pulse value display data is clear Resets the display data of the status indication “feedback pulse value” to 0.	1EA5
8200 to 824F	Parameter setting (RAM) Writes the values set in parameter No. 0 to 79 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No.	Convert the decimal values into hexadecimal before making setting.
8300 to 834F	Parameter setting (EEP-ROM) Writes the values set in parameter No. 0 to 79 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No.	Convert the decimal values into hexadecimal before making setting.
8400 to 85FF	Position data of position block (RAM) Writes the position data of position block No. 0 to 255 to RAM. These values are cleared when power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The lower 16 bits are written in even code and the upper 16 bits in odd code. Example Instruction code 083A: Lower 16 bits of position block No. 58 Instruction code 083B: Upper 16 bits of position block No. 58	Convert the values into hexadecimal before making setting.
8600 to 86FF	M code of position block (RAM) Writes the M codes of position block No. 0 to 255 to RAM. These values are cleared when power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	Convert the values into hexadecimal before making setting.

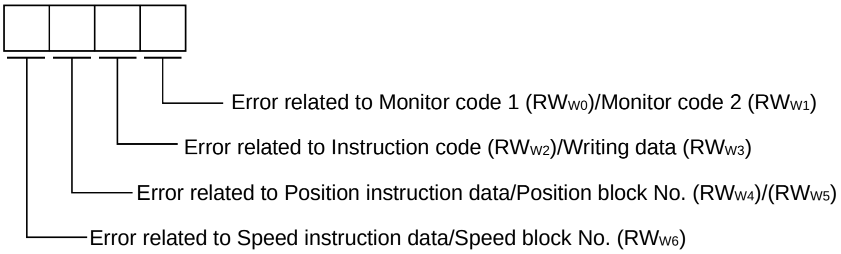
Code No.	Item	Writing data (RW$_{W3}$) contents (PLC → Servo amplifier)
8700 to 87FF	Speed block No. of position block (RAM) Writes the speed block Nos. of position block No. 0 to 255 to RAM. These values are cleared when power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	Convert the values into hexadecimal before making setting.
8801 to 8808	Rotational speed of speed block (RAM) Writes the speeds of speed block No. 1 to 8 to RAM. These values are cleared when power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	Convert the values into hexadecimal before making setting.
8901 to 8908	Acceleration time constant of speed block (RAM) Writes the acceleration time constants of speed block No. 1 to 8 to RAM. These values are cleared when power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	Convert the values into hexadecimal before making setting.
8A01 to 8A08	Deceleration time constant of speed block (RAM) Writes the deceleration time constants of speed block No. 1 to 8 to RAM. These values are cleared when power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	Convert the values into hexadecimal before making setting.
8B01 to 8B08	Acceleration/deceleration time constant of speed block (RAM) Writes the acceleration/deceleration time constants of speed block No. 1 to 8 to RAM. These values are cleared when power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No. These code Nos. are used when S-pattern acceleration/deceleration is selected.	Convert the values into hexadecimal before making setting.
8C01 to 8C08	S-pattern time constant of speed block (RAM) Writes the S-pattern time constants of speed block No. 1 to 8 to RAM. These values are cleared when power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No. These code Nos. are used when S-pattern acceleration/deceleration is selected.	Convert the values into hexadecimal before making setting.

Code No.	Item	Writing data (RW_{W3}) contents (PLC → Servo amplifier)
8D00 to 8E07	Position data of position block (EEP-ROM) Writes the position data of position block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The lower 16 bits are written in even code and the upper 16 bits in odd code. Example Instruction code 8D03: Lower 16 bits of position block No. 3 Instruction code 8E03: Upper 16 bits of position block No. 3	Convert the values into hexadecimal before making setting.
8F00 to 8F07	M code of position block (EEP-ROM) Writes the M codes of position block No. 0 to 7 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	Convert the values into hexadecimal before making setting.
9000 to 9007	Speed block No. of position block (EEP-ROM) Writes the speed block Nos. of position block No. 0 to 7 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable position block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the position block No.	Convert the values into hexadecimal before making setting.
9101 to 9108	Rotational speed of speed block (EEP-ROM) Writes the speeds of speed block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	Convert the values into hexadecimal before making setting.
9201 to 9208	Acceleration time constant of speed block (EEP-ROM) Writes the acceleration time constants of speed block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No.	Convert the values into hexadecimal before making setting.

Code No.	Item	Writing data (RW_{W3}) contents (PLC → Servo amplifier)
9301 to 9308	Deceleration time constant of speed block (EEP-ROM) Writes the deceleration time constants of speed block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No. These codes are used when linear acceleration/deceleration is selected.	Convert the values into hexadecimal before making setting.
9401 to 9408	Acceleration/deceleration time constant of speed block (EEP-ROM) Writes the acceleration/deceleration time constants of speed block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No. These code Nos. are used when S-pattern acceleration/deceleration is selected.	Convert the values into hexadecimal before making setting.
9501 to 9508	S-pattern time constant of speed block (EEP-ROM) Writes the S-pattern time constants of speed block No. 1 to 8 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The usable speed block Nos. depend on the feeding system and the number of occupied stations. The decimal value converted from the 2 lower digits of the code No. corresponds to the speed block No. These code Nos. are used when S-pattern acceleration/deceleration is selected.	Convert the values into hexadecimal before making setting.

3.5.5 Answer codes (RW_{R2})

If any of the monitor codes, instruction codes, position command data/position block Nos., speed command data/speed block Nos. set to the remote register is outside the setting range, the corresponding error code is set to Answer code (RW_{W2}). “0000” is set if they are normal.



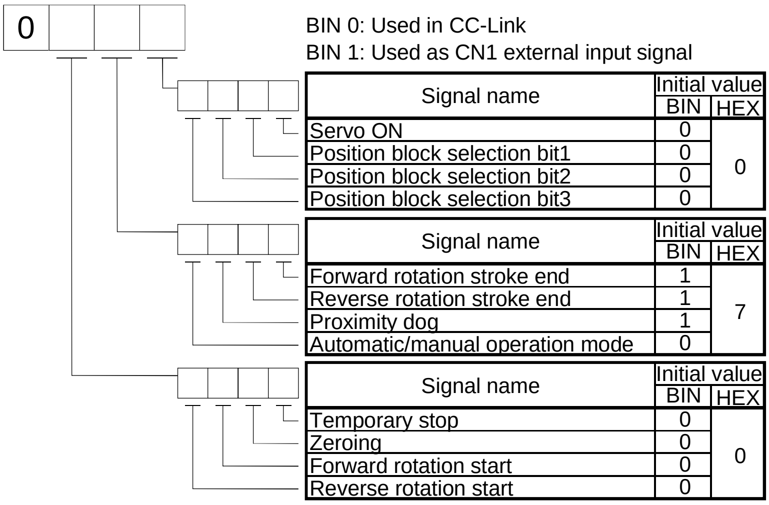
Code No.	Error	Details
0	Normal answer	Instruction was completed normally.
1	Code error	▪ The monitor code not in the specifications was set to RW_{W0} ▪ RW_{W1}. ▪ The instruction code not in the specifications was set to RW_{W2}. ▪ Read/write of the position block data of No. 256 or later was set to RW_{W2}. ▪ Read/write of the speed block data of No. 9 or later was set to RW_{W2}.
2	Parameter ▪ point table selection error	▪ The parameter No. disabled for reference was set to RW_{W2}. ▪ Read/write of the position block data of No. 8 or later was set when 1 station was occupied. ▪ Write of acceleration/deceleration time constant was set when S-pattern acceleration/deceleration was selected, or write of S-pattern acceleration/deceleration time constant was set when linear acceleration/deceleration was selected.
3	Write range error	▪ An attempt was made to write the parameter or point table value outside the setting range to RW_{W3}. ▪ The position command data/position block No./speed command data/speed block No. outside the setting range was set to RW_{W4} ▪ RW_{W5} ▪ RW_{W6}.

3.5.6 Setting the CN1 external input signals

Using parameter No. 66, you can assign the input signals as the CN1 external input signals. The signals assigned as the CN1 external input signals cannot be used in CC-Link. Refer to Section 3.5 for the pins to which signals can be assigned.

(1) Positioning system

In the initial status, the forward rotation stroke end, reverse rotation stroke end and proximity dog are preset to be usable as the CN1 external input signals.



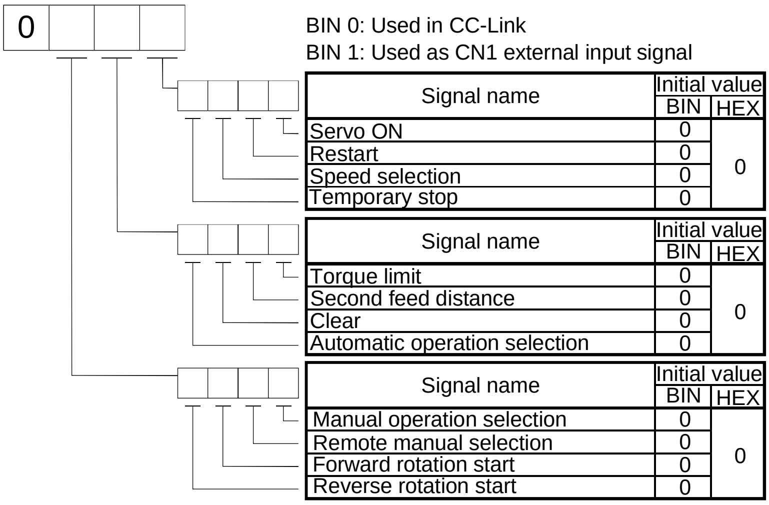
BIN 0: Used in CC-Link
BIN 1: Used as CN1 external input signal

Signal name	Initial value	
	BIN	HEX
Servo ON	0	0
Position block selection bit1	0	
Position block selection bit2	0	
Position block selection bit3	0	

Signal name	Initial value	
	BIN	HEX
Forward rotation stroke end	1	7
Reverse rotation stroke end	1	
Proximity dog	1	
Automatic/manual operation mode	0	

Signal name	Initial value	
	BIN	HEX
Temporary stop	0	0
Zeroing	0	
Forward rotation start	0	
Reverse rotation start	0	

(2) Roll feeding system



BIN 0: Used in CC-Link
BIN 1: Used as CN1 external input signal

Signal name	Initial value	
	BIN	HEX
Servo ON	0	0
Restart	0	
Speed selection	0	
Temporary stop	0	

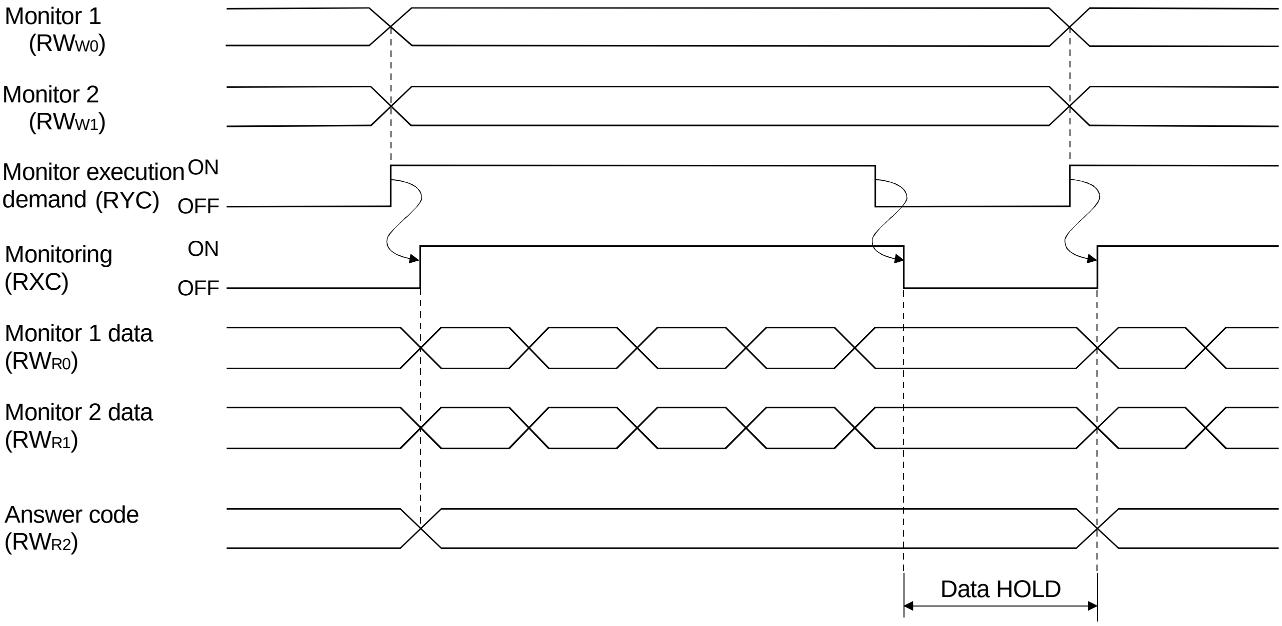
Signal name	Initial value	
	BIN	HEX
Torque limit	0	0
Second feed distance	0	
Clear	0	
Automatic operation selection	0	

Signal name	Initial value	
	BIN	HEX
Manual operation selection	0	0
Remote manual selection	0	
Forward rotation start	0	
Reverse rotation start	0	

3.6 Data communication timing charts

3.6.1 Monitor codes

(1) When 1 station is occupied

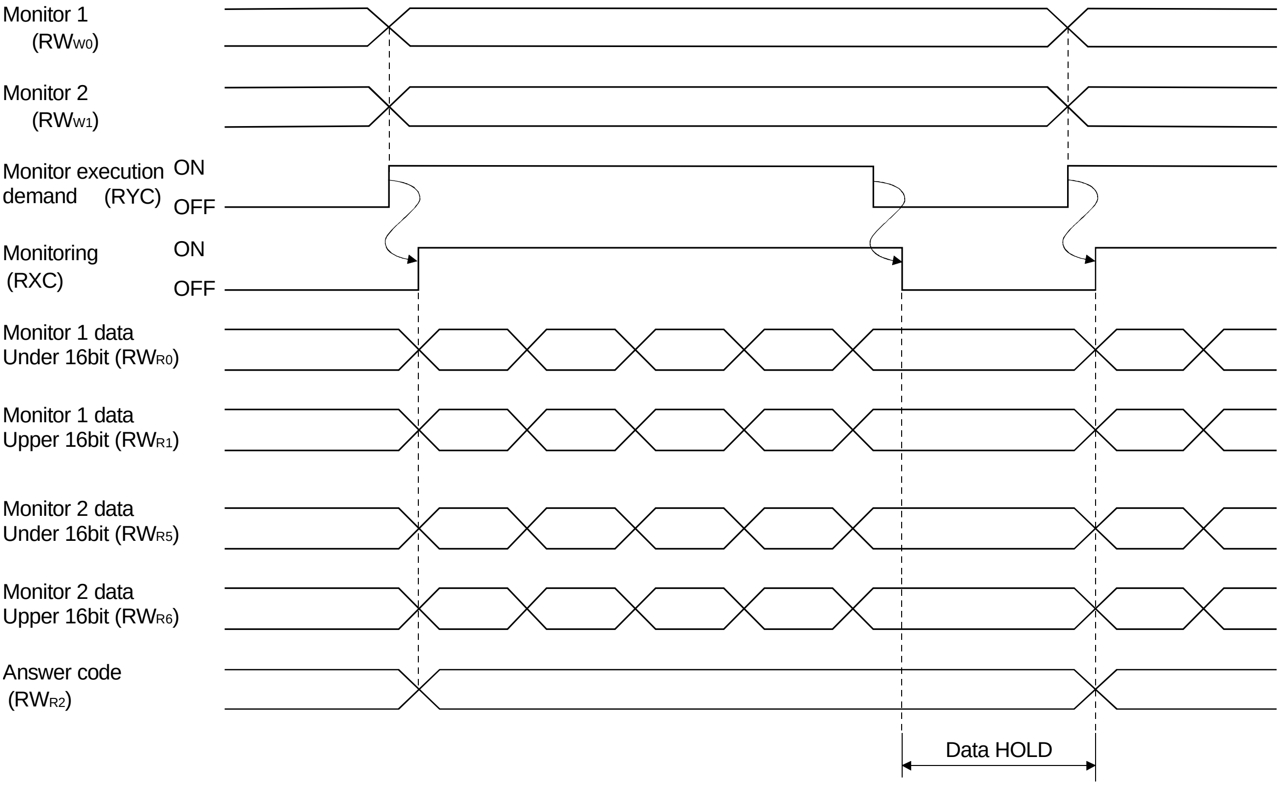


Set the monitor codes (refer to Section 3.5.3) to Monitor 1 (RW_{W0}) and Monitor 2 (RW_{W1}) and turn Monitor output execution demand (RYC) to “1” (ON). Turning RYC to “1” (ON) sets the next data. Data are all hexadecimal numbers. At this time, Monitoring (RXC) turns to “1” (ON) at the same time.

Monitor data 1 (RW_{R0}): Data demanded by Monitor 1 (RW_{W0})
Monitor data 2 (RW_{R1}): Data demanded by Monitor 2 (RW_{W1})
Answer code (RW_{R2}): Normal or error answer code

For 32-bit data, set the lower 16 bits of the monitor code to Monitor 1 (RW_{W0}) and the upper 16 bits to Monitor 2 (RW_{W1}) and read them simultaneously.
The monitor data set to the remote register are always updated while RXC is “1” (ON).
When RXC turns to “0” (OFF), the data set to Monitor data RW_{R0}, RW_{R1} are held. If the monitor code not in the specifications is set to either Monitor 1 (RW_{W0}) or Monitor 2 (RW_{W1}), the corresponding error code (□□□1) is set to Answer code.

(2) When 2 stations are occupied



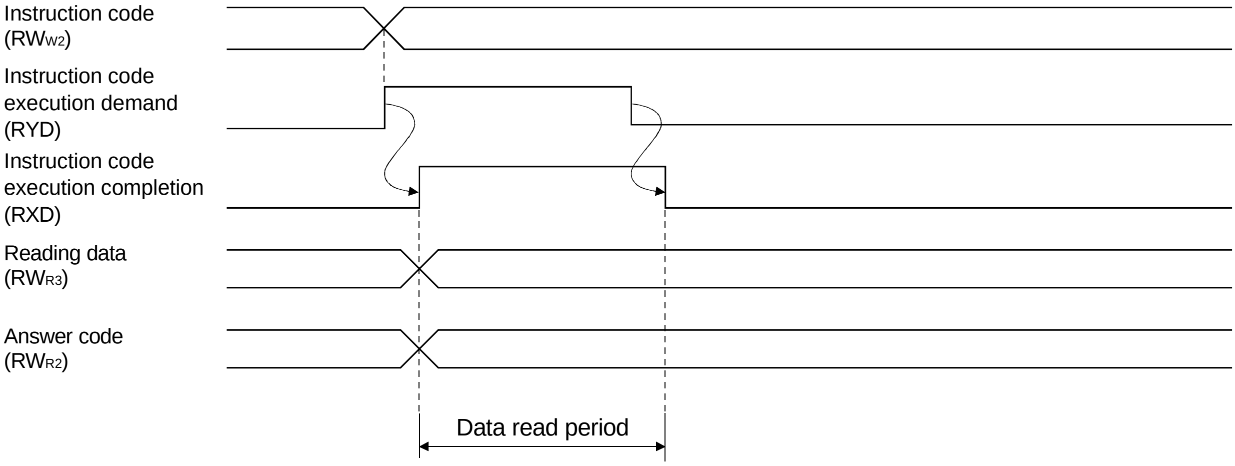
Set the monitor codes (refer to Section 3.5.3) to Monitor 1 (RWw0) and Monitor 2 (RWw1) and turn Monitor output execution demand (RYC) to “1” (ON). Turning RYC to “1” (ON) sets the next data. 32-bit data are all divided into the upper 16 bits and lower 16 bits, and set to the remote register. Data are all hexadecimal numbers. At this time, Monitoring (RXC) turns to “1” (ON) at the same time.

Monitor data 1 under 16 bit (RWr0): Lower 16 bits of data demanded by Monitor 1 (RWw0)
Monitor data 1 upper 16 bit (RWr1): Upper 16 bits of data demanded by Monitor 1 (RWw0)
Monitor data 2 under 16 bit (RWr5): Lower 16 bits of data demanded by Monitor 2 (RWw1)
Monitor data 2 upper 16 bit (RWr6): Upper 16 bits of data demanded by Monitor 2 (RWw1)

A sign is set if data does not exist in RWr1 • RWr6. A “+” sign is indicated by “0000”, and “—” by “FFFF”.
The monitor data set to the remote register are always updated while RXC is “1” (ON).
When RXC turns to “0” (OFF), the data set to Monitor data RWr0, RWr1, RWr5, RWr6 are held.
If the monitor code not in the specifications is set to either Monitor 1 (RWw0) or Monitor 2 (RWw1), the corresponding error code (□□□ 1) is set to Answer code.

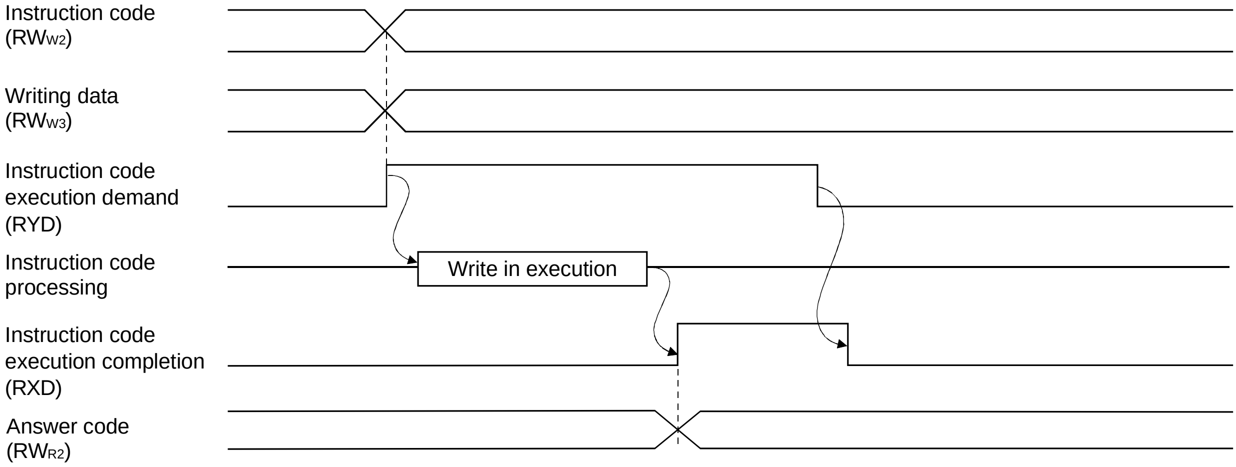
3.6.2 Instruction codes

(1) Read instruction codes (0000 to 7FFFh)



Set the read instruction code (refer to Section 3.5.4 (1)) to Instruction code (RWW2) and turn Instruction code execution demand (RYD) to "1" (ON). Turning RYD to "1" (ON) sets the data corresponding to the preset read code to Reading data (RWR3). Data are all hexadecimal numbers. At this time, Instruction code execution completion (RXD) turns to "1" (ON) at the same time.
Read the read data set to RWR3 while RXD is "1" (ON). The data set to Reading data (RWR3) is held until the next read instruction code is set and RYD is turned to "1" (ON).
If the instruction code not in the specifications is set to Instruction code (RWW2), the corresponding error code (□ □ 1 □) is set to Answer code. If any unusable parameter, position block or speed block is read, the corresponding error code (□ □ 2 □) is set.
Turn Instruction code execution demand (RYD) to "0" (OFF) after completion of data read.

(2) Write instruction codes (80000 to FFFFh)



Set the write instruction code (refer to Section 3.5.4 (2)) to Instruction code (RWw2) and the data to be written (data to be executed) to Writing data (RWw3) in hexadecimal, and turn Instruction code execution demand (RYD) to "1" (ON).

Turning RYD to "1" (ON) sets the data set in Wiring data (RWw3) to the item corresponding to the write instruction code. When write is executed, Instruction code execution completion (RXD) turns to "1" (ON).

If the instruction code not in the specifications is set to Instruction code (RWw2), the corresponding error code (☐☐ 1 ☐) is set to Answer code.

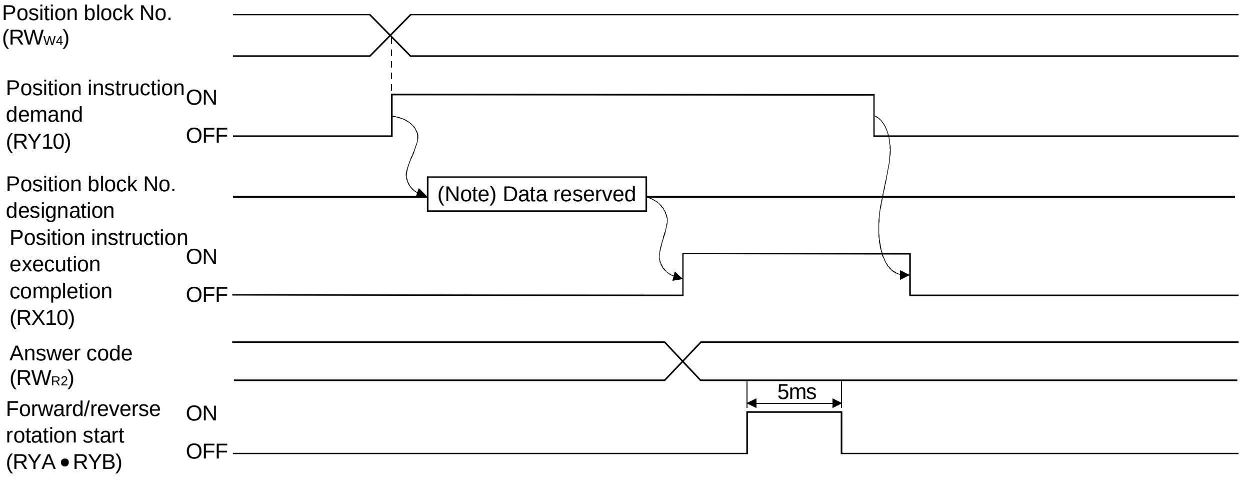
Turn Instruction code execution demand (RYD) to "0" (OFF) after Instruction code execution completion (RXD) has turned to "1" (ON).

3.6.3 Position and speed commands

The functions in this section are usable only when 2 stations are occupied.
This section shows the timing charts for specifying the position block No., speed block No., position command data and speed command data as word data.

(1) When specifying the position block No.

Preset "□□□ 0" (initial value) in parameter No. 65 to enable position block No.-specified operation.

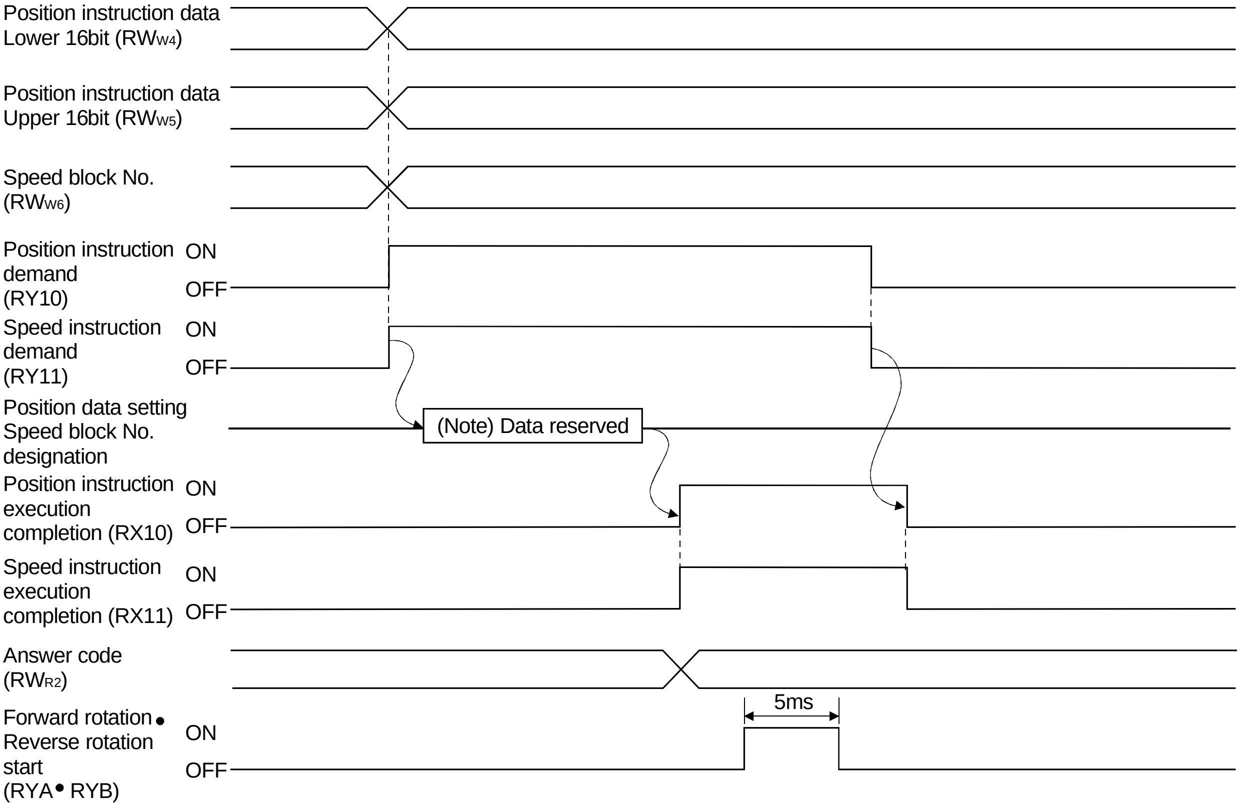


Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the position block No. to Position block No. (RWw4) and turn Position instruction demand (RY10) to "1" (ON).
Turning RY10 to "1" (ON) stores the position block No. into RAM of the servo amplifier.
When the data is stored, Position instruction execution completion (RX10) turns to "1" (ON).
If data outside the setting range is set to Position block No. (RWw4), the error code (refer to Section 3.5.5) is set to Answer code.
Turn Forward rotation start (RYA)/Reverse rotation start (RYB) to "1" (ON) after Position instruction execution completion (RX10) has turned to "1" (ON).

(2) When setting the position command data and specifying the speed block No.

Preset "□ □ □ 1" in parameter No. 65 to enable position command data-set and speed block No.-specified operation.



Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data under 16 bit (RWw4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWw5), and speed block No. to Speed block No. (RWw6), and turn Position instruction demand (RY10) and Speed instruction demand (RY11) to "1" (ON).

Turning RY10 and RY11 to "1" (ON) stores the position command data and speed block No. into RAM of the servo amplifier.

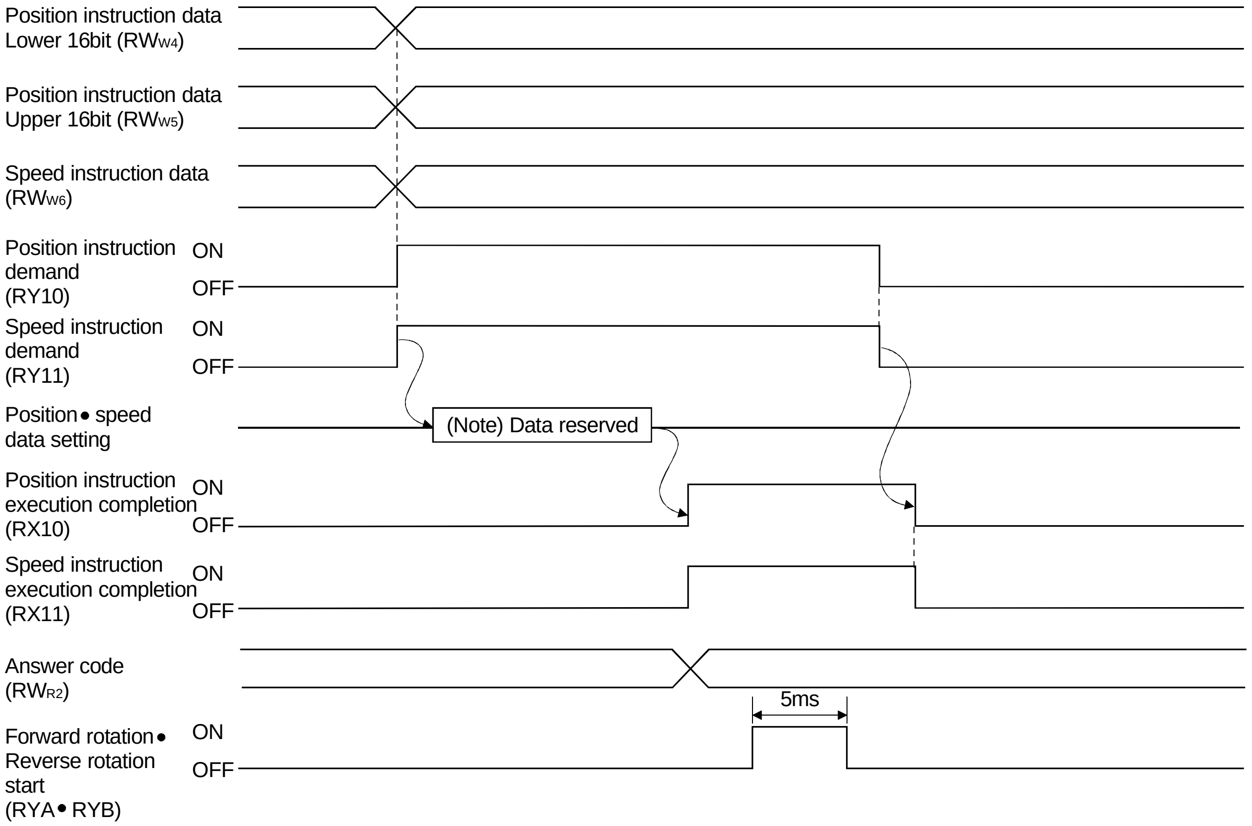
When the data are stored, Position instruction execution completion (RX10) and Speed instruction execution completion (RX11) turn to "1" (ON).

If data outside the setting range is set to any of Position instruction data under 16 bit (RWw4), Position instruction data upper 16 bit (RWw5) and Speed block No. (RWw6), the error code (refer to Section 3.5.5) is set to Answer code.

Turn Forward rotation start (RYA) • Reverse rotation start (RYB) to "1" (ON) after Position instruction execution completion (RX10) and Speed instruction execution completion (RX11) have turned to "1" (ON).

(3) When setting the position command data and speed command data

Preset "□ □ □ 2" in parameter No. 65 to enable position command data- and speed command data-set operation. As the acceleration ･ deceleration time constant for operation, use the setting of speed block No. 1.



Note. This data is stored into RAM of the servo amplifier. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data under 16 bit (RWw4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWw5), and speed instruction data to Speed instruction data (RWw6), and turn Position instruction demand (RY10) and Speed instruction demand (RY11) to "1" (ON).

Turning RY10 and RY11 to "1" (ON) stores the position command data and speed command data into RAM of the servo amplifier.

When the data are stored, Position instruction execution completion (RX10) and Speed instruction execution completion (RX11) turn to "1" (ON).

If data outside the setting range is set to any of Position instruction data under 16 bit (RWw4), Position instruction data upper 16 bit (RWw5) and Speed command data (RWw6), the error code (refer to Section 3.5.5) is set to Answer code.

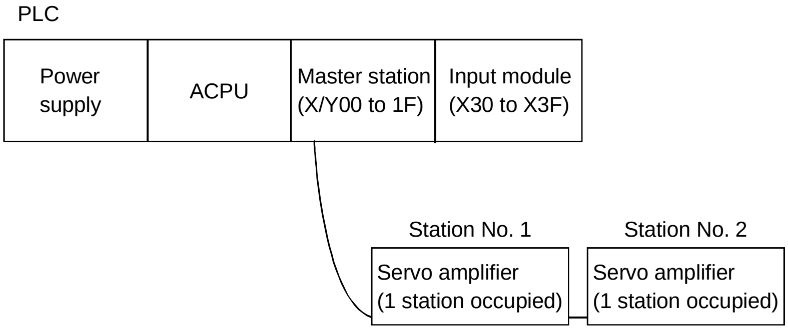
Turn Forward rotation start (RYA) ･ Reverse rotation start (RYB) to "1" (ON) after Position instruction execution completion (RX10) and Speed instruction execution completion (RX11) have turned to "1" (ON).

3.7 Function-by-function programming examples

This section explains specific programming examples for servo operation, monitor, parameter read and write, and others on the basis of the equipment makeup shown in Section 3.7.1.

3.7.1 System configuration example

As shown below, the CC-Link system master･local module is loaded to run two servo amplifiers (1 station occupied).

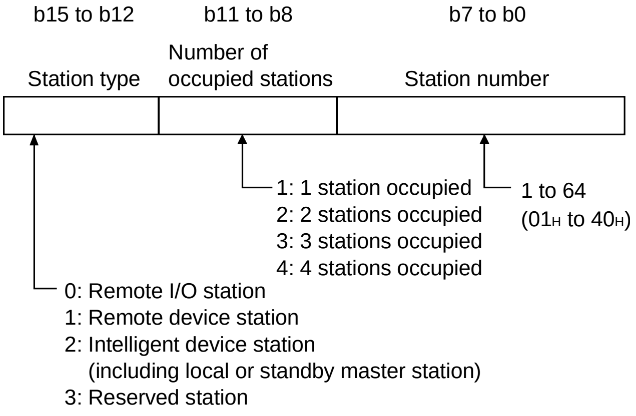


3.7.2 Master station parameter setting

Write the CC-Link parameters and CC-Link master station to the buffer memory of the CC-Link system master ▪ local module.

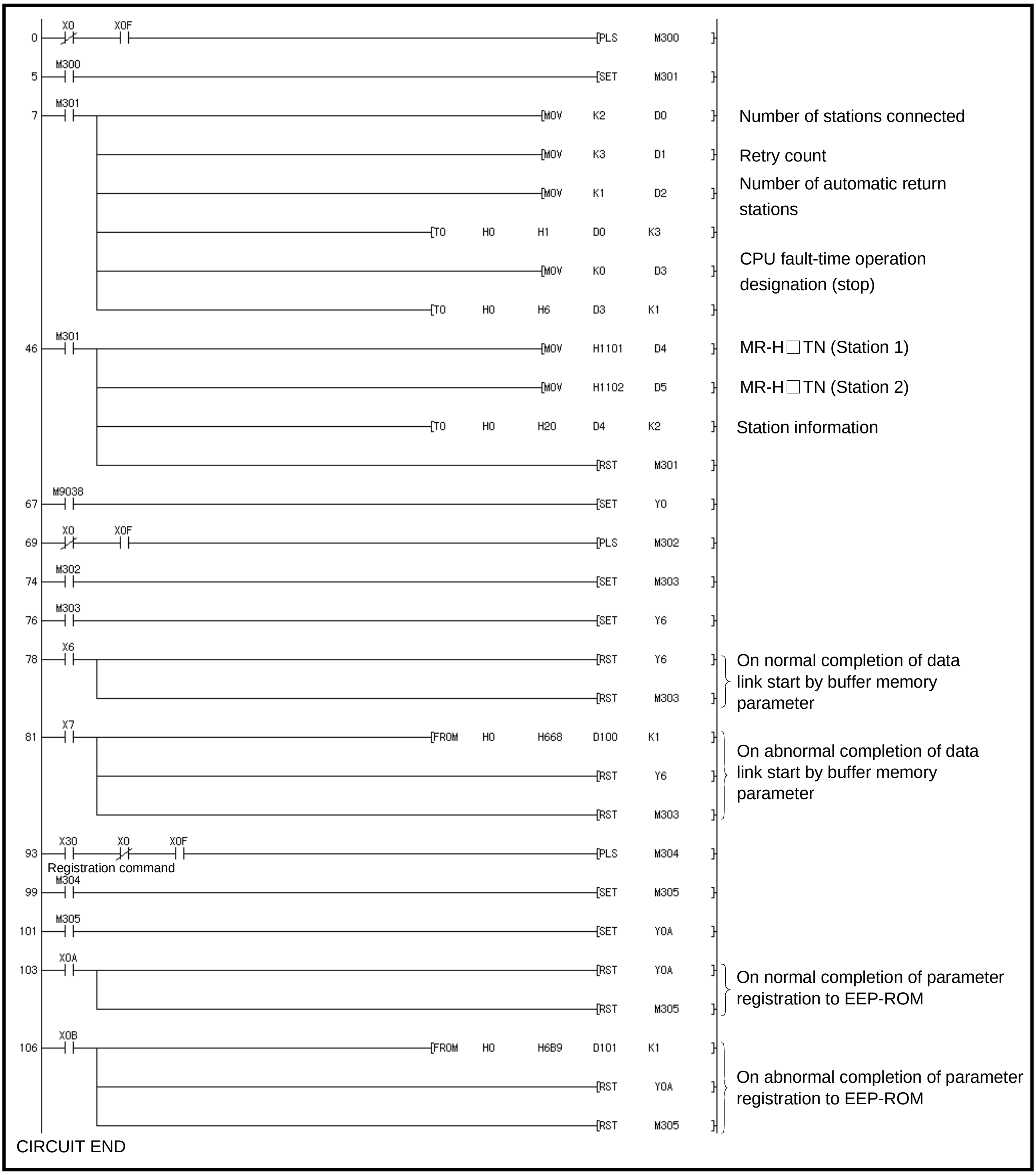
(1) Parameter setting items

The following table indicates the items to be set to “parameter information area (addresses 0H to 5FH)” of the master station buffer memory.

Setting item	Description	Buffer memory address
Number of stations connected	Set the number of remote and local stations connected to the master station. (Including the reserved stations) Default value: 42 Setting range: 1 to 64	1H
Retry count	Set the number of retries for a communication error. Default value: 3 (times) Setting range: 1 to 7 (times)	2H
Number of automatic return stations	Set the number of remote and local stations that can return to the system at 1 link scan. Default value: 1 (stations) Setting range: 1 to 10 (stations)	3H
CPU fault-time operation designation	Specify the data link status at occurrence of master station PLC CPU fault. Default value: 0 (stop) Setting range: 0 (stop) : 1 (continued)	4H
Reserved station designation	Specify the reserved station. Default value: 0 (no setting) Setting range: Turn ON the bit corresponding to the station number.	10H to 13H
Invalid station designation	Specify the invalid station. Default value: 0 (no setting) Setting range: Turn ON the bit corresponding to the station number.	14H to 17H
Station information	Set the types of the remote and local stations connected. Default value: 0101H (remote I/O station, 1 station occupied, station 1) to 0140H (remote I/O station, 1 station occupied, station 64) Setting range: See below.  	20H (first station) to 5FH (64th station)

(2) Program examples

(a) For debugging



Number of stations connected

Retry count

Number of automatic return stations

CPU fault-time operation designation (stop)

MR-H□TN (Station 1)

MR-H□TN (Station 2)

Station information

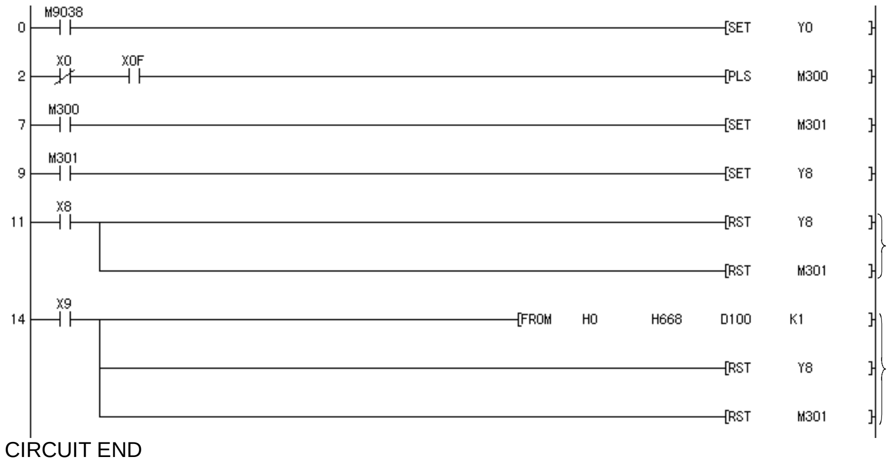
On normal completion of data link start by buffer memory parameter

On abnormal completion of data link start by buffer memory parameter

On normal completion of parameter registration to EEP-ROM

On abnormal completion of parameter registration to EEP-ROM

(b) CC-Link master station parameter setting (for operation) - initial setting



Refresh directive

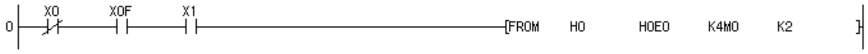
Data link start request by parameter to EEP-ROM

On normal completion of data link start by parameter to EEP-ROM

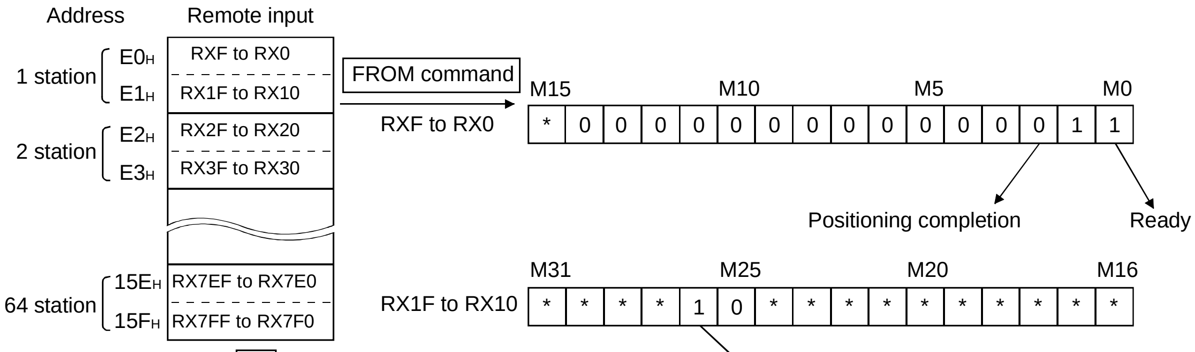
On abnormal completion of data link start by parameter to EEP-ROM

3.7.3 Reading the servo amplifier status

Read the status of the servo amplifier from the master station buffer memory. The servo amplifier status is always stored in the remote input RX (addresses E0H to 15FH). Read the servo amplifier status (in positioning mode) of station 1 to M0～M31.



Reads remote input (RX00 to RX1F) of buffer memory to M0～M31.



Note. ☐ area is for one servo amplifier.

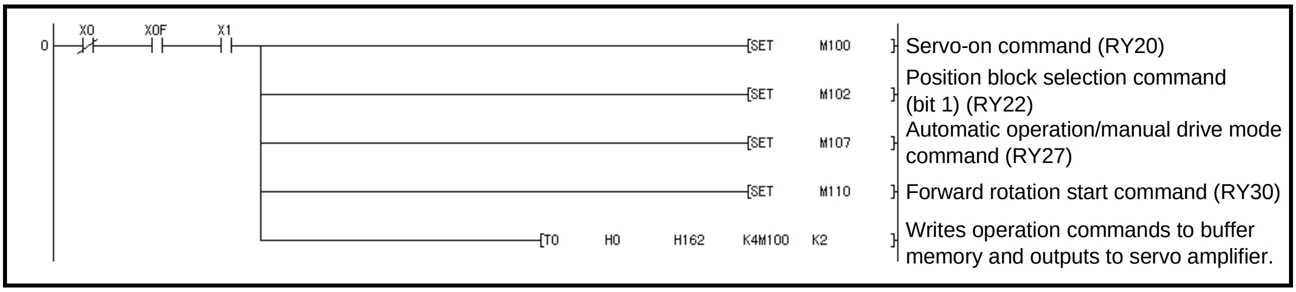
* : 0 or 1

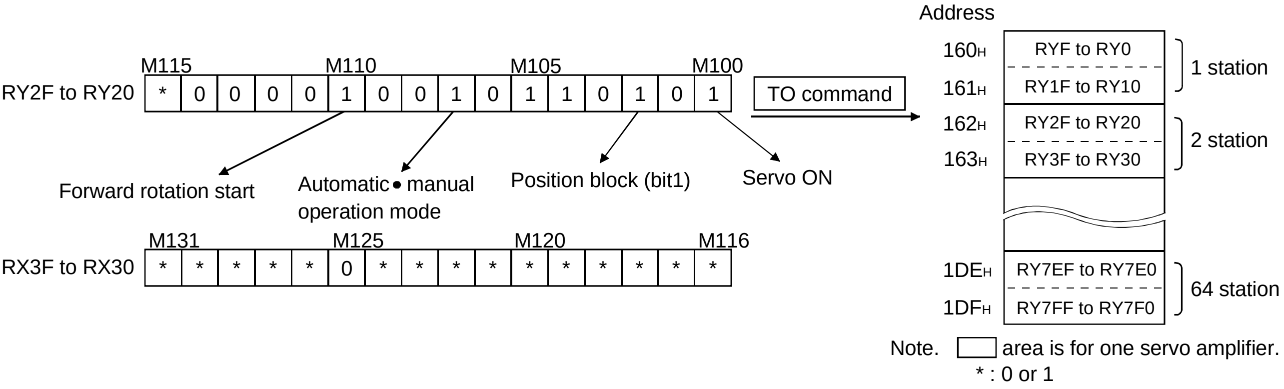
Servo amplifier status

M0: Ready (RD)
M1: In position (PF)
M2: Rough match (CPO)
M3: Zeroing completion (ZP)
M4: M code (bit 0)
M5: M code (bit 1)
M6: Alarm code (bit 0)
M7: Alarm code (bit 1)
M8: Alarm code (bit 2)
M9: Alarm code (bit 3)
M10: Limiting torque
M11: Electromagnetic brake interlock
M12: Monitoring
M13: Instruction code execution completion
M14: Warning
M15: ―――
M16: ―――
M17: ―――
M18: ―――
M19: ―――
M20: ―――
M21: ―――
M22: ―――
M23: ―――
M24: ―――
M25: ―――
M26: Trouble (ALM)
M27: Remote station communication ready
M28: ―――
M29: ―――
M30: ―――
M31: ―――

3.7.4 Writing the operation commands

To operate the servo amplifier, write the operation commands to the remote output RY (addresses 160H to 1DFH). Perform positioning operation of position block No. 2 for the servo amplifier of station 2.





Operation commands

M100: Servo on (SON)
M101: Position block selection (bit 1)
M102: Position block selection (bit 2)
M103: Position block selection (bit 3)
M104: Forward rotation stroke end (LSP)
M105: Reverse rotation stroke end (LSN)
M106: Proximity dog (CR)
M107: Automatic operation/manual drive mode (DI0)
M108: Temporary stop (DI1)
M109: Zeroing (DI2)
M110: Forward rotation start (ST1)
M111: Reverse rotation start (ST2)
M112: Monitor output execution demand (MOR)
M113: Instruction code execution demand (COR)
M114: Torque limit selection (TL)
M115: ———
M116: ———
M117: ———
M118: ———
M119: ———
M120: ———
M121: ———
M122: ———
M123: ———
M124: ———
M125: ———
M126: Reset (RES)
M127: ———
M128: ———
M129: ———
M130: ———
M131: ———

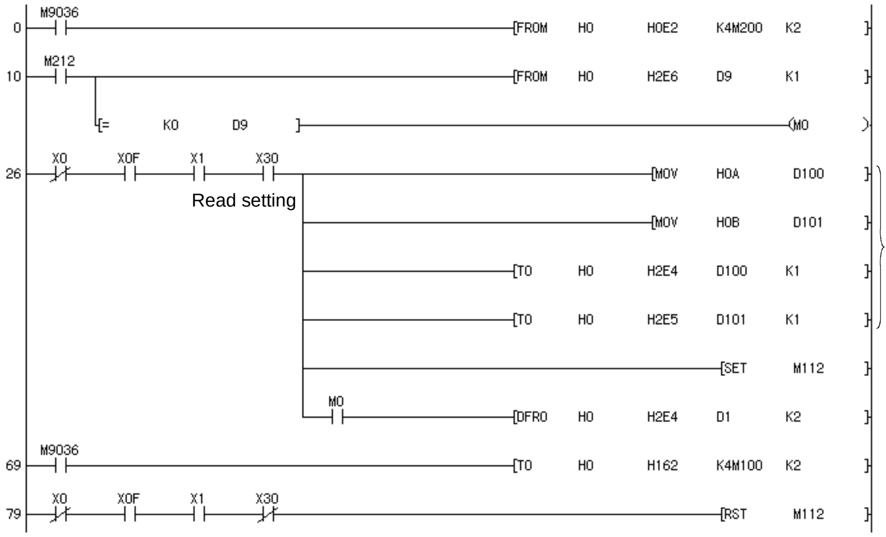
3.7.5 Reading the data

Read various data of the servo amplifier.

(1) Reading the monitor value

Read the “feedback pulse value” of the servo amplifier of station 2 to D1.

Data No.	Description
H000A	Lower 16-bit data of feedback pulse value
H000B	Upper 16-bit data of feedback pulse value



Reads remote input (RX20 to RX3F) of buffer memory to M200～M231.

Stores answer code to D9.

Outputs M0 for normal reply.

Sets monitor code (HOA) of feedback pulse value (lower 16 bits) to RWw4.

Sets monitor code (HOB) of feedback pulse value (upper 16 bits) to RWw5.

Turns on monitor command (RY2C).

Reads data to RWR4 and RWR5 of buffer memory when answer code is normal reply.

Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

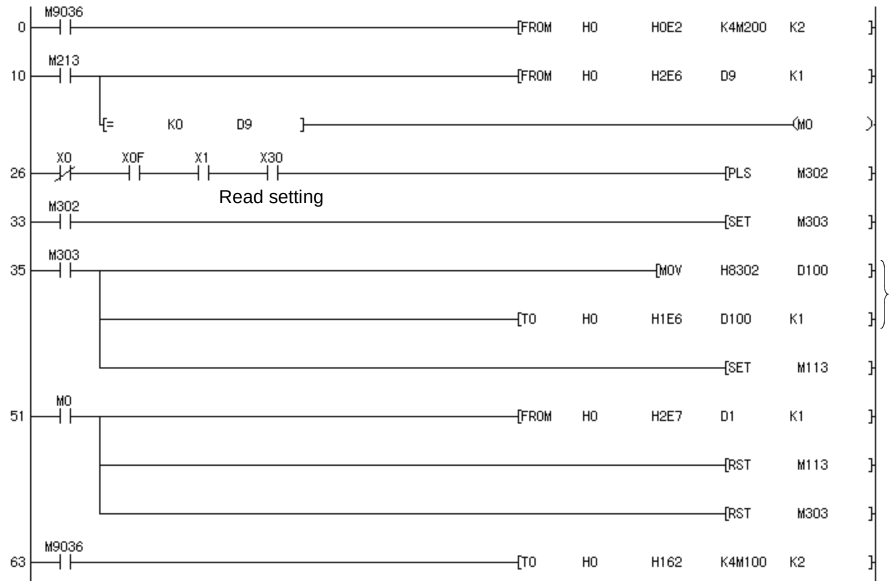
Monitor stop

(2) Reading the parameter

Read parameter No. 2 “Feeding system ･ regenerative brake option selection” of the servo amplifier of station 2 to D1.

Data No.	Description
H8302	Parameter No. 2 setting (hexadecimal)

The answer code at instruction code execution is set to D9.



Reads remote input (RX20 to RX3F) of buffer memory to M200～M231.

Outputs M0 for normal reply.

Writes parameter No. 2 read (H8302) to RW_{W6}.

Turns on instruction code execution demand (RY2D).

Reads RW_{R7} of buffer memory to D1 when answer code is normal reply.

Turns off instruction code execution demand (RY2D).

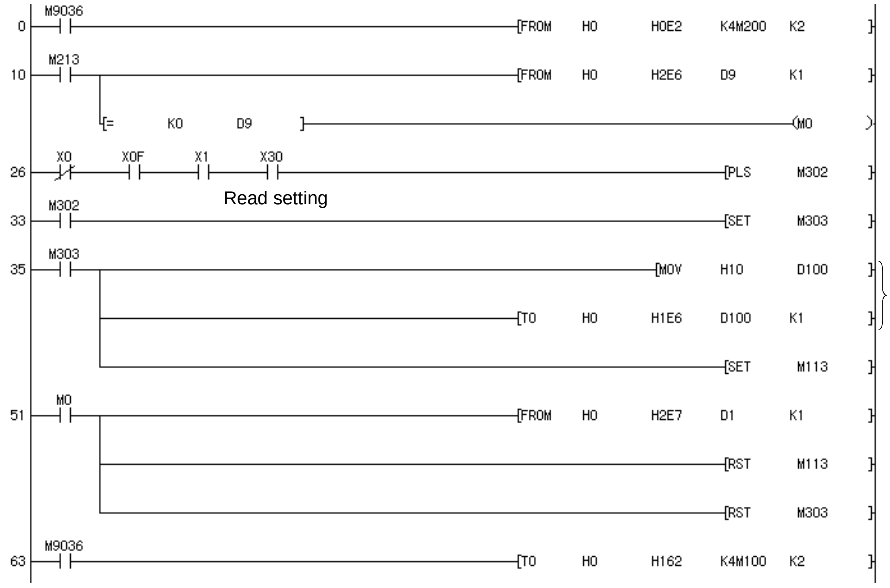
Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

(3) Reading the alarm definition

Read the alarm definition of the servo amplifier of station 2 to D1.

Data No.	Description
H0010	Occurring alarm/warning No. (hexadecimal)

The answer code at instruction code execution is set to D9.



Reads remote input (RX00 to RX2F) of buffer memory to M200～M231.

Stores answer code to D9.

Outputs M0 for normal reply.

Writes current alarm read (H0010) to RWW6.

Turns on instruction code execution demand (RY2D).

Reads RWR7 of buffer memory to D1 when answer code is normal reply.

Turns off instruction code execution demand (RY2D).

Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

3.7.6 Writing the data

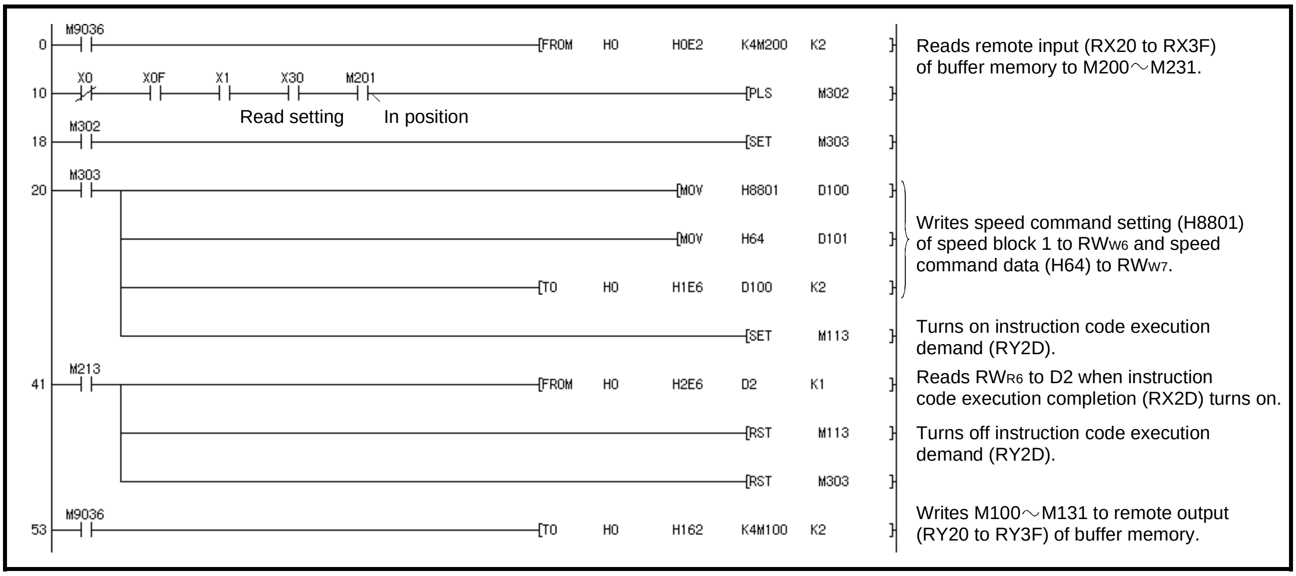
This section explains the programs for writing various data to the servo amplifier.

(1) Writing the speed command data (servo motor speed)

Change the speed command data in the speed block No. 1 of the servo amplifier of station 2 to 100.

Data No.	Description
H8801	Write of speed command data of speed block No. 1 (hexadecimal)
H0064	Speed command data of speed block No. 1 (hexadecimal)

The answer code at instruction code execution is set to D2.



Reads remote input (RX20 to RX3F) of buffer memory to M200～M231.

Writes speed command setting (H8801) of speed block 1 to RW_{W6} and speed command data (H64) to RW_{W7}.

Turns on instruction code execution demand (RY2D).

Reads RW_{R6} to D2 when instruction code execution completion (RX2D) turns on.

Turns off instruction code execution demand (RY2D).

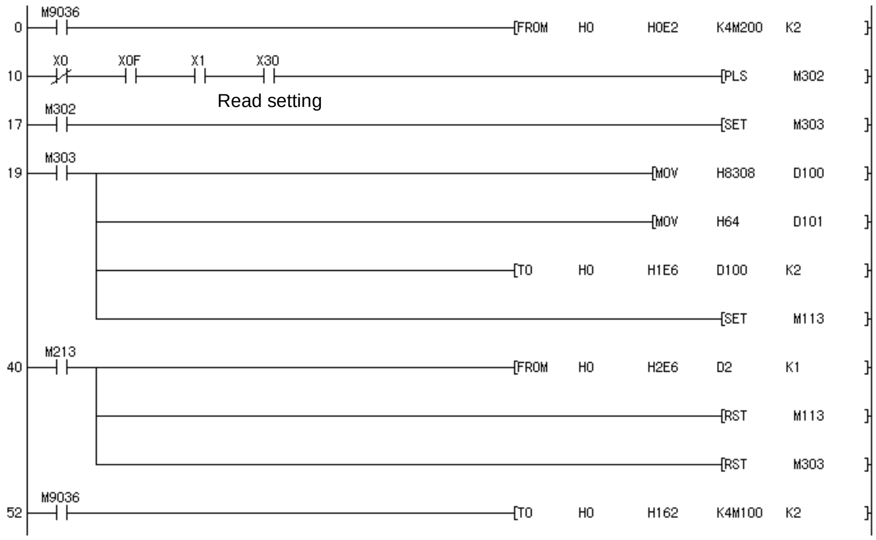
Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

(2) Writing the parameter

Change parameter No. 8 “JOG speed” of the servo amplifier of station 2 to 100.

Data No.	Description
H8308	Parameter No. 8 write (hexadecimal)
H0064	Set data (hexadecimal)

The answer code at instruction code execution is set to D2.



```
     M9036
0  ──┤ ├────────────────────────────────[FROM  H0    H0E2   K4M200  K2 ]
     X0     X0F    X1     X30
10 ──┤/├────┤ ├────┤ ├────┤ ├───────────────────────[PLS          M302 ]
     M302               Read setting
17 ──┤ ├────────────────────────────────────────────[SET          M303 ]
     M303
19 ──┤ ├──┬───────────────────────────────────[MOV   H8308        D100 ]
          ├───────────────────────────────────[MOV   H64          D101 ]
          ├─────────────────────────────[TO    H0    H1E6   D100    K2 ]
          └─────────────────────────────────────────[SET          M113 ]
     M213
40 ──┤ ├──┬─────────────────────────────[FROM  H0    H2E6   D2      K1 ]
          ├─────────────────────────────────────────[RST          M113 ]
          └─────────────────────────────────────────[RST          M303 ]
     M9036
52 ──┤ ├────────────────────────────────[TO    H0    H162   K4M100  K2 ]
```

Reads remote input (RX20 to RX3F) of buffer memory to M200～M231.

Writes parameter No. 8 write (H8308) to RW_{W6} and data (H64) to RW_{W7}.

Turns on instruction code execution demand (RY2D).

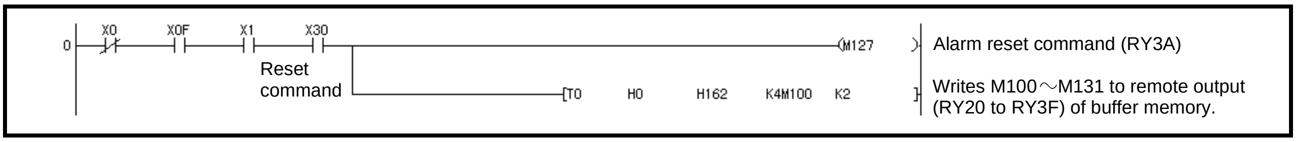
Reads RW_{R6} to D2 when instruction code execution completion (RX2D) turns on.

Turns off instruction code execution demand (RY2D).

Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

(3) Servo amplifier alarm resetting program examples

(a) Deactivate the alarm of the servo amplifier of station 2 by providing output from the PLC to the servo.



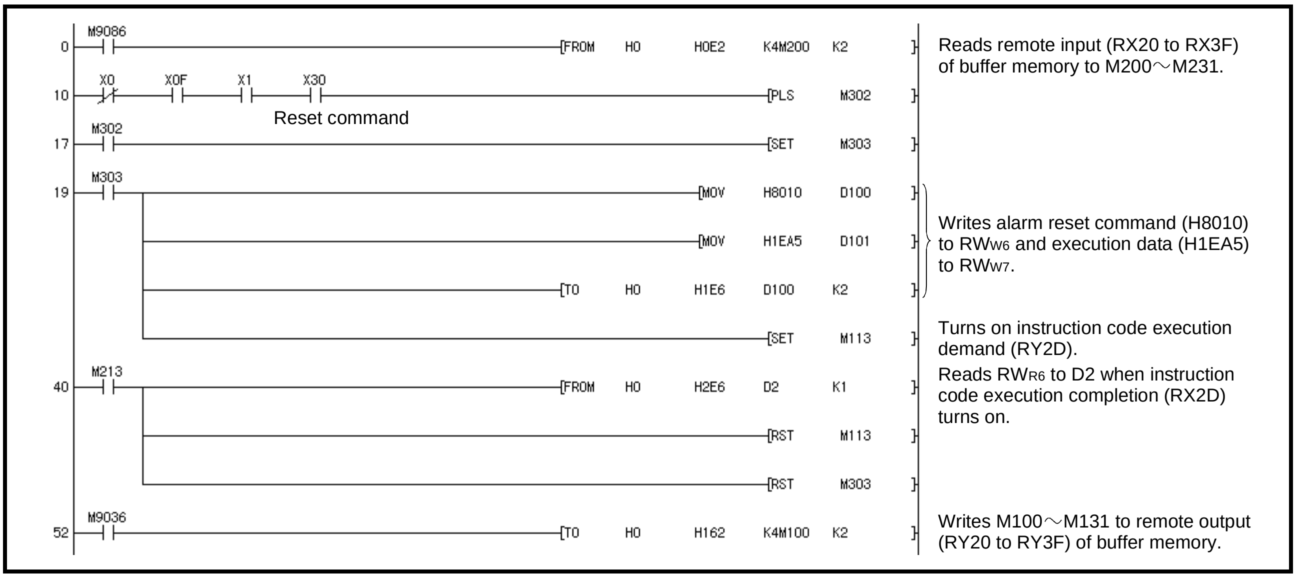
Alarm reset command (RY3A)

Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

(b) Deactivate the alarm of the servo amplifier of station 2 using the instruction code.

Data No.	Description
H8010	Alarm reset command (hexadecimal)
H1EA5	Execution data (hexadecimal)

The answer code at instruction code execution is set to D2.



Reads remote input (RX20 to RX3F) of buffer memory to M200～M231.

Writes alarm reset command (H8010) to RWw6 and execution data (H1EA5) to RWw7.

Turns on instruction code execution demand (RY2D).

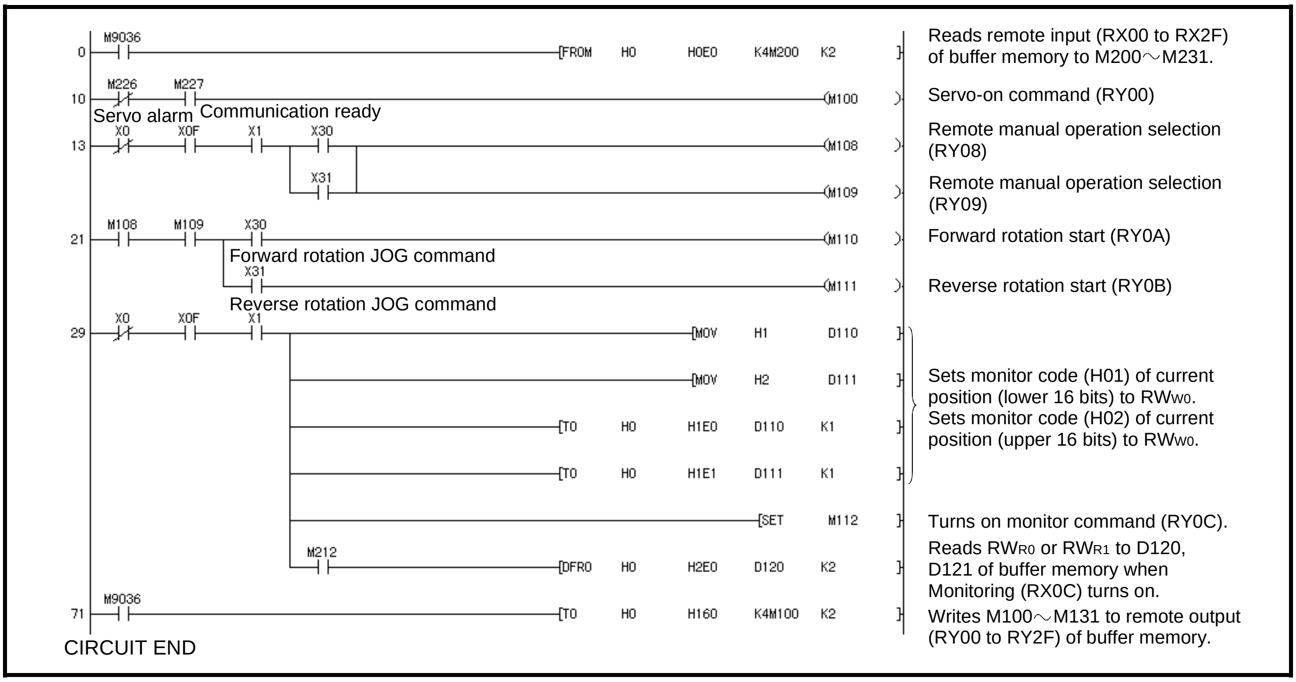
Reads RWr6 to D2 when instruction code execution completion (RX2D) turns on.

Writes M100～M131 to remote output (RY20 to RY3F) of buffer memory.

3.7.7 Operation

Perform JOG operation (roll feeding mode) of the servo amplifier of station 1 and read the "current position" data.

Data No.	Description
H0001	Lower 16-bit data of current position
H0002	Upper 16-bit data of current position

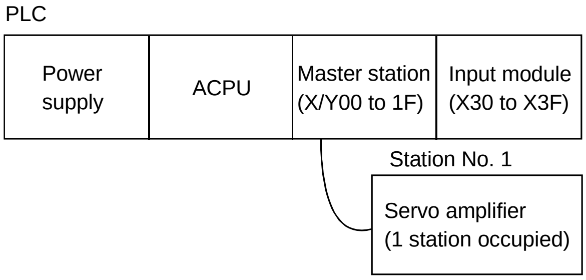


3.8 Continuous operation program example

This section shows a program example which includes a series of communication operations from a servo start. The program will be described on the basis of the equipment makeup shown in Section 3.8.1.

3.8.1 System configuration example

As shown below, the CC-Link system master・local module is loaded to run one servo amplifier (1 station occupied).

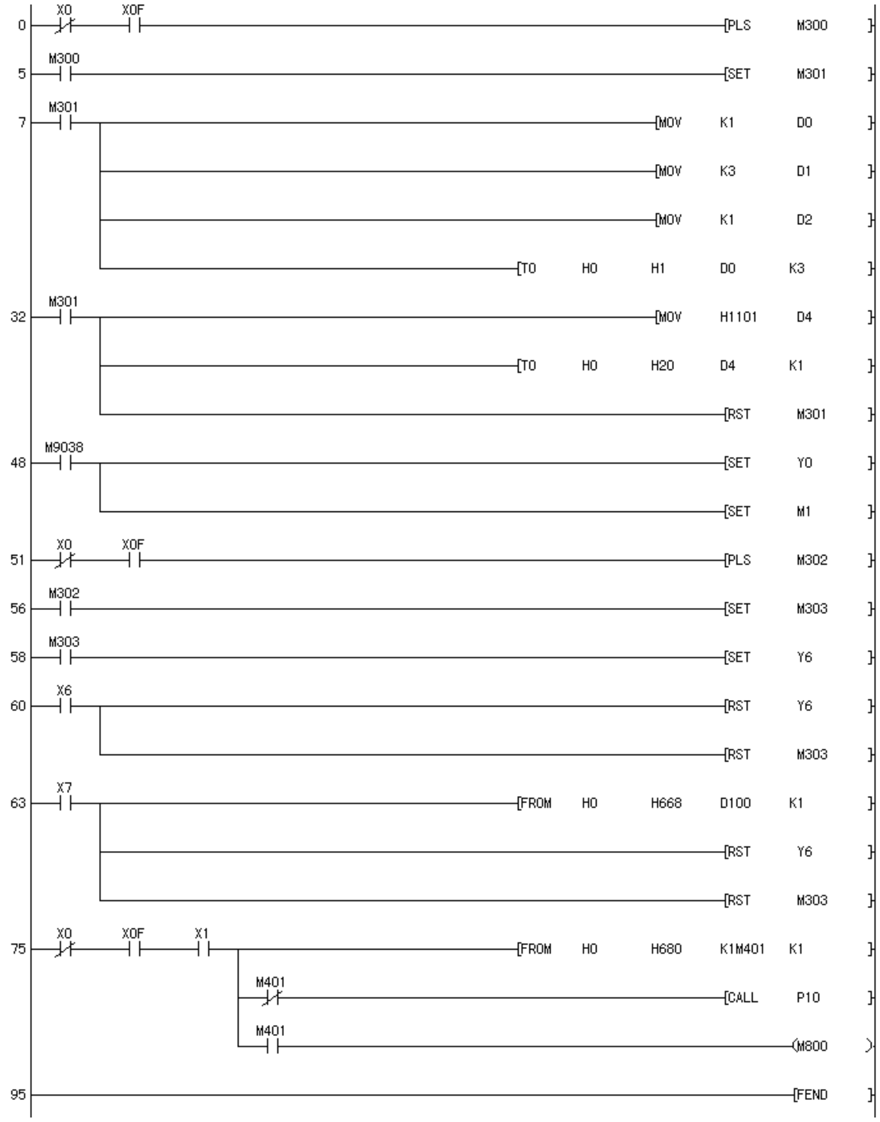


3.8.2 Program example

Operate the servo amplifier of station 1 in the positioning mode and read the “current position” data.

Operation: Alarm reset, dog type zeroing, JOG operation, automatic operation under point table command

Data No.	Description
H0001	Lower 16-bit data of current position
H0002	Upper 16-bit data of current position



Number of stations connected

Retry count

Number of automatic return stations

MR-H□TN (Station 1)

Station information

Initialize timer command

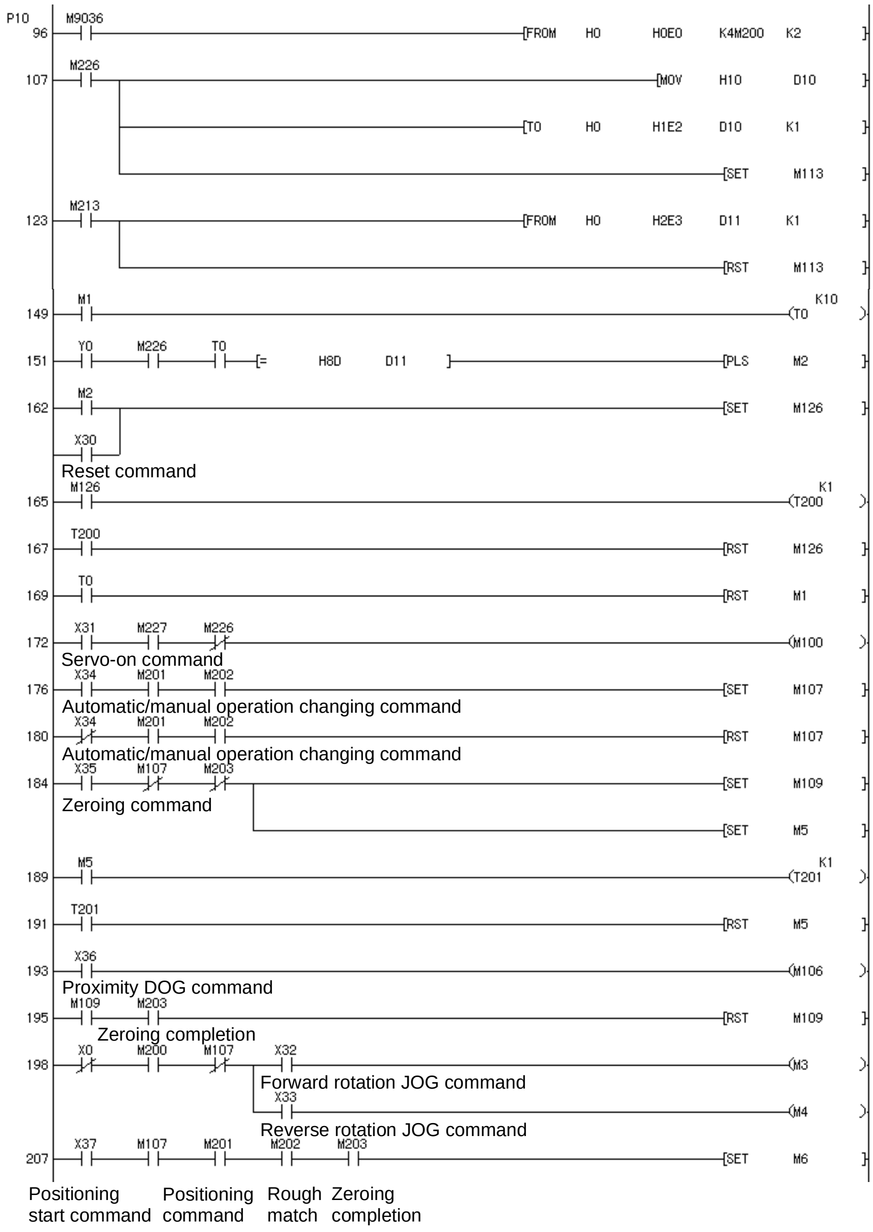
On normal completion of data link start by buffer memory parameter

On abnormal completion of data link start by buffer memory parameter

Reads data link status of remote device station.

During station 1 data link

Station 1 data link abnormal



Reads remote input (RX00 to RX2F) of buffer memory to M200～M231.

Writes current alarm read (H0010) to RWw2 at servo alarm (RY1A) occurrence.

Reads RWR3 of buffer memory to D11 when answer code is normal reply.

Turns off instruction code execution demand (RY0D).

Communication error (AL.8D) avoiding delay timer 1s at CPU reset. (Change according to actual scan time.)

Servo reset request for communication error (AL.8D) avoidance at CPU reset

Alarm reset command (RY1A)

Command request time 10ms

Alarm reset command (RY1A) reset

Initialize timer command reset

Servo-on command (RY00)

Automatic operation mode

Manual operation mode

Zeroing mode (RY09)

Forward rotation start request

Command request time 10ms

Forward rotation start request reset

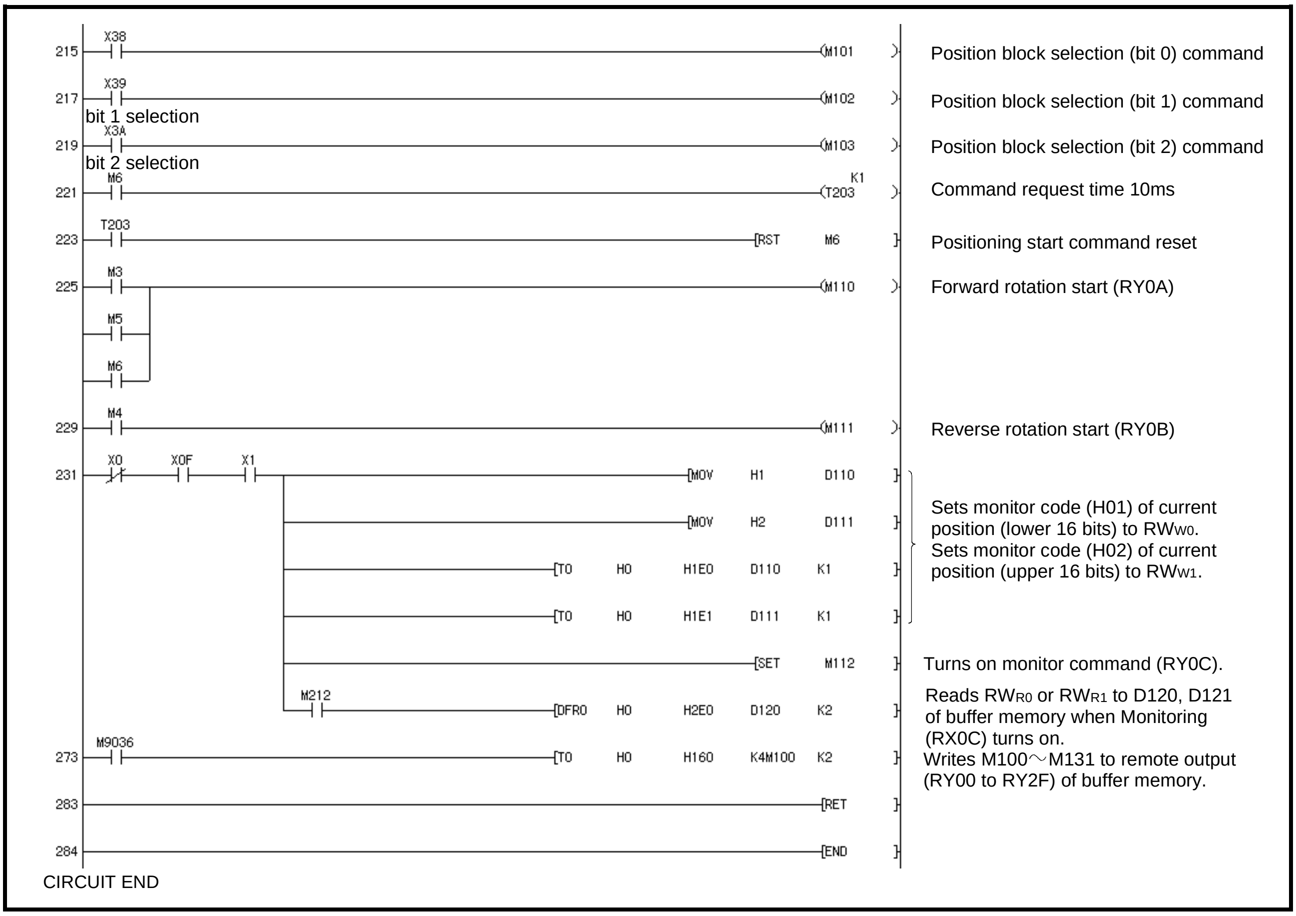
Proximity DOG command (RY06)

Zeroing mode (RY09) reset

Forward rotation start request

Reverse rotation start request

Positioning start command



Position block selection (bit 0) command

Position block selection (bit 1) command

Position block selection (bit 2) command

Command request time 10ms

Positioning start command reset

Forward rotation start (RY0A)

Reverse rotation start (RY0B)

Sets monitor code (H01) of current position (lower 16 bits) to RW_{W0}.
Sets monitor code (H02) of current position (upper 16 bits) to RW_{W1}.

Turns on monitor command (RY0C).

Reads RW_{R0} or RW_{R1} to D120, D121 of buffer memory when Monitoring (RX0C) turns on.

Writes M100～M131 to remote output (RY00 to RY2F) of buffer memory.

MEMO

4. POSITIONING SYSTEM

4.1 Positioning system specifications

Item			Specifications
Command system	Point table number input	Operational specifications	Position block number is specified for positioning.
		Position command input	▪ You can select 8 points when 1 station is occupied or 256 points when 2 stations are occupied. ▪ 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 command data input (when 2 stations are occupied)	Operational specifications	Remote register setting is used for positioning.
		Position command input	▪ Remote register is used to set position command data. ▪ Feed length input setting range: ±1µm to ±999.999m
		Speed command input	▪ Remote register is used to make selection from 8 speed blocks. ▪ Remote register is used to set speed command data (speed).
		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 120000r/min for MR-HDP01 ▪ Parameter setting is used to select the multiplying factor (×1, ×10, ×100) of the manual pulse generator input pulses. ▪ When 2 stations are occupied, the input signal is used to choose the multiplying factor (×1, ×10, ×100).
	(Note) Manual zeroing mode	Dog type	Z-phase 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 when 1 station is occupied or 00 to 99 when 2 stations are occupied ▪ Acceleration/deceleration method setting (S-shaped acceleration/deceleration, separate settings for acceleration and deceleration) ▪ Backlash compensation ▪ Alarm code is output.

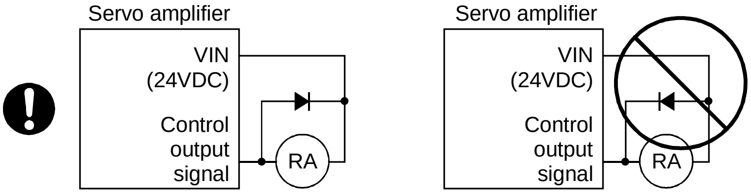
4.2 Standard connection examples

⚠ 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 servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+,−) is correct. Otherwise, a burst, 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 forced stop and other protective circuits.



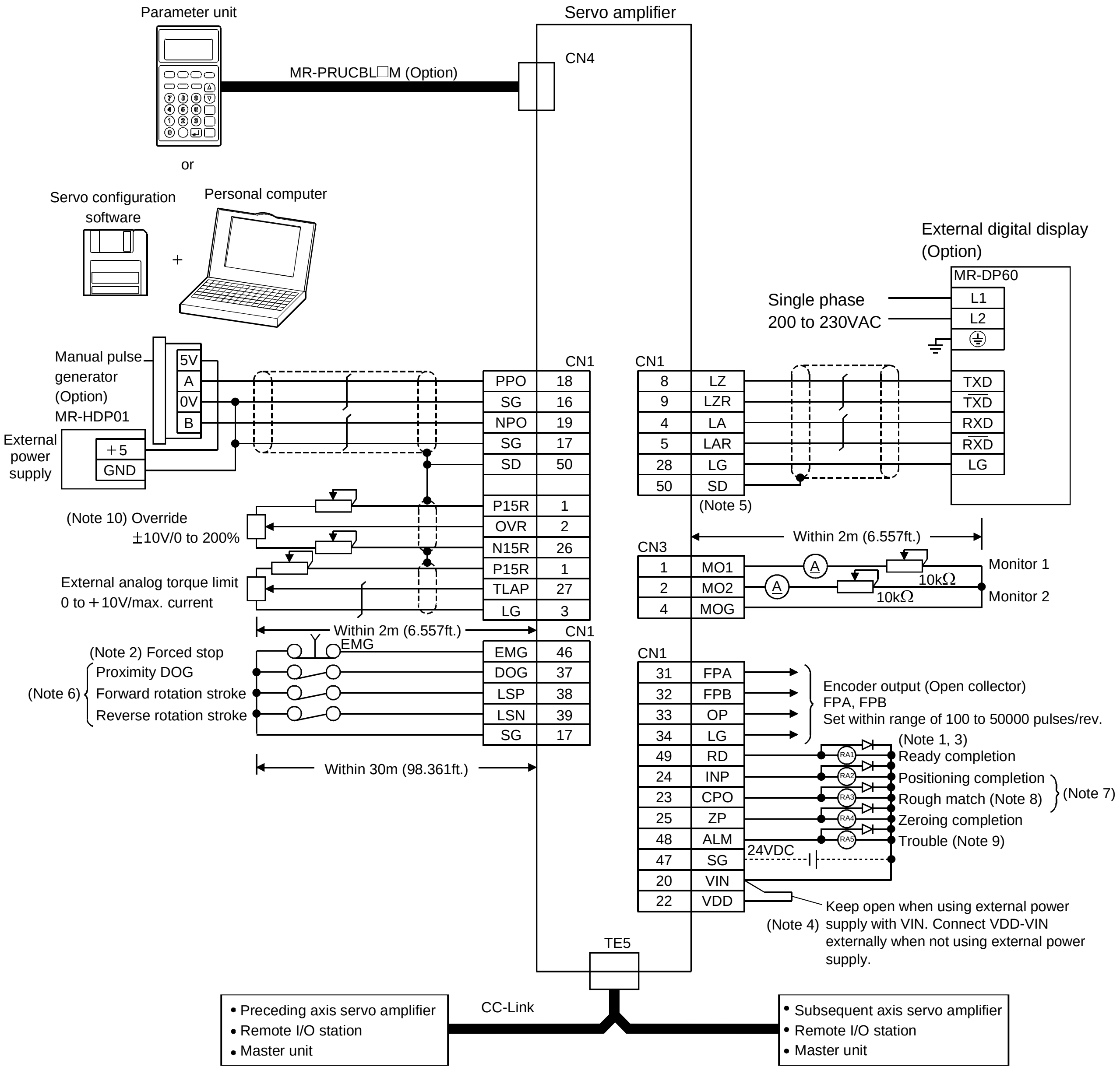
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo amplifier.
- When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

POINT

- Refer to Section 6.3 for connection of the power supply system, Section 6.4 for connection with the servo motor, and Section 3.2.2 for connection of CC-Link.

4.2.1 In factory-shipped status

In the factory-shipped status, the forward rotation stroke end, reverse rotation stroke end and proximity dog are valid as the CN1 external input signals.



Refer to the next page for Note.

Note:1. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop and other protective circuits.

2. The forced stop switch must be installed.

3. The sum of currents that flow in the external relays should be 200mA max. If it exceeds 200mA, supply interface power from external.

4. When using the internal power supply (VDD) as the interface power supply, always connect VDD-VIN. Keep them open when supplying external power.

5. Change the setting of parameter No.52 to "☐☐☐0" to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.

6. Can be used as the CN1 external input signals in the initial status of parameter No. 66.

7. Change the setting of parameter No.44 to "☐☐☐1" to use INP and CPO as an M code.

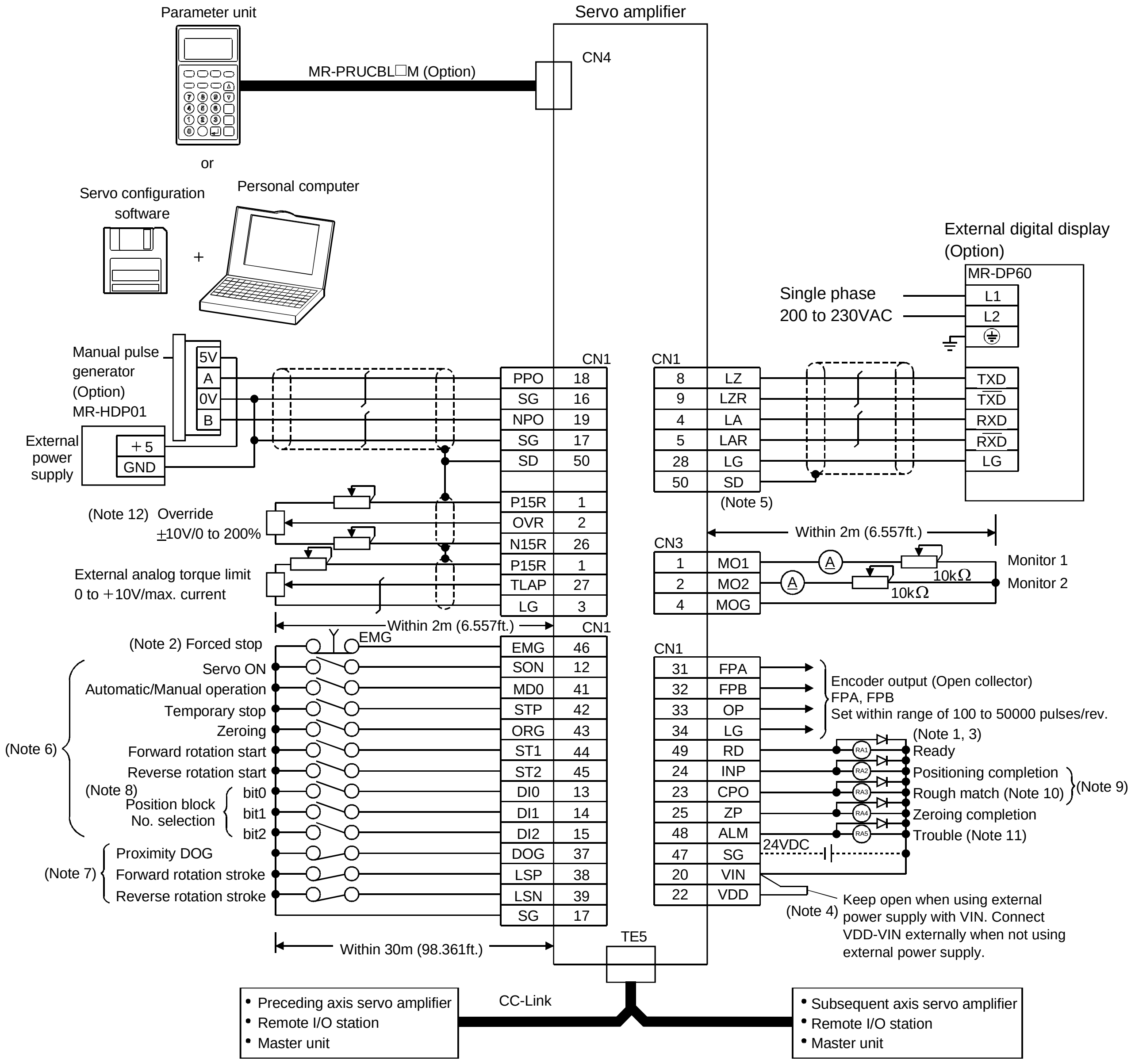
8. Change the setting of parameter No.3 to "☐☐1☐" to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to "☐1☐☐" to use CPO as a torque limit-in-progress.

9. ALM-SG are connected in a normal status, i.e. when there is no alarm.

10. The upper limit of the overriding speed is the permissible speed.

4.2.2 Input signals assigned to CN1

The following connection diagram assumes that the input signals that may be assigned to CN1 have all been assigned in the setting of parameter No. 66.



Refer to the next page for Note.

Note:1. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop and other protective circuits.

2. The forced stop switch must be installed.

3. The sum of currents that flow in the external relays should be 200mA max. If it exceeds 200mA, supply interface power from external.

4. When using the internal power supply (VDD) as the interface power supply, always connect VDD-VIN. Keep them open when supplying external power.

5. Change the setting of parameter No.52 to "□ □ □ 0" to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.

6. Can be used as the CN1 external input signals in the setting of parameter No. 6.

7. Can be used as the CN1 external input signals in the initial status of parameter No. 66.

8. Cannot be used when 2 stations are occupied.

9. Change the setting of parameter No.44 to "□ □ □ 1" to use INP and CPO as an M code.

10. 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.

11. ALM-SG are connected in a normal status, i.e. when there is no alarm.

12. The upper limit of the overriding speed is the permissible speed.

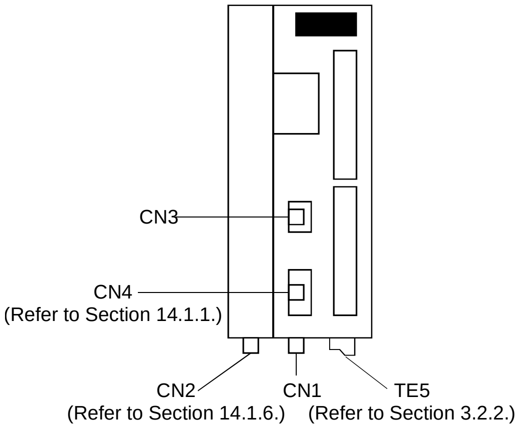
4.3 I/O connectors

4.3.1 Connector signal layouts

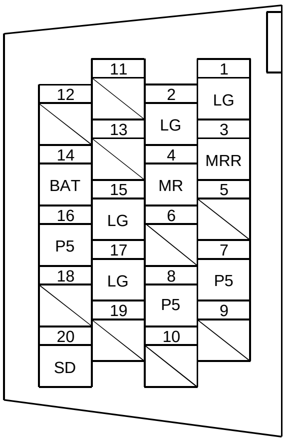
POINT

- The pin-outs of each connector are as viewed from the wiring section of the cable connector.

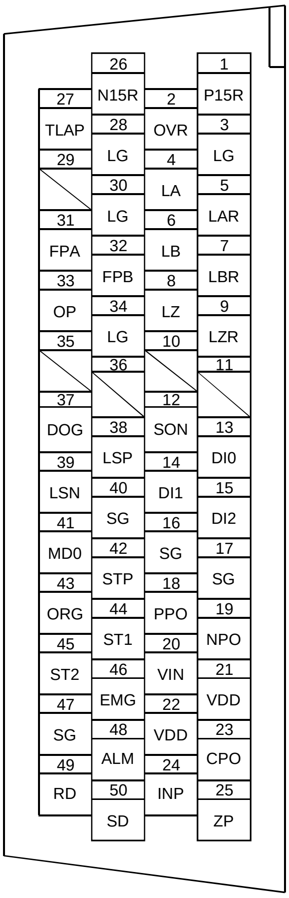
Servo amplifier



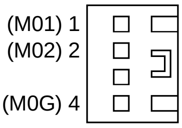
CN2 (For encoder signal)
Type PCR-S20FS (Honda Tsushin make)



CN1
Type PCR-S50FS (Honda Tsushin make)



CN3
Type 171822-4 (AMP make)



4.3.2 Signal explanations

Refer to Section 6.2.2 for the I/O interfaces (symbols in the I/O Category field in the table).

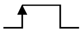
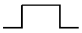
(1) CN1

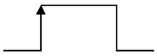
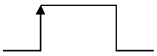
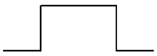
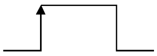
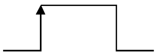
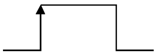
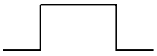
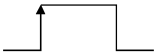
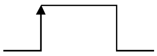
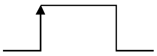
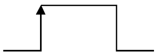
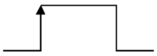
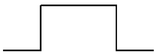
Signal name	Pin code	Pin No.	Function/Application	I/O category
Digital I/F power supply input	VIN	20	Driver power supply input terminal for digital interface Input 24VDC±10% for input interface. When using an external power supply, connect a 24VDC power supply of 200mA or more to this terminal.	
Driver 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	Refer to Section 3.5.2 (1)(a).	DI-1
Position block number selection bit0	DI0	13		DI-1
Position block number selection bit1	DI1	14		DI-1
Position block number selection bit2	DI2	15		DI-1
Manual pulse generator	PP0	18	Connect the manual pulse generator (MR-HDP01). Refer to Section 15.1.12 for details.	DI-2
	NP0	19		
Proximity dog	DOG	37	Refer to Section 3.5.2 (1)(a).	DI-1
Forward rotation stroke end	LSP	38		DI-1
Reverse rotation stroke end	LSN	39		DI-1
Automatic operation/manual drive mode	MD0	41		DI-1
Temporary stop	STP	42		DI-1
Zeroing	ORG	43		DI-1
Forward rotation start	ST1	44		DI-1
Reverse rotation start	ST2	45		DI-1
Forced stop	EMG	46	This signal is used for CN1 external input only. Refer to Section 3.5.2 (1)(b).	DI-1
Rough match	CPO	23	Refer to Section 3.5.2 (1)(b). This pin is set to rough match (CPO) in the initial status but can be changed for use as limiting torque (TLC) or electromagnetic brake interlock (MBR) by setting of parameter No. 3 or 44.	DO-1
Limiting torque	TLC	(23)		DO-1
Electromagnetic brake inter lock	MBR	(23)		DO-1

Signal name	Pin code	Pin No.	Function/Application	I/O category
In position	INP	24	Refer to Section 3.5.2 (1)(b).	DO-1
M code bit0	MC0	24		DO-1
M code bit1	MC1	23		DO-1
Zeroing completion	ZP	25		DO-1
Trouble	ALM	48		DO-1
Ready	RD	49		DO-1
Encoder pulse (open collector)	FPA FPB	31 32	In CCW rotation of the servo motor, FPA leads FPB by π/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	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. 1.77ms.	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 LB LBR	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

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.

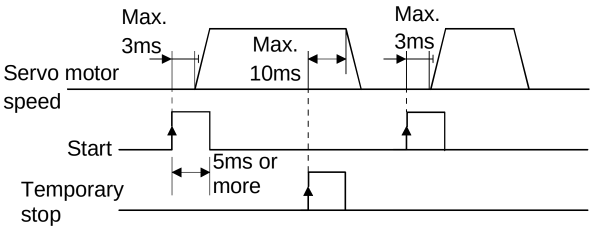
Operation mode / Signal			Automatic operation		Manual operation	Manual zeroing	Automatic positioning to home position
			Absolute command	Incremental command			
CN1 (Note)	Automatic/ Manual Operation	RY7	ON	ON	OFF	OFF	ON
	Zeroing	RY9	OFF	OFF	OFF	ON	ON
	Forward rotation start	RYA	 1(ON)	 1(ON)	 1(ON) (Forward rotation JOG)	 1(ON)	 1(ON) (First zeroing)
	Reverse rotation start	RYB		 1(ON)	 1(ON) (Reverse rotation JOG)		 1(ON) (Second zeroing)
	Temporary stop	RY8	 1(ON)	 1(ON)		 1(ON)	 1(ON)
Manual pulse generator							

Note: If you turn on-off RY7/RY9 during operation in the automatic operation mode, the operation mode cannot be changed. The operation mode is switched to the one specified by RY7 and RY9 after completion of positioning to the target position.

(2) Forward rotation start (RYA) ･ Reverse rotation start (RYB)

(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 (RX0).

(b) In the servo amplifier, a start is executed when the start signal changes from “0” (OFF) to “1” (ON). The internal processing of the servo amplifier delays 3ms maximum. The other signal delays 10ms maximum.



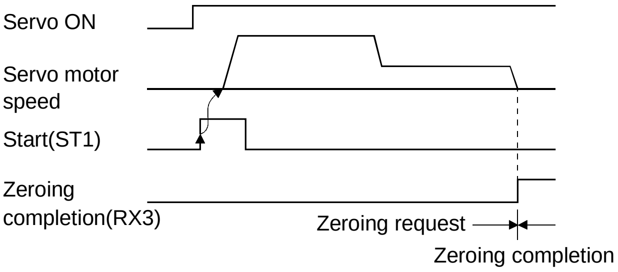
(c) The start signal (RYA/RYB) is not accepted during operation. The next operation must be started after the rough match signal has been output with the rough match output range set to zero, or after the in-position signal has been output.

(3) Proximity dog (RY6)

This signal is factory-set to be usable as the CN1 external input signal. Used for dog type and count type manual zeroing as a proximity dog detection signal. RY6 turns to “0” (OFF) to indicate detection of the dog. By setting “☐ 1 ☐ ☐” in parameter No. 9, RY6 turns to “1” (ON) to indicate detection.

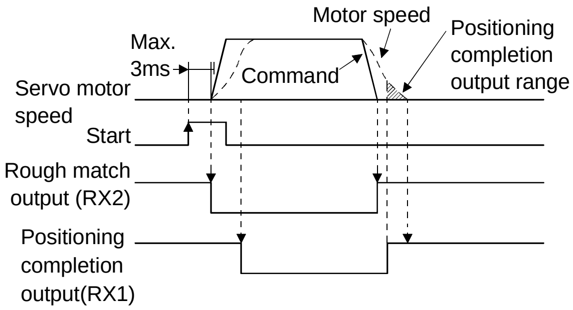
(4) Zeroing completion (RX3)

This signal turns to “1” (ON) after manual zeroing completion during power-on. After that, it is always “1” (ON). Use the zeroing completion signal (RX3) when making a zeroing request signal for interlock.



(5) Positioning completion signal (RX1)

This signal turns to “1” (ON) when the droop pulse value of the deviation counter is within the preset in-position range (parameter No. 16). If the in-position range (parameter No. 16) setting is large for low-speed operation, RX1 may remain “1” (ON) since the droop pulse value is small.



(6) Rough match (RX2)

This signal turns to “1” (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:

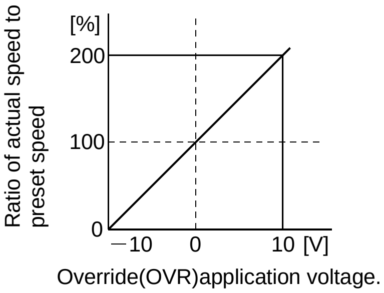
Item	Name	Remarks
Analog input signal	Override (OVR)	
Contact input signal	Override selection (RY12)	May be used only when 2 stations are specified.
Parameter	No.24 function selection 5	□□□ 1: Override used
	No.47 override offset	−9999 to 9999mV

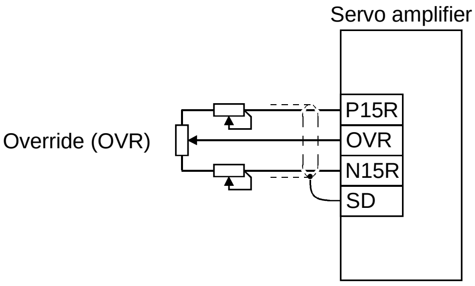
To use override, make it available by setting “□□□ 1” in parameter No. 24.

(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.

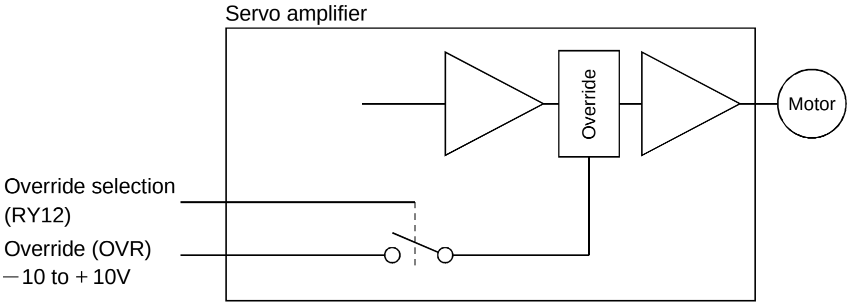
Refer to the following diagram when using the 15V power output (P15R/N15R) of the servo amplifier:





(b) Override selection (RY12)

Used to make the override (OVR) valid or invalid. This signal may be used only when 2 stations are specified.



Using the override selection (RY12), choose a change value as follows:

RY12	Speed change value
0 (OFF)	No change
1 (ON)	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

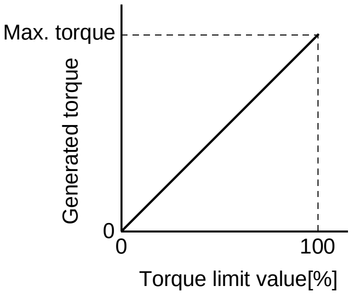
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLAP)	
Contact input signals	Torque limit selection (RYE)	Set "□0□□" (initial value) in parameter No. 41.
Contact output signal	Limiting torque (RX2)	
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.



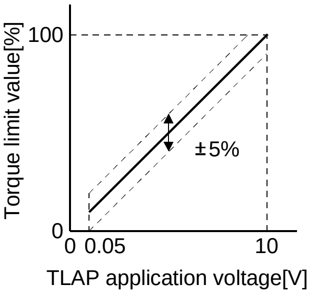
(b) External torque limit (TLAP)

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.

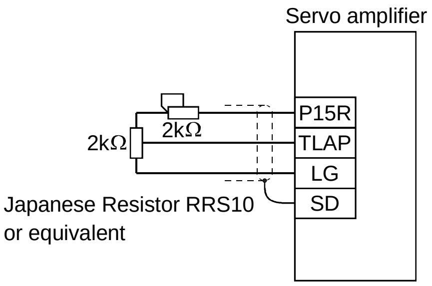
Depending on the servo amplifier, the limit value has about 5% variations to the input voltage.

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

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



TLAP Application voltage vs.
Torque Limit Value



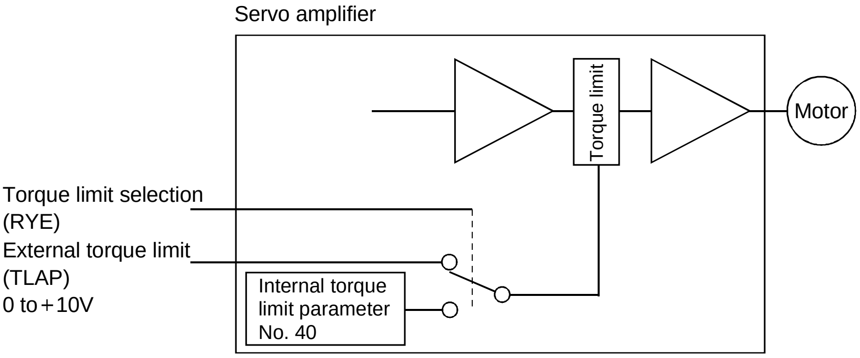
Connection Example

(c) Torque limit selection (RYE)

This input signal can be used to choose the torque limit value made valid.

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

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

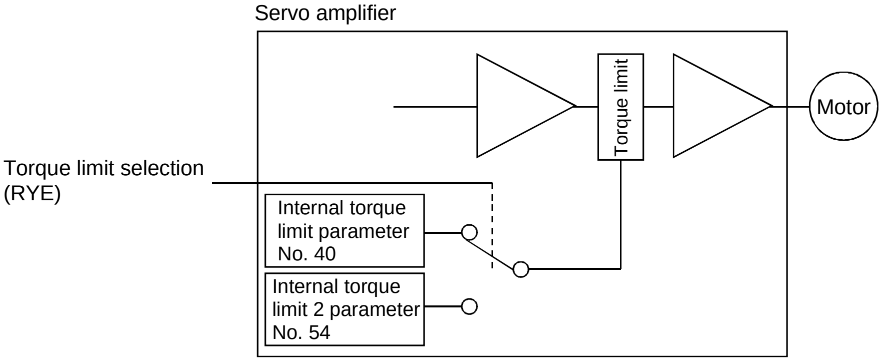


Using the torque limit selection (RYE), choose the limit value as follows. When RYE is turned on, the smaller value of the external torque limit and internal torque limit is chosen:

RYE	Torque limit value
1 (ON)	External torque limit (TLAP) if External torque limit (TLAP) < internal torque limit
	Internal torque limit if External torque limit (TLAP) > internal torque limit
0 (OFF)	Internal torque limit is valid.

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 torque limit selection (RYE), choose the limit value as follows. When RYE is turned to "1" (ON), the smaller value of the internal torque limit and internal torque limit 2 is chosen:

RYE	Torque limit value
0 (OFF)	Internal torque limit 2
1 (ON)	Internal torque limit if internal torque limit < internal torque limit 2
	Internal torque limit 2 if internal torque limit > internal torque limit 2

(9) Forward rotation stroke end (RY4) · Reverse rotation stroke end (RY5)

These signals are factory-set to be usable as the CN1 external input signals. During operation, keep RY4 and RY5 “1” (ON). Turning the stroke end signal (RY4 during CCW rotation or RY5 during CW rotation) to “0” (OFF) during servo motor rotation causes a sudden stop, then servo lock. At this time, the deviation counter is cleared.

(10) M code output (RX4, RX5)

(a) When 1 station is occupied (0 to 2)

These signals may be used only when 1 station is specified. The M code is output in 2-bit binary.

M code	(Note) Input signal	
	RX4	RX5
0	0	0
1	0	1
2	1	0

Note.0: OFF
1: ON

(b) When 2 stations are occupied (00 to 99)

When 2 stations are occupied, the M code of 00 to 99 is set to the remote register (RWR4).

(11) Manual pulse generator pulse magnification selection (RY13, RY14)

These signals may be used only when 2 stations are occupied. Using RY13 and RY14, choose the pulse multiplying factor as indicated below.

Pulse magnification	(Note) Input signal	
	RY14	RY13
1 time	0	0
10 times	0	1
100 times	1	0

Note:0: OFF
1: ON

(12) Alarm code output (RX6, RX7, RX8, RX9)

The alarm type is output in 4-bit code. For details, refer to Section 11.4.1.

4.4 When switching power on for the first time

4.4.1 Pre-operation checks

Before starting operation, check the following:

(1) Wiring

(a) A correct power supply is connected to the power input terminals (R, S, T) of the servo amplifier.

(b) The servo motor power supply terminals (U, V, W) of the servo amplifier match in phase with the power input terminals (U, V, W) of the servo motor.

(c) The servo motor power supply terminals (U, V, W) of the servo amplifier are not shorted to the power input terminals (R, S, T).

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

(e) When using the regenerative brake option, twisted cables are used and the lead of the built-in regenerative brake resistor has been removed.

(f) The forward rotation stroke end (RY4) and reverse rotation stroke end (RY5) are “0” (OFF).

(g) 24VDC or higher voltages are not applied to the pins of connectors CN1.

(h) SD and SG of connectors CN1 are not shorted.

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

(2) Environment

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

(3) Machine

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

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

4.4.2 Startup

WARNING

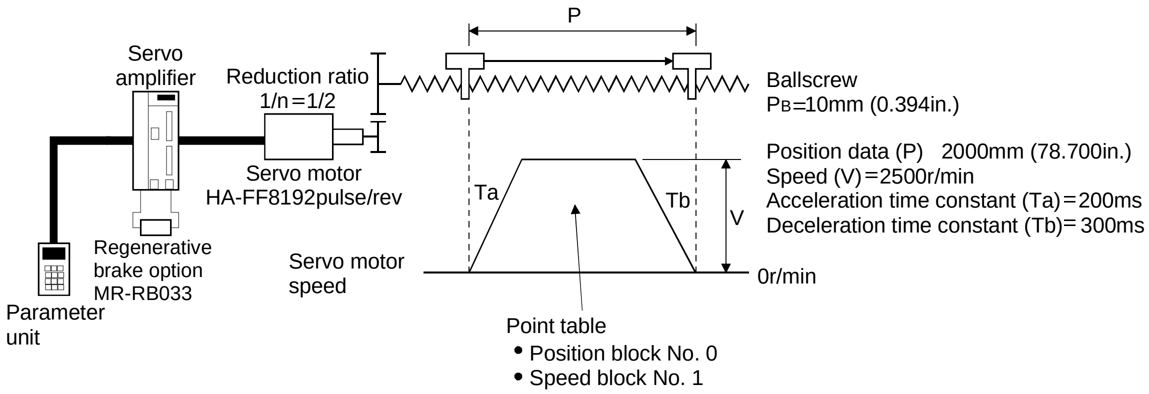
- Do not operate the switches with wet hands. You may get an electric shock.
- Do not operate the servo amplifier with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- During power-on or operation, do not open the front cover. You may get an electric shock.

CAUTION

- Before starting operation, check the parameters. Some machines may perform unexpected operation.
- During power-on or for some time after power-off, do not touch or close a parts (cable etc.) to the servo amplifier heat sink, regenerative brake resistor, servo motor, etc. Their temperatures may be high and you may get burnt or parts may damaged.

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

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

CMX=8192

CDV=5000

5) Position block No.0 is used to execute automatic operation once.

(2) Startup procedure

(a) Power on

1) Turn the servo on signal (RY0) to “0” (OFF).

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 Section 8.2.)

(c) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to Chapter 7 for the parameter definitions and to Sections 8.2 for the setting method.

Parameter	Name	Setting	Description
No.2	Feed system	□3□2 Absolute command system. MR-RB033 regenerative brake option is used.	
No.3	Function selection 1	1□□0 Linear acceleration/deceleration system. Used in absolute position detection system.	
No.4	Function selection 2	□0 0 1 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)	8192	From calculation result of formula (4.1)
No.6	Electronic gear denominator (CDV)	5000	From calculation result of formula (4.1)

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

(d) Position block setting

Set the position block according to the operation pattern. Refer to Section 4.6.1 for the position block details and to Section 4.10 for the setting method. Setting of position block No.0

Position data $[\times 10^{STM} \mu m]$	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	200	300

(e) Servo on

Switch the servo on in the following procedure:

1) Switch on main circuit/control power.
2) Turn the servo on signal (RY0) to “1” (ON).
   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 4.7 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 signal as indicated in the following table and turn the forward rotation start (RYA) to “1” (ON) to execute zeroing.

Device name	Device No.	ON/OFF	Description
Automatic/manual selection	RY7	0 (OFF)	Zeroing mode is selected.
Zeroing	RY9	1 (ON)	
Temporary stop	RY8	0 (OFF)	
Servo-on	RY0	1 (ON)	Servo-on status is reached.

(g) Automatic operation

Set the input signals as listed below and switch on the forward rotation start (RYA) to execute automatic operation of position block No.1

Device name	Device No.	ON/OFF	Description
Automatic/manual selection	RY7	1 (ON)	Automatic operation mode is selected.
Servo-on	RY0	1 (ON)	Servo-on status is reached.
Forward rotation stroke end	RY4	1 (ON)	Forward rotation side limit switch is turned on.
Reverse rotation stroke end	RY5	1 (ON)	Reverse rotation side limit switch is turned on.
Position block number selection bit0	RY1	0 (OFF)	Position block No.0 is selected.
Position block number selection bit1	RY2	0 (OFF)	
Position block number selection bit2	RY3	0 (OFF)	

(h) Stop

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

1) Turn the servo on signal (RY0) to “0” (OFF).
   The base circuit is shut off and the servo motor coasts.
2) Alarm occurrence
   When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.
3) Forced stop (EMG) OFF
   The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. Alarm AL.E6 occurs.
4) Turn the forward/reverse rotation stroke end signal (RY4/RY5) to “0” (OFF).
   The servo motor is brought to a sudden stop and servo-locked.

POINT

- A sudden stop indicates that a stop is made with the droop pulses erased.

4.5 Manual operation mode

For manual operation, set the operation mode selection signals (RY7, RY9) as listed below:

Operation mode selection signal	ON/OFF
RY7	0 (OFF)
RY9	0 (OFF)

4.5.1 JOG operation

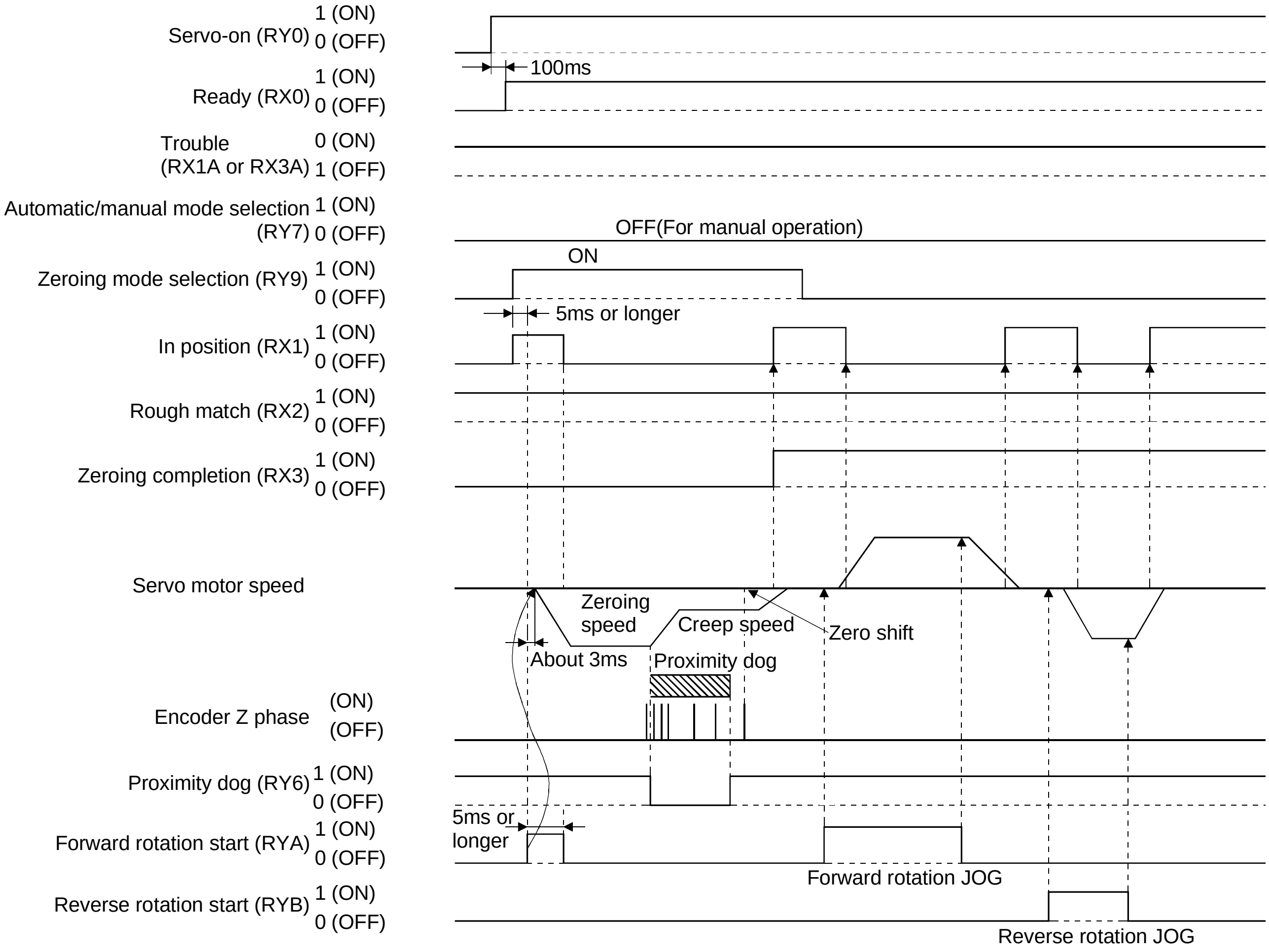
Set the JOG speed.

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

Turning the forward rotation start (RYA) or reverse rotation start (RYB) to "1" (ON) rotates the servo motor while it is "1" (ON). 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□
RYA	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
RYB	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)

The timing chart is as follows:



4.5.2 Manual pulse generator operation

(1) When 1 station is occupied

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

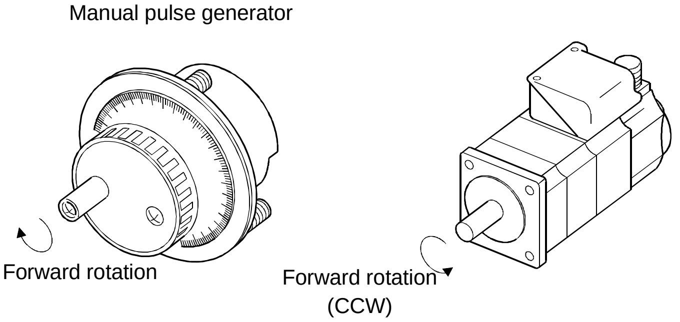
- - - 0

* 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 (0.039in.)
3	Used/pulse 100-time multiplication selected	10mm (0.394in.)

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)



(2) When 2 stations are occupied

The pulse multiplying factor of the manual pulse generator can be changed by using pulse multiplying factor selection in parameter No. 30 and the pulse multiplying factor selection signals (RY13, RY14). Set any of 1 to 4 in parameter No. 30 as listed below to make operation from the manual pulse generator valid.

Parameter No. 30

- - - □

* 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 (0.039in.)
3	Used/pulse 100-time multiplication selected	10mm (0.394in.)
4	Used/pulse multiplication selected externally Pulse multiplying factor is selected using RY13, RY14.	

Setting "□ □ □ 4" in parameter No. 30 enables the pulse multiplying factor to be set with the pulse multiplying factor selection signals (RY13, RY14). Relationships between the multiplying factors and pulse multiplying factor selection signals are listed below:

Multiplying factor	Pulse multiplying factor selection signals	
	RY14	RY13
1 time	0 (OFF)	0 (OFF)
10 time	0 (OFF)	1 (ON)
100 time	1 (ON)	0 (OFF)

Turn the manual pulse generator to rotate the servo motor. The turning direction is as indicated in (1) of this section.

4.6 Automatic operation mode

Set the operation mode select signals (RY7, RY9) as listed below.

Operation mode select signal	ON/OFF
RY7	1 (ON)
RY9	0 (OFF)

4.6.1 Positioning operation according to point tables

(1) Outline of point table data

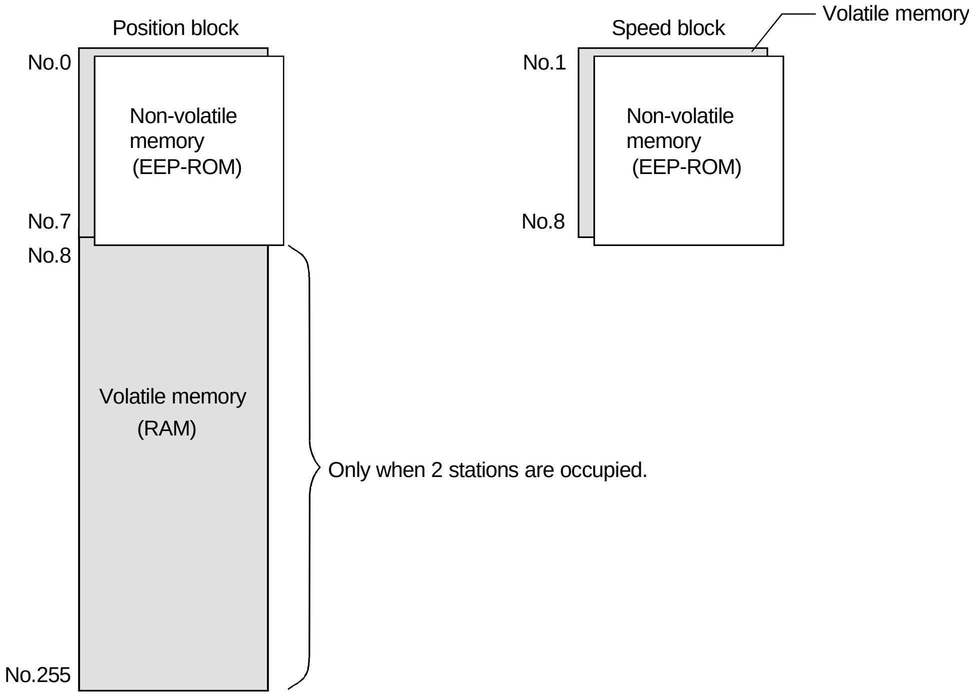
The point tables consist of the position blocks used to set the position data, M codes and speed block numbers and the speed blocks used to set the motor speeds, acceleration time constants and deceleration time constants.

When 1 station is specified, 8 position blocks and 8 speed blocks are usable. These data can be set to both non-volatile memory (EEP-ROM) and volatile memory (RAM).

When 2 stations are occupied, 256 position blocks and 8 speed blocks are usable. However, since the position blocks No. 8 to 255 do not have non-volatile memory, the position block data must be set before starting operation. As when 1 station is specified, the speed blocks can be set to both non-volatile memory and volatile memory.

When writing the position/speed block data, select which memory to use to write the data using the instruction code.

Whether 1 station or 2 stations are specified, the data written to non-volatile memory are saved in the servo amplifier if power is switched off. Note that the write life of non-volatile memory is about 100,000 times. Hence, when rewriting the point table data frequently, write the data to volatile memory for operation.



(2) 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 blocks (position block numbers 0 to 7) when 1 station is occupied, or 256 blocks (position block numbers 0 to 255) when 2 stations are occupied.

(a) 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 4.10.

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 output on completion of positioning operation. When 1 station is occupied : 0 to 2 When 2 stations are occupied: 00 to 99
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 (AL.E3) 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

The setting range is as given in Expression 4.2

$$\text{Number of encoder pulses} \times 32767 \times \frac{\text{CDV}}{\text{CMX}} / 10^{\text{STM}} \quad \text{...} \ (4.2)$$

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

(b) 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 up to motion destination
M code	Code output on completion of positioning operation. When 1 station is occupied : 0 to 3 When 2 stations are occupied: 00 to 99
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

(3) 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

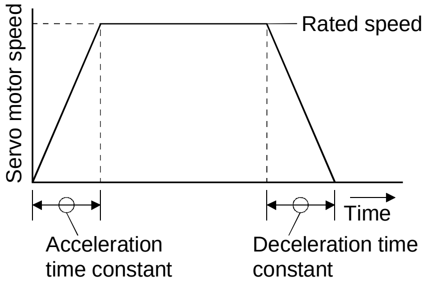
For linear acceleration/deceleration pattern, set "☐☐☐ 0" in parameter No.3.

Using the parameter unit, set the servo motor speed, acceleration time constant and deceleration time constant in the speed block.

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 4.10.

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.

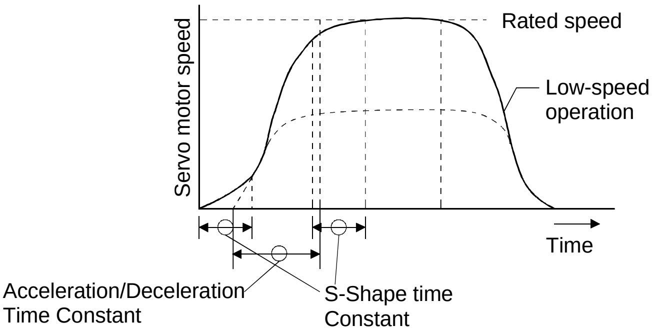


For S-shaped acceleration/deceleration pattern, smooths the rise and fall of servo motor rotation. Set "□□□ 1" in parameter No.3.

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.



(4) Selection of position block

When you have set the corresponding tables, choose the position block numbers used for positioning. When 1 station is specified, make selection in 3-bit binary of RY1, RY2 and RY3.

Standard (8 positions)

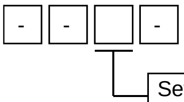
Position block No.	(Note) Input signal		
	RY3	RY2	RY1
0	0	0	0
1	0	0	1
2	0	1	0
⋮	⋮	⋮	⋮
7	1	1	1

Note.0: OFF
1: ON
When 2 stations are occupied, use the position block No. (RWw4) of the remote register. (Refer to Section 3.6.3)

(5) Start

For absolute command positioning, Turn the forward rotation start (RYA) to “1” (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. At this time, the reverse rotation start (RYB) is invalid.

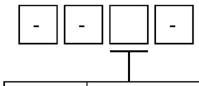
Parameter No.2



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, Turn the forward rotation start (RYA) or reverse rotation start (RYB) to “1” (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. The relationship between the set value and servo motor rotation is as listed below.

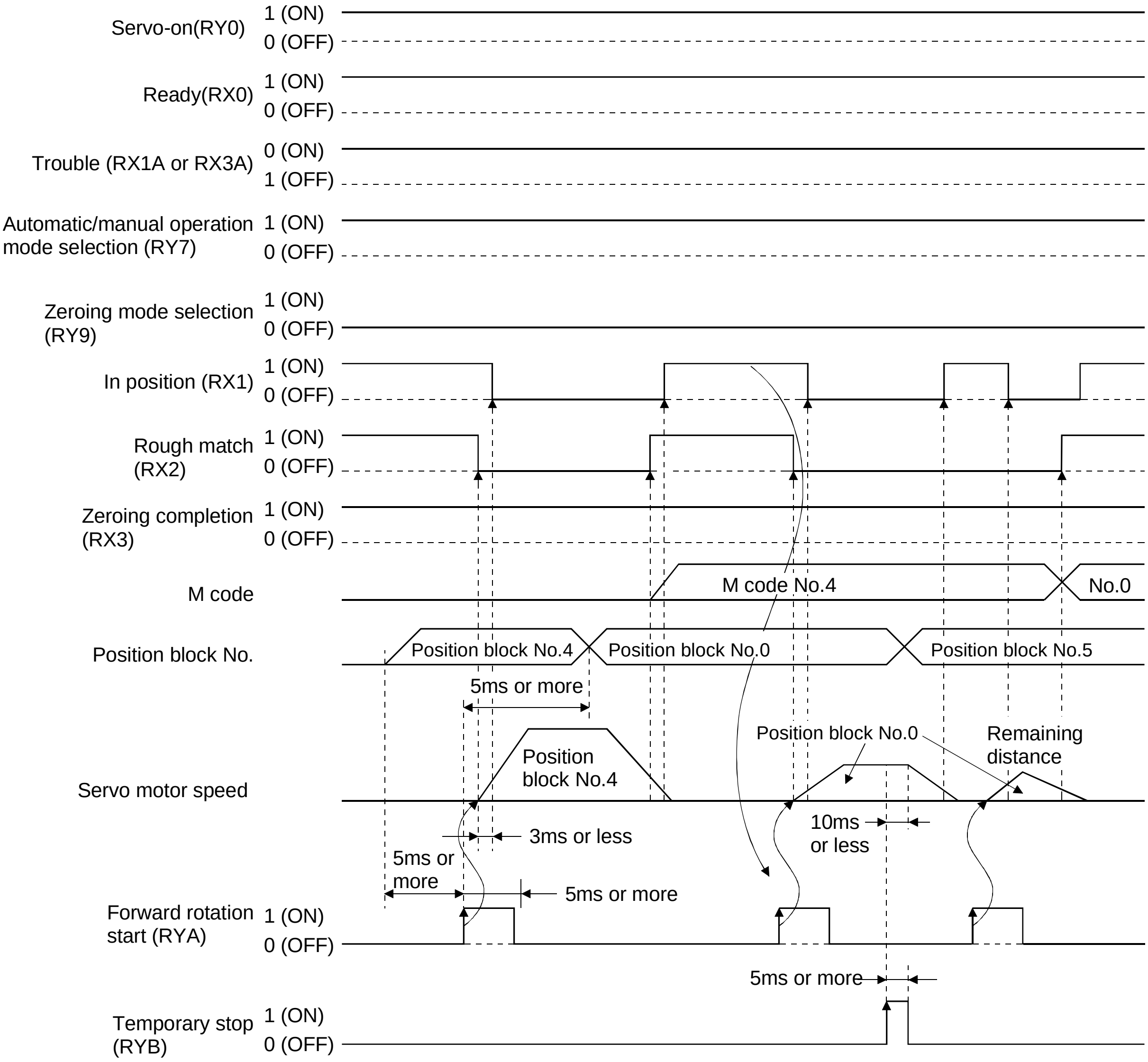
Parameter No.2



Set value	Servo motor rotation direction	
	RYA:ON	RYB: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)

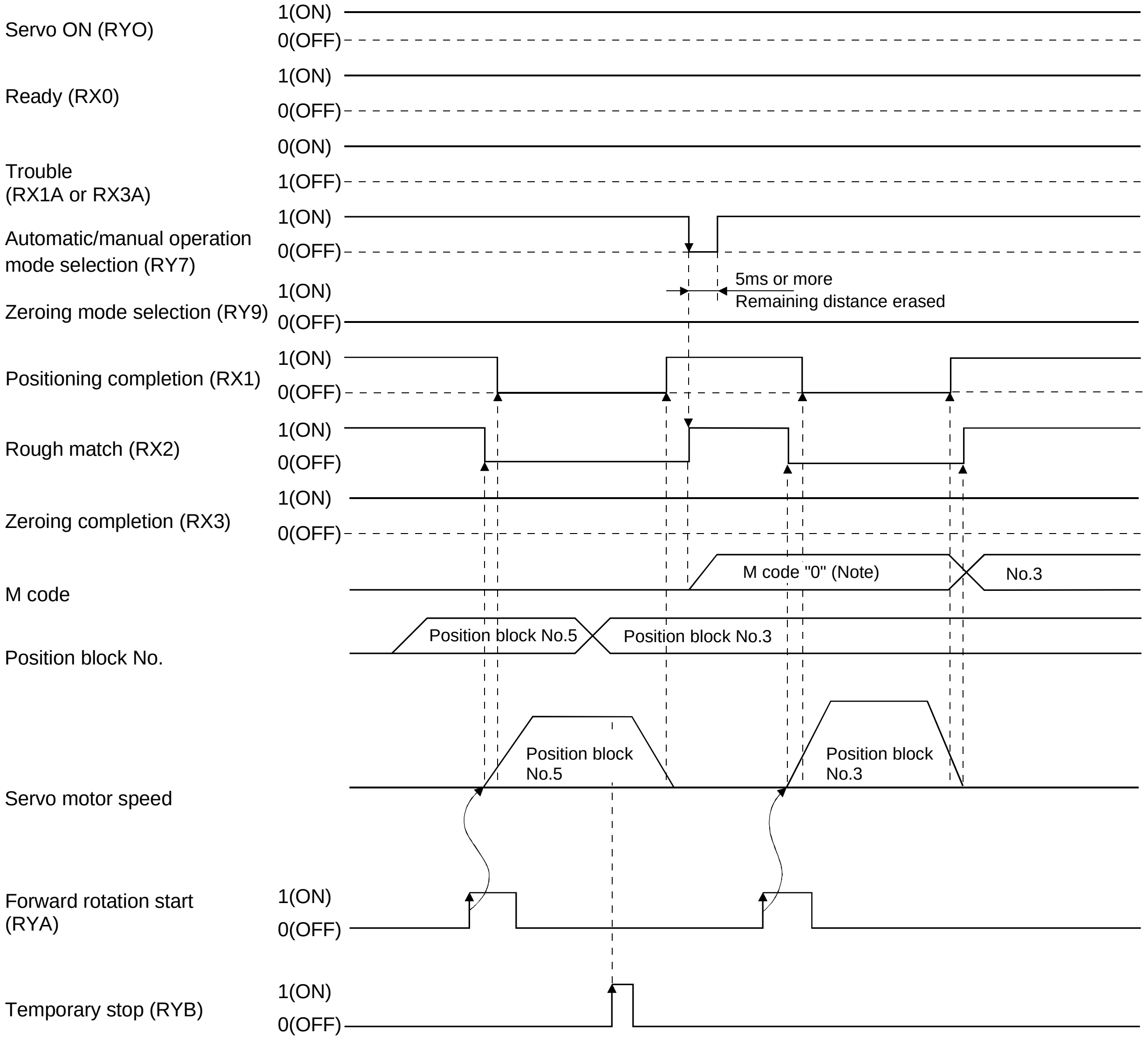
(6) Timing chart

Shows operation performed after power on and zeroing completion. Refer to Section 3.6.3 (1) for the position block No. setting timing chart when 2 stations are specified.



To erase the command remaining distance after a temporary stop, turn RY7 to “0” (OFF) for longer than 5ms on the leading edge of RX1 after the temporary stop. Changing the automatic mode to the manual mode erases the remaining distance. To start positioning operation anew, turn the start signal (RYA/RYB) to “1” (ON) after RX2 has turned to “1” (ON).

Operation performed after power on and zeroing completion is shown below:



Note. Turning RY7 to "0" (OFF) outputs "0".

4.6.2 Positioning operation according to position command data

This operation is available only when 2 stations are occupied. Set the position command data (position data) to the CC-Link remote register to perform operation.
Set “□□□ 1” or “□□□ 2” in parameter No. 65. Set “□□□ 1” to specify the speed block No., or “□□□ 2” to set the motor speed.

□□□□

Command system selection

Set value	Position command	Speed command
0	Specify the position block No.	Use the speed block No. of the position block to specify.
1	Use the remote register to set the position data.	Use the remote register to set the speed block No.
2		Use the remote register to set the motor speed.

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

(1) For absolute value command positioning

Set “□□□ 2” in parameter No. 2.

(a) Setting of position command data

Set the position data (absolute value) to the position command data lower 16 bits (RWw4) and position command data upper 16 bits (RWw5). The position data can be changed in unit ([mm], [inch]) and input range by the setting of parameter No. 4. The input range is the same as in Section 4.6.1 (2)(a).

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

(b) Setting of speed command data

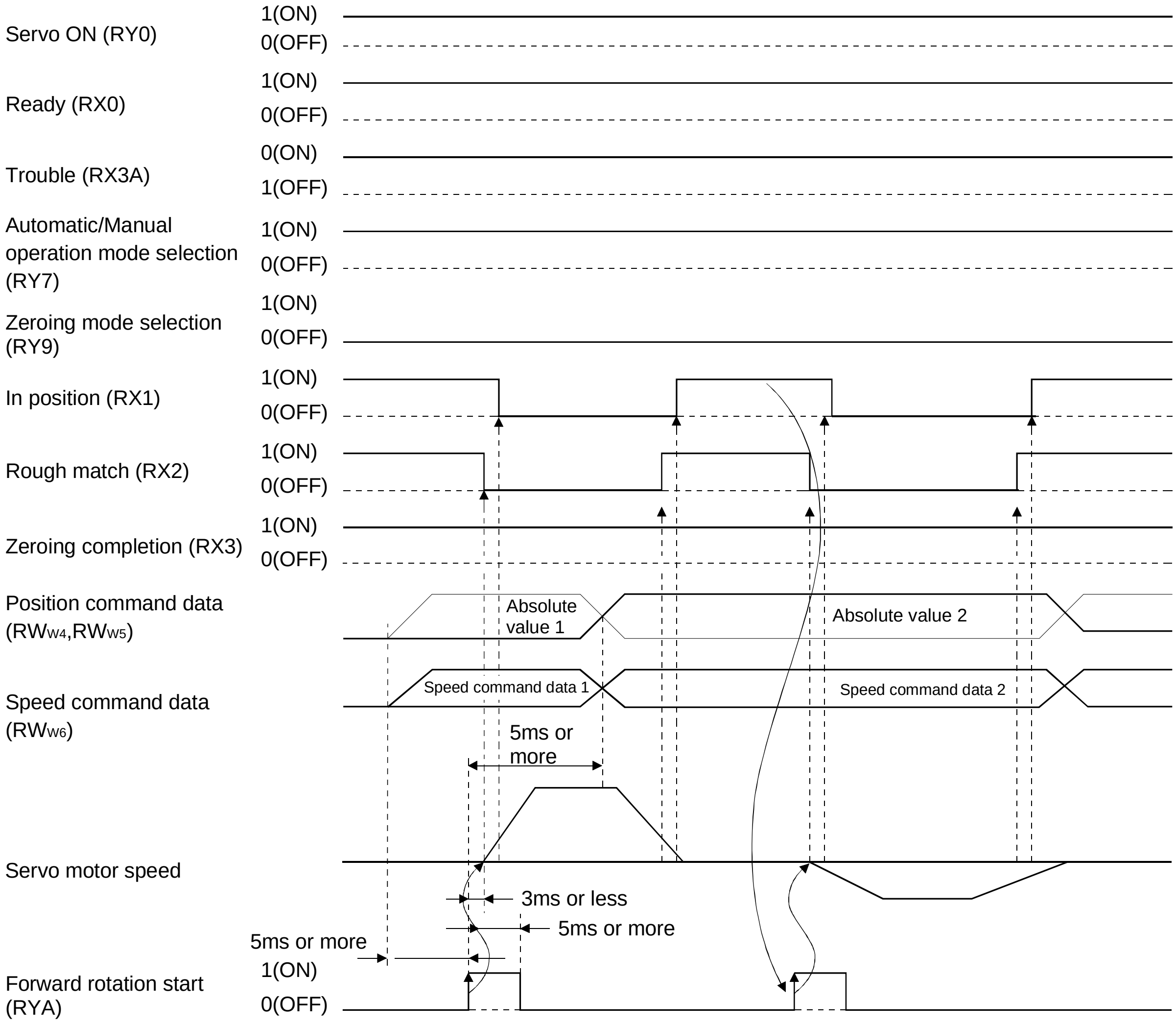
When specifying the speed block No., set the speed block No. to the speed command data (RWw6). When setting the speed, set the speed to the speed command data (RWw6). At this time, use the values set in speed block No. 1 as the acceleration and deceleration time constants.

(c) Start

Turning on the forward rotation start (RYA) rotates the servo motor to the preset position. The servo motor rotation direction is the same as in Section 4.6.1 (5).

(d) Timing chart

Operation performed after power on and zeroing completion is shown below. Refer to Section 3.6.3 (1) for the position command data and speed command data timing chart when 2 stations are occupied.

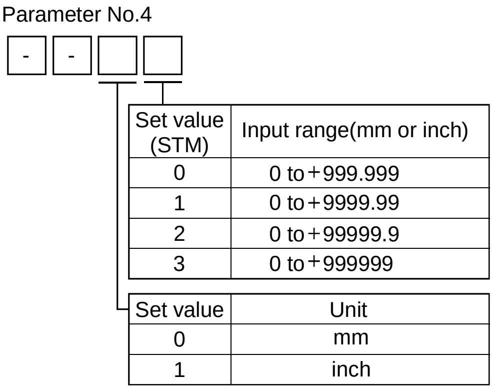


(2) For incremental value command positioning

Set “□□□1” in parameter No. 2.

(a) Setting of position command data

Set the position data (incremental value) to the position command data lower 16 bits (RW$_{W4}$) and position command data upper 16 bits (RW$_{W5}$). The position data can be changed in unit ([mm], [inch]) and input range by the setting of parameter No. 4. The input range is the same as in Section 4.6.1 (2)(b).



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 command data

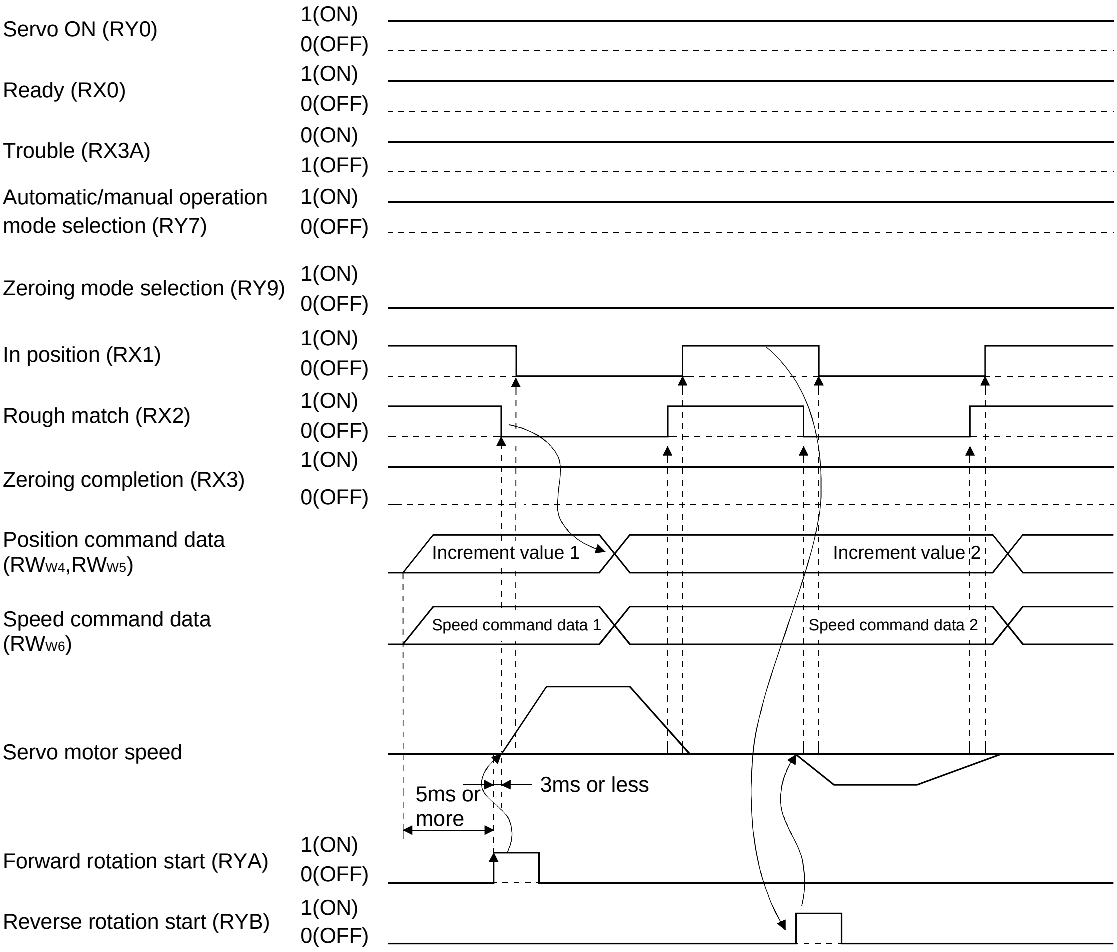
When specifying the speed block No., set the speed block No. to the speed command data (RW$_{W6}$). When setting the speed, set the speed to the speed command data (RW$_{W6}$). At this time, use the values set in speed block No. 1 as the acceleration and deceleration time constants.

(c) Start

Turning the forward rotation start (RYA) or reverse rotation start (RYB) to “1” (ON) rotates the servo motor to the preset position. The servo motor rotation direction is the same as in Section 3.6.1 (5).

(d) Timing chart

Operation performed after power on and zeroing completion is shown below. Refer to Section 3.6.3 (1) for the speed command data timing chart when 2 stations are occupied.


Servo ON (RY0)
1(ON)
0(OFF)
Ready (RX0)
1(ON)
0(OFF)
Trouble (RX3A)
0(ON)
1(OFF)
Automatic/manual operation mode selection (RY7)
1(ON)
0(OFF)
Zeroing mode selection (RY9)
1(ON)
0(OFF)
In position (RX1)
1(ON)
0(OFF)
Rough match (RX2)
1(ON)
0(OFF)
Zeroing completion (RX3)
1(ON)
0(OFF)
Position command data (RWw4,RWw5)
Increment value 1
Increment value 2
Speed command data (RWw6)
Speed command data 1
Speed command data 2
Servo motor speed
5ms or more
3ms or less
Forward rotation start (RYA)
1(ON)
0(OFF)
Reverse rotation start (RYB)
1(ON)
0(OFF)

4.7 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.

4.7.1 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-TN has the zeroing methods given in this section. Choose the most appropriate method for your machine structure and application.
The MR-H-TN has the automatic zeroing return function which executes zeroing by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by JOG operation or the like is not required.

(1) Manual zeroing types

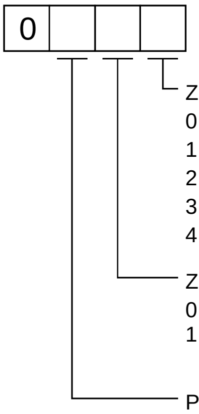
Four manual zeroing types are available. Choose the optimum zeroing according to the machine type, etc.

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. (Note)	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 by JOG, manual pulse generator or similar operation 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.

(2) Zeroing parameter

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



Zeroing system .... (a)
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 .... (b)
0: Address increment direction
1: Address decrement direction

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

(a) Choose the zeroing method.

(b) 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.

(c) Choose the polarity at which the proximity dog is detected. Set “0” to detect the dog when the proximity dog signal (RY6) turns off (0) or “1” to detect the dog when the signal turns on (1).

(3) Instructions

(a) Before starting zeroing, always make sure that the limit switch operates.

(b) Confirm the zeroing direction. Incorrect setting will cause the machine to run reversely.

(c) Confirm the proximity dog input polarity. Otherwise, misoperation can occur.

4.7.2 Dog type zeroing

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

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter used	Description
Manual zeroing mode selection	Automatic/manual selection signal (RY7)	Turn RY7 to “0” (OFF).
	Zeroing (RY9)	Turn RY9 to “1” (ON).
Dog type zeroing	Parameter No.9	□□□0: Dog type zeroing is selected.
Zeroing direction	Parameter No.9	Refer to section 4.7.1(2) and choose zeroing direction.
Dog input polarity	Parameter No.9	Refer to section 4.7.1(2) 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.

(2) Length of proximity dog

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

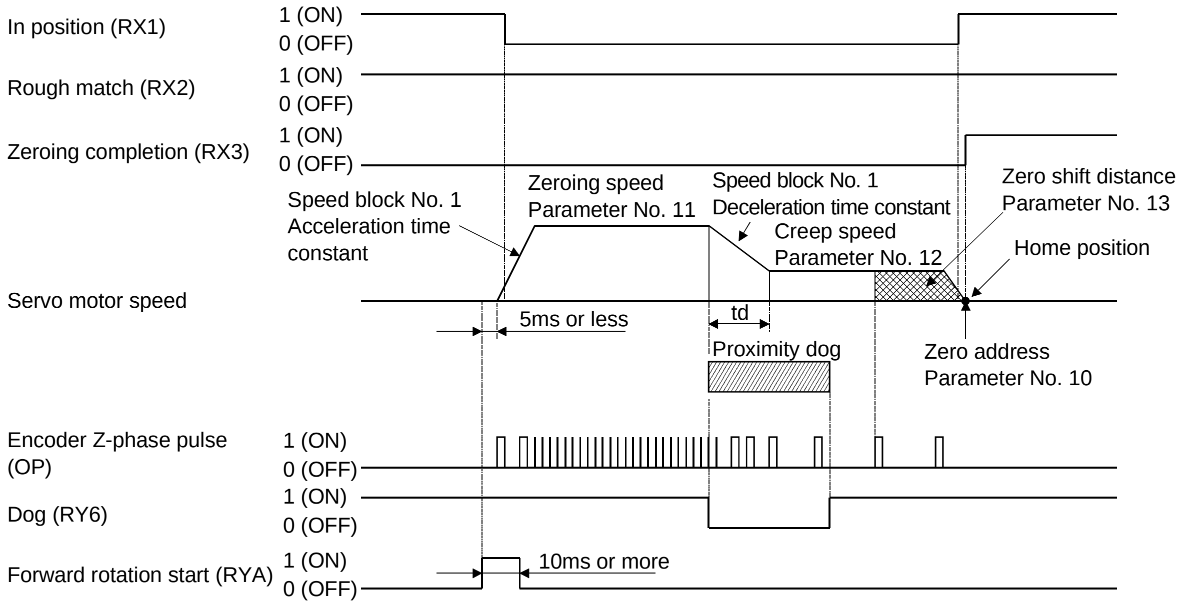
$$L1 \geq \frac{V}{60} \bullet \frac{td}{2} \quad \cdots\cdots (4.2)$$

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

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

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

(3) Timing chart

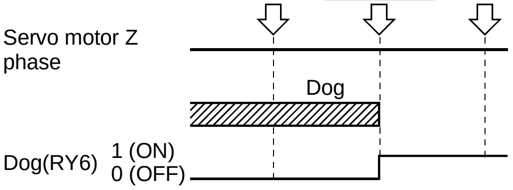


The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

(4) Adjustment

In dog type zeroing, adjust to ensure that the Z-phase signal is generated during dog detection. Locate the rear end of the proximity dog at approximately the center of two consecutive Z-phase signals.
The position where the Z-phase signal is generated can be monitored in “Within one-revolution position” of “Status display”.

Servo motor	Within one-revolution position		
HC-MF•HA-FF	0	4096	0
HC-SF•RF•UF	0	8192	0



4.7.3 Count type zeroing

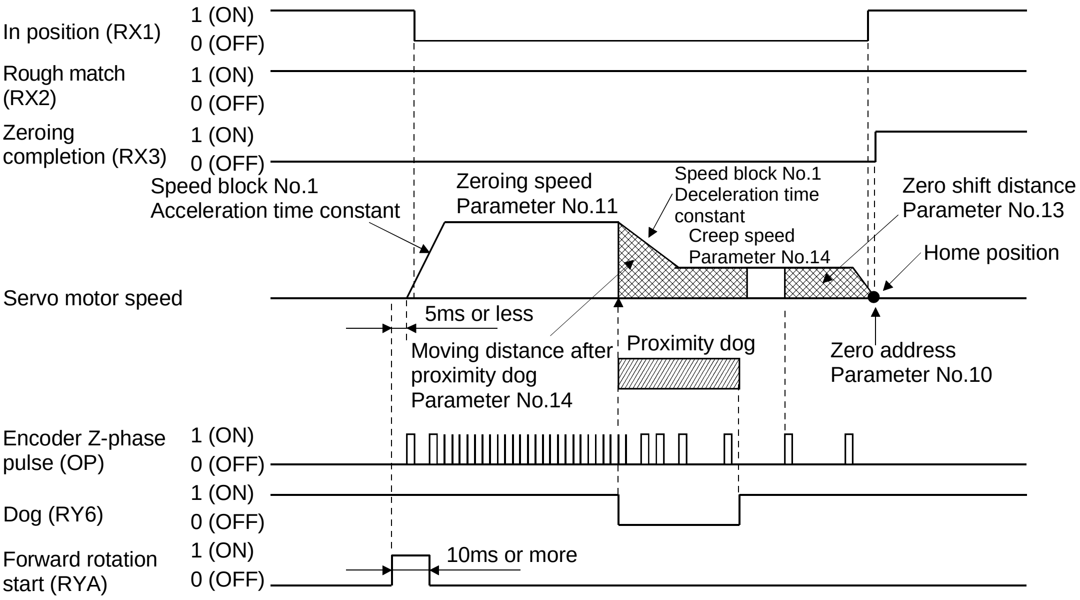
In count type zeroing, a motion is made over the distance set in parameter No.14 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the dog signal (RY6) is 10ms 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 servo amplifier or the like.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter used	Description
Manual zeroing mode selection	Automatic/manual selection signal (RY7)	Turn RY7 to “0” (OFF).
	Zeroing (RY9)	Turn RY9 to “1” (ON).
Count type zeroing	Parameter No.9	□□□ 1: Count type zeroing is selected.
Zeroing direction	Parameter No.9	Refer to section 4.7.1 (2) and choose zeroing direction.
Dog input polarity	Parameter No.9	Refer to section 4.7.1 (2) 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.

(2) Timing chart



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

4.7.4 Data setting type zeroing

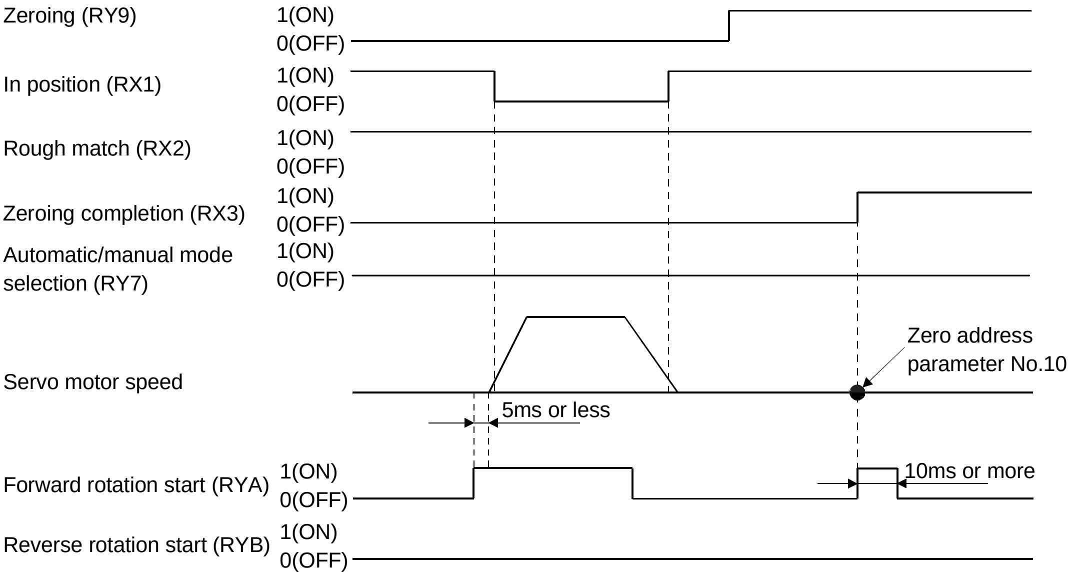
In data setting type zeroing, a motion is made to any position by JOG operation, manual pulse generator operation or the like to make a home position return, and the position reached is defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter used	Description
Manual zeroing mode selection	Automatic/manual selection signal (RY7)	Turn RY7 to “0” (OFF).
	Zeroing (RY9)	Turn RY9 to “1” (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.

(2) Timing chart



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

4.7.5 Stopper type zeroing

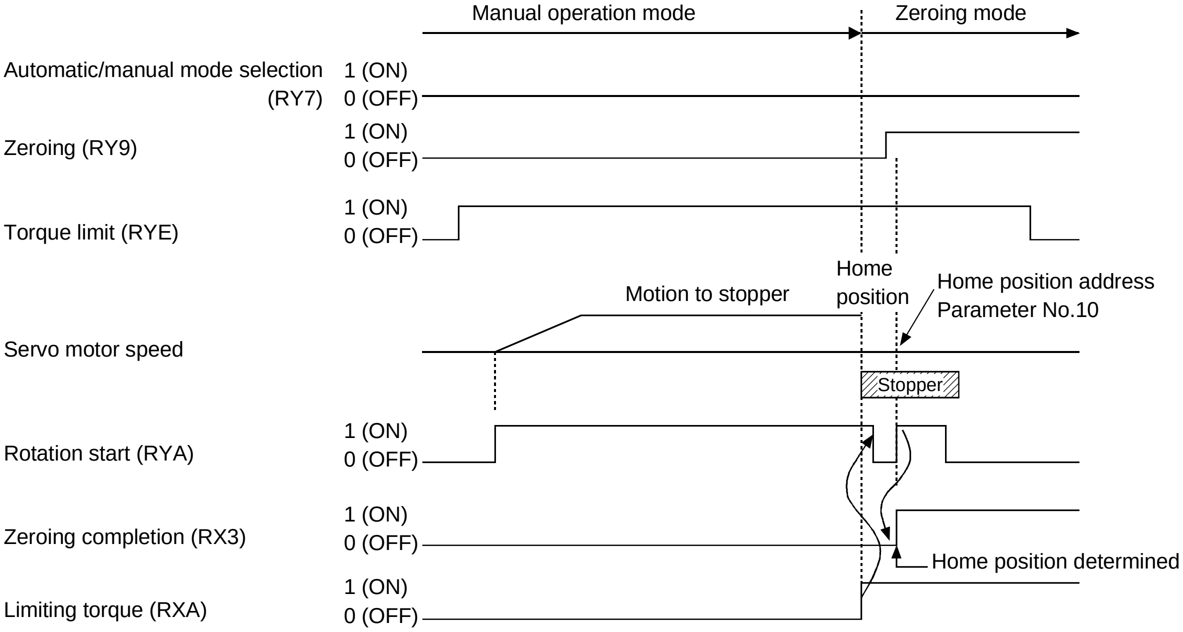
In stopper type zeroing, a machine part is pressed against a stopper or the like by JOG operation, manual pulse generator operation or the like to make a home position return and that position is defined as a home position.

(1) Signals, parameters

Set the input signals and parameters as follows:

Item	Device/Parameter used	Description
Manual zeroing mode selection	Automatic/manual selection signal (RY7)	Turn RY7 to “0” (OFF).
	Zeroing (RY9)	Turn RY9 to “1” (ON).
Stopper type zeroing	Parameter No.9	□□□3: Stopper type zeroing is selected.
Zeroing acceleration time constant	Speed block No. 1	Acceleration time constant of speed block No. 1 is used.
Zeroing position data	Parameter No.10	Address reached by zeroing is stored automatically.

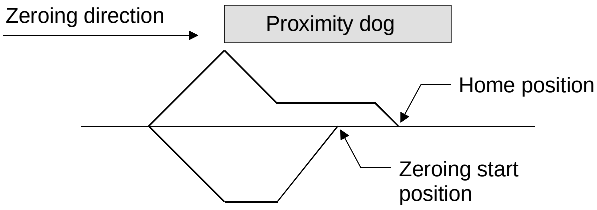
(2) Timing chart



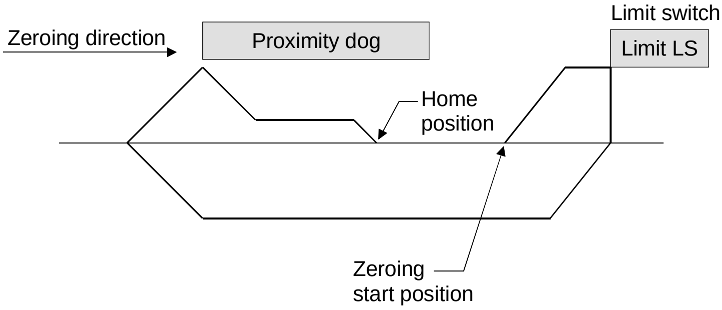
The address on completion of zeroing is the value automatically set in parameter No.10 (zeroing position data).

4.7.6 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.



4.8 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 (RY7, RY9) as indicated below:

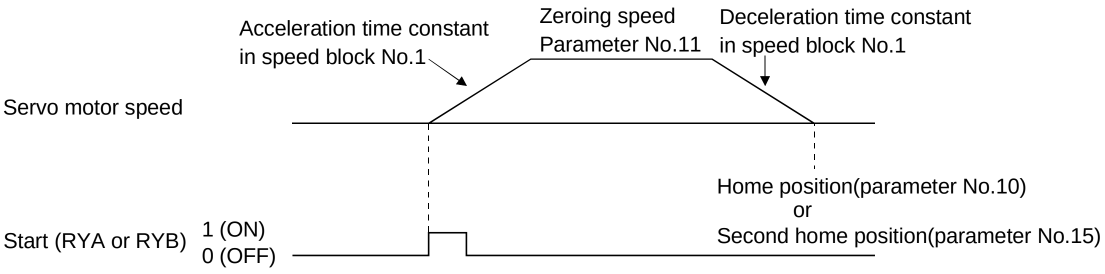
Operation mode select signal	ON/OFF
RY7	1 (ON)
RY9	1 (ON)

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. Turning the forward rotation start (RYA) to “1” (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. Turning the reverse rotation start (RYB) to “1” (ON) starts a high-speed automatic return to the second home position.



4.9 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
Servo amplifier		Use standard models.
Servo motor	HA-LH	Use a servo motor equipped with absolute position encoder (-Y).
	HC-KF 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 14.1.6

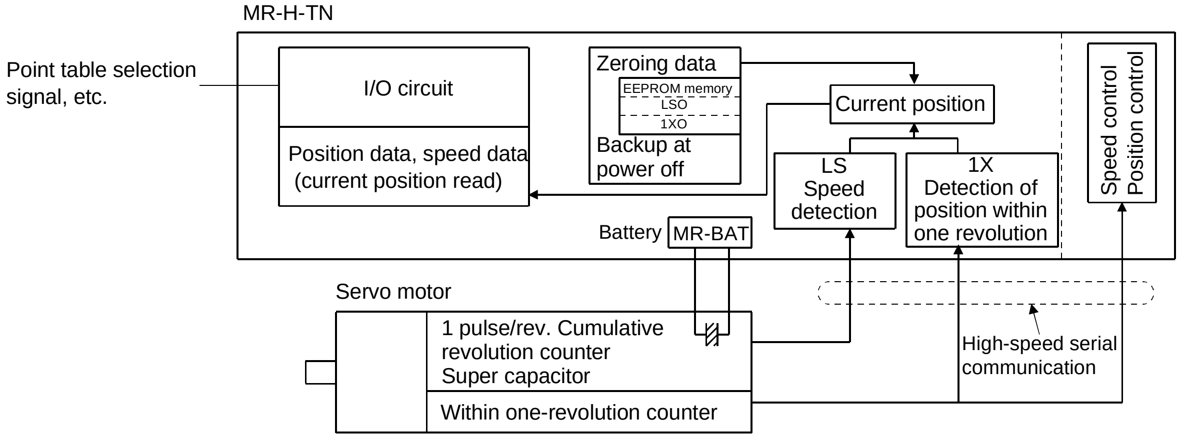
(4) Outline of absolute position detection data communication

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 on 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 servo amplifier may be damaged by static electricity.

Always take the following precautions:

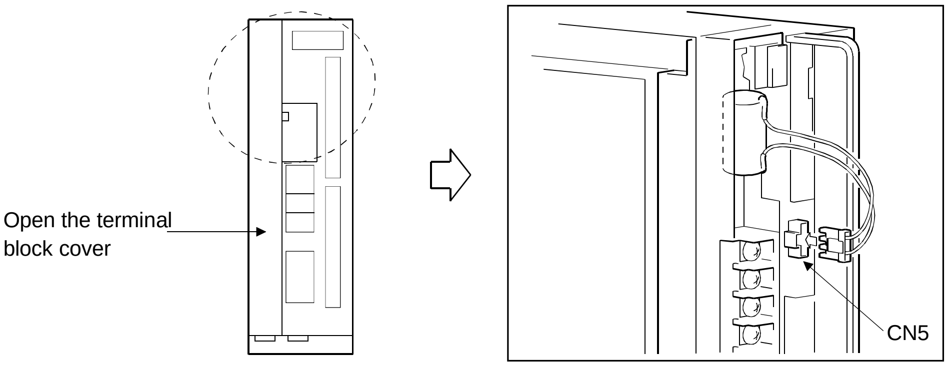
- Ground human body and work bench.
- Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.

(a) Open the terminal block cover and switch window. (When the model used is the MR-H500TN or more, also remove the front panel.)

(b) Install the battery in the battery holder.

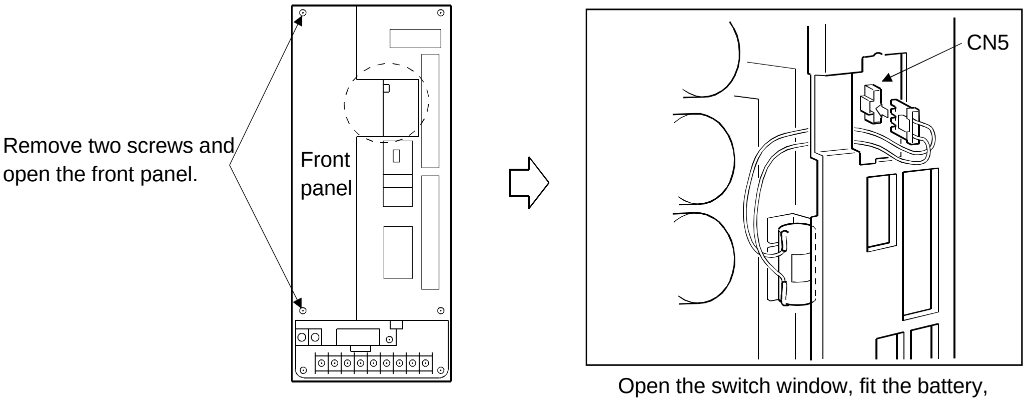
(c) Install the battery connector into CN5 unit it clicks.

1) MR-H10TN to MR-H350TN



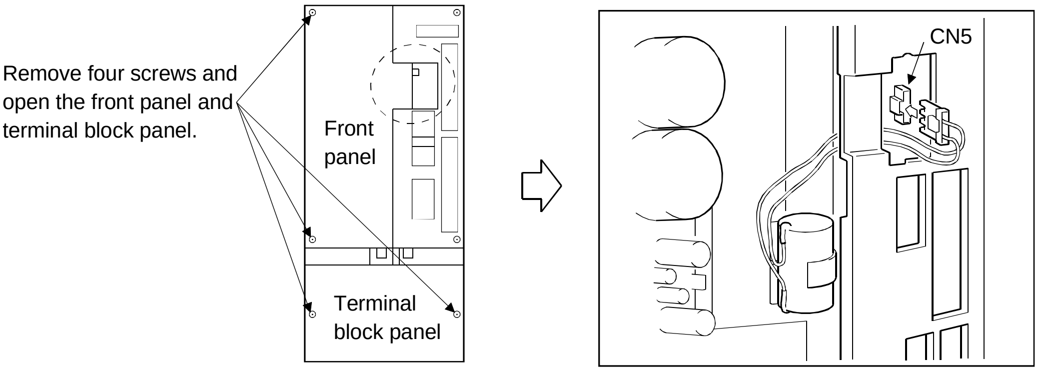
Open the switch window, fit the battery, and insert the plug into CN5.

2) MR-H500TN, MR-H700TN



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

3) MR-H11KTN to MR-H22KTN



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

4.10 Point table data setting procedures of the parameter unit

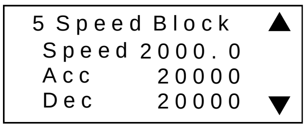
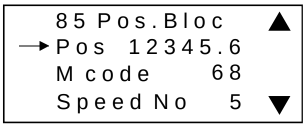
(1) Position block data

(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 3).	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 (RY7) off and the zeroing signal (RY9) 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 [E8] and [B5] 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 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 [1] 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 servo amplifier 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 servo amplifier.

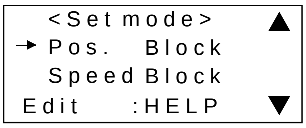
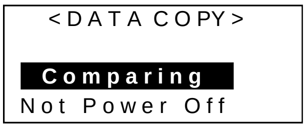
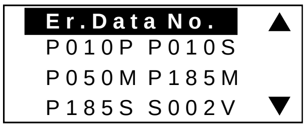
(a) Data read

Reads data from the servo amplifier to the parameter unit.

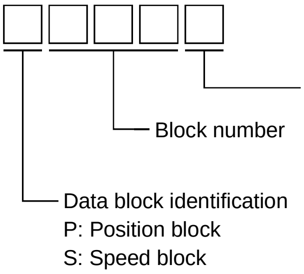
Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	<Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify READ). 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 servo amplifier.

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). 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 COMPARE). 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).	 <DATA COPY> **Compare Er.** Error No. :SFT Mode sel.:CAN [SHIFT]  **Er.Data No.** ▲ P010P P010S P050M P185M P185S S002V ▼

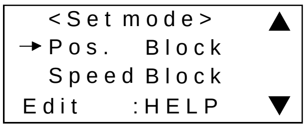
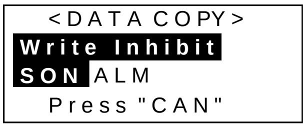
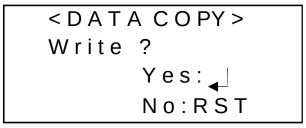
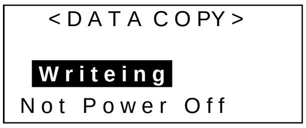
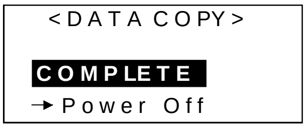
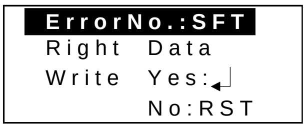
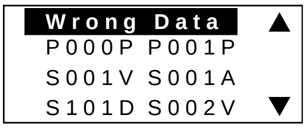
Error number make-up



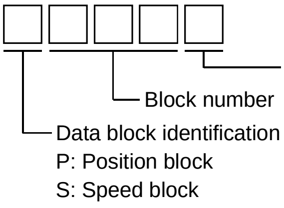
Position block		Speed block	
P	Position	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(c) Data write

Writes the data in the parameter unit to the servo amplifier.

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). 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 WRITE). 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



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

(4) Position data edition

(a) Data insertion

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

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). 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 INSERT). Press [↵] to define the mode (define INSERT).	<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) Data deletion

Deletes the position data of the specified position block number.

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). 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 DELETE). Press [↵] to define the mode (define DELETE).	<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. 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

Unused blocks

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

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.

5. ROLL FEEDING SYSTEM

5.1 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 or the CC-Link, positions are selected from those in 2 position blocks. ・Feed length setting range for 1 position: ±1μm to ±999.999m
		Speed command input	You can select 2 speeds by contact input or CC-Link when 1 station is occupied or 8 speeds and acceleration and deceleration times when 2 stations are occupied.
		System	Incremental command
	Position data input (when 2 stations are occupied)	Operational specifications	Digital switch or contact data input is used for positioning.
		Position command input	・Remote register is used to set position command data. ・Feed length input setting range: ±1 μm to ±999.999m
		Speed command input	・Remote register is used to make selection from 8 speed blocks. ・Remote register is used to set speed command data (speed).
		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 200kpps 120000r/min for MR-HDP01 ・Parameter setting is used to select the multiplying factor (×1, ×10, ×100) of the manual pulse generator input pulses. ・When 2 stations are occupied, the input signal is used to choose the multiplying factor (×1, ×10, ×100).
Functions of positioning control			・Acceleration/deceleration method setting (S-shaped acceleration/deceleration, separate settings for acceleration and deceleration) ・Backlash compensation ・Alarm code output (when 2 stations are occupied) ・External limit switches used by changing the internal parameter input contact assignment.

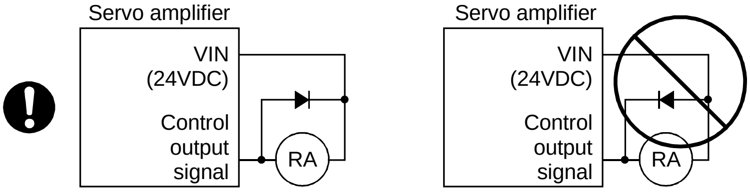
5.2 Standard connection example

⚠ **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 servo amplifier and servo motor until they have been installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠ **CAUTION**

- Wire the equipment correctly and securely. Otherwise, the servo motor may misoperate, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+,－) is correct. Otherwise, a burst, 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 forced stop and other protective circuits.

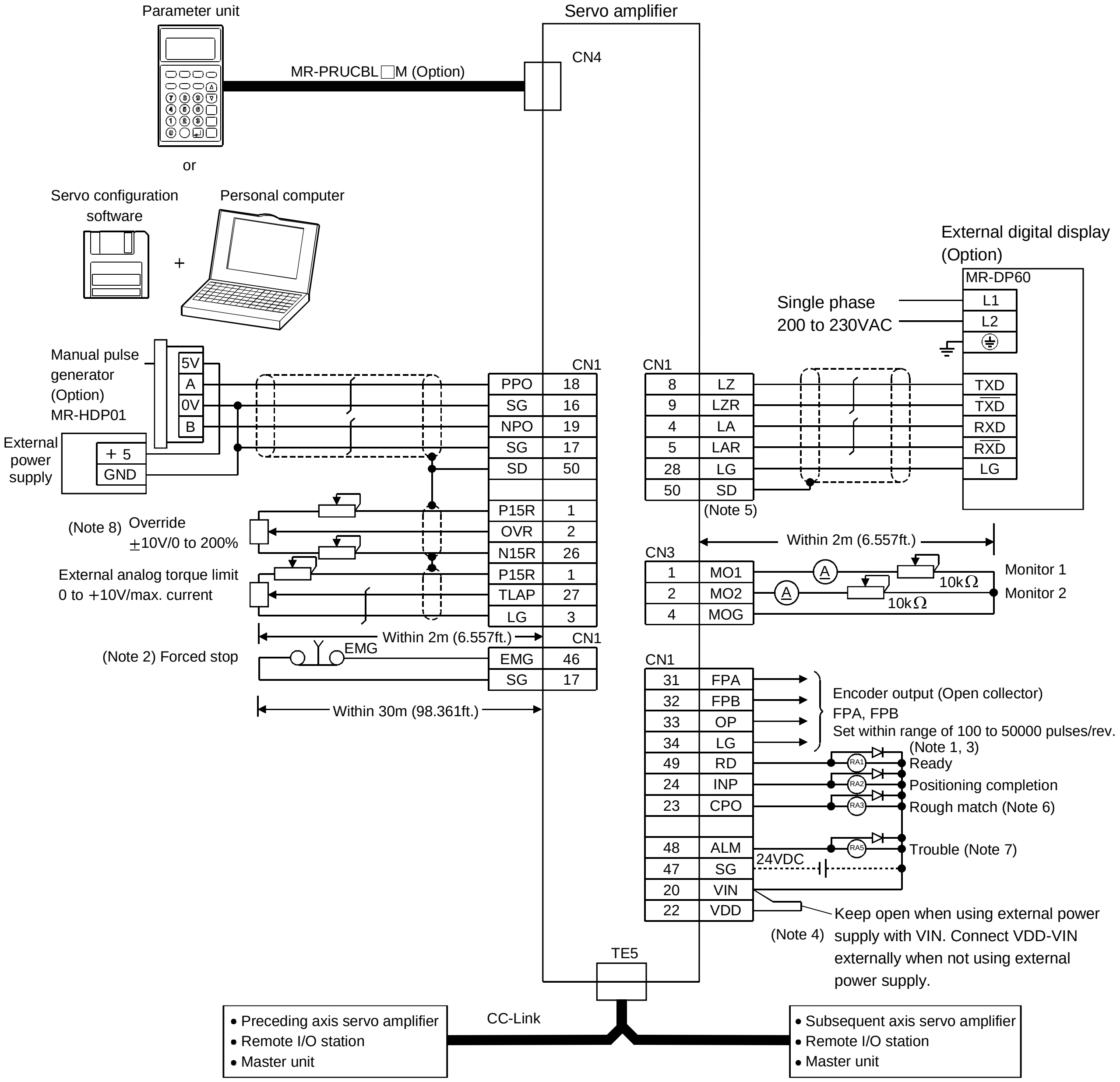


- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the servo amplifier.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF option) with the power line of the servo amplifier.
- When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

POINT

- Refer to Section 6.3 for connection of the power supply system, Section 6.4 for connection with the servo motor, and Section 3.2.2 for connection of CC-Link.

5.2.1 In factory-shipped status



Refer to the next page for Note.

Note:1. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop and other protective circuits.

2. The forced stop switch must be installed.

3. The sum of currents that flow in the external relays should be 200mA max. If it exceeds 200mA, supply interface power from external.

4. When using the internal power supply (VDD) as the interface power supply, always connect VDD-VIN. Keep them open when supplying external power.

5. Change the setting of parameter No.52 to "□ □ □ 0" to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.

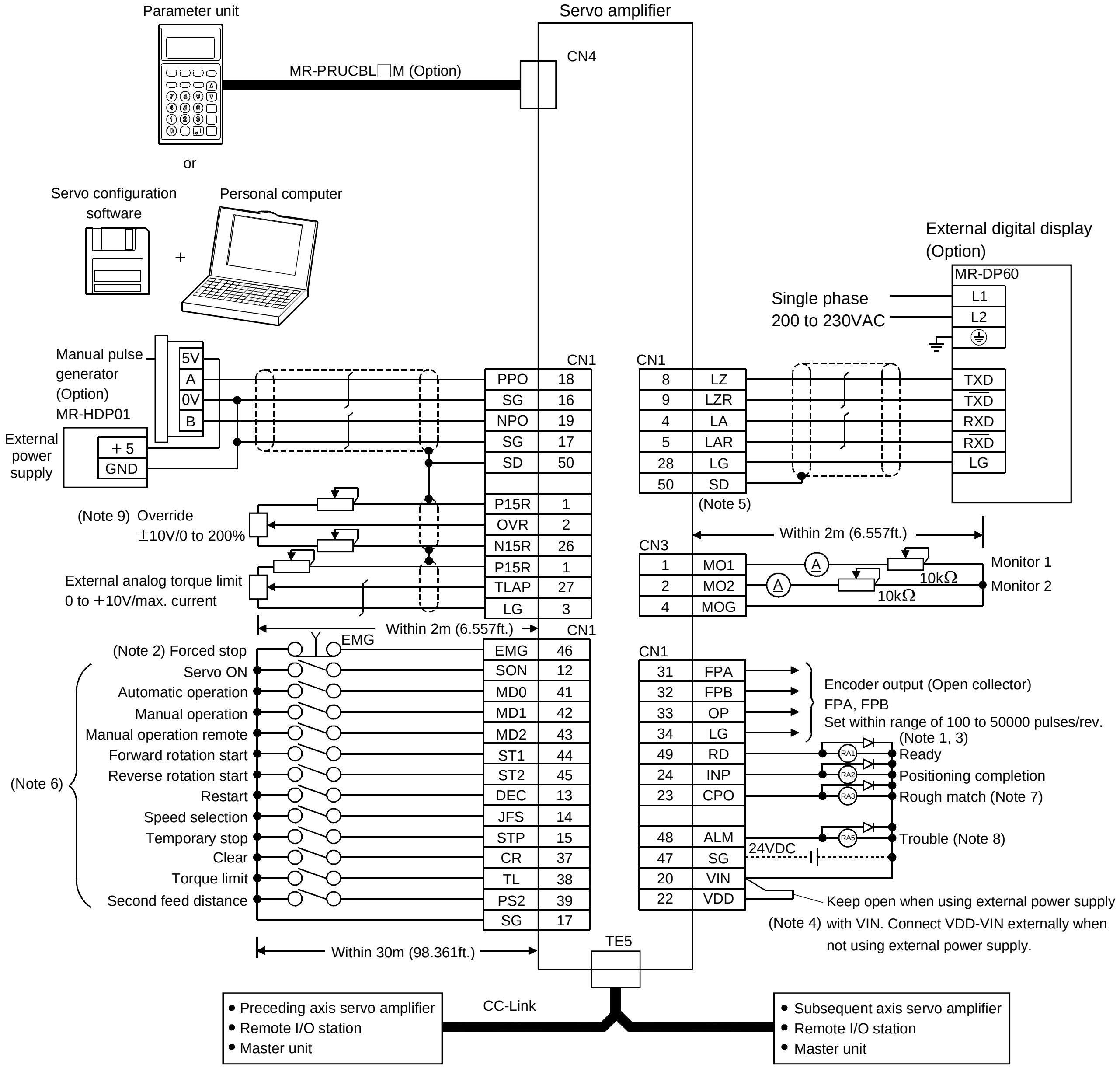
6. Change the setting of parameter No.3 to "□ □ 1 □" to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to "□ 1 □ □" to use CPO as a torque limit-in-progress.

7. ALM-SG are connected in a normal status, i.e. when there is no alarm.

8. The upper limit of the overriding speed is the permissible speed.

5.2.2 Input signals assigned to CN1

The following connection diagram assumes that the input signals that may be assigned to CN1 have all been assigned in the setting of parameter No.66.



Refer to the next page for Note.

Note:1. Connect the diode in the correct direction. If it is connected reversely, the servo amplifier will be faulty and will not output signals, disabling the forced stop and other protective circuits.

2. The forced stop switch must be installed.

3. The sum of currents that flow in the external relays should be 200mA max. If it exceeds 200mA, supply interface power from external.

4. When using the internal power supply (VDD) as the interface power supply, always connect VDD-VIN. Keep them open when supplying external power.

5. Change the setting of parameter No.52 to "☐ ☐ ☐ 0" to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.

6. Can be used as the CN1 external input signals in the initial status of parameter No. 66.

7. 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.

8. ALM-SG are connected in a normal status, i.e. when there is no alarm.

9. The upper limit of the overriding speed is the permissible speed.

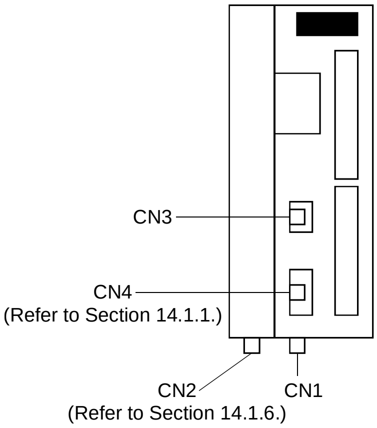
5.3 I/O connectors

5.3.1 Connector signal layouts

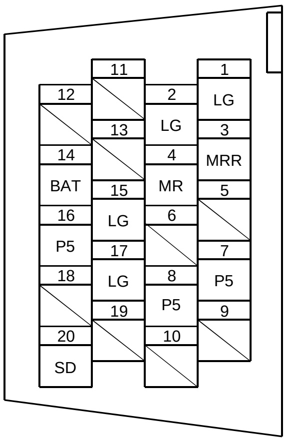
POINT

- The pin-outs of each connector are as viewed from the wiring section of the cable connector.

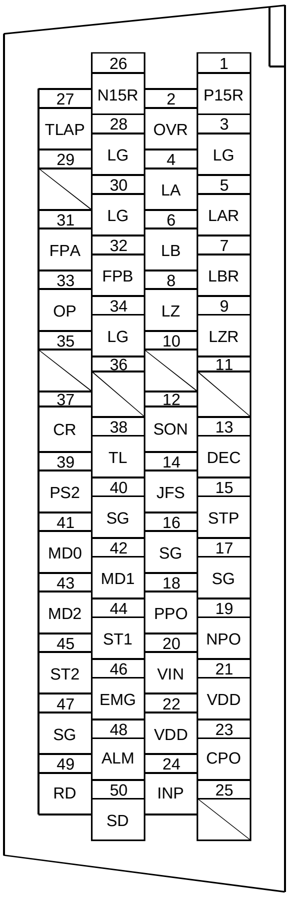
Servo amplifier



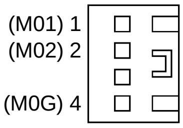
CN2 (For encoder signal)
Type PCR-S20FS (Honda Tsushin make)



CN1
Type PCR-S50FS (Honda Tsushin make)



CN3
Type 171822-4 (AMP make)



5.3.2 Signal explanations

Refer to Section 6.1.1 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.	
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	Refer to Section 3.5.2 (2)(a).	DI-1
Restart	DEC	13		
Speed selection	JFS	14		
Temporary stop	STP	15		
Manual pulse generator	PP0	18	Connect the manual pulse generator (MR-HDP01). Refer to Section 14.1.12 for details.	DI-2
	NP0	19		DI-2
In position	INP	24	Refer to Section 3.5.2 (2)(a).	DO-1
Clear	CR	37		DI-1
Torque limit selection	TL	38		
Second feed distance	PS2	39		
Automatic operation selection	MD0	41		
Manual operation selection	MD1	42		
Remote manual operation selection	MD2	43		
Forward rotation start	ST1	44		
Reverse rotation start	ST2	45		
Forced stop	EMG	46	This signal is used for CN external input only. Refer to Section 3.5.2 (2)(b).	DI-1

Signal name	Symbol	Pin No.	Description	I/O division
Zeroing completion	ZP	23	Refer to Section 3.5.2 (2)(b). CN1-23 is set to rough match (ZP) in the initial status but can be changed for use as limiting torque (TLC) or electromagnetic brake interlock (MBR) by setting of parameter No. 3 or 44.	DO-1
Limiting torque	TLC	(23)		
Electromagnetic brake inter lock	MBR	(23)		
Trouble	ALM	48	Refer to Section 3.5.2 (2)(b).	
Ready	RD	49		
Encoder pulse output (open collector system)	FPA FPB	31 32	In CCW rotation of the servo motor, FPA leads FPB by π/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	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 system)	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

5.3.3 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.

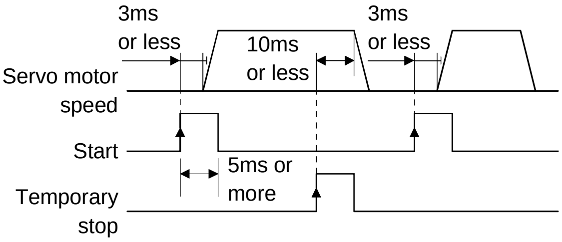
Operation mode Signal			Automatic	Manual	Remote manual
(Note)CN1	Automatic operation	RY7	1 (ON)	0 (OFF)	0 (OFF)
	Manual operation	RY8	0 (OFF)	1 (ON)	1 (ON)
	Remote manual operation	RY9	0 (OFF)	0 (OFF)	1 (ON)
	Forward rotation start	RYA	↑⎍ 1(ON) (Forward rotation start)		⎍ 1(ON) (Forward rotation JOG)
	Reverse rotation start	RYB	↑⎍ 1(ON) (Reverse rotation start)		⎍ 1(ON) (Reverse rotation JOG)
	Temporary stop	RY3	↑⎍ 1(ON) (Temporary stop)	↑⎍ 1(ON) (Temporary stop)	
Parameter unit	JOG	FWD REV		⎍ PUSH (Forward/reverse rotation JOG)	
	1STEP	1STEP		↑⎍ PUSH (1-step feed)	
Manual pulse generator				⎍	⎍

Note : If you turn on-off RY7/RY8/RY9 during operation in the automatic operation mode, the operation mode cannot be changed.
The operation mode is switched to the one specified by RY7, RY8 and RY9 after completion of positioning to the target position.

(2) Forward rotation start (RYA) · Reverse rotation start (RYB)

(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 (RX0).

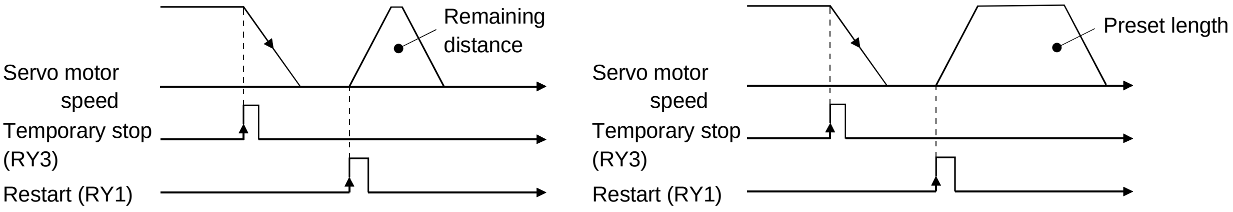
(b) In the servo amplifier, a start is executed when the start signal changes from “0” (OFF) to “1” (ON). The internal processing of the servo amplifier delays 3ms maximum. The other signal delays 10ms maximum.



(c) The start signal (RYA/RYB) 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 (RY1)

Turning the temporary stop (RY3) to “1” (ON) to make a stop and then turning the restart (RY1) to “1” (ON) executes the operation of the remaining feed length.

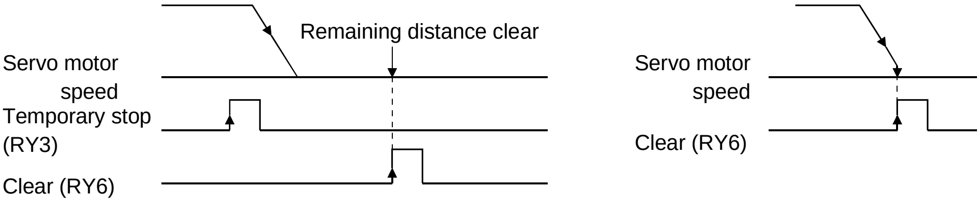


(a) Use of restart signal (RY1)

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

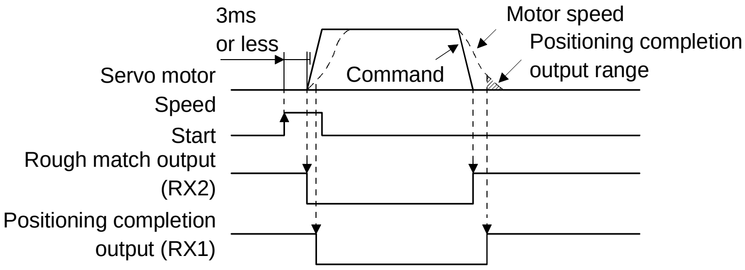
(4) Clear (RY6)

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 (RX1)

"1" (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 RX1 signal "1" (ON) if the positioning completion range (parameter No.16)setting is large.



(6) Rough match (RX2)

This signal turns to "1" (ON) when the command remaining distance is less than the rough match output range (parameter No. 17).

Refer to the timing chart in this section (5).

(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:

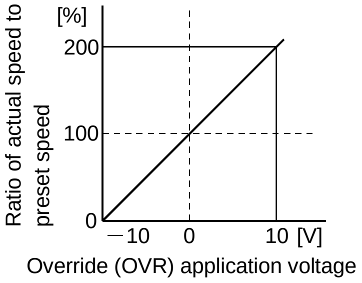
Item	Name	Remarks
Analog input signal	Override (OVR)	
Contact input signal	Override selection (RY12)	May be used only when 2 stations are specified.
Parameter	No.24 function selection 5	□□□ 1: Override used
	No.47 override offset	−9999 to 9999mV

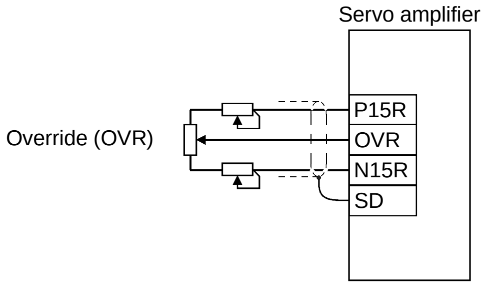
To use override, make it available by setting "□□□ 1" in parameter No. 24.

(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.

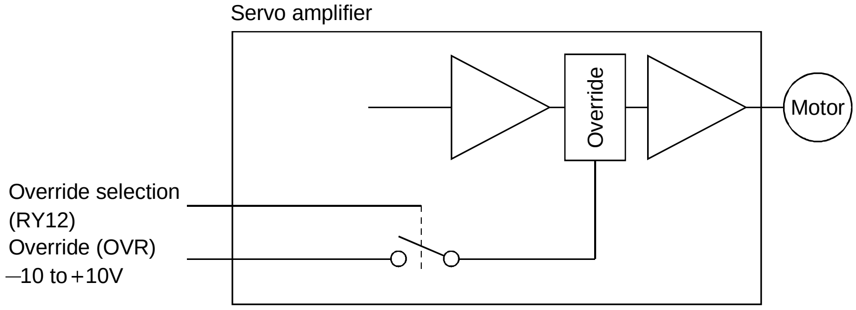
Refer to the following diagram when using the 15V power output (P15R, N15R) of the controller.





(b) Override selection (RY12)

Select between making override (OVR) Valid and invalid. This signal may be used only when 2 stations are specified.



Using the override selection (RY12), choose a change value as follows:

RY12	Speed change value
0 (OFF)	No change
1 (ON)	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

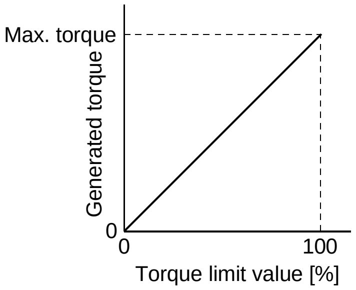
The following table lists the signals and parameters related to the torque limit:

Item	Name	Remarks
Analog input signal	External torque limit (TLAP)	
Contact input signals	Torque limit selection(RY4)	Set "□ 0 □ □" (initial value) in parameter No.41
Contact output signal	Limiting torque (RXA)	
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.

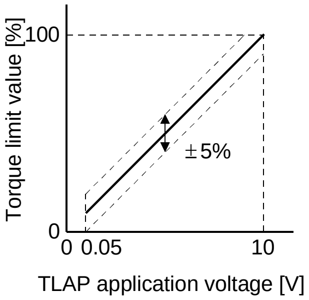


(b) External torque limit (TLAP)

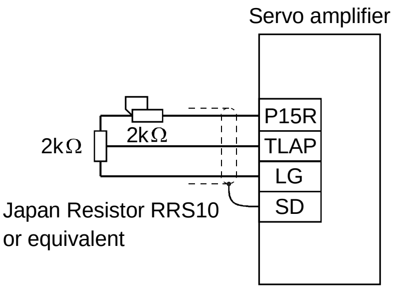
By applying a voltage (0 to +10V) to the external torque limit (TLAP) terminal, limit values can be set from outside consecutively. The following graph shows the relationship between input voltage and limit value.

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 servo amplifier:



TLAP Application Voltage vs.
Torque Limit Value



Connection Example

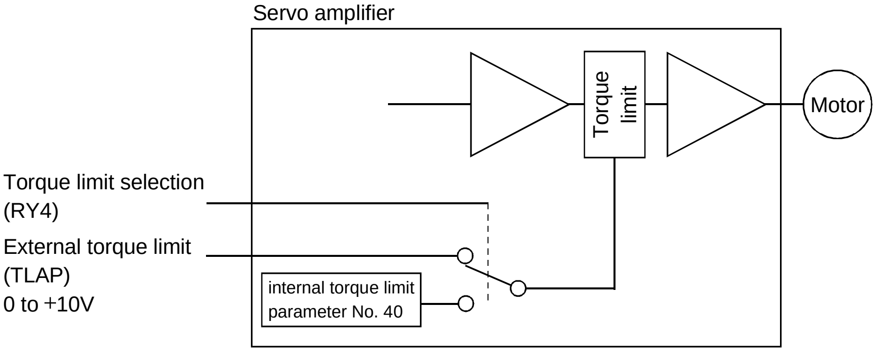
(c) Torque limit selection (RY4)

To use torque limit selection (RY4), set "□ 0 □ □" (initial value) 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.

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

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

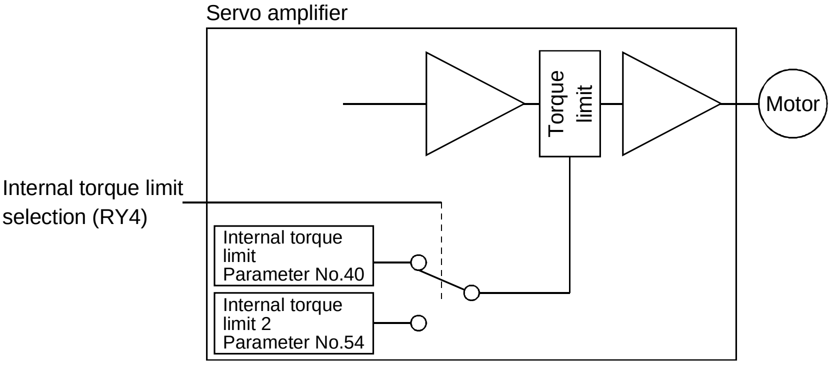


Using the internal torque limit selection (RY4), choose the limit value as follows. When LSD-SG are shorted, the smaller value of the external torque limit and internal torque limit is chosen:

RY4	Torque limit value
1 (ON)	External torque limit (TLAP) if External torque limit (TLAP) < internal torque limit
	Internal torque limit if External torque limit (TLAP) > internal torque limit
0 (OFF)	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 (RY4), choose the limit value as follows. When RY4 is turned on, the smaller value of the internal torque limit and internal torque limit 2 is chosen:

RY4	Torque limit value
0 (OFF)	Internal torque limit 2
1 (ON)	Internal torque limit if internal torque limit < internal torque limit 2
	Internal torque limit 2 if internal torque limit > internal torque limit 2

(9) Manual pulse generator pulse magnification selection (RY13, RY14)

These signals may be used only when 2 stations are occupied. Using RY13 and RY14, choose the pulse multiplying factor as indicated below.

Pulse magnification	(Note) Input signal	
	RY14	RY13
1 time	0	0
10 time	0	1
100 time	1	0

Note.0:OFF
1:ON

(10) Alarm code output (RX6, RX7, RX8, RX9)

The alarm type is output in 4-bit code.

For more information, refer to Section 11.4.1.

5.4 When switching power on for the first time

5.4.1 Pre-operation checks

Before starting operation, check the following:

(1) Wiring

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

(2) Environment

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

(3) Machine

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

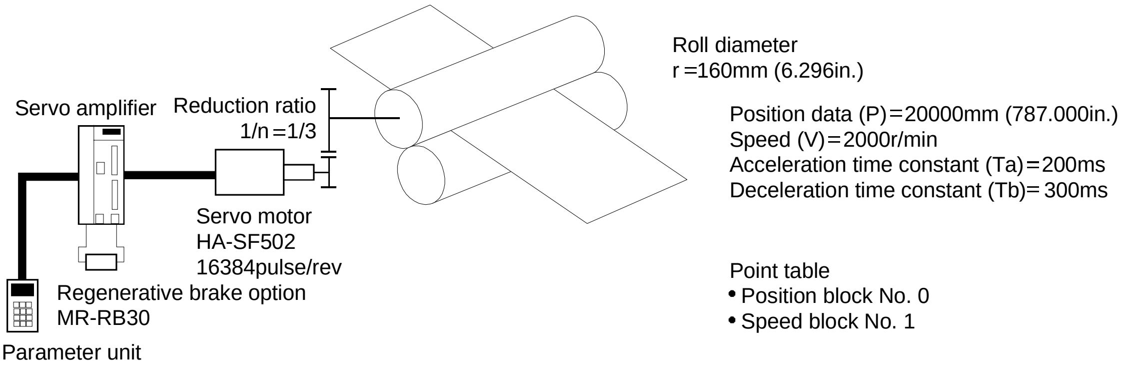
5.4.2 Startup

⚠ 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 for some time after power-off, do not touch or close a parts (cable etc.) to the servo amplifier heat sink, regenerative brake resistor, servo motor, etc. Their temperatures may be high and you may get burnt or parts may damaged.

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



(a) Absolute position detection system used

(b) Command resolution: 10μm

(c) Command system: Roll feeding system

(d) Electronic gear calculation

$$\frac{\text{CMX (pulse)}}{\text{CDV } (\mu\text{m})}=\frac{16384}{\frac{1}{n}\cdot r\cdot\pi\cdot 1000}=\frac{16384}{\frac{1}{3}\cdot 160\cdot\pi\cdot 1000}\fallingdotseq\frac{4096}{41888}=\frac{2048}{20944}\quad\text{.............................(5.1)}$$

CMX=2048

CDV=20944

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

(2) Startup procedure

(a) Power on

1) Turn the servo on signal (RY0) to "0" (OFF).

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

(b) Test operation

Using JOG operation in the "test operation mode" of the Parameter unit, make sure that the servo motor operates. (Refer to Section 8.2.)

(c) Parameter setting

Set the parameters according to the structure and specifications of the machine. Refer to Chapter 7 for the parameter definitions and to Sections 8.2 for the setting method.

Parameter	Name	Setting	Description
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	□0 0 1 As command resolution is 10 μm, 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 (5.1)
No.6	Electronic gear denominator (CDV)	20944	From calculation result of formula (5.1)

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 5.6.1 for the position block details and to Section 5.7 for the setting method.

Setting of position block No. 0

Position data [×10^{STM}μm]	(Note) M code	Speed block No.
200000		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) Turn the servo on signal (RY0) to “1” (ON).
   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 (RYA) or reverse rotation start (RYB) to execute automatic operation in accordance with point table No. 0.

Signal name	Device No.	ON/OFF	Description
Automatic/manual selection	RY7	1 (ON)	Automatic operation mode selected
Manual operation	RY8	0 (OFF)	
Manual operation remote	RY9	0 (OFF)	
Servo on	RY0	1 (ON)	Servo-on status is reached.
Second feed distance	RY5	0 (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) Turn the servo on signal (RY0) to “0” (OFF).
   The base circuit is shut off and the servo motor coasts.
2) Alarm occurrence
   When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.
3) Forced stop (EMG) OFF
   The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. Alarm AL.E6 occurs.

POINT

- A sudden stop indicates that a stop is made with the droop pulses erased.

5.5 Manual operation remote mode

For manual operation remote, set the operation mode selection signals (RY7, RY8, RY9) as listed below:

Operation mode selection signal	ON/OFF
RY7	0 (OFF)
RY8	1 (ON)
RY9	1 (ON)

5.5.1 Jog operation

(1) Speed setting

Using parameter No. 8 “JOG speed 1” and parameter No. 9 “JOG speed 2”, set the servo motor speeds for JOG operation.

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

Choose the JOG operation speed with the speed selection signal (RY2). The acceleration/ deceleration time constants for JOG operation are those of speed block No. 1.

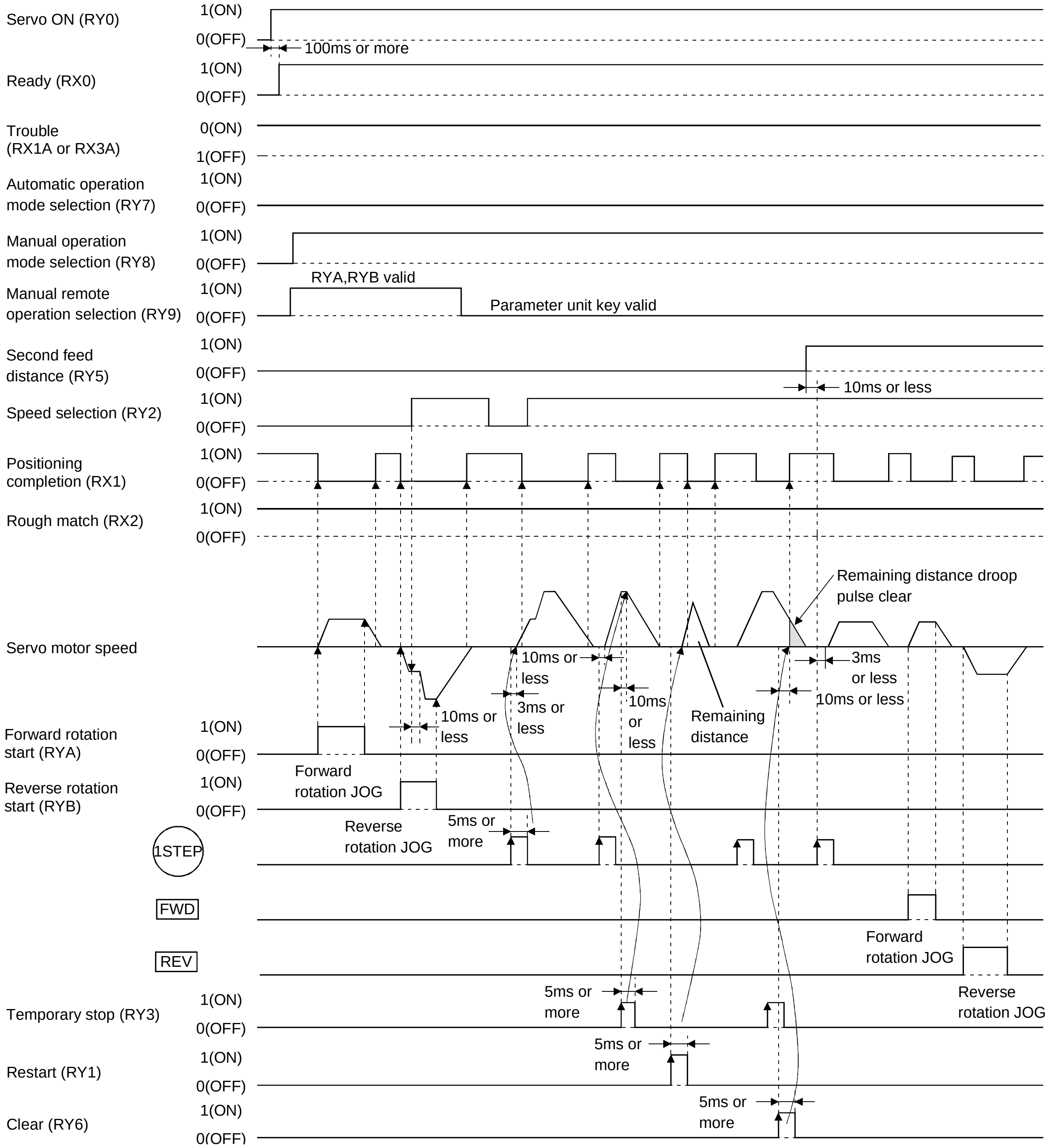
RY2	Setting value
0 (OFF)	JOG speed 1
1 (ON)	JOG speed 2

(2) Start

Turning the forward rotation start (RYA) or reverse rotation start (RYB) to “1” (ON) rotates the servo motor while it is “1” (ON). At this time, the rotation direction is as indicated in the following table:

Start signal	Parameter No. 2			
	□□0□	□□1□	□□2□	□□3□
RYA	CCW (address increase)	CW (address increase)	CCW (address decrease)	CW (address decrease)
RYB	CW (address decrease)	CCW (address decrease)	CW (address increase)	CCW (address increase)

(3) Timing chart



5.5.2 Manual pulse generator operation

(1) When 1 station is occupied

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

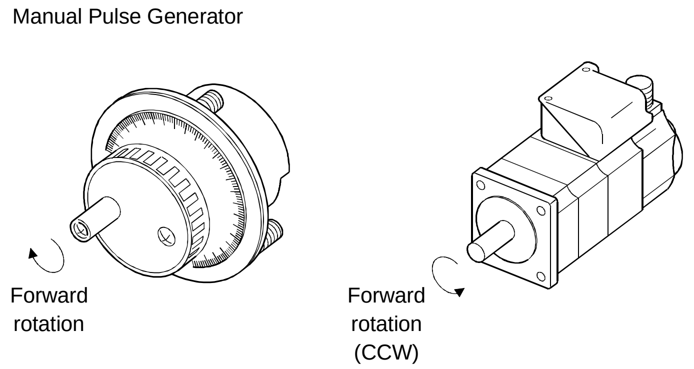
- - - □

* 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	100 µm
2	Used/pulse 10-time multiplication selected	1mm (0.039in.)
3	Used/pulse 100-time multiplication selected	10mm (0.394in.)

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)



(2) When 2 stations are occupied

The pulse multiplying factor of the manual pulse generator can be changed by using pulse multiplying factor selection in parameter No. 30 and the pulse multiplying factor selection signals (RY13, RY14). Set parameter No. 30 as listed below to make operation from the manual pulse generator valid.

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 (0.039in.)
3	Used/pulse 100-time multiplication selected	10mm (0.394in.)
4	Used/pulse multiplication selected eternally Pulse multiplying factor is selected using RY13, RY14.	

Setting "□ 4 □ □" in parameter No. 30 enables the pulse multiplying factor to be set with the pulse multiplying factor selection signals (RY13, RY14). Relationships between the multiplying factors and pulse multiplying factor selection signals are listed below:

Multiplying factor	Pulse multiplying factor selection signals	
	RY14	RY13
1 times	0 (OFF)	0 (OFF)
10 times	0 (OFF)	1 (ON)
100 times	1 (ON)	0 (OFF)

Turn the manual pulse generator to rotate the servo motor. The rotation direction is as in this section (1).

5.6 Manual operation mode

For manual operation, set the operation mode selection signals (RY7, RY8, RY9) as listed below:

Operation mode selection signal	ON/OFF
RY7	0 (OFF)
RY8	1 (ON)
RY9	0 (OFF)

5.6.1 JOG operation

(1) Speed setting

Using parameter No. 8 “JOG speed 1” and parameter No. 9 “JOG speed 2”, set the servo motor speeds for JOG operation.

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

Choose the JOG operation speed with the speed selection signal (RY2). The acceleration/ deceleration time constants for JOG operation are those of speed block No. 1.

RY2	Setting value
0 (OFF)	JOG speed 1
1 (ON)	JOG speed 2

(2) 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)

(3) Timing chart

Refer to Section 5.5.1 (3).

5.6.2 Stepped operation

Use the second feed distance signal (RY5) 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.	RY5
0	0 (OFF)
1	1 (ON)

5.6.3 Manual pulse generator operation

As in Section 5.5.2.

5.7 Automatic operation mode

Set the operation mode select signals (RY7, RY8, RY9) as listed on the right.

Operation mode select signal	ON/OFF
RY7	1 (ON)
RY8	0 (OFF)
RY9	0 (OFF)

5.7.1 Roll feeding operation according to point table

(1) Outline of point table data

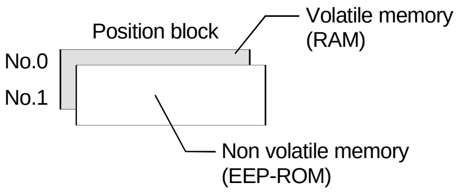
The point tables consist of the position blocks used to set the position data and the speed blocks used to set the motor speeds, acceleration time constants and deceleration time constants.

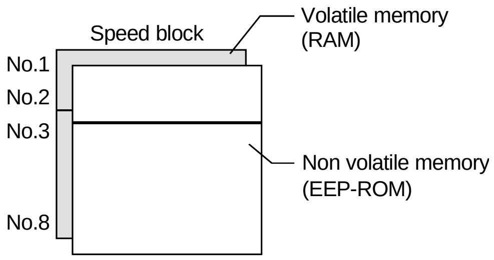
When 1 station is specified, 2 position blocks and 2 speed blocks are usable. These data can be set to both non-volatile memory (EEP-ROM) and volatile memory (RAM).

When 2 stations are occupied, 2 position blocks and 8 speed blocks are usable. As when 1 station is specified, these data can be set to both non-volatile memory and volatile memory.

When writing the position/speed block data, select which memory to use to write the data using the instruction code.

Whether 1 station or 2 stations are specified, the data written to non-volatile memory are saved in the servo amplifier if power is switched off. Note that the write life of non-volatile memory is about 100,000 times. Hence, when rewriting the point table data frequently, write the data to volatile memory for operation.





(2) 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 (RY5), select position block No.1.

2-position point data

Position Block No.	Second feed distance (RY5)
0	0 (OFF)
1	1 (ON)

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 5.8.

Position block No.	Position data	M code	Speed block No.
0	20000		
1	15000		

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

(3) 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 blocks (speed block No. 1, 2) when 1 station is occupied, or 8 speed blocks (speed block No. 1 to 8) when 2 stations are occupied.

Parameter No. 3

- - - ☐

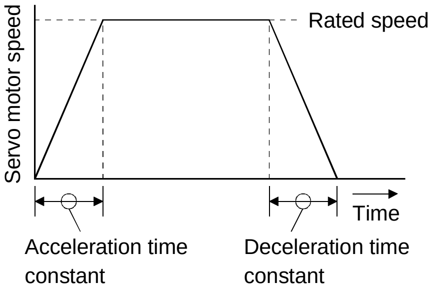
Set value	Acceleration/Deceleration pattern
0	Linear acceleration/deceleration
1	S-shaped acceleration/deceleration

For linear acceleration/deceleration pattern, set "☐ ☐ ☐ 0" in parameter No.3. In the speed blocks, set the servo motor speeds, acceleration time constants and deceleration time constants.

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 5.8.

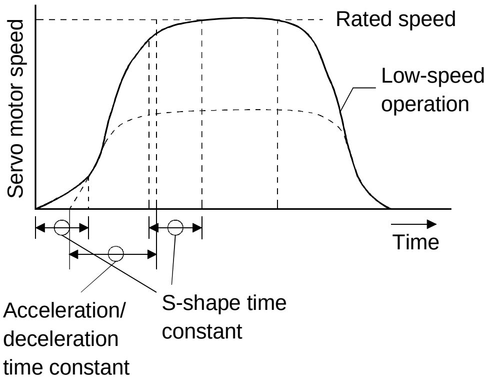
Item	Description
Speed	0 to max. speed r/min
Acceleration/Deceleration Time constant	0 to 20000ms The acceleration/deceleration time constant to be set is length of time (ms) required to reach the rated speed.



For S-shaped acceleration/deceleration pattern, smooths the rise and fall of servo motor rotation. Set "□□□1" in parameter No.3.
Refer to Section 5.8 for the speed block setting procedure.
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.



(4) Selection of position and speed blocks

When the setting of each point table is complete, select the position block number using the second feed distance signal (RY5). 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 (RY5)
0	0 (OFF)
1	1 (ON)

When 1 station is occupied, choose the speed block No. with the speed selection signal.

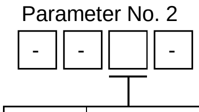
When 1 station is occupied (2 speed blocks)

Speed block No.	RY2
1	1 (ON)
2	0 (OFF)

When 2 stations are occupied, make selection using the speed command data (RWw6) of the remote register. (Refer to Section 3.6.3)

(5) Start

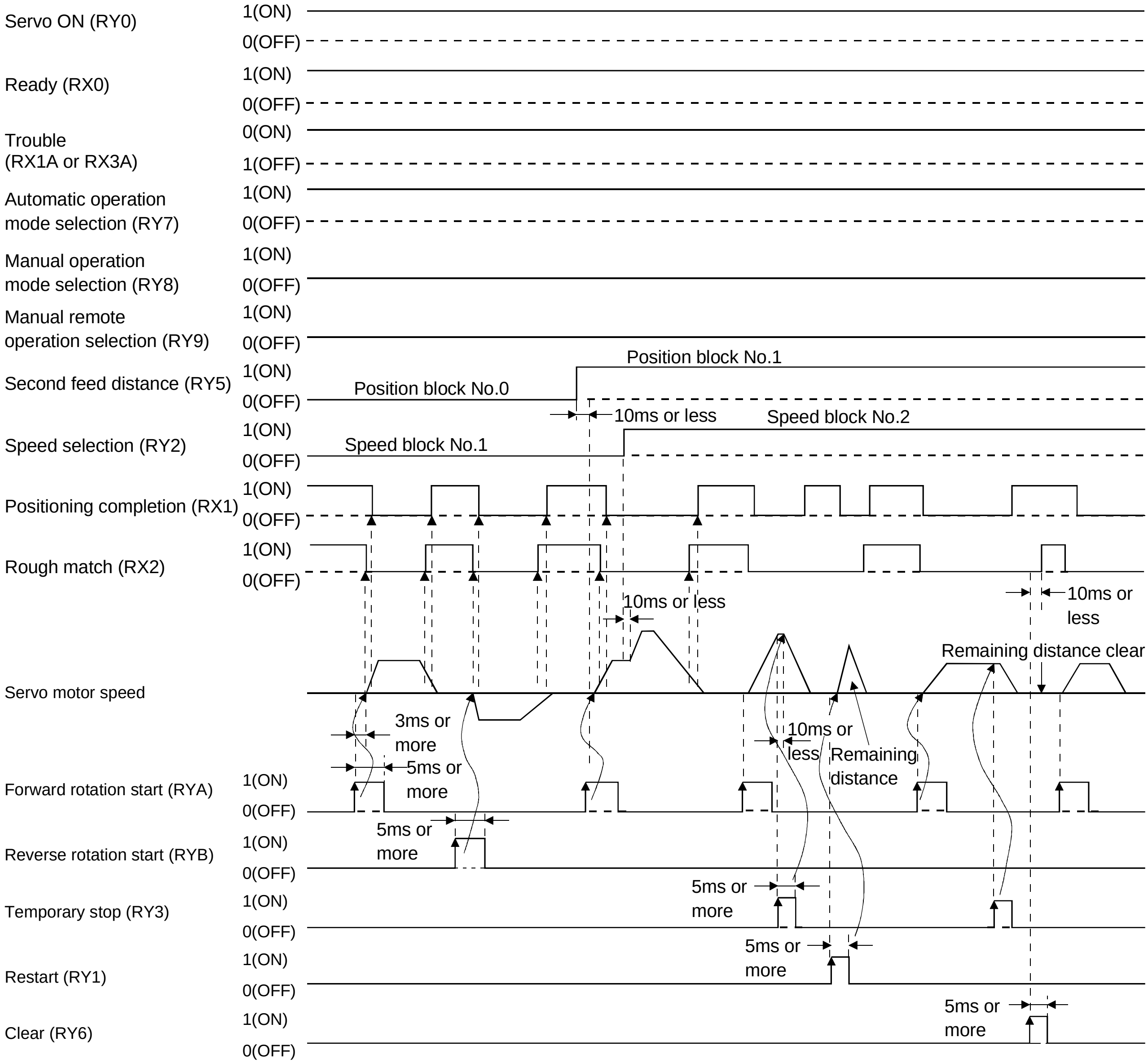
Turn the forward rotation start (RYA) or reverse rotation start (RYB) to “1” (ON) to rotate the servo motor to the preset position. The rotation direction of the servo motor depends on the setting of parameter No.2. The relationship between the set value and servo motor rotation is as listed below:



Set value	Servo motor rotation direction	
	RYA:ON	RYB: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)

(6) Timing chart

Shows operation performed after power on and zeroing completion. Refer to Section 3.6.3 (1) for the speed block No. setting timing chart when 2 stations are specified.



5.7.2 Roll feeding operation according to position command data

This operation is available only when 2 stations are occupied. Set the position command data (position data) to the CC-Link remote register to perform operation.
Set “□□□1” or “□□□2” in parameter No. 65. Set “□□□1” to specify the speed block No., or “□□□2” to set the motor speed.

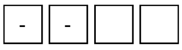
Parameter No. 65

Set value	Position command	Speed command
0	Use RY5 to specify the position block No.	Use RY2 to specify the speed block No.
1	Set the position data.	Use the remote register to set the speed data.
2		Use the remote register to set the motor speed.

(1) Setting of position command data

Set the position data (incremental value) to the position command data lower 16 bits (RWw4) and position command data upper 16 bits (RWw5). The position data can be changed in unit ([mm], [inch]) and input range by the setting of 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

(2) Setting of speed command data

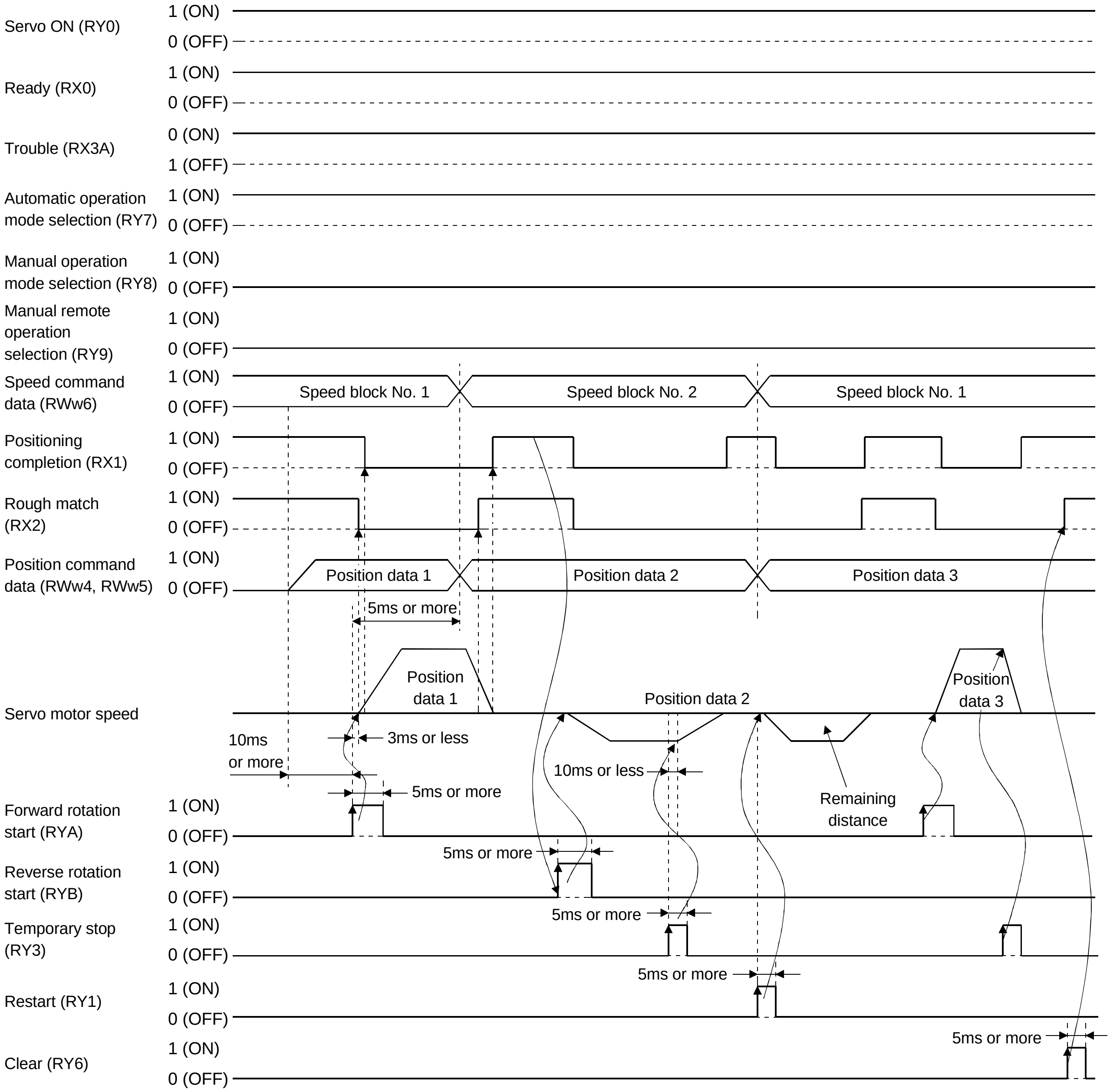
When specifying the speed block No., set the speed block No. to the speed command data (RWw6). When setting the speed, set the speed to the speed command data (RWw6). At this time, use the values set in speed block No. 1 as the acceleration and deceleration time constants.

(3) Start

Turning the forward rotation start (RYA) or reverse rotation start (RYB) to “1” (ON) rotates the servo motor to the preset position. The servo motor rotation direction is the same as in Section 5.6.1 (5).

(4) Timing chart

Operation performed after power on and zeroing completion is shown below. Refer to Section 3.6.3 (1) for the speed command data timing chart when 2 stations are occupied.



5.8 How to set the point table data from the parameter unit

(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 [^{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 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

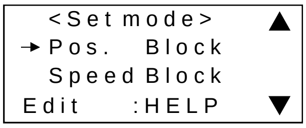
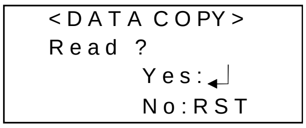
Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (call the data setting screen). Press [▲]/[▼] to select the block to be set (select the speed block). Press [↵] to define the block to be set.	<Set mode> ▲ Pos. Block →Speed Block Edit :HELP ▼
2)	Press [1] on the ten-key pad to 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 servo amplifier to the parameter unit and then copied to the other servo amplifier.

(a) Data read

Reads data from the servo amplifier to the parameter unit.

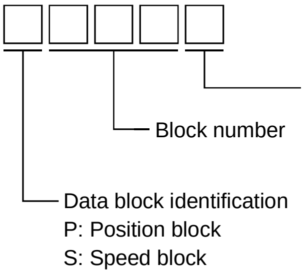
Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (Call the data setting screen). Press [SHIFT] [3] (position data copy initial screen). Press [CAN] to return to the previous screen.	 <Set mode> ▲ →Pos. Block Speed Block Edit :HELP ▼
2)	Press [▲]/[▼] to specify the mode (specify READ). 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 servo amplifier.

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (Call the data setting screen). 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 COMPARE). 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



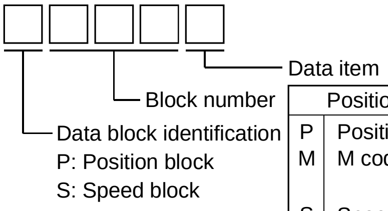
Position block		Speed block	
P	Position	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(c) Data write

Writes the data in the parameter unit to the servo amplifier.

Step	Parameter unit operation	Parameter unit screen
1)	Press [PARAM/DATA] (Call the data setting screen). 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 WRITE). Press [↲] to define the mode (define WRITE).	<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, [▲]/[▼] to switch to the preceding/next screen.	ErrorNo.:SFT Right Data Write Yes:↲ No:RST [SHIFT] Wrong Data ▲ P000P P001P S001V S001A S101D S002V ▼

Error number make-up

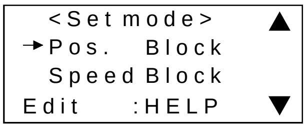
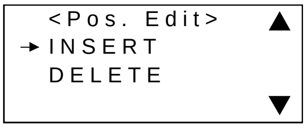
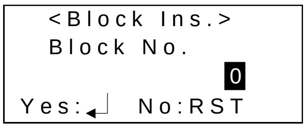
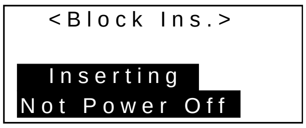
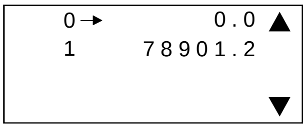
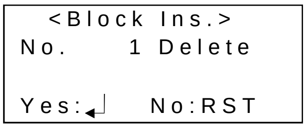


Position block		Speed block	
P	Position	V	Speed
M	M code	A	Acceleration time constant
S	Speed number	D	Deceleration time constant
		S	S-shape time constant

(4) Point table data edition

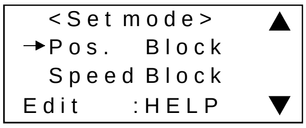
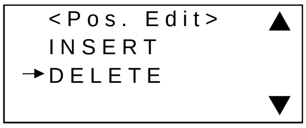
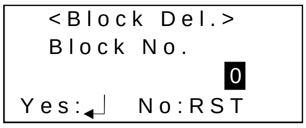
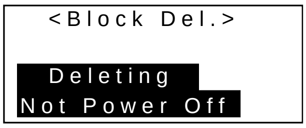
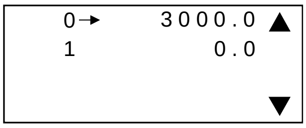
(a) Position block data insertion

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 INSERT). Press [↲] to define the mode (define INSERT).	 <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 No.1 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] (Call the data setting screen). 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 DELETE). Press [↵] to define the mode (define DELETE).	 <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

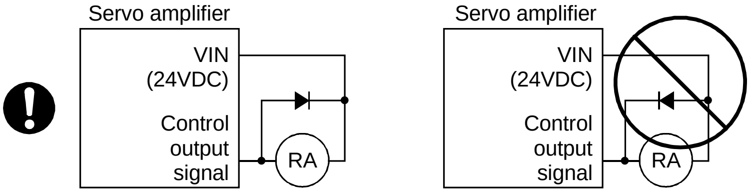
6. WIRINGS

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

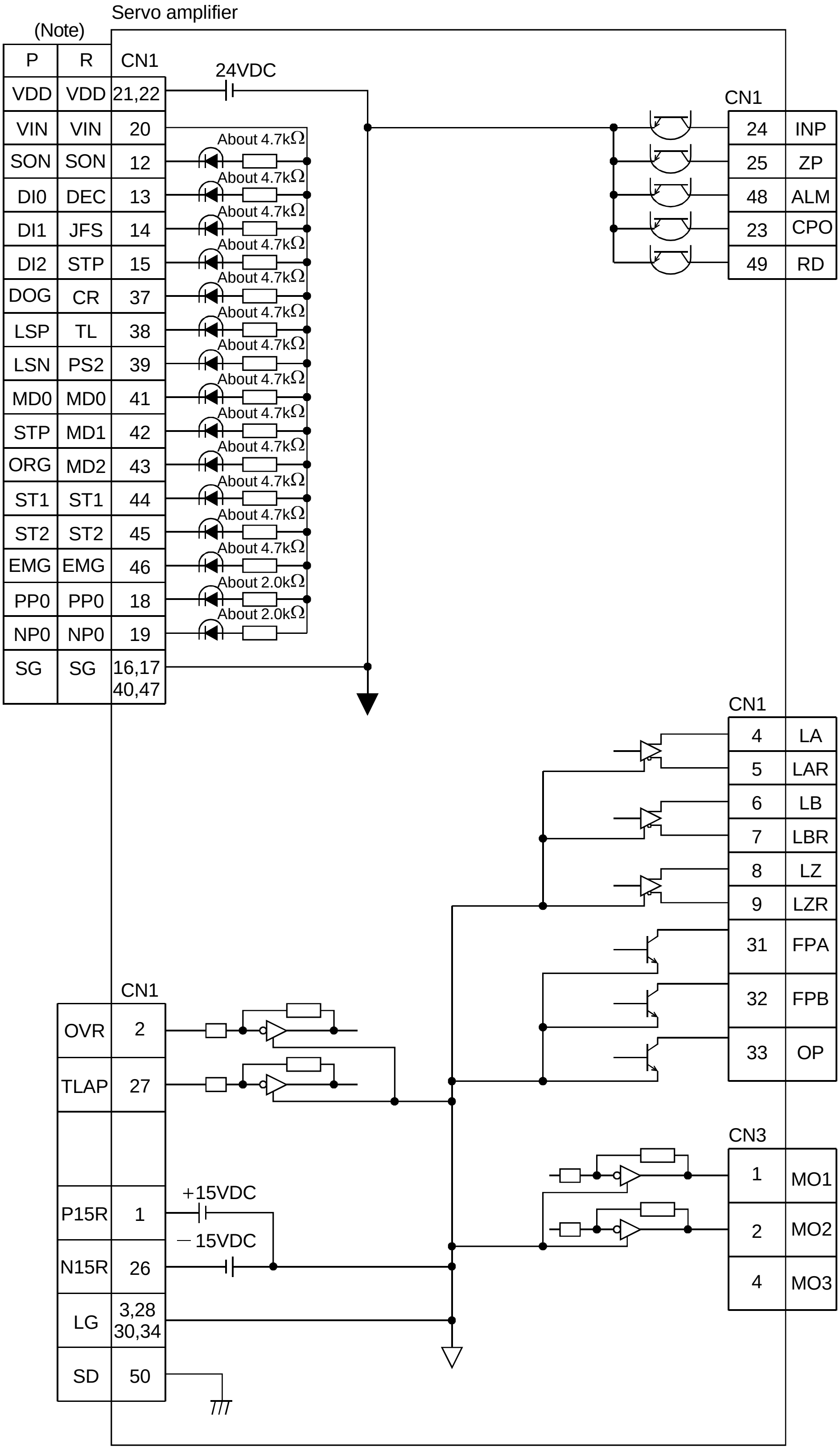
⚠ CAUTION

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



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

6.1 Internal connection diagram of servo amplifier

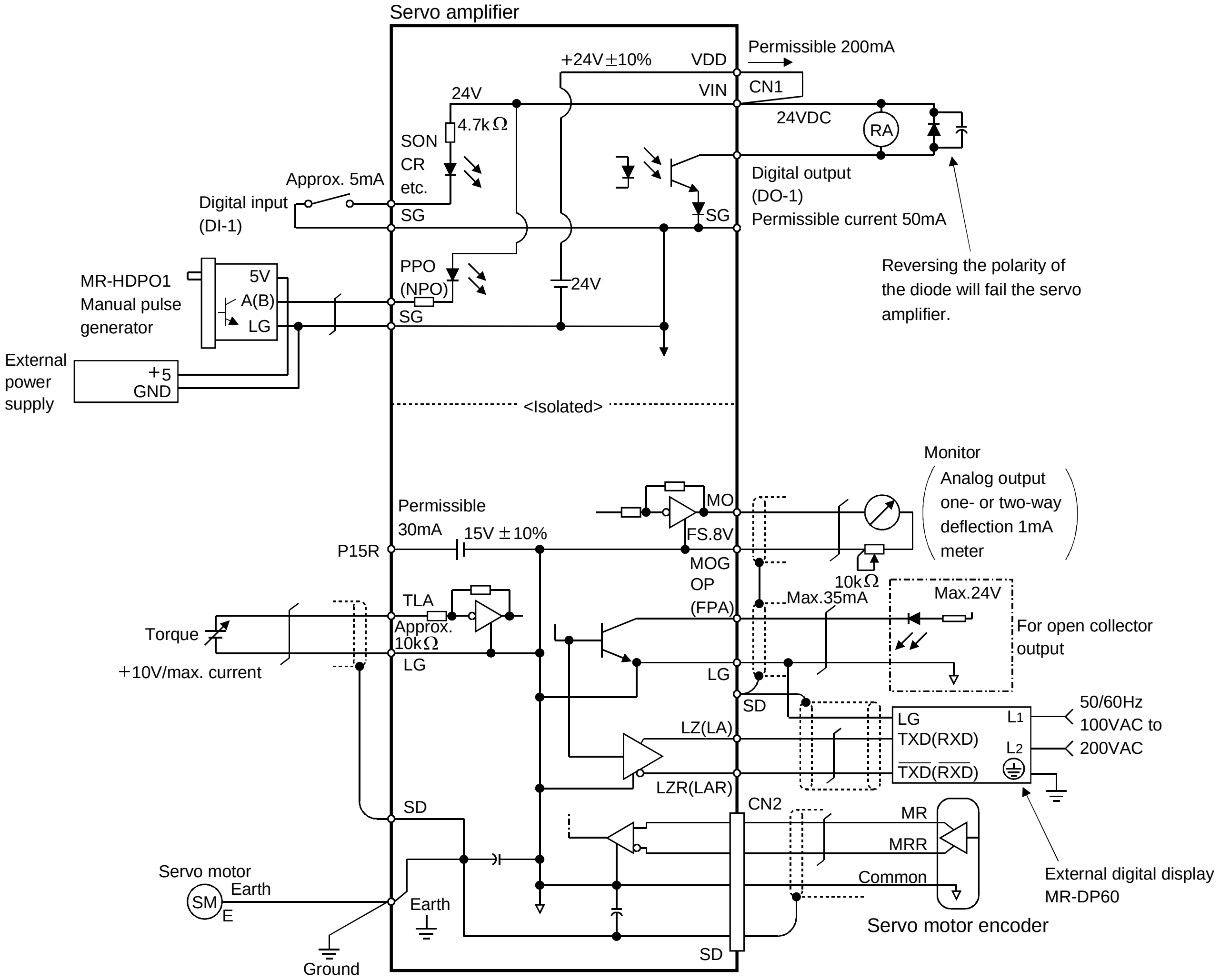


Note. P: Positioning system, R: Roll feeding system

6.2 Interfaces

6.2.1 Common line

The power supply and its common line are shown below.

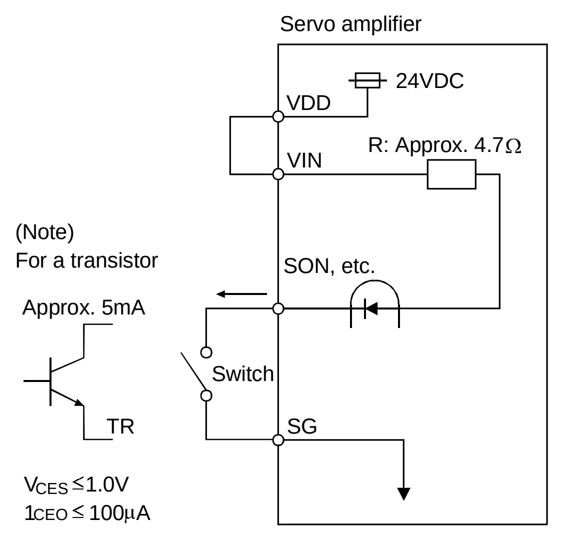
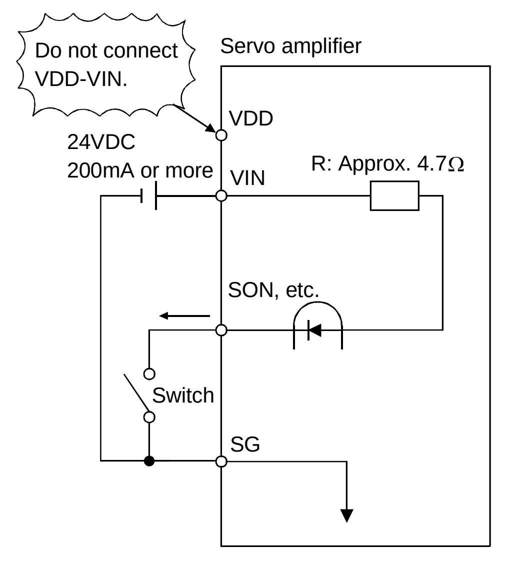


6.2.2 Detailed description of the interfaces

This section gives the details of the I/O signal interfaces (refer to I/O Division in the table) indicated in Sections 4.3.2 or Sections 5.3.2.
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.

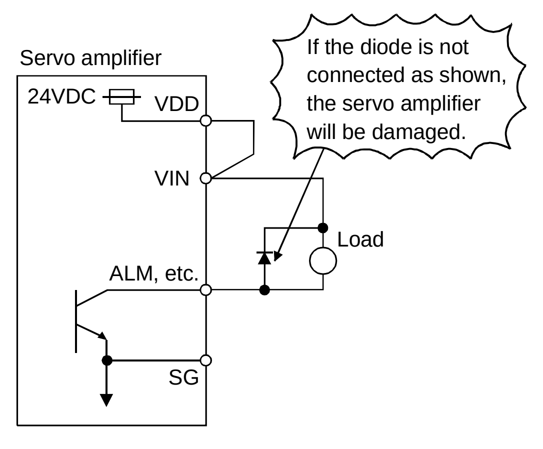
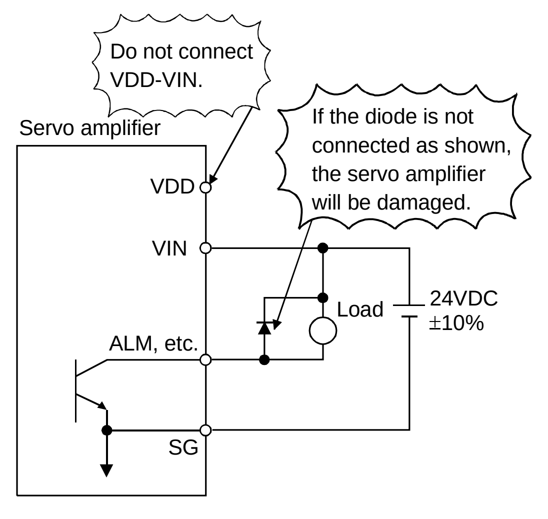
For use of internal power supply	For use of external power supply
	

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

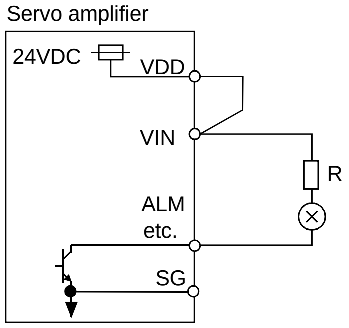
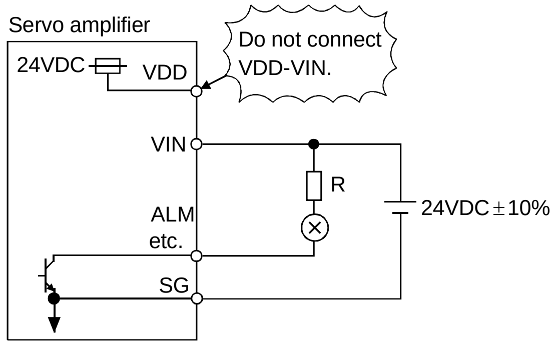
(2) Digital output interface DO-1

A lamp, relay or photocoupler can be driven. Provide a diode (D) for an inductive load, or an inrush current suppressing resister (R) for a lamp load. (Permissible current: 50mA or less, inrush current: 100mA or less)

(a) Inductive load

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

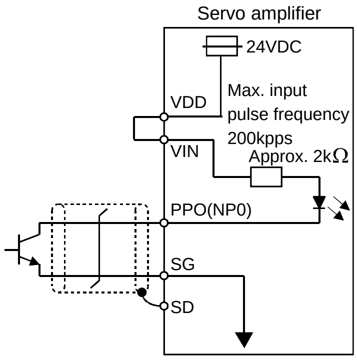
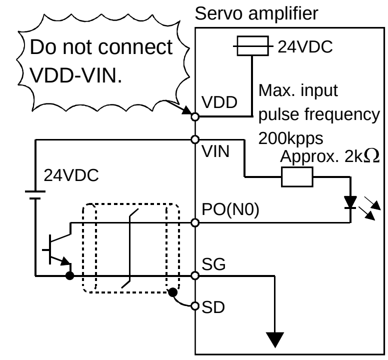
(b) Lamp load

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

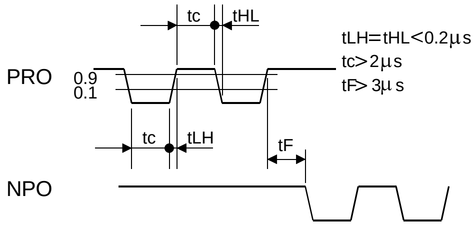
(3) Manual pulse generator input interface DI-2

The input signal is in the open collector system.

(a) Interface side

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

(b) Input pulse conditions

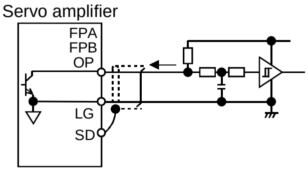


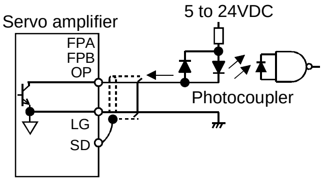
(4) Encoder pulse output D0-2

(a) Open collector system

1) Interface example

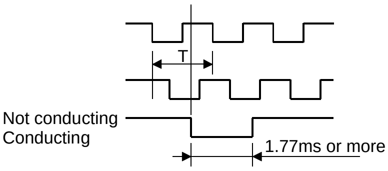
Max. output current 35mA





2) Output signal waveforms

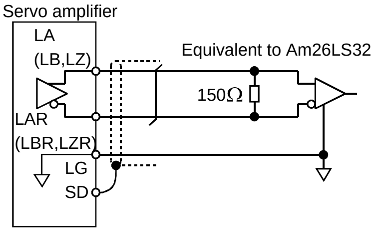
Servo motor CCW rotation

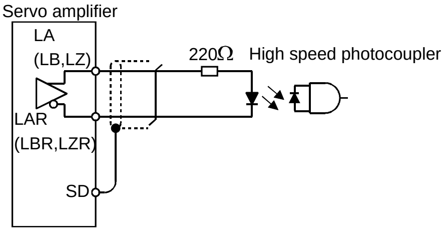


(b) Differential driver system

1) Interface example

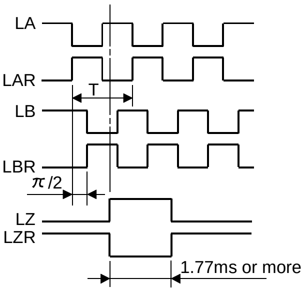
Max. output current 35mA





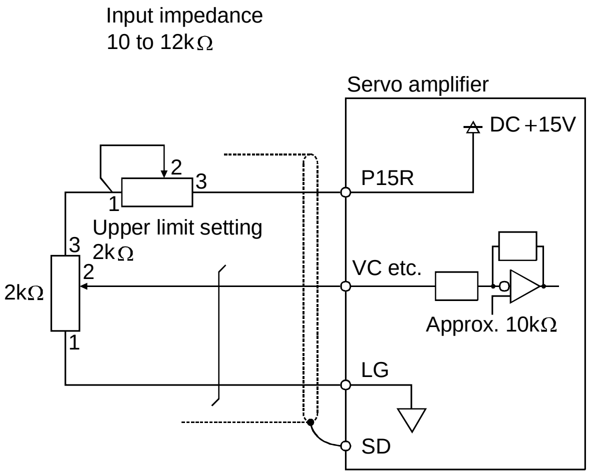
2) Output signal waveforms

Servo motor CCW rotation

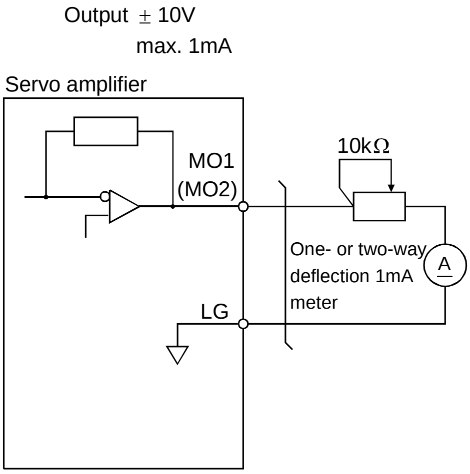


The leading edge of the LZ signal has variation of ±3/8T.

(5) Analog input



(6) Analog output



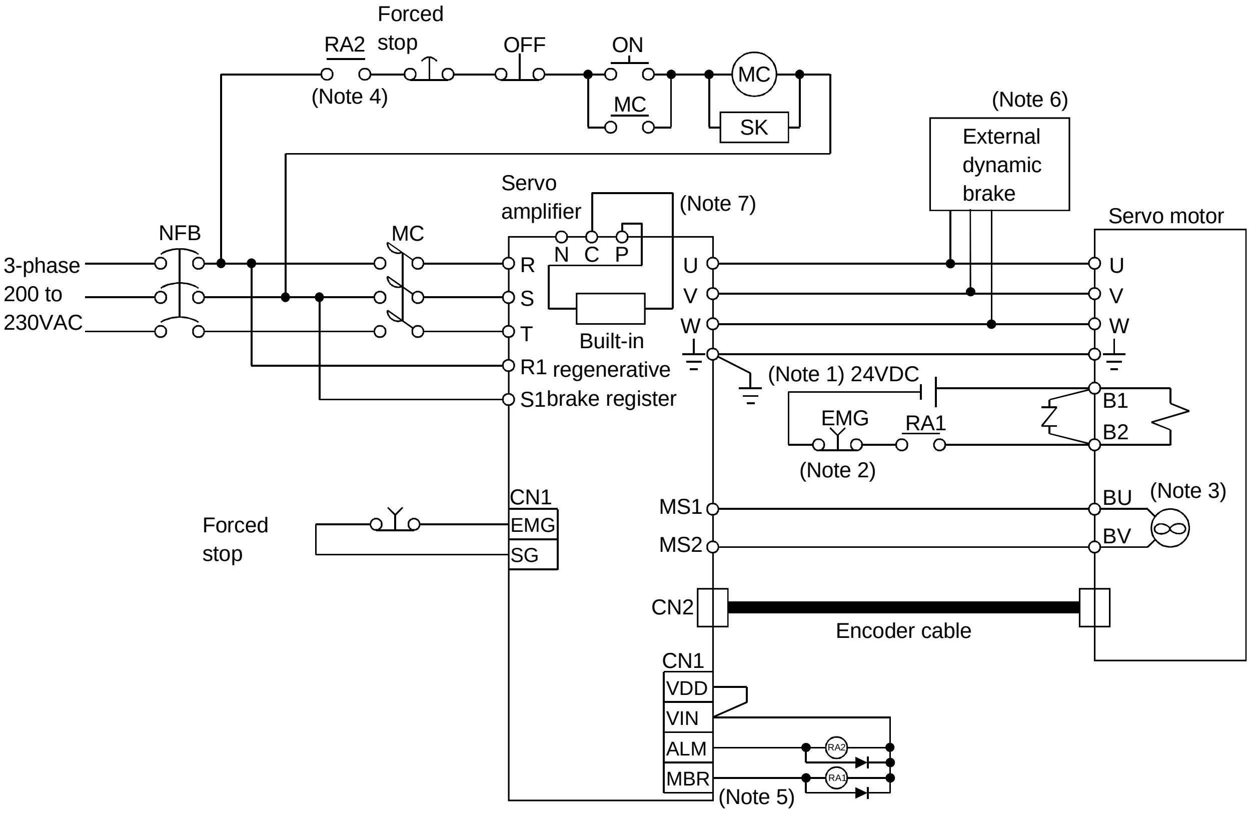
6.3 Power line circuit

⚠ CAUTION

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

6.3.1 Connection example

Wire the power supply and main circuit as shown below. A no-fuse breaker (NFB) must be used with the input cables of the power supply.
Design the circuit to ensure that the servo on signal will be turned off as soon as power is switched off on detection of alarm occurrence.



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 6.5.2(2),do not connected the EMG switch
3. For HA-LH15K2 or more.
4. Configure up a power circuit which will switch off the magnetic contactor after detection of an alarm.
5. Assign to CN1-23 using parameter No. 3 or 66.
6. Refer to Section 14.1.5 when using the external dynamic brake.
7. Refer to Section 14.1.2 to Section 14.1.4 when using the regenerative brake option, brake unit or power return converter.

6.3.2 The explanation of signals

The arrangement and signal layout of the terminal block change with the servo amplifier capacity. Refer to Section 12.1.

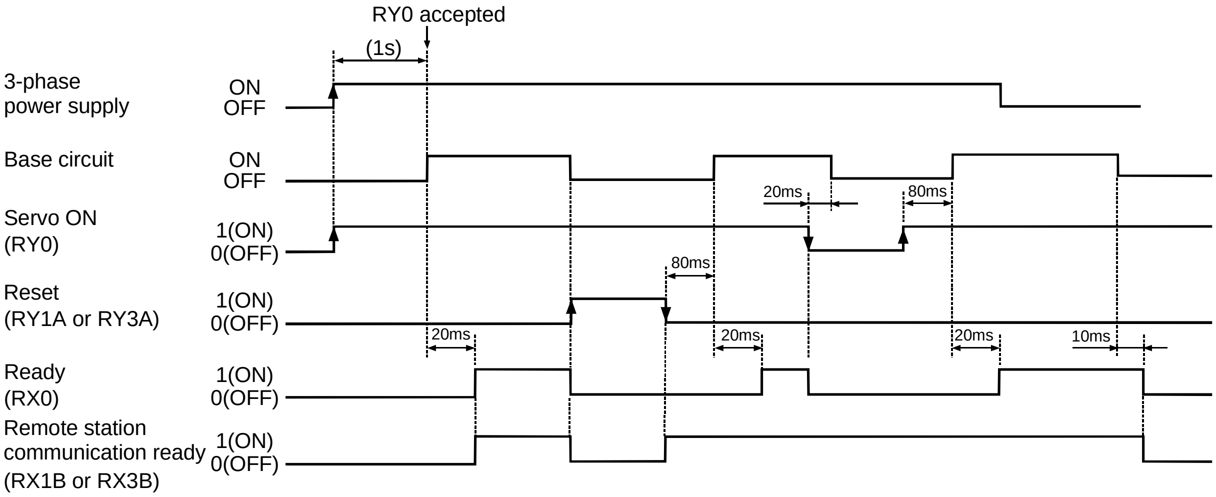
Symbol	Signal name	Description
R ▪ S ▪ T	Main circuit power supply	Main circuit power input terminals Connect a three-phase 200 to 230VAC, 50/60Hz power supply to R, S, T. For MR-H700TN or more, the voltage of 50Hz power supply is 200 to 220V.
U ▪ V ▪ W	Servo motor output	Servo motor power output terminals Connect to the servo motor power supply terminals (U, V, W).
R_1 ▪ S_1	Control circuit power supply	Control circuit power input terminals Connect a single-phase 200 to 230VAC, 50/60Hz power supply. For MR-H700TN or more, the voltage of 50Hz power supply is 200 to 220V.
P ▪ C ▪ D	Regenerative brake	Regenerative brake option connection terminals The MR-H400TN to MR-H700TN are factory-connected with a built-in regenerative brake resistor 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-H11KTN 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 servo amplifier of MR-H11KTN or more.
⏚	Grounding	Ground terminal Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.

6.3.3 Power-on sequence

(1) Power-on procedure

1) Always wire the power supply as shown in Section 6.3.1 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 R1,S1 simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the servo amplifier will operate properly.
3) The servo amplifier can accept the servo-on signal (RY0) about 1 second after the main circuit power supply is switched on. Therefore, when RY0 is turned to “1” (ON) as soon as the three-phase power supply is switched on, the base circuit will switch on in about 1 second, and the ready signal (RX0) will turn to “1” (ON) in further about 20ms, making the servo amplifier ready to operate.

(2) Timing chart

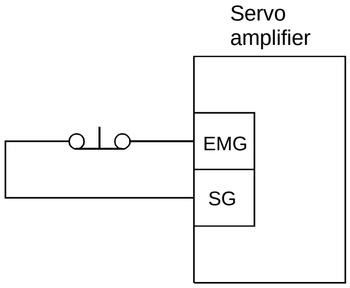


(3) Forced stop

CAUTION	▪ To stop operation and switch power off immediately, provide an external forced stop circuit.

Make up a circuit which shuts off main circuit power as soon as EMG-SG are opened at a forced stop. By disconnecting EMG-SG, the dynamic brake is operated to bring the servo motor to a sudden stop. At this time, the display shows the servo forced stop warning (AL.E6).

During ordinary operation, do not use the external forced stop signal to alternate stop and run. If the start signal turns to “1” (ON) or a pulse train is input during a forced stop, the servo motor will start rotating as soon as the warning is deactivated. During a forced stop, always shut off the run command.



6.4 Connection of servo amplifier and servo motor

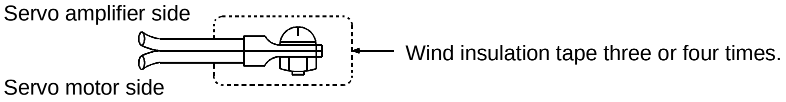
6.4.1 Connection instructions

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 servo amplifier and servo motor. Otherwise, the servo motor will operate improperly. ▪ Do not connect AC power supply directly to the servo motor. Otherwise, a fault may occur.

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.

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

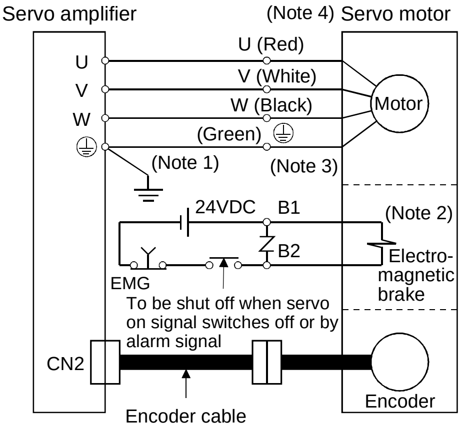
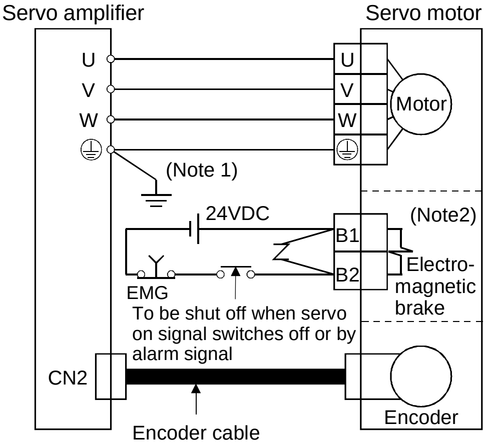
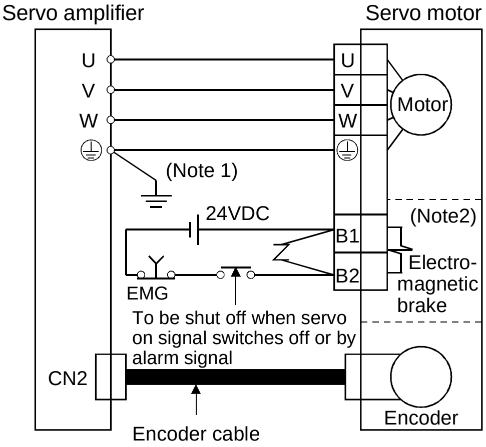


(2) For grounding, connect the earth cable of the servo motor to the ground terminal of the servo amplifier and connect the ground cable of the servo amplifier to the earth via earth plate of the control box.

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

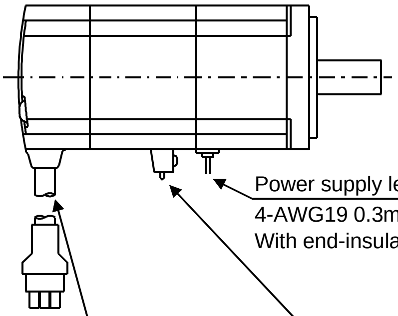
6.4.2 Connection diagram with the servo motor

The following table lists wiring methods according to the servo motor types. Use the connection diagram which conforms to the servo motor used. For cables required for wiring, refer to Section 14.2.1. For encoder cable connection, refer to Section 14.1.6.
For the signal layouts of the connectors, refer to Section 4.3.1.
For the servo motor connectors, refer to Chapter 3 in the Servo Motor Instruction Manual.

Servo motor	Connection diagram
HA-LH11K to 22K2 HC-MF053 (B) (-UE) to 73 (B) (-UE) HA-FF053 (B) to 63 (B) HC-UF13 (B) to 73 (B)	 Note 1. To prevent an electric shock, always connect the earth terminal of the servo amplifier to the earth of the control box. 2. This circuit applies to the servo motor with electromagnetic brake. 3. The HA-FF series has no lead wires. For the HA-FF series, connect the ground cable to the earth terminal of the servo motor. 4. The HA-LH11K2 to LH22K2 are equipped with a cooling fan. For wiring, refer to Section 3.8.4.
HA-FF053C (B)-UE to 63C (B)-UE HC-SF121 (B) to 301 (B) HC-SF202 (B) to 702 (B) HC-SF203 (B) ▪ 353 (B) HC-UF202 (B) to 502(B)	 Note 1. To prevent an electric shock, always connect the earth terminal of the servo amplifier to the earth of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.
HC-SF81 (B) HC-SF52 (B) to 152 (B) HC-SF53 (B) to 153 (B) HC-RF103 (B) to 503 (B) HC-UF72 (B) ▪ 152 (B)	 Note 1. To prevent an electric shock, always connect the earth terminal of the servo amplifier to the earth of the control box. 2. This circuit applies to the servo motor with electromagnetic brake.

6.4.3 Details of the servo motor side

(1) HC-MF □ (B) (-UE) series



Power supply lead
4-AWG19 0.3m (0.984ft.)
With end-insulated round crimping terminal 1.25-4
Red : U phase
White : V phase
Black : W phase
Green/yellow : Earth

Encoder cable 0.3m (0.984ft.)
With connector 172169-9 (AMP make)

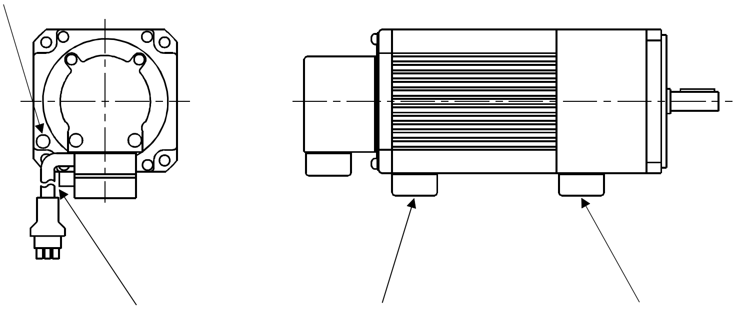
Brake cable
2-0.3² 0.3m (0.984ft.)
With end-insulated round crimping terminal 1.25-4

Encoder connector signal arrangement

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

(2) HA-FF □ (B) series

Earth terminal, M3 screw



Encoder cable 0.3m (0.984ft.)
With connector 172169-9 (AMP make)

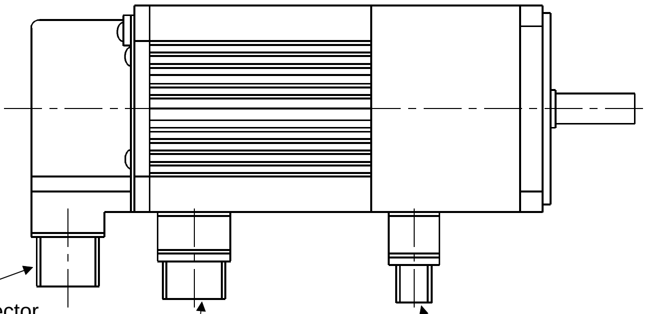
Power supply cable
VCTF3-1.25² 0.5m (1.639ft.)
With end-insulated round crimping terminal 1.25-4
Red : U phase
White : V phase
Black : W phase

Brake cable
VCTF2-0.5² 0.5m (1.639ft.)
With end-insulated round crimping terminal 1.25-4

Encoder connector signal arrangement

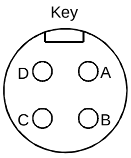
1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	
7	8	9
P5	LG	SHD

(3) HA-FF□C(B)–UE series



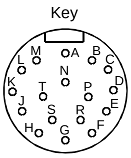
Servo motor	Connector		
	For power supply	For encoder	For brake
HA-FF053C(B)-UE to HA-FF63C(B)-UE	CE05-2A14S-2PD-B	MS3102A20-29P	MS3102E10SL-4P

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



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

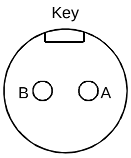
Encoder connector signal arrangement
MS3102A20-29P



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

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

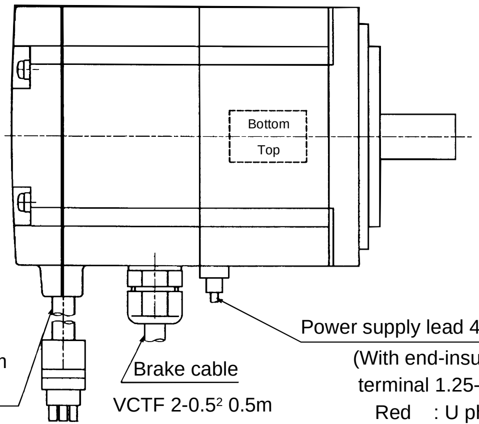
Brake connector signal arrangement
MS3102E10SL-4P



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

Note: 24VDC without polarity.

(4) HC-UF□(B) 3000r/min series



Encoder cable 0.3m (0.984ft.)
With connector 172169-9 (AMP make)

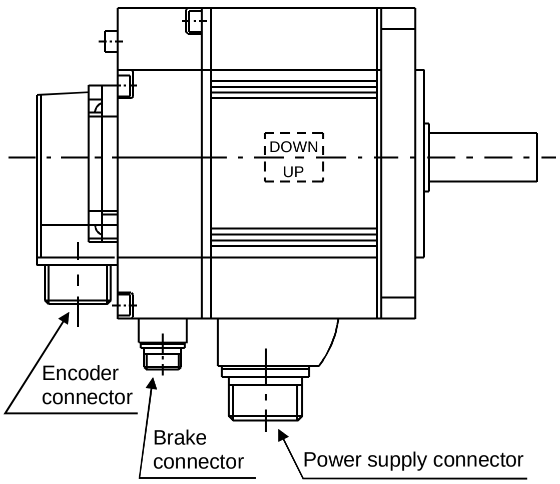
Brake cable
VCTF 2-0.5^2 0.5m (1.639ft.)
(With end-insulated round crimping terminal 1.25-4)

Power supply lead 4-AWG19 0.3m (0.984ft.)
(With end-insulated round crimping terminal 1.25-4)
Red : U phase
White : V phase
Black : W phase
Green/yellow : Earth

Encoder connector signal arrangement

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

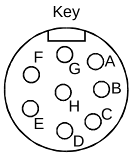
(5) HC-SF □ (B) ・ HC-RF □ (B) ・ HC-UF □ (B) 2000 r/min series



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

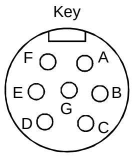
CE05-2A22-23PD-B



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

Note: 24VDC, without polarity

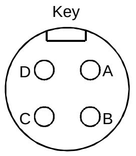
CE05-2A24-10PD-B



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

Note: 24VDC, without polarity

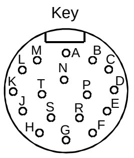
CE05-2A32-17PD-B



Pin	Signal
A	U
B	V
C	W
D	⏚ (Earth)

Encoder connector signal arrangement

MS3102A20-29P

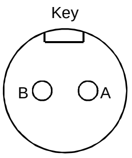


Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAD
G	LG
H	
J	

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

Brake connector signal arrangement

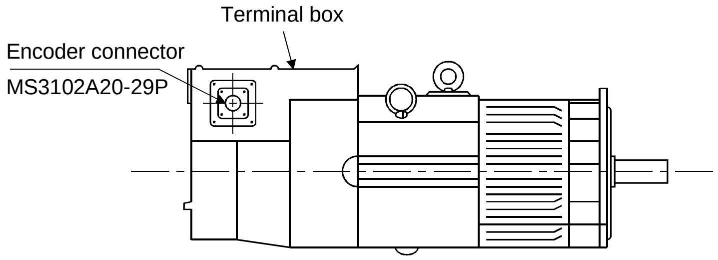
MS3102E10SL-4P



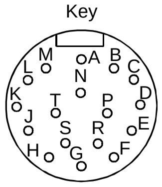
Pin	Signal
A	(Note) B1
B	(Note) B2

Note: 24VDC without polarity

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



Encoder connector signal arrangement MS3102A-29P

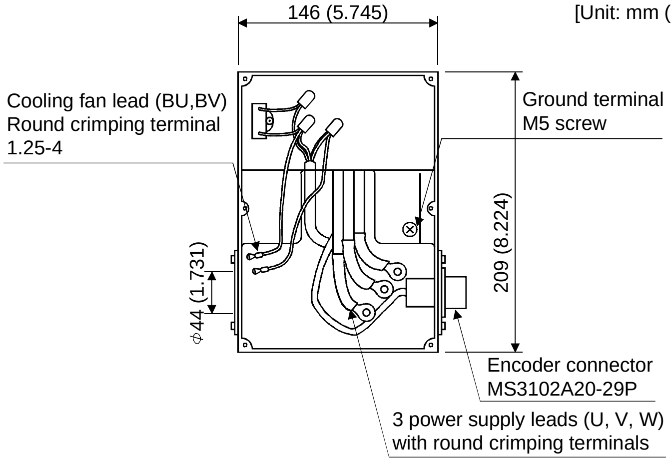


Pin	Signal
A	MD
B	MDR
C	MR
D	MRR
E	
F	BAT
G	LG
H	
J	

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

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

[Unit: mm (inch)]

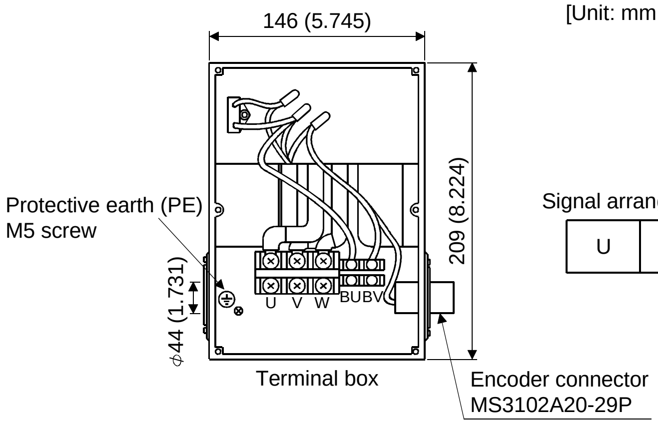


Power supply connection screw size

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 Terminal box

[Unit: mm (inch)]



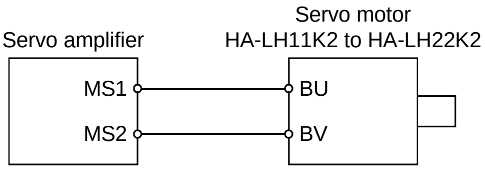
Signal arrangement of terminal block

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

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

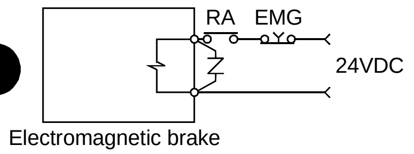
The 11kW or more of the HA-LH series are of totally-enclosed, force-cooled type. When performing operation, supply power to the cooling fan terminals (BU, BV) to operate the cooling fan. (Single-phase 200V, 35W)
Connect the fan terminals (BU, BV) of the servo motor to the cooling fan power terminals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



6.5 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 forced stop signal.



Contacts must be open when servo-on signal is off or when an alarm (trouble) is present and when an electromagnetic brake signal.

Circuit must be opened during forced stop signal.

POINT

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

Use the servo motor with electromagnetic brake to prevent a load drop on a vertical shaft or to ensure double safety at a forced stop. When using the signal of the servo motor with electromagnetic brake as the CN1 external input signal, set "□□1□" in parameter No. 3 to assign it to CN1-23.
Refer to the connection diagram in Section 6.3.1 and make connection.

6.5.1 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.
(4) Turn off the servo on signal after the servo motor has stopped.

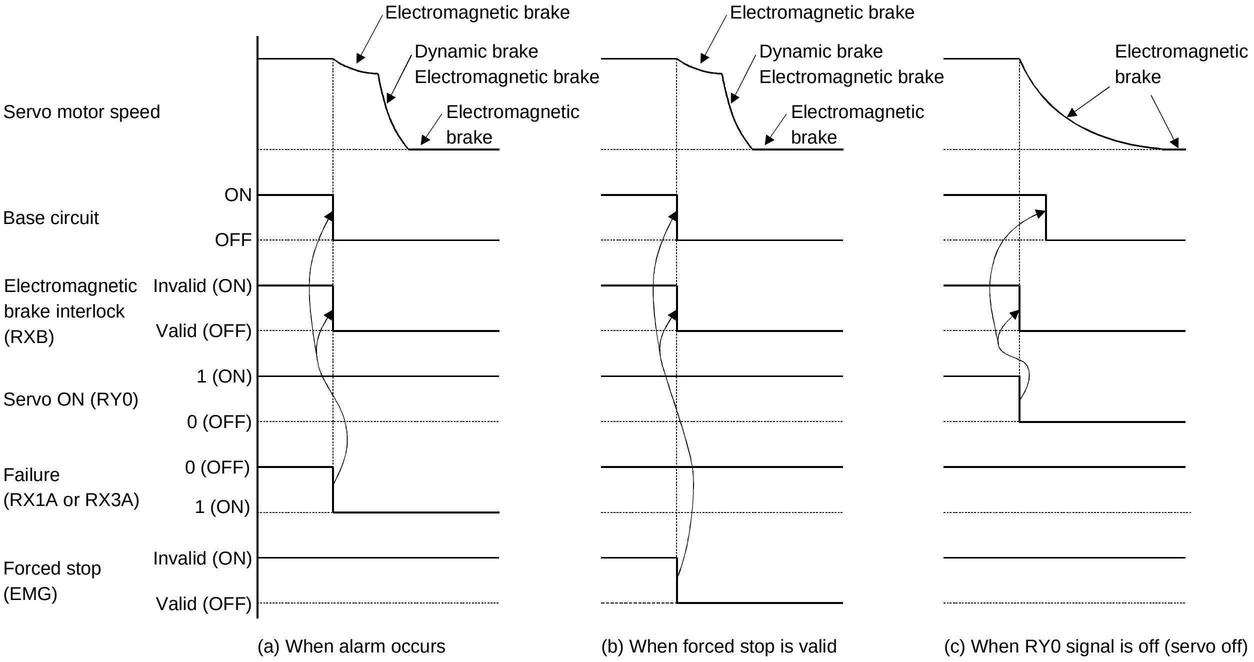
6.5.2 Operation of electromagnetic brake

(1) Electromagnetic brake operates when alarm occurs, forced stop is valid, or RY0 signal is off

(a) Setting

Set "0 ☐☐☐" (initial value) in parameter No. 44.

(b) Timing chart



(2) Electromagnetic brake operates under the condition in (1) of this section and at zero speed

(a) Setting

1) Set "1 ☐☐☐" in parameter No. 44 to change the electromagnetic brake interlock output timing.

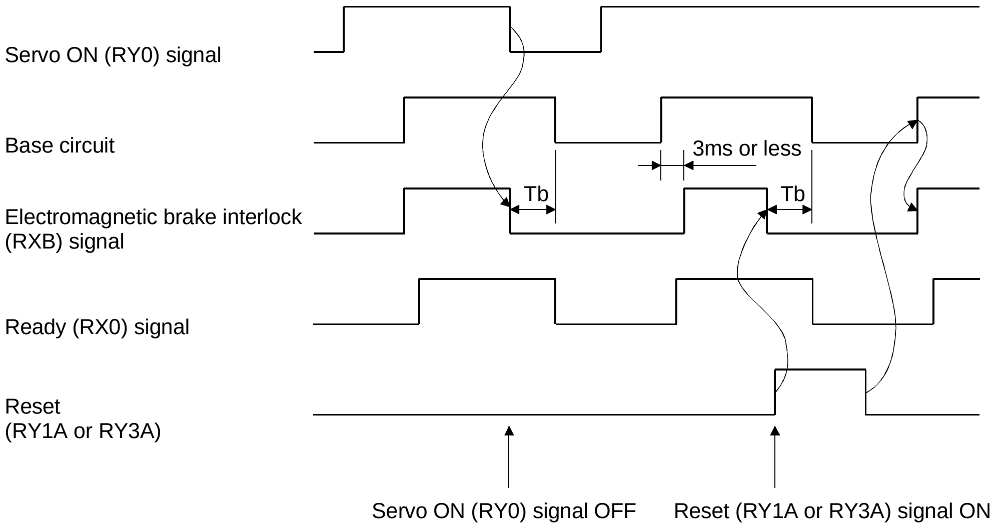
2) Using parameter No. 3 (servo type), change the function of CN1-23 pin from the trouble signal to the electromagnetic brake signal.

3) In parameter No. 53 (electromagnetic brake sequence output), set a time delay (Tb) between electromagnetic brake operation and base circuit shut-off as shown in the timing chart on the next page.

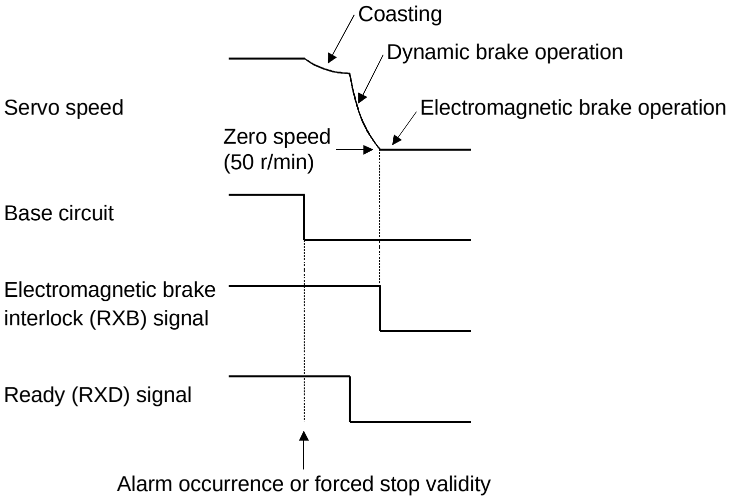
4) In this usage, do not install the EMG switch in Note 2 in the connection diagram of Section 6.3.1.

(b) Timing chart

1) Servo ON, reset timing chart.



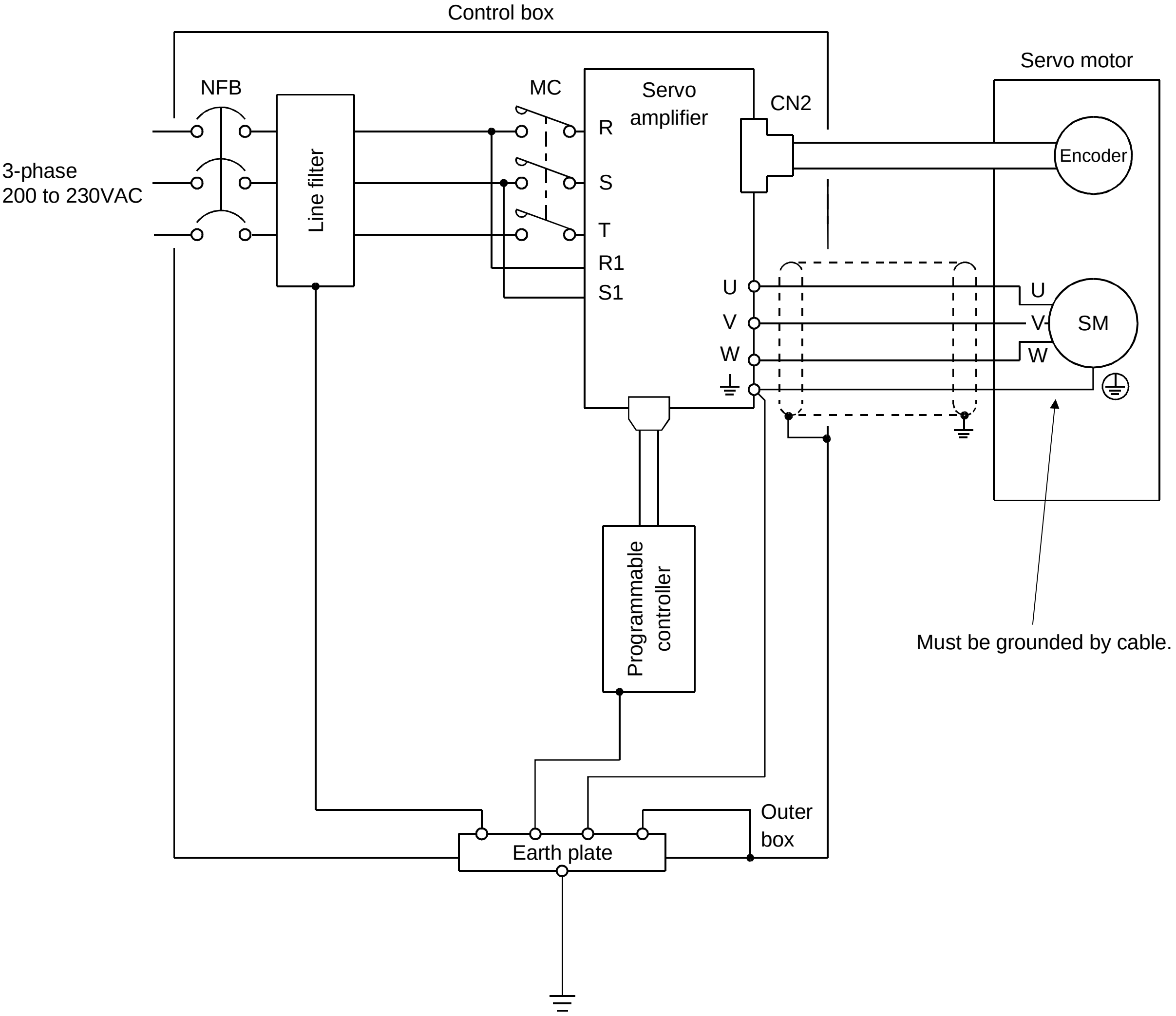
2) Alarm occurrence or forced stop validity timing chart.



6.6 Grounding

WARNING · Ground the servo amplifier and servo motor securely.

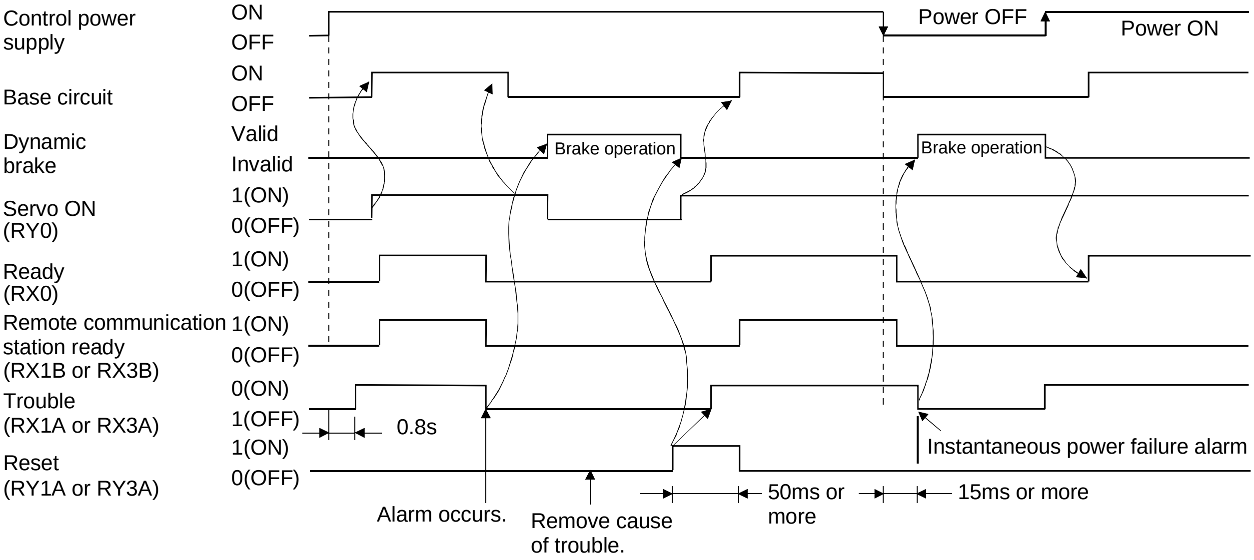
The servo amplifier switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cablerouting, the servo amplifier may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram for grounding.
To conform to the EMC Directive, refer to the EMC INSTALLATION GUIDELINES (IB(NA)67310).



6.7 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 servo amplifier, the base circuit is shut off and the dynamic brake operates to stop the servo motor. At the same time, 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 (RY1A or RY3A) 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 (AL.32), overload 1 (AL.50) or overload 2 (AL.51) alarm after its occurrence, without removing its cause, the servo amplifier and servo motor may become faulty due to temperature rise. Securely remove the cause of the alarm and also allow about 30 minutes for cooling before resuming operation.

(2) Regenerative alarm

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

(3) Instantaneous power failure

If a power failure continues 15ms or longer, the undervoltage (AL.10) alarm will occur. If the power failure still persists for 100ms or longer, the control circuit is switched off. If a power failure is restored in this status, the alarm is reset, and the motor will start suddenly if the servo on signal (RY0) is in the state of “1” (ON). To prevent a hazard, configure up the sequence to ensure that the servo on signal (RY0) will turn to “0” (OFF) when 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.

7. PARAMETERS

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

7.1 Parameter list

7.1.1 Parameter write inhibit

In this servo amplifier, its parameters are classified into the basic parameters (No.0 to 20) and expansion parameters (No.21 to 64) and option parameters (No.65 to 79) 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.
The following table lists the parameters that are enabled for reference and write by setting of parameter No. 19. Operation can be performed for the parameters marked ○.

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	○	○	○

7.1.2 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.

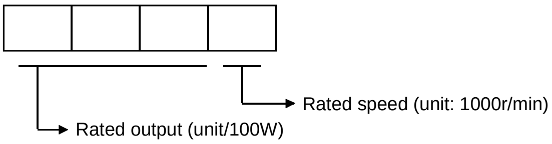
For details of the parameters, refer to the corresponding items.
The symbols in the Feeding System column of the table denote the following:
P: Positioning system
R: Roll feeding system

(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	P, R	—		
	2	*FTY	Feeding system, regenerative brake option selection	2 Feed mode	P, R	0001		
	3	*ST1	Function selection 1	3 Function 1	P, R	0000		
	4	*ST2	Function selection 2	4 Function 2	P, R	0000		
	5	*CMX	Electronic gear numerator	5 E-gear-N	P, R	1		
	6	*CDV	Electronic gear denominator	6 E-gear-D	P, R	1		
	7	PG1	Position control gain 1	7 Pos. gain 1	P, R	70	rad/s	
	8	JG1	Jog speed 1	8 JOG speed 1	P, R	100	r/min	
	9	JG2	Jog speed 2	9 JOG speed 2	R	1000	r/min	
		*ZTY	Zeroing type	9 ORG type	P	0010		
	10		For manufacturer setting	10 blank	R			
		ZSP	Zeroing position	10 ORG Add	P	0	Command unit $\times 10^{STM} \times 10^{-3}$	
	11		For manufacturer setting	11 blank	R			
		ZRF	Zeroing speed	11 ORG Speed	P	500	r/min	
	12		For manufacturer setting	12 blank	R			
		CRF	Creep speed	12 ORG Creep	P	10	r/min	
	13		For manufacturer setting	13 blank	R			
		ZST	Zero shift distance	13 ORG shift	P	0	Command unit	
	14		For manufacturer setting	14 blank	R			
		DCT	Moving distance after proximity dog signal ON	14 Near Dog	P	1000	Command unit $\times 10^{STM} \times 10^{-3}$	
	15		For manufacturer setting	15 blank	R			
		STN	Second home position data	15 ORG Add. 2	P	100	Command unit $\times 10^{STM} \times 10^{-3}$	
	16	INP	In-position range	16 IPN zone	P, R	25	Command unit $\times 10^{STM} \times 10^{-3}$	
	17	CRP	Rough match output range	17 CRP zone	P, R	0		
	18	MOD	Analog monitor output	18 Moni. sel.	P, R	0001		
	19	DMD	Status display selection	19 Disp. sel.	P, R	0000		
	20	*BLK	Parameter/point table write inhibit	20 Pr. block	P, R	0000		
Expansion parameters	21	AUT	Auto tuning	21 AT Tuning	P, R	0001		
	22	*OP1	Function selection 3	22 Function 3	P, R	0000		
	23	*OP2	Function selection 4	23 Function 4	P, R	0000		
	24	*OP3	Function selection 5	24 Function 5	P, R	0000		
	25	BKC	Backlash compensation	25 Backlash	P, R	0	pulse	
	26	FFC	Feed forward gain	26 FF gain	P, R	0	%	
	27	ERZ	Excessive error alarm level	27 AL.52 level	P, R	80	K pulse	
	28	INT	In-position output time	28 INP time	P, R	0	ms	
	29	*RMX	For manufacturer setting	29 Puls Func 1	P, R	0120		
	30	RM2	Pulse input function 2	30 Puls Func 2	P, R	0000		
	31	*DSP	Current position display	31 Pos Disply	R	0000		
			For manufacturer setting	31 blank	P			
	32		For manufacturer setting	32 blank				
	33		For manufacturer setting	33 blank				
	34		For manufacturer setting	34 blank				
	35		For manufacturer setting	35 blank				

classif-ication	No.	Code	Name	Parameter unit screen display	Feeding system	Initial value	Unit	Customer setting
Expansion parameters	36		For manufacturer setting	36 blank				
	37		For manufacturer setting	37 blank				
	38		For manufacturer setting	38 blank				
	39	*ENR	Encoder output pulse	39 PLG pulse	P, R	2048	pulse	
	40	TL	Internal torque limit 1	40 TQ limit 1	P, R	100	%	
	41	*IP1	Input signal selection 1	41 DI sel. 1	P, R	P : 0100 R : 0000		
	42	*IP2	Input signal selection 2	42 DI sel. 2	P, R	0000		
	43		For manufacturer setting	43 blank				
	44	*OPC	Output signal selection	44 DO sel.	P, R	0000		
	45		For manufacturer setting	45 blank				
	46	*MOA	Pre-alarm data selection	46 ALM memo	P, R	0001		
	47	VOC	VC offset	47 VC offset	P, R	0	mV	
	48	TPO	TLAP offset	48 TLAP offset	P, R	0	mV	
	49		For manufacturer setting	49 blank				
	50	MO1	MO1 offset	50 MO1 offset	P, R	0	mV	
	51	MO2	MO2 offset	51 MO2 offset	P, R	0	mV	
	52	*SIO	External digital display selection	52 SIO sel.	P, R	0101		
	53	MBR	Electromagnetic brake sequence output	53 BRK timing	P, R	100	ms	
	54	TL2	Internal torque limit value 2	54 TQ limit 2	P, R	100	%	
	55		For manufacturer setting	55 blank		0		
	56		For manufacturer setting	56 blank		0		
	57		For manufacturer setting	57 PID droop		0		
	58	DG2	Ratio of load inertia moment to servo motor inertia moment	58 Inertia	P, R	2.0	times	
	59	NCH	Machine resonance control filter	59 M-filter	P, R	0		
	60	PG2	Position control gain 2	60 Pos. gain 2	P, R	25	rad/s	
	61	VG1	Speed control gain 1	61 V-gain 1	P, R	1200	rad/s	
	62	VG2	Speed control gain 2	62 V-gain 2	P, R	600	rad/s	
	63	VIC	Speed integral compensation	63 V-int com	P, R	20	ms	
	64	VDC	Speed differential compensation	64 V-dif com	P, R	980		
Option parameters	65	*COM	Command system selection	65 com.sel	P, R	1000		
	66	*DIS	External DI selection	66 DI sel.	P, R	0000		
	67		For Manufacturer setting	67 LS DI sel		0000		
	68		For manufacturer setting	68 blank		0120		
	69		For manufacturer setting	69 blank				
	70		For manufacturer setting	70 blank				
	71		For manufacturer setting	71 blank				
	72		For manufacturer setting	72 blank				
	73		For manufacturer setting	73 blank				
	74		For manufacturer setting	74 blank				
	75		For manufacturer setting	75 blank				
	76		For manufacturer setting	76 blank				
	77		For manufacturer setting	77 blank				
	78		For manufacturer setting	78 blank				
	79		For manufacturer setting	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 servo amplifier. 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>P, R</td><td></td><td></td><td>0000
to
0005h</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 servo amplifier. 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		P, R	As given in the Left table		As given in the Left table

			Servo amplifier MR-H□TN											
	Servo motor	Capacity (W)	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				

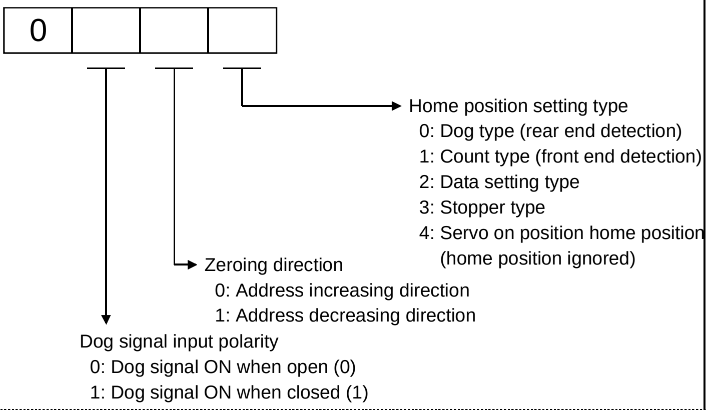
The values enclosed by □ are factory-set values.

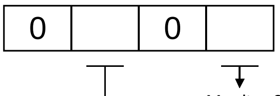
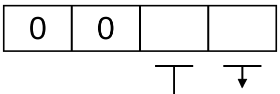
CAUTION

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

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting range
Basic parameters	2	*STY	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 } (P) 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-TN, the corresponding parameter error occurs.)	P, R	0001		0000 to 0E32h
	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. (CN1-23 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 servo amplifier in incremental system) 1: Valid (when using the servo amplifier 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 □ □ □
The magnification (STM) can be set to position data set in the position block number or by the digital switch. Refer to the following 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>
Unit of position data
0: Metric system
1: Inch system
(The unit on the machine speed screen is:
mm: mm/m
inch: inch/m)
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 the value of the electronic gear numerator.
Refer to Section 7.2.1 for setting.</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
Set the value of the electronic gear denominator.
Refer to Section 7.2.1 for setting.</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. 	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 10^{STM} times greater that the set value.	P	0	Com-mand unit $\times 10^{STM} \times 10^{-3}$	−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 $\times 10^{STM} \times 10^{-3}$	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 10^{STM} times greater that the set value.	P	0	Com-mand unit $\times 10^{STM} \times 10^{-3}$	−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 $\times 10^{STM} \times 10^{-3}$	0 to 50000
	18	MOD	Analog monitor output Used to set the signal provided to the analog monitor output. (Refer to Section 7.2.3.)  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: Speed command (±8V/maximum speed) 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 output selection Items are the same as in monitor 2 output selection. Note: 8V is output at the maximum torque. But 8V is output at the torque controlled by Parameter No.40.	P, R	0001		0000 to 0A0Ah
	19	DMD	Status display selection Used to choose the status display provided at power-on.  Servo amplifier 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 servo amplifier. When the rotary switch setting is "0", parameter No. 19 is made valid. (Refer to Section 8.5.) 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

<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>Basic parameters</td><td>20</td><td>*BLK</td><td>
Parameter/point table write inhibit
Used to limit write of the parameter values and point table data.
Operation can be performed for the parameters marked ○.
<table>
<tr><td>0</td><td></td><td>0</td><td></td></tr>
</table>
Parameter write is limited.
<table>
<tr><th>Set value</th><th>Operation</th><th>Parameters No.0 to No.20</th><th>Parameters No.21 to No.64</th><th>Parameters No.65 to No.79</th></tr>
<tr><td>0</td><td>Reference</td><td>○</td><td></td><td>○</td></tr>
<tr><td></td><td>Write</td><td>○</td><td></td><td>○</td></tr>
<tr><td>A</td><td>Reference</td><td>No.20 only</td><td></td><td></td></tr>
<tr><td></td><td>Write</td><td>No.20 only</td><td></td><td></td></tr>
<tr><td>C</td><td>Reference</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td></td><td>Write</td><td>○</td><td></td><td></td></tr>
<tr><td>E</td><td>Reference</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td></td><td>Write</td><td>○</td><td>○</td><td>○</td></tr>
</table>
When using the large setting/display unit (MR-PRU02) in the roll feeding system, the point table data is protected.
<table>
<tr><th rowspan="2">Set value</th><th colspan="3">Data Setting</th></tr>
<tr><th>Position data</th><th>Speed</th><th>Acceleration/ deceleration time constant</th></tr>
<tr><td>0</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>A</td><td></td><td></td><td></td></tr>
<tr><td>B</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>C</td><td></td><td></td><td>○</td></tr>
<tr><td>D</td><td></td><td>○</td><td></td></tr>
<tr><td>E</td><td>○</td><td></td><td></td></tr>
</table>
</td><td>P, R
R</td><td>0000</td><td></td><td>0000 to 0E0Eh</td></tr>
</table>

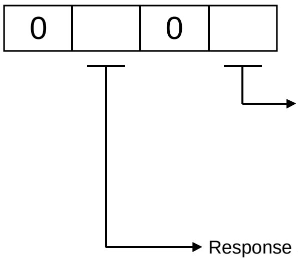
(2) Extension parameters

<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>21</td><td>AUT</td><td>

Auto tuning

Used to set the response, etc. for execution of the auto tuning function.

Refer to Chapter 9.



Auto tuning selection
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)
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.

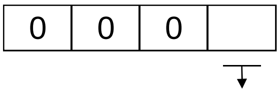
<table>
<tr><th rowspan="2">Machine type</th><th rowspan="2">Setting</th><th colspan="3">Description</th><th rowspan="2">Guideline for position setting time GDL^2/GDM^2 guideline = within 5 times</th></tr>
<tr><th>Response</th><th>Guideline for corresponding machine rigidity</th><th>GDL^2/GDM^2 guideline 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>Normal</td><td>1</td><td>Low response</td><td>Low rigidity</td><td>1 to 10 times</td><td>50 to 300ms</td></tr>
<tr><td></td><td>2</td><td>Middle response</td><td>to</td><td></td><td>10 to 70ms</td></tr>
<tr><td></td><td>3</td><td></td><td>Middle rigidity</td><td></td><td></td></tr>
<tr><td></td><td>4</td><td></td><td>to</td><td></td><td>10 to 30ms</td></tr>
<tr><td></td><td>5</td><td>High response</td><td>High rigidity</td><td></td><td></td></tr>
<tr><td>Large friction</td><td>8</td><td>Low response</td><td>Low rigidity</td><td></td><td>70 to 400ms</td></tr>
<tr><td></td><td>9</td><td>Middle response</td><td>to</td><td></td><td>10 to 100ms</td></tr>
<tr><td></td><td>A</td><td></td><td>Middle rigidity</td><td></td><td></td></tr>
<tr><td></td><td>B</td><td></td><td>to</td><td></td><td>10 to 50ms</td></tr>
<tr><td></td><td>C</td><td>High response</td><td>High rigidity</td><td></td><td></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

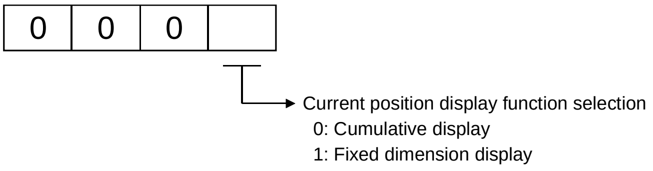
Used to select the optional function.



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.

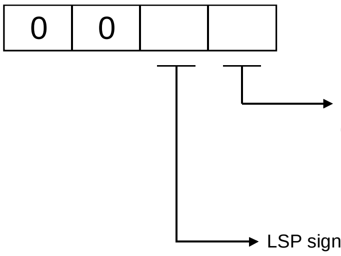
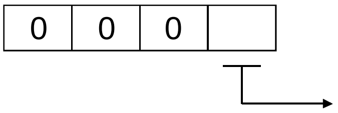
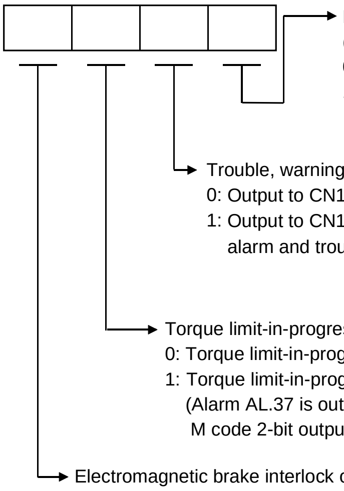
</td><td>P, R</td><td>0000</td><td></td><td>0000
to
0003h</td></tr>
</table>

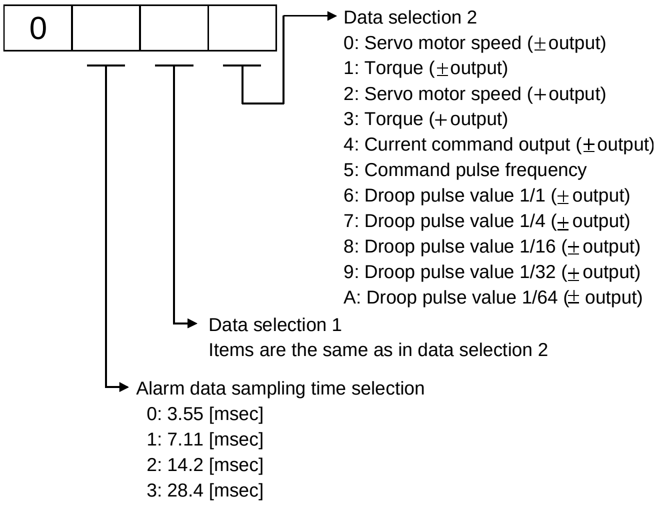
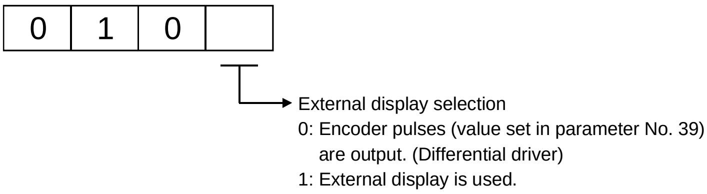
classif- ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting range
Extension parameters	23	*OP2	Function selection 4 Used to choose the stopping method when the forward rotation stroke end (RY4)/reverse rotation stroke end (RY5) is valid. 0 0 ☐ 0 Stopping pattern when RY4/RY5 is turned to "0" (OFF) 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	k pulse	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		For manufacturer setting Must not be changed.		0120		
	30	RM2	Pulse input function 2 Used to set the pulse magnification of the manual pulse generator (MR-HDP01). Setting of "0004" may be used only when 2 stations are occupied. When 1 station is occupied, choosing it will result in a parameter alarm (AL.37). 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 4: Pulse multiplying factor selected with RY13 and RY14.	P, R	0000		0000 to 0004h

classif-ication	No.	Code	Name and Function	Feeding system	Initial value	Unit	Setting range
Extension parameters	31	*DSP	Current position display Used to choose the display function of the current position.  Current position display function selection 0: Cumulative display 1: Fixed dimension display	R	0000		0000 to 0001h
	32 33 34 35 36 37 38		For manufacturer setting Must not be changed.				
	39	*ENR	Encoder output pulse Used to set the encoder output pulse per servo motor revolution. The value (pulses/rev) set in this parameter is output independently of the motor type.	P, R	2048	pulse /rev	100 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

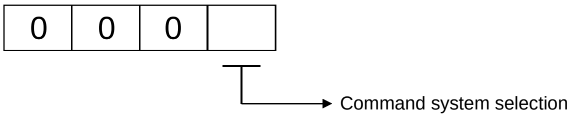
<table>
<tr><th>classif-
ication</th><th>No.</th><th>Code</th><th>Name and Function</th><th>Feeding system</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>Extension parameters</td><td>41</td><td>*IP1</td><td>Input signal selection 1
Used to select the functions of the input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

0 0 □ 0
Torque limit (RYE) switching function selection
<table>
<tr><td>0:</td><td>1(ON)</td><td>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.</td></tr>
<tr><td></td><td>0(OFF)</td><td>The internal torque limit value is valid.</td></tr>
<tr><td>1:</td><td>1(ON)</td><td>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.</td></tr>
<tr><td></td><td>0(OFF)</td><td>The internal torque limit value 2 (parameter No.54) is valid.</td></tr>
</table></td><td>P</td><td>0000</td><td></td><td>0000
to
0010h</td></tr>
<tr><td></td><td></td><td></td><td>0 0 □ 0
Torque limit (RY4) switching function selection
<table>
<tr><td>0:</td><td>1(ON)</td><td>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.</td></tr>
<tr><td></td><td>0(OFF)</td><td>The internal torque limit value is valid.</td></tr>
<tr><td>1:</td><td>1(ON)</td><td>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.</td></tr>
<tr><td></td><td>0(OFF)</td><td>The internal torque limit value 2 (parameter No.54) is valid.</td></tr>
</table></td><td>R</td><td>0000</td><td></td><td>0000
to
0010h</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.  LSP signal automatic ON 0: External (depending on the RY4) 1: Internal (always ON) LSP signal automatic ON 0: External (depending on the RY5) 1: Internal (always ON)	P	0000		0000 to 0011h
			Input signal selection 2 Used to select the functions of the input signals.  Clear signal function selection (RY6) 0: Cleared when signal turns from "0" (OFF) to "1" (ON) 1: Kept cleared when signal is "1" (ON)	R	0000		0000 to 0001h
	43		For manufacturer setting Must not be changed.				
	44	*OPC	Output signal selection Used to select the functions of the output signals.  M code 2-bit output selection (CN1-23, 24) 0: Not output as CN1 external signals 1: Output to CN1-23, 24. Trouble, warning output selection 0: Output to CN1-48 at alarm occurrence. 1: Output to CN1-48 at occurrence of either or both of alarm and trouble. Torque limit-in-progress output 0: Torque limit-in-progress is not output. 1: Torque limit-in-progress is output to CN1-23. (Alarm AL.37 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 occurred 3) Forced stop signal 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		For manufacturer setting Must not be changed.				

classif-ication	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.  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 selection 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		For manufacturer setting Must not be changed.				
	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.  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 0101h
	53	MBR	Electromagnetic brake sequence output Used to set a time delay (Tb) 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 (RY4) 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 RY4.	P, R	100	%	0 to 100
	55 56 57		For manufacturer setting Must not be changed.				

<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>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></td><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></td><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></td><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>20 to 5000</td></tr>
<tr><td></td><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>20 to 5000</td></tr>
<tr><td></td><td>63</td><td>VIC</td><td>Speed integral compensation
Used to set the time constant of the integral compensation.
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></td><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>

<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>Optional parameters</td><td>65</td><td>*COM</td><td>Command system selection
Used to choose the position command system and speed command system. When 1 station is occupied, setting 0001 or 0002 will result in a parameter error.

<For positioning system>
<table>
<tr><th>Set value</th><th>Position command</th><th>Speed command</th></tr>
<tr><td>0</td><td>Specify the position block No.</td><td>Use the speed block No. of the position block to specify.</td></tr>
<tr><td>1</td><td>Use the remote register to set the position data.</td><td>Use the remote register to specify the speed block No.</td></tr>
<tr><td>2</td><td></td><td>Use the remote register to set the motor speed.</td></tr>
</table>
<For roll feeding system>
<table>
<tr><th>Set value</th><th>Position command</th><th>Speed command</th></tr>
<tr><td>0</td><td>Use RY5 to specify the position block No.</td><td>Use RY2 to specify the speed block No.</td></tr>
<tr><td>1</td><td>Set the position data.</td><td>Use the remote register to specify the speed data.</td></tr>
<tr><td>2</td><td></td><td>Use the remote register to set the motor speed.</td></tr>
</table>
</td><td>P, R</td><td>0000</td><td></td><td>0000
to
0002h</td></tr>
</table>

<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">Optional parameters</td><td>66</td><td>*DIS</td><td>External DI selection
The input signals can be assigned to the pins of connector CN1 as CN1 external input signals. The signals assigned to the CN1 pins cannot be used as the CC-Link input signals. For the set values, convert the following binary numbers into hexadecimal
1) Positioning system
<table>
<tr><th rowspan="2">bit</th><th colspan="2">Set value</th><th rowspan="2">Signal name</th></tr>
<tr><th>0</th><th>1</th></tr>
<tr><td>0</td><td>RY0</td><td>CN1-12</td><td>Servo ON</td></tr>
<tr><td>1</td><td>RY1</td><td>CN1-13</td><td>Position block number selection bit0</td></tr>
<tr><td>2</td><td>RY2</td><td>CN1-14</td><td>Position block number selection bit1</td></tr>
<tr><td>3</td><td>RY3</td><td>CN1-15</td><td>Position block number selection bit2</td></tr>
<tr><td>4</td><td>RY4</td><td>CN1-38</td><td>Forward rotation stroke end</td></tr>
<tr><td>5</td><td>RY5</td><td>CN1-39</td><td>Reverse rotation stroke end</td></tr>
<tr><td>6</td><td>RY6</td><td>CN1-37</td><td>Proximity DOG</td></tr>
<tr><td>7</td><td>RY7</td><td>CN1-41</td><td>Automatic operation/manual drive mode</td></tr>
<tr><td>8</td><td>RY8</td><td>CN1-42</td><td>Temporary stop</td></tr>
<tr><td>9</td><td>RY9</td><td>CN1-43</td><td>Zeroing</td></tr>
<tr><td>A</td><td>RYA</td><td>CN1-44</td><td>Forward rotation start</td></tr>
<tr><td>B</td><td>RYB</td><td>CN1-45</td><td>Reverse rotation start</td></tr>
</table>
2) Roll feeding system
<table>
<tr><th rowspan="2">bit</th><th colspan="2">Set value</th><th rowspan="2">Signal name</th></tr>
<tr><th>0</th><th>1</th></tr>
<tr><td>0</td><td>RY0</td><td>CN1-12</td><td>Servo ON</td></tr>
<tr><td>1</td><td>RY1</td><td>CN1-13</td><td>Restart</td></tr>
<tr><td>2</td><td>RY2</td><td>CN1-14</td><td>Speed selection</td></tr>
<tr><td>3</td><td>RY3</td><td>CN1-15</td><td>Temporary stop</td></tr>
<tr><td>4</td><td>RY4</td><td>CN1-38</td><td>Torque limit selection</td></tr>
<tr><td>5</td><td>RY5</td><td>CN1-39</td><td>Second feed distance</td></tr>
<tr><td>6</td><td>RY6</td><td>CN1-37</td><td>Clear</td></tr>
<tr><td>7</td><td>RY7</td><td>CN1-41</td><td>Automatic operation selection</td></tr>
<tr><td>8</td><td>RY8</td><td>CN1-42</td><td>Manual operation selection</td></tr>
<tr><td>9</td><td>RY9</td><td>CN1-43</td><td>Remote manual operation selection</td></tr>
<tr><td>A</td><td>RYA</td><td>CN1-44</td><td>Forward rotation start</td></tr>
<tr><td>B</td><td>RYB</td><td>CN1-45</td><td>Reverse rotation start</td></tr>
</table>
</td><td>P, R</td><td>P:0070
R:0000</td><td></td><td>0000
to
0FFFh</td></tr>
<tr><td>67
68
69
70
71
72
73
74
75
76
77
78
79</td><td></td><td>For manufacturer setting
Must not be changed.</td><td></td><td>0000</td><td></td><td></td></tr>
</table>

7.2 Detailed explanation

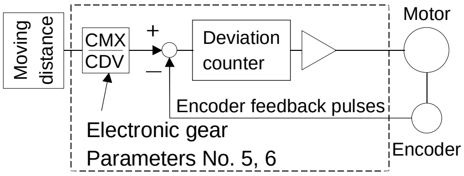
7.2.1 Electronic gear

POINT

- The electronic gear setting range is $\frac{1}{50} < \frac{CMX}{CDV} < 50$
- Setting any value outside the setting range may produce noise during acceleration/deceleration or may disable operation at the preset speed and/or acceleration/deceleration time constants.

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

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

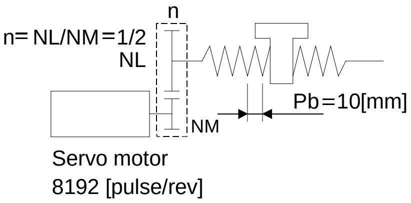


The following examples are used to explain how to calculate the electronic gear value:

(1) Ballscrew setting example

Machine specifications

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



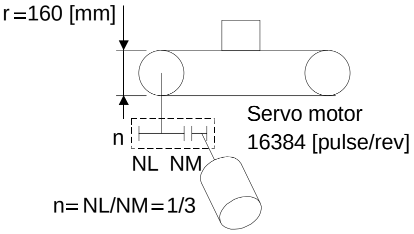
$$\frac{CMX}{CDV}=\frac{Pt}{\Delta S}=\frac{Pt}{n\cdot Pb\cdot 1000}=\frac{8192}{1/2\cdot 10\cdot 1000}=\frac{8192}{5000}=\frac{1024}{625}$$

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]



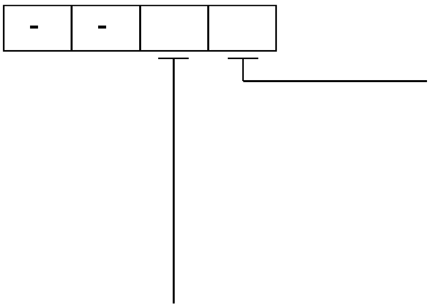
$$\frac{CMX}{CDV}=\frac{Pt}{\Delta S}=\frac{Pt}{n\cdot r\cdot \pi\cdot 1000}=\frac{16384}{1/3\cdot 160\cdot \pi\cdot 1000}=\frac{16384}{167551.61}\fallingdotseq\frac{4096}{41888}\fallingdotseq\frac{2048}{20944}$$

Reduce CMX and CDV to less than the setting range and round off the first decimal place.
Hence, set 2048 to CMX and 20944 to CDV.

7.2.2 Changing the status display screen

By changing the parameter No.19 value, you can change the status display item of the servo amplifier 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 8.3.

Parameter No. 19

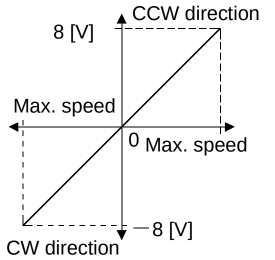
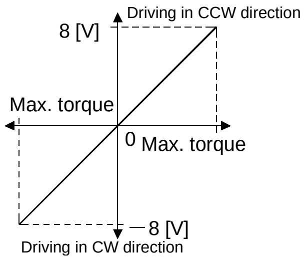
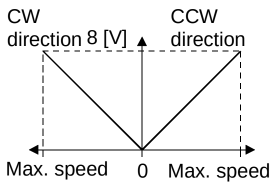
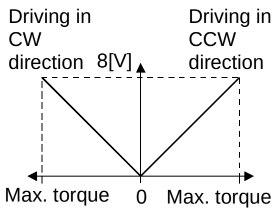
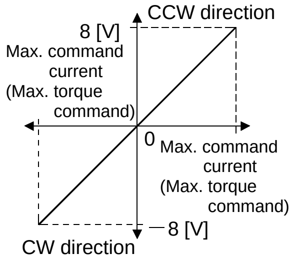
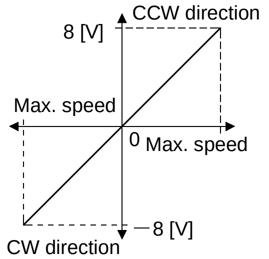
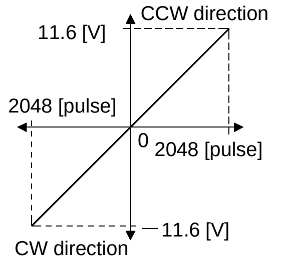
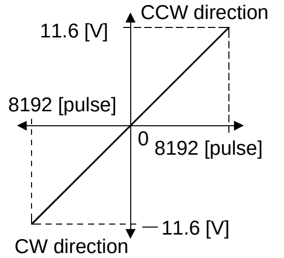
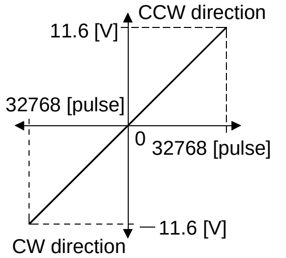
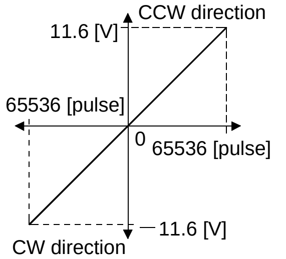
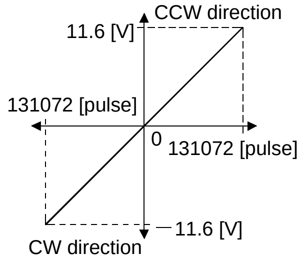


Status display of servo amplifier display
section or external digital display at
power-on with CS1 = 0
0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Override
4: Position block number
5: Feedback pulse value
6: Machine speed
7: Droop pulse
8: Torque limit command 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

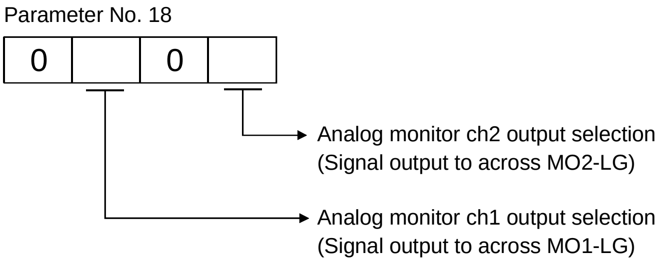
Status display of parameter
unit at power-on
0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Override
4: Position block number
5: Feedback pulse value
6: Machine speed
7: Droop pulse
8: Torque limit command voltage
9: Regenerative load factor
A: Effective load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

7.2.3 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 (±11.6V/2048pulse)	
7	Droop pulses (±11.6V/8192pulse)	
8	Droop pulses (±11.6V/32768pulse)	
9	Droop pulses (±11.6V/65536pulse)	
A	Droop pulses (±11.6V/131072pulse)	

Change the following digits of parameter No.18:



Parameter 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.	

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

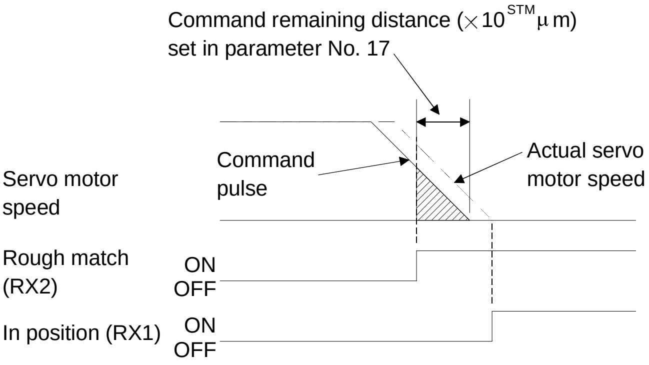
At the factory setting, the CN1-38 pin is valid for the forward rotation stroke end and the CN1-39 pin is valid for the reverse rotation stroke end.
The motor stops when CN1-38-SG are opened during forward rotation. It may be run in the reverse rotation direction. The motor stops when CN1-39-SG are opened during reverse rotation. It may be run in the forward rotation direction.
Changing the parameter No.23 value as indicated below can change the stopping method:

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.

Setting of parameter No. 66 enables the signals to be used as CC-Link input signals. For the device numbers, the forward rotation stroke end is RY4 and the reverse rotation stroke end is RY5.

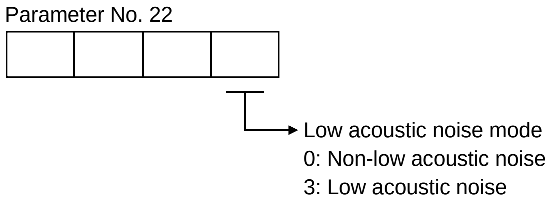
7.2.5 Rough match output

Rough match (RX2) is output when the command remaining distance reaches the value set in parameter No.17. The set remaining distance is 0 to 50000 [$\times 10^{\mathrm{STM}}\mu\mathrm{m}$].

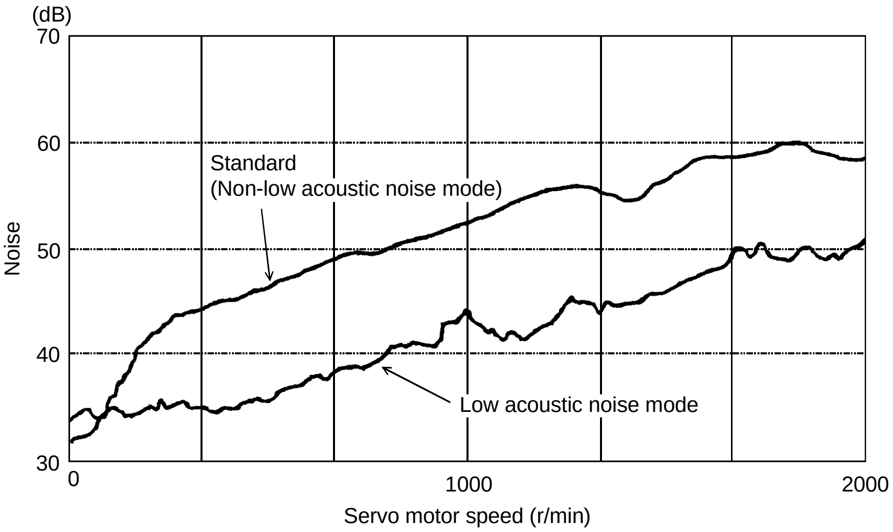


7.2.6 Low acoustic noise mode

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

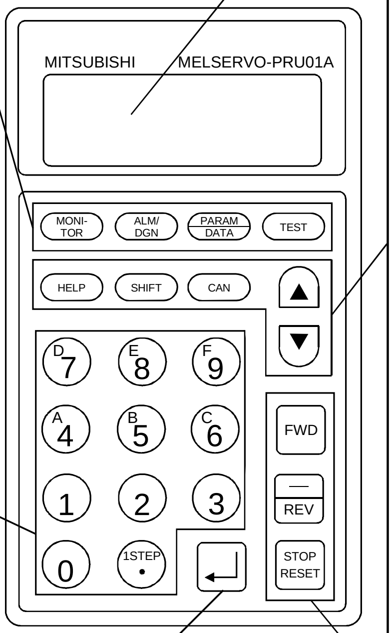


8. PARAMETER UNIT AND DISPLAY SECTION

8.1 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.

Numeral keys

0 to ^{F}9 : Numerals (0 to F)
- Used to enter the set value of the parameter. To type F, press [^{F}9] after pressing the [SHIFT] key.

1STEP • : (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.

Display • • • Liquid crystal screen (13 characters by 4 digits)
- Interactive parameter setting
- Help function, troubleshooting guidance
- Monitoring

etc.

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 [^{D}7]) 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.

Test run keys

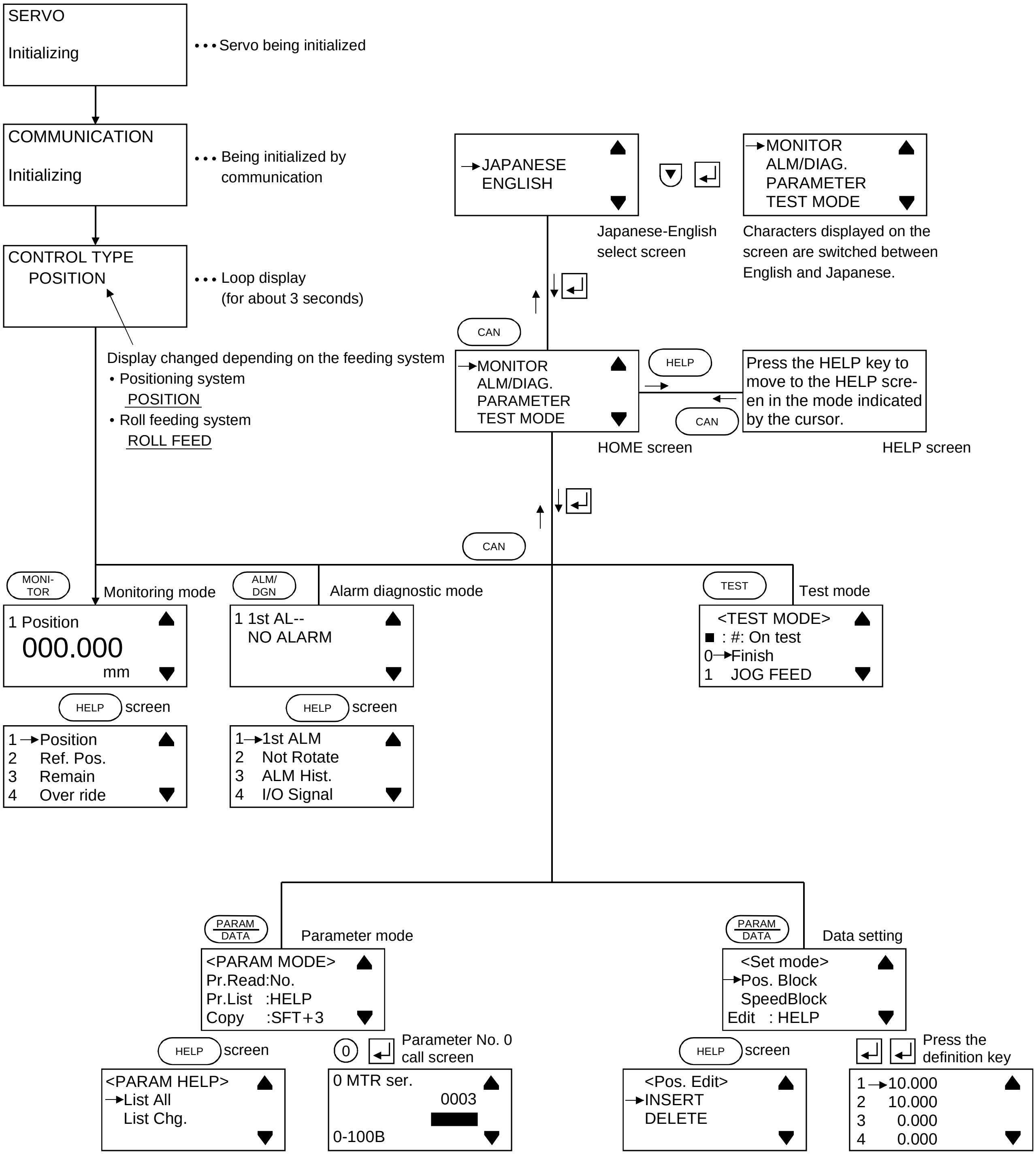
FWD : Forward rotation start key
- Used to start forward rotation in the test run mode.

— 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 data entered.

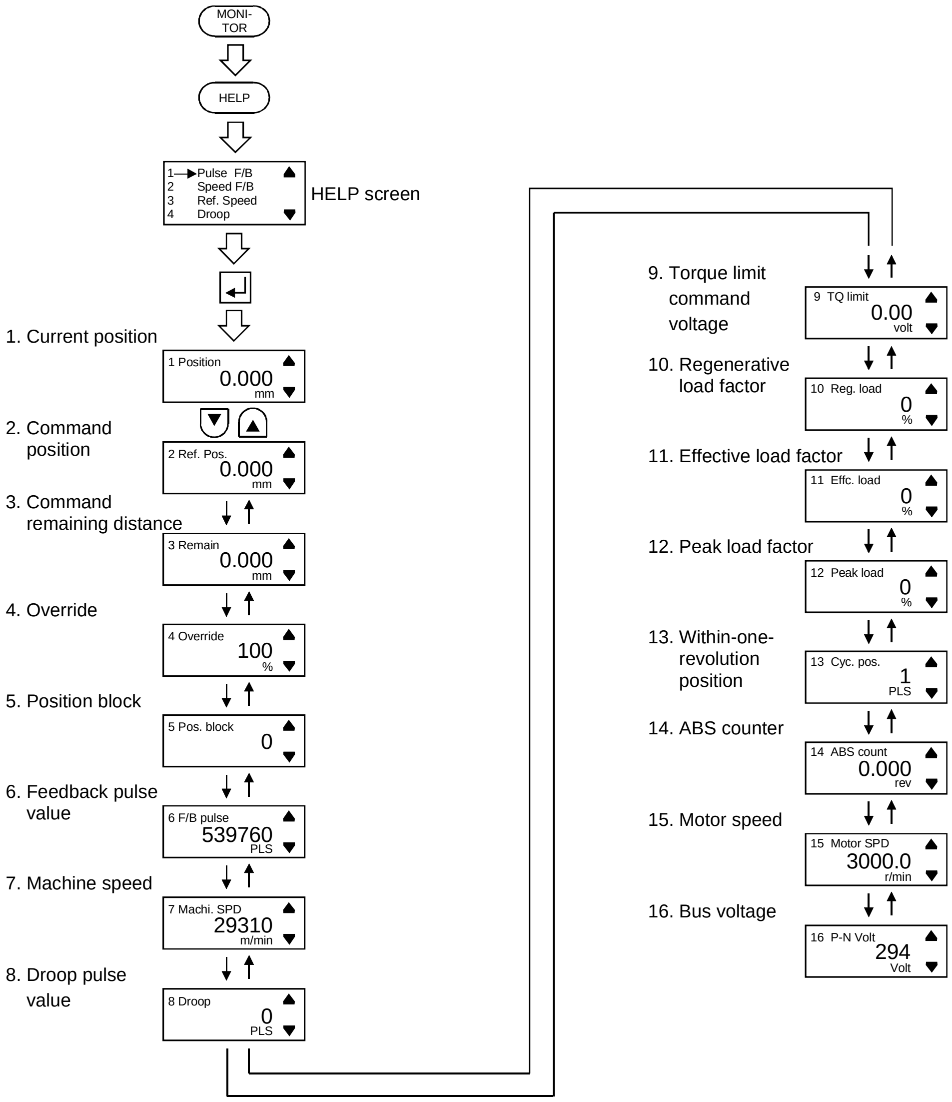
8.2 Operation of the parameter unit

(1) Outline of display sequence



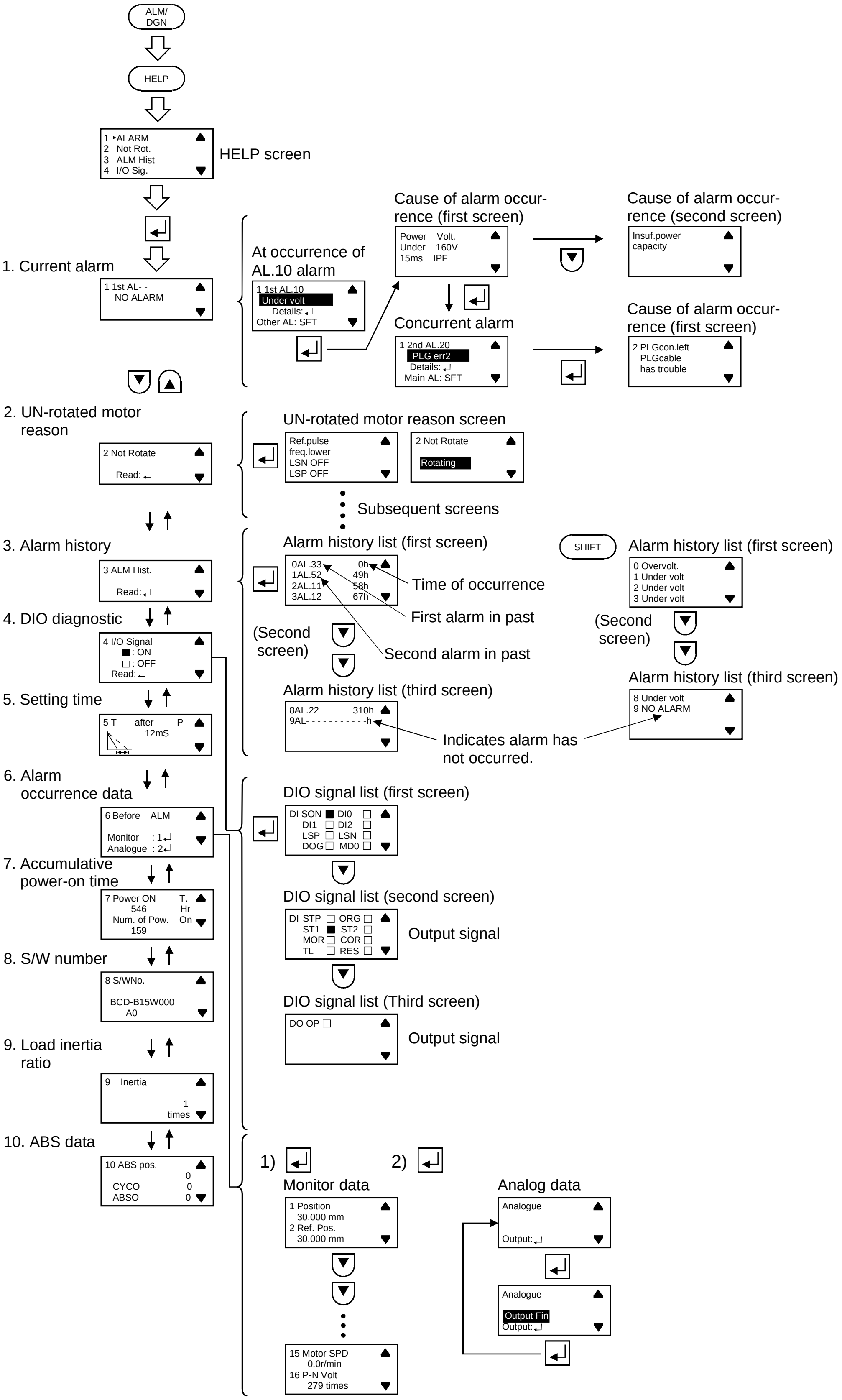
The displays and operation procedure in each mode are given on the following pages. Refer to them.

(2) Monitoring mode



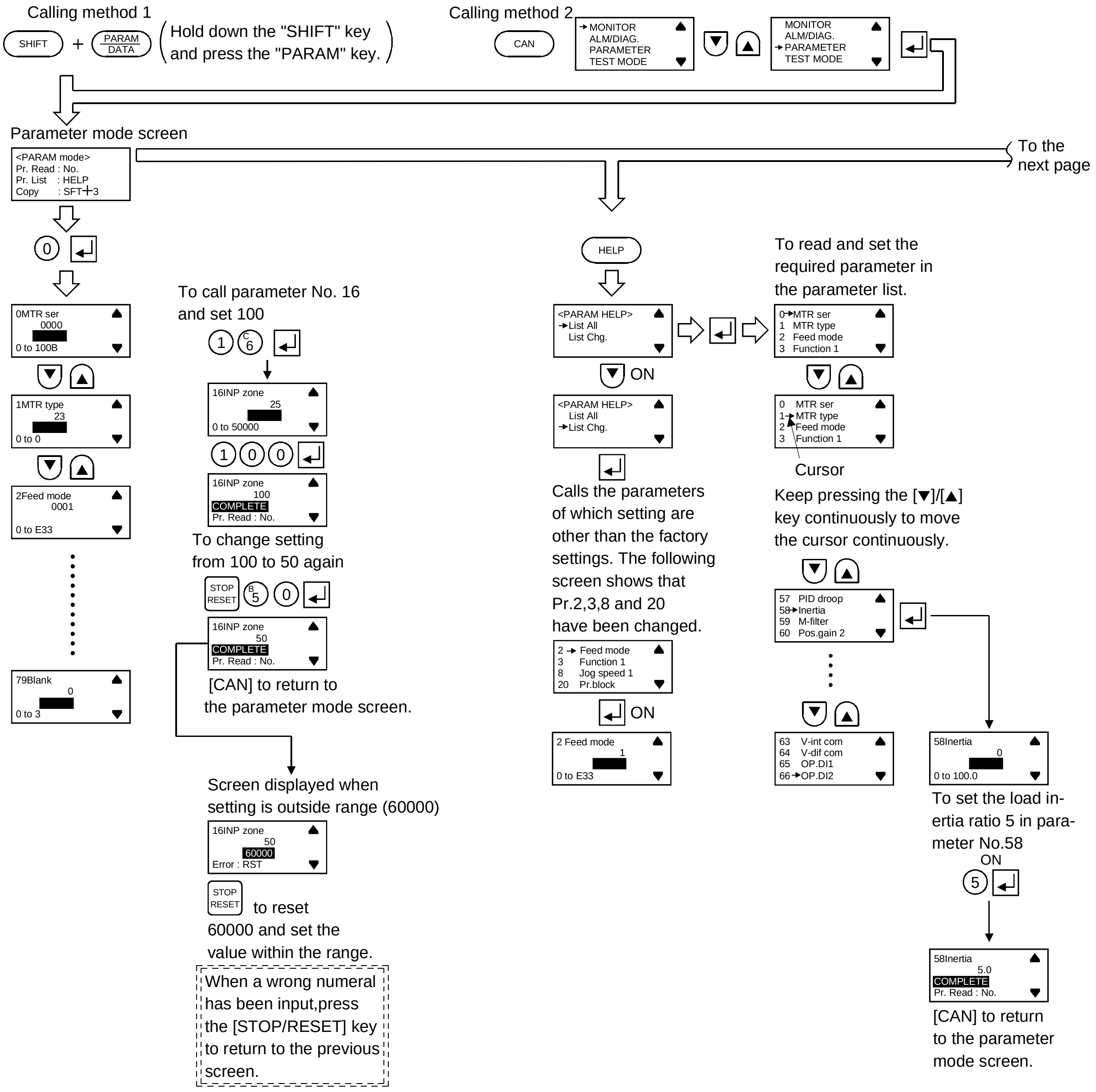
(3) Alarm mode

Refer to Section 8.4 for details of the alarm/diagnosis mode screens.



Note. The above applies to the case where the positioning system is used and one station is occupied. Refer to Section 3.5.1 for the meanings of the displayed signal abbreviations.

(4) Parameter mode



Calling method 1: Hold down the "SHIFT" key and press the "PARAM" key.

To call parameter No. 16 and set 100

To change setting from 100 to 50 again

[CAN] to return to the parameter mode screen.

Screen displayed when setting is outside range (60000)

STOP RESET to reset 60000 and set the value within the range.

When a wrong numeral has been input,press the [STOP/RESET] key to return to the previous screen.

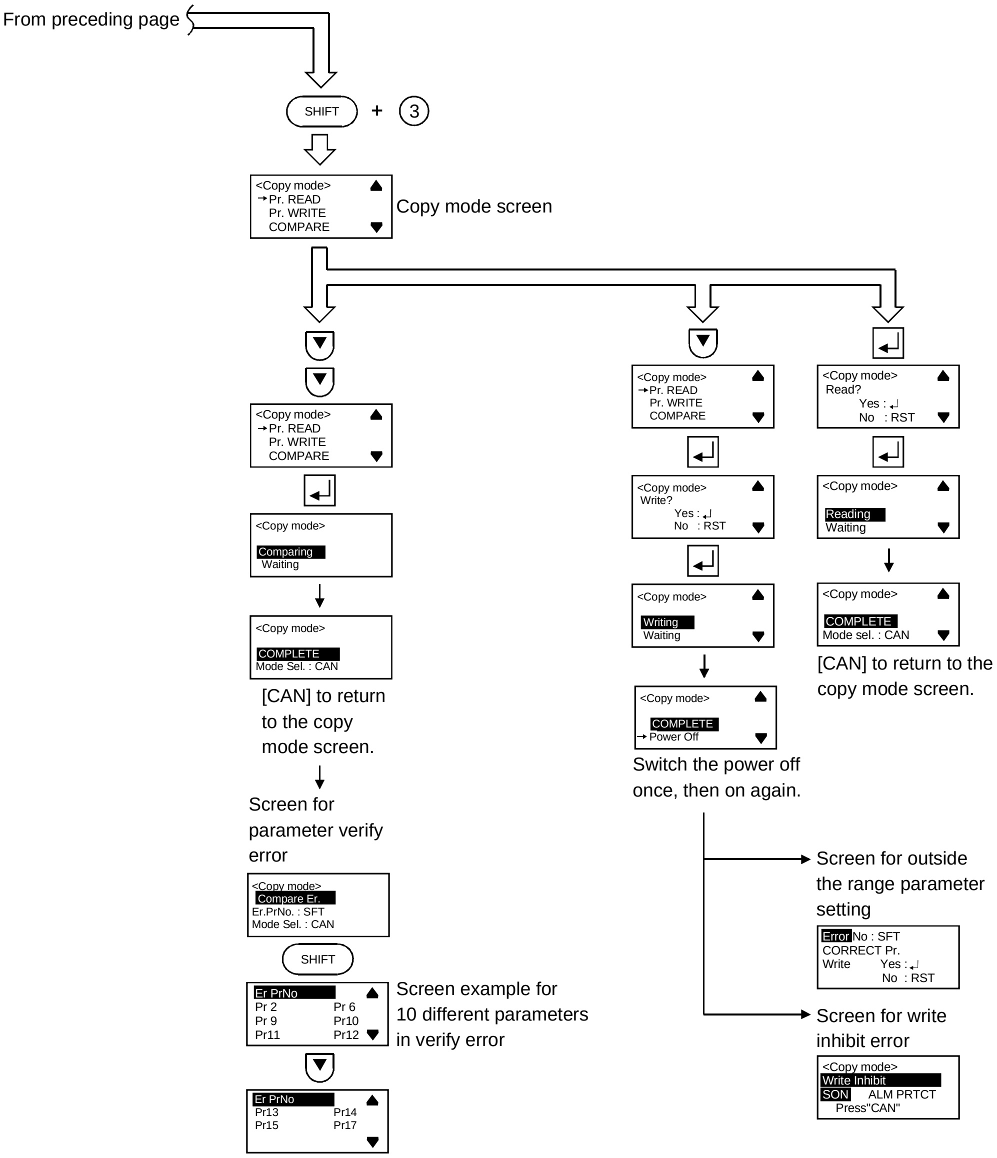
Calls the parameters of which setting are other than the factory settings. The following screen shows that Pr.2,3,8 and 20 have been changed.

To read and set the required parameter in the parameter list.

Keep pressing the [▼]/[▲] key continuously to move the cursor continuously.

To set the load in-ertia ratio 5 in para-meter No.58

[CAN] to return to the parameter mode screen.



Copy mode screen

[CAN] to return to the copy mode screen.

Screen for parameter verify error

Screen example for 10 different parameters in verify error

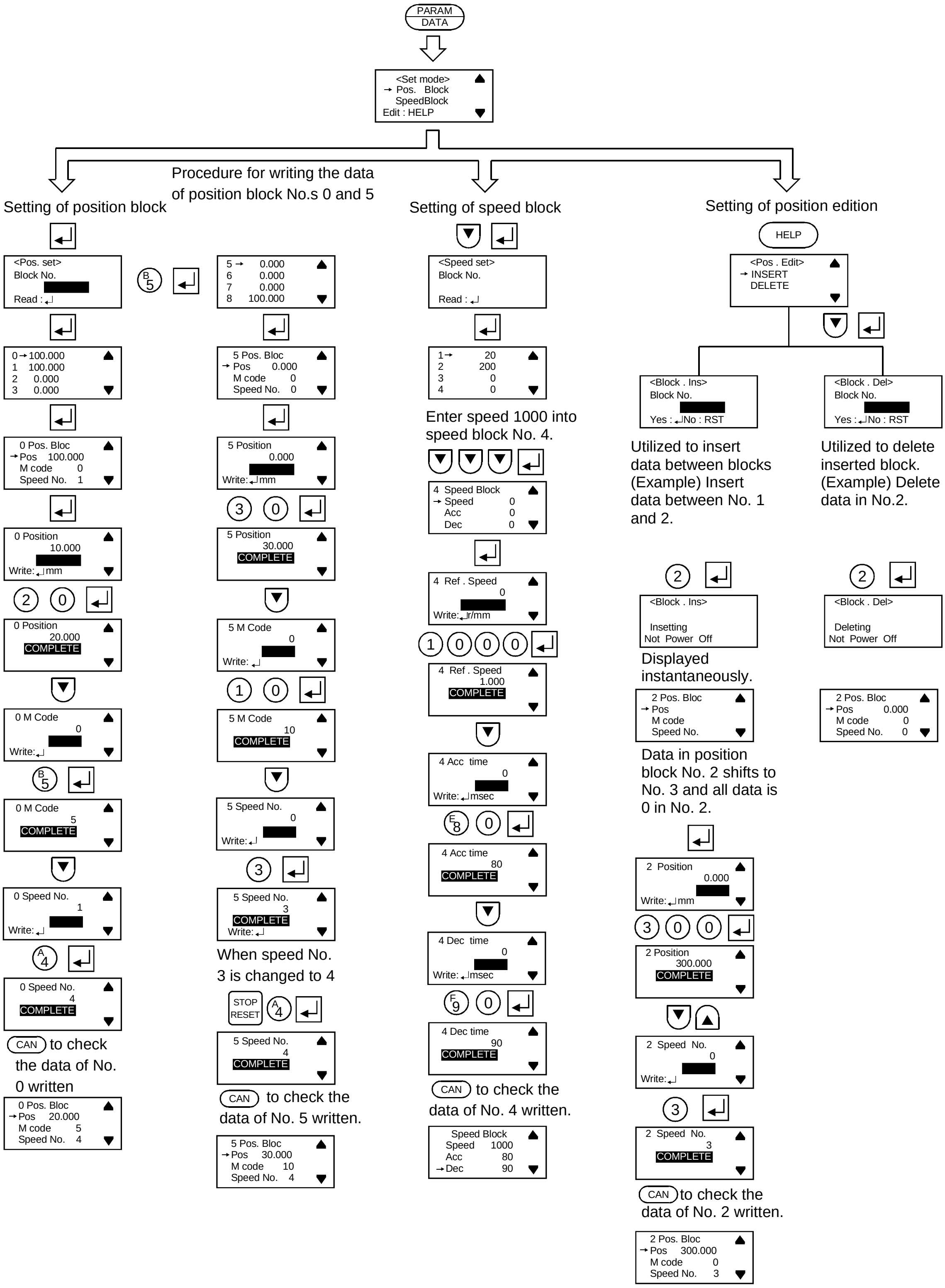
Switch the power off once, then on again.

[CAN] to return to the copy mode screen.

Screen for outside the range parameter setting

Screen for write inhibit error

(5) Point table setting mode



Setting of position block

Procedure for writing the data of position block No.s 0 and 5

Setting of speed block

Setting of position edition

CAN to check the data of No. 0 written

When speed No. 3 is changed to 4

CAN to check the data of No. 5 written.

Enter speed 1000 into speed block No. 4.

CAN to check the data of No. 4 written.

Utilized to insert data between blocks (Example) Insert data between No. 1 and 2.

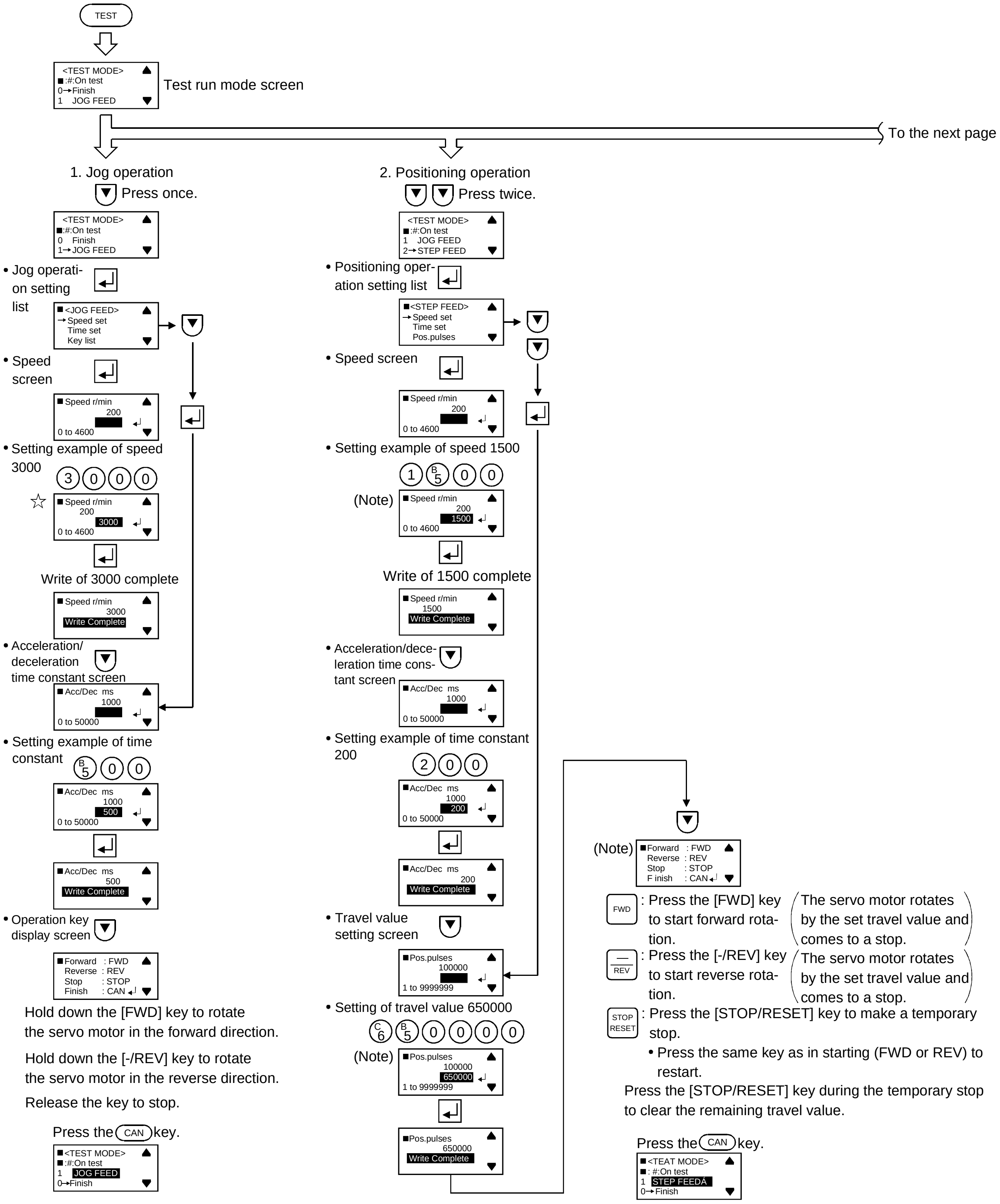
Utilized to delete inserted block. (Example) Delete data in No.2.

Displayed instantaneously.

Data in position block No. 2 shifts to No. 3 and all data is 0 in No. 2.

CAN to check the data of No. 2 written.

(6) Test run mode



Hold down the [FWD] key to rotate the servo motor in the forward direction.

Hold down the [-/REV] key to rotate the servo motor in the reverse direction.

Release the key to stop.

Press the CAN key.

FWD : Press the [FWD] key to start forward rotation. (The servo motor rotates by the set travel value and comes to a stop.)

REV : Press the [-/REV] key to start reverse rotation. (The servo motor rotates by the set travel value and comes to a stop.)

STOP RESET : Press the [STOP/RESET] key to make a temporary stop.

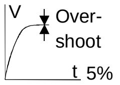
- Press the same key as in starting (FWD or REV) to restart.

Press the [STOP/RESET] key during the temporary stop to clear the remaining travel value.

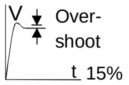
Press the CAN key.

To reset the test run

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

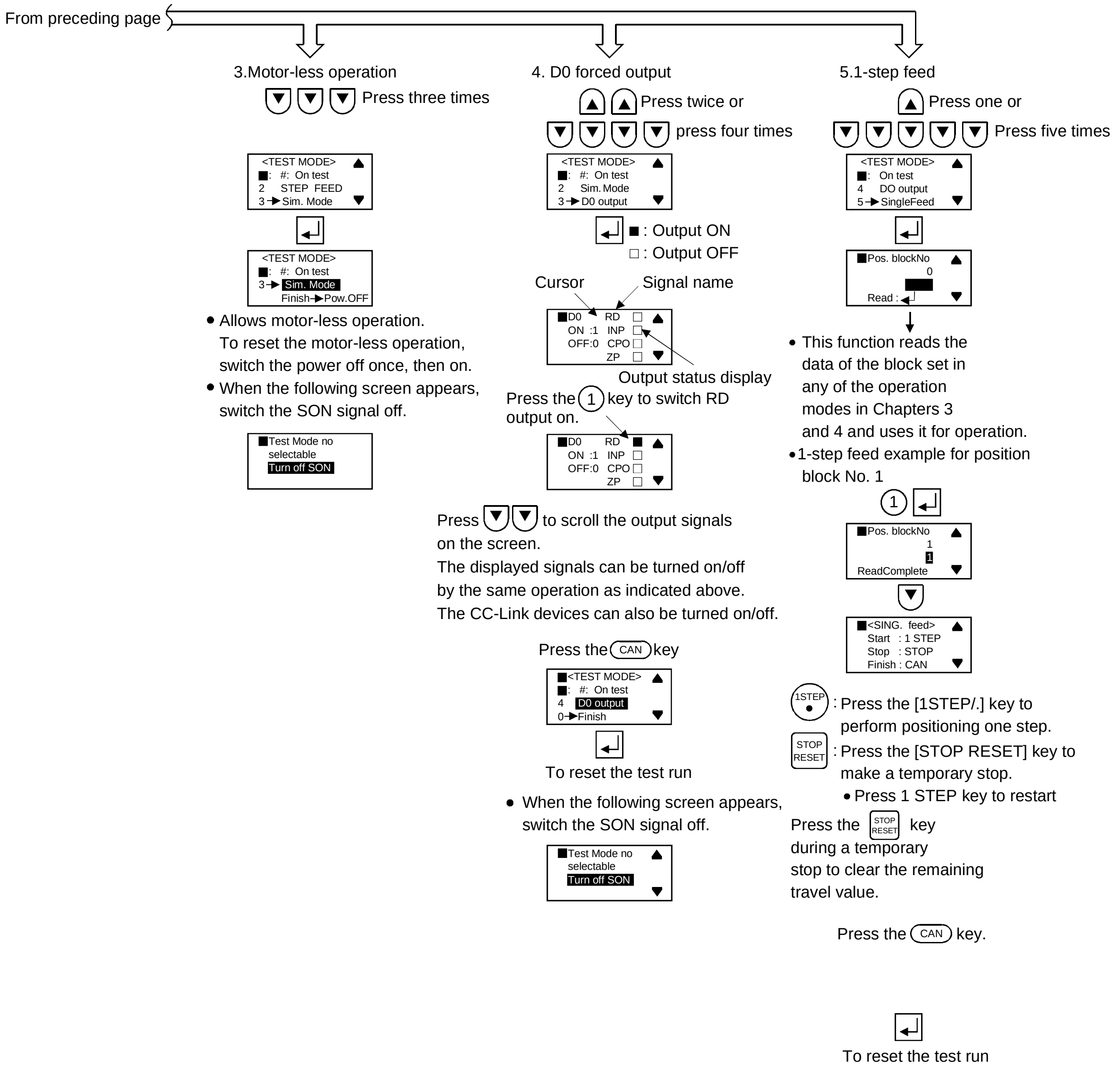


0 to 5% overshoot screen



0 to 30% overshoot screen

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



3.Motor-less operation

▼ ▼ ▼ Press three times

```
 <TEST MODE>      ▲
■:  #:  On test
2    STEP  FEED
3 ➔ Sim. Mode     ▼
```

↵

```
 <TEST MODE>      ▲
■:  #:  On test
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
  Turn off SON
```

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

```
■D0      RD  □  ▲
  ON  :1  INP □
  OFF:0  CPO □
          ZP  □  ▼
```

Output status display

Press the 1 key to switch RD output on.

```
■D0      RD  ■  ▲
  ON  :1  INP □
  OFF:0  CPO □
          ZP  □  ▼
```

Press ▼▼ to scroll the output signals on the screen.

The displayed signals can be turned on/off by the same operation as indicated above.

The CC-Link devices can also be turned on/off.

Press the CAN key

```
■<TEST MODE>      ▲
■:  #:  On test
4    D0 output
0 ➔ Finish         ▼
```

↵

To reset the test run

- When the following screen appears, switch the SON signal off.

```
■Test Mode no     ▲
  selectable
  Turn off SON
                   ▼
```

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

1 ↵

```
■Pos. blockNo     ▲
              1
              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 during a temporary stop to clear the remaining travel value.

Press the CAN key.

↵

To reset the test run

8.3 Status display

The running servo status can be shown on the parameter unit display and servo amplifier 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 8.5.

Status display	Parameter unit indication	Unit	Description	Indication range	
				Servo amplifier display	MR-DP60 and parameter unit
Current position	Position	$\times 10^{STM}$mm $\times 10^{STM}$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.	$\times 10^{STM}$mm $\times 10^{STM}$inch	The position data or preset command position in the position block is displayed.	−9999 to 9999	−999999 to 999999
Command remaining distance	Remain	$\times 10^{STM}$mm $\times 10^{STM}$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	No.	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	
				servo amplifier display	MR-DP60 and 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 servo amplifier display shows data in four digits, it shows the four lower digits of the actual position within one revolution. CCW rotation increases the value.	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 servo amplifier 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

8.4 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 servo amplifier display, parameter unit or digital display.

(1) Servo amplifier display

When abnormality occurs, its definition is indicated by the corresponding number. For definitions, refer to Section 11.4.

(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	1st AL	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 11.5)
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 CYSO ABS0	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

○: Relevant, \: Irrelevant

No.	Parameter unit display	Description	Feeding system	
			Positioning	Roll feeding
1	SON off	Servo on (RY0) signal is "0" (OFF).	○	○
2	Alarm	Alarm has occurred.	○	○
3	RES on	Reset (RY1A or RY3A) signal is "1" (ON).	○	○
4	EMG off	Forced stop (EMG) signal is "0" (OFF).	○	○
5	LSP on	Forward rotation stroke end (RY4) signal is "0" (OFF).	○	\
6	LSN off	Reverse rotation stroke end (RY5) signal is "0" (OFF).	○	\
7	ST1,ST2 on	・Forward rotation start (RYA) and reverse rotation start (RYB) are both "1" (ON). ・Start signal is "1" (ON) in the positioning or zeroing mode.	○	○
8	ST1,ST2 off	Forward rotation start (RYA) and reverse rotation start (RYB) are both "0" (OFF).	○	○
9	ST1 off	・Start (RYA) signal turns to "0" (OFF) when absolute position command is given. ・Start (RYA) signal is "0" (OFF) in the dog type zeroing mode.	○	\
10	Ext. torque limit low	The servo motor speed is 5r/min of less when the torque limit signal is switched on.	○	○
11	Int. torque limit low	The servo motor speed is 5r/min of less when the torque limit signal is switched on.	○	○
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.	○	○
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.	○	○
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.	○	○
15	Feed ref. lower	In positioning operation, the command remaining distance is less than the rough match output range.	○	○
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.	○	○
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.	○	○
18	Drive Mode Missetting	The operation mode has not been selected in the roll feeding system.	○	○
19	Speed No.0 Selected	Speed block No. 0 has been selected. Set any of speed blocks No. 1 to 8.	○	○
20	Once stop	During temporary stop.	○	○

POINT

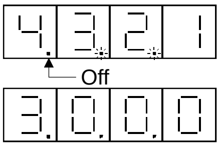
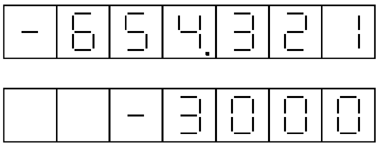
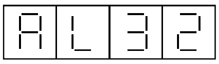
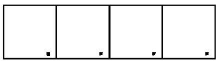
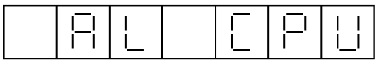
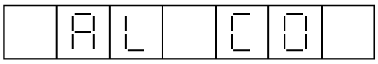
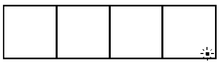
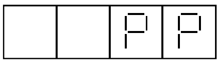
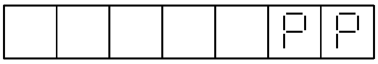
- When the roll feeding operation, automatic positioning operation or zeroing (dog type) mode has been set, a start is made when the start signal (RYA, RYB) turns from OFF to ON. After a start, therefore, return RYA or RYB to OFF. Operation cannot be performed if RYA or RYB remains ON.
- Check the unrotated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

8.5 Servo amplifier display

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

8.5.1 Display examples

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

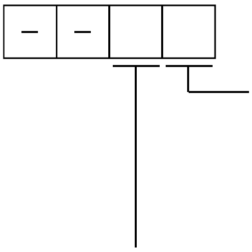
Item	4-digit display of servo amplifier		Display of digital display
Indication of current position (for −654.321) Motor speed (during reverse rotation at 3000r/min)		The decimal points are lit as shown on the left to indicate the value of negative polarity. At this time, the actual decimal point is turned off.	
Indication of alarm or warning occurrence (Indication of overcurrent alarm occurrence) (Indication of watchdog alarm)	 	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 servo amplifier display. However, the error related to MR-DP60 is displayed. ▪ CPU error  ▪ Communication error 
Indication during test operation		The decimal point in the lowest digit of the display flickers.	The parameter No. 19 setting or servo amplifier'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)			

8.5.2 Selection of display data

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

(1) Parameter setting

Parameter No.19



Status indication of servo amplifier 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.

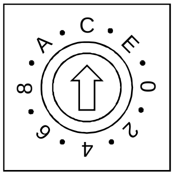
Status indication of parameter unit at power-on

0: Current position (initial value)
1: Command position
2: Command remaining distance
3: Override
4: Position block No.
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-one-revolution position
D: ABS counter
E: Servo motor speed
F: Bus voltage

(2) Setting of rotary switch CS1

You can select the status display by setting the rotary switch CS1 of the servo amplifier. Setting of “0” shows the status set in the first digit of parameter No. 19.

Rotary switch CS1



CS1 setting	Status display	CS1 setting	Status display
0	Parameter No. 19 setting	7	Droop pulse
1	Command position	8	Torque limit command voltage
2	Command remaining distance	9	Regenerative load factor
3	Override	A	Effective load factor
4	Position block	B	Peak load factor
5	Feedback pulse value	C	Within-one-revolution position
6	Machine speed	D	Servo motor speed

8.6 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. Always use the servo motor alone. ▪ If an operation fault occurs, use forced 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 8.2 (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 (RXB) of the controller.

8.6.1 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.

8.6.2 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.

8.6.3 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	When 1 station is occupied: 0 to 7 When 2 stations are occupied: 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.

8.6.4 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 Servo ON (RY0), 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.

8.6.5 DO forced output

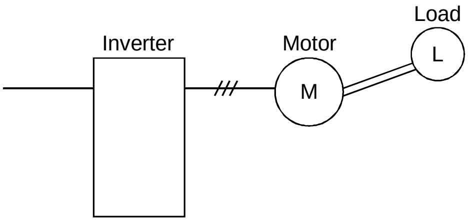
Each output signal can be turned on/off independently of the input signals and servo status. This function can be used for servo wiring check, etc.

9. ADJUSTMENT

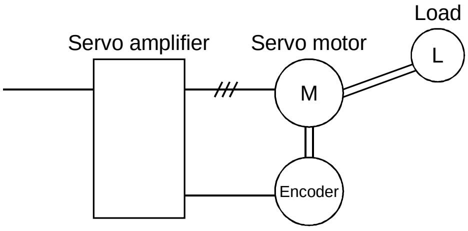
9.1 What is gain adjustment?

9.1.1 Difference between servo amplifier and other drives

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

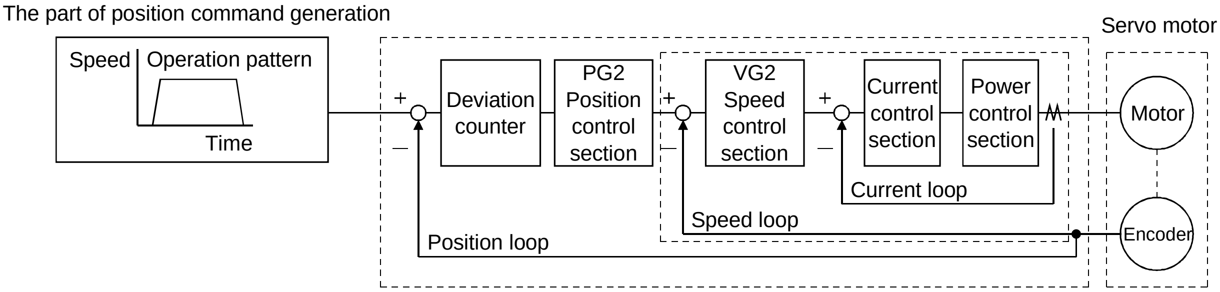


On the other hand, the servo amplifier always detects the positions and speeds of the motor and machine using the servo motor encoder, and exercises control to match the position and speed commands with the actual motor (machine) position and speed. In the servo system, adjustment is needed because:



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

9.1.2 Basics of the servo system



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

(1) Current loop

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

(2) Speed loop

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

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

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

J_L = load inertia moment

J_M = servo motor shaft inertia moment

(3) Position loop

The response level will not vary according to machine conditions

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

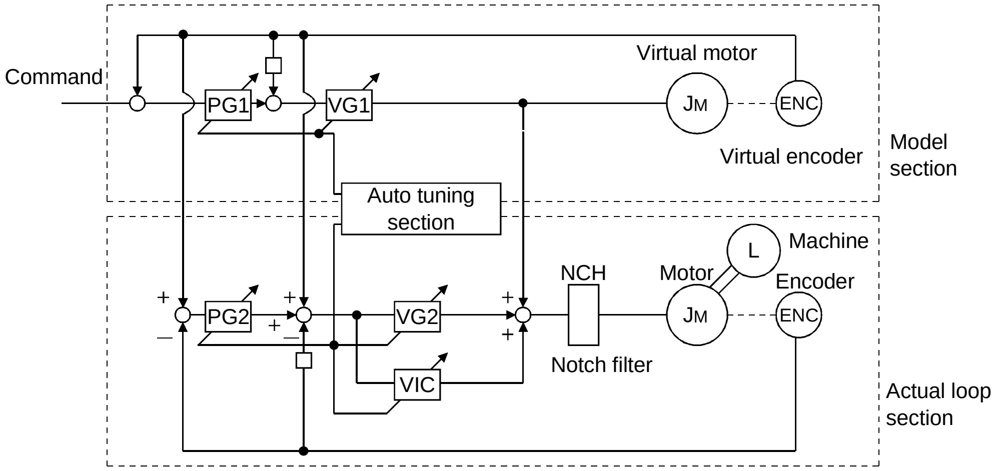
When the motor is installed to the machine, the gain must be adjusted to satisfy f_V = 4 to $6f_P$ according to the load inertia moment ratio m.

9.2 Gain adjustment

9.2.1 Parameters required for gain adjustment

Parameter No.	Symbol	Name
No.21	ATU	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

9.2.2 Block diagram



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

(1) Actual loop section

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

(2) Model section

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

(3) Auto tuning section

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

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

9.2.3 What is auto tuning?

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

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

J : Inertia moment
ω : Angular speed
T : Torque

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

(1) When the motor makes acceleration/deceleration, load inertia moment JL is estimated in the above method to calculate the load inertia moment ratio (GD2).

(2) Each gain (PG1, VG1, PG2, VG2, VIC) to the calculated load inertia moment ratio (GD2) is changed according to the response level set in parameter No.21. Note that these gains have been patterned beforehand to satisfy the aforementioned stabilization condition.

9.3 Gain adjustment by auto tuning

9.3.1 Adjustment method

The MR-H-TN is factory-set to make auto tuning valid (parameter No.21: □ 0 □ 1).
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:

Actual machine operation	Ideal machine operation	Parameter No.21 setting
Settling time is long (Note)	Reduce settling time.	Increase response setting.
Large overshoot at stop	Reduce overshoot.	Decrease response setting. Set machine selection setting to “large friction”.
Gear sound generated from machine	Reduce gear sound.	Decrease response setting.

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

9.3.2 Valid conditions

POINT

- If the acceleration/deceleration time is long or the motor speed used is only low speed, the valid conditions of auto tuning are not satisfied. Therefore, it may result in false tuning.
  In this case, after performing operation which satisfies the auto tuning conditions, set 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.

9.4 Manual gain adjustment

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

9.4.1 When machine rigidity is low

(1) Machine condition

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

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

(2) Adjustment procedure

(a) Adjustment 1

1) Execute auto tuning with the response setting of the level at which machine will not vibrate. Set 0101 in parameter No.21.
2) Set “Not executed” auto tuning in parameter No.21.
3) Gradually decrease the speed integral compensation VIC (parameter No.63) setting.

(b) Adjustment 2

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) If the machine condition does not become excellent after the above adjustment, reduce the setting of speed integral compensation as in Adjustment 1.

9.4.2 When the machine vibrates due to machine resonance frequency

(1) Machine condition

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

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

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

(2) Adjustment procedure

(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
7	PG1	Position loop gain 1
60	PG2	Position loop gain 2
61	VG1	Speed loop gain 1
62	VG2	Speed loop gain 2
63	VIC	Speed integral compensation

3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
4) Make the speed control gain (parameter No. 62) about 1000 lower than the automatically set value and repeat steps 2) to 4) in Procedure 1. The optimum value is obtained immediately before vibration increases.
5) When there is no machine resonance, check the operating status and gradually increase the speed loop gain 2 (parameter No.62) and repeat steps 2) to 4) in Adjustment 1.
   Set the value about 50 to 100 smaller than the value at which gear sound begins to be generated. Make this gain a little smaller if there is variation in the machine because a timing belt or the like is used.
6) To further shorten the settling time, gradually increase the response setting of parameter No.21 and repeat steps 1) to 5).

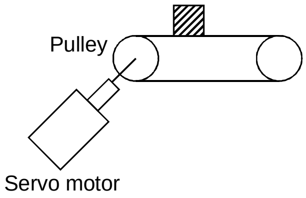
9.4.3 Load inertia moment is 20 or more times

(1) Machine condition

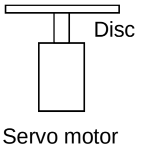
The machine inertia moment is 20 times or more and the servo motor oscillates at low frequency (5Hz or less). At this time, servo motor shaft vibration can be confirmed visually.

This adjustment method is valid for the following machines:

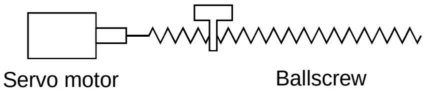
1) Machine in which a timing belt is driven without reduction gear



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
7	PG1	Position loop gain 1
60	PG2	Position loop gain 2
61	VG1	Speed loop gain 1
62	VG2	Speed loop gain 2
63	VIC	Speed integral compensation

3) Alternate a start and a stop several times, and check whether the machine does not vibrate.
4) If vibration still persists, repeat steps 2) and 3).
5) If vibration still persists, make (a) Adjustment 1 and (b) Adjustment 2 in Section 10.4.2 (2).
6) After adjustment is over, make Adjustment 1 in Section 9.4.1 to further improve the performance.

9.4.4 When shortening the settling time

(1) Machine condition

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

(2) Adjustment procedure

(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
7	PG1	Position loop gain 1
60	PG2	Position loop gain 2
61	VG1	Speed loop gain 1
62	VG2	Speed loop gain 2
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
7	PG1	Position loop gain 1	Higher setting shortens the settling time but is liable to cause overshooting.
60	PG2	Position loop gain 2	
61	VG1	Speed loop gain 1	Higher setting improves the servo response level but is liable to cause vibration.
62	VG2	Speed loop gain 2	
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.

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

(1) Machine condition

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

(2) Adjustment procedure

(a) To adjust the gains of each axis, adjust the gains of all axes in the adjustment procedures in Sections 9.4.1 to 9.4.5.

(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
7	PG1	Position loop gain 1
60	PG2	Position loop gain 2
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.

10. INSPECTION

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

POINT

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

10.1 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.

10.2 Life

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

For parts replacement, please contact your sales representative.

Part name		Life guideline
Servo amplifier	Smoothing capacitor	10 years
	Relay	100,000times
	Cooling fan	10,000 to 30,000 hours (2 to 3 years)
	Absolute position battery	Refer to Section 4.9.

(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) Servo amplifier cooling fan

The cooling fan bearings reach the end of their life in 10,000 to 30,000 hours. Normally, therefore, the fan must be changed in a few years of continuous operation as a guideline.
It must also be changed if unusual noise or vibration is found during inspection.

(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.

11. TROUBLESHOOTING

11.1 Trouble at start-up

⚠ CAUTION

- Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

POINT

- If the servo motor is inoperative, refer to the "unrotated motor reason" screen (Section 8.4 (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 and CN4 are disconnected.	1) Power supply voltage fault 2) Servo amplifier is faulty.	
			Improved when connectors CN1 is disconnected.	Power supply of CN1 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1) Power supply of encoder cabling is shorted. 2) Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply is shorted.	
		Alarm occurs.	Refer to Section 11.4 and remove cause.		Section 11.4
2	Switch on servo-on signal.	Alarm occurs.	Refer to Section 11.4 and remove cause.		Section 11.4
		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 VIN.	Section 8.3
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure: 1) Increase the auto tuning response level. 2) Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	Make gain adjustment in the following procedure: If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 9
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	

11.2 Operation performed at alarm/warning occurrence

Fault location	Description	Operation mode	
		Parameter unit test operation	CC-Link operation
Servo side warning occurrence	Servo operation	Continued	Continued
	Data communication	Continued	Continued
Servo side alarm occurrence	Servo operation	Stopped	Stopped
	Data communication	Continued	Continued
CC-Link communication alarm occurrence	Servo operation	Continued	Stopped
	Data communication	Stopped	Stopped

11.3 CC-Link communication alarm

Any of the following indications is provided on the communication alarm display.

(Note) Communication alarm display LEDs				Operation
L.RUN	SD	RD	L.ERR	
○	◎	◎	◎	Normal communications are made but CRC error sometimes occurs due to noise.
○	◎	◎	●	Normal communications
○	◎	●	◎	Hardware fault
○	◎	●	●	Hardware fault
○	●	◎	◎	Receive data resulted in CRC error and response cannot be made.
○	●	◎	●	Data does not reach host station.
○	●	●	◎	Hardware fault
○	●	●	●	Hardware fault
●	◎	◎	◎	Polling response is made but refresh receive is in CRC error.
●	◎	◎	●	Hardware fault
●	◎	●	◎	Hardware fault
●	◎	●	●	Hardware fault
●	●	◎	◎	Data addressed to host station resulted in CRC error.
●	●	◎	●	Data does not reach host station or data addressed to host station cannot be received due to noise.
●	●	●	◎	Hardware fault
●	●	●	○	Baudrate setting unauthorized
●	●	○	○	Station number setting unauthorized
●	○	○	◎	Baud rate or station number setting changed at any point (ERROR flickers for about 0.4s)
●	●	●	●	Data cannot be received due to power-off, power supply section failure, open cable or like. WDT error occurrence (hardware fault)

Note. ○: On ●: Off ◎: Flickering

11.4 At occurrence of alarm or warning

CAUTION

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

11.4.1 Alarm/warning list

POINT

- When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the servo amplifier, servo motor and regenerative brake option may become faulty.
  - Regenerative alarm (AL.30)
  - Overload 1 (AL.50)
  - Overload 2 (AL.51)
- The alarms can be deactivated by switching power off then on.
- The alarms marked "○" in the Alarm Deactivation field of the following table can be deactivated in either of the following ways:
  - Press the "RES" key of the parameter unit.
  - Turn on the reset signal (RY1A or RY3A).

	Indication	(Note) Alarm code				Function name	Parameter unit screen display	Alarm deactivation
		RX9	RX8	RX7	RX6			
Alarm codes	AL.10	0	0	1	0	Under voltage	Under volt	○
	AL.12	0	0	0	0	Memory alarm 1	Memory er1	
	AL.13	0	0	0	0	Clock alarm	OSC err	
	AL.14	0	0	0	0	Watchdog	Watch dog	
	AL.15	0	0	0	0	Memory alarm 2	Memory er2	
	AL.16	0	1	1	0	Encoder alarm 1	PLG err 1	
	AL.17	0	0	0	0	Board alarm	Board err	
	AL.19	0	0	0	0	Memory alarm 3	Memory er3	
	AL.1A	0	1	1	0	Motor combination error	Motor err.	
	AL.20	0	1	1	0	Encoder alarm 2	PLG err 2	
	AL.24	1	1	0	0	Ground fault	Grounded	○
	AL.25	1	1	1	0	Absolute position erase	ABS lost	
	AL.30	0	0	0	1	Regenerative alarm	Reg. err	
	AL.31	0	1	0	1	Over speed	Overspeed	○
	AL.32	0	1	0	0	Over current	Overcurr.	○
	AL.33	1	0	0	1	Over voltage	Overvolt.	○
	AL.35	1	1	0	1	Command pulse frequency alarm	Ref. f err	○
	AL.37	1	0	0	0	Parameter alarm	Pr. err	
	AL.42	0	1	1	0	Feedback alarm	Pos. err	○
	AL.45	0	0	1	1	Main circuit device overheat	Fin heat	○
	AL.46	0	0	1	1	Servo motor overheat	Motor heat	○
	AL.50	0	0	1	1	Over load 1	Overload1	
	AL.51	0	0	1	1	Over load 2	Overload2	
	AL.52	0	1	0	1	Error excessive	Over droop	○
	AL.77	1	1	1	1	H-T01board alarm	H-T01 error	
	AL.8D	0	0	0	0	CC-Link alarm	CC-link er	○
	AL.8E	0	0	0	0	RS-232C alarm	RS232 err	○
	AL.8F	1	0	0	0	RS-422 alarm	RS422 err	○

	Indication	(Note) Alarm code				Function name	Parameter unit screen display	Alarm deactivation
		RX7	RX6	RX5	RX4			
Warning codes	AL.90					Zeroing incomplete	ORG error	
	AL.92					Open battery cable warning	BTT cable	
	AL.96					Zero setting error	ZEROset er	
	AL.9D					CC-Link warning	CC-link er	
	AL.9F					Battery warning	BTT volt	
	AL.E0					Excessive regenerative load warning	OR warning	
	AL.E1					Over load warning	OL warning	
	AL.E3					Absolute position counter warning	ABS warning	
	AL.E6					Servo forced stop	EMG stop	
	AL.E9					Main circuit off warning	Main P-off	

11.4.2 Remedies for alarms

CAUTION

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.
- If an absolute position erase alarm (AL.25) occurred, always make home position setting again. Otherwise, misoperation may occur.

When an alarm occurs, the trouble signal 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		
AL.10	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-H700TN or less : 15ms or more In case of MR-HIIKTN or more : 10ms or more	
				Insuf. Power capacity	3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
					4. Power was restored after the bus voltage had dropped to 200VDC. (Main circuit power switched on within 5s after it had switched off.)	
					5. Faulty parts in the servo amplifier Checking method Alarm (AL.10) occurs if power is switched on after CN1, CN3 connectors are disconnected.	Change the Servo amplifier.
AL.12	Memory alarm 1	RAM, ROM memory fault	Memory er1	Board error	Faulty parts in the servo amplifier Checking method Alarm (any of AL.12 to 15) occurs if power is switched on after CN1, CN3 connectors are disconnected.	Change the Servo amplifier.
AL.13	Clock alarm	Printed board fault	OSC err			
AL.14	Watch dog	CPU fault	Watch dog			
AL.15	Memory alarm 2	EEPROM fault	Memory er2			
AL.16	Encoder alarm	Communication error occurred between encoder and controller.	PLG err 1	PLG con. left	1. Encode 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		Cause	Action
			Current alarm (name and definition)	Alarm occurrence factor		
AL.17	Board alarm	CPU/parts fault	Board err	Board error	Faulty parts in the servo amplifier Checking method Alarm (AL.17 or AL.19) occurs if power is switched on after CN1, CN3 connectors have been disconnected.	Change the servo amplifier.
AL.19	Memory alarm 3	Flash ROM fault	Memory er3	Board error		
AL.1A	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.
AL.20	Encoder alarm 2	Communication error occurred between encoder and servo amplifier.	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.
AL.24	Ground fault	Servo motor outputs (U, V, W phases) of servo amplifier resulted in ground fault.	Grounded	UVW ground fault	1. Contact of power supply input cables and servo motor outputs in main circuit terminal block.	Correct wiring.
					2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change cables.
					3. Main circuit of servo amplifier failed. Checking method AL.24 occurs if the servo is switched on after disconnecting the U, V, W power cables from the servo amplifier.	Change servo amplifier.
AL.25	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 leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
				BTT life time over	2. Battery voltage low	Change battery. Always make home position setting again.
				BTT cable has trouble	3. Battery cable or battery is faulty.	
		Power was switched on for the first time in the absolute position detection system.			4. Super capacitor of the absolute position encoder is not charged	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.

Indication	Name	Definition	Parameter unit screen display		Cause	Action
			Current alarm (name and definition)	Alarm occurrence factor		
AL.30	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 servo amplifier.
				Reg. Resist. has trouble	6. Built-in regenerative brake resistor or regenerative brake option faulty.	Change servo amplifier or regenerative brake option.
		Cooling fan stop			7. Unusual overheat due to cooling fan stop	1. Change the servo amplifier or cooling fan. 2. Reduce ambient temperature.
AL.31	Over speed	Speed has exceeded the instantaneous permissible speed.	Overspeed	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. Reset servo gain to proper value. 2. If servo gain cannot be set to proper value: 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/deceleration time constant.
				Pr. 1 missetting	3. Parameter No. 1 setting error.	Set correctly.
				PLG trouble	4. Encoder faulty.	Change the servo motor.
AL.32	Over current	Current that flew is higher than the permissible current of the controller.	Overcurr.	UVW short circuit	1. Short occurred in controller output phases U, V and W.	Correct the wiring.
				IPM damaged	2. Transistor (IPM) of the servo amplifier faulty. Checking method Alarm (AL.32) occurs if power is switched on after U, V and W are disconnected.	Change the servo amplifier
				UVW fault	3. Ground fault occurred in servo amplifier 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.

Indication	Name	Definition	Parameter unit screen display		Cause	Action
			Current alarm (name and definition)	Alarm occurrence factor		
AL.33	Over voltage	Converter bus voltage exceeded 400V.	Overvolt.	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 servo amplifier. 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.
AL.35	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.
AL.37	Parameter alarm	Parameter setting is wrong.	Pr. err	Pr. data destroyed	1. Servo amplifier fault caused the parameter setting to be rewritten.	Change the servo amplifier.
				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	
AL.42	Feedback alarm	Encoder signal is faulty.	Pos. err	PLG trouble	Encoder faulty.	Change the servo motor.
AL.45	Main circuit device overheat	Main circuit device overheat	Fin heat	Overload	1. Servo amplifier faulty.	Change the servo amplifier.
				Amb. temp. over 55℃	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.
AL.46	Servo motor overheat	Servo motor temperature rise actuated the thermal protector.	Motor overheat	Motor amb. over 40℃	1. Ambient temperature of servo motor is over 40℃.	Review environment so that ambient temperature is 0 to 40℃.
				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.

Indication	Name	Definition	Parameter unit screen display		Cause	Action
			Current alarm (name and definition)	Alarm occurrence factor		
AL.50	Over load 1	Load exceeded overload protection characteristic of servo amplifier. Load ratio 300%: 2.5s or more Load ratio 200%: 100s or more	Overload1	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. Vibrate. by unstable	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.
AL.51	Over load 2	Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked: 1s or more	Overload2	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 unstable	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 servo amplifier.
				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		Cause	Action
			Current alarm (name and definition)	Alarm occurrence factor		
AL.52	Error excessive	Droop pulse value of the deviation counter exceeded 80k pulses.	Over droop	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 the servo amplifier.
				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.
AL.77	H-T01 board alarm	Printed circuit board H-T01 faulty	H-T01 error	H-T01 left	1. Printed circuit board H-T01 is disconnected.	Repair or change the servo amplifier.
				H-T01 trouble	2. Printed circuit board H-T01 has failed.	
AL.8D	CC-Link alarm	Communication with master station cannot be made normally.	CC-link er	Station no. missetting	1. Station number switch setting is 0 or 65 or more.	Set the correct station number (1 to 64).
				Baudrate missetting	2. Baudrate switch setting is 5 or more.	Set the correct baudrate (0 to 4).
				CC-link CBL has trouble	3. Cable connection wrong	Check wiring.
					4. Cable fault	Repair or change the cable.
					5. CC-Link connector is unplugged.	Make proper connection.
AL.8E	RS-232C alarm	Serial communication error occurred between servo amplifier and communication device (parameter unit, personal computer or similar device).	RS232 err	RS232 comm. error	1. Encoder cable faulty. (write breakage or short)	Repair or change the cable.
					2. Telecommunications equipment faulty.	Change the telecommunication equipment.
AL.8F	RS-422 alarm	Serial communication error occurred between servo amplifier 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.	Wiring is repaired.
					2. External digital display faulty.	Change the external digital display.

11.4.3 Remedies for warnings

Occurrence of a warning does not lead to a servo off status. However, if operation is continued with the warning occurring, an alarm may occur or normal operation not performed.

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		
AL.90	Zero setting error	In incremental system: 1. Positioning operation was performed without zeroing. 2. Zeroing ended abnormally.	ORG error	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.
AL.92	Open battery cable warning	Absolute position detection system battery voltage is low.	BTT cable	BTT cable has trouble BTT voltage low	1. Battery cable is open.	Repair cable or changed.
					2. Battery voltage dropped to 2.8V or less.	Change battery.
AL.96	Zero setting error	1. In incremental system: Zeroing could not be made. 2. In absolute position detection system: Zero setting could not be made.	ZEROset er	Ref. P input after CR on Out of imposition	Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence
AL.9D	CC-link warning	Station number switch or baudrate switch setting was changed after power-on.	CC-link er	Station No. changed	1. Station number switch setting was changed after power-on.	Return it to the setting before power-on.
				Baudrate SW. changed	2. Baudrate switch setting was changed after power-on.	Return it to the setting before power-on.
AL.9F	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		
AL.E0	Excessive regenerative load warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative brake resistor or regenerative brake option.	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.
AL.E1	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. Checking method Refer to AL.50, 51.	Refer to AL.50, AL.51.
AL.E3	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.
AL.E6	Servo forced stop	EMG-SG are open.	EMG stop	EMG off	External forced stop was made valid. (EMG-SG opened.)	Ensure safety and deactivate forced stop.
AL.E9	Main circuit off warning	Servo was switched on with main circuit power off.	Main P-off	Main power down while SON-on		Switch on main circuit power.

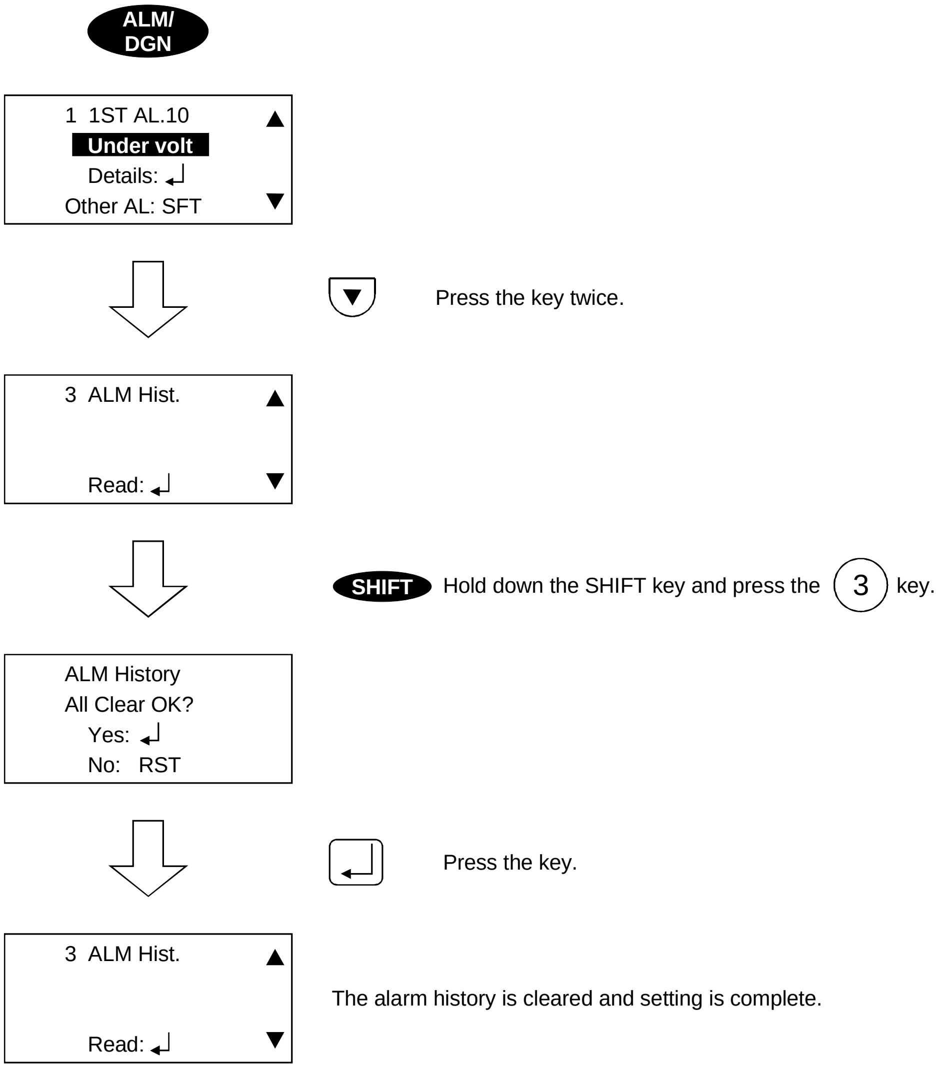
11.4.4 RS-232C communication error

When a communication fault occurs between the servo amplifier 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 servo amplifier and parameter unit during servo operation.	1. Parameter unit cable or communication cable connection fault 2. Parameter unit cable or communication cable snapping 3. Servo amplifier faulty. 4. Parameter unit faulty.	1. Connect properly. 2. Change the cable. 3. Change the servo amplifier. 4. Change the parameter unit.
SERVO CPU ERROR	Communication cannot be made at power-on between the servo amplifier and parameter unit.		
PRU MEMORY ERROR	Parameters cannot be copied from the servo amplifier to the parameter unit.	Memory (EEPROM) in the parameter unit faulty.	Change the parameter unit.

11.5 Clearing the alarm history

The parameter unit can be used to confirm an alarm history. The servo amplifier 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.



```
1  1ST AL.10
   Under volt
   Details: ↵
Other AL: SFT
```

▼ Press the key twice.

```
3  ALM Hist.

   Read: ↵
```

SHIFT Hold down the SHIFT key and press the 3 key.

```
ALM History
All Clear OK?
   Yes: ↵
   No:  RST
```

↵ Press the key.

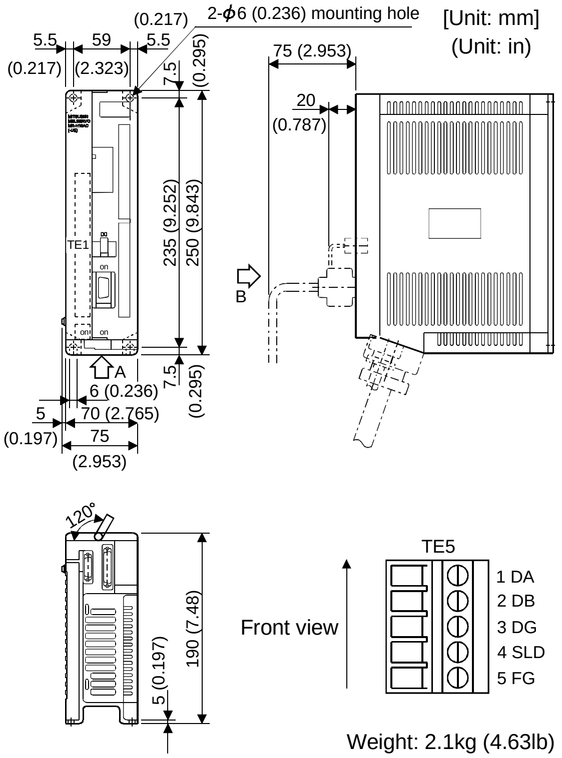
```
3  ALM Hist.

   Read: ↵
```

The alarm history is cleared and setting is complete.

12. OUTLINE DIMENSIONAL DRAWINGS

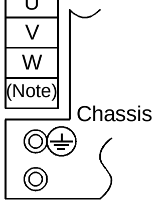
12.1 Servo amplifiers

MR-H10TN(-UE) to MR-H60TN(-UE)



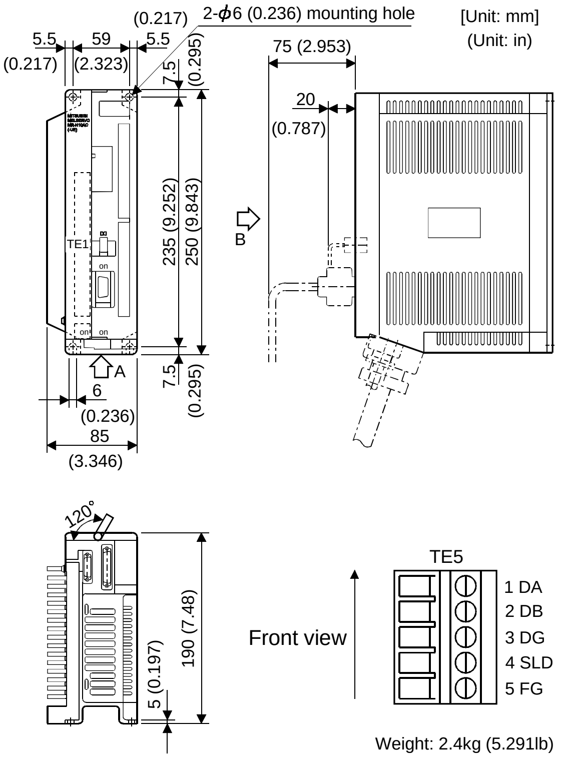
Weight: 2.1kg (4.63lb)

Terminal block TE1	
MR-H□TN	MR-H□TN-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)



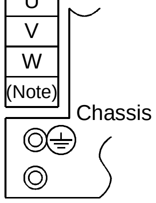
Note: Keep it open.

MR-H100TN(-UE)



Weight: 2.4kg (5.291lb)

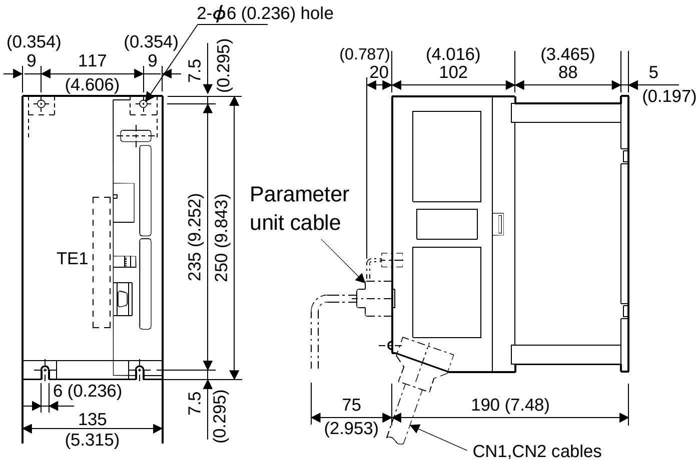
Terminal block TE1	
MR-H□TN	MR-H□TN-UE
Terminal screw: M4	Terminal screw: M4
P	P
C	C
N	N
R	L1
S	L2
T	L3
R1	L11
S1	L21
U	U
V	V
W	W
⏚	(Note)

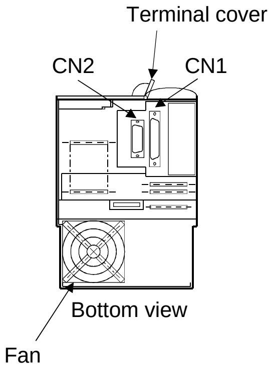


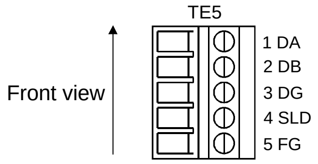
Note: Keep it open.

MR-H200TN(-UE) · MR-H350TN(-UE)

[Unit: mm]
(Unit: in)





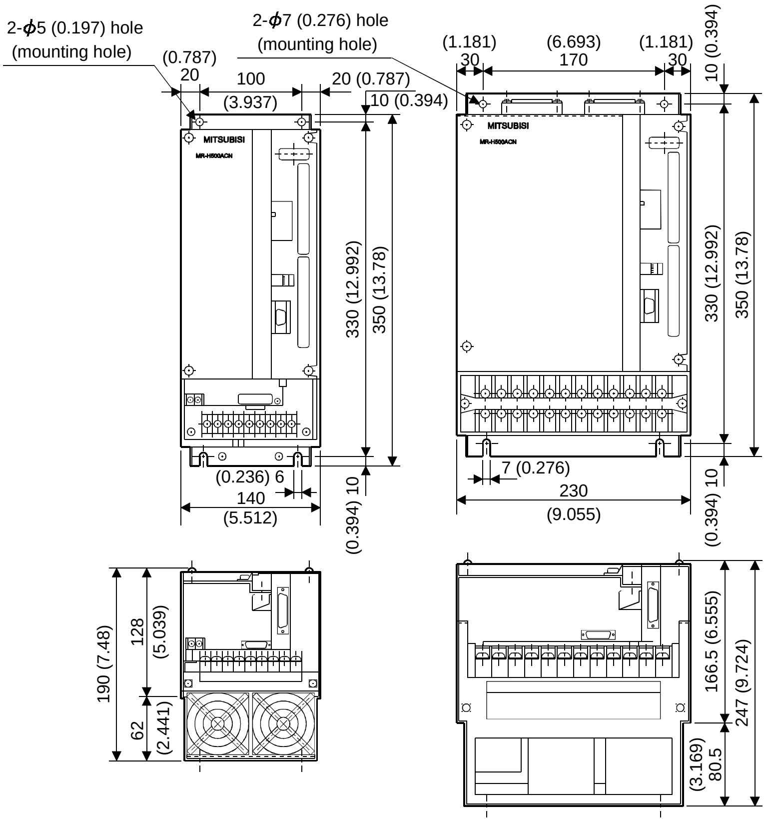


Weight: 4.4kg (9.7lb)

Terminal block TE1	
MR-H□TN	MR-H□TN-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.

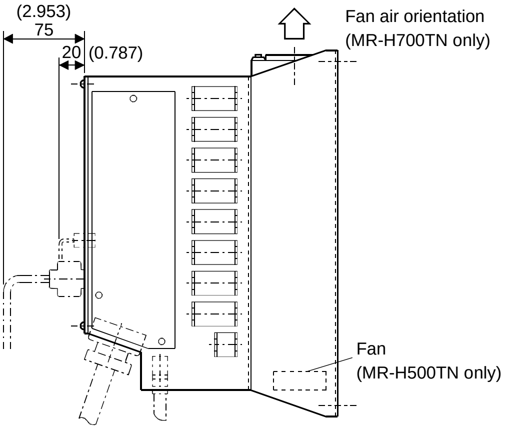
MR-H500TN(-UE) · MR-H700TN(-UE)

[Unit: mm]
(Unit: in)

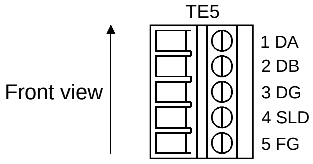


MR-H500TN(-UE)

MR-H700TN(-UE)



Model	Weight [kg (lb)]
MR-H500TN(-UE)	7 (15.432)
MR-H700TN(-UE)	12 (22.455)



Terminal block signal arrangement

· MR-H500TN

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-H700TN

TE1

P	C	N	R	S	T	R1	S1	U	V	W	⏚

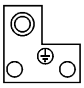
Terminal screw: M5

· MR-H500TN-UE

TE2

L11	L21

PE



Terminal screw: M4

TE1

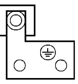
P	C	N	L1	L2	L3	U	V	W

Terminal screw: M4

· MR-H700TN-UE

TE1

P	C	N	L1	L2	L3	L11	L21	U	V	W

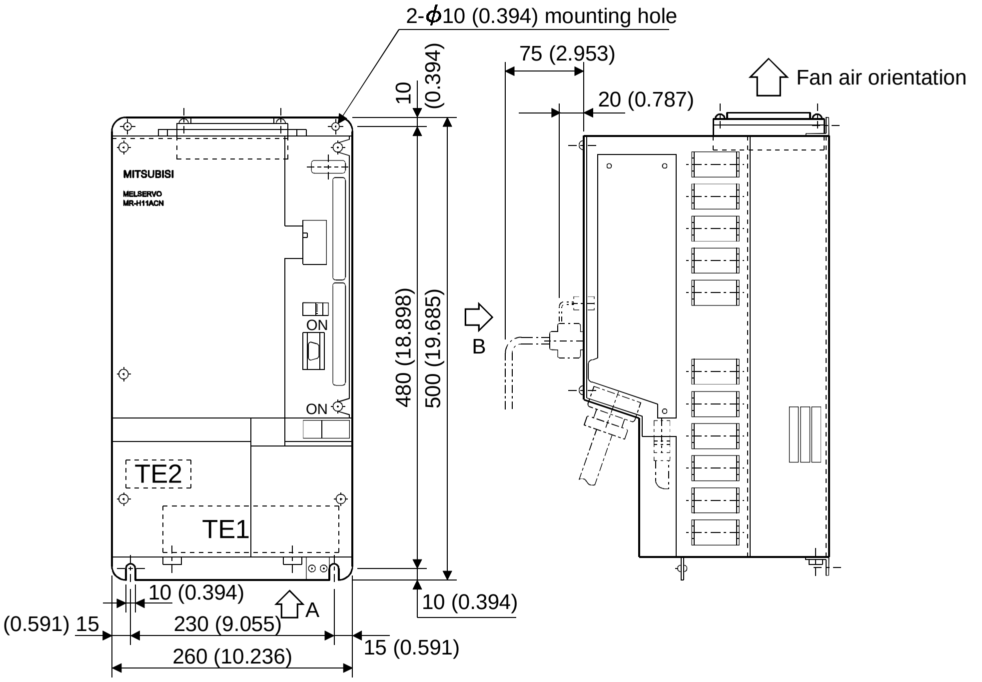


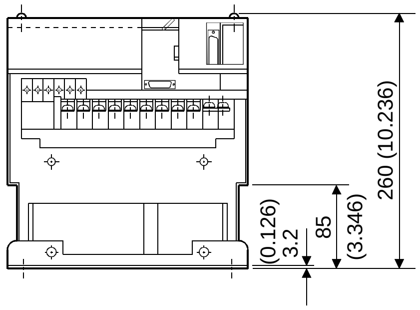
Terminal screw: M5

PE

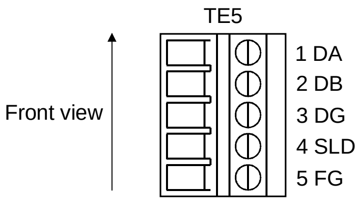
MR-H11KTN(-UE)

[Unit: mm]
(Unit: in)





Weight: 21kg (46.297lb)



Terminal block signal arrangement

- MR-H11KTN

TE2

R1	S1		MS1	MS2	

Terminal screw: M4

TE1

R	S	T	U	V	W	P	C	N	⏚

Terminal screw: M5

- MR-H11KTN-UE

TE2

L11	L21		MS1	MS2	

Terminal screw: M4

TE1

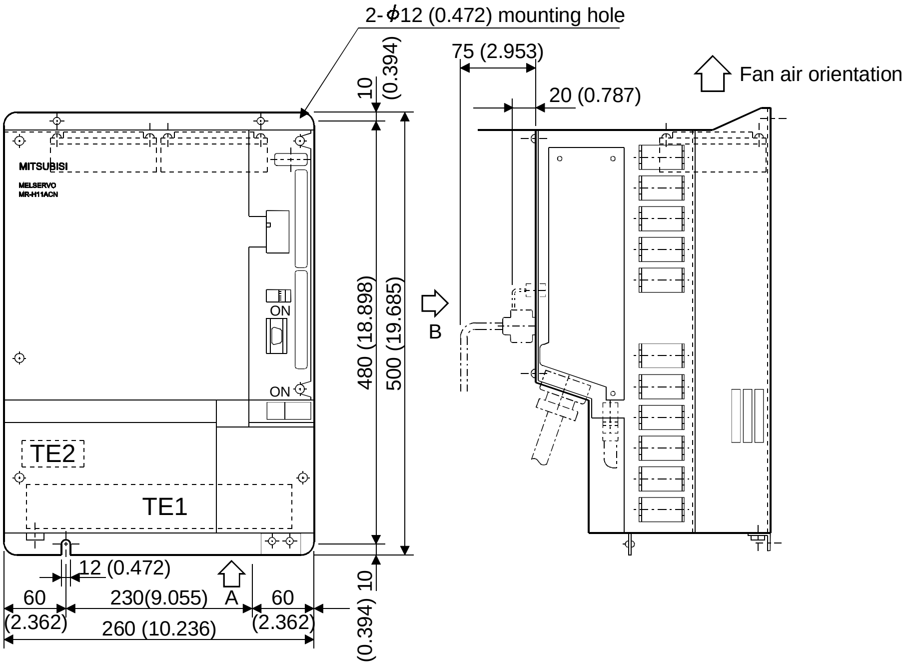
L1	L2	L3	U	V	W	P	C	N	⏚

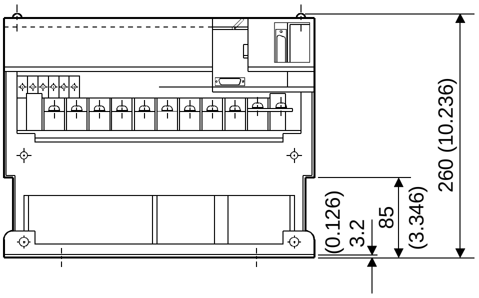
Terminal screw: M5

PE

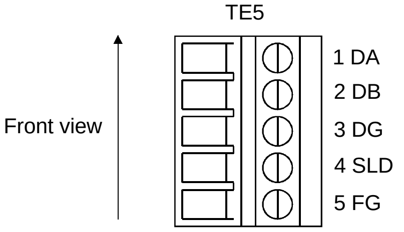
MR-H15KTN(-UE) · MR-H22KTN(-UE)

[Unit: mm]
(Unit: in)





Model	Weight [kg (lb)]
MR-H15KTN(-UE)	27 (59.525)
MR-H22KTN(-UE)	30 (66.139)



Terminal block signal arrangement

- MR-H15KTN•MR-H22KTN

TE2

R1	S1		MS1	MS2	

Terminal screw: M4

TE1

R	S	T	U	V	W	P	C	N	⏚

Terminal screw: M6(MR-H15KTN)
M8(MR-H22KTN)

- MR-H15KTN-UE•MR-H22KTN-UE

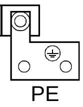
TE2

L11	L21		MS1	MS2	

Terminal screw: M4

TE1

L1	L2	L3	U	V	W	P	C	N

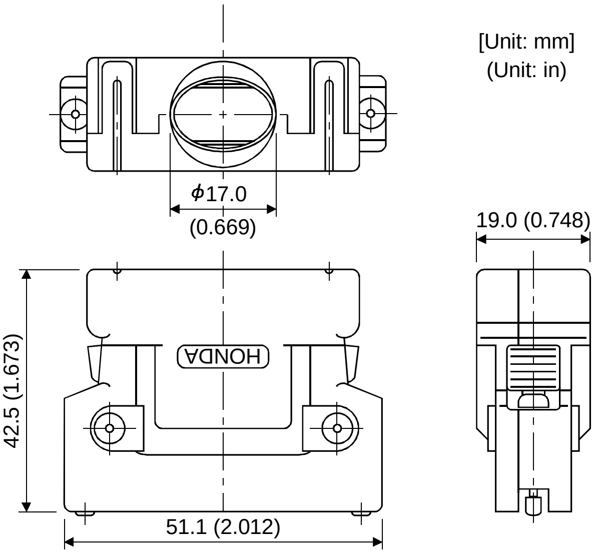


Terminal screw: M6(MR-H15KTN)
M8(MR-H22KTN)

12.2 Connectors

(1) Servo amplifier side connector

<Honda Tsushin Kogyo make>

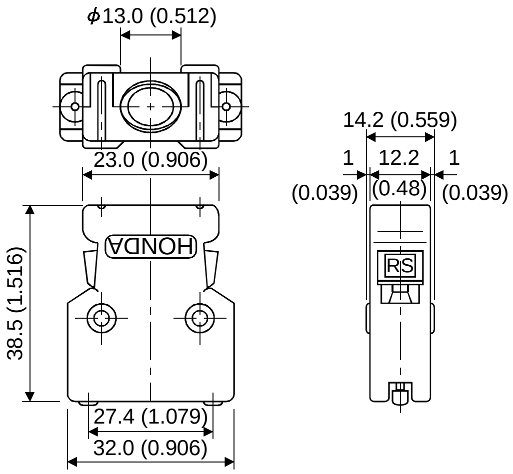


Number of pins	Model	
	Connector	Case
50	PCR-S50FS (soldering type) PCR-S50F (insulation displacement type)	PCR-LS50LA1

Crimping terminal: FHAT-002A

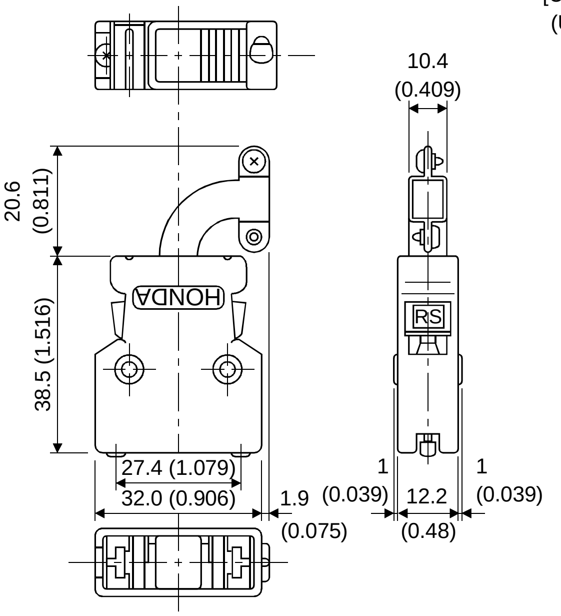
Note: PCR-S50F is not an option and is to be supplied by the customer.

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

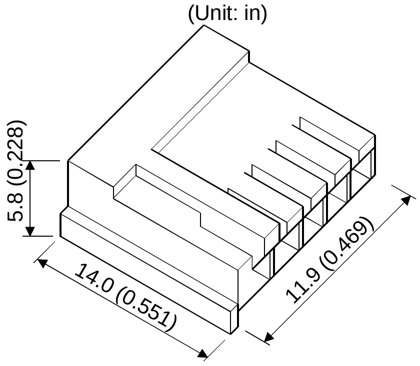
Crimping terminal: FHAT-002A

Note: PCR-S20F and PCR-LS20LA1W are not options and are to be supplied by the customer.

<Nippon AMP make>

- Housing Model: 171822-4

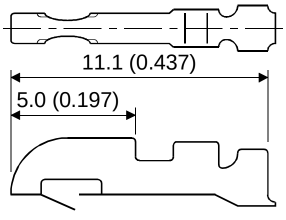
[Unit: mm]
(Unit: in)



- 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

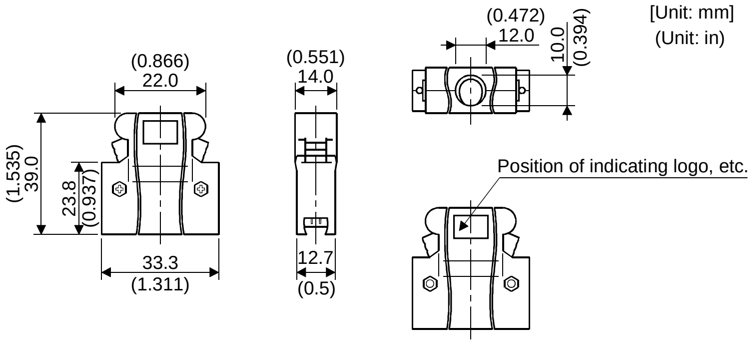
Signal connector

<Sumitomo 3M make>

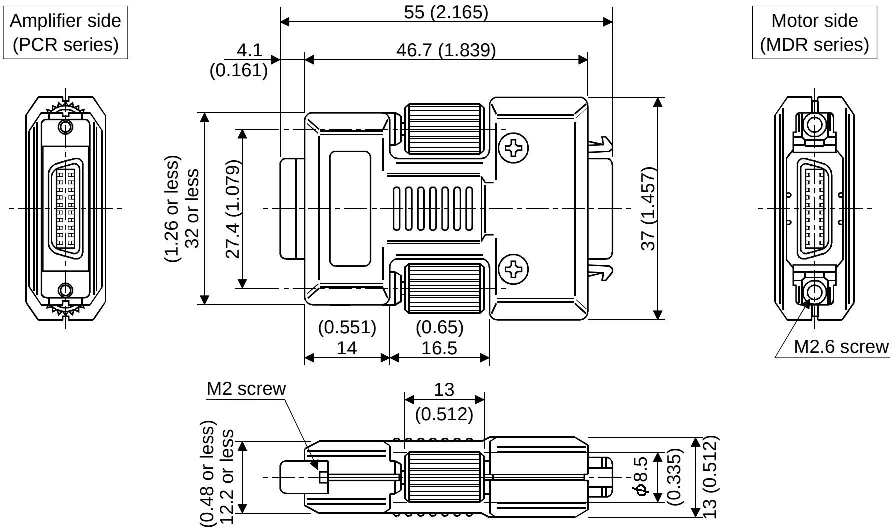
Type

Connector: 10120-3000VE

Shell kit: 10320-52F0-008



(3) Conversion connector



13. CHARACTERISTICS

13.1 Overload protection characteristics

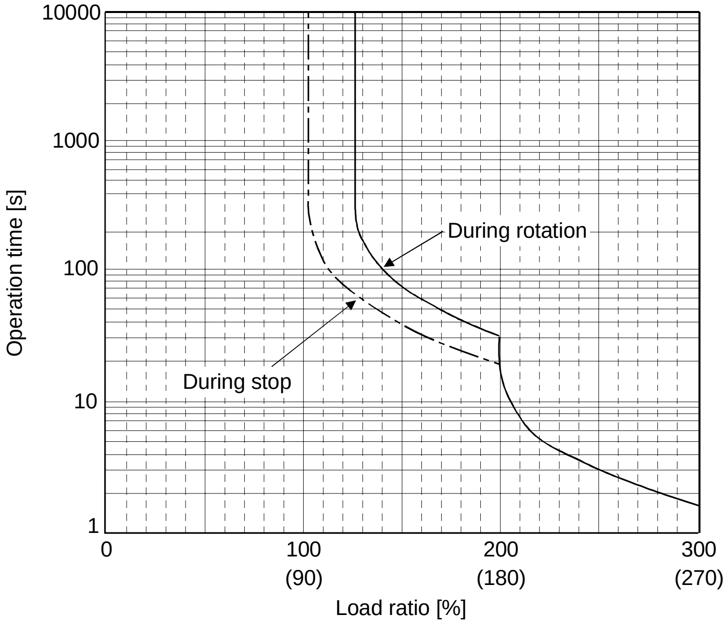
An electronic thermal relay is built in the servo amplifier to protect the servo motor and servo amplifier from overloads. The operation characteristics of the electronic thermal relay are shown below.

Overload 1 alarm (AL.50) occurs if overload operation performed is above the electronic thermal relay protection curve shown below. Overload 2 alarm (AL.51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.

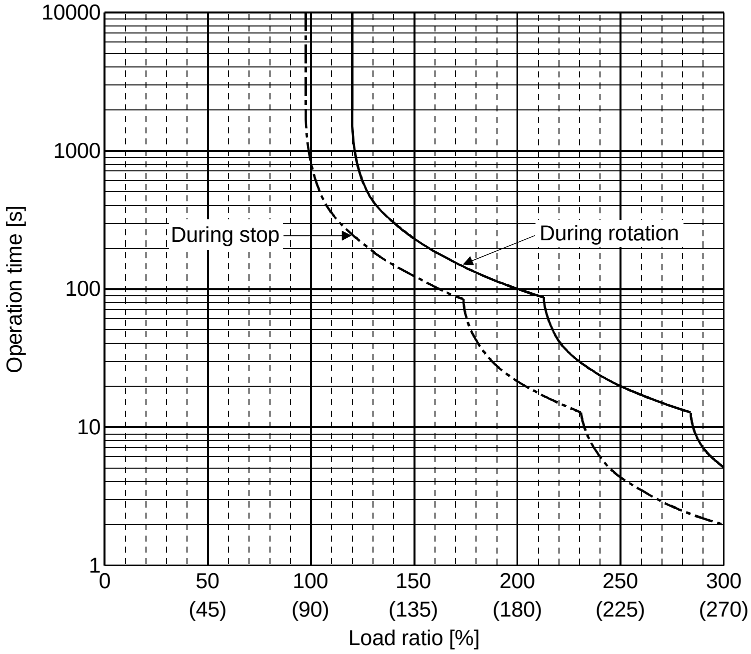
HA-LH series
(11kW or more)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



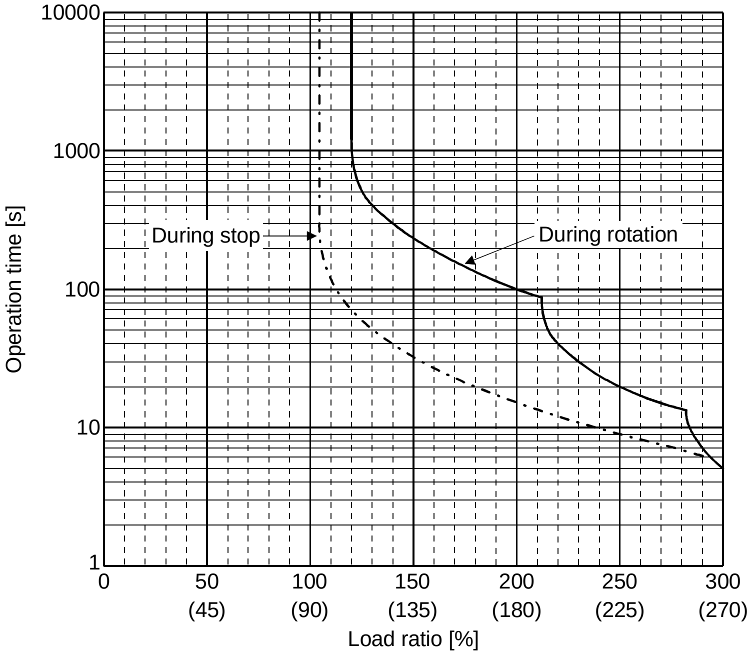
HC-KF series
HC-MF series
HC-SF series
HC-RF series
HC-UF series

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



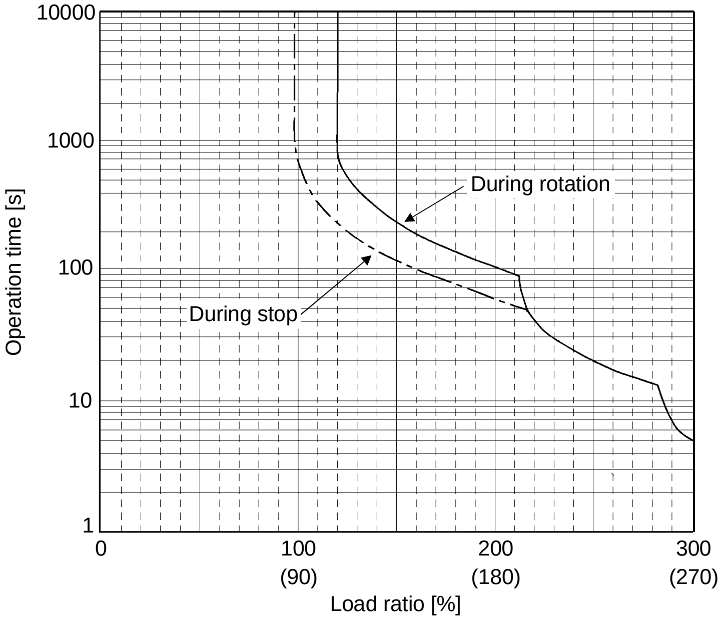
HC-FF series
(200W or less)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



HC-FF series
(300W or more)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



13.2 Servo amplifier and generated loss

(1) Amount of heat generated by the servo amplifier

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

Table 13.1 Power Supply Capacity and Generated Heat Per one axis at Rated Output

Servo amplifier	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Controller-generated heat [W]		Area required for heat dissipation	
			At rated torque	With servo off	[m^2]	[ft^2]
MR-H10TN	HC-KF053 ▪ 13	0.3	40	30	0.8	8.6
	HA-FF053 ▪ 13	0.3	40	30	0.8	8.6
	HC-UF13	0.3	40	30	0.8	8.6
MR-H20TN	HC-KF23	0.5	40	30	0.8	8.6
	HC-MF053 ▪ 13	0.3	40	30	0.8	8.6
	HA-FF23	0.5	40	30	0.8	8.6
MR-H40TN	HC-KF43	0.9	55	30	1.0	10.8
	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-H60TN	HC-MF43	0.9	55	30	1.0	10.8
	HA-FF63	1.1	55	30	1.0	10.8
	HC-SF52 ▪ 53	1.0	55	30	1.0	10.8
	HC-UF43	0.9	55	30	1.0	10.8
MR-H100TN	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-H200TN	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-H350TN	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-H500TN	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-H700TN	HC-SF702	10.0	320	45	6.0	64.6
MR-H11KTN	HA-LH11K2	16	540	57	10.0	107.6
MR-H15KTN	HA-LH15K2	22	660	68	13.0	139.9
MR-H22KTN	HA-LH22K2	33	870	82	16.0	172.2

Note: 1. Note that the power supply capacity varies according to the power supply impedance.

2. Heat generated during regeneration is not included in the controller-generated heat. To calculate heat generated by the regenerative brake option, use Equation 14.1 in Section 14.1.2.

(2) Heat dissipation area for an enclosed control box for servo amplifier

An enclosed control box for the servo amplifier (control box) should be designed to operate at the ambient temperature of 40℃ (104°F) within a temperature rise of 10℃ (50°F). (With a 5℃ (41°F) safety margin, the system should operate within a maximum 55℃ (131°F) limit.) The necessary control box heat dissipation area can be calculated by Equation 14.1:

$$A=\frac{P}{K\cdot\Delta T} \qquad \text{(13.1)}$$

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

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

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

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

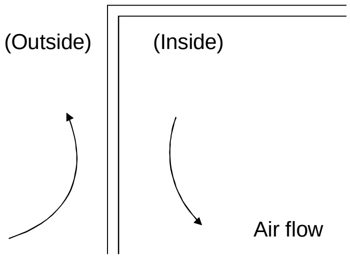


Fig. 13.1 Temperature Distribution in control box

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

(3) Fitting of the servo amplifier (MR-H200TN or more)

When mounted with the heat sink outside mounting attachment (option), the servo amplifier 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 13.1 is dissipated to the outside of the control box. For details of the heat sink outside mounting attachment, refer to Section 14.1.9.

13.3 Dynamic brake characteristics

When an alarm, forced stop or power failure occurs, the dynamic brake is operated to bring the servo motor to a sudden stop. Fig. 13.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 13.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to Fig. 13.3 and Table 13.5.)

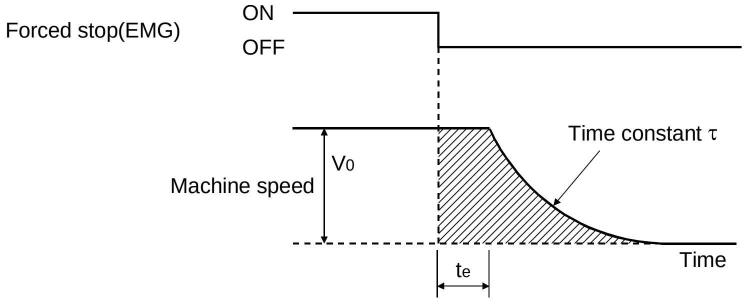


Fig. 13.2 Dynamic Brake Operation Diagram

$$L\max = \frac{V_0}{60} \cdot \left\{ te + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \text{ .... } (13.2)$$

L max : Maximum coasting distance .... [mm][in]

V_0 : Machine rapid feedrate .... [mm/min][in/min]

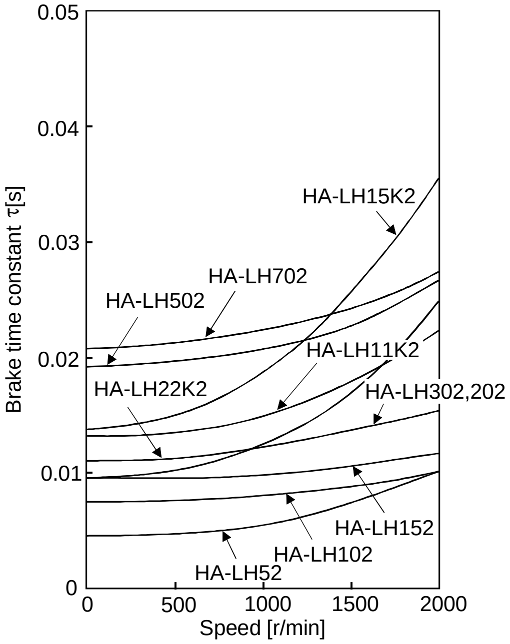
J_M : Servo motor inertia moment .... $[kg \cdot cm^2][oz \cdot in^2]$

J_L : Load inertia moment converted into equivalent value on servo motor shaft ..... $[kg \cdot cm^2][oz \cdot in^2]$

τ : Brake time constant (Fig. 13.3・Table 13.4) .... [s]

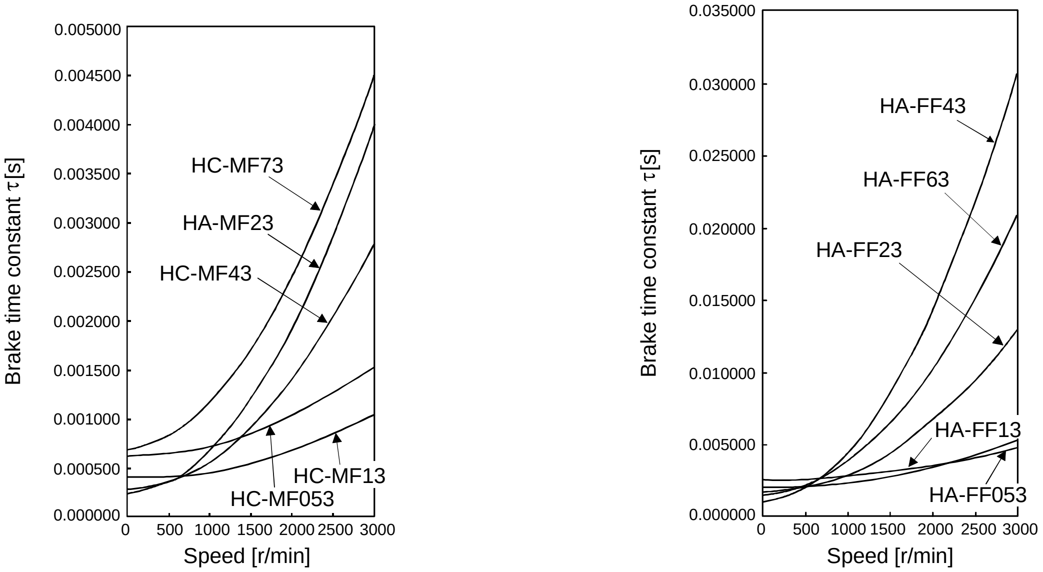
t_e : Delay time of control section (Fig. 13.2) .... [s]

(There is internal relay delay time of about 30ms.)



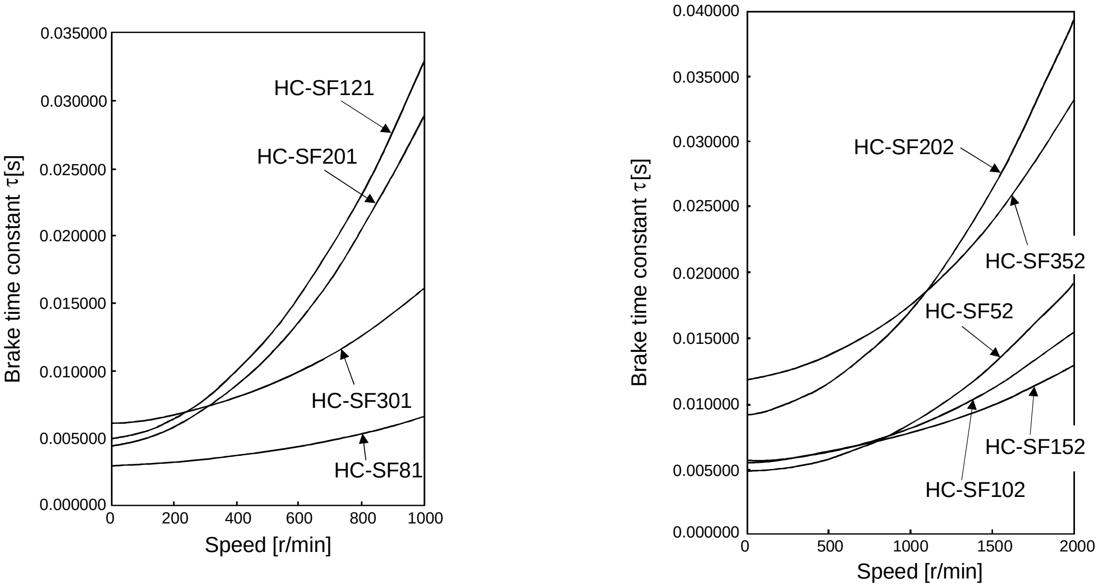
a. HA-LH Series

Fig. 13.3 Dynamic Brake Time Constant 1



b. HC-MF Series

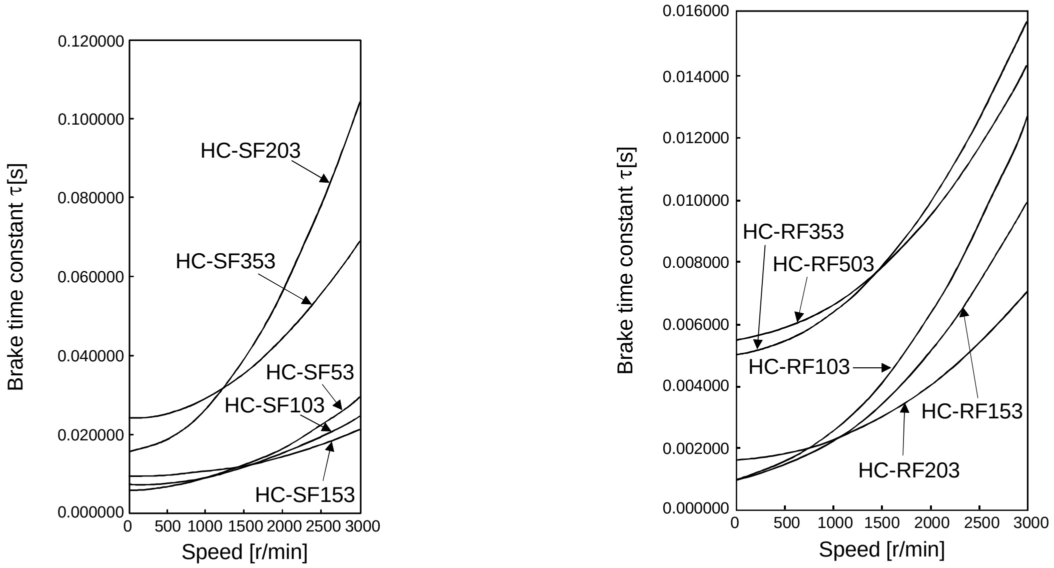
c. HA-FF Series



d. HC-SF1000r/min Series

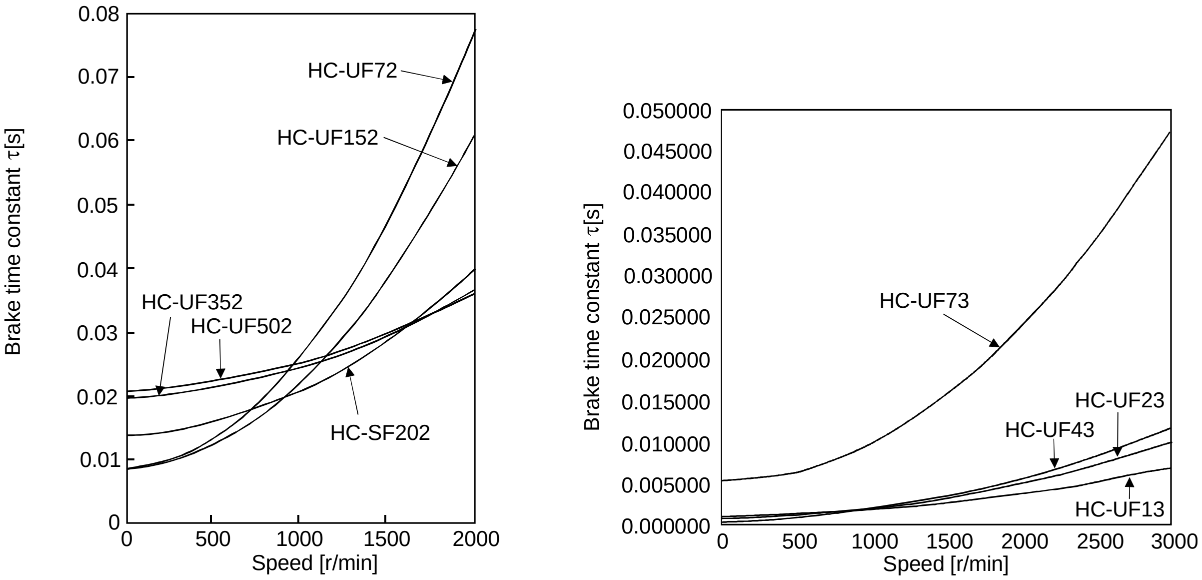
e. HC-SF2000r/min Series

Fig. 13.4 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. 13.5 Dynamic Brake Time Constant 3

[Dynamic brake's permissible load inertia moment]

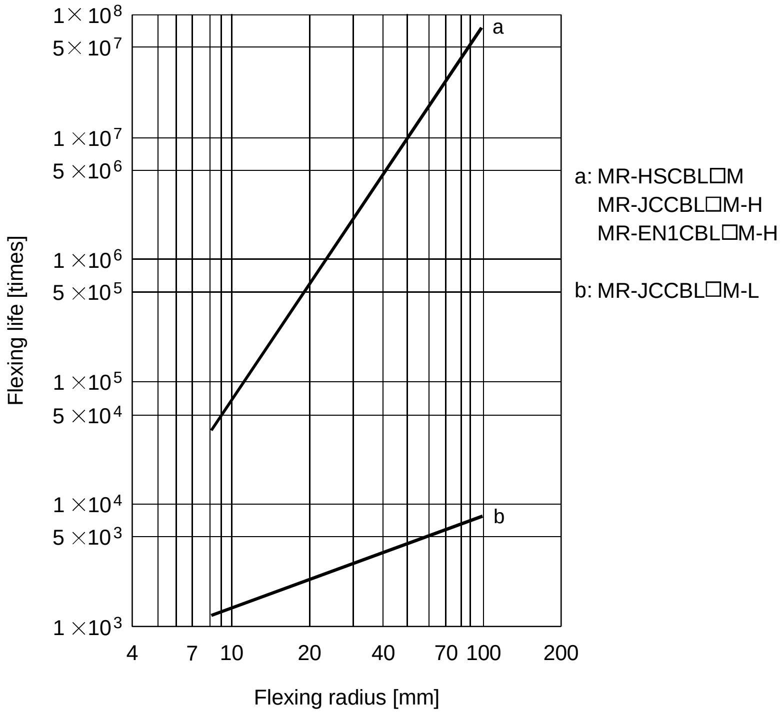
If the dynamic brake is operated at the load inertia moment above the corresponding value indicated in the following list, the brake resistor in the servo amplifier (external brake resistor for 11kW or more) may burn out. If the value is exceeded, contact us.

Servo amplifier	J_L/J_M
MR-H10TN to MR-H100TN	30 times
MR-H200TN	20 times
MR-H350TN to MR-H700TN	10 times (Note)
MR-H11KTN to MR-H22KTN	30 times

Note: 15 times for the HC-SF series.

13.4 Encoder cable flexing life

The flexing life of the cables is shown below. Provide a little allowance for values.



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

14. OPTIONS AND AUXILIARY EQUIPMENT

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

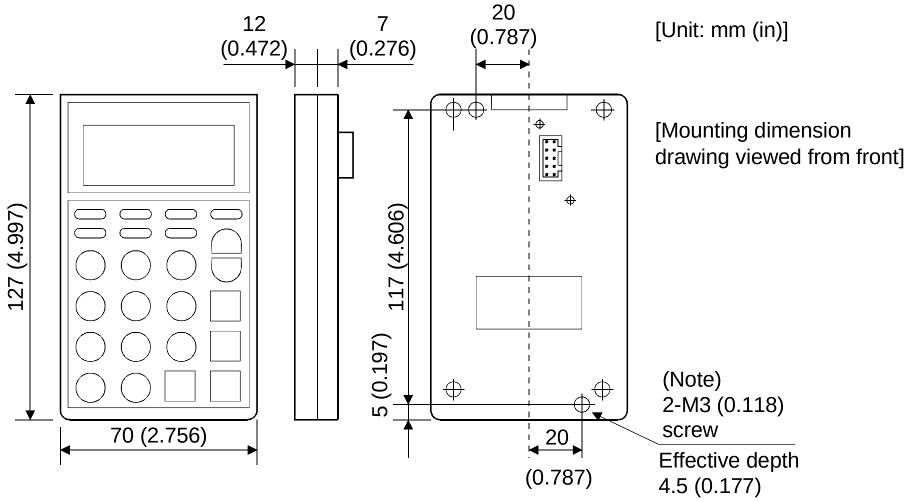
⚠CAUTION	・Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

14.1 Options

14.1.1 Parameter unit

One parameter unit (MR-PRU01A) is required to use this servo amplifier. It displays parameter settings, test operation and alarms. Use it with the parameter unit cable (MR-PRUCBL☐M).

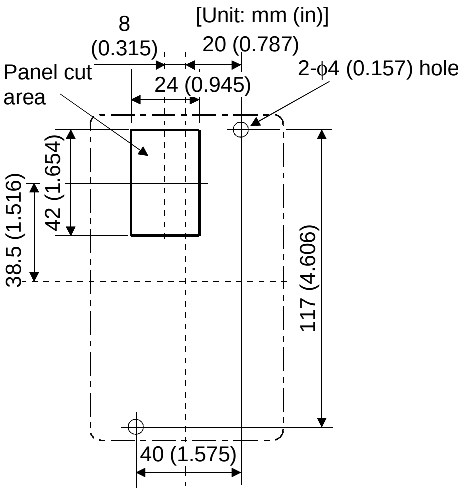
(1) Outline drawing



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.



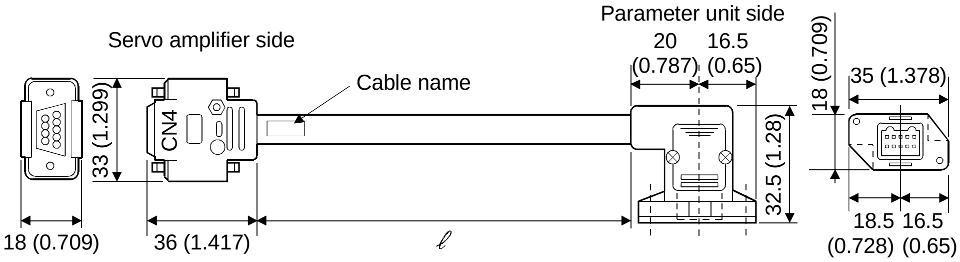
(3) Parameter unit cable

Used for connection of the parameter unit and servo amplifier.

Model: MR-PRUCBL□M

Symbol	Cable length [m (ft.)]
1	1 (3.281)
3	3 (9.843)
5	5 (16.404)

[Unit: mm (in.)]



14.1.2 Regenerative brake options

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

(1) Combination and regenerative power

The regenerative power values listed below are not the permissible power values of the resistors.

Servo amplifier	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-H10TN	None	10	30			
MR-H20TN	None	10	30			
MR-H40TN	50			300		
MR-H60TN	50			300		
MR-H100TN	80			300		
MR-H200TN	80				300	500

Note:Always install a cooling fan.

Servo amplifier	Regenerative power [W]				
	Built-in regenerative brake resistor	MR-RB30 [13Ω]	MR-RB31 [6.7Ω]	MR-RB50 [13Ω]	(Note) MR-RB51 [6.7Ω]
MR-H350TN	130	300		500	
MR-H500TN	130	300		500	
MR-H700TN	170		300		500

Note:Always install a cooling fan.

Servo amplifier	Regenerative power [W]			
	(Note) External regenerative brake resistor (Accessory)	MR-RB65 [8Ω]	MR-RB66 [5Ω]	MR-RB67 [4Ω]
MR-H11KTN	500 (800)	500 (800)		
MR-H15KTN	850 (1300)		850 (1300)	
MR-H22KTN	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:

$$\text{Permissible duty} = \frac{\text{Permissible duty for servo motor with no load (value indicated in Section 5.1 of the Servo Motor Instruction Manual)}}{(m+1)} \times \left(\frac{\text{rated speed}}{\text{Running speed}} \right)^2 \text{[times/min]}$$

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]

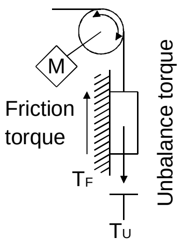
Select the regenerative brake option out of the combinations in (1) in this section.

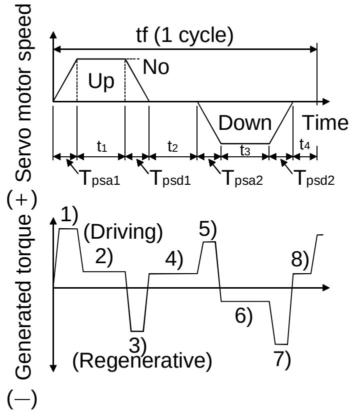
(b) To make selection according to regenerative energy

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)	$T_1=\frac{(J_L+J_M)\bullet N_0}{9.55\times10^4}\bullet\frac{1}{T_{Psa1}}+T_U+T_F$	$E_1=\frac{0.1047}{2}\bullet N_0\bullet T_1\bullet T_{Psa1}$
2)	$T_2=T_U+T_F$	$E_2=0.1047\bullet N_0\bullet T_2\bullet t_1$
3)	$T_3=\frac{(J_L+J_M)\bullet N_0}{9.55\times10^4}\bullet\frac{1}{T_{Psd1}}+T_U+T_F$	$E_3=\frac{0.1047}{2}\bullet N_0\bullet T_3\bullet T_{Psd1}$
4), 8)	$T_4=T_U$	$E_4\geq0$ (No regeneration)
5)	$T_5=\frac{(J_L+J_M)\bullet N_0}{9.55\times10^4}\bullet\frac{1}{T_{Psa2}}-T_U+T_F$	$E_5=\frac{0.1047}{2}\bullet N_0\bullet T_5\bullet T_{Psa2}$
6)	$T_6=T_U+T_F$	$E_6=0.1047\bullet N_0\bullet T_6\bullet t_3$
7)	$T_7=\frac{(J_L+J_M)\bullet N_0}{9.55\times10^4}\bullet\frac{1}{T_{Psd2}}-T_U+T_F$	$E_7=\frac{0.1047}{2}\bullet N_0\bullet T_7\bullet T_{Psd2}$
Sum total of regenerative energies Es		Sum total of negative energies in 1) to 8) Es

2) Losses of servo motor and servo amplifier in regenerative mode

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

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-H10TN	55	9
MR-H20TN	70	9
MR-H40TN	85	9
MR-H60TN	85	9
MR-H100TN	85	15
MR-H200TN	85	25

Servo amplifier	Inverse efficiency [%]	Capacitor charging [J]
MR-H350TN	90	30
MR-H500TN	90	45
MR-H700TN	90	70
MR-H11KTN	90	120
MR-H15KTN	90	180
MR-H22KTN	90	250

Inverse efficiency (η) :Efficiency including some efficiencies of the servo motor and servo amplifier

when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

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

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

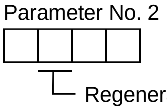
$ER\ [J] = \eta \cdot Es - Ec$

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

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

(3) Parameter setting

When using the regenerative brake option, set parameter No.2 according to the regenerative brake option used.



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

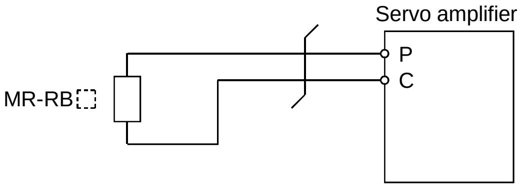
(4) Connection of the regenerative brake option

When using the regenerative brake option, always remove the wiring of the built-in regenerative brake resistor connected across P-C and fit the regenerative brake option across P-C. The regenerative brake option will generate heat of about 100℃. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use fire-retarding cables and keep them clear of the regenerative brake option body.

Always use twisted cables of max. 5m (16.404ft) length for connection with the servo amplifier.

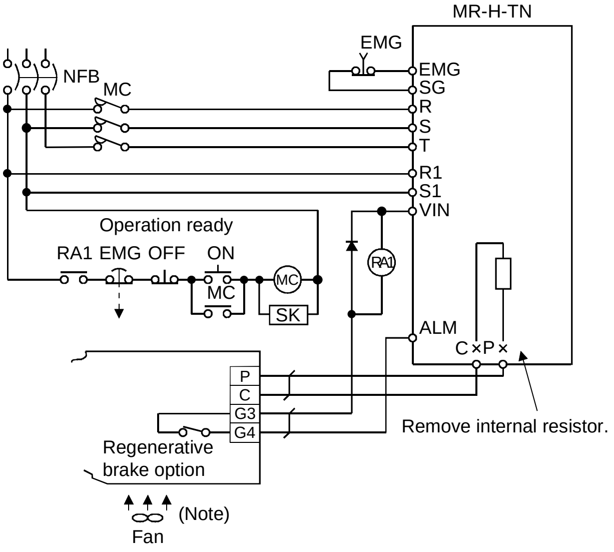
(a) MR-H10TN・MR-H20TN

This servo amplifier does not have the built-in regenerative brake resistor.



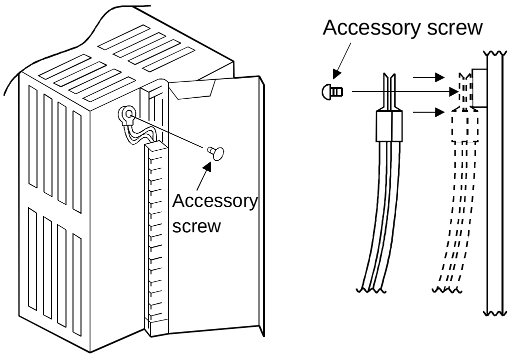
(b) MR-H40TN to MR-H700TN

When any of the MR-RB50 to MR-RB54 is used, the regenerative brake option must be forcibly cooled by the cooling fan.



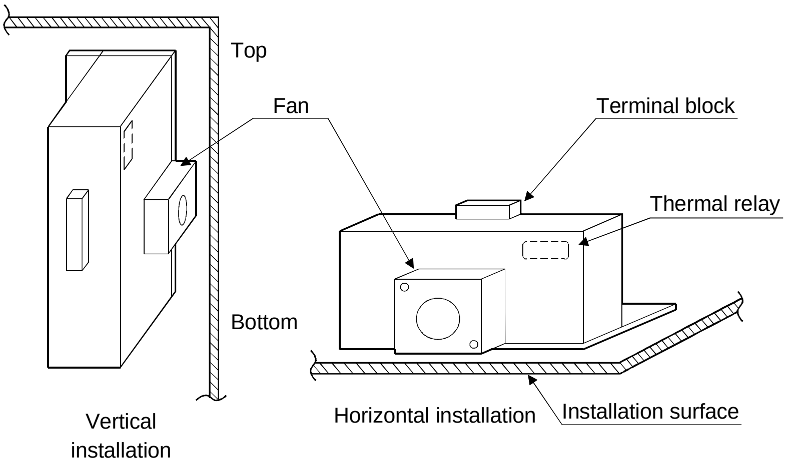
Note: When the MR-RB5□ is used, cool it forcibly by the cooling fan (1.0m^3/min, about □92).

When the regenerative brake option is used, disconnect the cables from the regenerative brake resistor terminals (across C-P) in the servo amplifier and fix them to the area provided at the opposite side on the front cover as shown in the figure below.

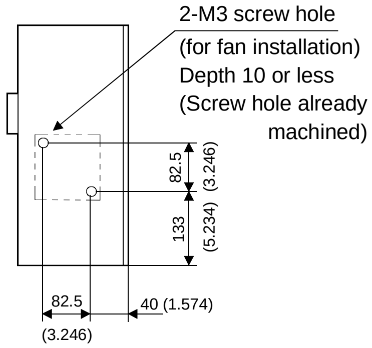


For the MR-RB50, MR-RB51 or MR-RB54, install the cooling fan as shown.

[Unit: mm (in.)]



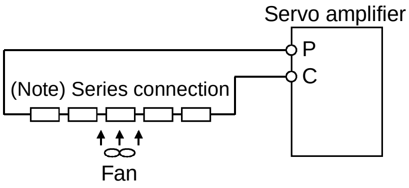
Fan installation screw hole dimensions



Recommended fan:
Toyo Denki's TL396A or equivalent

(c) MR-H11KTN to MR-H22KTN(when using the supplied regenerative brake resistor)

When using the regenerative brake resistors supplied to the servo amplifier, 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 servo amplifier may become faulty and/or the regenerative brake resistors burn. Install the resistors at intervals of about 70mm. Cool the resistors with fans (10m^3/min, □92 ×2 units as reference) to increase the regenerative capability.

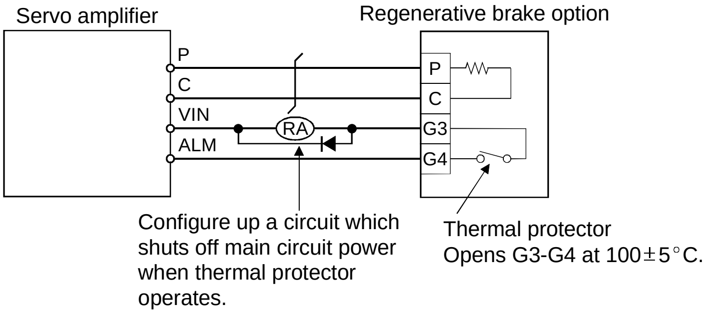


Note:The number of resistors connected in series depends on the resistor type.

Servo amplifier	Regenerative brake resistor	Regenerative power (W)		Resistance (Ω)	Number of resistors
		Normal	Cooling		
MR-H11KTN	GRZG400-2Ω	600	800	8	4
MR-H15KTN	GRZG400-1Ω	600	1300	5	5
MR-H22KTN	GRZG400-0.8Ω	600	1300	4	5

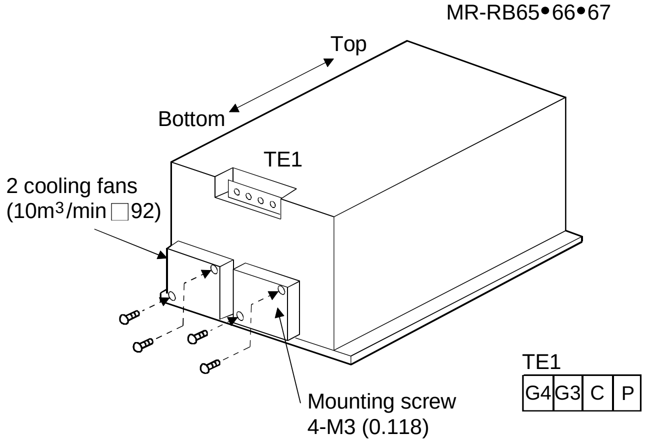
(d) MR-H11KTN-P90 to MR-H22KTN-P90 (when using the regenerative brake option)

Cooling the regenerative brake option with fans improves regenerative capability.



Servo amplifier	Regenerative brake option model	Resistor (Ω)	(Note) Regenerative power	
			Without fans	With fans
MR-H11KTN	MR-RB65	8	500	800
MR-H15KTN	MR-RB66	5	850	1300
MR-H22KTN	MR-RB67	4	850	1300

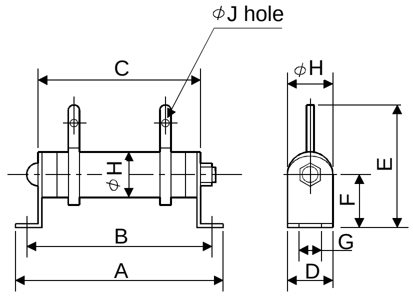
When using fans, install them using the mounting holes provided in the bottom of the regenerative brake option.



(5) Outline dimension drawings

[Unit:mm(in.)]

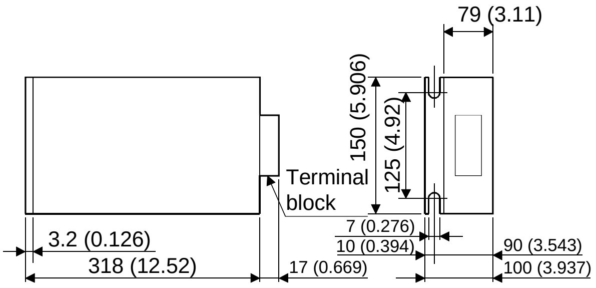
MR-RB013 ▪ MR-RB033



Regene-rative 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

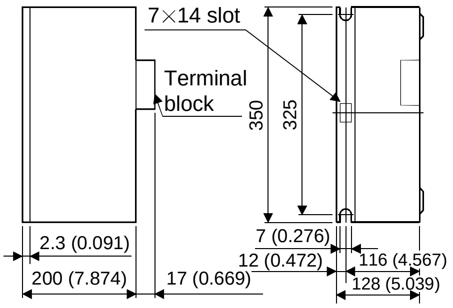
[Unit : mm(in.)]



Regenerative brake option	Weight [kg(lb)]
MR-RB30	2.9 (6.393)
MR-RB31	
MR-RB32	
MR-RB34	

MR-RB50 ▪ MR-RB51 ▪ MR-RB54

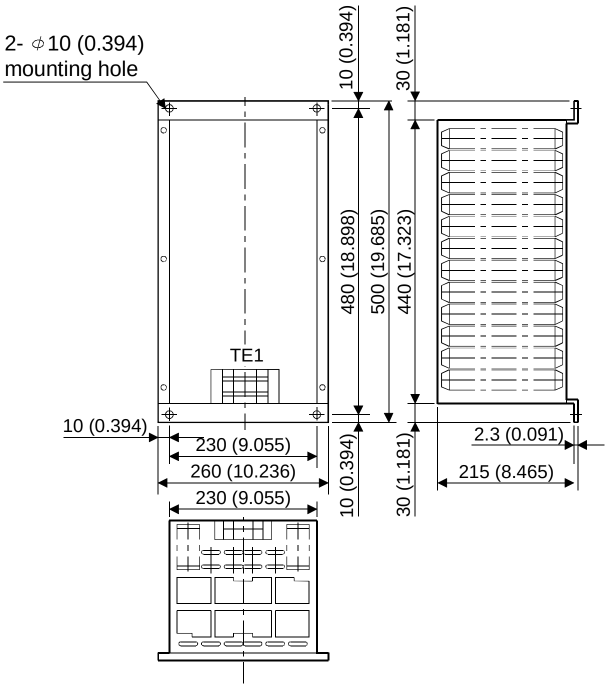
[Unit : mm(in.)]



Regenerative brake option	Weight [kg(lb)]
MR-RB50	5.6 (12.346)
MR-RB51	
MR-RB54	

MR-RB65 ▪ MR-RB66 ▪ MR-RB67

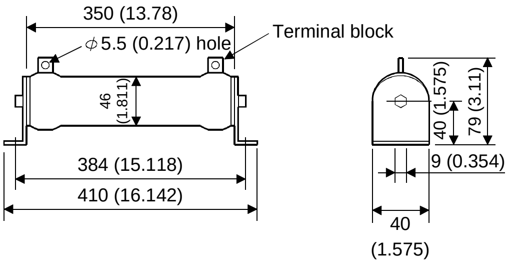
[Unit : mm(in.)]



Regenerative brake option	Weight [kg(Ib)]
MR-RB65	10(22.046)
MR-RB66	11(24.251)
MR-RB67	11(24.251)

GRZG400-2Ω ▪ GRZG400-1Ω ▪ GRZG400-0.8Ω (standard accessories)

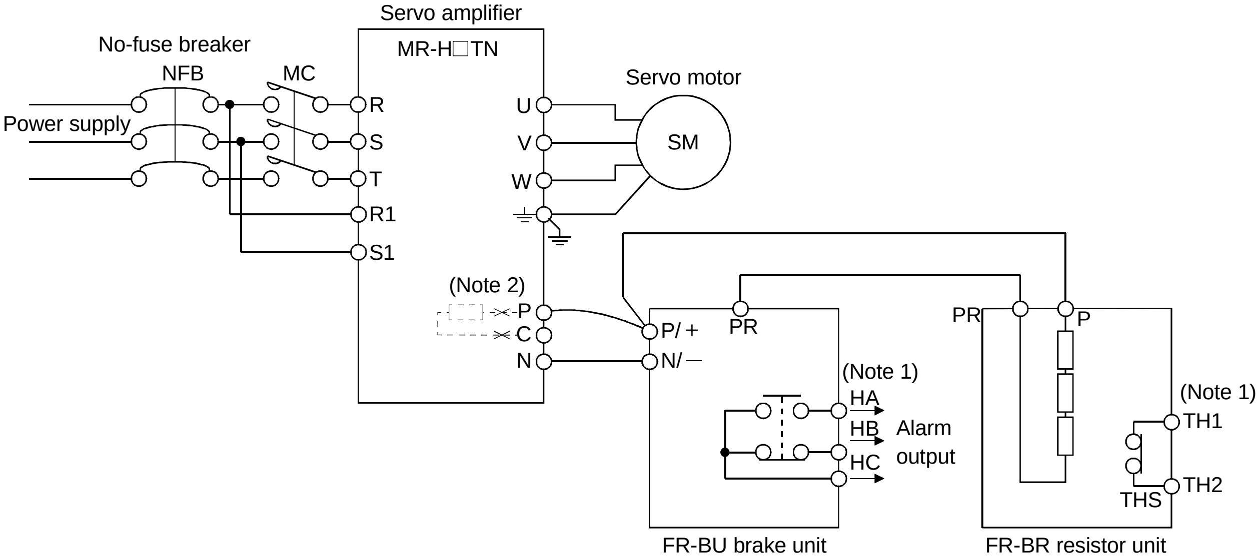
[Unit : mm(in.)]



14.1.3 Brake unit

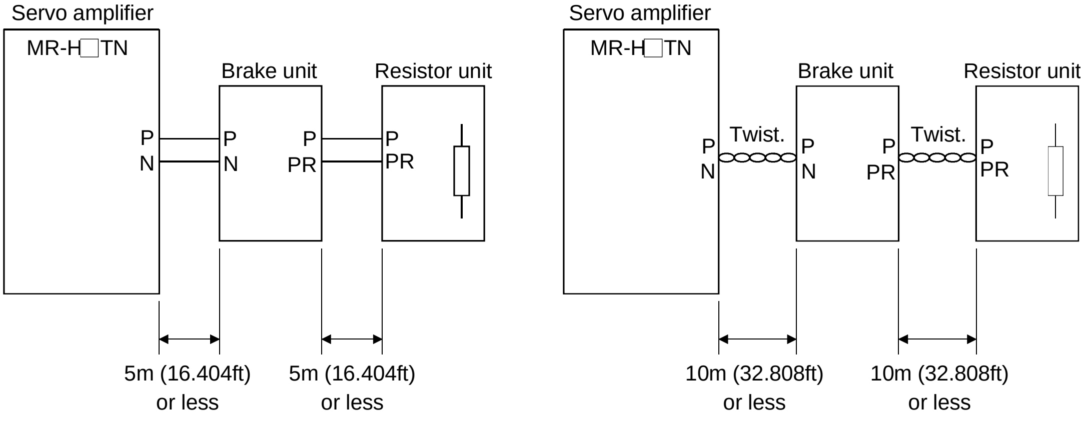
The brake unit is the integration of the regenerative control and resistor and is connected to the bus (across P-N) of the servo amplifier. As compared to the MR-RB regenerative brake option, the brake unit can return larger power. Hence, use the this brake unit when the MR-RB cannot provide sufficient 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 servo amplifier across P-C must be disconnected.
11kW or more does not contain the regenerative brake resistor.

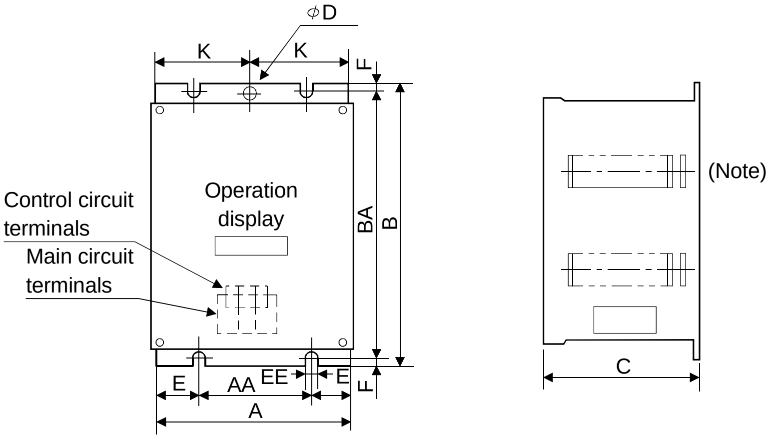
The cables between the servo amplifier and brake unit and between the resistor unit and brake unit should be 5m (16.404ft) of less. The cables longer than 5m (16.404ft) should be twisted.
If twisted, the cables must not be longer than 10m (32.808ft).
The cable size should be equal to or larger than the recommended size. See the brake unit instruction manual. You cannot connect one set of brake unit to two servo amplifiers or two sets of brake units to one servo amplifier.



(2) Outside dimensions

・Brake unit (FR-BU)

[Unit : mm(in.)]

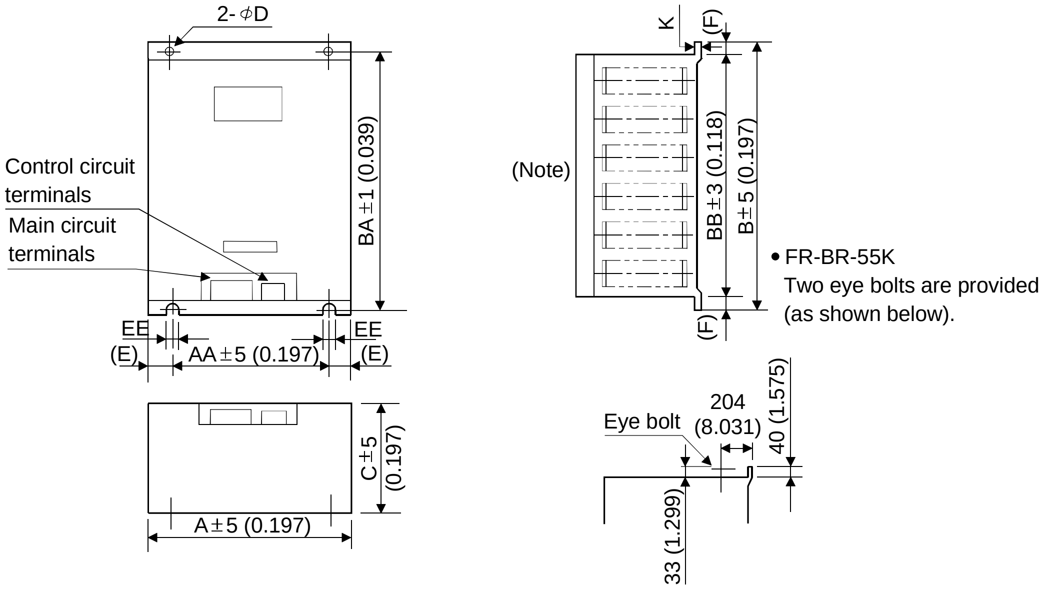


Note:Ventilation ports are provided in both side faces and top face. The bottom face is open.

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.)]



- FR-BR-55K
  Two eye bolts are provided (as shown below).

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

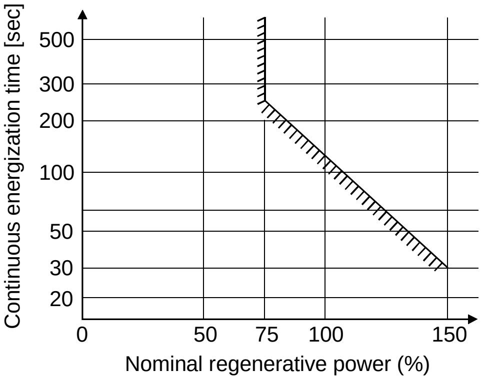
- The brake unit and resistor unit of other than 200V class are not applicable to the servo amplifier.
- The brake unit and resistor unit of the same capacity must be combined. The units of different capacities may result in damage.
- The brake unit and resistor unit must be installed on a vertical surface 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℃. Do not cause cables and combustibles to make contact with the casing.

14.1.4 Power return converter

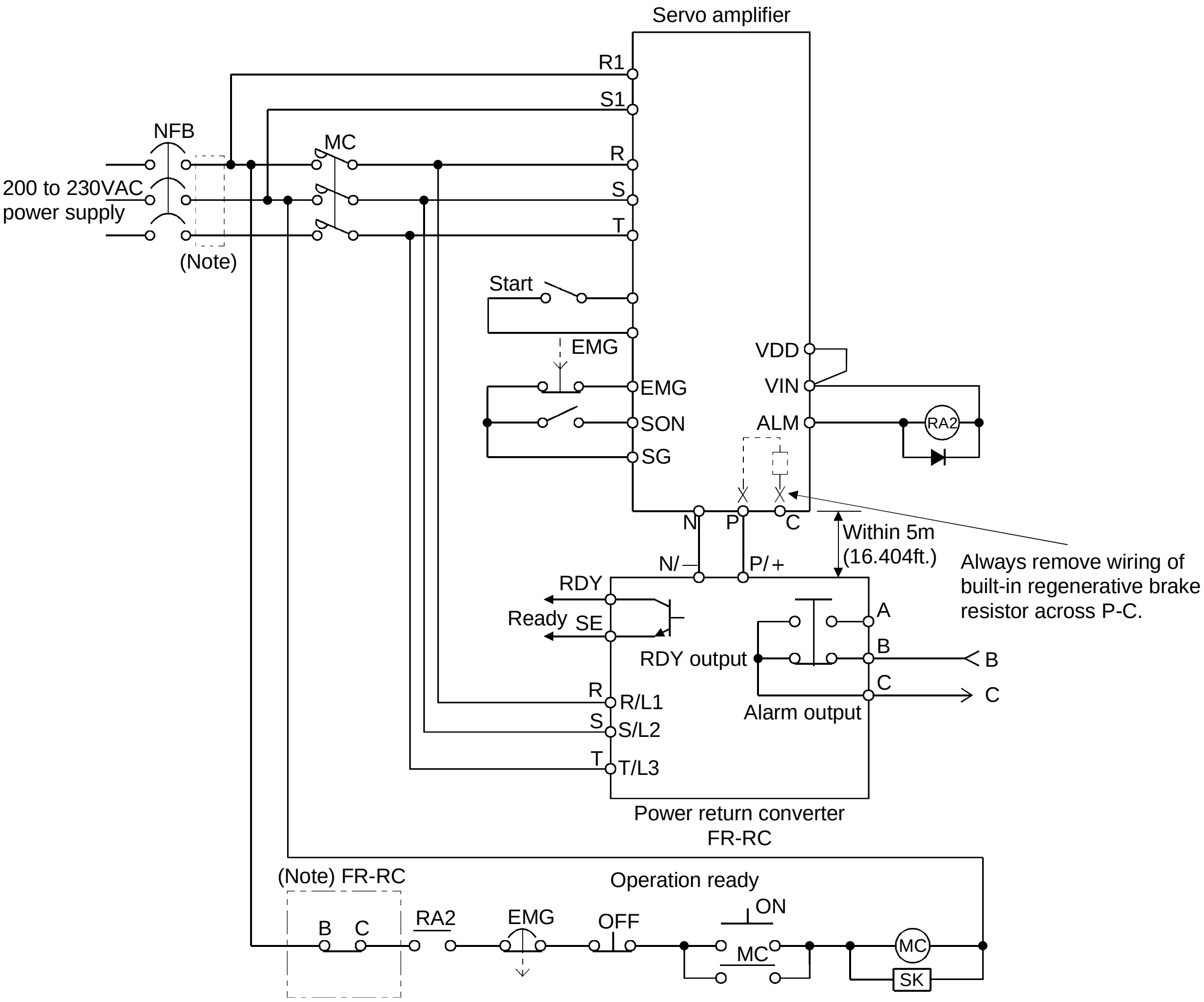
(1) Selection

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 servo amplifiers of the MR-H350TN or more.

Model	Nominal regenerative power (kW)	Applied servo amplifier
FR-RC15	15	MR-H350TN to MR-H700TN
FR-RC30	30	MR-H11KTN MR-H15KTN
FR-RC55	55	MR-H22KTN

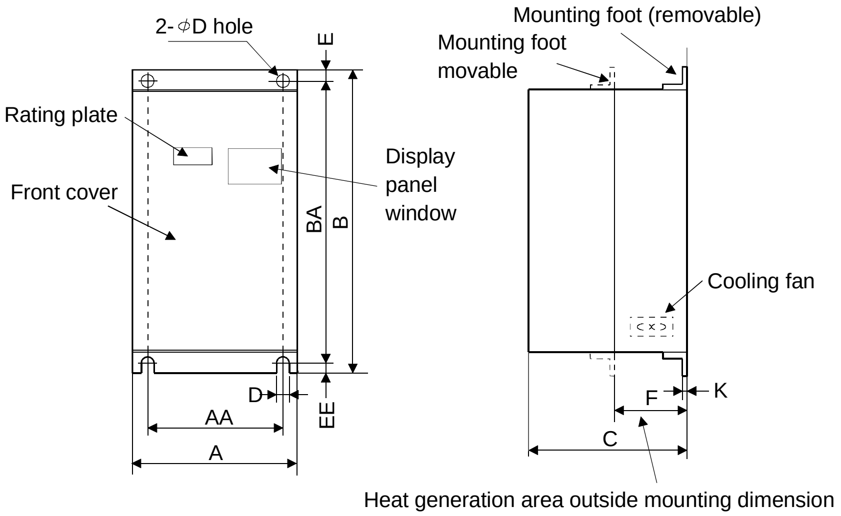


(2) Connection example



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

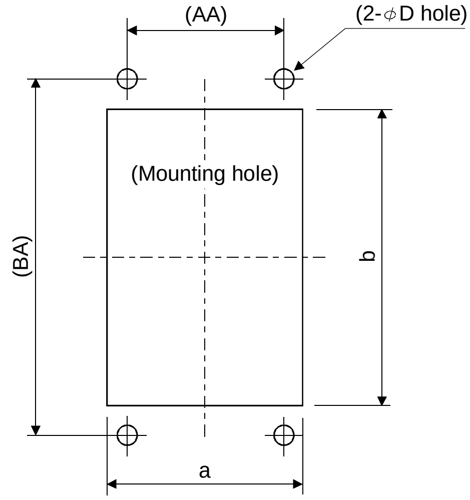


[Unit : mm(in.)]

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 enclosed control 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)

14.1.5 External dynamic brake

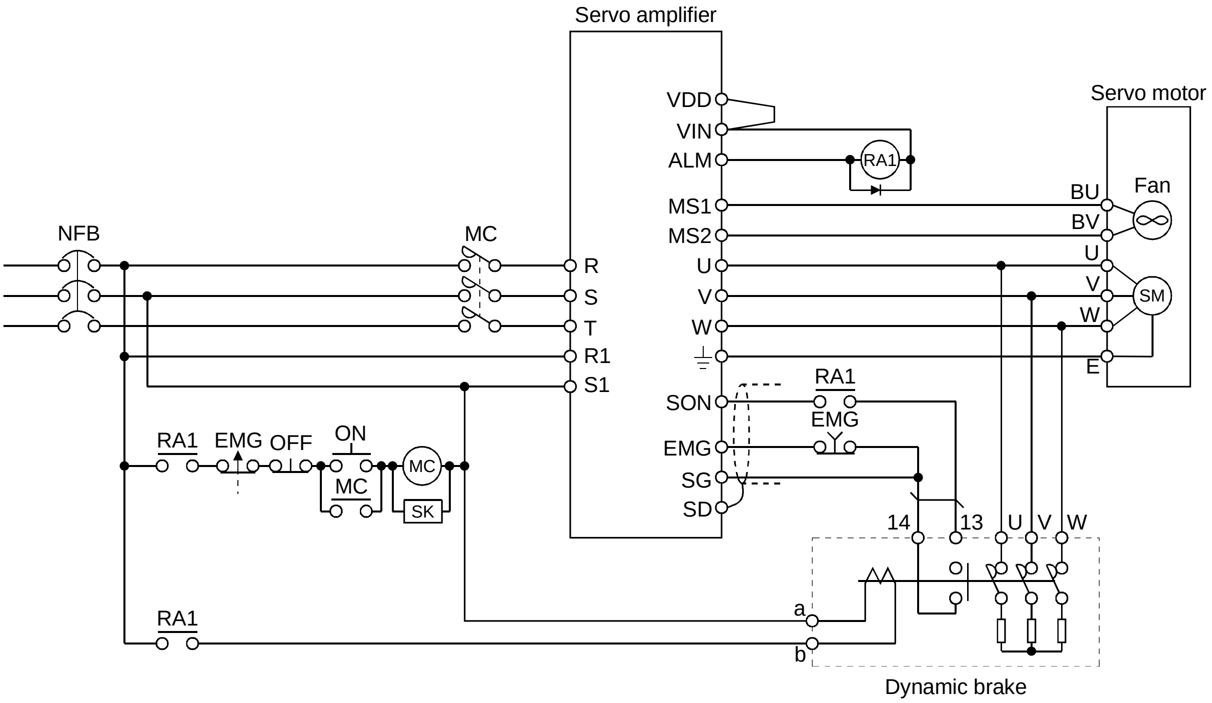
(1) Selection of dynamic brake

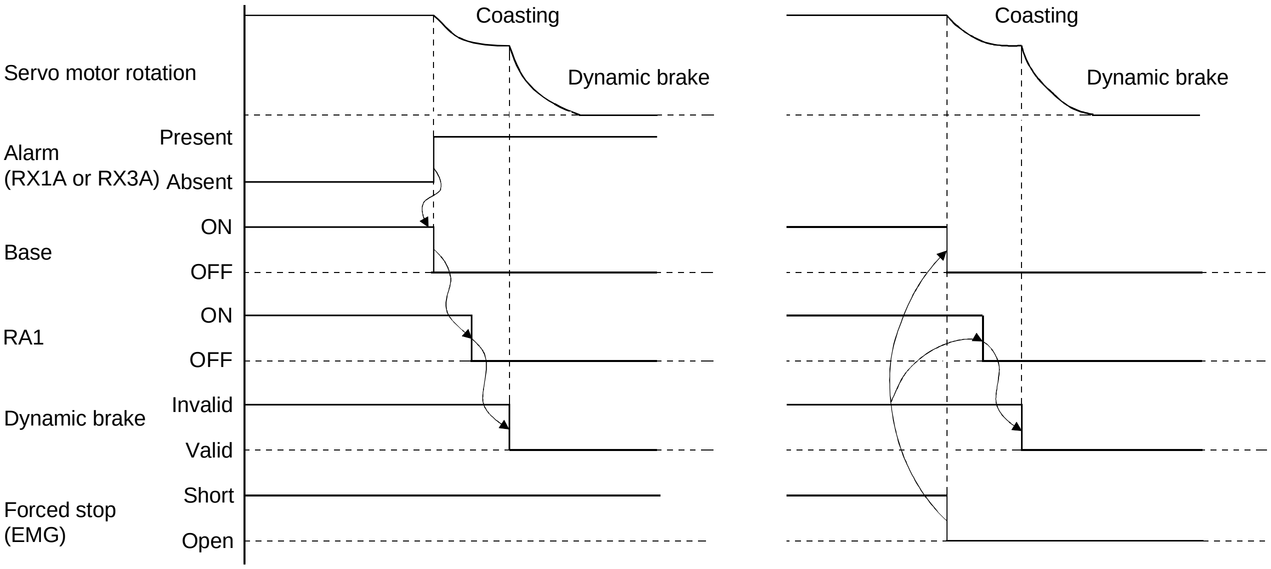
The dynamic brake is designed to bring the motor to a sudden stop when a power failure occurs or the protective circuit is activated. This brake is contained in the servo amplifier of 7kW or less but is not included in the servo amplifier of 11kW or more. When this brake is required, refer to the following 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 servo amplifier of 7kW or less may be used. (Refer to Section 13.3)

Servo amplifier	Dynamic brake
MR-H11KTN	DBU-11K
MR-H15KTN	DBU-15K
MR-H22KTN	DBU-22K

(2) Connection example



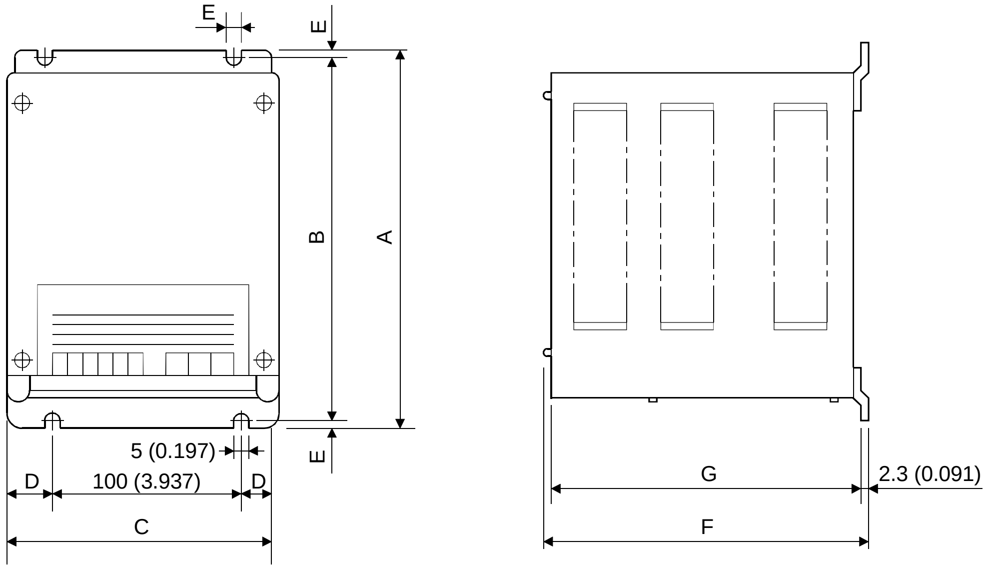


a. Timing chart at alarm (RX1A or RX3A) occurrence

b. Timing chart at forced 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)	190 (7.486)	140 (5.512)	20 (0.787)	5 (0.197)	170 (6.693)	163.5 (6.437)	2 (4.409)	5.5
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

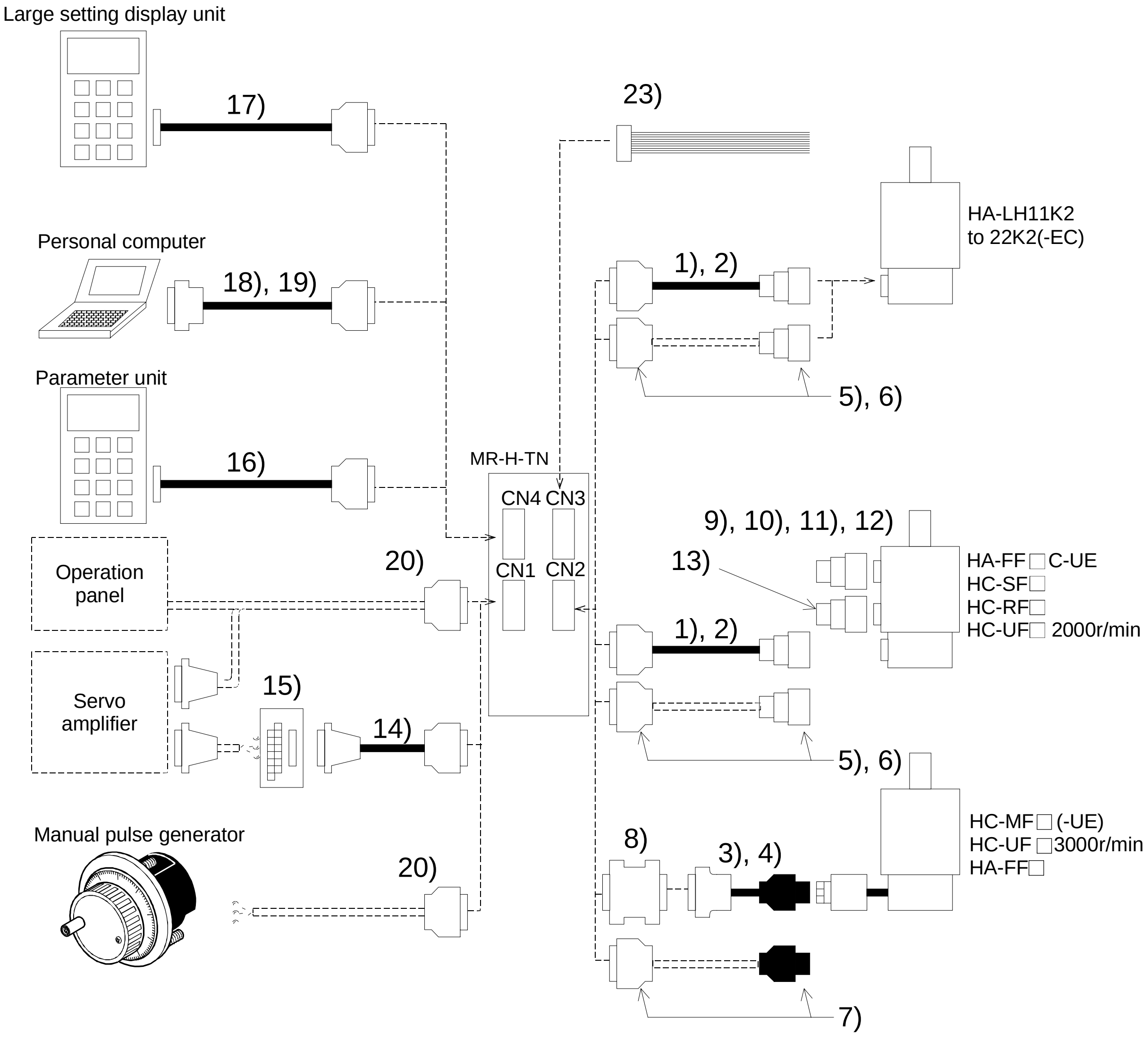
POINT

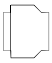
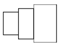
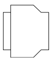
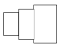
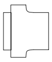
- Configure up a sequence which switches off the contact of the brake unit after (or as same as) it has turned off the servo on signal at a power failure or failure.
- For the braking time taken when the dynamic brake is operated, refer to Section 13.3.
- The brake unit is rated for a short duration. Do not use it for high duty.

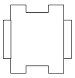
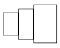
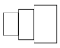
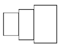
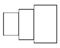
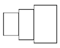
14.1.6 Cables and connectors

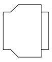
(1) Cable make-up

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.	Servo amplifier 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 IP20
2)	Encoder cable for IP65	MR-EN1CBL□M-H Refer to (2) in this section.	Servo amplifier 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
3)	Standard encoder cable	MR-JCCBL□M-L Refer to (2) in this section.	Servo amplifier side connector (3M make or equivalent) Connector: 10120-3000VE Shell kit: 10320-52F0-008 Encoder side connector (AMP make or equivalent) Housing: 1-172161-9 Connector pin: 170359-1 	Standard flexing life IP20
4)	Long flexing life encoder cable	MR-JCCBL□M-H Refer to (2) in this section.		Long flexing life IP20
5)	Encoder connector set	MR-JSCNS	Servo amplifier 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  	IP20
6)	Encoder connector set	MR-EN1CNS	Servo amplifier 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  	IP65
7)	Encoder connector set	MR-HCNM	Servo amplifier side connector (Honda Tsushin Kogyo make) Connector: PCR-S20FS Cable: PCR-LS20LA1 Encoder side connector (AMP make or equivalent) Housing: 1-172161-9 Pin: 170359-1 Cable clamp: MTI-0002 (Toa Denki Kogyo make)  	IP20

No.	Product name	Model	Description	Application
8)	Conversion connector	MR-HCN2	Servo amplifier side  Encoder cable side	
9)	Power connector set	MR-PWCF Refer to Servo Motor Instruction Manual	 Plug: CE05-6A14S-2SD-B (DDK make) Cable connector: YS014-9 to 11 (Daiwa Dengyo make)	Must be used for compliance with the EN Standard. IP65
10)	Power connector set	MR-PWCNS1 Refer to Servo Motor Instruction Manual	 Plug: CE05-6A22-23SD-B-BSS Cable clamp: CE3057-12A-2(D265) (DDK make)	
11)	Power connector set	MR-PWCNS2 Refer to Servo Motor Instruction Manual	 Plug: CE05-6A24-10SD-B-BSS Cable clamp: CE3057-16A-2(D265) (DDK make)	
12)	Power connector set	MR-PWCNS3 Refer to Servo Motor Instruction Manual	 Plug: CE05-6A32-17SD-B-BSS Cable clamp: CE3057-20A-1(D265) (DDK make)	
13)	Brake connector set	MR-BKCN Refer to Servo Motor Instruction Manual	 Plug: MS3106A10SL-4S(D190) (DDK make) Cable connector: YS010-5 to 8 (Daiwa Dengyo make)	Compliant with the EN standard IP65
14)	Junction terminal block cable	MR-HTBL□M Refer to Section 14.1.7.	Junction terminal block side connector (Izumi Denki make) Connector: JE1S-501 Servo amplifier side connector (Honda Tsushin Kogyo make) Connector: PCR-S50FS Cable: PCR-LS50LA 	
15)	Junction terminal block	MR-TB50	Refer to Section 14.1.7.	
16)	Parameter unit cable	MR-PRUCBL□M Refer to Section 14.1.1.		
17)	Large setting /display unit cable	MR-PRUBCBL□M Refer to Section 14.1.10.	Servo amplifier 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.	Servo amplifier 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.	Servo amplifier 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: DE-C2-J9 	For connection with PC-AT-compatible personal computer
20)	Connector set	MR-HCN1	 Servo amplifier side connector (Honda Tsushin Kogyo make) Connector: PCR-S50FS Cable: PCR-LS50LA	
21)	CN3 cable	MR-H3CBL1M	 Servo amplifier 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 13.4 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) MR-HSCBL☐M (long flexing life product)

This encoder cable is used with the HC-SF, HC-RF, HC-UF2000r/min and HA-FF☐C-UE series servo motors.

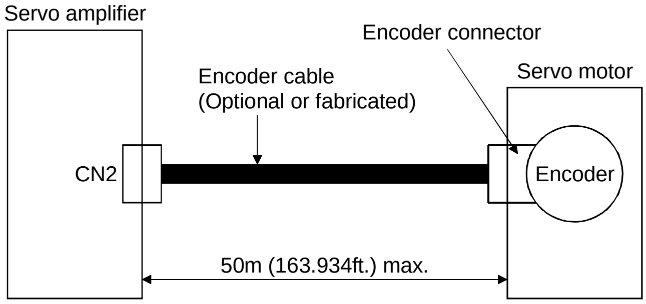
1) Explanation of model name

Model: MR-HSCBL☐M

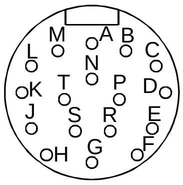
Symbol	Cable length [m (ft.)]
2	2 (6.557)
5	5 (16.393)
10	10 (32.787)
20	20 (65.574)
30	30 (98.361)
40	40 (131.148)
50	50 (163.934)

2) Connection diagram

Refer to Section 4.3.1 or Section 5.3.2 for the servo amplifier side pin assignment.



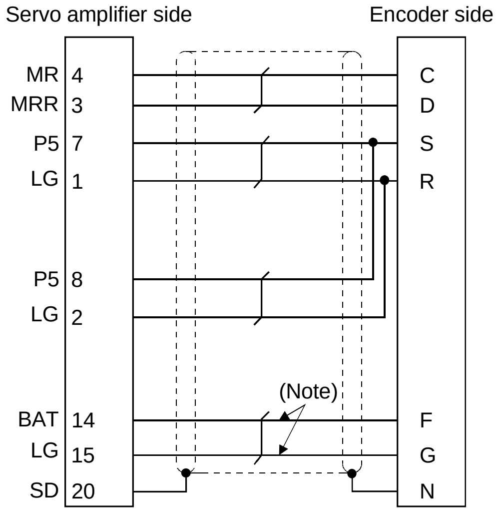
Encoder connector



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

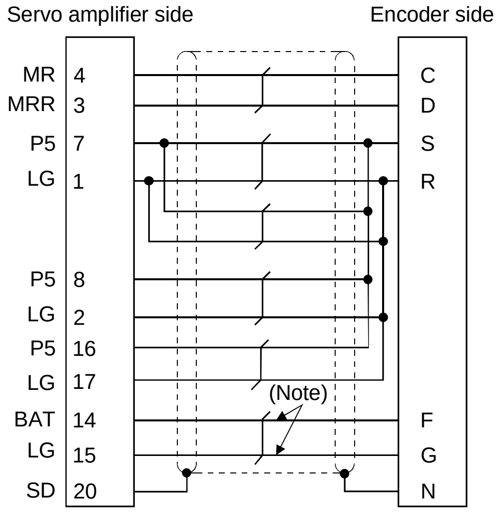
Pin	Signal
K	
L	
M	CNT
N	SHD
P	
R	LG
S	P5
T	

MR-HSCBL2M
MR-HSCBL5M



(10m (32.787ft.) or less)

MR-HSCBL10M to MR-HSCBL50M



(10m (32.787ft.) to 50m (163.934ft.))

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 14.2.1 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 (163.934ft) length including the length of the encoder cable supplied to the servo motor.

(b) MR-EN1CBL☐M-H (long flexing life product)

This encoder cable is used with the HC-SF, HC-RF, HC-UF2000r/min, HA-LH and HA-FF☐C-UE series servo motors.

The servo motor side connector of this encoder cable is IP65 compatible. However, if the cable is used with the HA-FF☐C-UE, motor protection (IP54) does not improve.

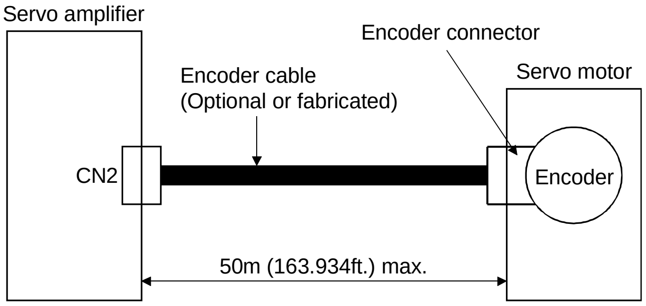
1) Explanation of model name

Model: MR-EN1CBL☐M-H

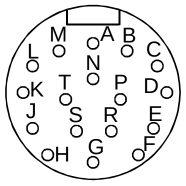
Symbol	Cable length [m (ft.)]
2	2 (6.557ft.)
5	5 (16.393ft.)
10	10 (32.787ft.)
20	20 (65.574ft.)
30	30 (98.361ft.)
40	40 (131.148ft.)
50	50 (163.934ft.)

2) Connection diagram

Refer to Section 4.3.1 or Section 5.3.2 for the servo amplifier side pin assignment.



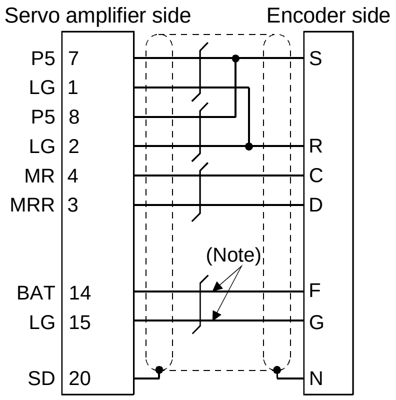
Encoder connector



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

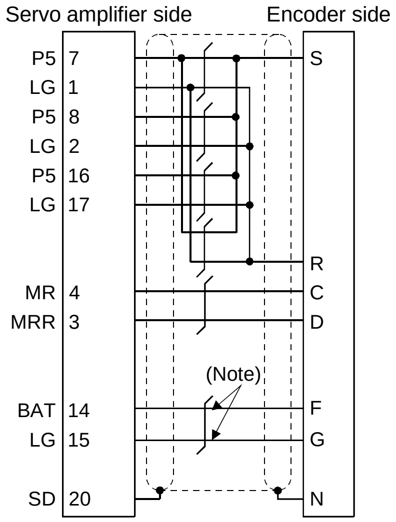
Pin	Signal
K	
L	
M	
N	SHD
P	
R	LG
S	P5
T	

MR-EN1CBL2M-H
MR-EN1CBL5M-H



AWG24 used
(less than 10m (32.787ft.))

MR-EN1CBL10M-H to MR-EN1CBL50M-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.

AWG24 used
(10m (32.787ft.) to
50m (163.934ft.))

When fabricating an encoder cable, use the recommended wires given in Section 14.2.1 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 (163.934ft) length including the length of the encoder cable supplied to the servo motor.

(c) MR-JCCBL□M-L・MR-JCCBL□M-H

These encoder cables are used with the HC-MF, HC-UF3000r/min and HA-FH series servo motors.

1) Explanation of model name

Model: MR-JCCBL□M-□

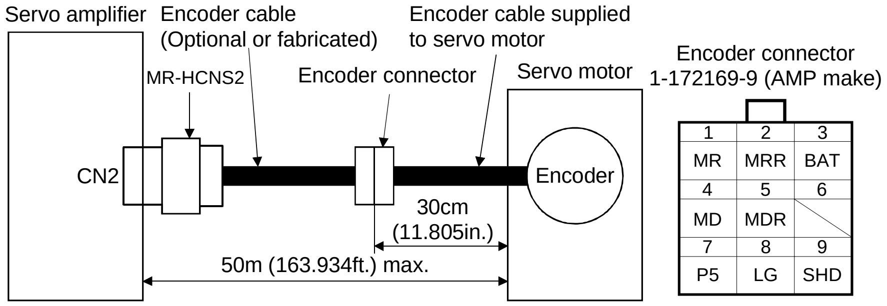
Symbol	Specifications
L	Standard flexing life
H	Long flexing life

Symbol	(Note) Cable length [m (ft.)]
2	2 (6.557)
5	5 (16.393)
10	10 (32.787)
20	20 (65.574)
30	30 (98.361)
40	40 (131.148)
50	50 (163.934)

Note: MR-JCCBL□M-L has no 40 and 50m (131.148 and 163.934ft.) sizes.

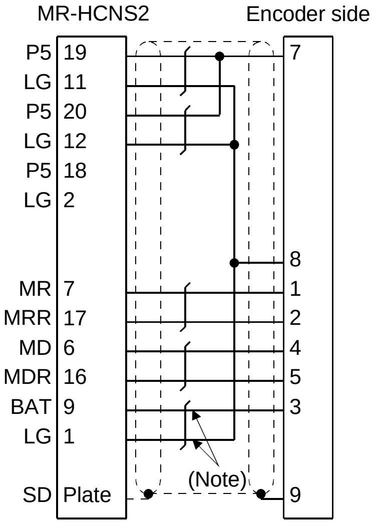
2) Connection diagram

Refer to Section 4.3.1 or Section 5.3.2 for the servo amplifier side pin assignment.

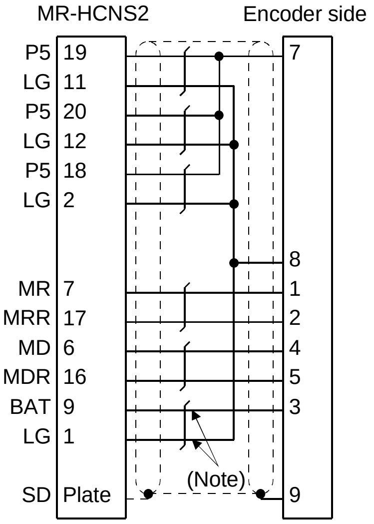


1	2	3
MR	MRR	BAT
4	5	6
MD	MDR	
7	8	9
P5	LG	SHD

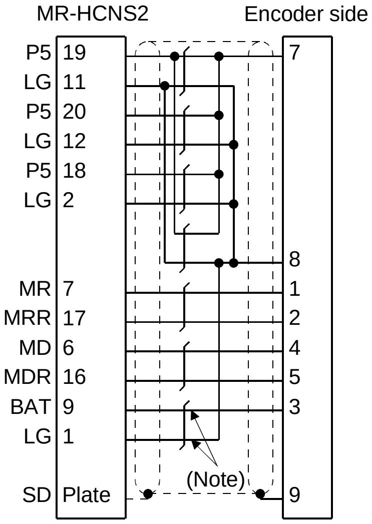
MR-JCCBL2M-L
MR-JCCBL5M-L
MR-JCCBL2M-H
MR-JCCBL5M-H



MR-JCCBL10M-L to MR-JCCBL30M-L



MR-JCCBL10M-H to MR-JCCBL50M-H



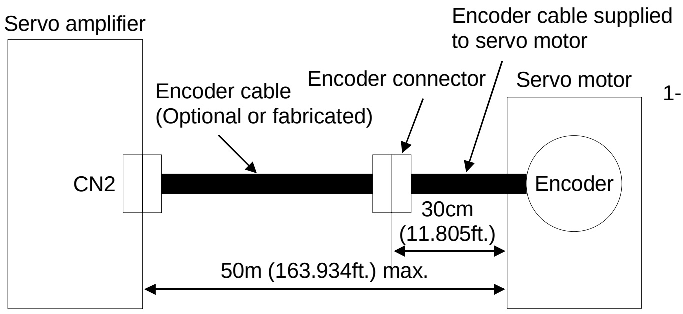
Note: This wiring is required for use in the absolute position detection system.
This wiring is not needed for use in the incremental system.

(e) When using MR-HCNM

This encoder connector set is used with the HC-MF, HC-UF3000r/min and HA-FH series servo motors.

Refer to Section 4.3.1 or Section 5.3.2 for the servo amplifier side pin assignment. Use the recommended wires given in Section 14.2.1 and fabricate the encoder cable in accordance with the connection diagram shown below. In this connection, an up to 50m (163.934ft) long encoder cable including the encoder cable supplied to the servo motor can be fabricated.

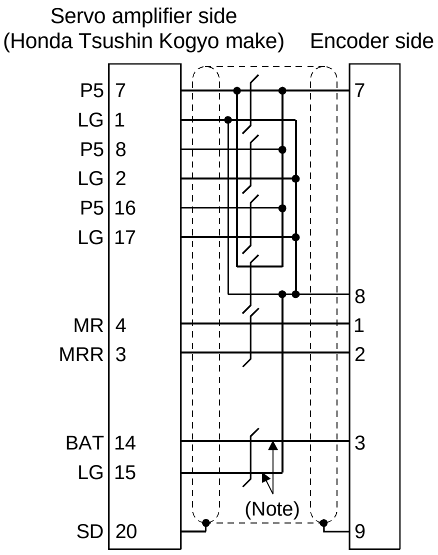
When the encoder cable is to be fabricated by the customer, the wiring of MD and MDR is not required.



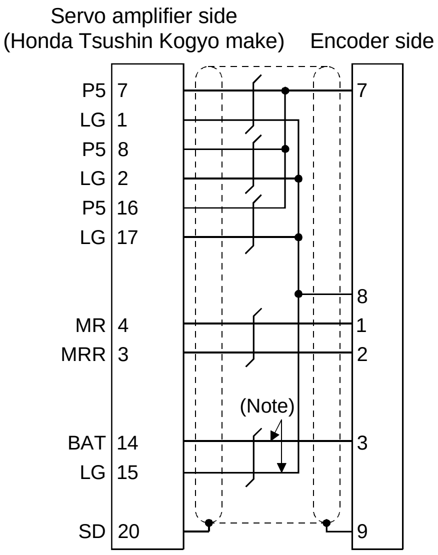
Encoder connector
1-172169-9(AMP make)

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

When using AWG24



When using AWG22



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

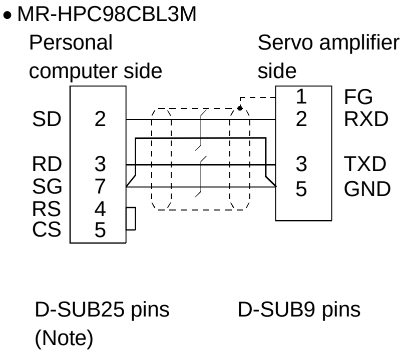
- This cable may not be used with some personal computers. After fully examining the signals of the RS-232C connector, refer to this section and fabricate the cable.

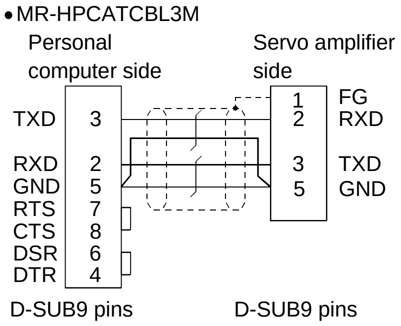
Select the communication cable according to the shape of the RS-232C connector of the personal computer used. When fabricating the cable, refer to the connection diagram in this section.

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



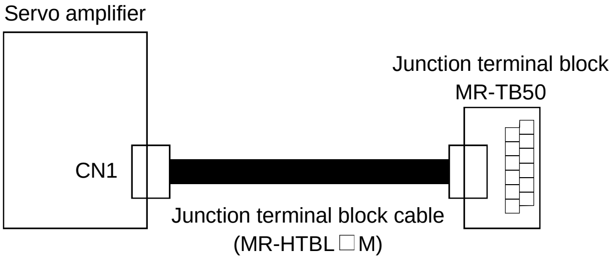


Note: The PC98 Notes having the connector of half-pitch 14 pins are also available.
Confirm the shape of the RS-232C connector of the personal computer used.

14.1.7 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 Section 14.2.6 (3).

(2) Terminal block labels

The junction terminal block does not include the terminal block labels which indicate the signal layouts for MR-H-TN. Cut off the terminal block label in Appendix 2 at the dotted line and fold it up at the centerline for use.

(a) For positioning

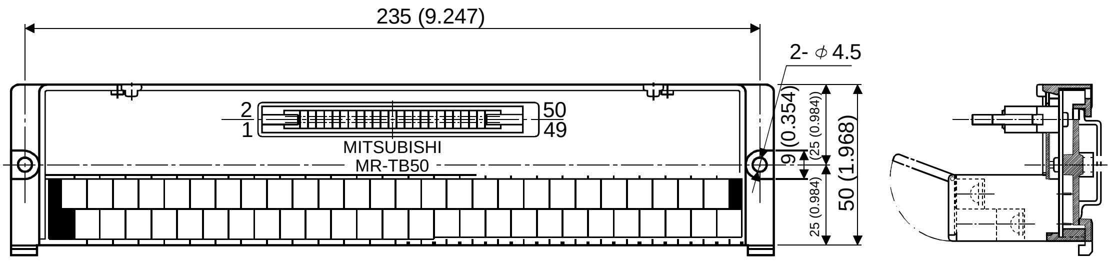
VDD	DOG	PPO	NPO	SG	SG	DI1	LSP	DI0	INP	ALM	MD0	STP	ST2	P15R	LA	LB	LZ	FPA	PPB	N15R	LG			
RD	SG	SG	VDD	VIN	SON	DI2	LSN	CPO	ZP	EMG	ORG	ST1	LG	OP	LAR	LBR	LZR	LG	LG	OVR	TLAP			SD

(b) For roll feeding

VDD	DOG	PPO	NPO	SG	SG	JFS	TL	DEC	INP	ALM	MD0	MD2	ST2	P15R	LA	LB	LZ	FPA	PPB	N15R	LG			
RD	SG	SG	VDD	VIN	SON	STP	PS2	CPO	ZP	EMG	MD1	ST1	LG	OP	LAR	LBR	LZR	LG	LG	OVR	TLAP			SD

(3) Outline drawing

[Unit: mm (inch)]



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

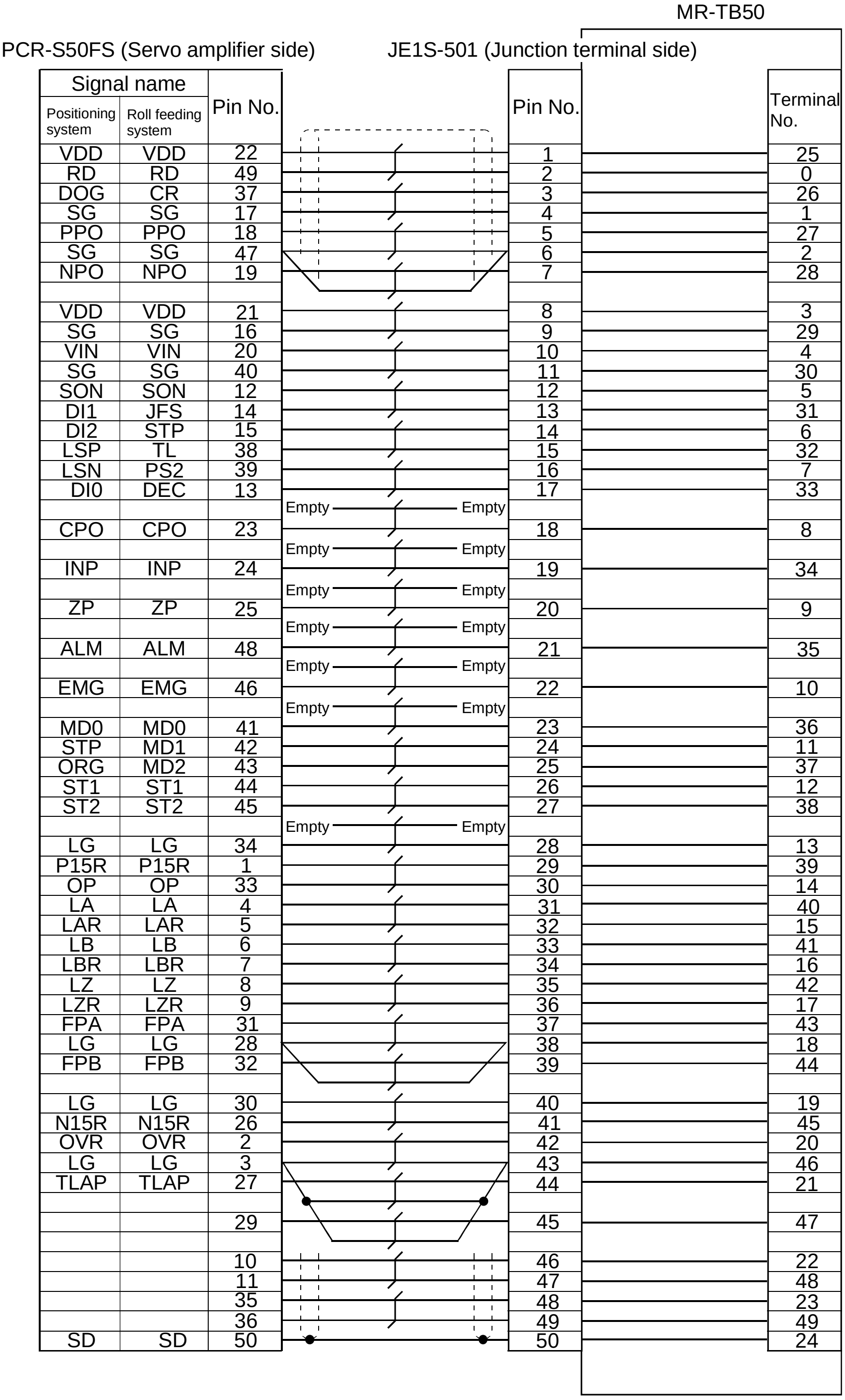
(4) Junction terminal block cable (MR-HTBL□M)

(a) Explanation of model name

Model: MR-HTBL□M

Symbol	Cable length [m (ft.)]
05	0.5 (1.639)
1	1 (3.279)

(b) Connection diagram



MR-TB50

PCR-S50FS (Servo amplifier side)

JE1S-501 (Junction terminal side)

Signal name		Pin No.	Pin No.	Terminal No.
Positioning system	Roll feeding system			
VDD	VDD	22	1	25
RD	RD	49	2	0
DOG	CR	37	3	26
SG	SG	17	4	1
PPO	PPO	18	5	27
SG	SG	47	6	2
NPO	NPO	19	7	28
VDD	VDD	21	8	3
SG	SG	16	9	29
VIN	VIN	20	10	4
SG	SG	40	11	30
SON	SON	12	12	5
DI1	JFS	14	13	31
DI2	STP	15	14	6
LSP	TL	38	15	32
LSN	PS2	39	16	7
DI0	DEC	13	17	33
		Empty	Empty	
CPO	CPO	23	18	8
		Empty	Empty	
INP	INP	24	19	34
		Empty	Empty	
ZP	ZP	25	20	9
		Empty	Empty	
ALM	ALM	48	21	35
		Empty	Empty	
EMG	EMG	46	22	10
		Empty	Empty	
MD0	MD0	41	23	36
STP	MD1	42	24	11
ORG	MD2	43	25	37
ST1	ST1	44	26	12
ST2	ST2	45	27	38
		Empty	Empty	
LG	LG	34	28	13
P15R	P15R	1	29	39
OP	OP	33	30	14
LA	LA	4	31	40
LAR	LAR	5	32	15
LB	LB	6	33	41
LBR	LBR	7	34	16
LZ	LZ	8	35	42
LZR	LZR	9	36	17
FPA	FPA	31	37	43
LG	LG	28	38	18
FPB	FPB	32	39	44
LG	LG	30	40	19
N15R	N15R	26	41	45
OVR	OVR	2	42	20
LG	LG	3	43	46
TLAP	TLAP	27	44	21
		29	45	47
		10	46	22
		11	47	48
		35	48	23
		36	49	49
SD	SD	50	50	24

14.1.8 Servo configuration software

The Servo Configuration software(MRZJW3-SETUP71E) uses the communication function of MR-H-TN 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	9600bps
Monitor	Batch display, high-speed display, graph display The minimum resolution changes with the processing speed of the personal computer.
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

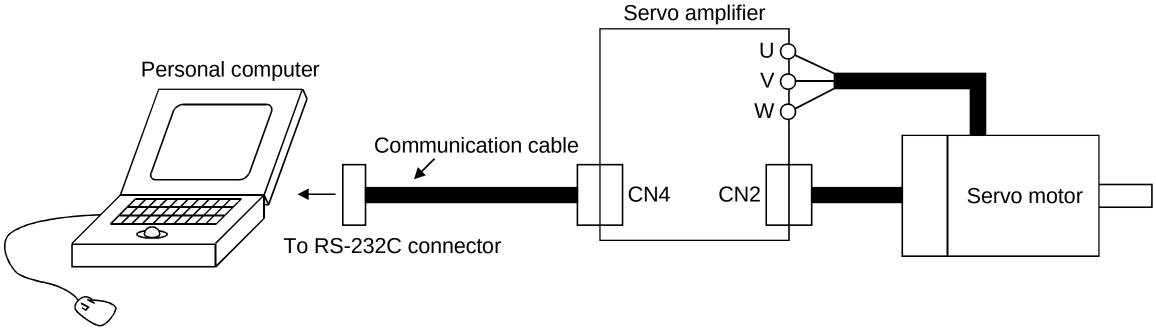
(a) Components

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

Model	Description
Personal computer	Which contains a 80386 or higher CPU and on which Windows 3.1 ・ 95 runs (80486 or higher recommended).Memory: 8MB or more, hard disk: 1MB or more, serial port used.
OS	Windows 3.1 or Windows 95 (English)
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 or Windows 95 (English). Note that a serial mouse is not used.
Printer	Which can be used with Windows 3.1 or Windows 95 (English).
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



14.1.9 Heat sink outside mounting attachment (MR-ACN)

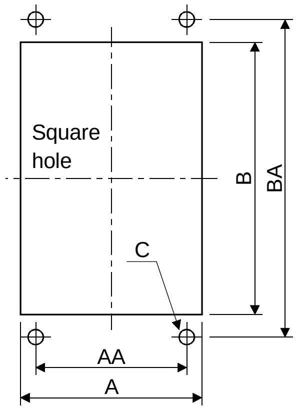
Use the heat sink outside mounting attachment to mount the heat generation area of the servo amplifier in the outside of the control box to dissipate servo amplifier-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed.

In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the servo amplifier with the fitting screws (4 screws supplied), and install the servo amplifier 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 servo amplifier operating environment conditions.

(1) Panel cut dimensions

(a) MR-ACN350 to MR-ACN700

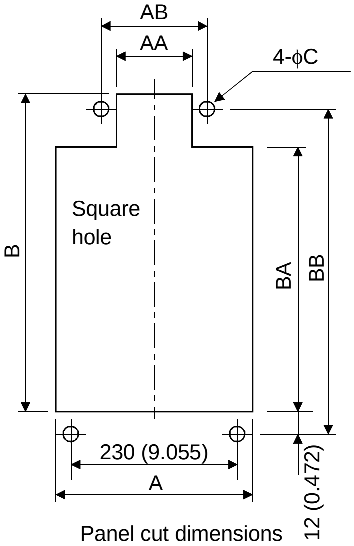


Panel cut dimensions

[Unit: mm (in.)]

Variable dimensions / Model	AA	BA	A	B	C	Servo amplifier
MR-ACN350	117 (4.606)	280 (11.024)	131 (5.157)	265 (10.433)	4-5M	MR-H200TN MR-H350TN
MR-ACN500	100 (3.937)	370 (14.567)	134 (5.276)	355 (13.976)	4-5M	MR-H500TN
MR-ACN700	170 (6.693)	380 (14.961)	222 (8.740)	360 (14.173)	4-5M	MR-H700TN

(b) MR-ACN11K, MR-ACN22K



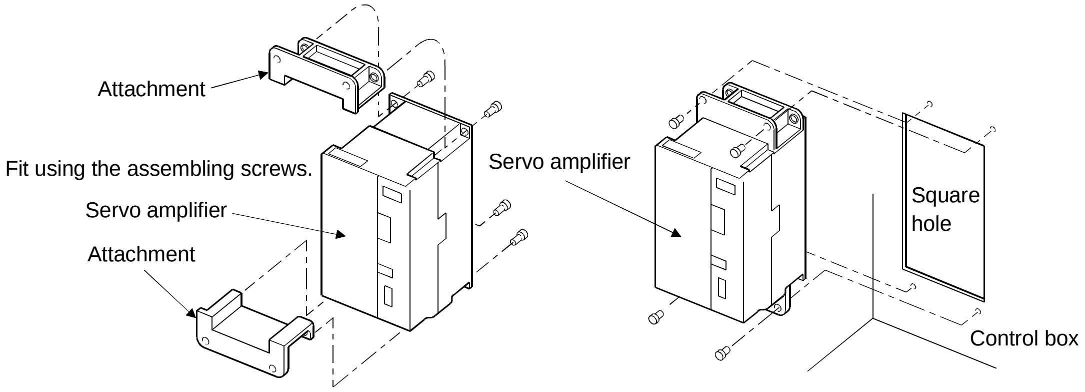
Panel cut dimensions

[Unit: mm (in.)]

Variable dimensions / Model	A	AA	AB	B	BA	BB	C	Servo amplifier
MR-ACN11K	250 (9.843)	190 (7.480)	230 (9.055)	553 (21.772)	483 (19.016)	523 (20.591)	4-M8	MR-H11KTN
MR-ACN22K	340 (13.386)	284 (11.181)	308 (12.126)	556 (21.890)	483 (19.016)	526 (20.724)	4-M10	MR-H15KTN MR-H22KTN

(1) Fitting method

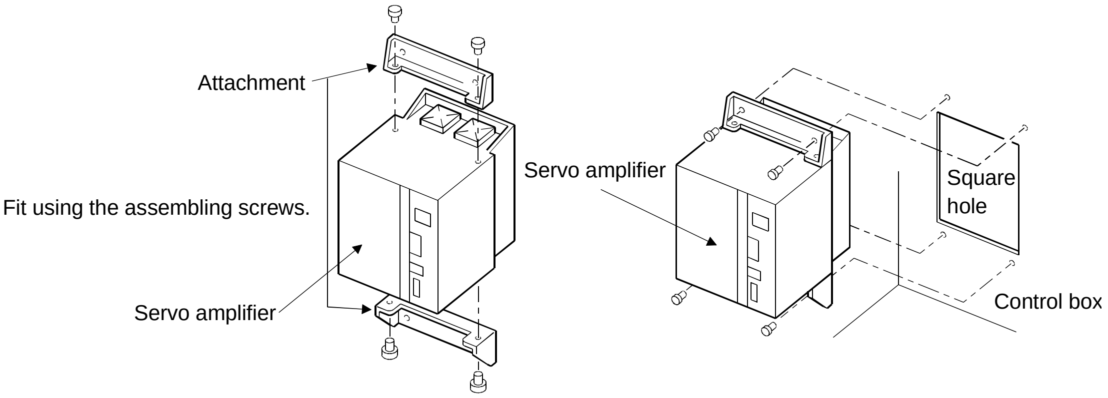
(a) MR-ACN350 (for MR-H200TN, MR-H350TN)



a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

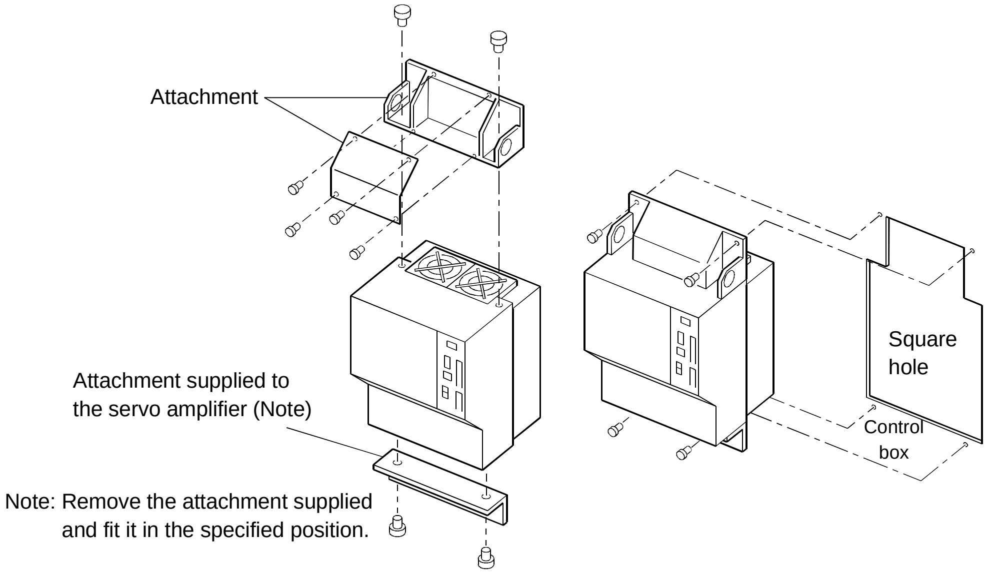
(b) MR-ACN500 (for MR-H500TN), MR-ACN700 (for MR-H700TN)



a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

(c) MR-ACN11K (for MR-H11KTN), MR-ACN22K (for MR-H15KTN, MR-H22KTN)



Note: Remove the attachment supplied and fit it in the specified position.

a. Assembling the heat sink outside mounting attachment

b.Installation to the control box

14.1.10 Large setting/display unit (MR-PRU02)

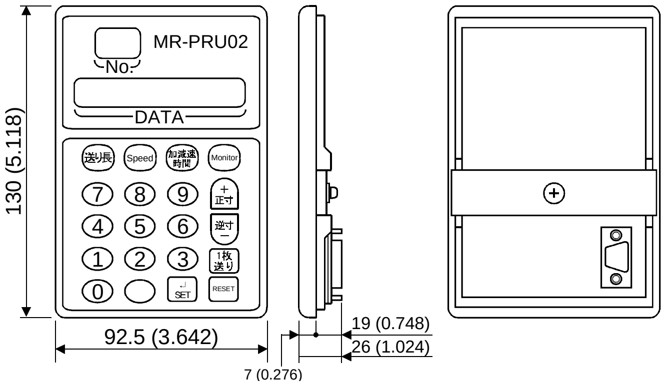
When using the MR-H-TN in the roll feeding system, the MR-PRU02 allows status display, test operation, and reference to point table data. For details of its usage, refer to the installation guide of the MR-PRU02 large setting/display unit.
Use it with the large setting/display unit cable (MR-PRUBCBL☐M).

(1) Specification

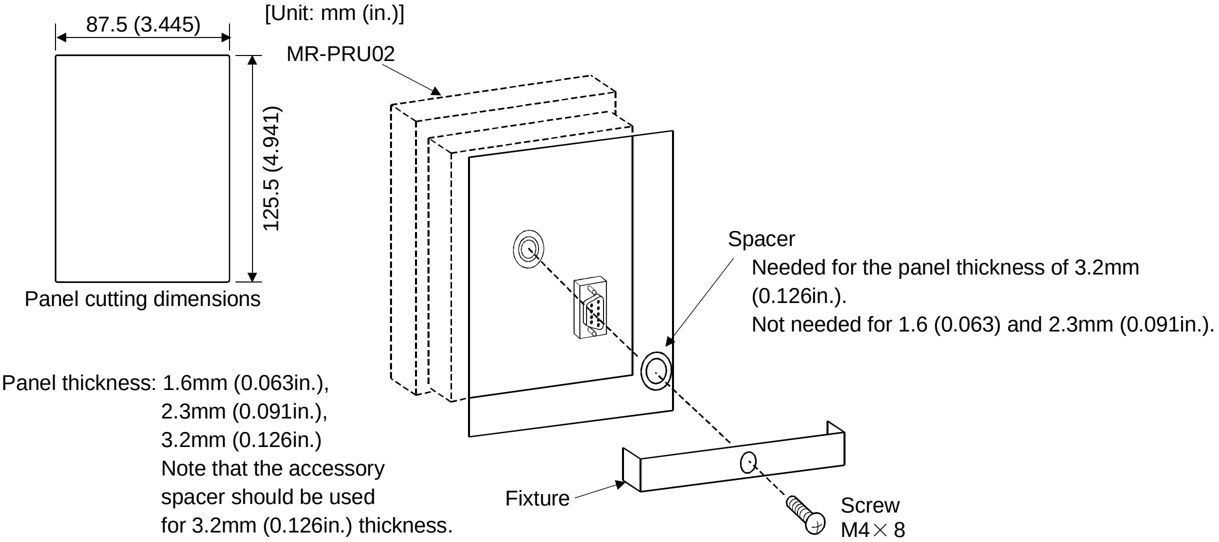
Item		Specification
Model		MR-PRU02
Function	Manual operation	JOG operation, 1 step feed operation
	Status display	Current position, Command position, Command remaining distance, Override, Position block, Command pulse value, Machine speed, Droop pulse, Torque limit command voltage, Regenerative load 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 [℃] (non-freezing)
		32 to +131 [℉] (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature	−20 to +65 [℃] (non-freezing)
		−4 to +149 [℉] (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 Thickness [mm(in)]		1.6(0.063),2.3(0.091),3.2(0.126)
Weight [g(oz)]		130(4.586)

(2) Outline drawing

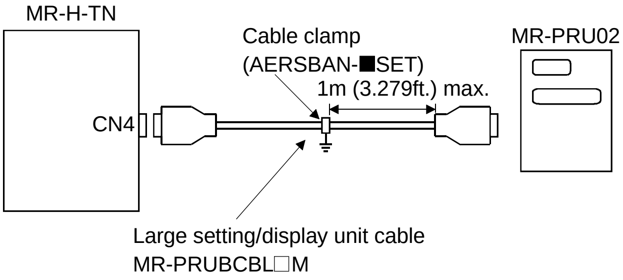
[Unit: mm (in.)]



(3) Panel cutting/fitting method



(4) Makeup



POINT

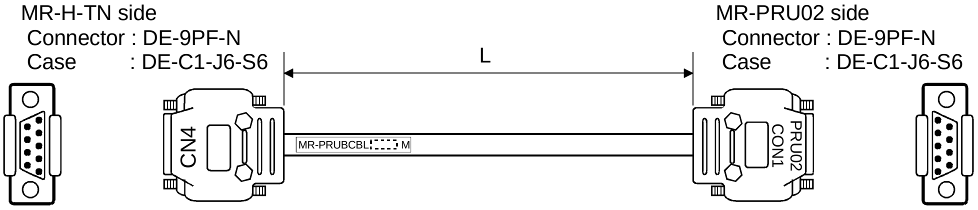
- If noise is generated to malfunction the equipment, use the cable clamp (AERSBAN-■SET) to suppress noise. Use the cable clamp fixture in accordance with Section 14.2.6, (3).

(5) Large setting/display unit cable

Used to connect the large setting/display unit and MR-H-TN.

Model: MR-PRUBCBL□M

Symbol	Cable length L [m (in.)]
3	3 (9.843)
5	5 (16.404)

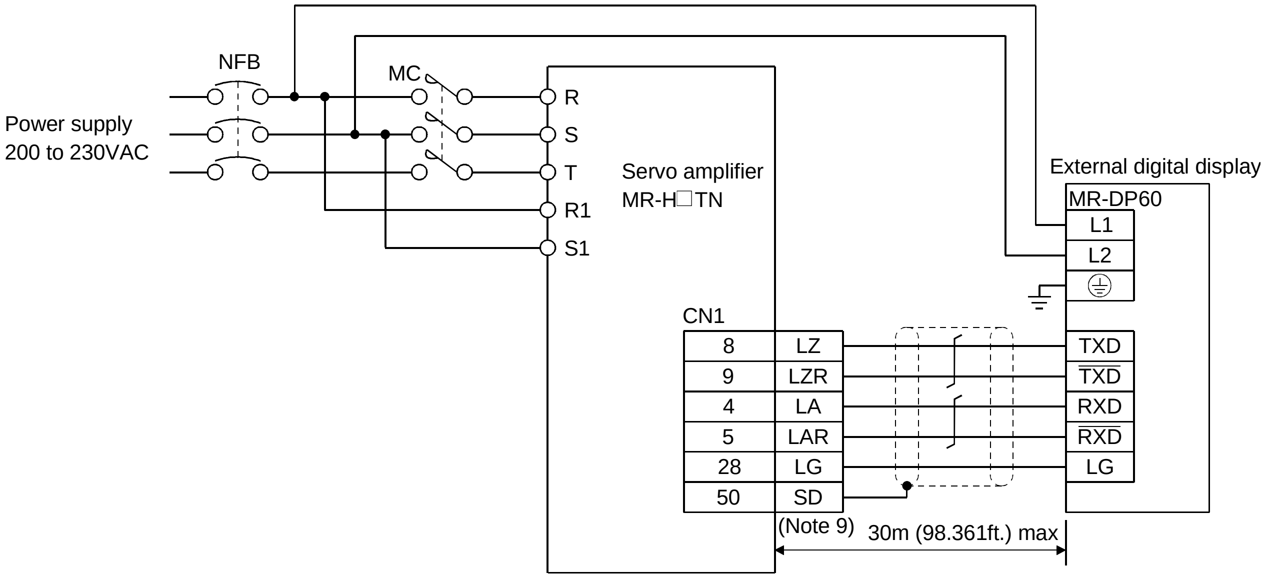


14.1.11 External digital display (MR-DP60)

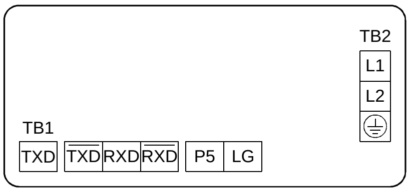
(1) Specifications

Item		Specifications
Display		Red 7-segment LED, signed 6 digits
Power supply	Permissible voltage fluctuation	Single phase, 85 to 253VAC, 50/60Hz
	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 protocol
	Communication commands	Commands dedicated to the MELSERVO
Operating temperature range		0℃ to +60℃, 90%RH or less, non-condensing
Storage temperature range		−5℃ to +70℃

(2) Connection example



(3) Terminal layout

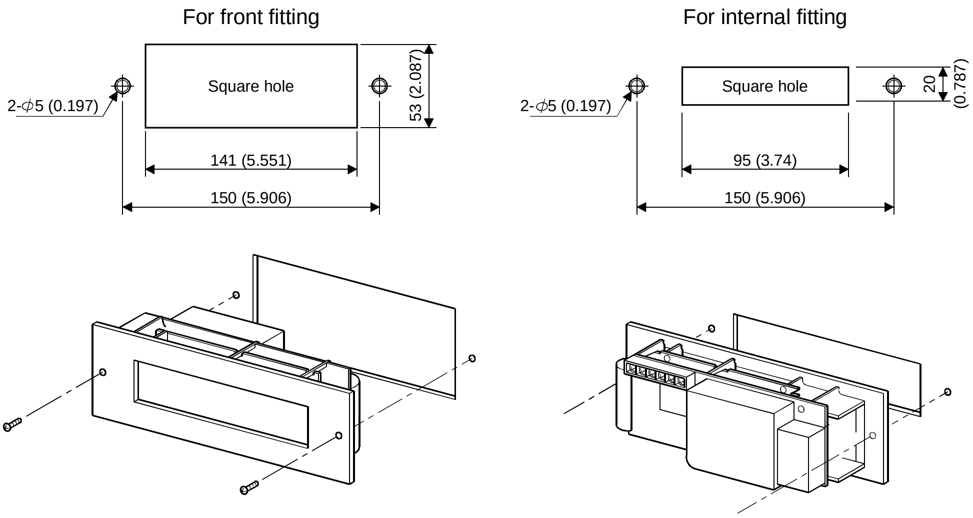


Signal	Description
L1	Single-phase, 100 to 230VAC power input
L2	
⏚	Earth
RXD	Receive signal input
$\overline{\text{RXD}}$	Inverse receive signal input
$\overline{\text{TXD}}$	Inverse transmission signal output
TXD	Transmission signal output
P5	5VDC output (Note)
LG	Control common

Note:The 5VDC output is used for the internal control circuit to check voltage, etc. Do not use this terminal to supply voltage to the other equipment.

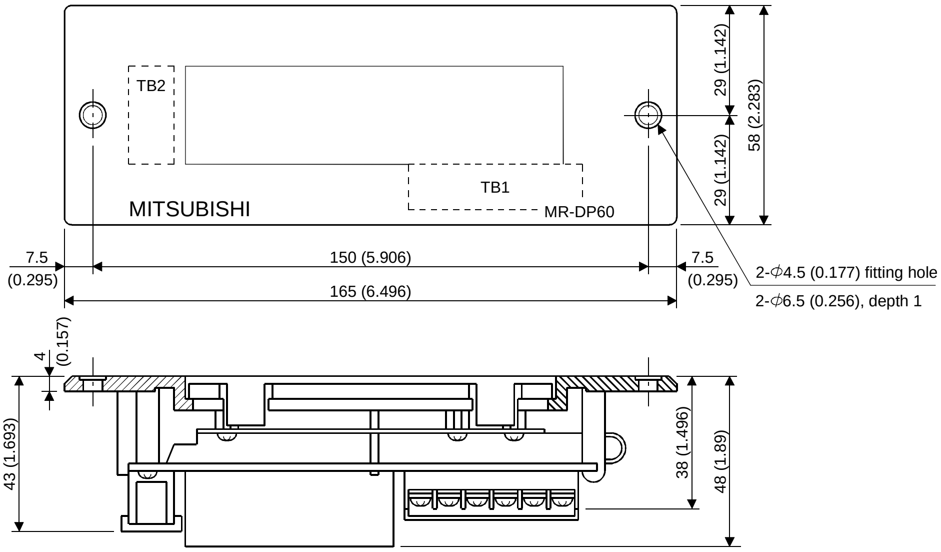
(4) Fitting

[Unit: mm (in.)]



(5) Outline dimensional drawing

[Unit: mm (in.)]



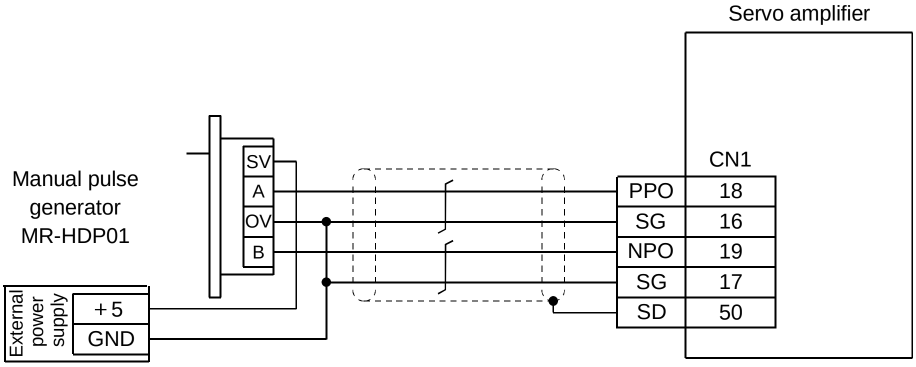
14.1.12 Manual pulse generator (MR-HDP01)

(1) Specifications

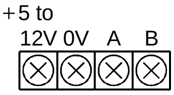
Item		Specifications
Power supply	Voltage	4.5 to 13.2VDC
	Current consumption	60mA or less
Interface		Output current max. 20mA for open collector output
Pulse signal form		A phase, B phase, 2 signals of 90° phase difference
Pulse resolution		100P/rev
Max. speed		Max. 600r/min instantaneously, 200r/min normally
Operating temperature range		−10℃ to +60℃
Storage temperature range		−30℃ to + 80℃

(2) Connection example

Supply external power to the manual pulse generator.

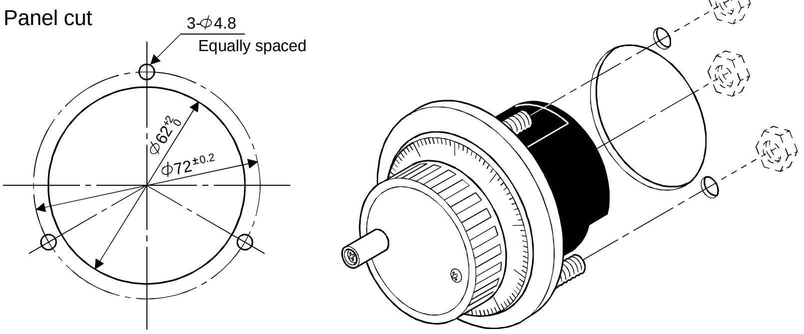


(3) Terminal layout



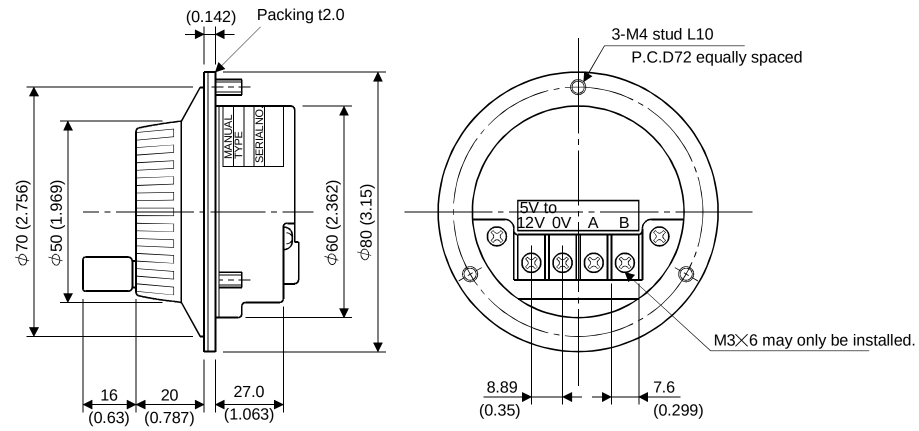
Signal	Description
+5 to 12V	Power input
0V	Common for power and signal
A	A-phase pulse output
B	B-phase pulse output

(4) Installation



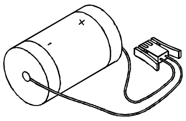
(5) Outline drawing

[Unit: mm(in.)]



14.1.13 Battery (MR-BAT, A6BAT)

Used to configure up the absolute position detection system.



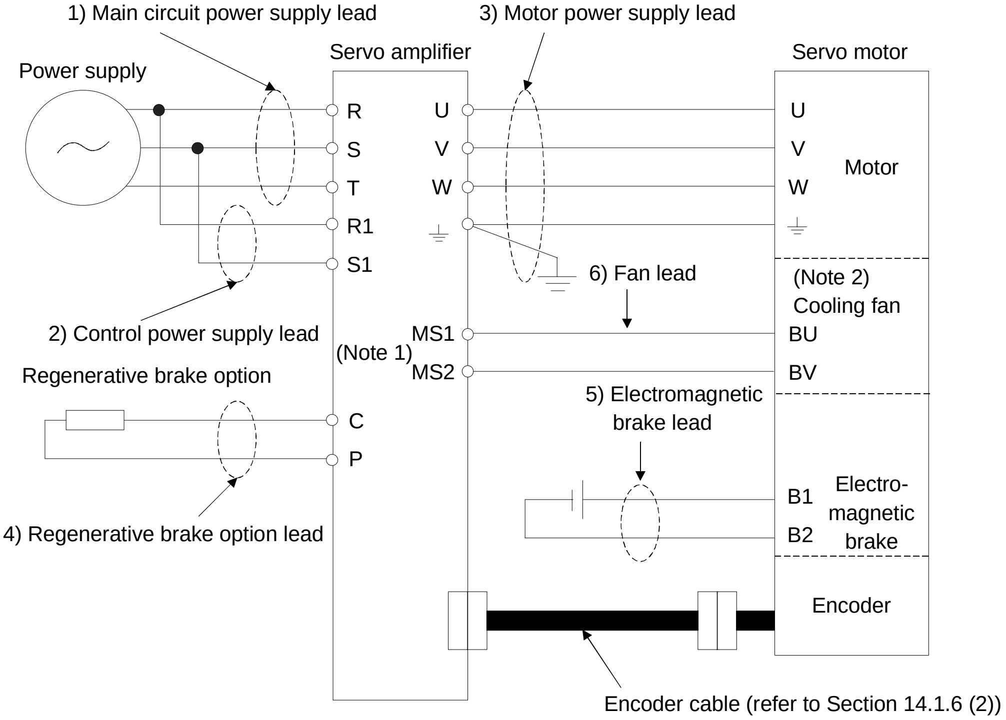
14.2 Auxiliary equipment

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

14.2.1 Recommended wires

(1) Wires for power supply wiring

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



Note: 1. Provided for the 11kW and more servo amplifier.
2. Provided for the HA-LH11KA to 22KA servo motors.

The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m (98.361ft) max. If the wiring distance is over 30m (98.361ft) , 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 3.3.

The crimping terminals used with the U, V and W wires for the servo amplifier should be those of Japan Crimping Terminal's 22-S5 or equivalent.

Tale 14.1 Recommended Wires

Servo amplifier	Wires [mm^2]					
	1) R ▪ S ▪ T	2) R1 ▪ S1	3) U ▪ V ▪ W ▪ ⏚	4) P ▪ C	5) B1 ▪ B2	6) BU ▪ BV
MR-H10TN	2 (AWG14)	2 (AWG14)	1.25 (AWG16)	2 (AWG14)	1.25 (AWG10)	
MR-H20TN						
MR-H40TN						
MR-H60TN						
MR-H100TN			2 (AWG14)			
MR-H200TN	3.5 (AWG12)		3.5 (AWG12)			
MR-H350TN	5.5 (AWG10)		(Note) 5.5 (AWG10)			
MR-H500TN			5.5 (AWG10)			
MR-H700TN	8 (AWG8)		8 (AWG8)	3.5 (AWG12)		2 (AWG14)
MR-H11KTN	14 (AWG6)		22 (AWG4)	5.5 (AWG10)		
MR-H15KTN	22 (AWG4)		30 (AWG2)			
MR-H22KTN	50 (AWG1/0)		60 (AWG2/0)			

Note:3.5mm^2 (AWG12) 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 [mm^2]
FR-BU-15K	3.5 (AWG12)
FR-BU-30K	5.5 (AWG10)
FR-BU-55K	14 (AWG6)
FR-RC-15K	14 (AWG1/0)

(2) Wires for cables

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

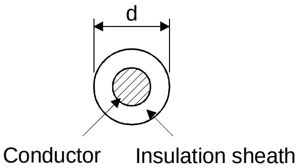
Table 14.2 Wires for Option Cables

Type	Model	Length [m(ft)]	Wire model
Encoder cable	MR-JCCBL□M-L	2 to 10 (6.557 to 32.787)	UL20276 AWG#28 7pair(BLAC)
		20 ▪ 30 (65.574 ▪ 98.361)	UL20276 AWG#22 6pair(BLAC)
	MR-JCCBL□M-H	2 ▪ 5 (6.557 ▪ 16.393)	A14B2343 6P
		10 to 50 (32.787 ▪ 163.934)	A14B0238 7P
	MR-HSCBL□M	2 ▪ 5 (6.557 ▪ 16.393)	A14B2339 4P
		10 to 50 (32.787 to 163.934)	A14B2343 6P
	MR-EN1CBL□M-H	2 ▪ 5 (6.557 ▪ 16.393)	A14B2339 4P
		10 to 50 (32.787 ▪ 163.934)	A14B2343 6P
Communication cable	MR-HPC98CBL3M	3 (9.843)	TKVVBS(P) 0.2mm^2×2p
	MR-HPCATCBL3M	3 (9.843)	TKVVBS(P) 0.2mm^2×2p

Table 14.3 Wire Specifications

(Note 2) Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			(Note 3) Finish outline [mm]
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulation sheath outline d [mm](Note 1)	
UL20276 AWG#28 7pair (BLAC)	0.08	14 pcs. (7 pairs)	7/0.127	222 or less	0.38	5.6
UL20276 AWG#22 6pair (BLAC)	0.3	12 pcs. (6 pairs)	12/0.18	62 or less	1.2	8.2
TKVVBS(P) 0.2mm^2×2p	0.2	4 pcs. (2 pairs)	7/0.18	119 or less	0.54	5.9
A14B2343 6P	0.2	12 pcs. (6 pairs)	40/0.08	105 or less	0.88	7.2
A14B2339 4P	0.2	8 pcs. (4 pairs)	40/0.08	105 or less	0.88	6.5
A14B0238 7P	0.2	14 pcs. (7 pairs)	40/0.08	105 or less	1.88	8.0

Note 1. d is as shown below.



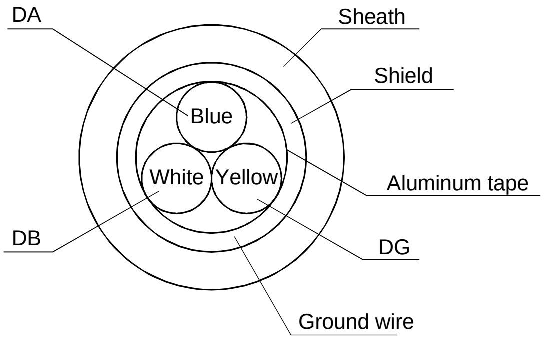
2. Purchase: Toa Denki Kogyo
3. Standard outline. Max. outline is about 10% larger.

(3) CC-Link twisted cable

POINT

- For the cables other than the one indicated here, refer to the open field network CC-Link catalog (L(NA)74108143).

The specifications of the twisted cable usable in CC-Link and the recommended cable are indicated below. If the cable used is other than the recommended cable indicated in the following table, we cannot guarantee the performance of CC-Link.

Item	Specifications
Model	Kurashige Kogyo make FANC-SB 0.5mm^2×3 (Note)
Cable type	Shielded twisted cable
Conductor sectional area	0.5mm^2
Conductor resistance (20℃)	37.8Ω/km or less
Insulation resistance	10000Ω/km or more
Withstand voltage	500VDC 1 minute
Capacitance (1kHz)	60nF/km or less
Characteristic impedance (1MHz)	100±15Ω
Section	
Outline dimension	7mm
Approx. weight	65kg/km

Note. For any inquiry, please contact your nearest Mitsubishi Electric System Service Co., Ltd.

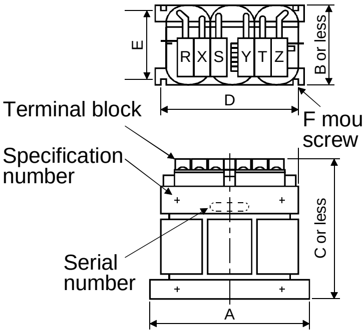
14.2.2 No-fuse breakers, magnetic contactors

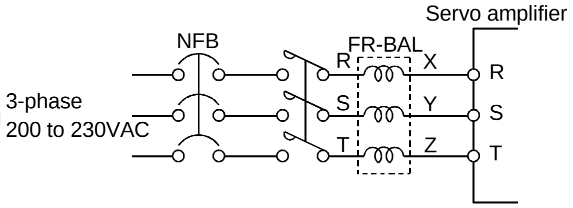
Always use one no-fuse breaker and one magnetic contactor with one servo amplifier.

Servo amplifier	No-Fuse breaker	Magnetic contactor
MR-H10TN	Model NF30 5A	S-N10
MR-H20TN	Model NF30 10A	S-N10
MR-H40TN	Model NF30 10A	S-N10
MR-H60TN	Model NF30 10A	S-N10
MR-H100TN	Model NF30 15A	S-N10
MR-H200TN	Model NF30 20A	S-N18
MR-H350TN	Model NF50 30A	S-N25
MR-H500TN	Model NF50 05A	S-N35
MR-H700TN	Model NF100 75A	S-N50
MR-H11KTN	Model NF100 100A	S-N65
MR-H15KTN	Model NF225 125A	S-N95
MR-H22KTN	Model NF225 175A	S-N125

14.2.3 Power factor improving reactors

When using the power return converter, consider the regenerative power of the power return converter and select the power factor improving reactor.





Servo amplifier	Model	Dimensions [mm (in.)]						Approx. weight [kg (lb)]
		A	B	C	D	E	F	
MR-H10TN	FR-BAL-0.4K	135 (5.315)	64 (2.520)	120 (4.724)	120 (4.724)	45 (1.772)	M4	2 (4.409)
MR-H20TN								
MR-H40TN	FR-BAL-0.75K	135 (5.315)	74 (2.913)	120 (4.724)	120 (4.724)	57 (2.244)	M4	3 (6.614)
MR-H60TN	FR-BAL-1.5K	160 (6.299)	76 (2.992)	145 (5.709)	145 (5.709)	55 (2.165)	M4	4 (8.818)
MR-H100TN	FR-BAL-2.2K	160 (6.299)	96 (3.780)	145 (5.709)	145 (5.709)	75 (2.953)	M4	6 (13.228)
MR-H200TN	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-H350TN	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-H500TN	FR-BAL-11K	280 (11.024)	140 (5.512)	245 (9.646)	255 (10.039)	100 (3.937)	M6	19 (41.888)
MR-H700TN	FR-BAL-15K	295 (11.614)	156 (6.142)	280 (11.024)	270 (10.630)	110 (4.331)	M6	27 (59.525)
MR-H11KTN								
MR-H15KTN	FR-BAL-22K	290 (11.417)	200 (7.874)	300 (11.811)	240 (9.449)	170 (6.693)	M8	35 (77.162)
MR-H22KTN	FR-BAL-30K	290 (11.417)	220 (8.661)	300 (11.811)	240 (9.449)	190 (7.480)	M8	43 (94.799)

14.2.4 Relays

The following relays should be used with the interfaces:

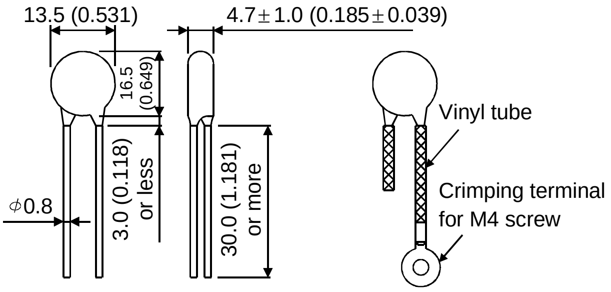
Interface	Selection example
Relay used especially for switching on-off analog input command and input command (interface DI-1) signals	To prevent defective contacts , use a relay for small signal (twin contacts). (Ex.) OMRON : type G2A , MY
Relay used for digital output signals (interface DO-1)	Small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

14.2.5 Surge absorbers

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

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

Note: 1 time＝8 × 20μs



(Example) ERZV10D221
(Matsushita Electric make)
TNR-12G221K
(Marukon Electronic make)
Outline dimension drawing [mm (in.)]
(ERZV10D221)

14.2.6 Noise reduction techniques

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

Also, the servo amplifier can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the servo amplifier, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) General reduction techniques

- Avoid laying power lines (input and output cables) and signal cables for the servo amplifier side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the servo amplifier, servo motor, etc. together at one point (refer to Section 5.6).

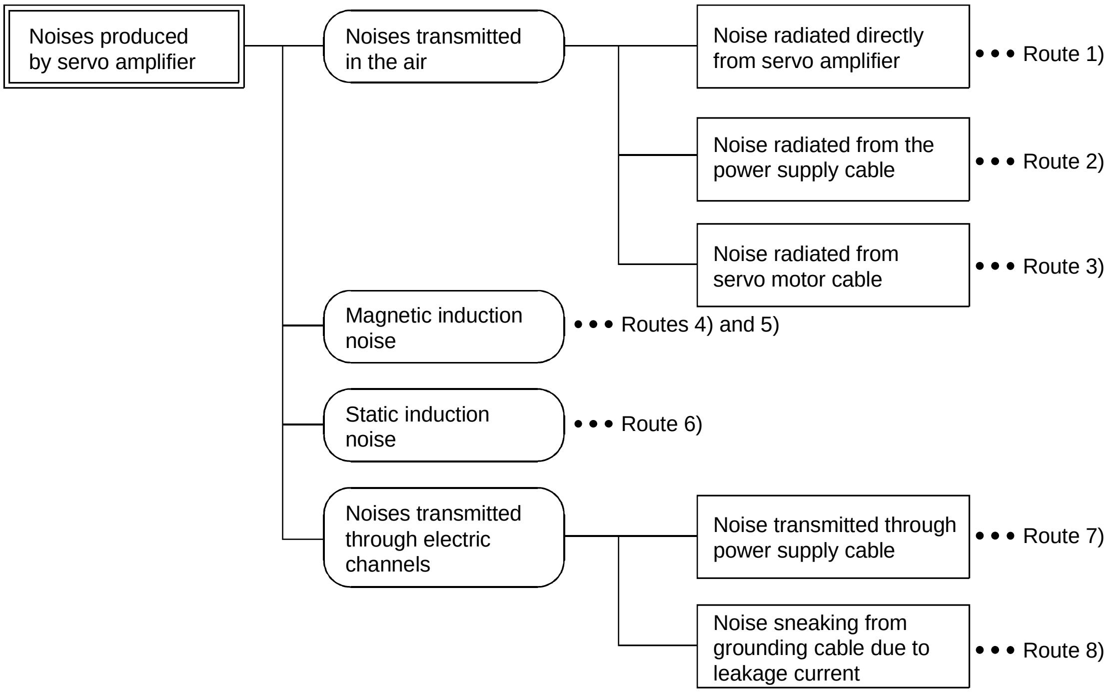
(2) Reduction techniques for external noises that cause the servo amplifier to malfunction

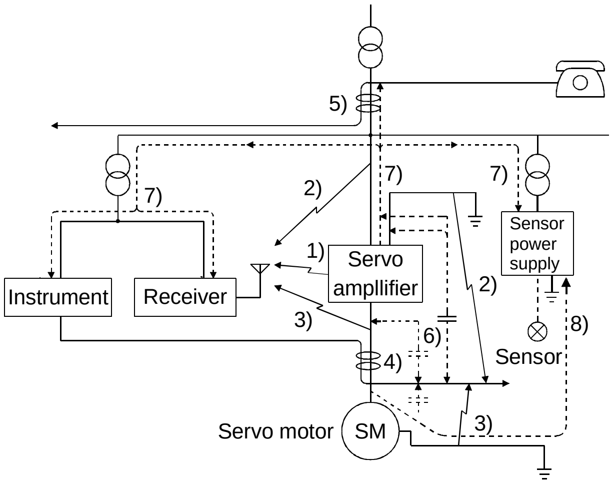
If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the servo amplifier and the servo amplifier may malfunction, the following countermeasures are required.

- Provide surge suppressors 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 servo amplifier that cause peripheral devices to malfunction

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





Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a control box together with the servo amplifier or run near the servo amplifier, such devices may malfunction due to noises transmitted through the air. The following techniques are required. (1) Provide maximum clearance between easily affected devices and the servo amplifier. (2) Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. (3) Avoid laying the power lines (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. (4) Insert a line noise filter to the I/O cables or a radio noise filter on the input line. (5) Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. (1) Provide maximum clearance between easily affected devices and the servo amplifier. (2) Provide maximum clearance between easily affected signal cables and the I/O cables of the servo amplifier. (3) Avoid laying the power lines (I/O cables of the servo amplifier) and signal cables side by side or bundling them together. (4) Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices is connected to the power supply of the servo amplifier system, noises produced by the servo amplifier may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. (1) Insert the radio noise filter (FR-BIF) on the power cables of the servo amplifier. (2) Insert the line noise filter (FR-BIF·FR-BSF01) on the power cables of the servo amplifier.
8)	When a closed loop circuit is formed by the ground cables of the peripheral device and servo amplifier, 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

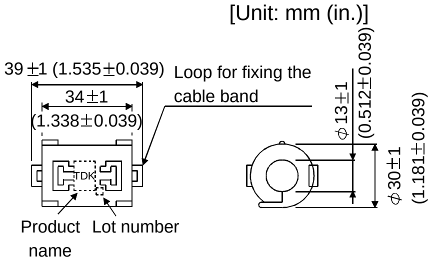
Noise can be prevented by installing a data line filter onto the encoder cable, etc.

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

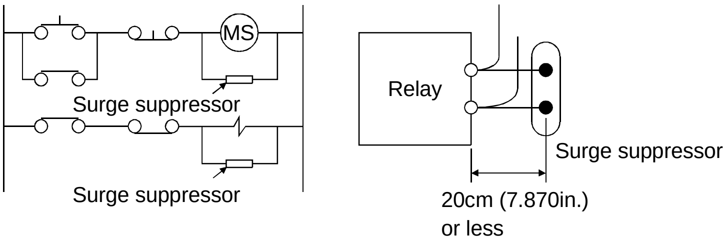
The above impedances are reference values and not guaranteed values.



Outline drawing (ZCAT3035-1330)

(2) Surge suppressor

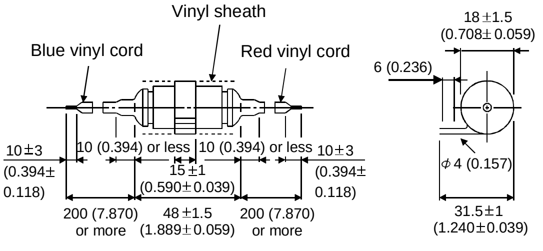
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the servo amplifier is shown below. Use this product or equivalent.



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

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

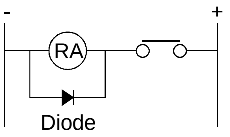
Outline drawing [Unit: mm(in.)]



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

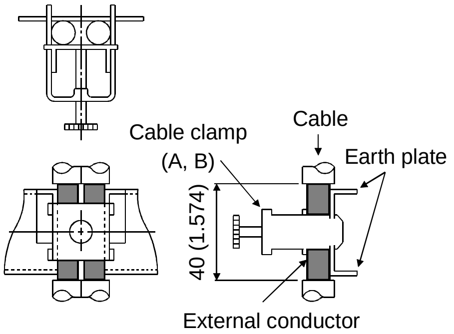


(3) Cable clamp fitting (AERSBAN-□SET)

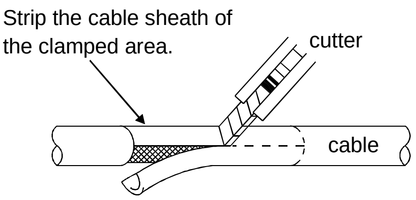
Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth plate near the servo amplifier for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.

[mm (in.)]



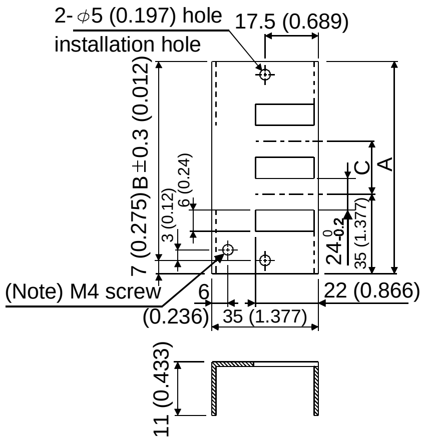
Clamp section diagram



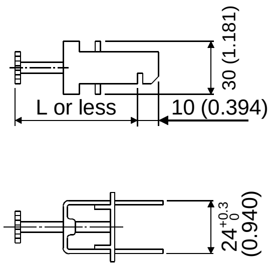
・Outline drawing

[Unit: mm (in.)]

Earth plate



Clamp section diagram



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

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

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

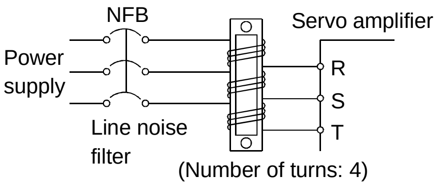
(4) Line noise filter (FR-BLF, FR-BSF01)

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

Connection diagram

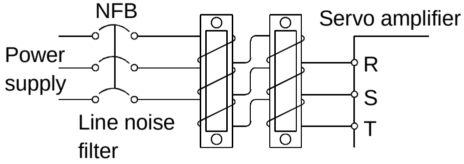
Wind the three-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the servo amplifier.
The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four.
On the output side, the number of turns must be four or less.
Do not wind the grounding wire together with the three-phase wires. The filter effect will decrease.
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



(Number of turns: 4)

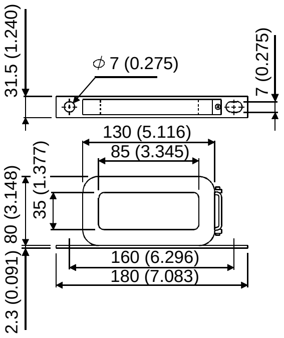
Example 2



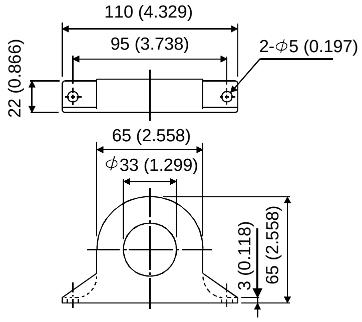
Two filters are used
(Total number of turns: 4)

Outline drawing [Unit: mm (in.)]

FR-BLF (MR-H350TN or more)



FR-BSF01 (for MR-H200TN or less)

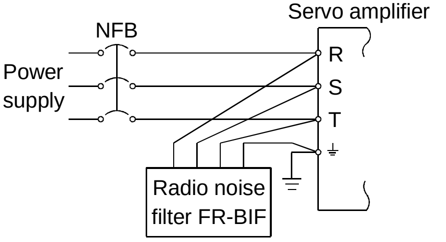


(5) Radio noise filter (FR-BIF)

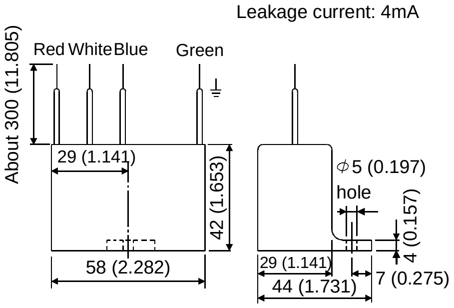
This filter is effective in suppressing noises radiated from the power supply side of the servo amplifier especially in 10MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

Connection diagram

Make the connection cables as short as possible.
Grounding is always required.



Outline drawing (Unit: mm(in.))



14.2.7 Leakage current breaker

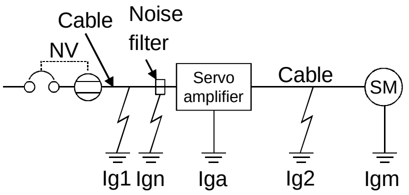
(1) Selection method

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

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

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

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



K: Constant considering the harmonic contents

Leakage current breaker		K
Type	Mitsubishi products	
Models provided with harmonic and 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 servo amplifier (Found from Fig. 14.1.)

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

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

Iga: Leakage current of the servo amplifier (Found from Table 14.5.)

Igm: Leakage current of the servo motor (Found from Table 14.4.)

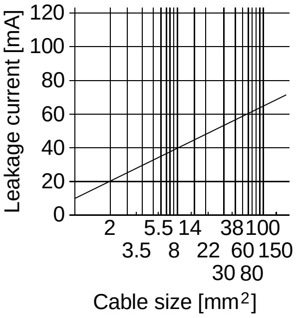


Fig.14.1 Leakage Current per 1km Example (lg1,lg2)for CV Cable Run in Metal Conduit

Table 14.4 Servo Motor's Leakage Current Example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 0.5	0.1
0.6 to 1.0	0.1
1.2 to 2.2	0.2
3, 3.5	0.3
4.5	0.3
5	0.5
7	0.7
11	1.0
15	1.3
22	2.3

Table 14.5 Servo amplifier's Leakage Current Example (Iga)

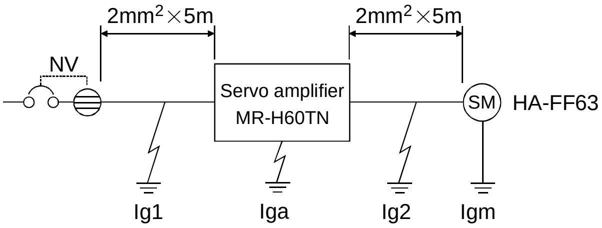
Servo amplifier	Leakage current [mA]
All series	2

Table 14.6 Leakage Circuit Breaker Selection Example

Servo amplifier	Rated sensitivity current of leakage circuit breaker
MR-H10TN to MR-H350TN	15mA
MR-H500TN	30mA
MR-H700TN	50mA
MR-H11KTN to MR-H22KTN	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:

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

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

$$Ign=0\ (\text{not used})$$

$$Iga=0.1\ [mA]$$

$$Igm=0.1\ [mA]$$

Insert these values in Equation (14.2):

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

$$\geq 8.0\ [mA]$$

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.

14.2.8 Setting potentiometers for analog inputs

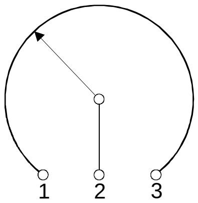
The following variable resistors are available for use with analog inputs such as override and analog torque commands:

(1) Single-revolution type

WA2WYA2SEBK2KΩ (Japan Resistor make)

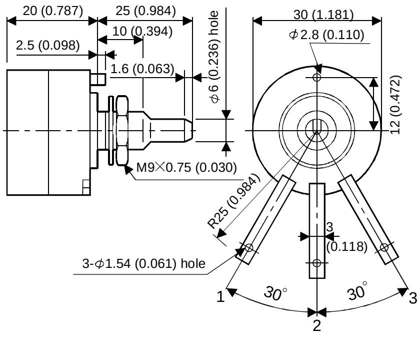
Rated power	Resistance	Resistance tolerance	dielectric strength (for 1 minute)	Insulation resistance	Mechanical rotary angle	Rotary torque
2W	2kΩ	±10%	700V A.C	100MΩor more	300° ±5°	10 to 100g-cm or less

connection diagram



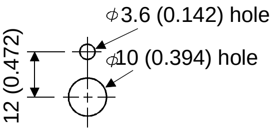
Outline dimension drawing

[Unit: mm (in.)]



Panel hole machining diagram

[Unit: mm (in.)]

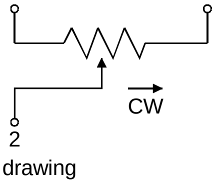


(2) Multi-revolution type

RRS10(M)2KΩ (Japan Resistor make)

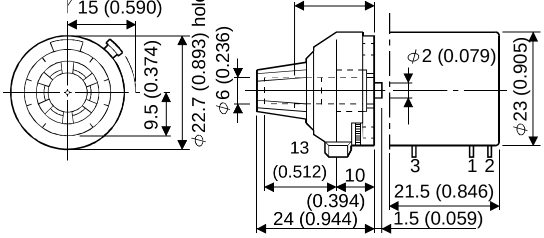
Rated power	Resistance	Resistance tolerance	dielectric strength (for 1 minute)	Insulation resistance	Mechanical rotary angle	Rotary torque
1W	2kΩ	±10%	700V A.C	1000MΩ or more	$3600^{\circ}\,^{+10^{\circ}}_{-0^{\circ}}$	100g-cm or less

connection diagram



Outline dimension drawing

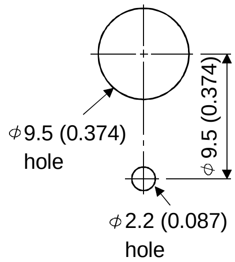
[Unit: mm (in.)]



Panel hole machining diagram

[Unit: mm (in.)]

Panel thickness: 2 to 6 (0.079 to 0.236)



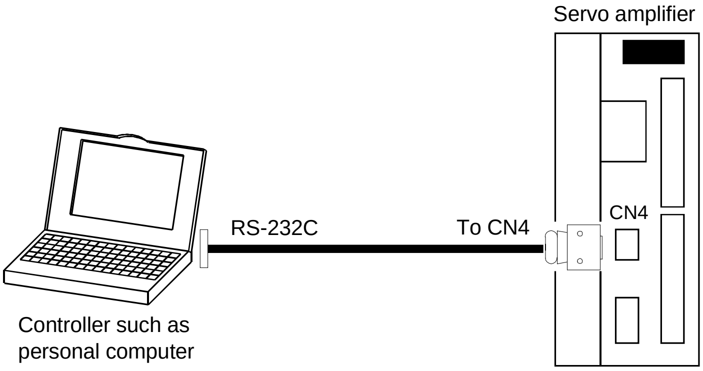
MEMO

15. RS-232C COMMUNICATION FUNCTIONS

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

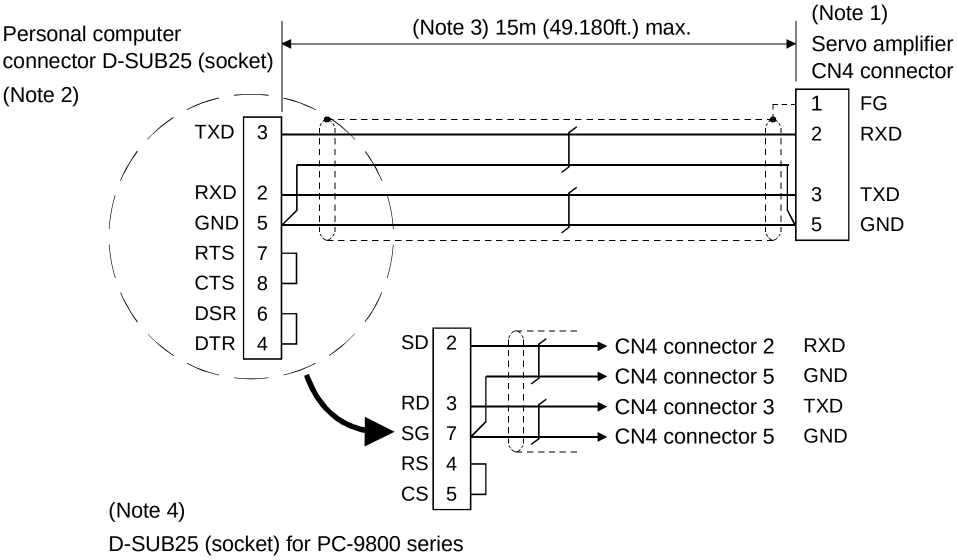
15.1 Configuration

(1) Outline



(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 14.1.6.)

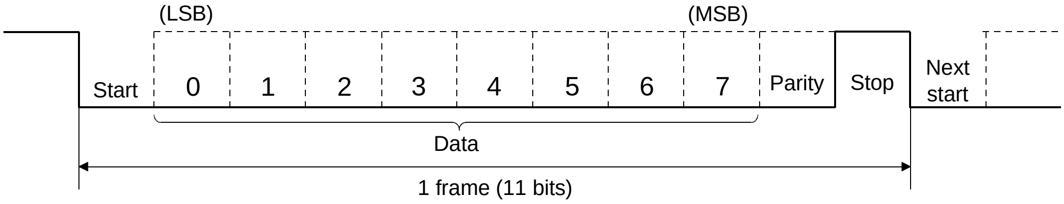


Note: 1. Honda Tsushin's CN3 connector
Connector: DE-9PF-N
Shell kit: DE-C1-J6-S6
2. For the PC-AT compatible controller series.
3. 15m (49.180ft.) max. in environment of little noise.
4. The PC-9800 series also has the half-pitch type.

15.2 Communication specifications

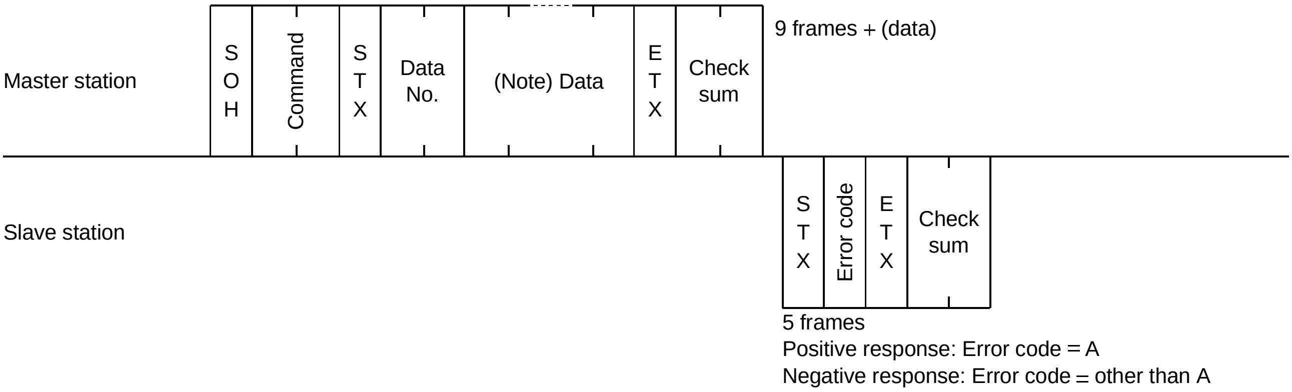
Servo Amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (Servo Amplifier) is called a master station and the device which sends a reply in response to the instruction (Servo Amplifier) is called a slave station. When fetching data successively,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

Item	Description
Baudrate	9600 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, variable frame, half-duplex communication system



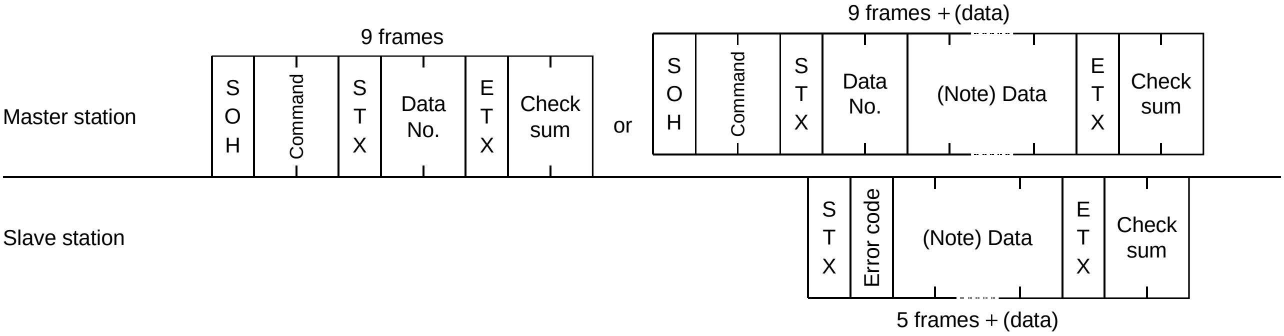
15.3 Protocol

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



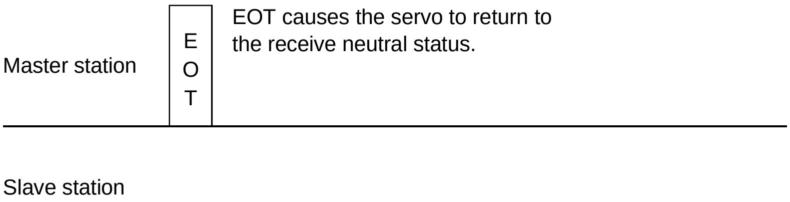
Note: Refer to (4) in this section for the number of data frames.

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



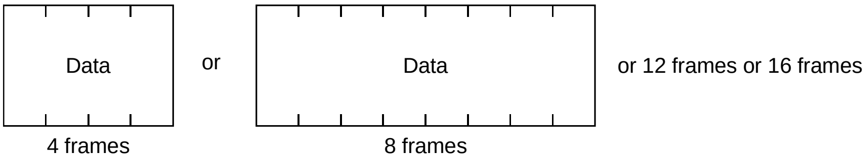
Note: Refer to (4) in this section for the number of data frames.

(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



15.4 Character codes

(1) Control codes

Code name	Hexadecimal (ASCII code)	Description	Personal computer terminal key operation (General)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

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 to b_5	b_4	b_3	b_2	b_1
	0	0	0	0
	0	0	0	1
	0	0	1	0
	0	0	1	1
	0	1	0	0
	0	1	0	1
	0	1	1	0
	0	1	1	1
	1	0	0	0
	1	0	0	1
	1	0	1	0
	1	0	1	1
	1	1	0	0
	1	1	0	1
	1	1	1	0
	1	1	1	1

R \ C	0	1	2	3	4	5	6	7
0	NUL	DLE	Space	0	@	P	`	p
1	SOH	DC$_1$	!	1	A	Q	a	q
2	STX	DC$_2$	“	2	B	R	b	r
3	ETX	DC$_3$	#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			‘	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
10			*	:	J	Z	j	z
11			+	;	K	[	k	{
12			,	<	L	\	l	|
13			—	=	M	]	m	}
14			.	>	N	^	n	‾
15			/	?	O	_	o	DEL

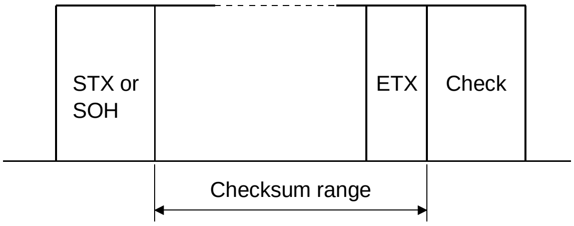
15.5 Error codes

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

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

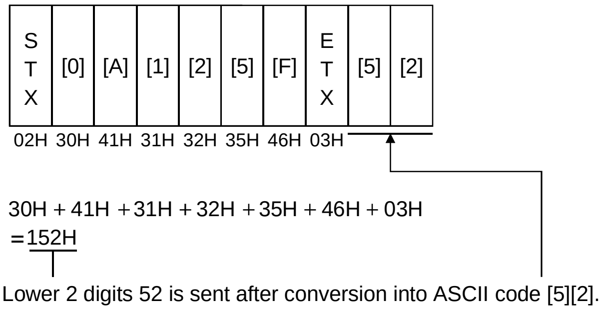
15.6 Checksum

Checksum range



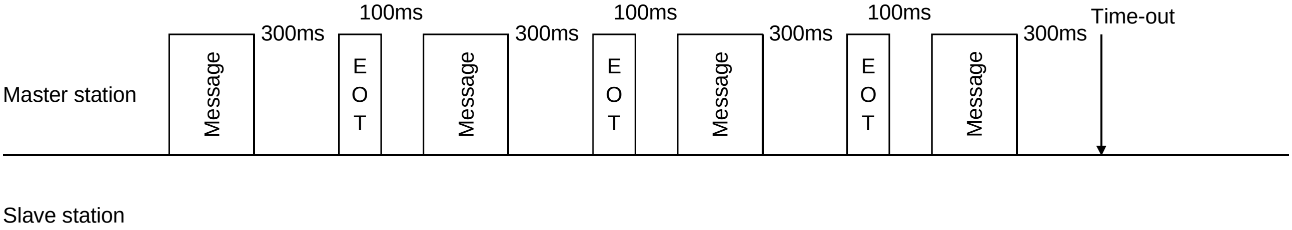
The checksum is sent as a JIS8-coded hexadecimal code representing the lower two digits of the sum of JIS8-coded hexadecimal values up to ETX, with the exception of the first control code (STX or SOH).

(Example)



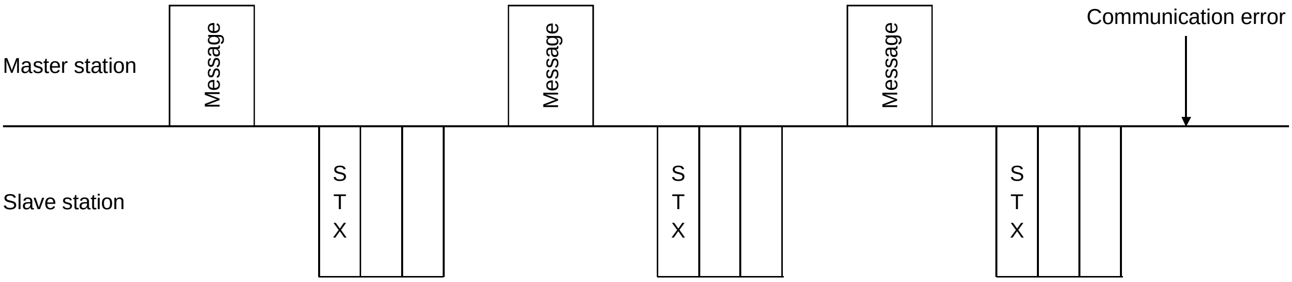
15.7 Time-out operation

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



15.8 Retry operation

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [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.

15.9 Initialization

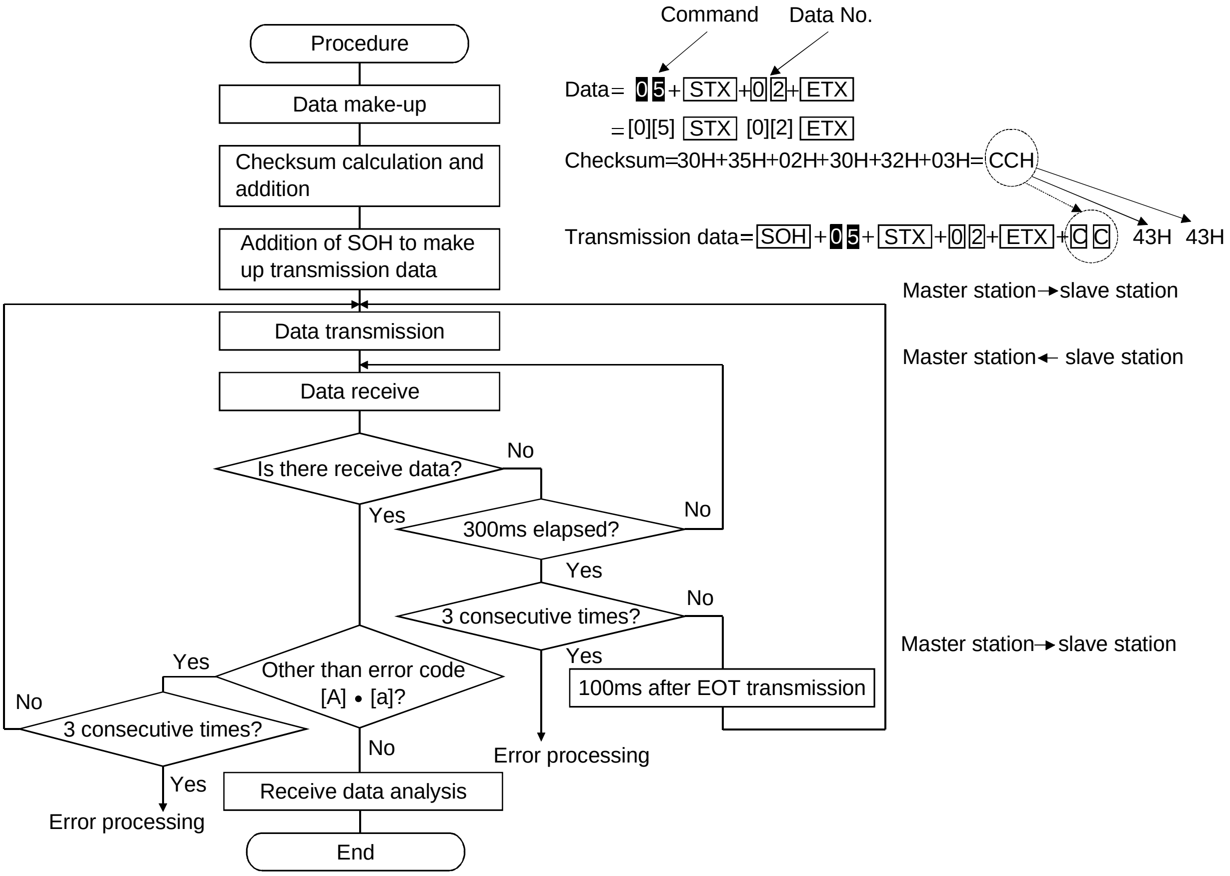
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

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

15.10 Communication procedure example

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

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



15.11 Command and data No. list

15.11.1 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]	[0][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] to [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] to [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] to [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] to [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])

The signals corresponding to the data numbers change with the feeding system and the number of occupied stations.

Command	Data No.	Description	Signal abbreviations				Frame length
			Positioning system		Roll feeding system		
			1 station occupied	2 stations occupied	1 station occupied	2 stations occupied	
[3][4]	[1][1]	External input signal name and ON/OFF status	SON	SON	SON	SON	4
[3][4]	[1][2]		DI0	LSP	DEC	DEC	4
[3][4]	[1][3]		DI1	LSN	JFS	JFS	4
[3][4]	[1][4]		DI2	DOG	STP	STP	4
[3][4]	[1][5]		LSP	MD0	TL	TL	4
[3][4]	[1][6]		LSN	STP	PS2	PS2	4
[3][4]	[1][7]		DOG	ORG	CR	CR	4
[3][4]	[1][8]		MD0	ST1	MD0	MD0	4
[3][4]	[1][9]		STP	ST2	MD1	MD1	4
[3][4]	[1][A]		ORG	MOR	MD2	MD2	4
[3][4]	[1][B]		ST1	COR	ST1	ST1	4
[3][4]	[1][C]		ST2	TL	ST2	ST2	4
[3][4]	[1][D]		MOR	PSR	MOR	MOR	4
[3][4]	[1][E]		COR	SPR	COR	COR	4
[3][4]	[1][F]		TL	OVR	PSR		4
[3][4]	[2][0]		RES	TP0	RES	SPR	4
[3][4]	[2][1]		EMG	TP1	EMG	OVR	4
[3][4]	[2][2]		RES	TP0			4
[3][4]	[2][3]		EMG	TP1			4
[3][4]	[2][4]		LSP				4
[3][4]	[2][5]		LSN				4
[3][4]	[2][6]		RES				4
[3][4]	[2][7]		EMG				4
[3][4]	[9][1]	External output signal name and ON/OFF status	RD	RD	RD	RD	4
[3][4]	[9][2]		INP	INP	INP	INP	4
[3][4]	[9][3]		CPO	CPO	CPO	CPO	4
[3][4]	[9][4]		ZP	ZP	AC0	AC0	4
[3][4]	[9][5]		MC0	AC0	AC1	AC1	4
[3][4]	[9][6]		MC1	AC1	AC2	AC2	4
[3][4]	[9][7]		AC0	AC2	AC3	AC3	4
[3][4]	[9][8]		AC1	AC3	TLC	TLC	4
[3][4]	[9][9]		AC2	TLC	MBR	MBR	4
[3][4]	[9][A]		AC3	MBR	MOF	MOF	4
[3][4]	[9][B]		TLC	MOF	COF	COF	4
[3][4]	[9][C]		MBR	COF	WNG	WNG	4
[3][4]	[9][D]		MOF	WNG	ALM	PSF	4
[3][4]	[9][E]		COF	PSF	CRD	SPF	4
[3][4]	[9][F]		WNG	SPF	OP	ALM	4
[3][4]	[A][0]		CRD	CRD	CRD		4
[3][4]	[A][1]		ALM	ALM	OP		4
[3][4]	[A][2]		OP	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

15.11.2 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 0005	4

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

The signals corresponding to the data numbers change with the feeding system and the number of occupied stations.

Command	Data No.	Description	Signal abbreviations				Setting range	Frame length
			Positioning system		Roll feeding system			
			1 station occupied	2 stations occupied	1 station occupied	2 stations occupied		
[8][B]	[8][1]	DO forced output 0000: OFF 0001: ON	RD	RD	RD	RD	0000 ▪ 0001	4
[8][B]	[8][2]		INP	INP	INP	INP	0000 ▪ 0001	4
[8][B]	[8][3]		CPO	CPO	CPO	CPO	0000 ▪ 0001	4
[8][B]	[8][4]		ZP	ZP	AC0	AC0	0000 ▪ 0001	4
[8][B]	[8][5]		MC0	AC0	AC1	AC1	0000 ▪ 0001	4
[8][B]	[8][6]		MC1	AC1	AC2	AC2	0000 ▪ 0001	4
[8][B]	[8][7]		AC0	AC2	AC3	AC3	0000 ▪ 0001	4
[8][B]	[8][8]		AC1	AC3	TLC	TLC	0000 ▪ 0001	4
[8][B]	[8][9]		AC2	TLC	MBR	MBR	0000 ▪ 0001	4
[8][B]	[8][A]		AC3	MBR	MOF	MOF	0000 ▪ 0001	4
[8][B]	[8][B]		TLC	MOF	COF	COF	0000 ▪ 0001	4
[8][B]	[8][C]		MBR	COF	WNG	WNG	0000 ▪ 0001	4
[8][B]	[8][D]		MOF	WNG	CRD	PSF	0000 ▪ 0001	4
[8][B]	[8][E]		COF	PSF	ALM	SPF	0000 ▪ 0001	4
[8][B]	[8][F]		WNG	SPF	CRD		0000 ▪ 0001	4
[8][B]	[9][1]		CRD	CRD	ALM		0000 ▪ 0001	4
[8][B]	[9][2]		ALM	ALM			0000 ▪ 0001	4
[8][B]	[9][3]						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) (Command [A][0])

Command	Data No.	Description	Setting range	Frame length
[A][0]	[0][0]	Forces the external input signals except EMG, LSP and LSN to turn ON/OFF.	00000000 to FFFFFFFF	8
[A][0]	[0][1]	Forces the external output signals to turn ON/OFF.	00000000 to FFFFFFFF	8
[A][0]	[0][2]	Forces the external input signals to turn ON/OFF.	00000000 to FFFFFFFF	8
[A][0]	[0][3]	Forces the external output signals to turn ON/OFF.	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 (positioning operation).	80000000 to 7FFFFFFF	8
[A][0]	[1][5]	Temporary stop command of the test operation mode (positioning operation)	1EA5	4
[A][0]	[1][A]	Writes the position block No. of the test operation mode (1 step feed operation).	00000000 to 000000FF	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

15.12 Detailed explanations of commands

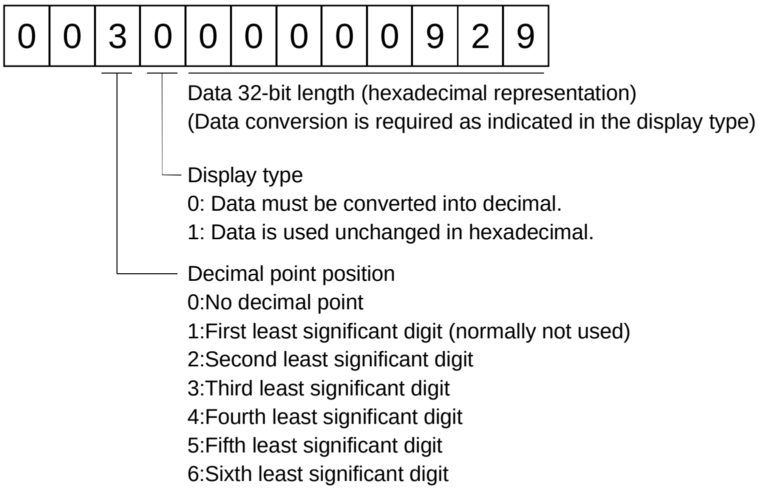
15.12.1 Data processing

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

(1) Processing the read data

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

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



Data 32-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.

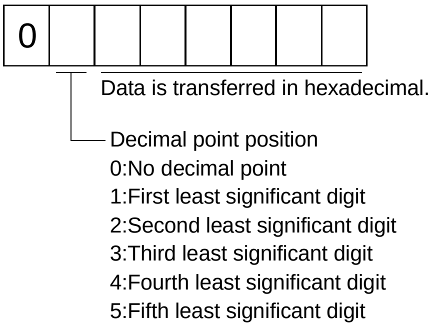
Decimal point position
0:No decimal point
1:First least significant digit (normally not used)
2:Second least significant digit
3:Third least significant digit
4:Fourth least significant digit
5:Fifth least significant digit
6:Sixth least significant digit

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.

15.12.2 Status display

(1) Reading the status display name and unit

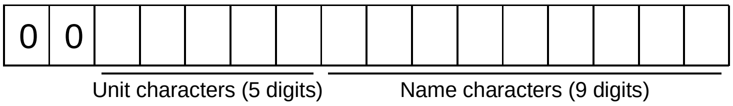
Read the status display name and unit.

(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 15.11.1.)

(b) Reply

The slave station sends back the status display name and unit requested.



(2) Status display data read

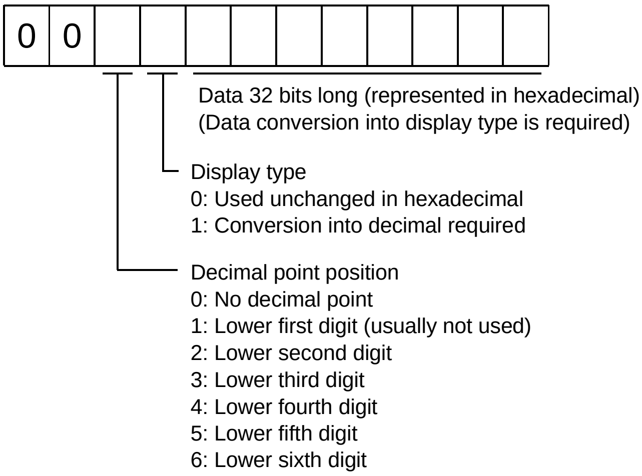
Read the status display data and processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. (Refer to Section 15.11.1.)

(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]	1EA5

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

15.12.3 Parameters

(1) Reading the name

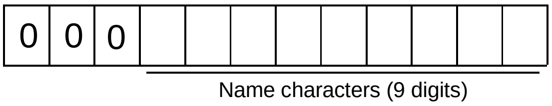
Read the parameter name.

(a) Transmission

Transmit command [0][8] and the data No. corresponding to the parameter No., [0][0] to [6][3]. (Refer to Section 15.11.1.)

(b) Reply

The slave station sends back the name of the parameter No. requested.



(2) Reading the setting

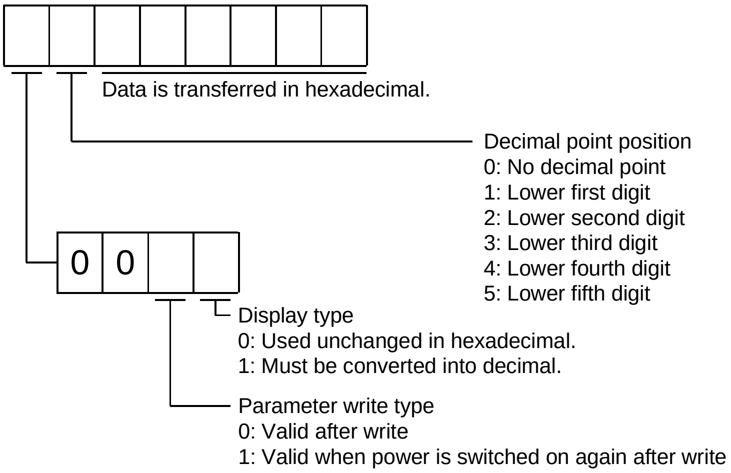
Read the parameter setting.

(a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No., [0][0] to [6][3]. (Refer to Section 15.11.1.)

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



(For example)

Data “1201869F” means 9999.9 (decimal display format).

Data “0023ABC” means 23ABC (hexadecimal display format).

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

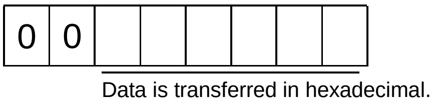
Read the parameter setting range.

(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 15.11.1.)

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



For example, data “10FFFFEC” means −20.

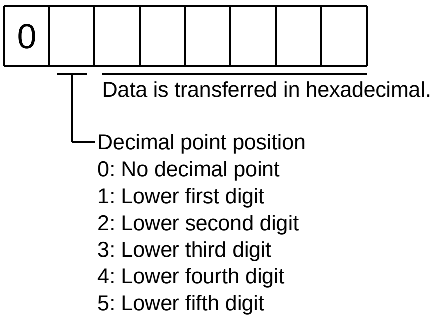
(4) Parameter write

POINT

- The number of parameter write times is restricted to 100,000 times.

Write the parameter setting into EEP-ROM of the MR-H-TN.
Write the value within the setting enabled range. For the setting enabled range, refer to Section 7.2 or read the setting range by performing operation in (3) of this section.
Transmit command [8][4], the data No. corresponding to the parameter No., and the set data.
When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify 0 as the decimal point position.
Write the data after making sure that it is within the upper/lower limit value range.
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.
Write cannot be performed to the parameters which are not enabled for write in parameter No. 20.

Command	Data No.	Set data
[8][4]	[0][0] to [6][3]	See below.



15.12.4 External I/O signal status (DIO diagnosis)

(1) Reading the external input signal ON/OFF status

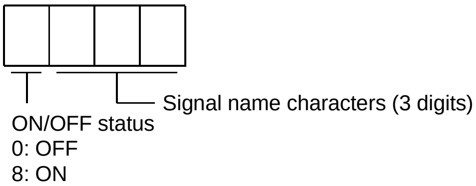
Read the ON/OFF status of the external input signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

(a) Transmission

Transmit command [3][4] and the data No. corresponding to the input signal to be read. (Refer to Section 15.11.1.)

(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

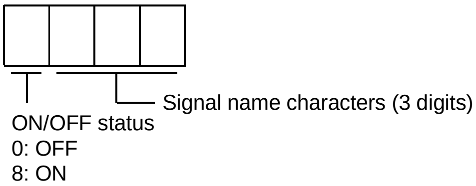
Read the ON/OFF status of the external output signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

(a) Transmission

Transmit command [3][4] and the data No. corresponding to the output signal to be read. (Refer to Section 15.11.1.)

(b) Reply

The slave station sends back the ON/OFF status of the output signal requested.

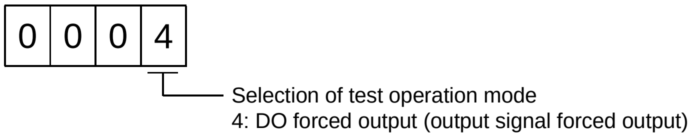


15.12.5 External output signal ON/OFF (DO forced output)

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.

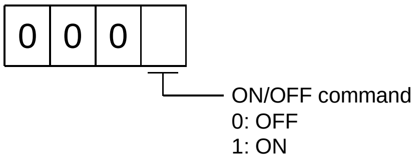
(1) Choosing DO forced output in test operation mode

Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.



(2) Turning the output signal ON/OFF signal-by-signal

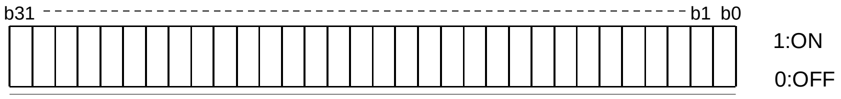
Transmit command [8][B] + data No. corresponding to the output signal, [8][1] to [8][6], and the data which means ON/OFF. (Refer to Section 15.11.1.)



(3) Turning all output signals ON/OFF at once

Transmit the following communication commands:

Command	Data No.	Setting data
[A][0]	[0][1]	See below.



Command of each bit is sent to the slave station in hexadecimal.

(a) Positioning system

1) Data No.[0][1]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0	RD	8	AC2	16	PSF	24	
1	INP	9	AC3	17	SPF	25	
2	CPO	10	TLC	18		26	
3	ZP	11	MBR	19		27	
4	MC0	12	MOF	20		28	
5	MC1	13	COF	21		29	
6	AC0	14	WNG	22		30	
7	AC1	15		23		31	

2) Data No.[0][3]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0		8		16		24	
1		9		17		25	
2		10	ALM	18		26	
3		11	CRD	19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	

(b) Roll feeding system

1) Data No.[0][1]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0	RD	8	AC2	16	PSF	24	
1	INP	9	AC3	17	SPF	25	
2	CPO	10	TLC	18		26	
3		11	MBR	19		27	
4		12	MOF	20		28	
5		13	COF	21		29	
6	AC0	14	WNG	22		30	
7	AC1	15		23		31	

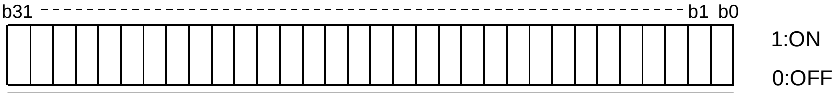
2) Data No.[0][3]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0		8		16		24	
1		9		17		25	
2		10	ALM	18		26	
3		11	CRD	19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	

15.12.6 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.

Command	Data No.	Setting data
[A][0]	[0][0]	See below.



Command of each bit is sent to the slave station in hexadecimal.

(1) Positioning system

(a) Data No.[0][0]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0	SON	8	STP	16	PSR	24	
1	DI0	9	ORG	17	SPR	25	
2	DI1	10	ST1	18	OVR	26	
3	DI2	11	ST2	19	TP0	27	
4		12	MOR	20	TP1	28	
5		13	COR	21		29	
6	DOG	14	TL	22		30	
7	MD0	15		23		31	

(b) Data No.[0][2]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0		8		16		24	
1		9		17		25	
2		10	RES	18		26	
3		11		19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	

(2) Roll feeding system

(a) Data No.[0][0]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0	SON	8	MD1	16	PSR	24	
1	DEC	9	MD2	17	SPR	25	
2	JFS	10	ST1	18	OVR	26	
3	STP	11	ST2	19	TP0	27	
4	TL	12	MOR	20	TP1	28	
5	PS2	13	COR	21		29	
6	CR	14		22		30	
7	MD0	15		23		31	

(b) Data No.[0][2]

bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation	bit	Signal abbreviation
0		8		16		24	
1		9		17		25	
2		10	RES	18		26	
3		11		19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	

15.12.7 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

15.12.8 Test operation mode

(1) Instructions for test operation mode

The test operation mode must be executed in the following procedure. If communication is interrupted for longer than 0.5s during test operation, the MR-H-TN 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 ST1/ST2 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) Stop

Turn off ST1/ST2 using command [A][0] + data No. [0][0].

Item	Command	Data No.	Data
Stop	[A][0]	[0][0]	00000001: Turns on SON only.

(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 ST1/ST2 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.

15.12.9 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

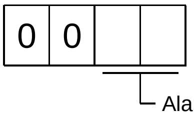
Read the alarm No. which occurred in the past.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][9]. (Refer to Section 15.11.1.)

(b) Reply

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



Alarm No. is transferred in decimal.

(For example)
AL.32: 0032
AL.50: 0050
AL__: 00FF (no alarm)

(2) Alarm occurrence time read

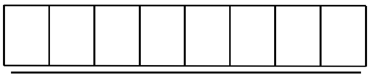
Read the occurrence time of alarm which occurred in the past.
The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][9].
(Refer to Section 15.11.1.)

(b) Reply

The slave station returns the alarm occurrence time corresponding to the data No.



Alarm occurrence time is transferred in hexadecimal.
Hexadecimal must be converted into decimal.

(For example)
Data "01F5" means that the alarm occurred 501 hours after start of operation.

(3) Reading the alarm name

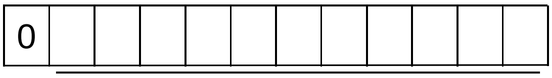
Read the name of the past alarm.

(a) Transmission

Transmit command [3][3] + data No. [3][0] to [3][9]. (Refer to Section 15.11.1.)

(b) Reply

The slave station sends back the alarm name corresponding to the data No.



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

15.12.10 Current alarm

(1) Current alarm No. read

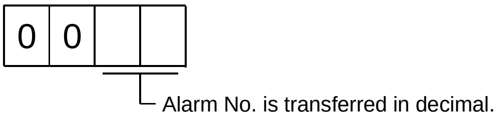
Read the alarm No. which is occurring currently.

(a) Transmission

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

(b) Reply

The slave station sends back the alarm currently occurring.



(For example)

AL.32: 0032

AL.50: 0050

AL__: 00FF (no alarm)

(2) Reading the concurrent alarm No.

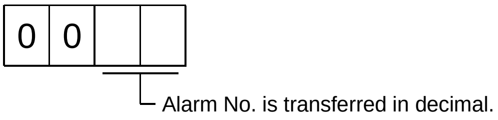
Read the concurrent alarm No.

(a) Transmission

Transmit command [0][2] + data No. [0][8].

(b) Reply

The slave station sends back the concurrent alarm.



(3) Reading the current alarm name

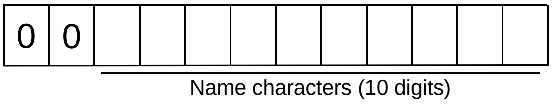
Read the name of the current alarm.

(a) Transmission

Transmit command [0][2] + data No. [0][0].

(b) Reply

The slave station sends back the current alarm.



(4) Reading the concurrent alarm name

Read the concurrent alarm name.

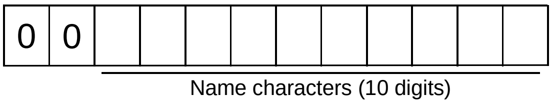
(a) Transmission

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

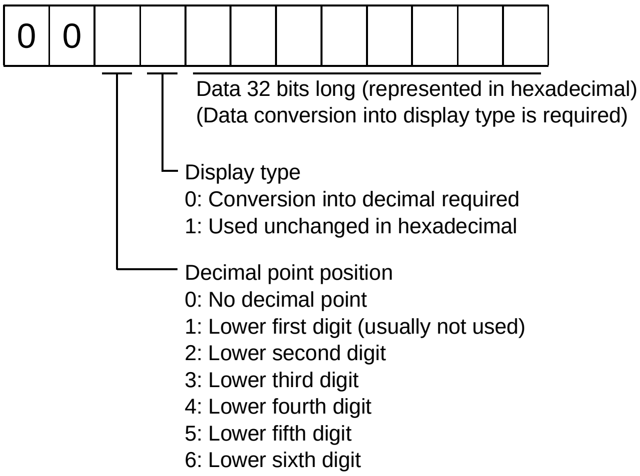
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(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 15.11.1.)

(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 servo amplifier alarm to make the servo amplifier ready to operate. After removing the cause of the alarm, reset the alarm with no command entered. Transmission

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

(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

15.12.11 Position block

(1) Reading of the settings

Read the position data, M code and speed block No.

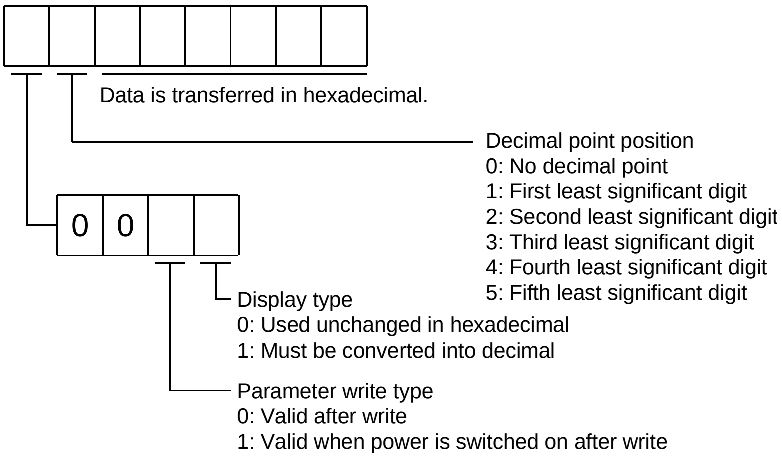
(a) Transmission

Transmit the following communication commands (refer to Section 15.11.1):

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)

- Data “13F0BDC1” of position data indicates −9999.99.
- Data “10000063” of M code indicates 99.
- Data “10000005” of speed block No. indicates 5.

(2) Reading of the position data unit

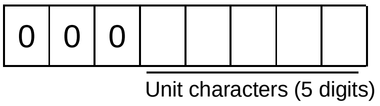
Read the unit of the position data.

(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.

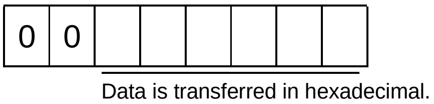
(a) Transmission

Transmit the following communication commands (refer to Section 15.11.1):

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.



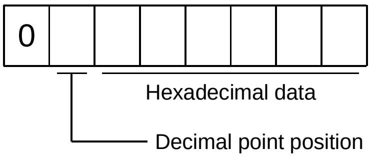
(4) Writing of the settings

Write the position data, M code and speed block No. to the EEP-ROM of the servo amplifier.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 15.11.2):

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]	



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.

15.12.12 Speed block

(1) Reading of the settings

Read the speed, acceleration time constant, deceleration time constant and S-pattern time constant.

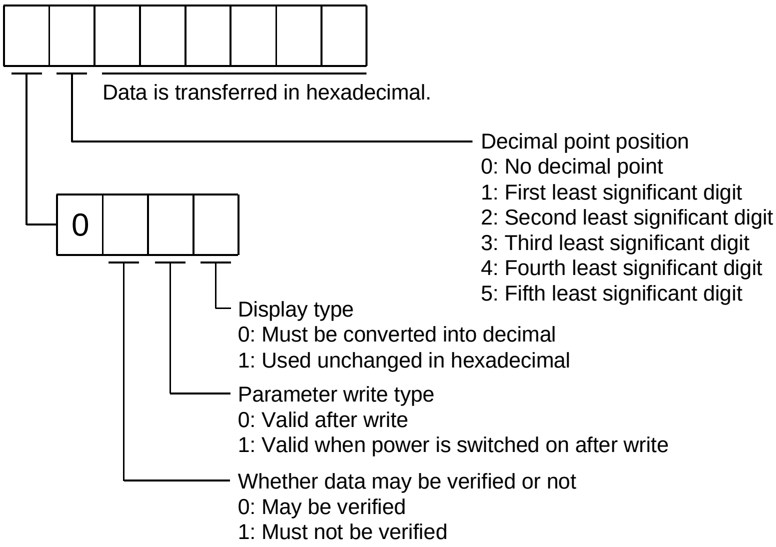
(a) Transmission

Transmit the following communication commands (refer to Section 15.11.1):

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

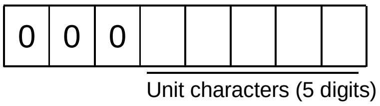
Read the unit of the speed.

(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.

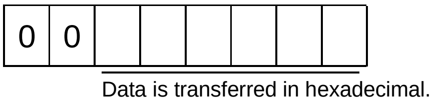
(a) Transmission

Transmit the following communication commands (refer to Section 15.11.1):

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.



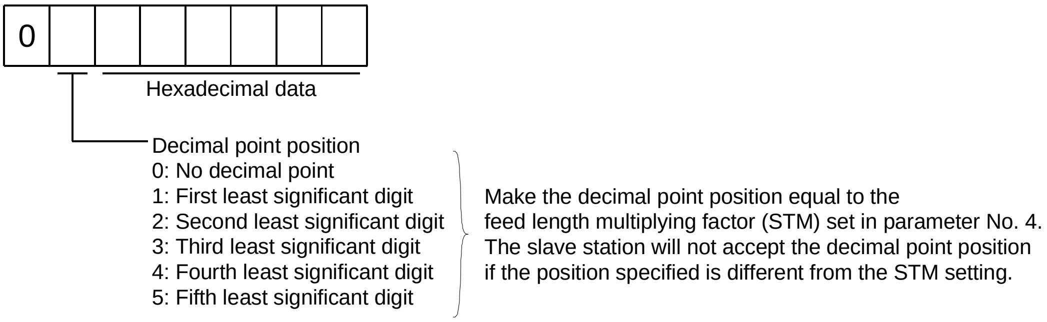
(4) Writing of the settings

Write the speed, acceleration time constant, deceleration time constant and S-pattern time constant to the EEP-ROM of the servo amplifier.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 15.11.2):

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]	



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.

15.12.13 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

16. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

POINT

- The EN・UL/C-UL Standard-compliant products are scheduled for release. The standard products are incompliant.

16.1 Compliance with EC directives

16.1.1 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 servo amplifiers have been installed.

(1) EMC directive

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

This servo is certified by TUV, third-party assessment organization, to comply with the EMC directive in the conforming methods of the EMC Installation Guidelines.

(2) Low voltage directive

The low voltage directive applies also to servo units alone. Hence, they are designed to comply with the low voltage directive.

This servo is certified by TUV, third-party assessment organization, to comply with the low voltage directive.

(3) Machine directive

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

16.1.2 For compliance

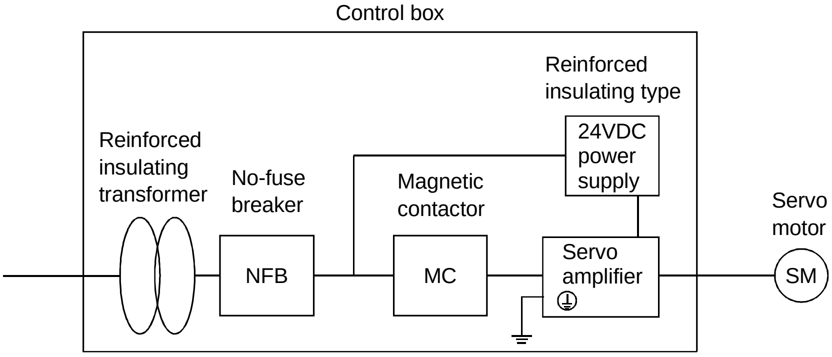
(1) Servo amplifiers and servo motors used

Use the servo amplifiers and servo motors which comply with the EN Standard.

Servo amplifier series	:	MR-H10TN-UE to MR-H22KTN-UE (Scheduled for release)
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 servo amplifier at or above the contamination level 2 set forth in IEC664. For this purpose, install the servo amplifier in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

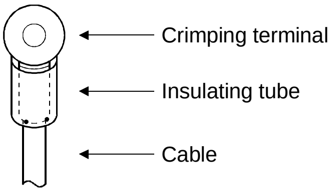
(4) Power supply

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

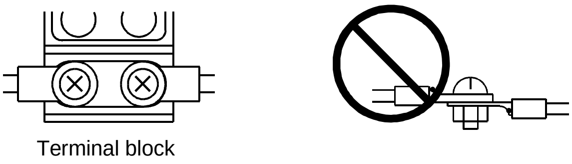
(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(5) Wiring

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



(b) Use a fixed terminal block to connect the power supply lead of the servo motor to the servo amplifier. 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. (Refer to Section 14.1.6.)

(6) Noise reduction techniques

Use the EMC filter for noise reduction. The radio noise filter (FR-BIF) is not required.
For the way the servo amplifier should comply with the EMC Directives,
refer to "EMC INSTALLATION GUIDELINES".

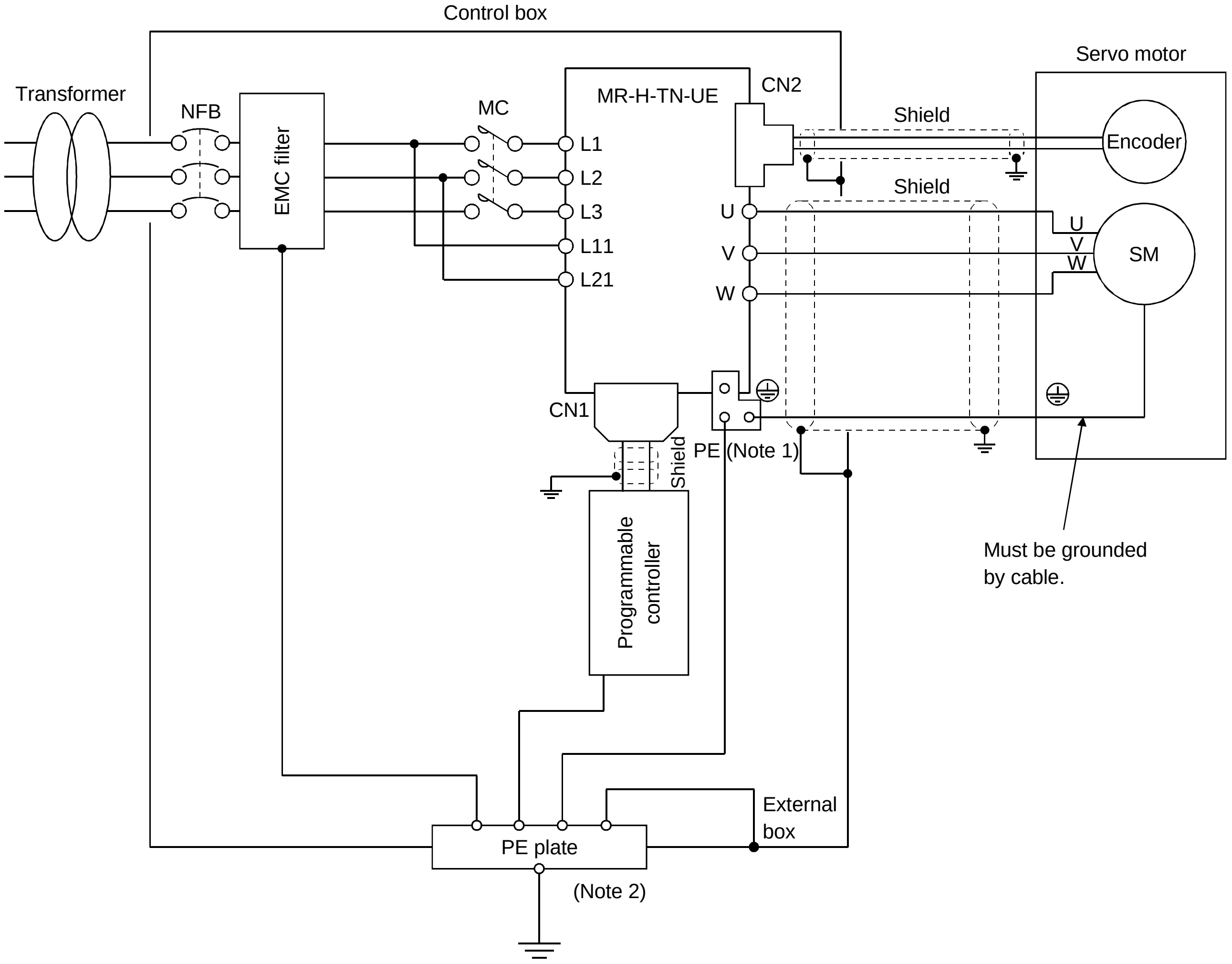
(7) Grounding

WARNING	- Securely ground the servo amplifier and servo motor. - To prevent an electric shock, the protective earth (PE) terminal (marked ⏚) of the servo amplifier must be connected to the protective earth (PE) of the control box.

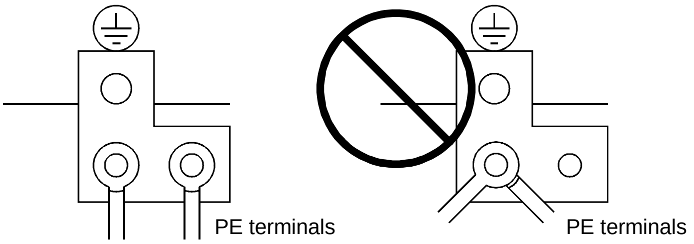
The servo amplifier switches the power transistor to supply power to the servo motor. Depending on the routing of the wiring and ground cables, the servo amplifier may be affected by the switching noises (due to di/dt and dv/dt) of the transistor.

To prevent such a fault, refer to the following diagram and securely ground the servo amplifier and servo motor.

Even when a leakage current breaker is used, always earth the protective earth (PE) terminal of the servo amplifier 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 Chapter 14.

And the cable sizes listed in Section 14.2.1 are used under the following conditions.

When the cables are used under the conditions other than the following, refer to table 5 and Appendix C in EN60204 - 1.

Item	Description
Ambient temperature	40℃
Sheath	PVC (polyvinyl chloride)
Installation method	Run on wall surface or in open cable tray

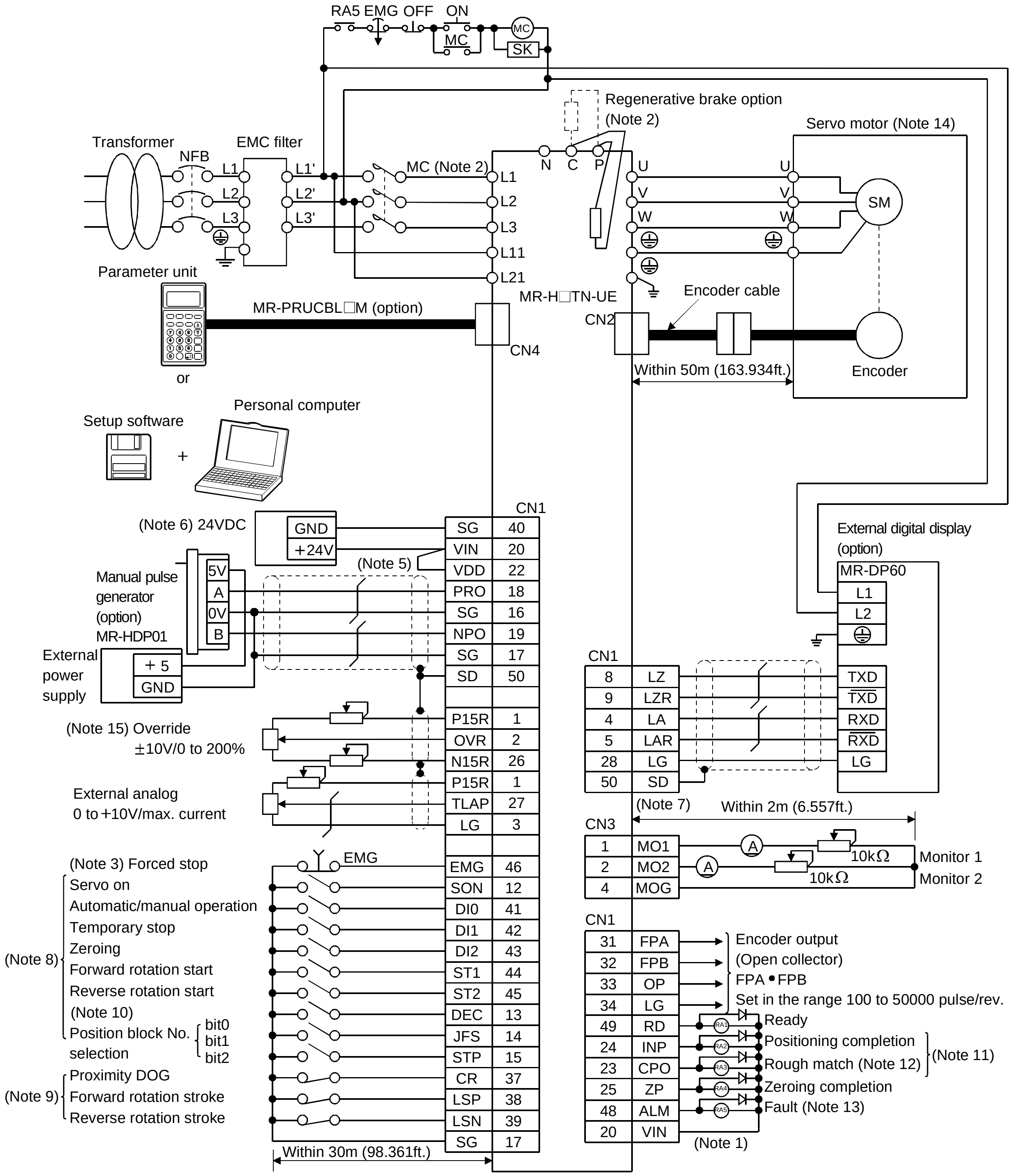
(9) Performing EMC tests

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”.

16.1.3 Standard connection examples

(1) Positioning system



For the notes, refer to the next page.

Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the forced 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 forced stop switch must be installed.

4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.

5. Always connect VDD-VIN externally.

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

7. Change the setting of parameter No.52 to “□□□0” to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.

8. Can be used as the CN1 external input signals by setting of parameter No. 66.

9. Can be used as the CN1 external input signals in the initial status of parameter No. 66.

10. Cannot be used when 2 stations are occupied.

11. Change the setting of parameter No.44 to “□□□” 1 to use PF and CPO as an M code.

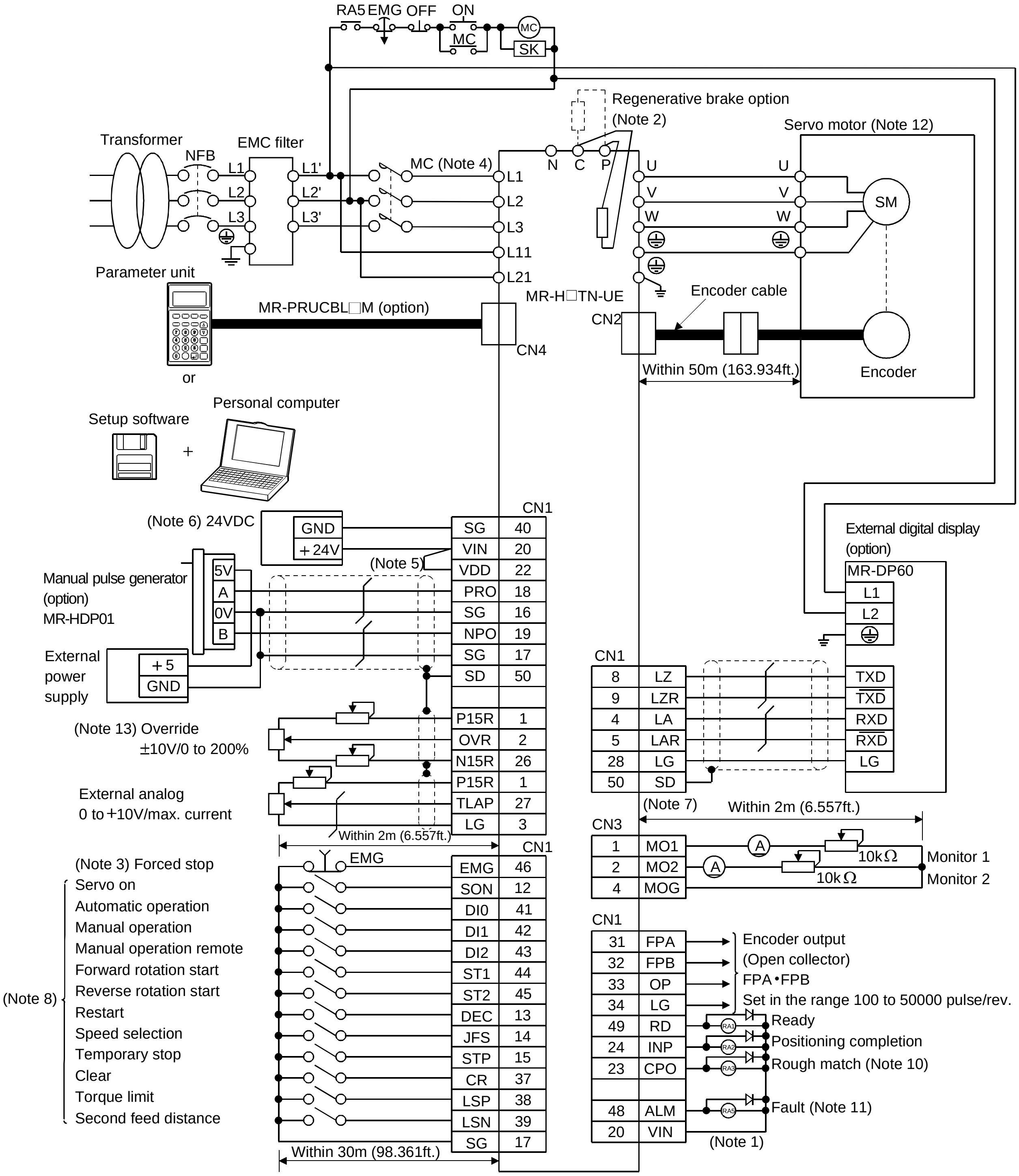
12. Change the setting of parameter No.3 to “□□1□” to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to “□1□□” to use CPO as a torque limit-in-progress.

13. At a normal time when no alarm has occurred, ALM-SG are conducting.

14. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Section 6.4.

15. The upper limit of the overriding speed is the permissible speed.

(2) Roll feeding system



For the notes, refer to the next page.

Note: 1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the forced 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 forced stop switch must be installed.
4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
5. Always connect VDD-VIN externally.
6. Use a 24VDC power supply which has been insulation-reinforced in I/O.
7. Change the setting of parameter No.52 to "□□□0" to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
8. Can be used as the CN1 external input signals by setting of parameter No. 66.
9. Cannot be used when 2 stations are occupied.
10. 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.
11. At a normal time when no alarm has occurred, ALM-SG are conducting.
12. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Section 6.4.
13. The upper limit of the overriding speed is the permissible speed.

16.2 Conformance with UL/C-UL standard

16.2.1 Servo amplifier and servo motor used

Use the UL/C-UL Standard-compliant model of servo amplifier and servo motor. The 11kW and higher servo amplifiers 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.

Servo amplifier series : MR-H10TN-UE to MR-H700TN-UE (Scheduled for release)
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:

16.2.2 Installation

Install a fan of 100CFM air flow 10.16[cm] (4[in.]) above the servo amplifier or provide cooling of at least equivalent capability to ensure that the ambient temperature conforms to the environment conditions.

16.2.3 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.

16.2.4 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.

Servo amplifier	Crimping terminals, crimping tools			
	L1 ▪ L2 ▪ L3	U ▪ V ▪ W ▪ ⏚	L11 ▪ L21	P ▪ C
MR-H10TN-UE	a	a	a	a
MR-H20TN-UE	a	a	a	a
MR-H40TN-UE	a	a	a	a
MR-H60TN-UE	a	a	a	a
MR-H100TN-UE	a	a	a	a
MR-H200TN-UE	b	b	a	a
MR-H350TN-UE	b	b	a	a
MR-H500TN-UE	b	b	c	a
MR-H700TN-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

16.2.5 Fuses

When using a fuse instead of the no-fuse breaker, use the one which has the specifications given in this section.

Servo amplifier	Fuse		
	Class	Current [A]	Voltage
MR-H10TN-UE	K5	10	250VAC
MR-H20TN-UE	K5	10	
MR-H40TN-UE	K5	15	
MR-H60TN-UE	K5	20	
MR-H100TN-UE	K5	25	
MR-H200TN-UE	K5	40	
MR-H350TN-UE	K5 or H	70	
MR-H500TN-UE	K5 or H	125	
MR-H700TN-UE	K5 or H	150	

16.2.6 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 12.1.

Screw size		M3.5	M4	M5	M6
Recommended tightening torque value	[N ▪ m]	0.8	1.2	2.0	2.5
	[lb ▪ in.]	8	11	20	24

16.2.7 Standard connection example

Same as in Section 16.1.3.

16.3 Signals

16.3.1 Main circuit terminal block

Note that the power supply symbols of the MR-H□TN-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□TN	MR-H□TN-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 servo amplifier capacity. Refer to Section 12.1.

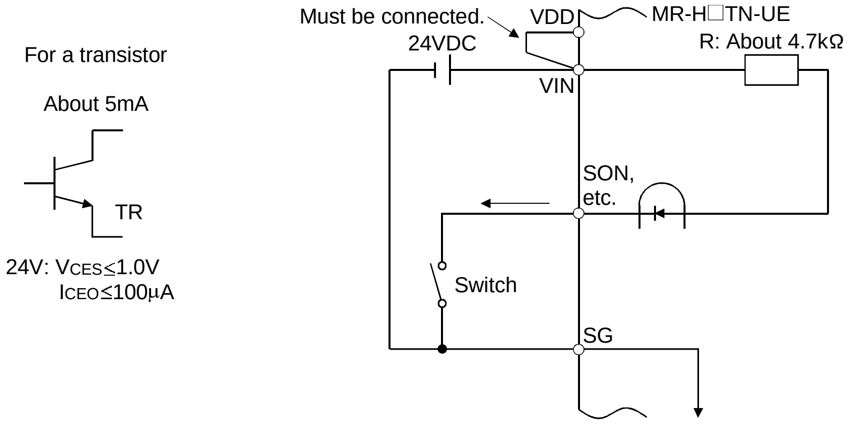
Symbol	Signal	Description
L1, L2, L3	Main circuit power supply	Connect a three-phase 200 to 230VAC, 50/60Hz power supply to L1, L2, L3. But, for MR-H700TN-UE or more, the voltage of 50Hz power is 200 to 220V.
U, V, W	Servo motor output	Connect to the servo motor power supply terminals (U, V, W).
L11, L21	Control circuit power supply	L11 and L21 should be in phase with L1 and L2, respectively. Connect a single-phase 200 to 230VAC, 50/60Hz power supply. But, for MR-H700TN-UE or more, the voltage of 50Hz power is 200 to 220V.
P, C, D	Regenerative brake	In the MR-H-400TN-UE to MR-H700TN-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-H11KTN-UE or more, always connect the supplied regenerative brake resistor across P-C.
MS1 ▪ MS2	Servo motor fan	Connect to the cooling fan which is built in the HA-LH11K2-EC to HA-LH22K2-EC servo motors. Provided for the servo amplifiers of MR-H11KTN-UE or more.
⏚	Grounding	Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.

16.3.2 Interfaces

(1) Digital input interface DI-1

Always use an external power supply.

Provide a signal using a relay or open collector transistor.

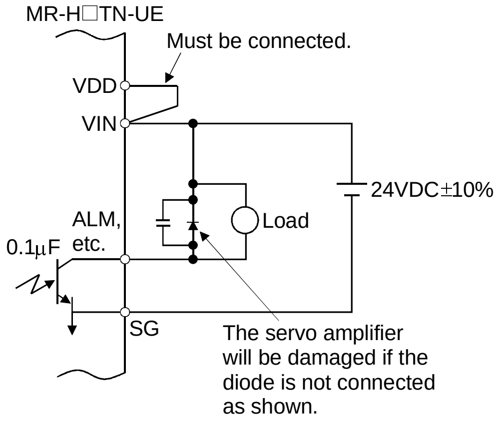


(2) Digital output interface DO-1

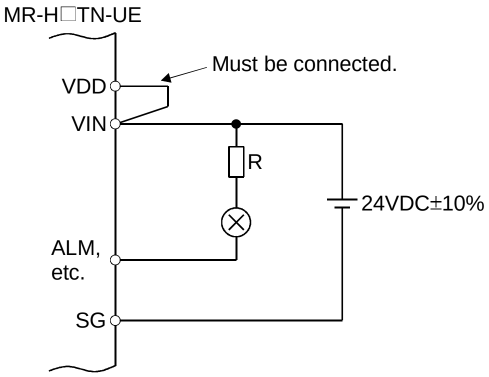
Always use an external power supply.

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



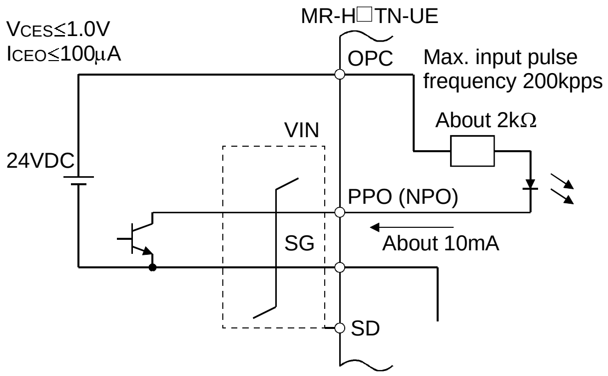
- Lamp load



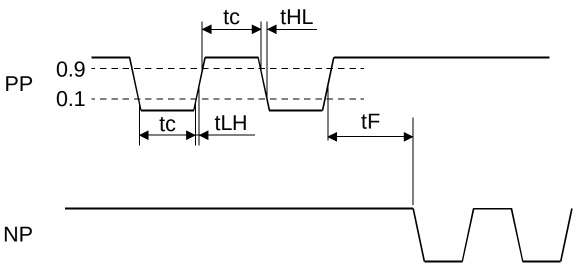
(3) Pulse train input interface DI-2

(a) Open collector system

- Interface example



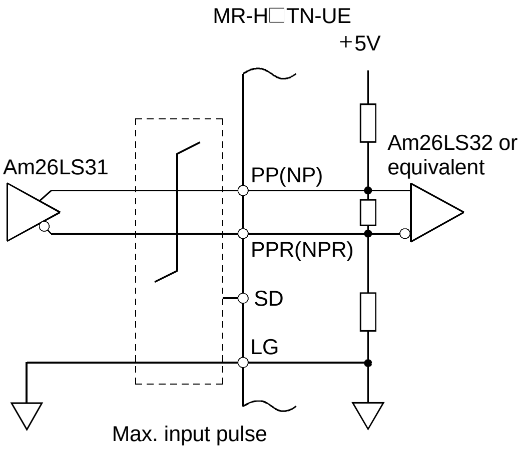
- Input pulse conditions



tLH=tHL<0.2µs
tc>2µs
tF< 3µs

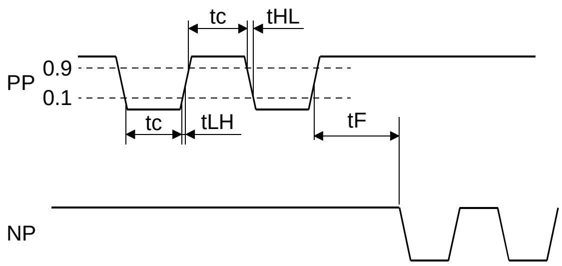
(b) Differential line driver system

- Interface example



Max. input pulse frequency 400kpps

- Input pulse conditions



tLH=tHL<0.1µs
tc >1µs
tF< 3µs

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APPENDICES

Appendix 1 Point table data recording forms

(1) Position blocks

1) 256-positions (positioning)

Position block No.	Position data	M code	Speed block No.
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
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49			

Position block No.	Position data	M code	Speed block No.
50			
51			
52			
53			
54			
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Position block No.	Position data	M code	Speed block No.
100			
101			
102			
103			
104			
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149			

Position block No.	Position data	M code	Speed block No.
150			
151			
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199			

Position block No.	Position data	M code	Speed block No.
200			
201			
202			
203			
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252			
253			
254			
255			

2) 8-positions (positioning)

Position block No.	Position data	M code	Speed block No.
0			
1			
2			
3			
4			
5			
6			
7			

3) 2-positions (roll feeding)

Position block No.	Position data
0	
1	

(2) Speed blocks

1) 8 speeds (positioning ▪ roll feeding)

Speed block No.	Speed (r/min)	Acceleration time constant (ms) or acceleration/ deceleration time constant (ms)	Deceleration time constant (ms) or S-shape time constant (ms)
1			
2			
3			
4			
5			
6			
7			
8			

2) 2 speeds (roll feeding)

Speed block No.	Speed (r/min)	Acceleration time constant (ms) or acceleration/ deceleration time constant (ms)	Deceleration time constant (ms) or S-shape time constant (ms)
1			
2			

Appendix 2 Joint terminal block (MR-TB50) terminal block labels

For positioning system

0	RD	25	VDD
1	SG	26	DOG
2	SG	27	PRO
3	VDD	28	NPO
4	VIN	29	SG
5	SON	30	SG
6	DI2	31	DI1
7	LSN	32	LSP
8	CPO	33	DI0
9	ZP	34	INP
10	EMG	35	ALM
11	ORG	36	MD0
12	ST1	37	STP
13	LG	38	ST2
14	OP	39	P15R
15	LAR	40	LA
16	LBR	41	LB
17	LZR	42	LZ
18	LG	43	FPA
19	LG	44	FPB
20	OVR	45	N15R
21	TLAP	46	LG
22		47	
23		48	
24	SD	49	

For roll feeding system

0	RD	25	VDD
1	SG	26	CR
2	SG	27	PRO
3	VDD	28	NPO
4	VIN	29	SG
5	SON	30	SG
6	STP	31	JFS
7	PS2	32	TL
8	CPO	33	DEC
9	ZP	34	INP
10	EMG	35	ALM
11	MD1	36	MD0
12	ST1	37	MD2
13	LG	38	ST2
14	OP	39	P15R
15	LAR	40	LA
16	LBR	41	LB
17	LZR	42	LZ
18	LG	43	FPA
19	LG	44	FPB
20	OVR	45	N15R
21	TLAP	46	LG
22		47	
23		48	
24	SD	49	

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REVISIONS

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

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