Position Controller with I/O Control Function

IAI
Quality and Innovation

MSEP-LC

First Step Guide First Edition

Thank you for purchasing our product.
Make sure to read the Safety Guide and detailed Instruction Manual (DVD) included with the product in addition to this First Step Guide to ensure correct use.
This Instruction Manual is original.

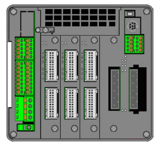
> ⚠ Warning : Operation of this equipment requires detailed installation and operation instructions which are provided on the DVD Manual included in the box this device was packaged in. It should be retained with this device at all times.
> A hardcopy of the Manual can be requested by contacting your nearest IAI Sales Office listed at the back cover of the Instruction Manual or on the First Step Guide.

When using this product for the first time, refer to the processes shown below and make sure not to have any missing in checking or mistake in wiring.

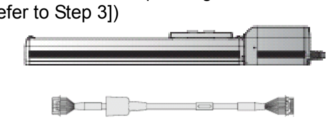
Step1 Confirm all the necessary things are prepared (Contact us or our sales agency in case of any missing)

Refer to Section "Product Check" in this manual for details.

☆MSEP-LC



☆Actuator and Connection Cable
(The cable differs depending on the actuator type [Refer to Step 3])



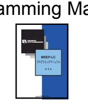
☆CD-ROM (Enclosed in RCM-101-□□)
(The following software is included)
1) RC PC Software
2) Gateway parameter setting tool

☆DVD Instruction Manual
(The following instruction manual is included)

1) MSEP Instruction Manual（M□0299）

2) MSEP-LC Ladder Edit Software Manual（M□0330）

3) MSEP-LC Programming Manual（M□0329）



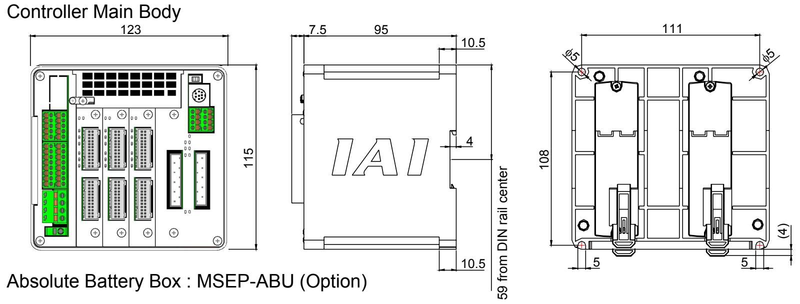
☆Ladder Edit Program (LC-LDS-01)
Download it in IAI homepage
(http://www.iai-robot.co.jp)

Step2 Installation

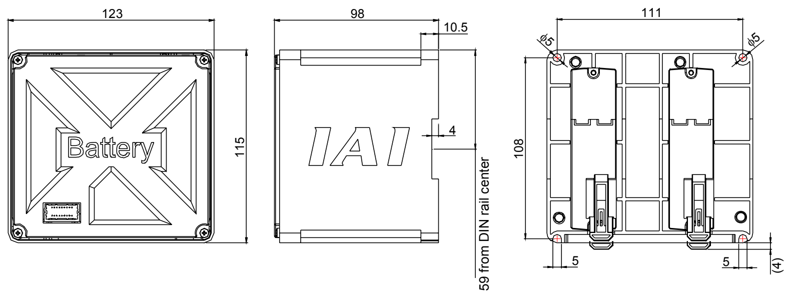
Refer to "Installation Environment" and "Installation and Noise Elimination" in this manual, or "1.7 Installation and Storage Environment" and "Noise Elimination and Mounting Method" in MSEP Instruction Manual

- External Dimensions

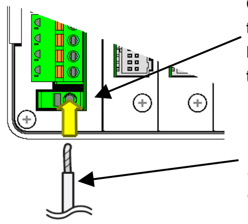
Controller Main Body



Absolute Battery Box : MSEP-ABU (Option)



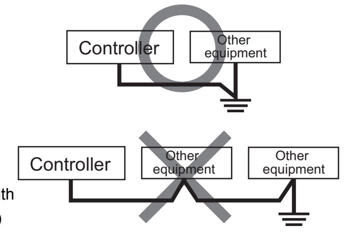
1. Noise Elimination Grounding (Frame Ground)



Connect the ground line to the FG terminal block on the controller unit. Put a tool such as a screwdriver into the square slot and connect the line.

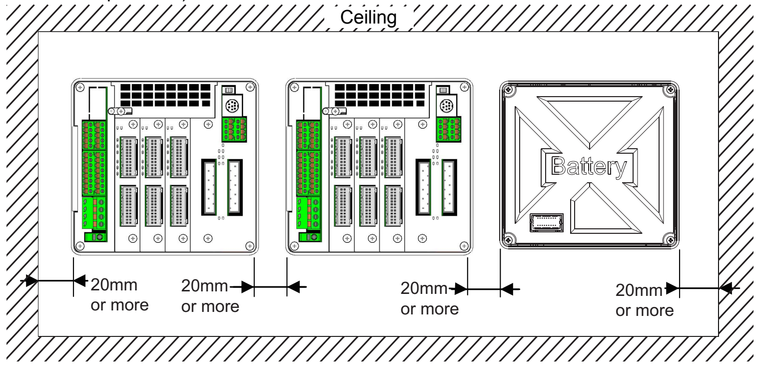
Copper wire: Connect a ground wire with a diameter of 1.6 mm (2mm²: AWG 14) or larger.

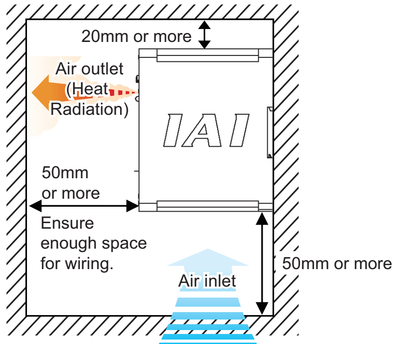
Earth Terminal: Class D grounding (Formerly Class-III grounding : Grounding resistance at 100Ω or less)



Do not share the ground wire with or connect to other equipment. Ground each controller.

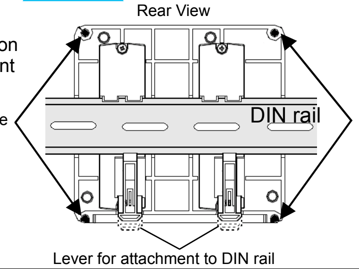
2. Cooling Factors and Installation
Keep the ambient temperature of the controller at 40°C or less.
Especially, keep the temperature around the battery at room temperature. (Approximately 20°C is the recommended temperature.)





Rear View

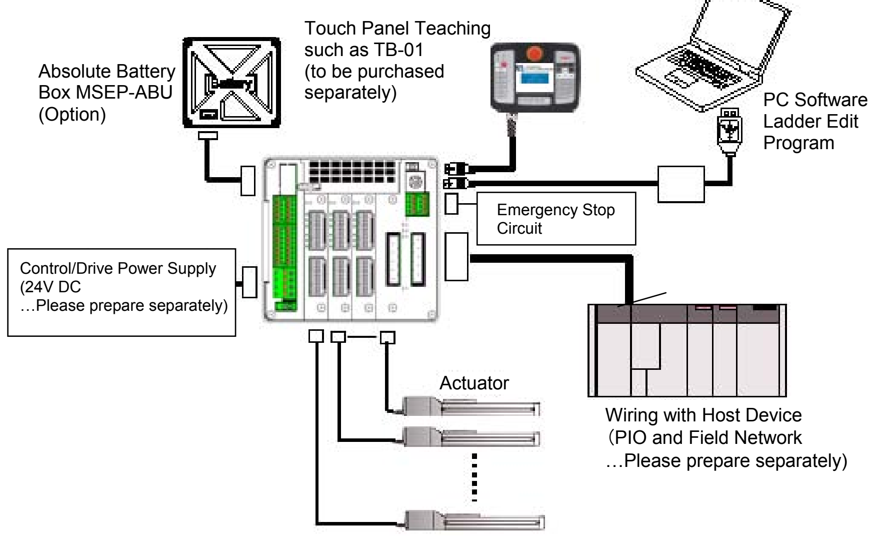
For the attachment of the unit, use the fixture holes on the four corners or attach on the DIN rail. (Attachment should be the same for the absolute battery box.)



Step3 Wiring

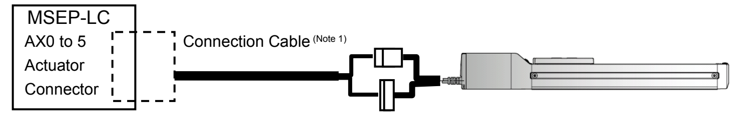
Refer to the contents below or Chapter 2 "Wiring" in MSEP Instruction Manual

Example for Basic Wiring

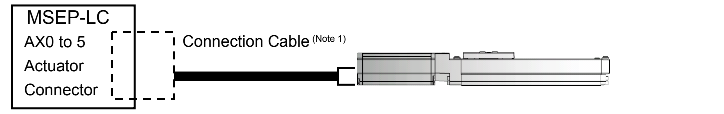


Connection of Actuator • • Connect the actuator following the contents described on the model code card.

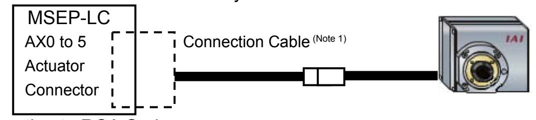
1) Connection to RCP2 Series



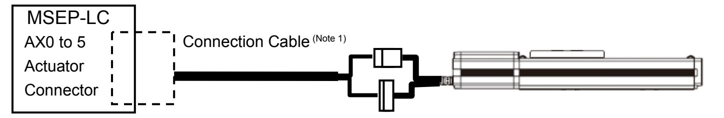
2) Connection to RCP3, RCP4, RCP5, RCA2 and RCL Series



3) Connection to RCP2 Small Rotary Series



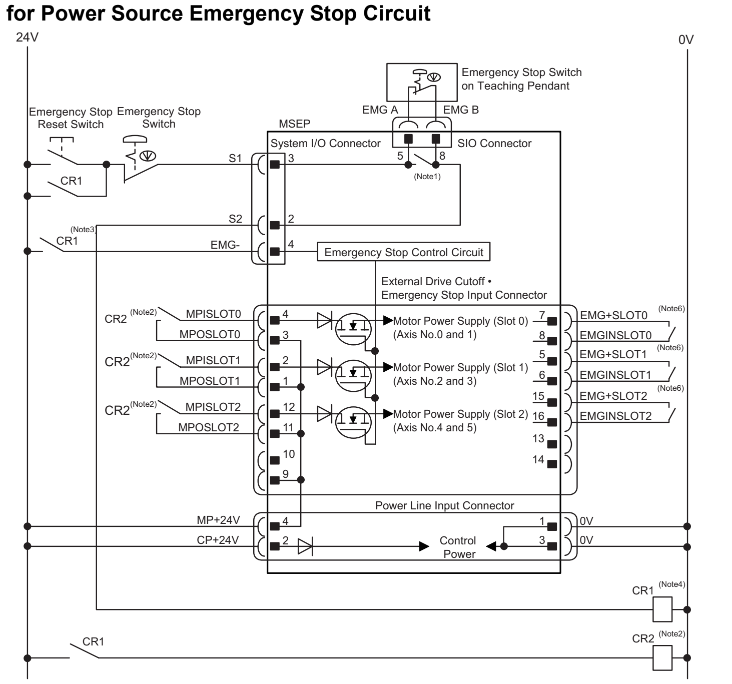
4) Connection to RCA Series



Note 1 Connection Cable Model Codes

Model	Cable□□□: Cable Length	Remarks
RCP2 (Other than Small Rotary)	CB-PSEP-MPA□□□	Robot cable from 0.5 to 20m
Small Rotary Type RCP2-RTBL, RTCL, RTBSL, RTCSL, RTBBL, RTCBL	CB-RPSEP-MPA□□□	Robot cable from 0.5 to 20m
RCA	CB-ASEP-MPA□□□	Robot cable from 0.5 to 20m
RCP3, RCA2, RCL	CB-APSEP-MPA□□□	Robot cable from 0.5 to 20m
	CB-APSEP-MPA□□□-LC	Standard cable from 0.5 to 20m
RCP4 (Other than GR* Type), RCD (Applicable Controller Symbol : D3)	CB-CA-MPA□□□-RB	Robot cable from 0.5 to 20m
	CB-CA-MPA□□□	Standard cable from 0.5 to 20m
RCP4 (GR* Type), RCP5, RCD (Applicable Controller Symbol : D5)	CB-CAN-MPA□□□-RB	Robot cable from 0.5 to 20m
	CB-CAN-MPA□□□	Standard cable from 0.5 to 20m

Example for Power Source Emergency Stop Circuit



Note 1 When the teaching pendant is not connected, S1 and S2 become short-circuited inside the controller.
Note 2 When the motor driving source is cut off externally, connect a contact such as a contactor to the wires between MPISLOT* and MPOSLOT*.
Note 3 The rating for the emergency stop signal (EMG-) to turn ON/OFF at contact CR1 is 24V DC and 10mA.
Note 4 For CR1, select the one with coil current 0.1A or less.
Note 5 When supplying the power by turning on/off the 24V DC, keep the 0V being connected and have the +24V supplied/disconnected (cut one side only).
Note 6 By having a disconnection between EMG+SLOT* and EMGINSLOT+, it is possible to have only the disconnected slot number in emergency stop condition. (*:slot number)

Wiring of I/O (When using Input and output of PIO)
Refer to "Wiring of I/O" in this manual or Chapter 2 "Wiring" in MSEP Instruction Manual.

Wiring of Field Network (When using Field Network)
Refer to the section for wiring of each field network or Chapter 2 "Wiring" in MSEP Instruction Manual.

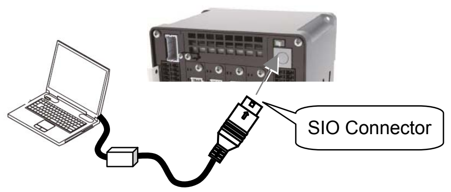
Step4 Establish MSEP-LC Initial Setting • • If none of (1) or (2) is applicable, go to Step 5.

Software Necessary for Initial Setting

1) RC PC Software
(It is necessary when operation is to be made with the operation mode (positioner mode) to register the stop position in advance)

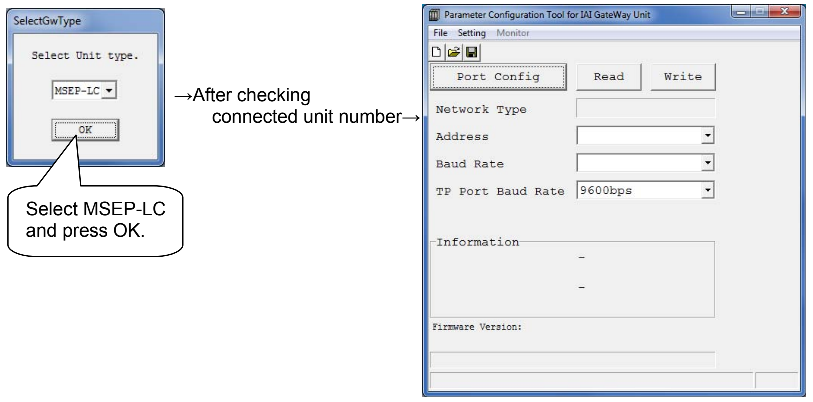
2) Gateway Parameter Setting Tool
(It is necessary when the field network is selected on the extended I/O)

Connect the PC to MSEP-LC with the dedicated cable enclosed in the PC software.



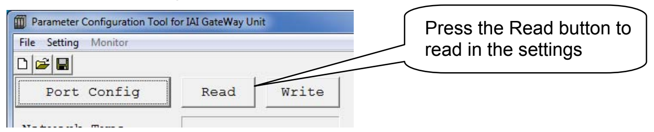
(1) Setting of Field Network (Note) Conduct it only when the field network is mounted on the extended I/O.

1) Start up Gateway Parameter Setting Tool.

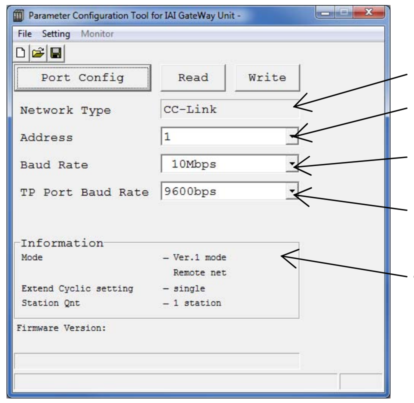


Initial Screen

2) Read in the settings for MSEP-LC.

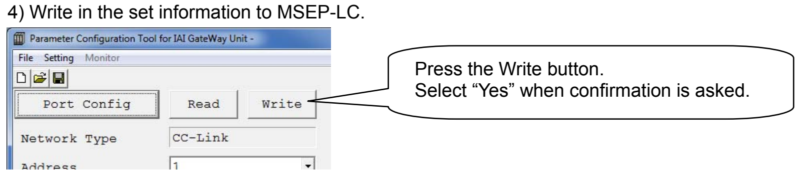


3) Check the node address, baud rate setting and occupation information of the field network.



- Check network type
- Set node address (Box is in white only when setting is available)
- Baud rate (Box is in white only when setting is available)
- Baud rate setting of SIO connector
- Occupation information of each field network is shown (Make sure to have a memo for the information necessary for the host controller settings)

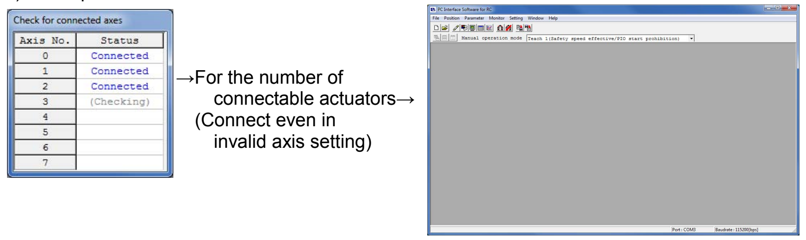
4) Write in the set information to MSEP-LC.



After write, finish Gateway Parameter Setting Tool.

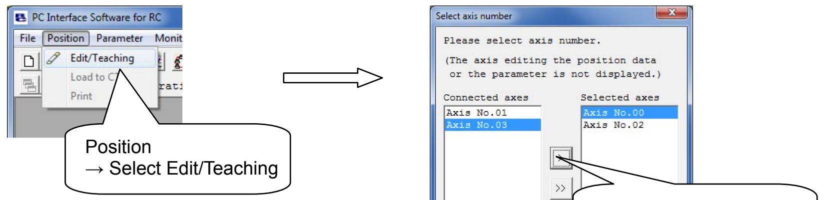
(2) Setting of Target Position (Note) Conduct it only when an operation is made in the positioner mode.

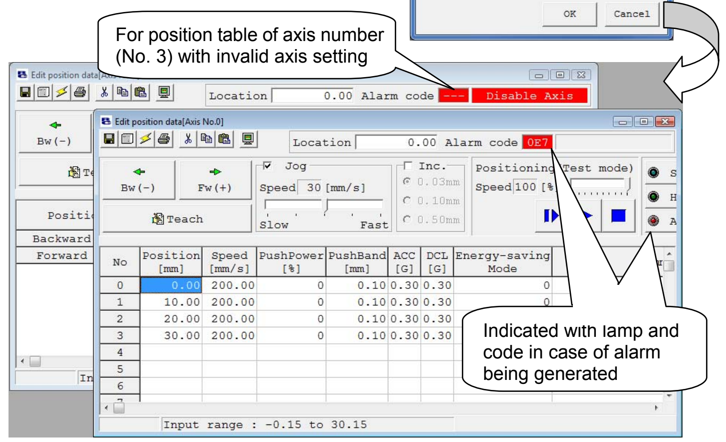
1) Start up RC PC Software.



Initial Screen

2) Open the position table.

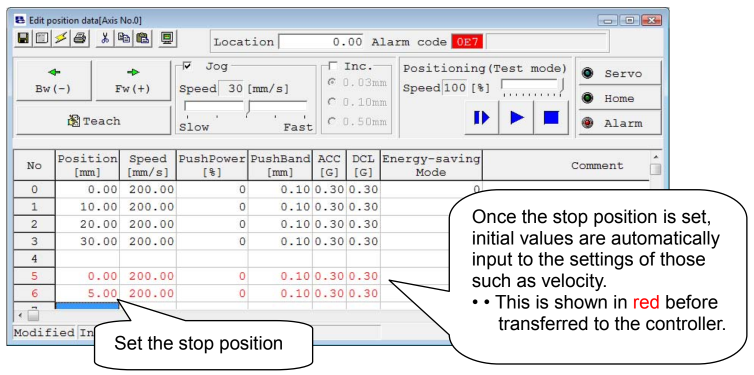




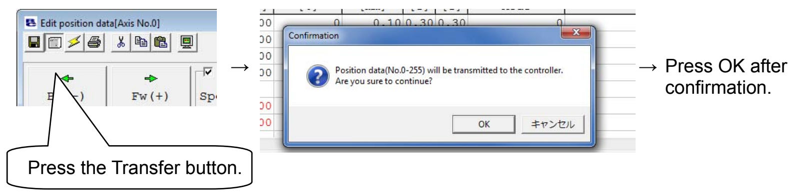
Position table of the selected axis number opens (No. 0 and 3 in this example)

> ⚠ **Caution:** If there are only two to three areas of the lines to input the position for the open position table, conduct Steps 1 to 4 in 3.2.2 "Initial Setting" of MSEP Instruction Manual to establish the settings in Operation Pattern 6.

3) Establish the settings such as stop position in the position table.
Refer to 3.3 "Setting o Position Data" in MSEP Instruction Manual for the details of the position table.



4) Transfer the settings to MSEP-LC.



After transfer, finish RC PC software.

Step5 Creating of Ladder Program

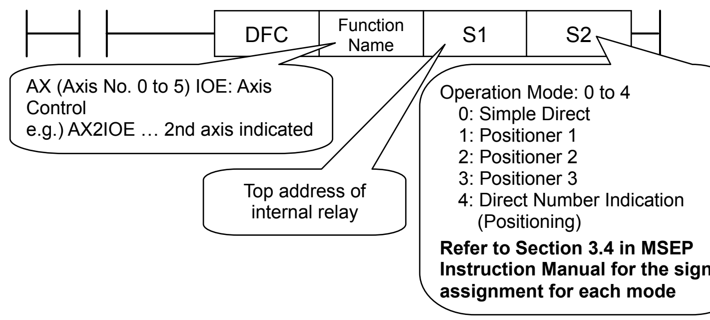
Software and instruction manuals necessary for creating (Installed in DVD Instruction Manuals)

- Ladder Edit Program (LC-LDS-01)
- MSEP-LC Ladder Edit Software Manual (M□0330)
- MSEP-LC Programming Manual (ME0329)
- MSEP Controller Instruction Manual (ME0299)

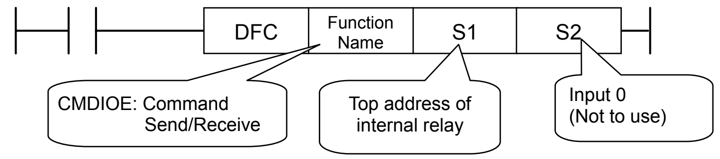
☆ Edit the ladder program by referring to the MSEP-LC ladder edit software manuals above.

[Point]
For the axis control (actuator operation mode indication and operation), writing and reading of position data and fieldbus control, use the dedicated command "DFC". [Refer to the section of the dedicated command in MSEP-LC Programing Manual]

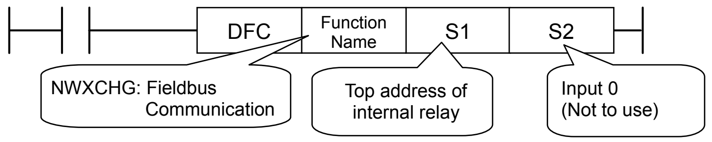
• Axis Control • • [Refer to the section of the operation patterns in this manual and Section 3.2.1 in MSEP Instruction Manual]



•Position Data Reading/Writing • • Refer to 3.4.9 About "Command" in MSEP Instruction Manual



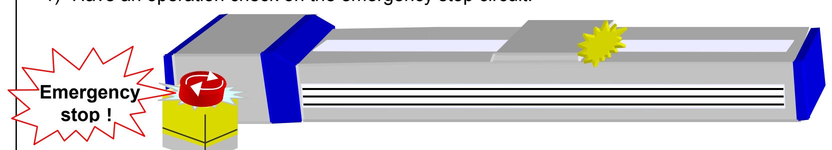
• Fieldbus Communication Command



☆The communication data area of the field network is assigned with one station one time of the remote device station for internal relay top address to CC-Link, and 8 bytes for each input and output for others.

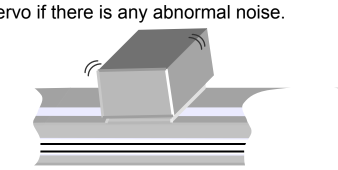
Step6 Test Run

1) Have an operation check on the emergency stop circuit.



2) Without any work piece mounted, check in low speed for any debugging in the ladder, operation of the actuator, and also the cooperation with peripheral devices.

3) Check the operation in the desired speed with a work piece loaded. Check the condition of the actuator attachment and adjust the servo if there is any abnormal noise.



4) Put the operation mode setting switch on MSEP-LC to AUTO, and have an operation with a command of the host.

Product Check

This product is comprised of the following parts if it is of standard configuration.
If you find any fault in the contained model or any missing parts, contact us or our distributor.

1. Parts

No.	Part Name	Model	Remarks
1	Controller Main Body	Refer to "How to read controller model code"	
Accessories			
2	Power Connector	FKC2.5HC/4-ST-5.08 (Supplier: PHOENIX CONTACT)	Recommended cable size • Control Power Supply 0.5 to 0.3mm²(AWG20～22) • Motor Driving Power Supply 2.5 to 0.5mm²(AWG12～20)
3	External Brake Input Connector	FMCD1.5/5-ST-3.5 (Supplier: PHOENIX CONTACT)	Recommended cable size 0.5 to 0.2mm²(AWG20～24)
4	Drive Cutoff/Emergency Stop Input Connector	FMCD1.5/8-ST-3.5 (Supplier: PHOENIX CONTACT)	Recommended cable size • Emergency Stop 0.5 to 0.2mm²(AWG20～24) • Motor Power External Input 1.25 to 0.5mm²(AWG16～20)
5	System I/O Connector	FMCD1.5/4-ST-3.5 (Supplier: PHOENIX CONTACT)	Recommended cable size 0.5 to 0.2mm²(AWG20～24)
6	I/O Flat Cable (For PIO Type)	CB-PAC-PIO***	***shows the cable length (Example) *** : 020 = 2 [m]
7	CC-Link Connector (For CC-Link Type)	MSTB2.5/5-STF-5.08 AU (Supplier: PHOENIX CONTACT)	Terminal Resistance (130Ω1/2W, 110Ω1/2W) enclosed one unit each
8	DeviceNet Connector (For DeviceNet Type)	MSTB2.5/5-STF-5.08 AU (Supplier: PHOENIX CONTACT)	Prepare a terminal resistor separately if this controller is to be allocated at the terminal.
9	Absolute Battery Box (Option)	MSEP-ABU (Battery AB-7)	For Simple Absolute Type
10	First Step Guide		
11	Instruction Manual (CD/DVD)		
12	Safety Guide		

2. Teaching Tool (Please purchase separately)
A teaching tool such as PC software is necessary when performing the setup for position setting, parameter setting, etc. that can only be done on the teaching tool.
Please prepare either of the following teaching tools.

No.	Part Name	Model
1	PC Software (Includes RS232C Exchange Adapter + Peripheral Communication Cable)	RCM-101-MW
2	PC Software (Includes USB Exchange Adapter + USB Cable + Peripheral Communication Cable)	RCM-101-USB
3	Teaching Pendant (Touch Panel Teaching)	CON-PTA
4	Teaching Pendant (Touch Panel Teaching with deadman switch)	CON-PDA
5	Teaching Pendant (Touch Panel Teaching with deadman switch + TP Adapter (RCB-LB-TG))	CON-PGA
6	Teaching Pendant (Touch Panel Teaching)	TB-01
7	Teaching Pendant (Touch Panel Teaching with deadman switch)	TB-01D
8	Teaching Pendant (Touch Panel Teaching with deadman switch + TP Adapter (RCB-LB-TG))	TB-01DR

3. Instruction manuals related to this product, which are contained in the instruction manual (DVD).

No.	Name	Manual No.
1	MSEP Controller Instruction Manual	ME0299
2	PC Software RCM-101-MW/RCM-101-USB Instruction Manual	ME0155
3	Touch Panel Teaching CON-PTA/PDA/PGA Instruction Manual	ME0295
4	Touch Panel Teaching TB-01/TB-01D/TB-01DR Instruction Manual	ME0324
5	MSEP-LC Programming Manual	ME0329
6	MSEP-LC Ladder Edit Software Manual	M□0330

4. How to read the model plate

Model→	MODEL		MSEP-LC-4-20PI-PI-10I-N-NP-2-0-ABB-NP
Serial number→	PRODUCT DATE		2013/12/01
Manual No.→	MANUAL No.		ME***
Input power supply→	CP INPUT		DC24V 2.0A
	MP INPUT		DC24V 5.0A
	AXIS No. /OUTPUT		
Information of the connected axes → (Axis No. 0 to 5)	0	0-24Vac 3ph 0-333Hz 1.0A	
	1		
	2	0-24Vac 3ph 0-333Hz 2.0A	
	3		
	4		
	5		

5. How to read controller model code
(Example) Consists of 4 axes: Axis No.0=pulse motor type, No.1=Ineffective axis, Axis No.2=servo motor type, Axis No.3=No connected axis and Axis

MSEP-LC-3-20PWAI-PWAI-10I-N-NP-2-0-ABB-CC-**

<Series>

<Type>
LC : Ladder Sequence Type

<Connected Axes>
1 to 6: Number of driver axes

<Detail of Connected Axis>

[Pulse Motor Type]		[Servo Motor Type]	
20P	:20□ pulse motor	2	:2W servo motor
20SP	:20□ pulse motor	5	:5W servo motor
28P	:28□ pulse motor	5S	:5W servo motor
28SP	:28□ pulse motor	10	:10W servo motor
35P	:35□ pulse motor	20	:20W servo motor
42P	:42□ pulse motor	20S	:20W servo motor
56P	:56□ pulse motor	30	:30W servo motor
		3D	:3WDC brushless motor

P : Ineffective axis (Pulse motor)
A : Ineffective axis (Servo motor)
N : Not connected

[Encoder Type]
WAI : Incremental / Battery-less Absolute Shared (Pulse Motor Type)
I : Incremental (Servo Motor Type)
SA : Simple Absolute (Pulse Motor / Servo Motor)

[Option]
HA : High Acceleration/Deceleration Type (when servo motor selected)
LA : Low Power Consumption Type (when servo motor selected)
T : High-Output Setting Type (when pulse motor selected)

< Standard I/O Type>
NP : NPN Type (Sink type)

<I/O Cable Length>
0 : No cable 2 : 2m (Standard)
3 : 3m 5 : 5m

<Power Voltage>
0 : 24V DC

<Applicable for Simple Absolute Type>
ABB : Simple Absolute Type (with absolute battery)
ABBN : Simple Absolute Type (with no absolute battery)
No indication : Incremental

<Extended I/O Type >
NP : NPN Type (Sink type) (Standard)
DV : DeviceNet Type
CC : CC-Link Type
PR : PROFIBUS-DP Type
CN : CompoNet Type
EP : EtherNet/IP Type
EC : EtherCAT Type

<Identification for IAI use only>
* There is no identification in some cases

Basic Specifications

List of Specifications

Specification Item		Driver for Servo Motor				Driver for Pulse Motor	
Number of Controlled Axes		MAX. 6 axes					
Control/Motor Power Supply Voltage		24V DC ±10%					
Brake Power Supply		0.15A × Number of axes					
Control Power Current Consumption		0.8A					
Control Power In-Rush Current		MAX. 5A 30ms or less					
Motor Current Consumption		Motor Type	Rated	Low power	MAX.(Note 1)	Motor Flange Size	MAX.(Note 2)
		2W	0.8A		4.6A	20P	2.0A
		3W (RCD)	0.7A		1.5A	28P	2.0A
		5W	1.0A		6.4A	35P	2.0A (High output invalid) 3.5A (Rated) / 4.2A (MAX.) (High output valid) (Note 4)
		10W(RCL)	1.3A		6.4A	42P	
		10W (RCA/RCA2)	1.3A	2.5A	4.4A	42P	
		20W	1.3A	2.5A	4.4A	56P	
		20W (20S type)	1.7A	3.4A	5.1A	56P	
		30W	1.3A	2.2A	4.4A		
Motor Power In-Rush Current		Number of slots × MAX. 10A 5ms or less					
Heat Generation		Max. 26W					
Control System		Vector control (Rectangular waveform drive only for 3W of the motor type)				Weak field-magnet vector control	
Encoder Resolution	RCP2 to RCP5	All types				800Pulse/rev	
	RCA2	RCA2-□□□N				1048Pulse/rev	
		Except for RCA2-□□□N				800Pulse/rev	
	RCL	RA1L • SA1L • SA4L • SM4L				715Pulse/rev	
		RA2L • SA2L • SA5L • SM5L				855Pulse/rev	
		RA3L • SA3L • SA6L • SM6L				1145Pulse/rev	
	RCD	All types				400Pulse/rev	
Actuator Cable Length		MAX. 20m (Note) 10m maximum for Simple Absolute type					
Serial Communication Interface (SIO Port: Only for teaching)		RS485 1CH (based on Modbus Protocol) Speed 9.6 to 230.4kbps					
External Interface	PIO	PIO Type: Signal I/O dedicated for 24V DC (dedicated for NPN Type) Number of max. input: 32 points, Number of max. output: 32points (in total of standard I/O and extension I/O) Cable length MAX. 10m					
	Field Network (Occupied domains or number of points)	CC-Link (Remote device station, 1 station 1 time) DeviceNet, PROFIBUS-DP, CompoNet, EtherNet/IP, EtherCAT (Other than CC-Link: Input and output 64 points (8 bytes))					

Specification Item		Driver for Servo Motor	Driver for Pulse Motor
Data Setting and Input		PC Software, Touch Panel Teaching, Gateway Parameter Create Tool	
Ladder Execution System		Interpreter System	
Program Capacity		2K steps (4 bytes per step)	
Data Retention Memory		Position data and parameters are saved in the nonvolatile memory. (There is no limitation in number of writing) Ladder storage domains: 30,000 times max.	
Number of Positioning Points		256 points (There is no limit for simple direct and direct indication modes) (The number of positioning points differs depending on the operation mode select by the parameter setting.)	
LED Display (Mounted on Front Panel))		8 LED lamps for driver status display (for each driver board) Status LED 9 points	
Electromagnetic Brake Compulsory Release		Brake release available for each axis by compulsory release signal input (24V DC input)	
Protective functions (Note3)		Overcurrent Protection (Equipped with a built-in cutoff circuit using a semiconductor for each slot)	
Protection Function against Electric Shock		Class I basic insulation	
Insulation Resistance		500V DC 10MΩ	
Weight		700g or less, absolute battery box 1650g(for 6-axis type)	
Cooling Method		Forced air-cooling	
External Dimensions		123W × 115H × 95D	
Environment	Surrounding Air Temperature	0 to 40°C	
	Surrounding Humidity	85%RH or less (non-condensing)	
	Surrounding Environment	[Refer to Installation Environment]	
	Surrounding Storage Temperature	-20 to 70°C 0 to 40°C for absolute battery	
	Surrounding storage humidity	85%RH or less (non-condensing)	
	Usable Altitude	1000m or lower above sea level	
	Vibration Durability	Frequency 10 to 57Hz/ Swing width : 0.075mm Frequency 57 to 150Hz/ Acceleration : 9.8m/s² XYZ Each direction Sweep time: 10 min. Number of sweep: 10 times	
	Shock Resistance	150mm/s² 11ms Semi-sine wave pulse XYZ Each direction 3 times	
	Protection Class	IP20	

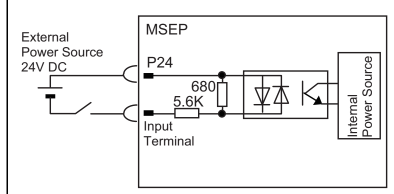
Note 1 The current becomes maximum when the excitation phase of the servo-motor is detected, which is performed during the initial servo-motor ON processing after the power is injected. (Normal: Approx. 1 to 2 sec, MAX.: 10 sec).
Note 2 The current is maximized at the excitation phase detection conducted in the first servo-on process after the power is supplied (ordinary 100ms).
Note 3 For servo-motor, the protection is triggered with the current greater in 1.4 times than the maximum load current.
Note 4 High-output type driver board can control one axis per board.

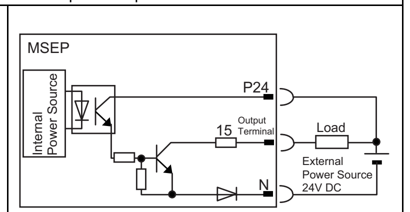
< Calculation of 24V DC Power Capacity >
For the calculation of 24V DC power capacity, figure out the numbers for (1) to (5) below, and then follow Step (7).
(1) Control Power Current Consumption: 0.8A··········1)
(2) Current Consumption of Motor Power Supply:
Total of motor current consumption of connected actuator··········2)
(3) Current Consumption at Excitation Phase Detection:
Maximum current in the total of maximum motor current to turn the servo on at the same time··········3)
(4) Control Power In-Rush Current: 5A··········4)
(5) Motor Power In-Rush Current: Number of slots × 10A··········5)
(6) Current consumption of brake power supply: Number of actuators with brake × 0.15A··········6)
(7) Selection of Power Supply:
Usually, the rated current is to be approximately 1.3 times higher than 1) + 2) + 6) above considering approximately 30% of margin to the load current. However, considering the current of 3) to 5), even though it is a short time, select a power supply with "peak load corresponding" type or that with enough capacity. For the current of 3) to 5), it can be avoided from the current consumption occurred at the same time by the timing for the emergency stop release (motor power-on) and servo-on being changed. In the case that the capacity margin is not sufficient, voltage might be dropped in a moment. In particular, be careful of the power unit with the remote sensing function.
(Note) Make short-circuit on 0V side when separate power sources are used for the control power and motor power.

(Reference) Selection of Power Supply Protection Circuit Breaker
It is recommended that the power supply protection is conducted on the primary side (AC power side) of the 24V DC power supply unit.
Pay attention to the in-rush current of 24V DC power supply unit and rated cutoff current of the circuit breaker.
• Rated Breaking Current > Short-circuit Current = Primary Power Supply Capacity/Power Voltage
• (Reference) In-rush Current of IAI Power Supply Unit PS241 = 50 to 60A, 3msec

● Specifications of PIO Interface

	Input section		Output section	
Specification	Input Voltage	24V DC ±10%	Load Voltage	24V DC ±10%
	Input Current	5mA 1 circuit	Peak Load Electric Current	50mA 1 circuit
	ON/OFF voltage	ON voltage MIN. 18V DC OFF voltage MAX. 6V DC	Leak Current	MAX. 2mA/1 point
	External circuit insulation with photocoupler			
NPN				





● Extended I/O Field Network type
Refer to Section 1.4 in MSEP Instruction Manual

Installation Environment

This product is capable for use in the environment of pollution degree 2[*1] or equivalent.
*1 Pollution Degree 2 : Environment that may cause non-conductive pollution or transient conductive pollution by frost (IEC60664-1).

Installation Environment
Do not use this product in the following environment.

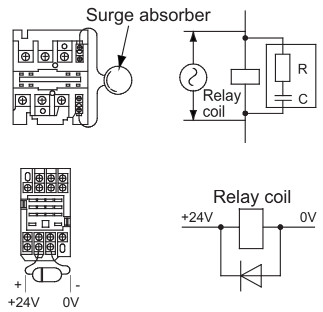
- Location where the surrounding air temperature exceeds the range of 0 to 40°C
- Location where condensation occurs due to abrupt temperature changes
- Location where relative humidity exceeds 85%RH
- Location exposed to corrosive gases or combustible gases
- Location exposed to significant amount of dust, salt or iron powder
- Location subject to direct vibration or impact
- Location exposed to direct sunlight
- Location where the product may come in contact with water, oil or chemical droplets
- Environment that blocks the air vent [Refer to 1.7 Noise Elimination and Mounting Method]

When using the product in any of the locations specified below, provide a sufficient shield.

- Location subject to electrostatic noise
- Location where high electrical or magnetic field is present
- Location with the mains or power lines passing nearby

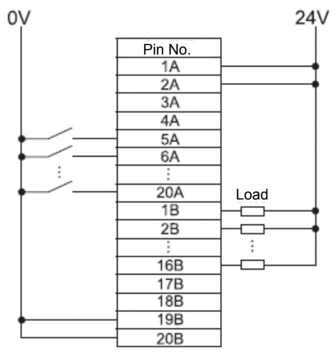
Installation and Noise Elimination

2. Precautions regarding wiring method
   1) Wire is to be twisted for the 24V DC power supply.
   2) Separate the signal and encoder lines from the power supply and power lines.
3. Noise Sources and Elimination
   Carry out noise elimination measures for electrical devices on the same power path and in the same equipment.
   The following are examples of measures to eliminate noise sources.
   1) AC solenoid valves, magnet switches and relays
      [Measure] Install a Surge absorber parallel with the coil.
   2) DC solenoid valves, magnet switches and relays
      [Measure] Mount the windings and diodes in parallel. Select a diode built-in type for the DC relay.

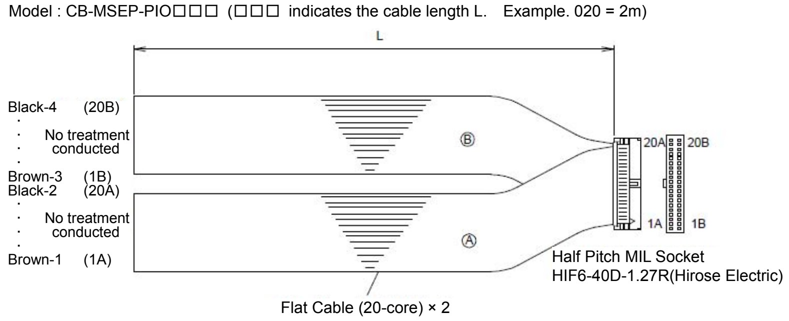


Wiring of I/O

Use the attached cable for the connection.

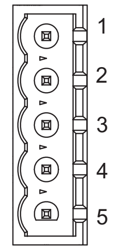


Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

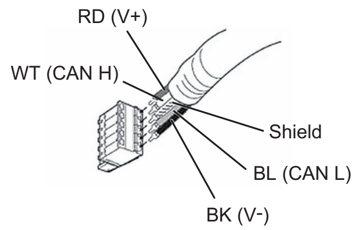


Wiring of DeviceNet

Refer to the instruction manuals for each Field Network master unit and mounted Host Device for the details.



Front View of Connector on Controller side

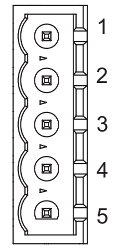


Connector Name	DeviceNet Connector	
Cable Side	MSTB2.5/5-STF-5.08AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MSTBA2.5/5-GF-5.08AU	

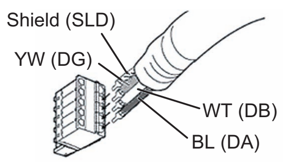
Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	V- (BK)	Power Supply Cable Negative Side	Dedicated cable for DeviceNet
2	CAN L (BL)	Communication Data Low Side	
3	Shield (None)	Shield	
4	CAN H (WT)	Communication Data High Side	
5	V+ (RD)	Power Supply Cable Positive Side	

Wiring of CC-Link

Refer to the instruction manuals for each Field Network master unit and mounted Host Device for the details.



Front View of Connector on Controller side

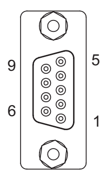


Connector Name	CC-Link Connector	
Cable Side	MSTB2.5/5-STF-5.08AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MSTBA2.5/5-GF-5.08AU	

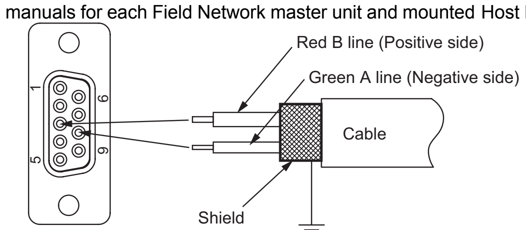
Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	DA (BL)	Communication Line A	Dedicated cable for CC-Link
2	DB (WT)	Communication Line B	
3	DG (YW)	Digital GND	
4	SLD	Connect the shield of the shielded cable (Connect the FG of the 5 pins and controller FG internally)	
5	FG	Frame Ground (Connect the SLD of the 4 pins and controller FG internally)	

Wiring of PROFIBUS-DP

Refer to the instruction manuals for each Field Network master unit and mounted Host Device for the details.



Front View of Connector on Controller side

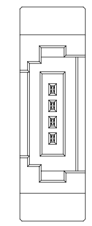


Connector Name	PROFIBUS-DP Connector	
Cable Side	9-pin D-sub Connector (Male)	Please prepare separately
Controller Side	9-pin D-sub Connector (Female)	

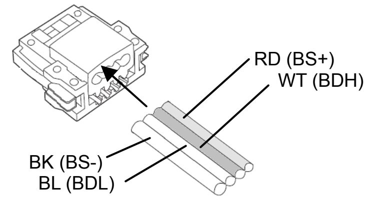
Pin No.	Signal Name	Description	Applicable cable diameter
1	NC	Disconnected	PROFIBUS-DP Dedicated Cable
2	NC	Disconnected	
3	B-Line	Communication Line B (RS485)	
4	RTS	Request for Sending	
5	GND	Signal GND (Insulation)	
6	+5V	+5V Output (Insulation)	
7	NC	Disconnected	
8	A-Line	Communication Line A (RS485)	
9	NC	Disconnected	

Wiring of CompoNet

Refer to the instruction manuals for each Field Network master unit and mounted Host Device for the details.



Front View of Connector on Controller side



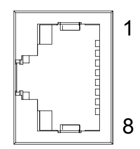
Connector Name	CompoNet Connector	
Cable Side	Prepare a connector complied with CompoNet standards.	
Controller Side	XW7D-PB4-R	Produced by OMRON

Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	BS+ (RD)	Communication Power Supply + (Note 1)	CompoNet Dedicated Cable
2	BDH (WT)	Signal line H side	
3	BDL (BL)	Signal line L side	
4	BS- (BK)	Communication Power Supply - (Note 1)	

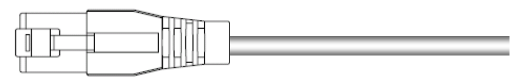
Note 1 It is not necessary to supply the communication power. (Internal power source is used.)
There is no problem if the power supply is connected to BS+ or BS-.

Wiring of EtherNet/IP and EtherCAT

Refer to the instruction manuals for each Field Network master unit and mounted Host Device for the details.

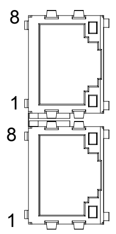


EtherNet/IP, Front View of Connector on Controller side



Connector Name	EtherNet/IP Connector (EtherNet/IP), EtherCAT Connector (EtherCAT)	
Cable Side	8P8C Modular Plug	
Controller Side	8P8C Modular Jack	

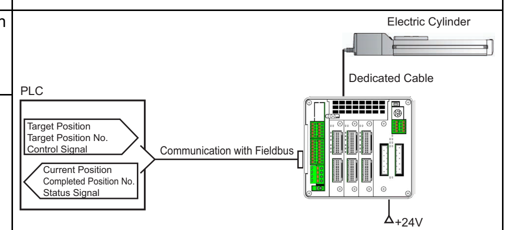
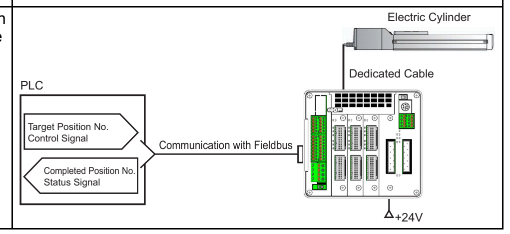
Pin No.	Signal Name	Description	Applicable cable diameter
1	TD+	Data sending +	For EtherNet cable, use a straight STP cable that possesses the performance of Category 5e or more.
2	TD-	Data sending -	
3	RD+	Data receiving +	
4	-	Disconnected	
5	-	Disconnected	
6	RD-	Data receiving -	
7	-	Disconnected	
8	-	Disconnected	

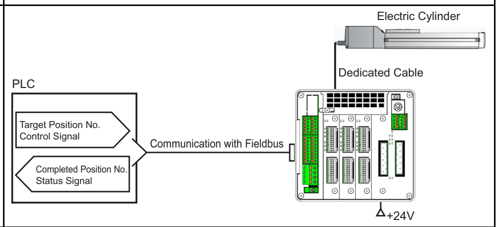
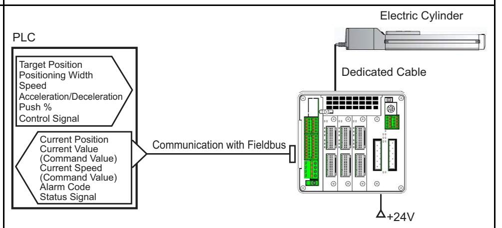


EtherCAT Front View of Connector on Controller side

Operation Pattern

There are five patterns of control systems. Establish the setting in the ladder command (DFC) with the most suitable operation pattern to your purpose of use.

Operation Pattern	Description	Overview
Simple Direct Mode	In Simple Direct Mode, the target position can be indicated directly by inputting a value. Monitoring of the current position is also available.	
Positioner 1 Mode	In Positioner 1 Mode, 256 points of position data can be registered at the maximum and is able to stop at the registered positions. Monitoring of the current position is also available.	
Positioner 2 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available. This mode is that the transferred data is reduced from Positioner 1 Mode.	

Operation Pattern	Description	Overview
Positioner 3 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available. This is the mode to control with the minimized number of signals to perform the positioning operation by reducing the amount of sent and received data from Positioner 2 Mode.	
Direct Numeric Specification Mode	The target position, speed acceleration/deceleration and pressing current limit can be indicated with inputting a number. Monitoring of not only the current position, but also the current speed and indicated current are available.	

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Manual No.: ME0334-1C

MSEP-C/LC Controller

Instruction Manual Seventh Edition

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Instruction Manual describes all necessary information items to operate this product safely such as the operation procedure, structure and maintenance procedure.

To ensure the safe operation of this product, please read and fully understand this manual.
The enclosed DVD in this product package includes the Instruction Manual for this product.
For the operation of this product, print out the necessary sections in the Instruction Manual or display them using the personal computer.

After reading through this manual, keep this Instruction Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Instruction Manual is original.
- The product cannot be operated in any way unless expressly specified in this Instruction Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Instruction Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
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- EtherCAT® is a registered mark of Beckoff Automation GmbH.
- EtherNet/IP is a trademark used under the license of ODVA.

Table of Contents

Safety Guide

"Safety Guide" has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into "Danger", "Warning", "Caution" and "Notice" according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	⚠ Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	⚠ Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	⚠ Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	! Notice

Precautions in Operation

1. Make sure to follow the usage condition, environment and specification range of the product.
   Not doing so may cause a drop of performance or malfunction of the product.

2. Use an appropriate teaching tool.
   Use the PC Software for RoboCylinder or an appropriate teaching pendant to interface with this controller.
   [Refer to 1.1.2 Teaching Tool]

3. Create a secure data backup for use in case of a breakdown.
   A non-volatile memory is used as the backup memory for this controller. All the registered position data and parameters are written into this memory and backed-up at the same time. Therefore, you will not usually lose the data even if the power is shut down. However, make sure to save the latest data so a quick recovery action can be taken in case the controller is broken and needs to be replaced with another one.

   How to Save Data
   (1) Save the data to CD-R or hard disk using the PC software
   (2) Hard-copy the information of position tables and parameters on paper

4. Set the operation patterns.
   This product can be applied an various ways according to application requirements. It can be controlled via PIO or a fieldbus, with multiple patterns of operation available in either mode. The setup can be performed in the initial setting. [Refer to Chapter 3 Operation and Chapter 5 Parameter]
   The PIO pattern is set to “0” (Standard Type) when the unit is delivered. Set the operation pattern setting to the logic that suits your use after the power is turned ON.

Warning : Please note it is very risky when the control sequence and PIO pattern setting do not match each other. The normal operation might not occur. There may be no movement, or there may be unexpected movement.

5. Actuator would not operate without servo-on and pause signals.

(1) Servo ON Signal (SON)
The servo-on signal (SON) is available to select whether to enable or disable in the initial setting process "Servo Control".
If it is set to "Enable", the actuator would not operate unless turning this signal ON.
If parameter No.21 is set to "Not to use", SON is made disable. If it is set to "Disable", the servo becomes on and the actuator operation becomes enabled as soon as the power supply to the controller is turned ON and the emergency stop signal is cancelled.
Have the setting that suits to the desirable control logic.

(2) Pause Signal (STP, *STP)
If Single Solenoid is selected and the stop signal is set to "Use" in the initial setting, unless this signal is enabled, the actuator would not operate.
If this signal is not to be used, set the stop signal to "Not to use" in the initial setting process.
If not in use, the operation of the actuator is available even with this signal not being enabled.

6. Clock Setting in Calendar Function

There may be a case in the first time to supply the power after delivery that Gateway Error Code 4A "Real Time Clock Vibration Stop Detected" is generated. In the case this happens, set the current time with a teaching tool.
If the battery is fully charged, the clock data is retained for approximately 10 days after the power is turned OFF.
Even though the time setting is conducted before the product is shipped, the battery is not fully charged. Therefore, there may be a case that the clock data is lost even if the days described above have not passed.

7. Rotary actuator cannot be set to Multi-Rotation Specification.

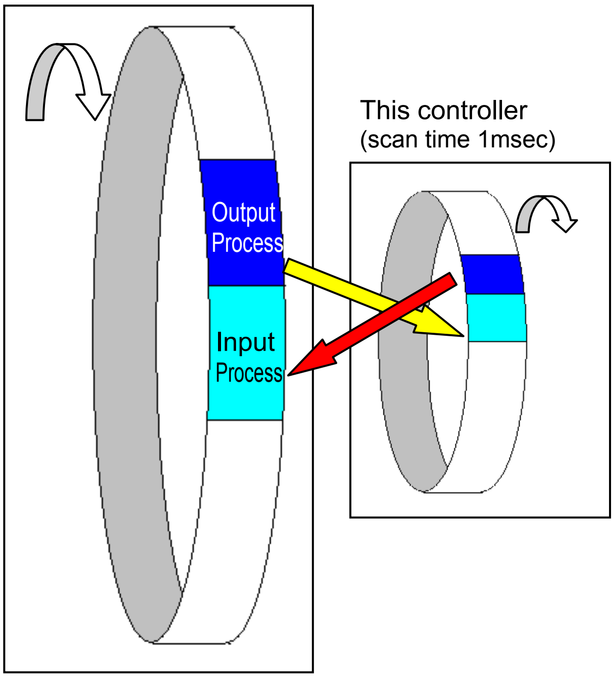
Rotary actuator cannot be set to Multi-Rotation Specification since the index mode setting cannot be performed.

8. According to Sequence Program Creation

Please note the following things when creating a sequence program.
When data transfer is necessary between two devices that have a different scan time from each other, duration more than the longer scan time is required to certainly read the signal. (It is recommended to have a timer setting of at least twice as long as the scan time in order for the PLC to adequately perform the reading process.)

● Operation Image

PLC
(e.g. scan time is 20msec)



As shown in the diagram, the input and output timings of two devices that have different scan time do not match, when transferring a signal. There is no guarantee that PLC would read the signal as soon as this controller signal turns ON. In such a case, make the setting to read the signal after a certain time that is longer than the longer scan time to ensure the reading process succeeds on the PLC side.
It is the same in the case this controller side reads the signal.
In such a case, it is recommended to ensure 2 to 4 times of the scan time for the timer setting margin.
It is risky to have the setting below the scan time since the timer is also processed in the scan process.
In the diagram, PLC can only read the input once in 20msec even though this controller output once in 1msec.
Because PLC only conducts output process once in 20msec, this controller identifies the same output status for that entire time period.

Also, if one tries to read the signal that is being re-written by the other, the signal may be read wrong. Make sure to read the signal after the rewriting is complete. (It is recommended to have more than 2 scan periods to wait.) Make sure not to have the output side to change the output until the other side completes the reading. Also, a setting is made on the input area not to receive the signal less than a certain time to prevent a wrong reading of noise. This duration also needs to be considered.

9. PLC Timer Setting

Do not have the PLC timer setting to be done with the minimum setting.
Setting to “1” for 100msec timer turns ON at the timing from 0 to 100msec while 10msec timer from 0 to 10msec for some PLC.
Therefore, the same process as when the timer is not set is held and may cause a failure such as the actuator cannot get positioned to the indicated position number in Positioner Mode.
Set “2” as the minimum value for the setting of 10msec timer and when setting to 100msec, use 10msec timer and set to “10”.

10. Regarding Battery-less Absolute Type Actuator

1) The setting switched over between the absolute type and incremental type with the parameters.
   - Parameter No.18 Simple Absolute Function
     Set to 0 = Incremental Type, Set to 1 = Absolute Type
2) For the first time to turn the servo on after turning on the power, it will have slight position adjustment due to the characteristics of the stepping motor.
   The maximum movement amount at position adjustment operation is the distance of 0.025 × lead length [mm].
   Also, the current position displayed on the teaching tool before turning the servo on is the coordinates before adjustment operation.
3) After the first time the servo is tuned on after the power has been supplied, the home-return complete signal [HEND] and the limit switch output signal (LS) are output.
4) When the first servo-on is conducted out of the soft limit range, an error would not be output. Soft limit monitoring starts after it is moved into the range.
5) Make sure to have a home-return operation (absolute reset) after detaching the motor unit from the actuator for motor replacement purpose and so on.

International Standards Compliances

MSEP with the following overseas standard.

RoHS Directive	CE Marking	UL
○	○	○

CE Marking

If a compliance with the CE Marking is required, please follow Overseas Standards Compliance Manual (ME0287) that is provided separately.

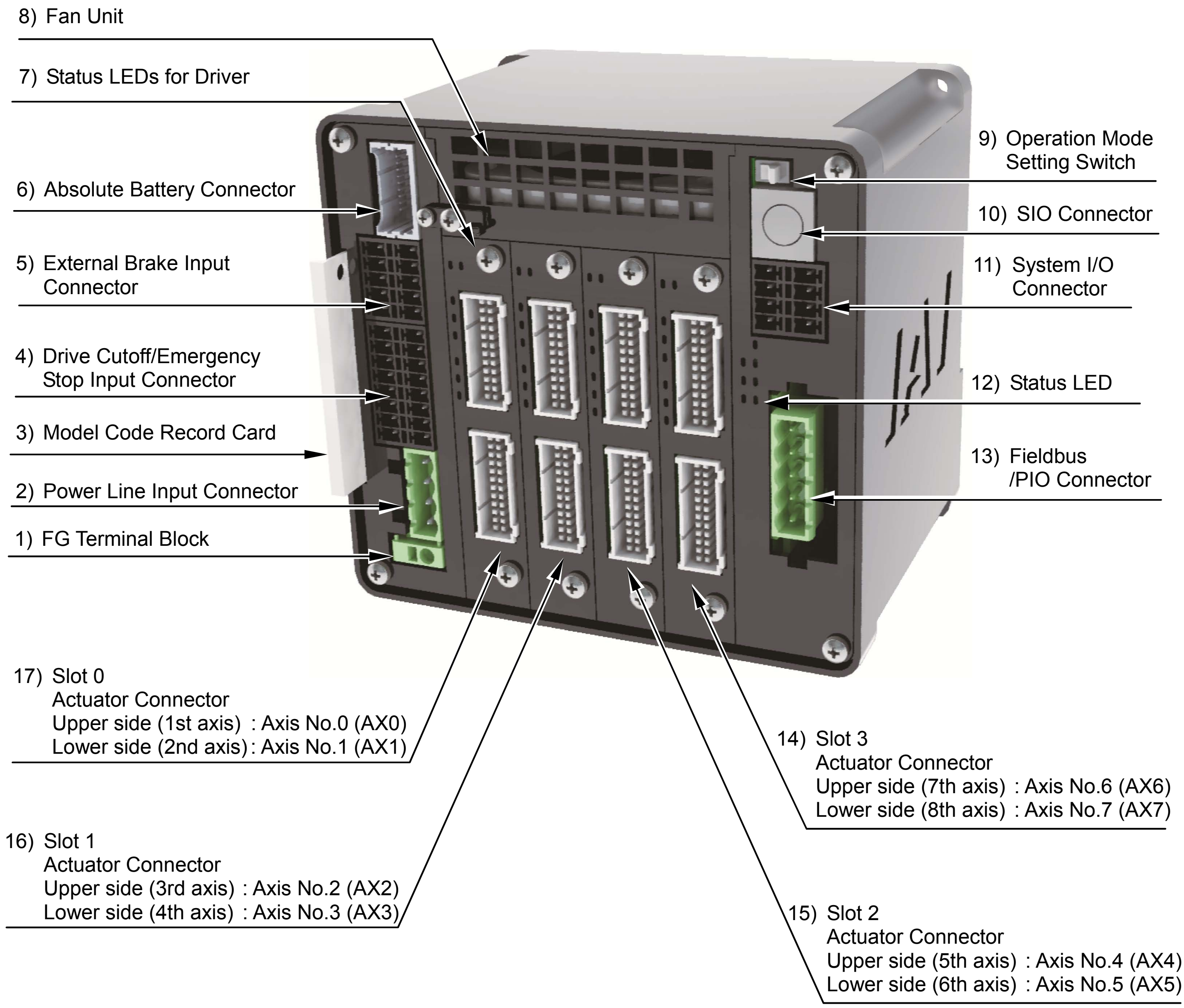
UL

To comply with UL, please be aware and take an action for the following items;

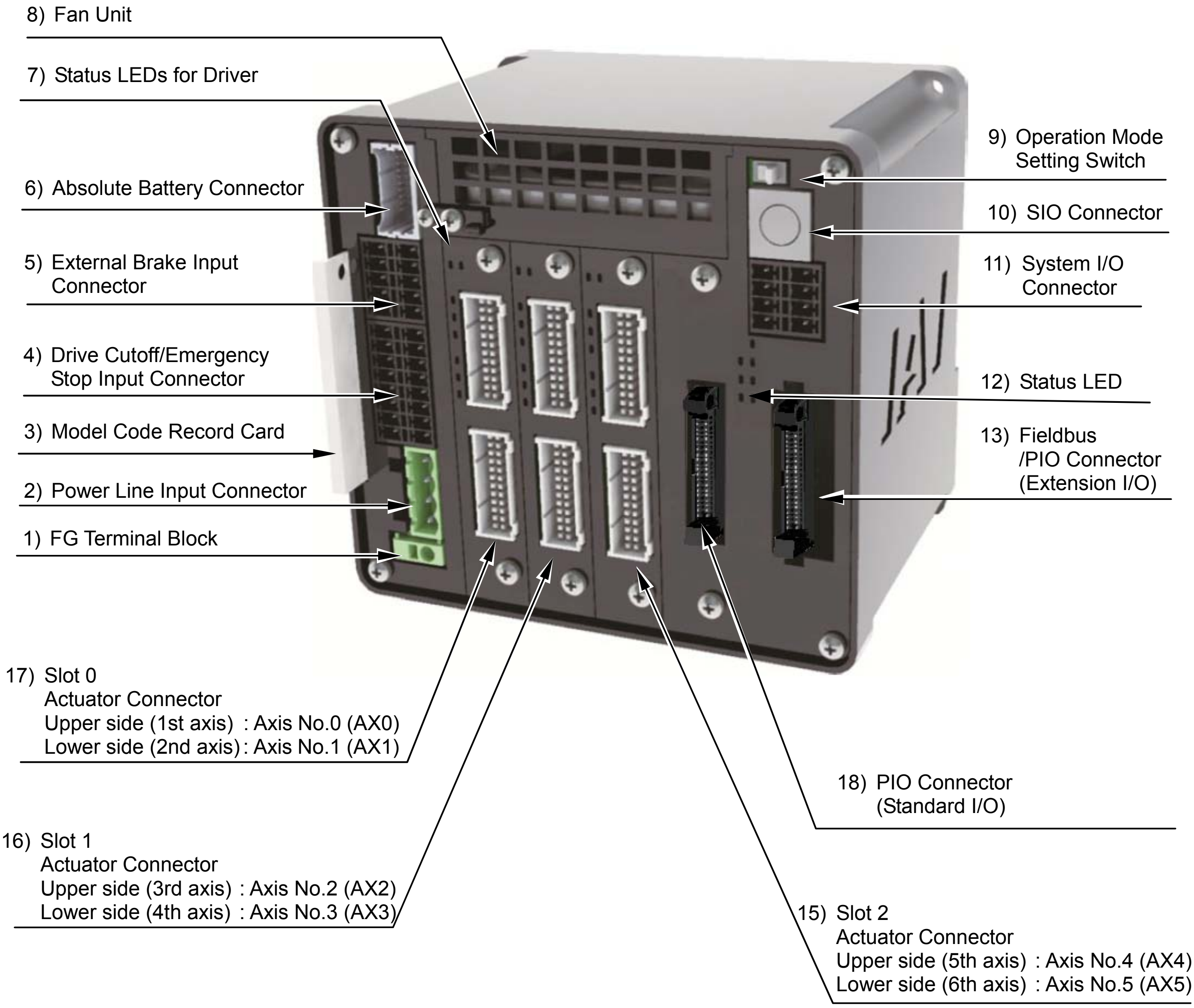
●Use Environment
MSEP can be used in an environment of pollution degree 2 and the surrounding air temperature between 0 to 40 degree C.

Name for Each Parts and Their Functions

●MSEP-C Type



●MSEP-LC Type


8) Fan Unit
7) Status LEDs for Driver
6) Absolute Battery Connector
5) External Brake Input Connector
4) Drive Cutoff/Emergency Stop Input Connector
3) Model Code Record Card
2) Power Line Input Connector
1) FG Terminal Block
9) Operation Mode Setting Switch
10) SIO Connector
11) System I/O Connector
12) Status LED
13) Fieldbus /PIO Connector (Extension I/O)
17) Slot 0
Actuator Connector
Upper side (1st axis) : Axis No.0 (AX0)
Lower side (2nd axis): Axis No.1 (AX1)
18) PIO Connector (Standard I/O)
16) Slot 1
Actuator Connector
Upper side (3rd axis) : Axis No.2 (AX2)
Lower side (4th axis) : Axis No.3 (AX3)
15) Slot 2
Actuator Connector
Upper side (5th axis) : Axis No.4 (AX4)
Lower side (6th axis) : Axis No.5 (AX5)

1) FG Terminal Block
This is the terminal block for frame grounding. Since this controller is made of plastic, it is necessary to ground from this terminal block. Ground Type should be Class D (formally Class 3 grounding = ground resistance 100Ω or less).

2) Power Line Input Connector
This is the connector to supply 24V DC power supply to the controller. The control power supply and the motor power supply are to be input separately. This enables external drive cutoff that cuts only the motor power supply.

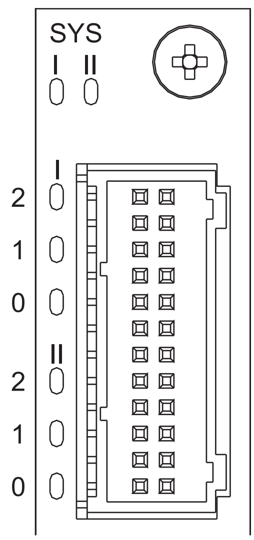
3) Model Code Record Card
This is a card with information of the connected axes recorded on for eight axes at the maximum. It is available to pull out from the controller and check the information.

4) Drive Cutoff/Emergency Stop Input Connector
External drive cutoff and emergency stop can be performed individually for each slot (2 axes).

5) Compulsory Brake Release Signal Input Connector
An external compulsory brake release can be performed on each axis. The brake is ordinarily released with the servo ON and activated with the servo OFF. In the tuning at the startup or in the maintenance work, have a brake release switch for each axis connected to this connector to make a compulsory brake release available, and the actuator can be moved manually while the servo is OFF.

6) Absolute Battery Connector
This connector is mounted on the absolute type. An external absolute battery box for eight axes can be connected with one cable. This is not mounted on the incremental type.

7) Status LEDs for Driver
These lamps indicate the status of the driver and that for absolute type for each slot (in 2 axes unit). There is no absolute status display for the incremental type.



Part Name	Description
SYS I	System status of driver for axis connected to upper connector (Servo ON: GN, Servo OFF: OFF, Alarm generated: RD)
SYS II	System status of driver for axis connected to lower connector (Servo ON: GN, Servo OFF: OFF, Alarm generated: RD)
I–0	Absolute status of driver for axis connected to upper connector 0
I–1	Absolute status of driver for axis connected to upper connector 1
I–2	Absolute status of driver for axis connected to upper connector 2
II–0	Absolute status of driver for axis connected to lower connector 0
II–1	Absolute status of driver for axis connected to lower connector 1
II–2	Absolute status of driver for axis connected to lower connector 2

8) Fan Unit
This is the fan unit to cool down the controller. This unit can be detached from the controller for maintenance by removing the screw on the hook in the front of the controller.

9) Operation Mode Setting Switch
This is a switch to change the operation mode between Automatic Operation (AUTO) and Manual Operation (MANU). The operation modes are provided to avoid the duplication of the SIO (Serial) communication operation using PC software or a teaching pendant (described as teaching tool from now on) and the operation with Fieldbus or PIO (Parallel I/O)
For the details of the mode selection, refer to 11) System I/O Connector.

10) SIO Connector
This is a connector dedicated for the teaching tool connection.

11) System I/O Connector
This is a connector for additional devices for the input of all-axes external emergency stop, AUTO/MANU switchover and external regenerative resistor.
It is connected in a series with the operation mode setting switch (AUTO/MANU) on the front panel. The controller can be in the following modes by the mode selection on each switch and teaching tool.

MSEP status	Condition		
	Switch on Front Panel	Teaching Tool Note 1	Operation Mode Switchover Input Note 2
AUTO	AUTO	Prohibit PIO Startup	OFF (Input 0V)
	AUTO	Accept PIO Startup	OFF (Input 0V)
	AUTO	Accept PIO Startup	ON (Release)
	MANU	Accept PIO Startup	ON (Release)
	MANU	Accept PIO Startup	OFF (Input 0V)
MANU	AUTO	Prohibit PIO Startup	ON (Release)
	MANU	Prohibit PIO Startup	ON (Release)
	MANU	Prohibit PIO Startup	OFF (Input 0V)

Note 1 : "Accept PIO Startup" and "Prohibit PIO Startup" are the functions to select the operation mode of when the teaching tool is connected.
Note 2 : Refer to 2.3 [4] for the details.

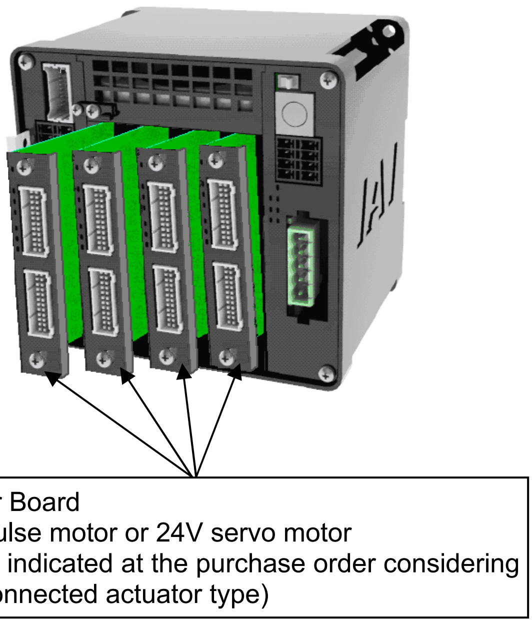
⚠ Caution : (1) If "Accept PIO Startup" is selected on the teaching tool, the AUTO operation becomes available no matter the condition of the front panel or external switchover signal input, thus attention may have to be paid. In such a condition, the actuator may get activated by following the signal from the host.
(2) The information of "Accept PIO Startup" or "Prohibit PIO Startup" is remained when the teaching tool is removed from the controller. Do not fail to select "Prohibit PIO Startup" when removing the teaching tool after finishing the teaching operation or debugging.

12) Status LED
They are the LED lamps to show the status of the controller and PIO or Fieldbus.
The layout and the content of LED display differ depending on PIO or each Fieldbus.
Refer to the operation of each mode for the details.
[Refer to 3.10 Status LEDs.]

13) Fieldbus/PIO Connector
A connector for Fieldbus connection is mounted for the Fieldbus. Type while PIO connector is equipped for PIO Type.

14) to 17) Slot 0 to 3 Actuator Connector
Insert one driver board to one slot each. (Four driver boards are available to insert at the maximum.)
A driver board of the high output setting type is able to control one axis per piece. For others, two axes can be controlled by one piece of driver board.

⚠Caution : (1) The driver board differs depending on the actuator to be connected. (2) Do not attempt to insert the driver board to a slot other than the one that the board was originally inserted to. The parameter dedicated for the indicated actuator is already written to the driver board at the purchase order. Inserting the driver board to another slot may lead to a wrong wiring. (3) On the slot without a driver board inserted, there is a face plate attached.



⚠Caution : Cutoff/boot of driving source is to be done on each driver board (2 axes) (control by one axis to another cannot be performed). Therefore, when Cold Start Level (Drive Cutoff) Alarm is generated on one axis out of two, the other axis with the alarm not being generated will also stop. Consider this when constructing the system.

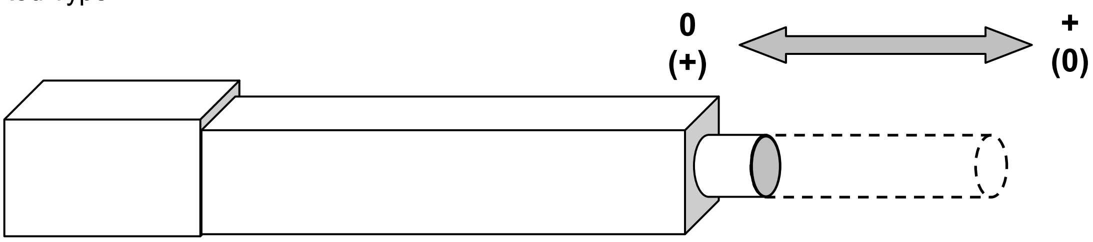
18) PIO Connector (Dedicated for LC Type: Standard I/O)
It is equipped with a connector for PIO connection.

Actuator Axes

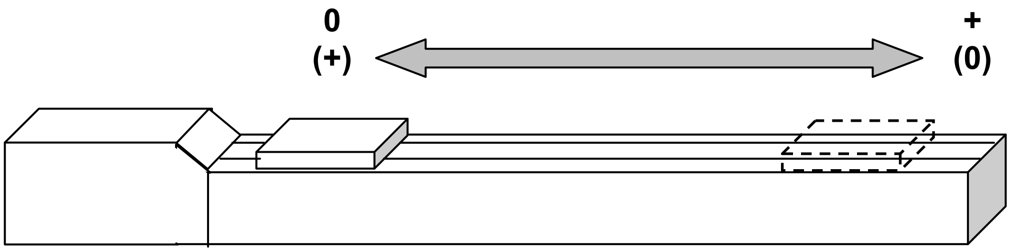
Refer to the pictures below for the actuator axes that can be controlled by MSEP.
0 defines the home position, and items in ( ) are for the home-reversed type (option).

> ⚠ Caution: There are some actuators that are not applicable to the origin reversed type.
> Check further on the catalog or the Instruction Manual of the actuator.

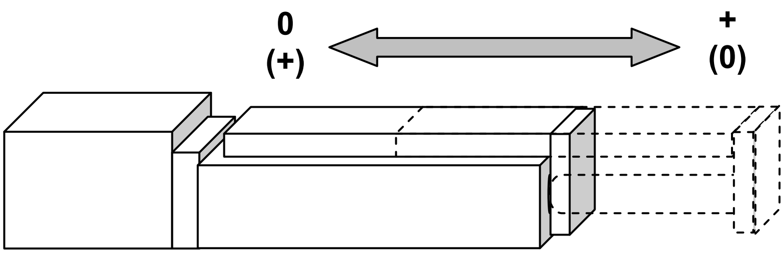
(1) Rod Type



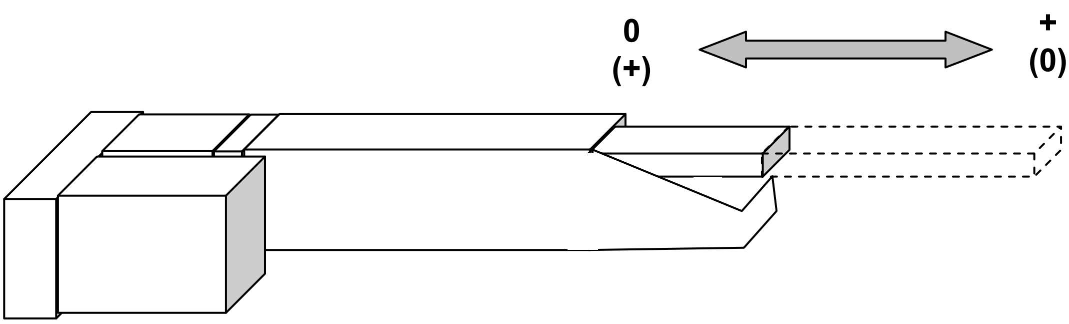
(2) Slider Type



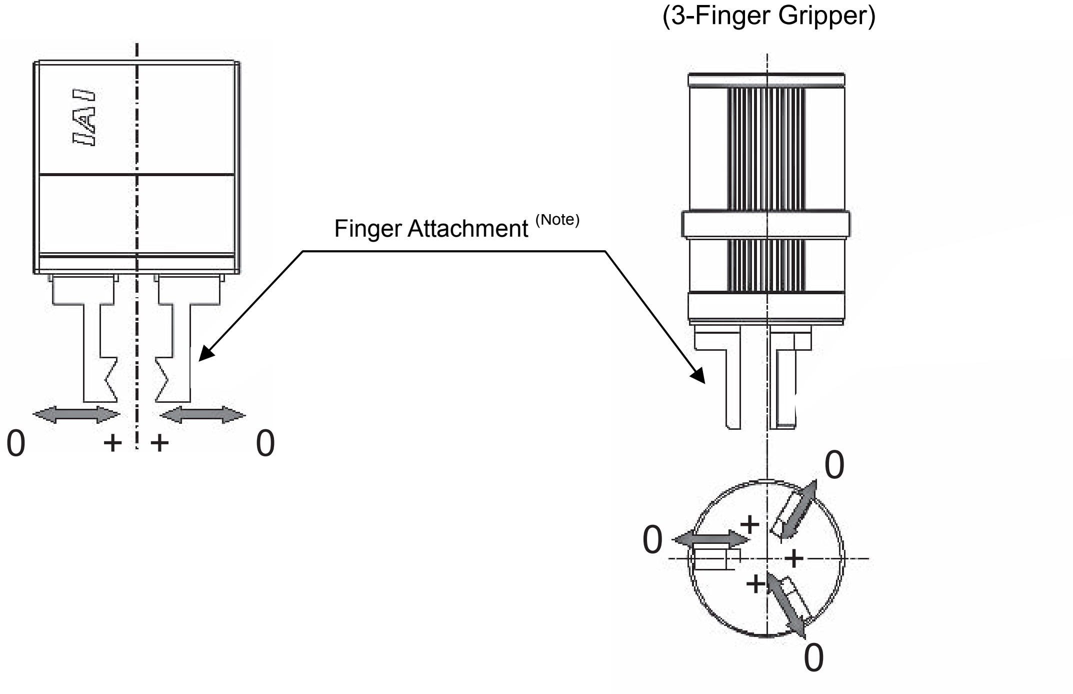
(3) Table Type



(4) Arm Type

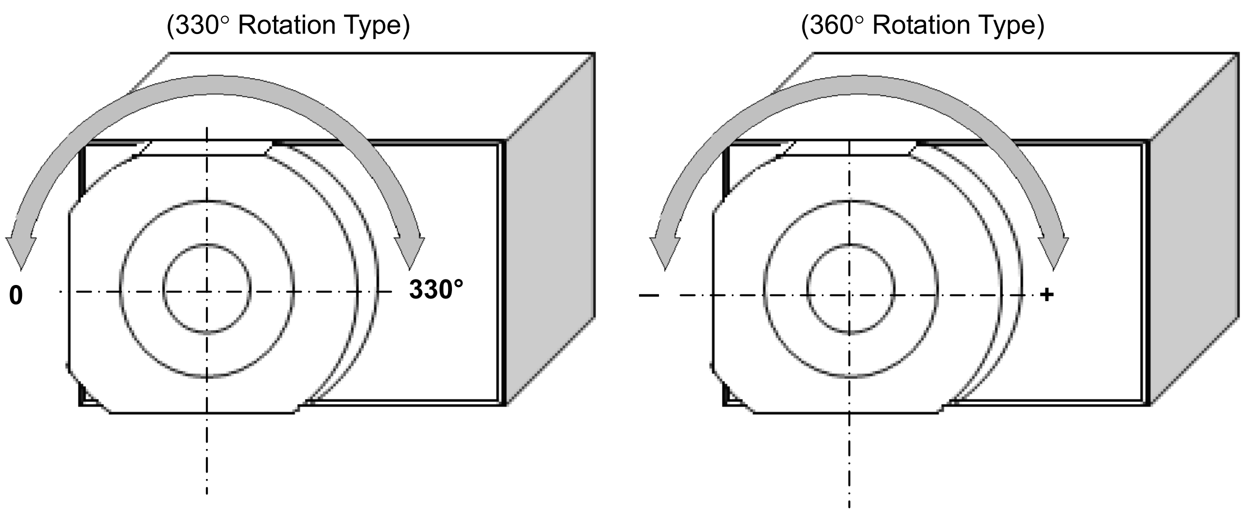


(5) Gripper Type



Note Finger attachment is not included in the actuator package. Please prepare separately.

(6) Rotary Type



For 360° Rotation Type with the origin reversed type, the directions of + and – are the other way around.

Starting Procedures

When using this product for the first time, make sure to avoid mistakes and incorrect wiring by referring to the procedure below. “PC” stated in this section means “PC software”.

Check of Packed Items
Have all the items been delivered?

No → Contact your local IAI distributor.

↓ Yes

Installation and Wiring [Refer to Chapter 1 and 2]
Perform the installation of and wiring for the actuator and controller.

↓

Point Check Item
・Is frame ground (FG) connected?
・Has the noise countermeasure been taken?

↓

Power Supply and Alarm Check
Connect the PC, put the operation mode setting switch to MANU side, and then turn the power ON.
Select “Teach Mode 1 Safety Speed Valid / Prohibit PIO Startup” in the PC software.

↓

Check Item
Is SYS in Status LEDs turned ON in green?

No → Connect the teaching tool, such as the PC software, confirm the alarm code, and remedy the indicated situation.

↓ Yes

Initial setting and operation mode select [Refer to Section 3.2]
Set the initial settings in the PC to establish the setting for operation patterns. (It is mandatory to select 6: Positioner Mode for MSEP-LC Type.) Set the field network in Gateway Parameter Setting Tool and also register the operation mode selected I the initial setting for MSEP-C.

↓

Servo ON
Turn the servo ON for all the connected axes by operating a teaching tool such as PC.

⚠Caution
Please perform this process with the actuator away from the mechanical end or interfering objects as much as possible. Move the actuator away from interfering surroundings. It may generate an alarm if the actuator hit the mechanical end or interfering objects when the servo is turned ON.
The slider may get slightly dropped by self-weight if servo ON and OFF is repeatedly performed at the same position. Be careful not to pinch the hand or damage the work.

↓

Check Item [Refer to Name for Each Parts and Their Functions 7).]
Is SYS* on the status LED display for the driver on the axis number indicated for the servo-on turned ON in green?

No → If an alarm gets generated, check the content of the alarm on the PC and have a counteraction.

↓ Yes

Safety Circuit Check
Does the emergency stop circuit (drive cutoff circuit) work properly and turn the servo OFF?

No → Check the emergency stop circuit.

↓ Yes

Target Position Setting [Except for simple direct mode and direct numerical specification mode: Chapter 3]
Set the target position in “Position” Box in each position table.

↓

Create Ladder Program (only for MSEP-LC Type)
Create the ladder with the ladder edit software. [Refer to MSEP-LC Programming Manual (ME0329)]

↓

Link to Field Network (only for Field Network Type)
1) Assign MSEP to the host controller, put the operation mode setting switch to AUTO side, and then turn the power ON again.
2) Once the link is established to the master unit, turn ON MON Signal in the gateway control signals.
(Control can be held from the field network while MON Signal is ON)

↓

Test Run Adjustment 1
1) Cancel the emergency stop and check the operation with a command from the PC, at the setting of low speed, without any work piece loaded.
2) Have an operation check (confirmation of communication) with a command from the host (such as PLC).

↓

Check Item
Any vibration or abnormal noise?

No → Check if there is any problem with the installation of the actuator and the condition of the actuator use exceeds the ranges of the rated values. Adjust the servo if necessary.

↓ Yes

Test Run Adjustment 2
Have a check with the system operation run.

Chapter 1 Specifications Check

1.1 Product Check

1.1.1 Parts

The standard configuration of this product is comprised of the following parts.
If you find any faulty or missing parts, contact your local IAI distributor.

No.	Part Name	Model	Remarks
1	Controller Main Body	Refer to “How to read the model plate”, “How to read the model”.	
Accessories			
2	Power Connector	FKC2.5HC/4-ST-5.08 (Supplier : PHOENIX CONTACT)	
3	External Brake Input Connector	FMCD1.5/5-ST-3.5 (Supplier : PHOENIX CONTACT)	
4	Drive Cutoff/Emergency Stop Input Connector	FMCD1.5/8-ST-3.5 (Supplier : PHOENIX CONTACT)	
5	System I/O Connector	FMCD1.5/4-ST-3.5 (Supplier : PHOENIX CONTACT)	
6	I/O Flat Cable (For PIO Type)	CB-MSEP-PIO□□□	□□□shows the cable length (Example) □□□ : 020 = 2 [m]
7	CC-Link Connector (For CC-Link Type)	[MSEP-C] MSTB2.5/5-ST-5.08ABGY AU [MSEP-LC] MSTB2.5/5-STF-5.08 AU (Supplier : PHOENIX CONTACT)	
8	DeviceNet Connector (For DeviceNet Type)	[MSEP-C] MSTB2.5/5-ST-5.08ABGY AU [MSEP-LC] MSTB2.5/5-STF-5.08 AU (Supplier : PHOENIX CONTACT)	
9	Absolute Battery Box (Option)	MSEP-ABU (Battery AB-7)	For Simple Absolute Type
10	First Step Guide		
11	Instruction Manual (DVD)		
12	Safety Guide		

1.1.2 Teaching Tool

A teaching tool such as PC software is necessary when performing the setup for position setting, parameter setting, etc. that can only be done on the teaching tool.
Please prepare either of the following teaching tools.

No.	Part Name	Model
1	PC Software (Includes RS232C Exchange Adapter + Peripheral Communication Cable)	RCM-101-MW
2	PC Software (Includes USB Exchange Adapter + USB Cable + Peripheral Communication Cable)	RCM-101-USB
3	Teaching Pendant (Touch Panel Teaching)	CON-PTA
4	Teaching Pendant (Touch Panel Teaching with dead man's switch)	CON-PDA
5	Teaching Pendant (Touch Panel Teaching with dead man's switch + TP Adapter (RCB-LB-TG))	CON-PGA
6	Teaching Pendant (Touch Panel Teaching)	TB-01
7	Teaching Pendant (Touch Panel Teaching with dead man's switch)	TB-01D
8	Teaching Pendant (Touch Panel Teaching with dead man's switch on right side)	TB-01DR

1.1.3 Instruction manuals related to this product, which are contained in the instruction manual (DVD).

No.	Name	Manual No.
1	MSEP Controller Instruction Manual	ME0299
2	MSEP-LC Programming Manual	ME0329
3	PC Software RCM-101-MW/RCM-101-USB Instruction Manual	ME0155
4	MSEP-LC Ladder Edit Software Manual	ME0330
5	Touch Panel Teaching CON-PTA/PDA/PGA Instruction Manual	ME0295
6	Touch Panel Teaching TB-01/TB-01D/TB-01DR	ME0324
7	X-SEL Controller RC Gateway Function Instruction Manual	ME0188

1.1.4 How to read the model plate

Model →	MODEL	MSEP-C-5-20PI-N-42PI-PI-10I-20ILA-DV-2-0-ABB
Serial No.→	SERIAL No.	200307221
Manufactured date →	PRODUCT DATE	2012/02/01
Manual No. →	MANUAL No.	ME0299
Input power supply →	CP INPUT	24VDC 2.0A
	MP INPUT	24VDC 7.6A
	AXIS No. /OUTPUT	
Information of the connected axes → (Axis No.0 to 7)	0	0-24Vac 3ph 0-333Hz 1.0A
	1	
	2	0-24Vac 3ph 0-333Hz 2.0A
	3	0-24Vac 3ph 0-333Hz 2.0A
	4	0-24Vac 3ph 0-333Hz 1.3A
	5	0-24Vac 3ph 0-333Hz 1.3A
	6	
	7	
	⚠ CAUTION: Connect the wiring correctly and properly. Use IAI Corporation specified cables. Made In Japan	

1.1.5 How to read the model

(Example) Consists of 5 axes: Axes No.0, 2, 3 : Pulse motor type
Axes No.4, 5 : Servo motor type
Axis No.1 : Not connected
Axis No.3 : Inactive Axis

MSEP – C – 5 - 20PI–N–42PI–PI–10I–20ILA – NP - 2 – 0 – ABB –CC–**

<Type>
- C : Standard Type
- LC : Ladder Sequence Type

<Connected Axes>
- 1 to 8 : Number of driver axes (MSEP-C Type)
- 1 to 6 : Number of driver axes (MSEP-LC Type)

<Detail of Connected Axis>

[Motor Type]
- 20P : Applicable for 20□ pulse motor
- 20SP : Applicable for 20□ pulse motor
- 28P : Applicable for 28□ pulse motor
- 28SP : Applicable for 28□ pulse motor
- 35P : Applicable for 35□ pulse motor
- 42P : Applicable for 42□ pulse motor
- 56P : Applicable for 56□ pulse motor
- 2 : Applicable for 2W servo motor
- 5 : Applicable for 5W servo motor
- 5S : Applicable for 5W servo motor
- 10 : Applicable for 10W servo motor
- 20 : Applicable for 20W servo motor
- 20S : Applicable for 20W servo motor
- 30 : Applicable for 30W servo motor
- 3D : 3W Brushless DC Electric Motor
- A : Ineffective axis (equipped with pulse motor driver)
- P : Ineffective axis (equipped with servo motor driver)
- N : Not connected (not equipped with motor driver)

[Encoder Type]
- WAI : Incremental / Battery-less Absolute Shared (Pulse Motor Type)
- I : Incremental (Servo Motor Type)
- SA : Simple Absolute (Pulse Motor / Servo Motor)

[Option]
- HA : High Acceleration/Deceleration Type (when servo motor selected)
- LA : Power Saving Type (when servo motor selected)
- T : High Output Setting Type (when pulse motor selected)

<I/O Type>

(Note) Only NP is available to select for MSEP-LC
- NP : NPN PIO Type (Sink type)
- PN : PNP PIO Type (Source type)
- DV : DeviceNet Type
- CC : CC-Link Type
- PR : PROFIBUS-DP Type
- CN : CompoNet Type
- EC : EtherCAT Type
- EP : EtherNet/IP Type
- PRT : PROFINET-IO Type

<I/O Cable Length>
- 0 : No cable
- 2 : 2m (Standard)
- 3 : 3m
- 5 : 5m

<Power Voltage>
- 0 : 24V DC

<Applicable for Simple Absolute Type>
- ABB : Simple Absolute Type (with absolute battery)
- ABBN : Simple Absolute Type (with no absolute battery)
- No description : Incremental Type

<Dedicated for MSEP-LC: Extended I/O Type>
- NP : NPN PIO Type (Sink Type)
- DV : DeviceNet Type
- CC : CC-Link Type
- PR : PROFIBUS-DP Type
- CN : CompoNet Type
- EC : EtherCAT Type
- EP : EtherNet/IP Type
- PRT : PROFINET-IO Type

<Identification for IAI use only>

* There is no identification in some cases

1.2 List of Basic Specifications

Specification Item			Driver for Servo Motor	Driver for Pulse Motor
Number of Controlled Axes			Max.8 axis (MSEP-C), Max.6 axis (MSEP-LC)	
Control/Motor Power Supply Voltage			24V DC ±10%	
Brake Power Supply			0.15A×Number of axes	
Control Power Current Consumption			2A (Brake power supply 0.15A × 8 axes included)	
Control Power In-Rush Current			MAX. 5A 30ms or less	
Motor Current Consumption			(see below)	
Motor Power In-Rush Current			Number of slots × MAX. 10A 5ms or less	
Controller Heat Generation			MAX. 26W	
Control System			Vector control	Weak field-magnet vector control
Encoder Resolution	RCA, RCP2 to RCP5		All types	800Pulse/rev
	RCA2		RCA2-□□□N	1048Pulse/rev
			Other than RCA2-□□□N	800Pulse/rev
	RCL		RA1L・SA1L・SA4L・SM4L	715Pulse/rev
			RA2L・SA2L・SA5L・SM5L	855Pulse/rev
			RA3L・SA3L・SA6L・SM6L	1145Pulse/rev
	RCD			400pulse/rev(RA1D/GRSN), 480pulse/rev(RA1DA/GRSNA)
Actuator Cable Length			MAX. 20m (Note) 10m maximum for Simple Absolute type	
Serial Communication (SIO Port: Only for teaching)			RS485 1CH (complying with Modbus Protocol) Speed 9.6 to 230.4kbps	
MEP-C	External Interface	PIO Type	PIO Type: Signal I/O dedicated for 24V DC (to be selected when purchased NPN/PNP) Number of max. input: 4 points per axis, Number of max. output: 4 points per axis Cable length MAX. 10m	
		Fieldbus Type	DeviceNet (Note), CC-Link, PROFIBUS-DP, CompoNet, EtherNet/IP, EtherCAT and PROFINET-IO [Refer to Section 1.4 Specifications for each Fieldbus.] (Note) An operation by RC Gateway Function is available. [Refer to the other instruction manual for more details.]	
	Data Setting and Input		PC software, Touch panel teaching, Gateway parameter setting tool	
	Data Retention Memory		Position data and parameters are saved in the nonvolatile memory. (There is no limitation in number of writing)	
MSEP-LC	External Interface	PIO Type	PIO Type: 24V DC general-purposed signal input and output (for NPN type only) Number of max. input: 32 points per axis, Number of max. output: 32 points per axis (in total of standard I/O and extended I/O) Cable length MAX. 10m	
		Fieldbus Type	DeviceNet, CC-Link, PROFIBUS-DP, CompoNet, EtherNet/IP, EtherCAT and PROFINET-IO [Refer to Section 1.4 Specifications for each Fieldbus.]	
	Ladder Execution System		Interpreter System	
	Program Capacity		4k Steps (4 bytes per step)	
	Data Setting and Input		PC software, Touch panel teaching, Gateway parameter setting tool, Ladder edit software	
	Data Retention Memory		Position data and parameters are saved in the nonvolatile memory. (There is no limitation in number of writing)	
Positioning Points			(MSEP-C) PIO Type: 2 or 3 points (MSEP-C/LC) Fieldbus Type: 256 points (There is no limit for simple direct and direct indication modes) (Note) The number of positioning points differs depending on the operation mode select by the parameter setting.	

Motor Current Consumption:

Motor type	Rated	Low power	MAX. (Note 1)	Motor flange size	MAX. (Note 2)
2W	0.8A		4.6A	20P	2.0A
3W(RCD)	0.7A		1.5A	28P	2.0A
5W	1.0A		6.4A	35P	2.0A (High output invalid)
10W(RCL)	1.3A		6.4A	42P	3.5A (Rated) / 4.2A (MAX.) (High output valid) (Note 4)
10W(RCA/RCA2)	1.3A	2.5A	4.4A	42P	
20W	1.3A	2.5A	4.4A	56P	
20W(20S Type)	1.7A	3.4A	5.1A	56P	
30W	1.3A	2.2A	4.4A		

Specification Item		Driver for Servo Motor	Driver for Pulse Motor
LED Display (mounted on Front Panel)		LED for driver status : 8 points (for each driver board) (MSEP-C) Status LED : 4 points (PIO type), 7 points (fieldbus type) (MSEP-LC) Status LED : 9 points	
Forcibly Releasing of Electromagnetic Brake		Can be released with the forcibly releasing signal input (24V DC input) to each axis	
Protective Functions (Note 3)		Overcurrent Protection (Equipped with a built-in cutoff circuit using a semiconductor for each slot)	
Protection Function against Electric Shock		Class I basic insulation	
Insulation Resistance		500V DC 10MΩ	
Weight		(MSEP-C) 620g Max., 690g Max. for simple absolute type (MSEP-LC) 700g Max. Absolute battery box: 1950g (for 8-axis type) Max.	
Cooling Method		Forced air-cooling	
External Dimensions		123W × 115H × 95D	
Environ-ment	Ambient Temperature	0 to 40°C	
	Ambient Humidity	85%RH or less (non-condensing)	
	Ambient Environment	[Refer to Installation Environment]	
	Ambient Storage Temperature	-20 to 70°C 0 to 40°C for absolute battery	
	Ambient Storage Humidity	85%RH or less (non-condensing)	
	Usable Altitude	1000m or lower above sea level	
	Vibration Durability	Frequency 10 to 57Hz / Swing width: 0.075mm Frequency 57 to 150Hz / Acceleration: 9.8m/s^2 XYZ Each direction Sweep time: 10 min. Number of sweep: 10 times	
	Shock Resistance	150mm/s^2 11ms Semi-sine wave pulse three times to each of the directions X, Y and Z	
	Protection Class	IP20	

Note 1 Maximum current draw is realized during the excitation phase following the initial servo power ON. (Normal: Approx. 1 to 2 sec, MAX: 10 sec).
Note 2 The current is maximized at the excitation phase detection conducted in the first servo-on process after the power is supplied (ordinary 100ms).
Note 3 For servo motor, the over-current protection is triggered at 1.4 times the maximum load current.
Note 4 High-output type driver board can control one axis per board.

1.3 Calculation for Power Capacity

For the calculation of 24V DC power capacity, figure out the numbers for (1) to (6) below, and then follow Step (7).

(1) Control Power Current Consumption :
0.8A (0.15A × 8 axes included for brake-equipped actuator)··········1)

(2) Motor Power Current Consumption :
Add the total motor current consumption of all connected actuators.··········2)

(3) Current Consumption at Excitation Phase Detection :
Add the inrush current for all connected axes. ··········3)

(4) Add the Control Power Inrush Current : 5A ··········4)

(5) Add the Motor Power Inrush Current : Number of slots × 10A each. ··········5)

(6) Current consumption of brake power supply : Number of actuators with brake × 0.15A··········6)

(7) Selection of Power Supply :
Usually, the rated current is to be approximately 1.3 times higher than the total of Control Power 1) + 2) + 6) above considering approximately 30% of margin to the load current. However, considering the inrush currents [excitation 3), control 4) and motor power 5)], even though it is a short time, select a power supply with “sufficient peak load capacity. High cumulative inrush currents can be avoided by taking precautions to phase the initial servo ON condition and e-stop recovery so that they occur at different times. If a power supply with insufficient peak capacity is utilized, voltage drooping may occur. This may present issues with power supplies providing remote sensing functionality.

(Note) Ensure motor and control power supplies reference the same potential when using multiple power supplies.

(Reference) Selection of Power Supply Protection Circuit Breaker

It is recommended that the power supply protection is conducted on the primary side (AC power side) of the 24V DC power supply unit.

When selecting the protection breaker, consider the rated cutoff current of the circuit breaker so a cutoff is surely performed even in the case of inrush current of 24V DC power supply unit or a short-circuit of the power supply.

- Rated Breaking Current > Short-circuit Current = Primary Power Supply Capacity / Power Voltage
- (Reference) In-rush Current of IAI Power Supply Unit PS241 = 50 to 60A, 3msec

1.4 Specifications for each Fieldbus

1.4.1 Specifications of DeviceNet Interface

Item	Specification			
Communication Protocol	DeviceNet2.0			
	Group 2 Dedicated Server			
	Network-Powered Insulation Node			
Baud Rate	Automatically follows the master			
Communication System	Master-Slave System (Polling)			
Number of Occupied Channels	Refer to 3.4.1 PLC Address Construction by each Operation Mode			
Number of Occupied Nodes	1 Node			
Communication Cable Length (Note 2)	Baud Rate	Max. Network Length	Total Branch Line Length	Max. Branch Line Length
	500kbps	100m	39m	6m
	250kbps	250m	78m	
	125kbps	500m	156m	
Communications Cable	Use the dedicated cable.			
Connector (Note 1)	(MSEP-C) MSTBA2.5/5-G-5.08-ABGY AU (Manufactured by PHOENIX CONTACT or equivalent) (MSEP-LC) MSTBA2.5/5-GF-5.08- AU (Manufactured by PHOENIX CONTACT or equivalent)			
Consumption Current of Communication Power Supply	60mA			
Communication Power Supply	24V DC (Supplied from DeviceNet)			

Note 1 The cable-side connector is a standard accessory.
(MSEP-C) Manufactured by PHOENIX CONTACT : MSTB2.5/5-ST-5.08ABGY AU
(MSEP-LC) Manufactured by PHOENIX CONTACT : MSTB2.5/5-STF-5.08 AU

Note 2 For T branch communication, refer to the Instruction Manuals for the master unit and programmable logic controller (PLC) to be mounted.

1.4.2 Specifications of CC-Link Interface

Item	Specification					
Communication Protocol	CC-Link ver1.1 or ver2					
Station Type	Remote Device Station (MAX. four stations occupied)					
Baud Rate	10M/5M/2.5M/625k/156kbps					
Communication System	Broadcast Polling System					
Number of occupied stations	Refer to 3.4.1 PLC Address Construction by each Operation Mode					
Communication Cable Length (Note 2)	Baud Rate (bps)	10M	5M	2.5M	625k	156k
	Total Cable Length (m)	100	160	400	900	1200
Communications Cable	Apply the dedicated cable					
Connector (Note 1)	(MSEP-C) MSTBA2.5/5-G-5.08-ABGY AU (Manufactured by PHOENIX CONTACT or equivalent) (MSEP-LC) MSTBA2.5/5-GF-5.08- AU (Manufactured by PHOENIX CONTACT or equivalent)					

Note 1 The cable-side connector is a standard accessory.
(MSEP-C) Manufactured by PHOENIX CONTACT : MSTB2.5/5-ST-5.08ABGY AU
(MSEP-LC) Manufactured by PHOENIX CONTACT : MSTB2.5/5-STF-5.08 AU

Note 2 For T branch communication, refer to the Instruction Manuals for the master unit and PLC to be mounted.

1.4.3 Specifications of PROFIBUS-DP Interface

Item	Specification		
Communication Protocol	PROFIBUS-DP		
Baud Rate	Automatically follows the master		
Communication System	Hybrid System (Master-Slave System or Token Passing System)		
Number of occupied stations	Refer to 3.4.1 PLC Address Construction by each Operation Mode		
Communication Cable Length	MAX. Total Network	Baud Rate	Cable Type
	100m	12,000/6,000/3,000kbps	Type A Cable
	200m	1,500kbps	
	400m	500kbps	
	1000m	187.5kbps	
	1200m	9.6/19.2/93.75kbps	
Communications Cable	STP cable AWG18		
Connector (Note 1)	9-pin female D-sub Connector		
Transmission Path Format	Bus/Tree/Star		

Note 1 Please prepare a 9-pin male D-sub connector for the cable-end connector.

1.4.4 Specifications of CompoNet Interface

Item	Specification
Communication System	CompoNet dedicated protocol
Communication Type	Remote I/O communication
Baud Rate	Automatically follows the master
Communication Cable Length	Follows CompoNet specifications
Slave Type	Word-Mixed Slave
Available Node Addresses for Setting	0 to 63 (Setting conducted on controller parameter)
Number of occupied channels	Refer to 3.4.1 PLC Address Construction by each Operation Mode
Communications Cable (Note 1)	Round Cable (JIS C3306, VCTF2-core) Flat cable I (with no sheathed) Flat cable II (sheathed)
Connector (Controller Side)	XW7D-PB4-R (Manufactured by OMRON or equivalent)

Note 1 Prepare the communication cable separately.

1.4.5 Specifications of EtherNet/IP Interface

Item	Specification
Communication Protocol	IEC61158 (IEEE802.3)
Baud Rate	10BASE-T/100BASE-T (Autonegotiation setting is recommended)
Communication Cable Length	Follows EtherNet/IP specifications (Distance between hub and each node: 100m max.)
Number of Connection	Master Unit
Available Node Addresses for Setting	0.0.0.0 to 255.255.255.255
Communications Cable (Note 1)	Category 5 or more (Double shielded cable braided with aluminum foil recommended)
Connector	RJ45 Connector × 1pc

Note 1 Prepare separately for the communication cable.

1.4.6 Specifications of EtherCAT Interface

Item	Specification
Communication Protocol	IEC61158 type 12
Physical Layer	100Base-TX (IEEE802.3)
Baud Rate	Automatically follows the master
Communication Cable Length	Follows EtherCAT® specifications (Distance between each node: 100m max.)
Slave Type	I/O slave
Available Node Addresses for Setting	0 to 127
Communications Cable (Note 1)	Category 5e or more (Double shielded cable braided with aluminum foil recommended)
Connector	RJ45 Connector × 2pcs (Input × 1, Output × 1)
Connect	Daisy chain only

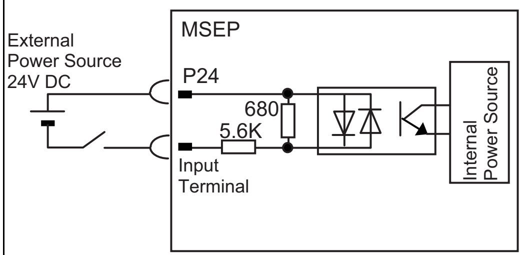
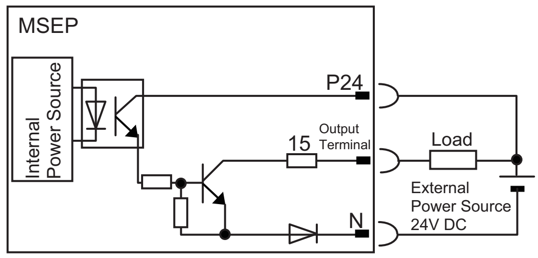
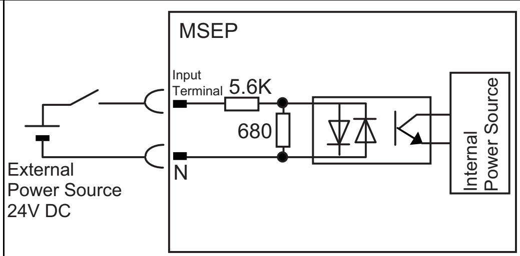
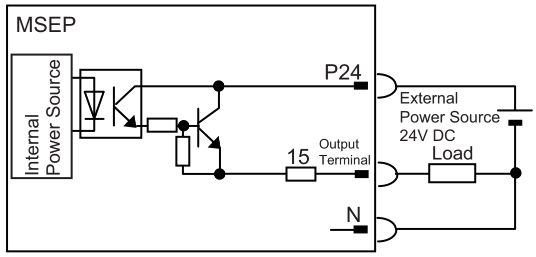
Note 1 Prepare separately for the communication cable.

1.4.7 Specifications of PROFINET-IO Interface

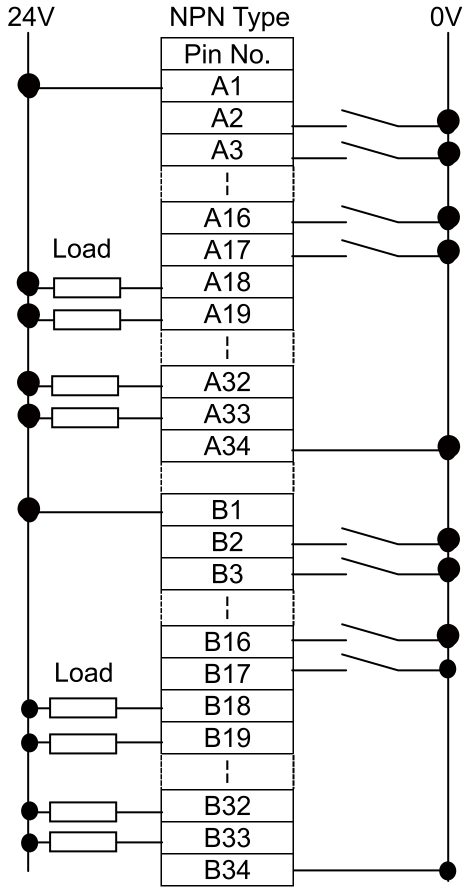
Item	Specification
Communication Protocol	IEC61158 (IEEE802.3), IEC61784
Baud Rate	100Mbps
Communication Cable Length	Distance between each segment: 100m Max.
Number of Connection	Master Unit
Available Node Addresses for Setting	0.0.0.0 to 255.255.255.255
Communications Cable (Note 1)	Category 5 or more (Double shielded cable braided with aluminum foil recommended)
Connector	RJ45 Connector × 1pc
GSDML File Version	Ver 2.3

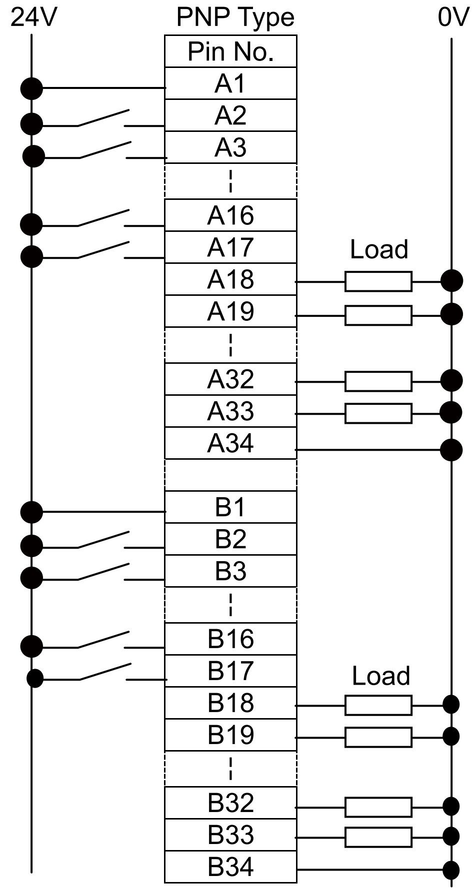
Note 1 Prepare separately for the communication cable.

1.4.8 PIO Input and Output Interface

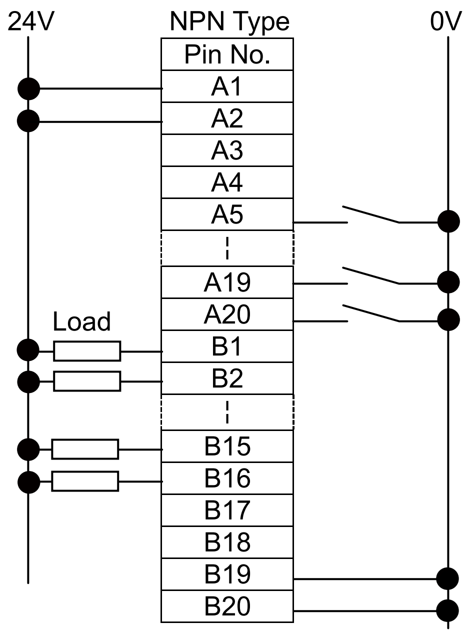
	Input section		Output section	
Specification	Input Voltage	24V DC ±10%	Load Voltage	24V DC ±10%
	Input Current	5mA 1 circuit	Peak Load Electric Current	50mA 1 circuit Load current total: 1A or less
	ON/OFF voltage	ON voltage MIN. 18V DC OFF voltage MAX. 6V DC	Leak Current	MAX 2mA/1 point
	External circuit insulation with Photocoupler			
NPN				
PNP				
I/O Cable	Refer to 2.4.8 Connection of PIO			

[1] MSEP-C





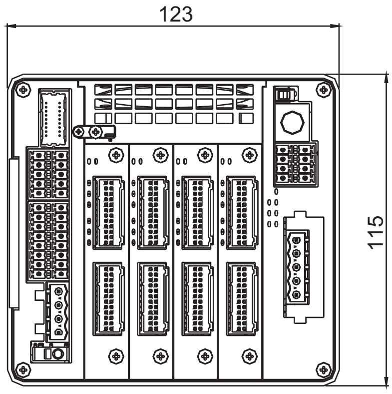
[2] MSEP-LC



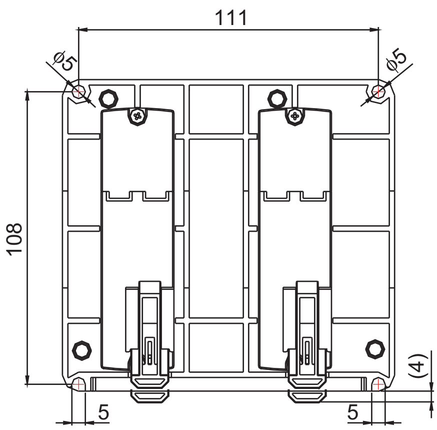
1.5 External Dimensions

1.5.1 Controller Main Unit (The figure shows MSEP-C. The dimensions are the same for MSEP-LC.)

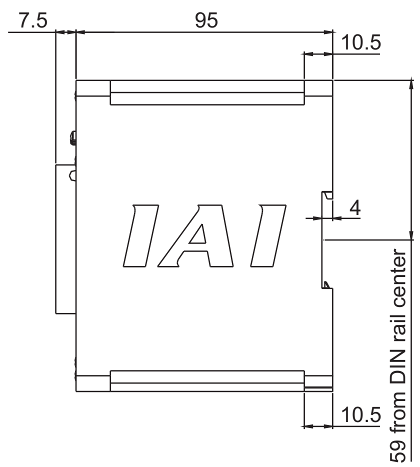
Front View



Rear View

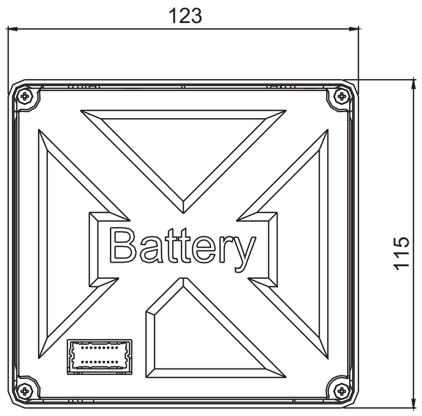


Side View

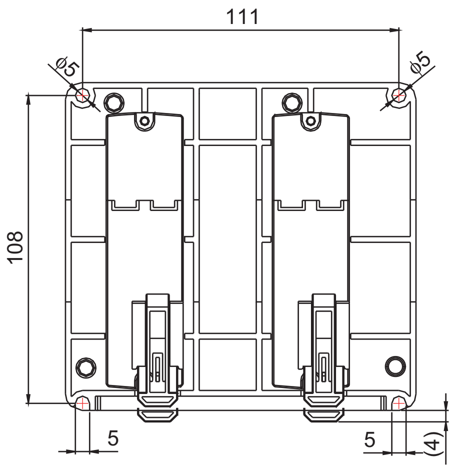


1.5.2 Absolute Battery Box

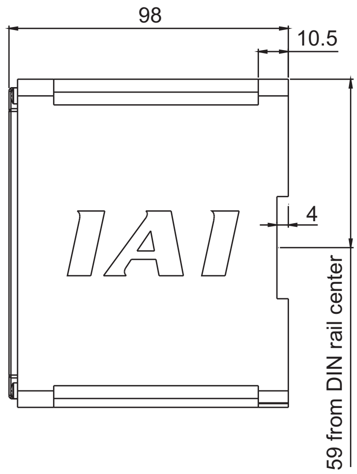
Front View



Rear View



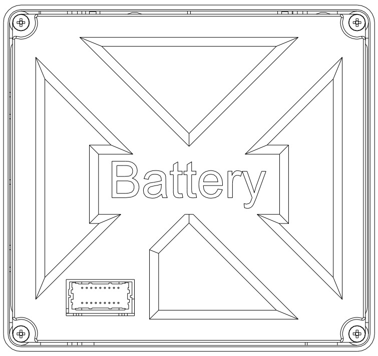
Side View



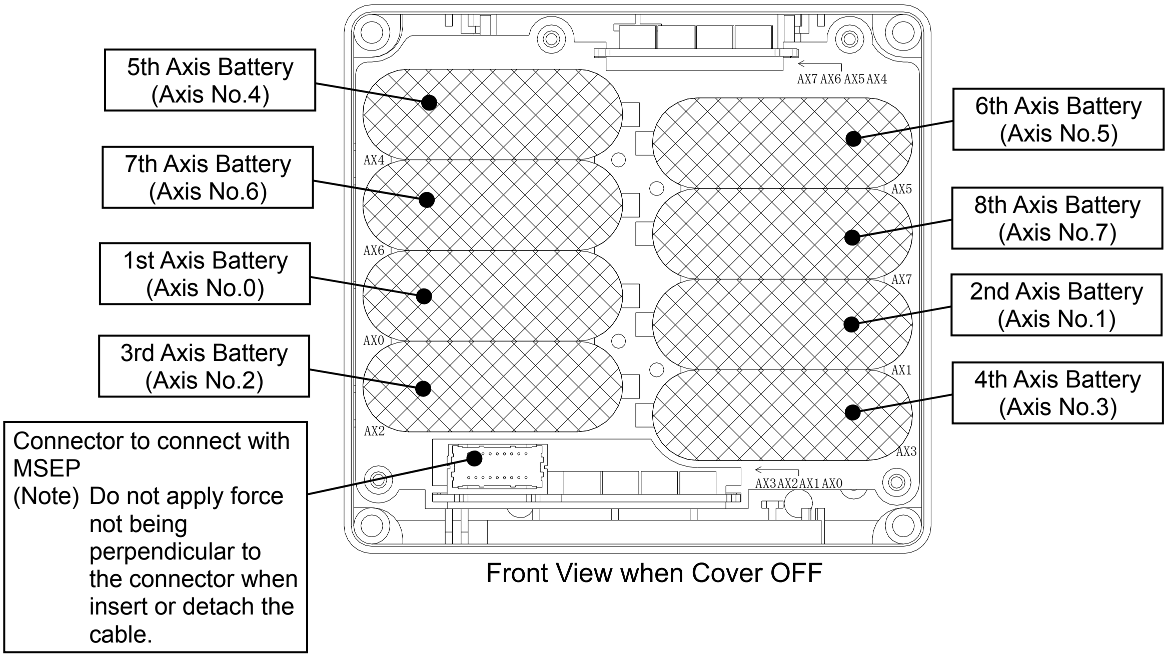
1.6 Option

1.6.1 Absolute Battery Box

For Simple Absolute type, an absolute battery box capable for the batteries for 8 axes is used.
The battery is to be attached only to the axes for Simple Absolute Type.
The connection to MSEP controller is to be made with the dedicated cable (CB-MSEP-AB005).
(Note) Cable length: 0.5m



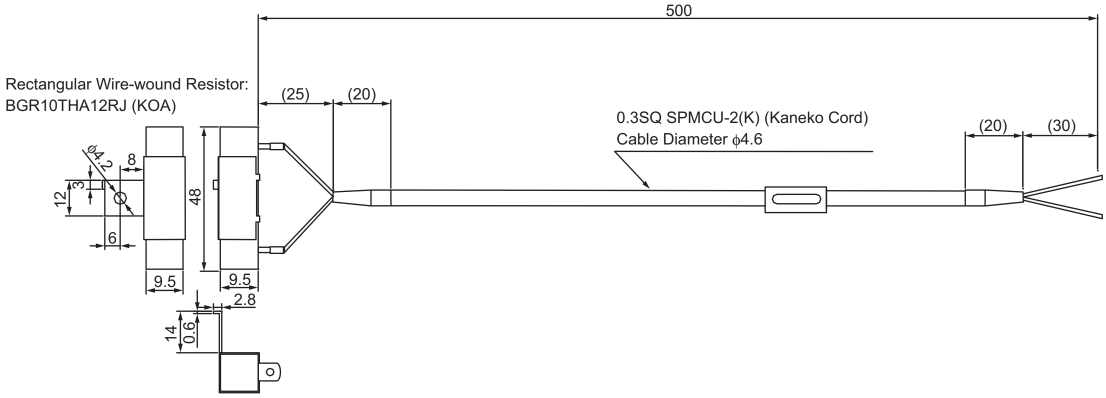
Front View when Cover ON



Front View when Cover OFF

1.6.2 Regenerative Resistor Unit

This unit is necessary to be connected in the case that the regenerative energy cannot be consumed by the regenerative resistor built into the MSEP controller.
It is necessary to connect the unit in the following case:



Condition to Require Regenerative Units

Number of Connected Actuator	3 to 8 units of high acceleration/deceleration type actuators
Number of Regenerative Unit	1

⚠ Caution: The regenerative resistor consumes regenerative current and converts it to heat. Therefore, the temperature may get high in some operational conditions. Attach on the metal part of the device with a screw to radiate the heat.

1.7 Installation and Storage Environment

This product is capable for use in the environment of pollution degree 2[*1] or equivalent.
*1 Pollution Degree 2 : Environment that may cause non-conductive pollution or transient conductive pollution by frost (IEC60664-1)

[1] Installation Environment

Do not use this product in the following environment.

- Location where the surrounding air temperature exceeds the range of 0 to 40°C
- Location where condensation occurs due to abrupt temperature changes
- Location where relative humidity exceeds 85%RH
- Location exposed to corrosive gases or combustible gases
- Location exposed to significant amount of dust, salt or iron powder
- Location subject to direct vibration or impact
- Location exposed to direct sunlight
- Location where the product may come in contact with water, oil or chemical droplets
- Environment that blocks the air vent [Refer to 1.8 Noise Elimination and Mounting Method]

When using the product in any of the locations specified below, provide a sufficient shield.

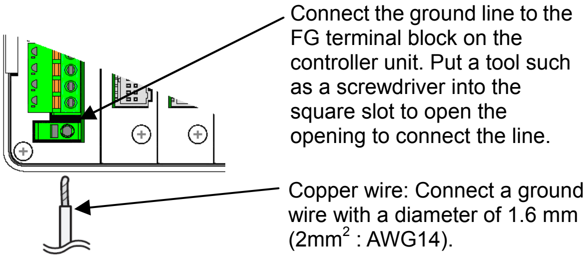
- Location subject to electrostatic noise
- Location where high electrical or magnetic field is present
- Location with the mains or power lines passing nearby

[2] Storage and Preservation Environment

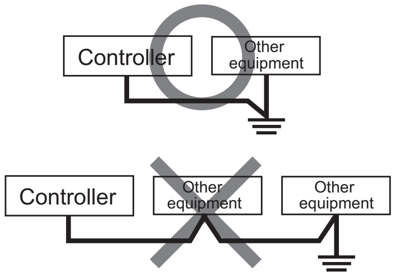
- Storage and preservation environment follows the installation environment. Especially, when the product is to be left for a long time, pay special attention to condensed water.
  Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package.

1.8 Noise Elimination and Mounting Method

(1) Noise Elimination Grounding (Frame Ground)



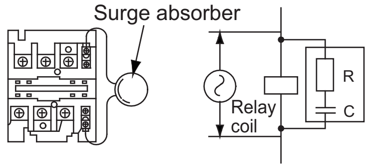
Earth Terminal
Class D grounding
(Formerly Class-III grounding :
Grounding resistance at 100Ω or less)



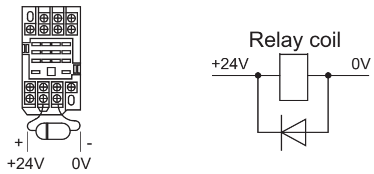
Do not share the ground wire with or connect to other equipment. Ground each controller.

(2) Precautions regarding wiring method
1) Wire is to be twisted for the power supply.
2) Separate the signal and encoder lines from the power supply and power lines.

(3) Noise Sources and Elimination
Carry out noise elimination measures for electrical devices on the same power path and in the same equipment.
The following are examples of measures to eliminate noise sources.
1) AC solenoid valves, magnet switches and relays
[Measure] Install a Surge absorber parallel with the coil.

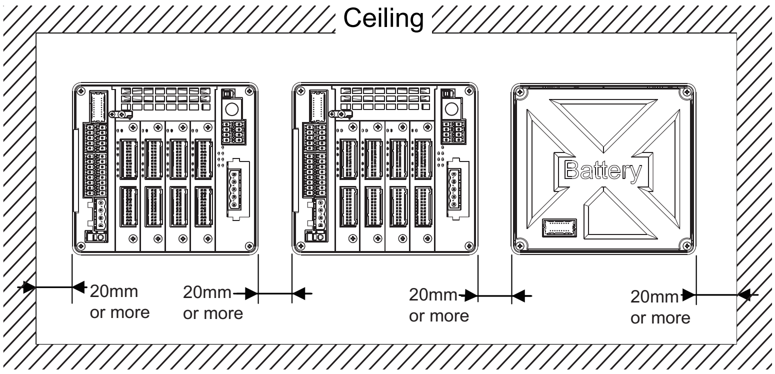


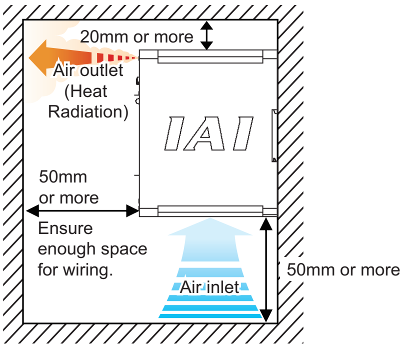
2) DC solenoid valves, magnet switches and relays
[Measure] Mount the windings and diodes in parallel.
Select a diode built-in type for the DC relay.



(4) Cooling Factors and Installation

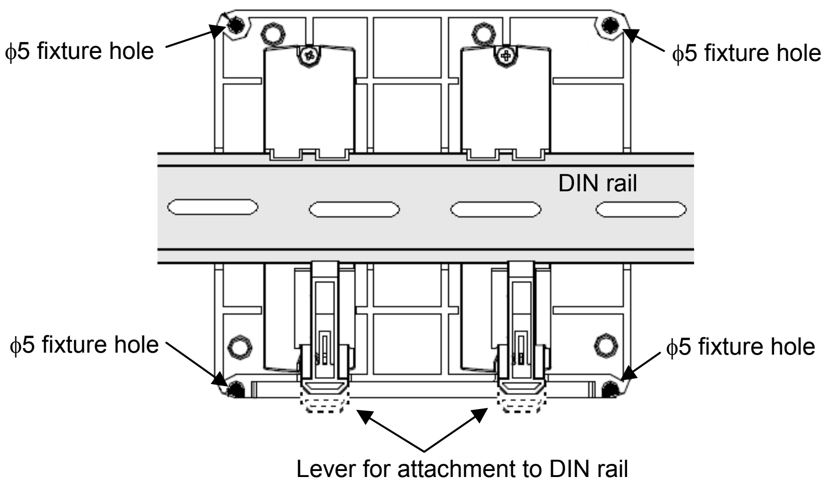
Design and Build the system considering the size of the controller box, location of the controller and cooling factors to keep the ambient temperature around the controller below 40°C.
Pay a special attention to the battery unit since the performance of it would drop both in the low and high temperatures. Keep it in a room temperature environment as much as possible. (Approximately 20°C is the recommended temperature.)





Rear View

For the attachment of the unit, use the fixture holes on the four corners or attach on the DIN rail. (Attachment should be the same for the absolute battery box.)

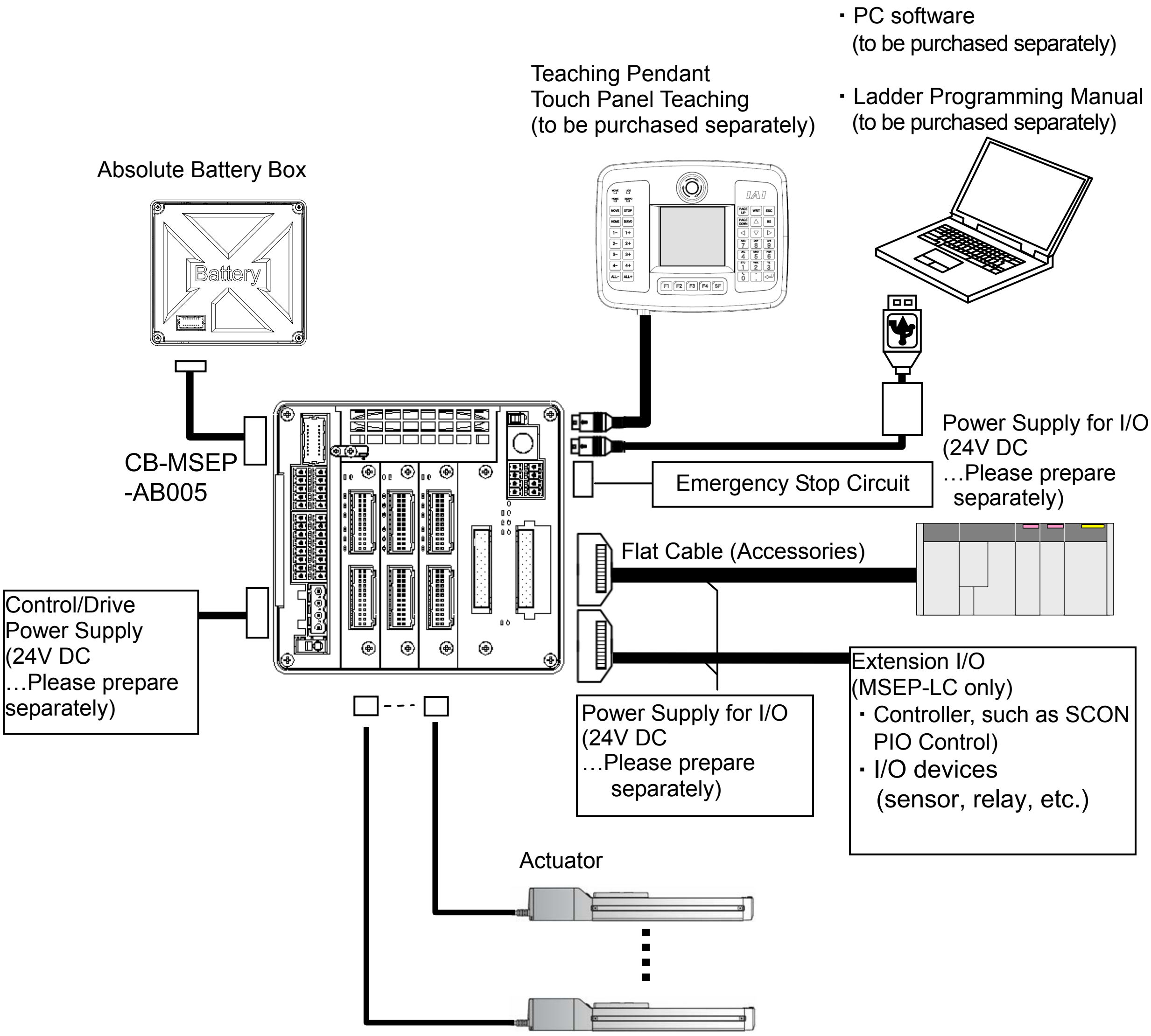


Chapter 2 Wiring

2.1 Wiring Diagram (Connection of construction devices)

2.1.1 For PIO Control

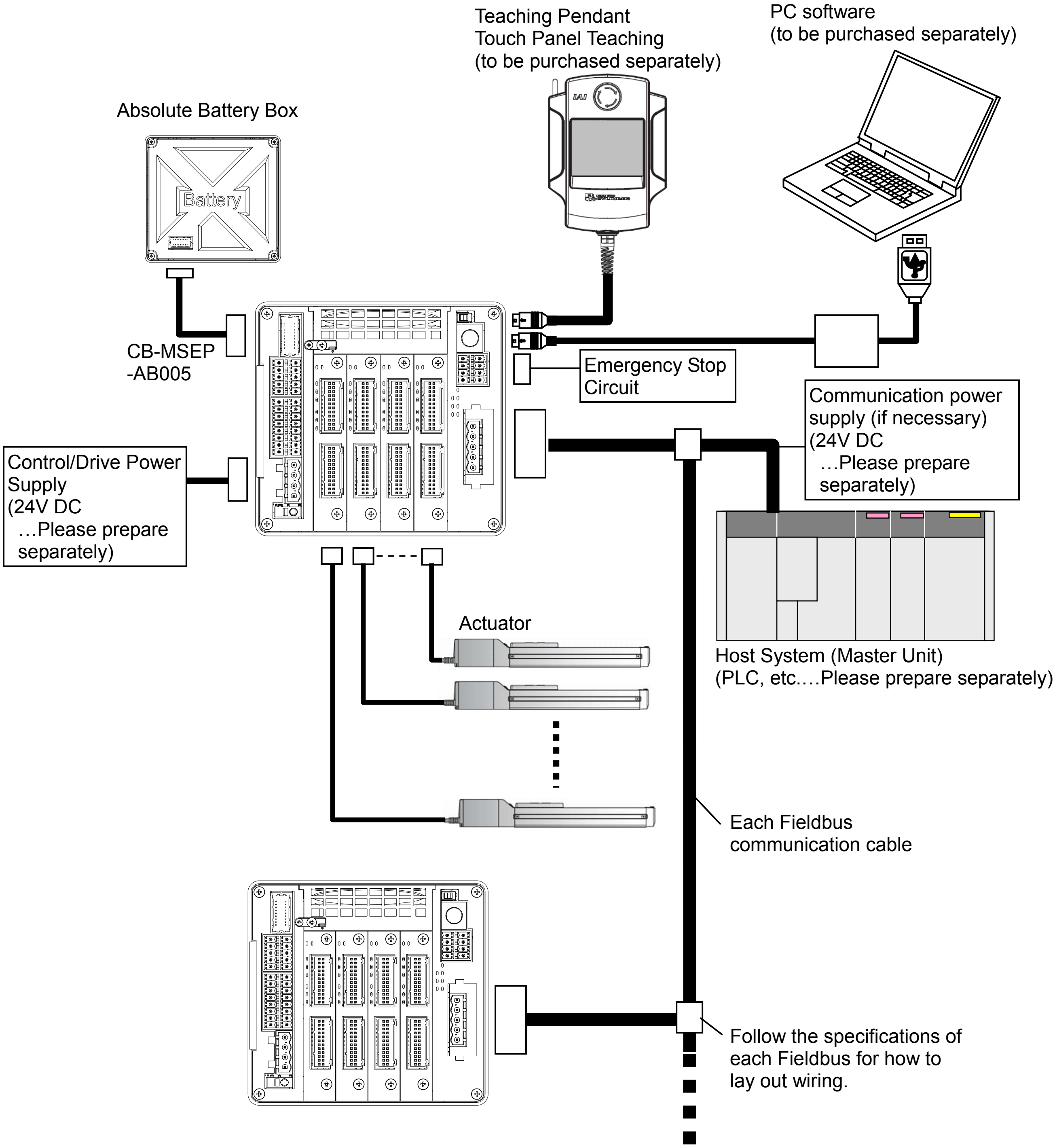
(Note) The figure shows MSEP-LC for an example. The basic construction is the same for MSEP-C except for the numbers of the driver boards and the I/O connectors.



⚠ Caution: Make sure to turn the power to the controller OFF when inserting or removing the connector that connects the PC software or teaching pendant to the controller. Inserting or removing the connector while the power is turned ON causes a controller failure.

2.1.2 When Controlled by Fieldbus

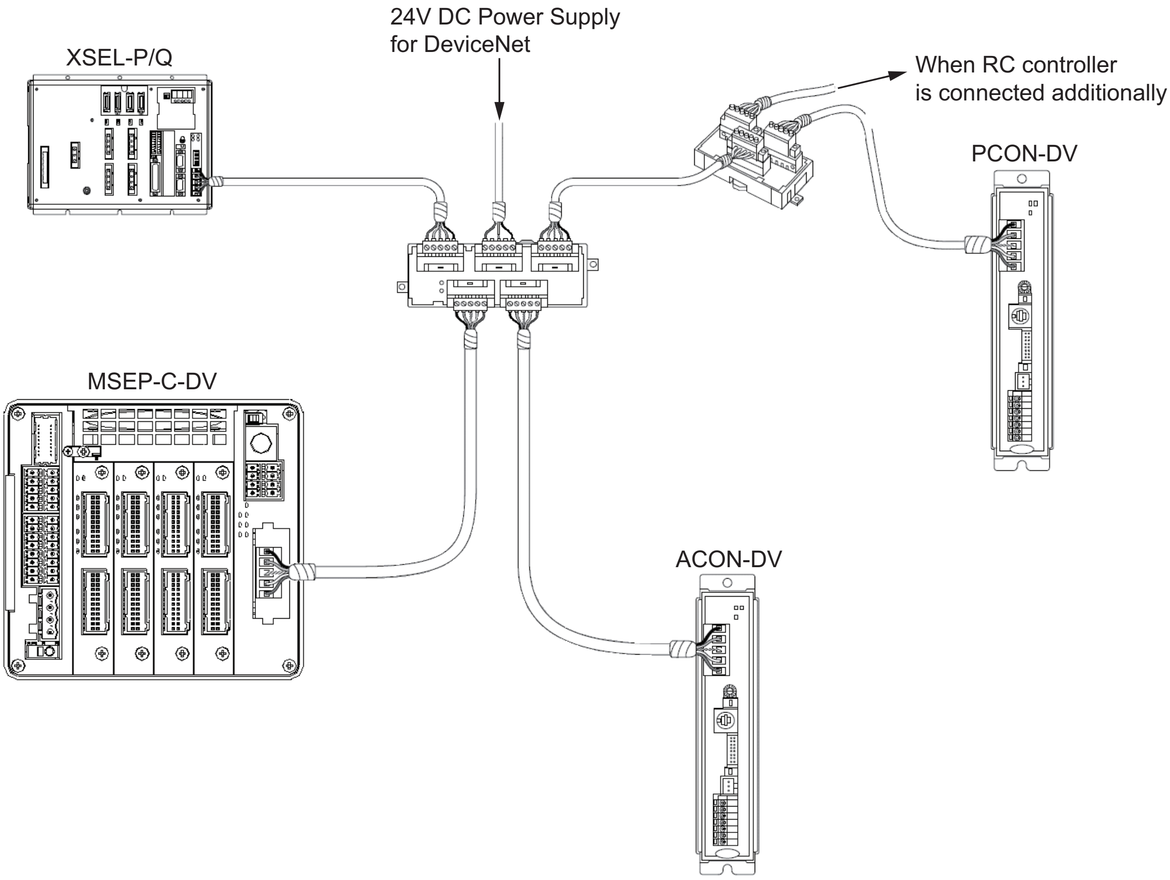
(Note) The figure shows MSEP-C for an example. The basic construction is the same for MSEP-LC except for the numbers of the driver boards and the I/O connectors.



⚠ Caution: Make sure to turn the power to the controller OFF when inserting or removing the connector that connects the PC software or teaching pendant to the controller. Inserting or removing the connector while the power is turned ON causes a controller failure.

2.1.3 For RC Gateway Control

MSEP-C is capable for the connection to the RC Gateway Function (Fieldbus Type) equipped in XSEL controller to make an operation in harmony with XSEL controller.



2.2 Operation Pattern Selected

2.2.1 Outline for Operation Patterns

PIO type MSEP units provide 6 varying patterns of PIO operation. Fieldbus type MSEP units provide 6 varying modes of fieldbus operation. Select an appropriate pattern or fieldbus mode based upon your application requirements. See Section 3 Operation for the details of the operation patterns.

(Note) Setting can be done only to Operation Pattern 6 of the fieldbus type for MSEP-LC.

Interface	Operation Pattern		Number of position points		Description	Details
PIO Type (Cannot be selected for MSEP-LC)	0 : Point-to-Point Movement		2 (Forward end, Backward end)	Single Solenoid System	Control is performed with one input signal as it is done for the single solenoid.	3.1.1 (1)
				Double Solenoid System	Control is performed with two input signals as it is done for the double solenoid.	
	1 : Point-to-Point Movement, Movement Speed Change		2 (Forward end, Backward end)	Single Solenoid System	Speed is available to change during a movement. Control is performed with one input signal as it is done for Single Solenoid, however, the speed can be changed while in move if a movement speed change signal is input.	
				Double Solenoid System	Speed is available to change during a movement. Control is performed with two input signals as it is done for Double Solenoid, however, the speed can be changed while in move if a movement speed change signal is input.	
	2 : Point-to-Point Movement, Target Position Change		2 (Forward end, Backward end)	Single Solenoid System	Control is performed with one input signal as it is done for Single Solenoid, however, the target position and operational condition can be changed while in move if a target position change signal is input.	
				Double Solenoid System	Control is performed with two input signals as it is done for Double Solenoid, however, the target position and operational condition can be changed while in move if a target position change signal is input.	
	3 : 2-Input, 3-Point Movement		3 (Forward end, Backward end, Intermediate)		Movement is made among three points with the combination of two input signals.	
	4 : 3-Input, 3-Point Movement		3 (Forward end, Backward end, Intermediate)		Movement is made among three points with three input signals.	
	5 : Continuous Reciprocating Operation		2 (Forward end, Backward end)		Movement is made between the forward end and backward end repeatedly while one input signal is ON.	
Fieldbus Type	0 to 5	SEP I/O (Cannot be selected for MSEP-LC)	2 or 3		The same control as PIO stated previously is available if the interface is Fieldbus.	3.1.1 (2)
	6	Positioner 1	256		The position data can be registered at 256 points at the maximum and a stop can be made at the registered points. Monitoring of the current position is also available.	
		Simple Direct			The target position can be indicated directly with inputting a number. Monitoring of the current position is also available.	
		Number of direct numerical specification			The target position, speed acceleration/deceleration and pressing current limit can be indicated with inputting a number. Monitoring of not only the current position, but also the current speed and indicated current are available.	
		Positioner 2	256		The position data can be registered at 256 points at the maximum and a stop can be made at the registered points. The monitoring of the current position is not available. This mode is that the transferred data is reduced from Positioner 1 Mode.	
		Positioner 3	256		The position data can be registered at 256 points at the maximum and a stop can be made at the registered points. The monitoring of the current position is not available. This mode is that the transferred data is reduced from Positioner 2 Mode to control only the minimum signals necessary only for the movement operation.	

2.2.2 PIO Pattern Selection and PIO Signal (for MSEP-C)

1) PIO Patterns and Signal Assignment

The signal assignment of I/O flat cable by the PIO pattern is as shown below. Follow the following table to connect the external equipment (such as PLC).

Pin No.	Category	PIO Functions	Operation Pattern (PIO pattern)									
			0		1		2		3	4	5	
			Point-to-Point Movement		Movement speed setting		Target position change		2-Input, 3-Point Movement	3-Input, 3-Point Movement	Continuous reciprocating operation	Fieldbus connection
	Input	Number of positioning points	2 points		2 points		2 points		3 points	3 points	2 points	
	Input	Home return signal	× (Home-return operation at the power-on or the first movement operation)									
	Input	Servo ON signal	○ (Automatic servo-on is also available at the power-on)									
	Input	Movement speed setting	×		○		×		×	×	○	
	Input	Target position change	×		×		○		×	×	×	
	Output	Servo ON signal	○ (Selection available in the initial setting whether to use)									
	Output	Home return completion signal	○ (Selection available in the initial setting whether to use)						×	○ (Selection available in the initial setting whether to use)		
	Output	Zone signal, Position zone sig	×		×		×		×	×	×	
		Solenoid system	Single	Double	Single	Double	Single	Double	–	Double	–	
A1	–	COM	24V									Refer to 3.4 Fieldbus Type Address Map
A2	Input (Axis No.0)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A3	Input (Axis No.0)	IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A4	Input (Axis No.0)	IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A5	Input (Axis No.0)	IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A6	Input (Axis No.1)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A7	Input (Axis No.1)	IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A8	Input (Axis No.1)	IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A9	Input (Axis No.1)	IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A10	Input (Axis No.2)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A11	Input (Axis No.2)	IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A12	Input (Axis No.2)	IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A13	Input (Axis No.2)	IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A14	Input (Axis No.3)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A15	Input (Axis No.3)	IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A16	Input (Axis No.3)	IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A17	Input (Axis No.3)	IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A18	Output (Axis No.0)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A19	Output (Axis No.0)	OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A20	Output (Axis No.0)	OUT2	HEND/SV		HEND/SV		HEND/SV		LS2/PE2	LS2/PE2	HEND/SV	
A21	Output (Axis No.0)	OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A22	Output (Axis No.1)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A23	Output (Axis No.1)	OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A24	Output (Axis No.1)	OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A25	Output (Axis No.1)	OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A26	Output (Axis No.2)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A27	Output (Axis No.2)	OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A28	Output (Axis No.2)	OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A29	Output (Axis No.2)	OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A30	Output (Axis No.3)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A31	Output (Axis No.3)	OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A32	Output (Axis No.3)	OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A33	Output (Axis No.3)	OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A34	–	COM	0V									

(Note) "*" in codes above shows the signal of the active low.
Note 1 It is invalid before home-return operation.
Note 2 The description in the brackets shows the condition before the home return operation.

Pin No.	Category	PIO Functions	Operation Pattern									
			0		1		2		3	4	5	6
			Point-to-Point Movement		Movement speed change		Target position change		2-Input, 3-Point Movement	3-Input, 3-Point Movement	Continuous reciprocating operation	Fieldbus connection
		Solenoid system	Single	Double	Single	Double	Single	Double	–	Double	–	
B1	–	COM	24V									
B2	Input (Axis No.4)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	Refer to 3.4 Fieldbus Type Address Map
B3		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B4		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B5		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B6	Input (Axis No.5)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B7		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B8		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B9		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B10	Input (Axis No.6)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B11		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B12		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B13		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B14	Input (Axis No.7)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B15		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B16		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B17		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B18	Output (Axis No.4)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B19		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B20		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B21		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B22	Output (Axis No.5)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B23		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B24		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B25		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B26	Output (Axis No.6)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B27		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B28		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B29		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B30	Output (Axis No.7)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B31		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B32		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B33		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B34	–	COM	0V									

(Note) Change the output and class considering the initial setting.
[Refer to [Step 5] in 3.1.2 Initial Setting for the settings, and 3.8.2 SEP I/O of Fieldbus Mode and PIO Operation of MSEP-C for the details of the signals.]

Note 1 It is invalid before home-return operation.

Note 2 The description in the brackets shows the condition before the home return operation.

(Reference) Signal of Active Low

Signal with "*" expresses the signal of active low. A signal of active low is a signal that the input signal is processed when it is turned OFF, output signal is ordinary on while the power is ON, and turns OFF when the signal is output.

2) List of PIO Signals
The table below lists the functions of PIO signals. Refer to the section shown in Relevant Sections for the details of the control of each signal.

Category	Signal Abbreviation	Signal Name	Function Description	Relevant Sections
Input	ST0	• Moving Signal (Single Solenoid System) • Backward End Movement Signal (Double Solenoid System) • Move Signal 1 (PIO Pattern 3)	The positioning to the corresponding target position is performed, when the signal leading edge created in the mode change from OFF to ON, or ON level is detected.	3.8.2 [4] [5]
	ST1	• Forward End Movement Signal • Move Signal 2 (PIO Pattern 3)		
	ST2	• Intermediate Point Movement Signal		
	*STP	Pause	When this signal is turned OFF while in move, the actuator decelerates and then stops. The remaining movement is in a hold while the actuator is stopped and will resume when the signal turns back ON.	3.8.2 [3]
	RES	Reset	An alarm will be reset when this signal is turned ON. (Note) Depending on the alarm level, alarm reset might not be available. Refer to the Trouble Shooting for the details.	3.8.2 [3]
	SON	Servo ON	The servo remains ON while this signal is ON, or OFF while this signal is OFF.	3.8.2 [1]
	SPDC	Movement Speed Change	To change the speed during a movement operation, input the movement signal while this signal is ON. (Note) This signal is available only in the operation pattern 1.	3.8.2 [10]
	CN1	Target Position Change	Turn this signal ON when an operation is made with a change to the operation condition. When this signal is turned ON or OFF during the operation, the position data is changed. (Note) This signal is available only in the operation pattern 2.	3.8.2 [11]
	ASTR	Continuous Reciprocating Operation	A back and forth movement is performed repeatedly between the forward end and the backward end while this signal is ON. When this signal is turned OFF during the movement operation, after the actuator is positioned to the current target, it is stopped. (Note) This signal is available only in the operation pattern 5.	3.8.2 [13]
Output	LS0	Backward End Position Detection	The same operation as of the limit switch of the air cylinder is performed. It is turned ON when the current position is within the positioning width for each position detection output.	3.8.2 [5]
	LS1	Forward End Position Detection		
	LS2	Intermediate Point Detection		
	PE0	Backward End Point Positioning Completion	This signal is turned ON when the current position goes within the positioning width, and the positioning to the target position is complete. It is turned OFF in the Servo-Motor OFF mode or the Emergency Stop Mode.	3.8.2 [4]
	PE1	Forward End Point Positioning Completion		
	PE2	Intermediate Point Positioning Completion		
	HEND	Home Return Completion	This signal will turn ON when home return has been completed. It will be kept ON unless the home position is lost.	3.8.2 [6]
	SV	Servo ON	This signal will remain ON while the servo is ON.	3.8.2 [1]
	*ALM	Alarm Output	This signal remains ON in normal conditions of use and turns OFF when an alarm is generated.	3.8.2 [2]

Signal with "*" expresses the signal of active low. In the controller, the process is held when the input signal is turned OFF.

2.2.3 PIO Pattern Selection and PIO Signal (for MSEP-LC)

1) PIO Patterns and Signal Assignment

The signal assignment of I/O flat cable by the PIO pattern is as shown below. Follow the following table to connect the external equipment.

Refer to MSEP-LC Programming Manual (ME0329) provided separately for how to assign or use the built-in logic controller memory.

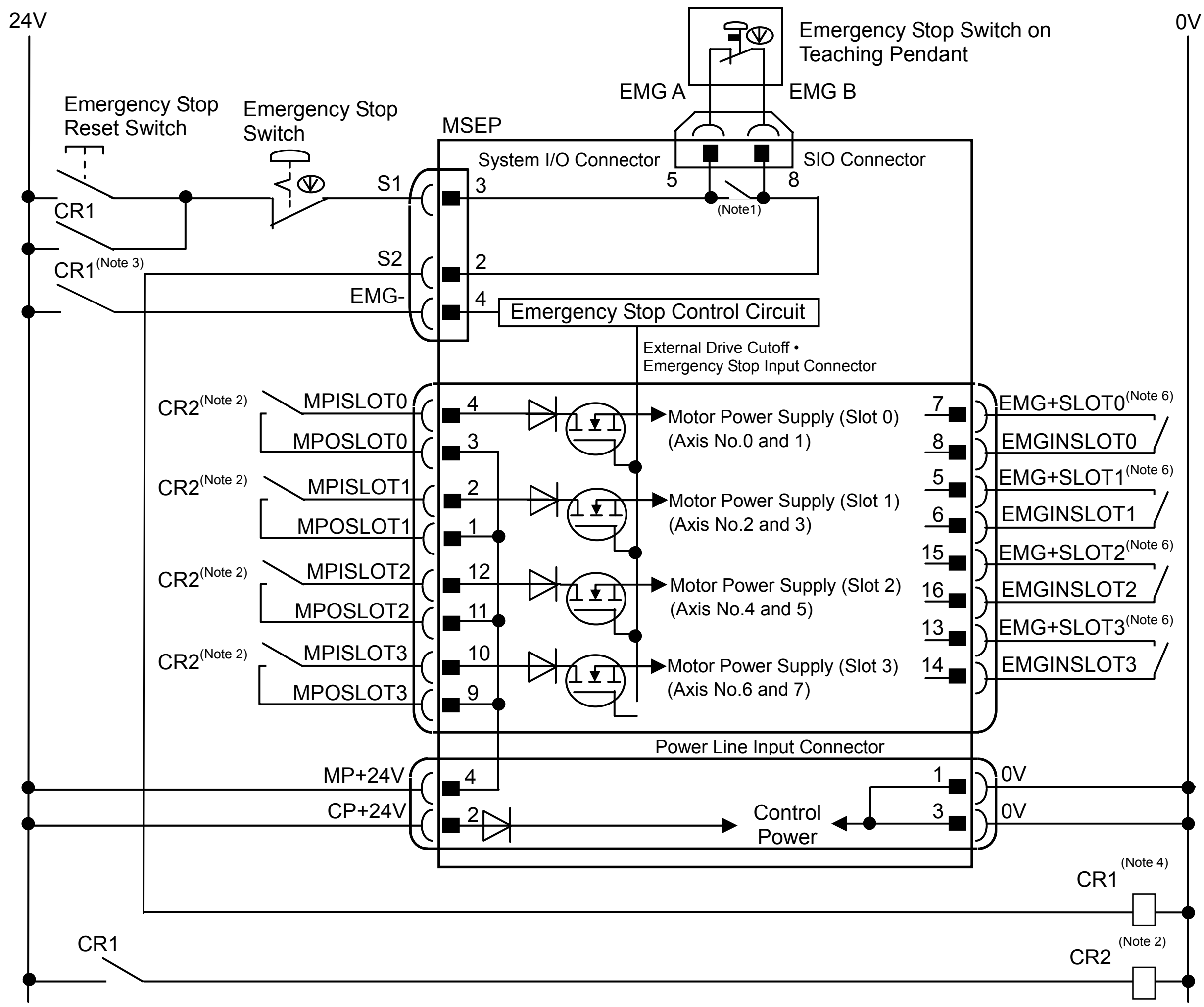
Pin No.	PIO Functions	Operation Pattern (PIO pattern)				
		0 to 5	6			
			Standard I/O		Extended I/O	
			Signal Name	Destination to Assign Memory	Signal Name	Destination to Assign Memory
A1	COM	24V				
A2						
A3						
A4						
A5	General-Purposed Input	N/A	IN0	X000	IN16	X010
A6			IN1	X001	IN17	X011
A7			IN2	X002	IN18	X012
A8			IN3	X003	IN19	X013
A9			IN4	X004	IN20	X014
A10			IN5	X005	IN21	X015
A11			IN6	X006	IN22	X016
A12			IN7	X007	IN23	X017
A13			IN8	X008	IN24	X018
A14			IN9	X009	IN25	X019
A15			IN10	X00A	IN26	X01A
A16			IN11	X00B	IN27	X01B
A17			IN12	X00C	IN28	X01C
A18			IN13	X00D	IN29	X01D
A19			IN14	X00E	IN30	X01E
A20			IN15	X00F	IN31	X01F
B1	General-Purposed Output		OUT0	Y000	OUT16	Y010
B2			OUT1	Y001	OUT17	Y011
B3			OUT2	Y002	OUT18	Y012
B4			OUT3	Y003	OUT19	Y013
B5			OUT4	Y004	OUT20	Y014
B6			OUT5	Y005	OUT21	Y015
B7			OUT6	Y006	OUT22	Y016
B8			OUT7	Y007	OUT23	Y017
B9			OUT8	Y008	OUT24	Y018
B10			OUT9	Y009	OUT25	Y019
B11			OUT10	Y00A	OUT26	Y01A
B12			OUT11	Y00B	OUT27	Y01B
B13			OUT12	Y00C	OUT28	Y01C
B14			OUT13	Y00D	OUT29	Y01D
B15			OUT14	Y00E	OUT30	Y01E
B16			OUT15	Y00F	OUT31	Y01F
B17						
B18						
B19	COM	0V				
B20						

2.3 Circuit Diagram

Sample circuit diagrams are shown below.

[1] Power Supply and Emergency Stop

The diagram shown below is an example of a circuit for when reflecting the emergency stop switch on a teaching pendant to the emergency stop circuit of the system.



Note 1 When the teaching pendant is not connected, S1 and S2 become short-circuited inside the controller.

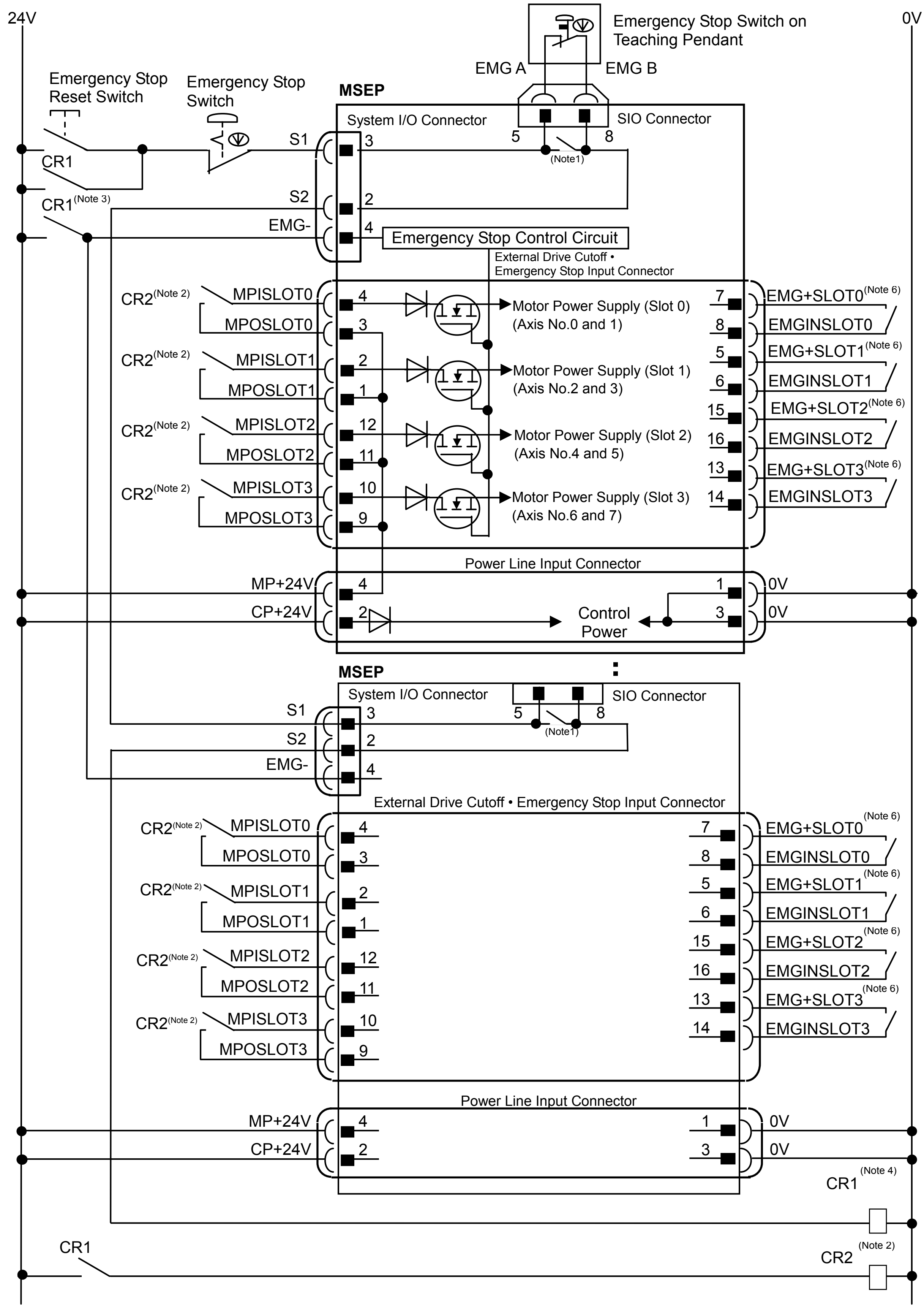
Note 2 When the motor power must be disconnected externally for safety category compliance, apply a safety rated contactor between MPISLOT* and MPOSLOT*. Choose one that is capable to open and close with the motor current consumption of the connected actuator [Refer to 1.2 List of Basic Specifications.].

Note 3 The rating for the emergency stop signal (EMG-) to turn ON/OFF at contact CR1 is 24V DC and 10mA.

Note 4 For CR1, select the one with coil current 0.1A or less.

Note 5 If supplying power with using a 24V DC, having it turned ON/OFF, keep the 0V connected and have the +24V supplied/cut (cut one side only).

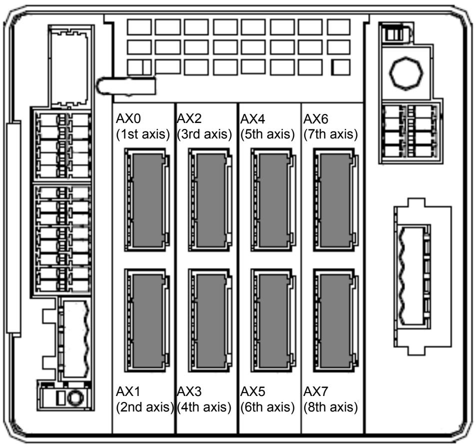
Note 6 By cutting out the connection between EMG+SLOT* and EMGINSLOT*, only the disconnected slot number can be made in the condition of an emergency stop. (*: Slot Number)



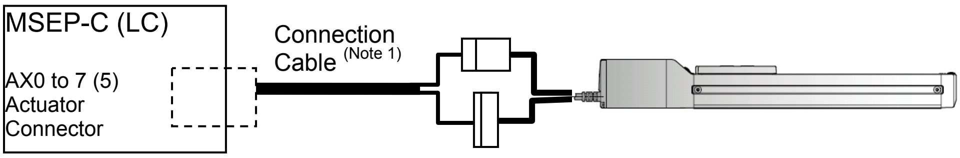
Check the previous page for Notes 1 to 6.

[2] Motor • Encoder Circuit

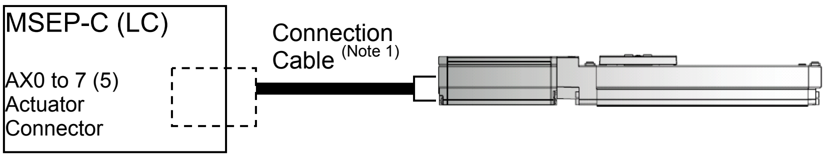
⚠ Caution: There is an axis number (MSEP-C: AX0 to AX7, MSEP-LC: AX0 to AX5) shown on the actuator cables. Refer to the figure below to plug the actuators correctly. Wrong connection will issue an error such as the encoder wire breakage. Check in the instruction manual of each actuator for the details (connection layout diagram) of each cable.



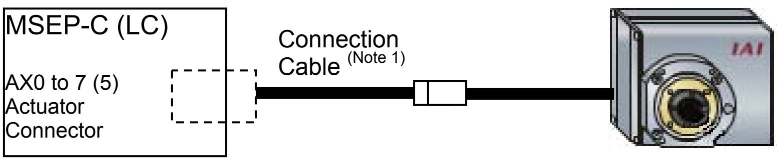
1) Connection to RCP2 Series



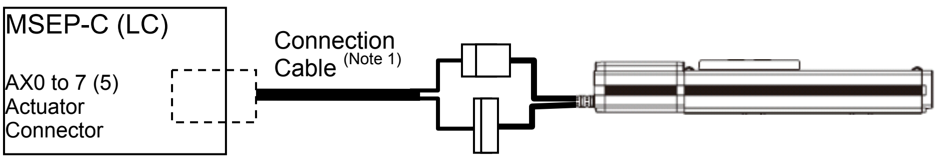
2) Connection to RCP3, RCP4, RCP5, RCA2, RCD and RCL Series



3) Connection to RCP2 Small Rotary Series



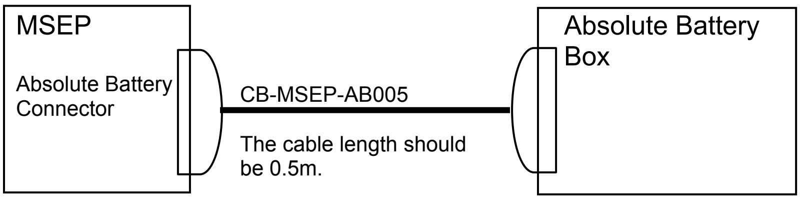
4) Connection to RCA Series



Note 1 Applicable Connection Cable Model Codes □□□: Cable length Example) 030 = 3m

Model	Cable	Remarks
RCP2 (Except for small rotary)	CB-PSEP-MPA□□□	Robot cable from 0.5 to 20m
Small rotary type RCP2-RTBL/RTCL /RTBSL/RTCSL /RTBBL/RTCBL	CB-RPSEP-MA□□□	Robot cable from 0.5 to 20m
RCA	CB-ASEP-MPA□□□	Robot cable from 0.5 to 20m
RCP3, RCA2, RCL	CB-APSEP-MPA□□□	Robot cable from 0.5 to 20m
	CB-APSEP-MPA□□□-LC	Standard cable from 0.5 to 20m
RCP4 (Except for GR* type), RCD (Applicable Controller Symbol : D3)	CB-CA-MPA□□□-RB	Robot cable from 0.5 to 20m
	CB-CA-MPA□□□	Standard cable from 0.5 to 20m
RCP4 (GR* type), RCP5, RCD (Applicable Controller Symbol : D5)	CB-CAN-MPA□□□-RB	Robot cable from 0.5 to 20m
	CB-CAN-MPA□□□	Standard cable from 0.5 to 20m

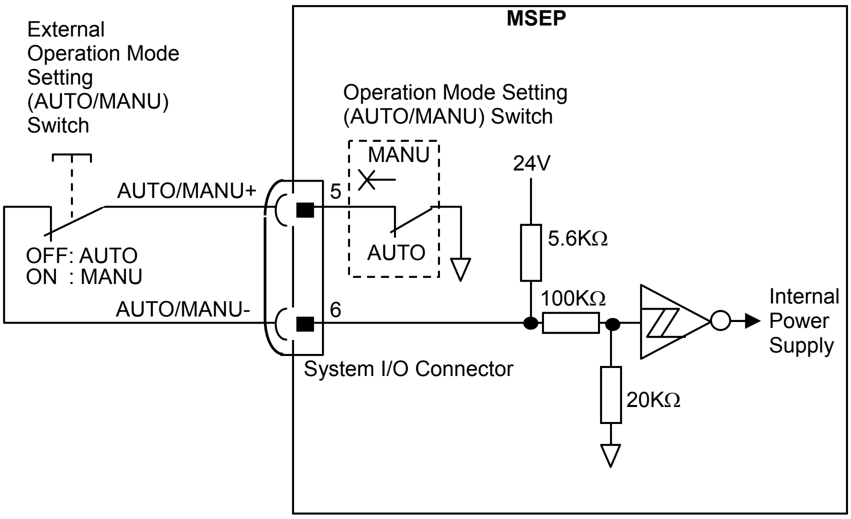
[3] Connection to Absolute Battery Unit (for Simple Absolute Type Only)



(Note) Do not apply force not being perpendicular to the connector when insert or detach the cable.

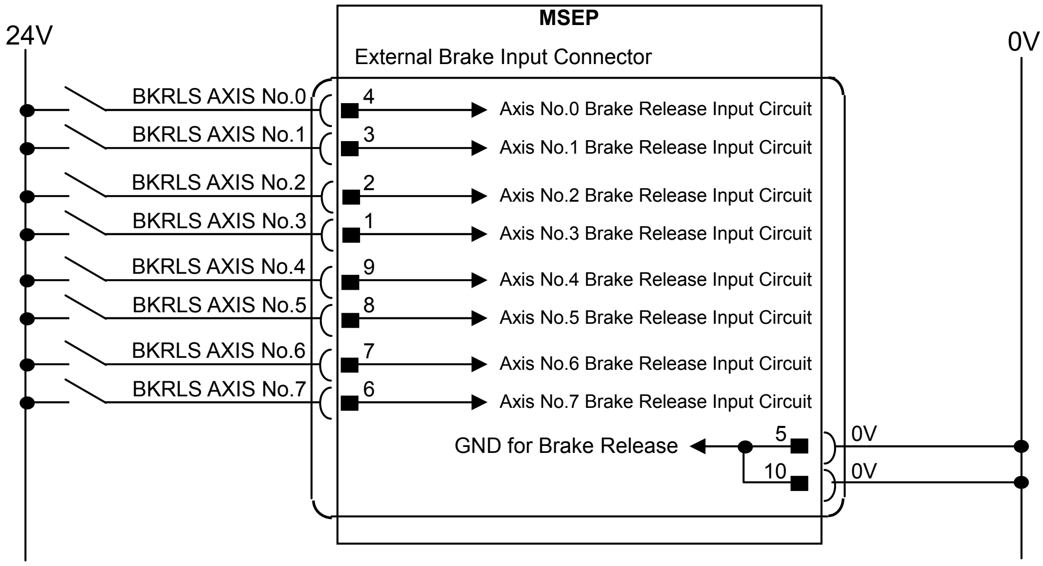
[4] Layout for Mode Switchover (AUTO/MANU) Circuit

When a switchover of the operation modes (AUTO/MANU) is required with an external input, connect a device such as a switch between AUTO/MANU + terminal and AUTO/MANU – terminal.
If not switching externally, apply a jumper on AUTO/MANU + terminal and AUTO/MANU – terminal.

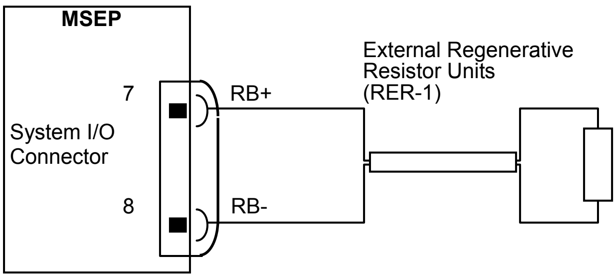


[5] Layout for External Brake Input Circuit

Lay out the circuit when an external compulsory brake release with using an actuator equipped with a brake is desired. It is not necessary if an external release is not required.
It is possible to release the brake as long as the control power is supplied to MSEP even without the main power being supplied to the controller. (Note) MSEP-LC does not use Axis No. 6 and 7.



[6] Layout of Regenerative Resistor (Option)



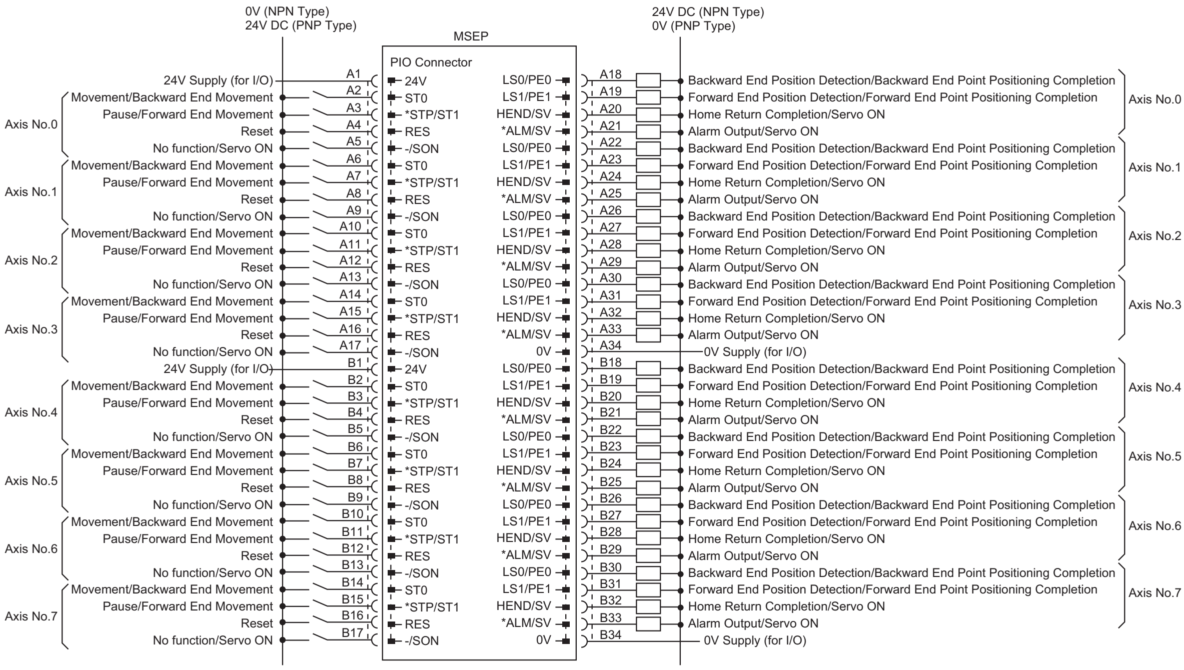
Condition to Require Regenerative Units

Number of Connected Actuator	3 to 8 units of high acceleration/deceleration type actuators
Number of Regenerative Unit	1

⚠ Caution: The regenerative resistor consumes regenerative current and converts it to heat. Therefore, the temperature may get high in some operational conditions. Attach on the metal part of the device with a screw the heat.

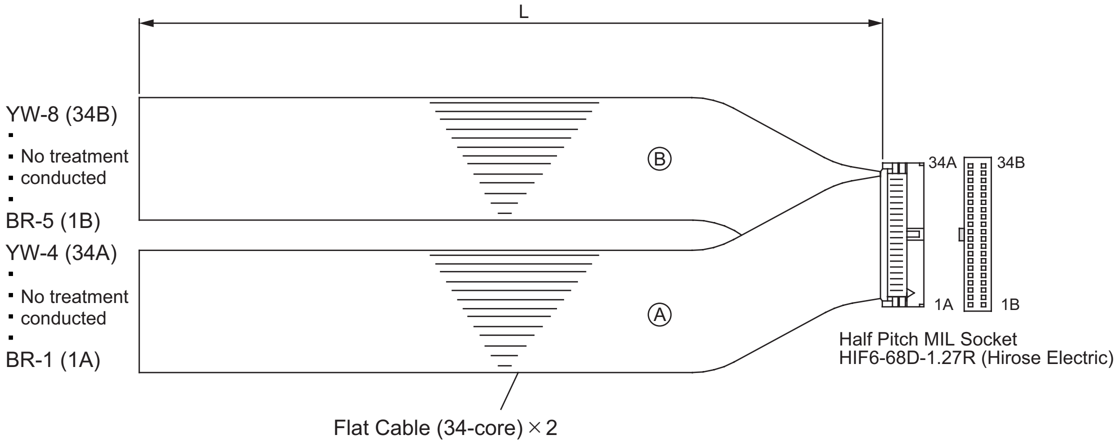
[7] Wiring Layout for PIO (lay out the circuit for PIO type)

● Operation pattern 0 ····· Point-to-Point Movement (Standard)
(Note) It is not applicable for MSEP-LC.

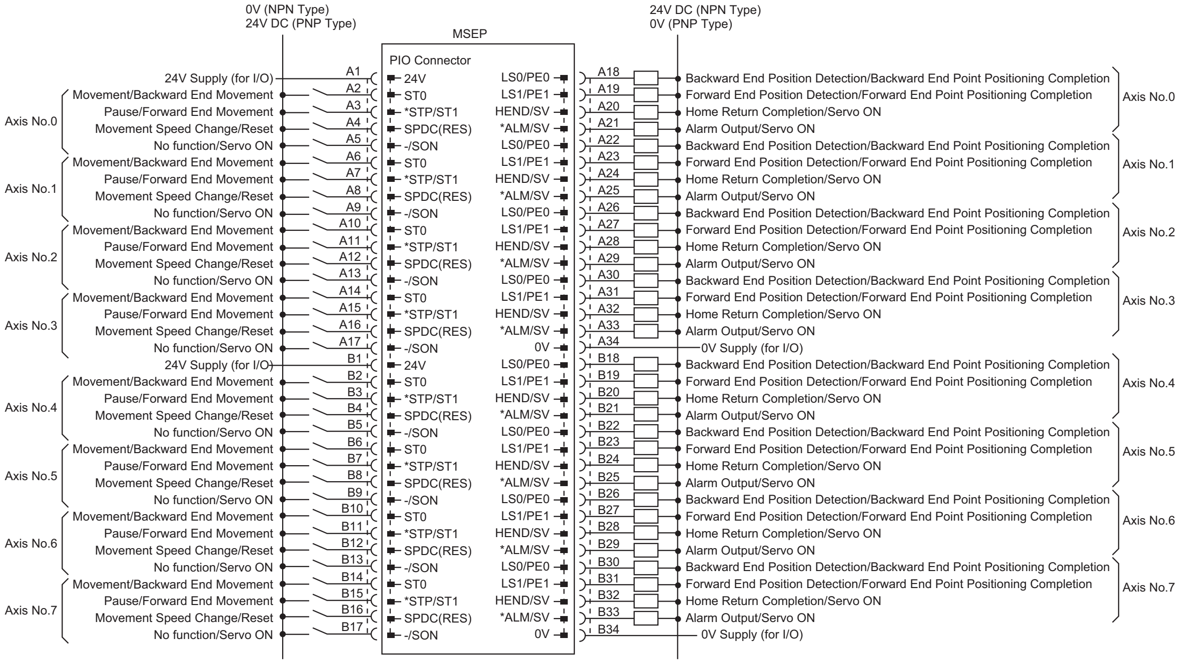


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

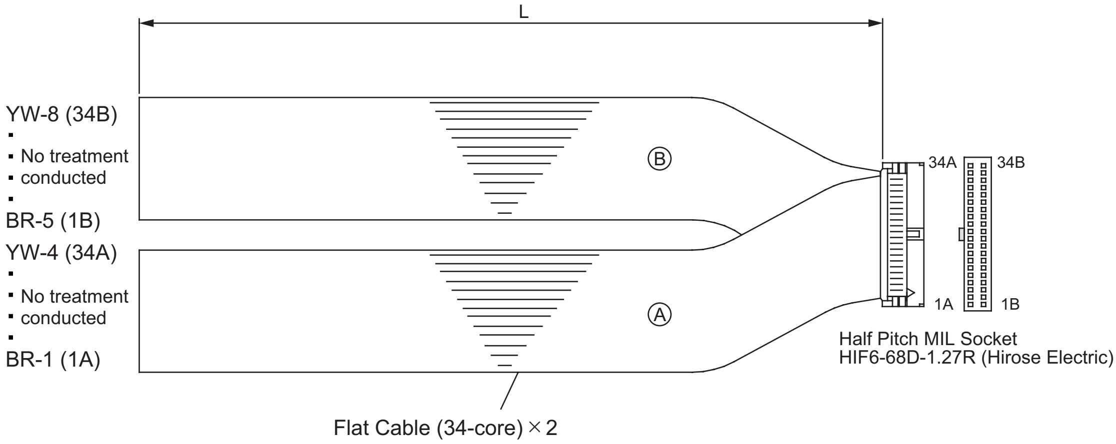


- Operation pattern 1 ····· Point-to-Point Movement (Moving Speed Setting)
  (Note) It is not applicable for MSEP-LC.

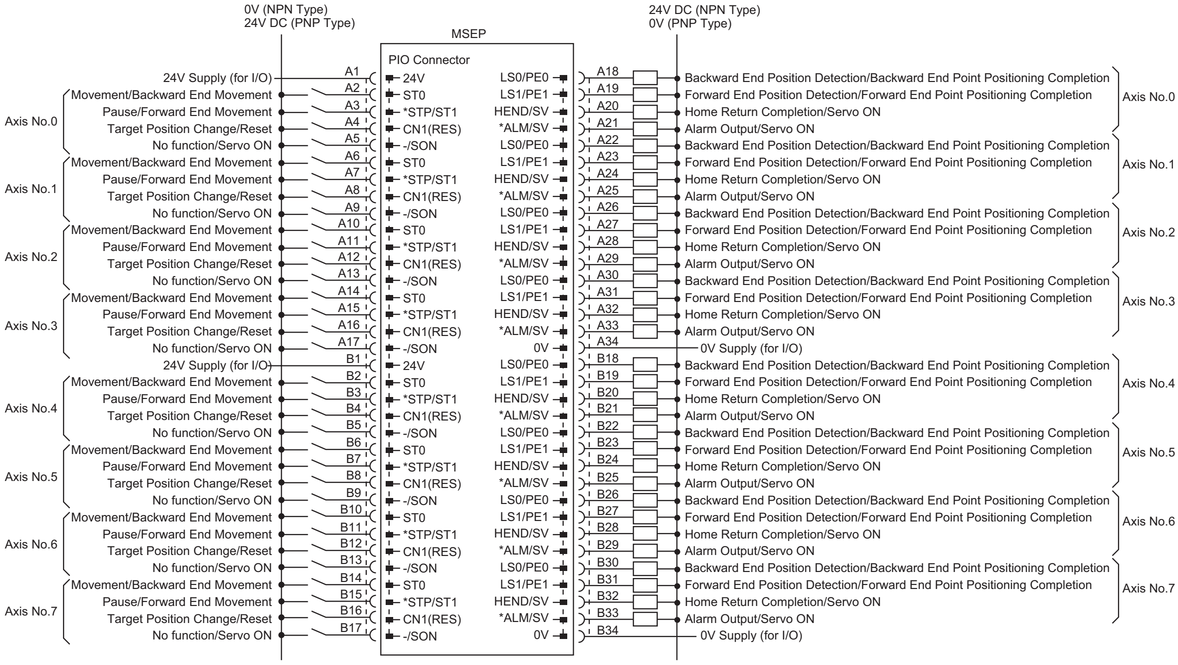


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L.   Example. 020 = 2m)

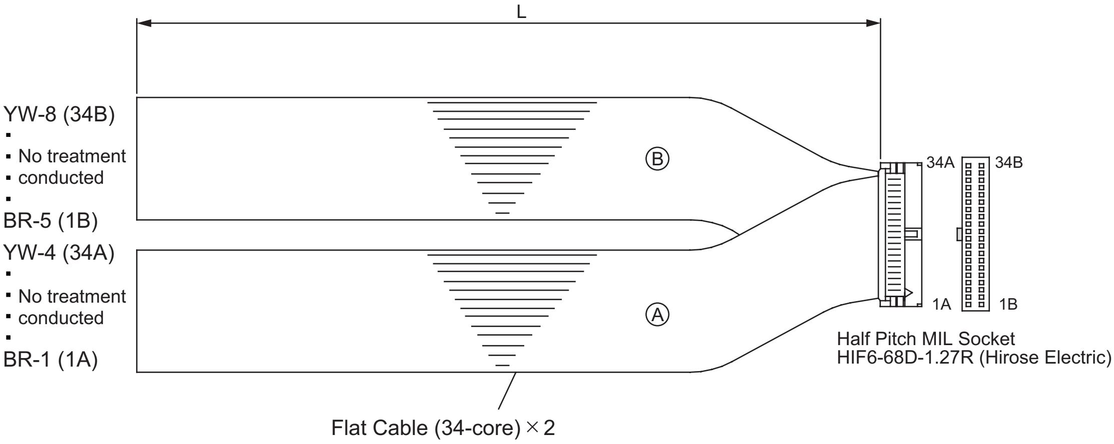


● Operation pattern 2 ····· Point-to-Point Movement (Target Position Change)
(Note) It is not applicable for MSEP-LC.

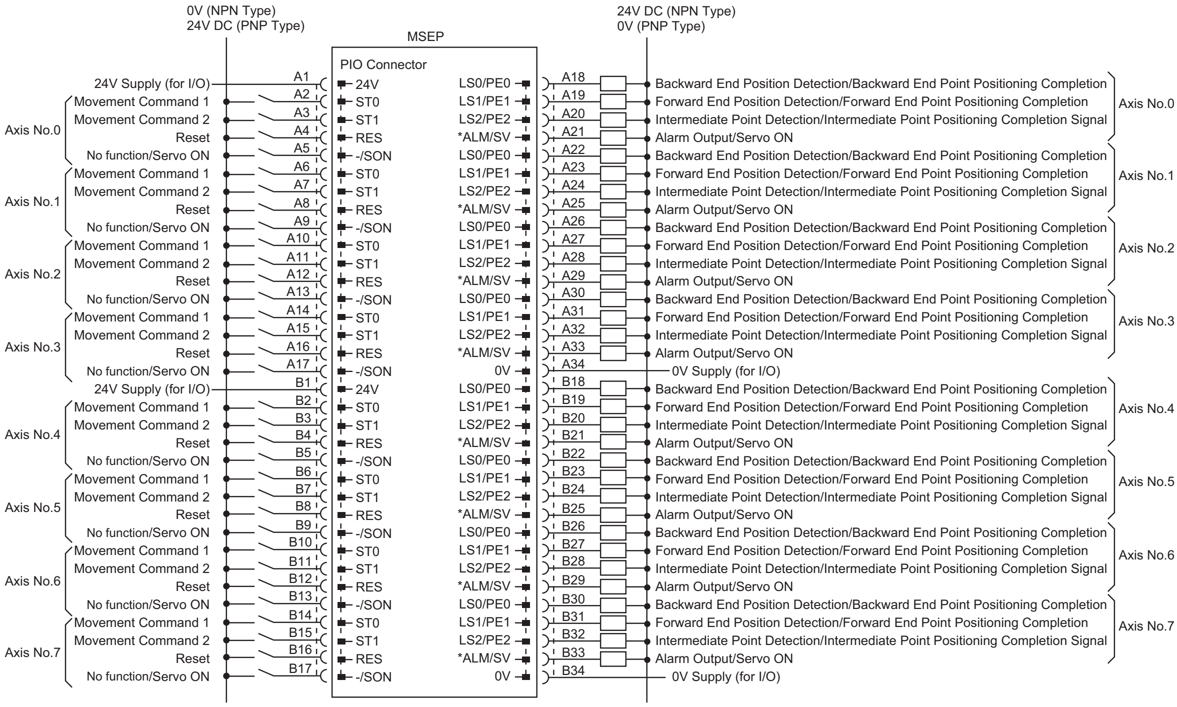


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

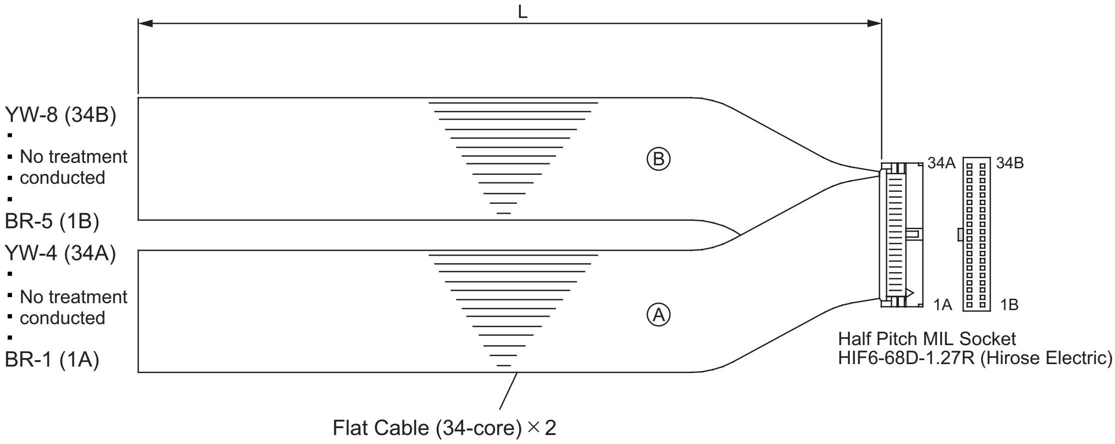


● Operation pattern 3 ····· 2-Input, 3-Point Movement
(Note) It is not applicable for MSEP-LC.

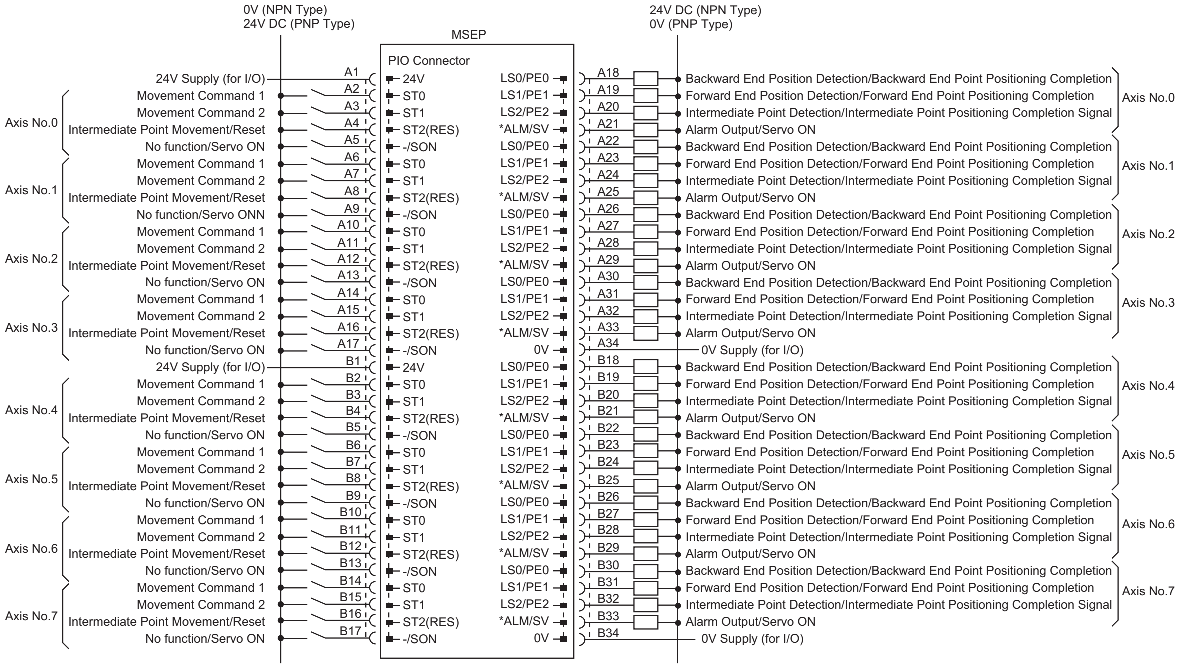


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

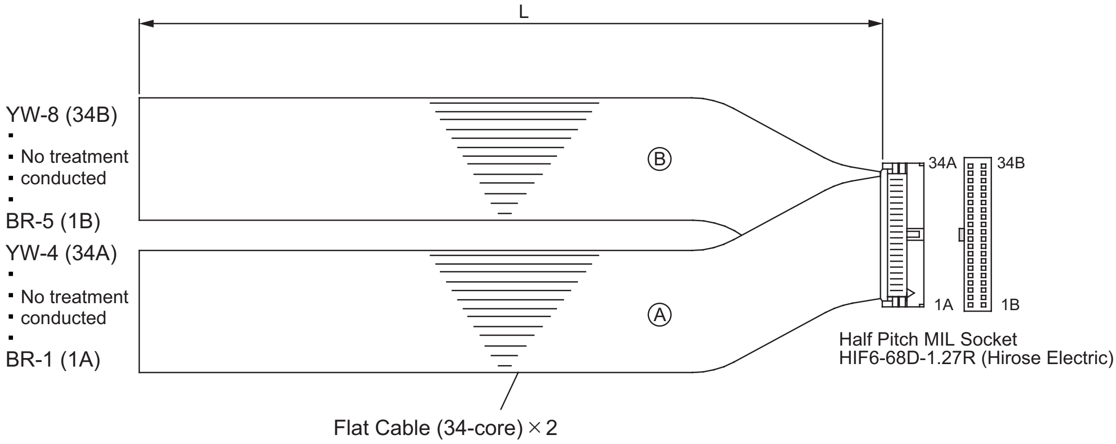


● Operation pattern 4 ····· 3-Input, 3-Point Movement
(Note) It is not applicable for MSEP-LC.

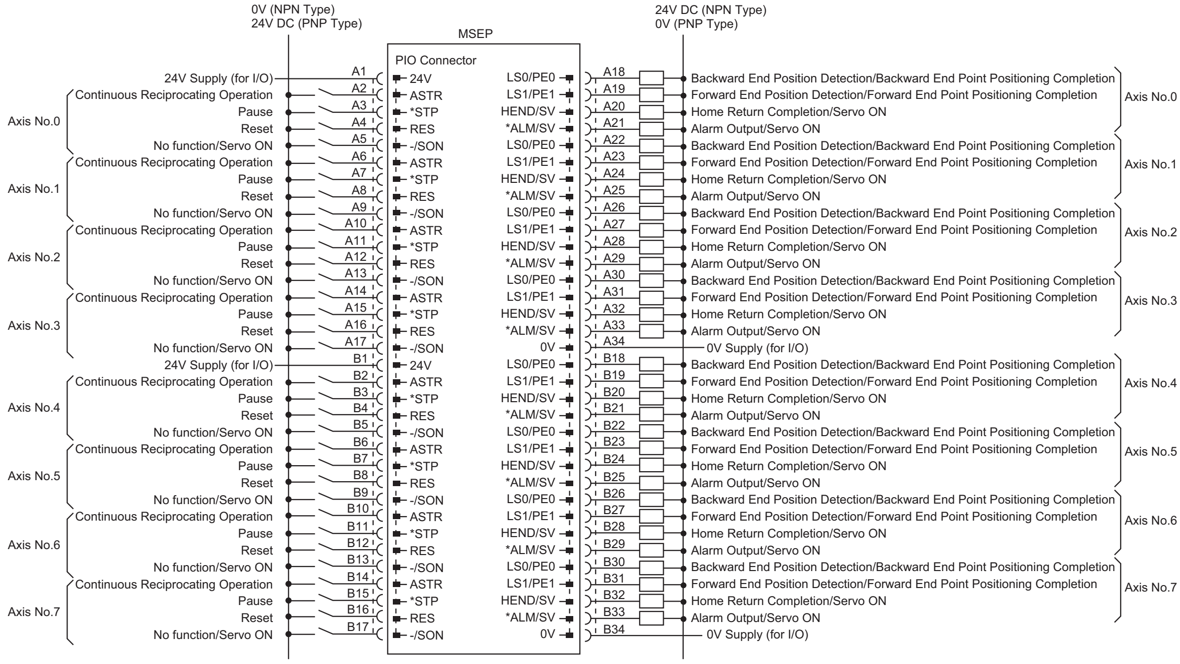


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L.   Example. 020 = 2m)

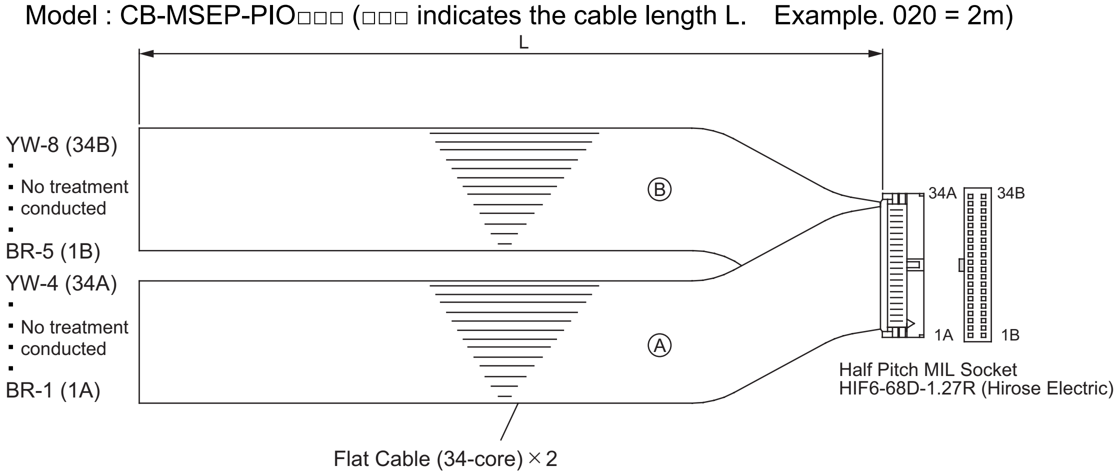


● Operation pattern 5 ····· Continuous Reciprocating Operation
(Note) It is not applicable for MSEP-LC.

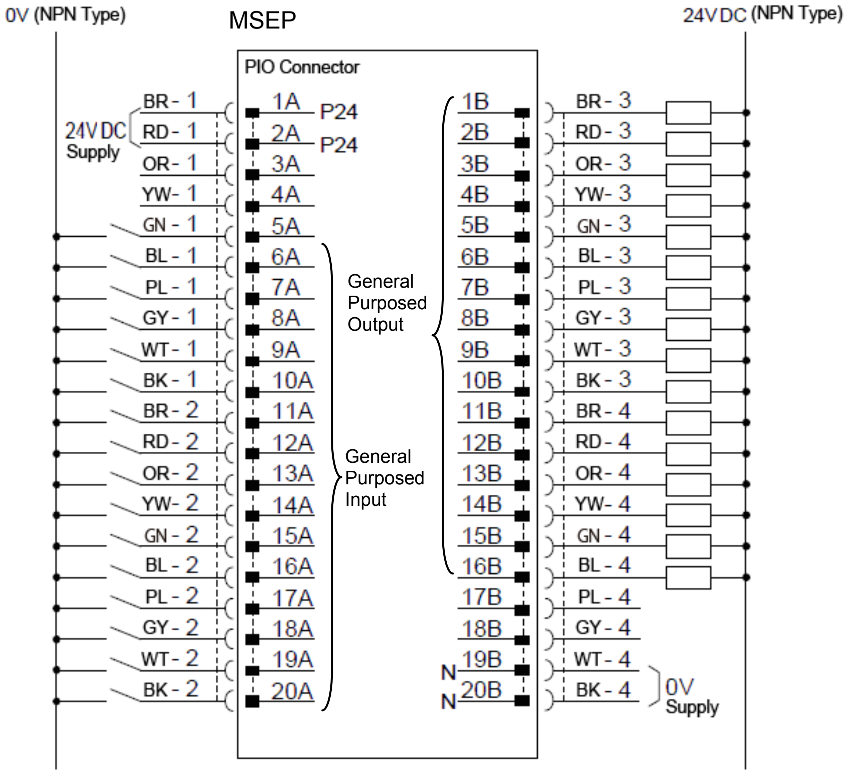


"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

Use the attached cable for the I/O connection.
Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

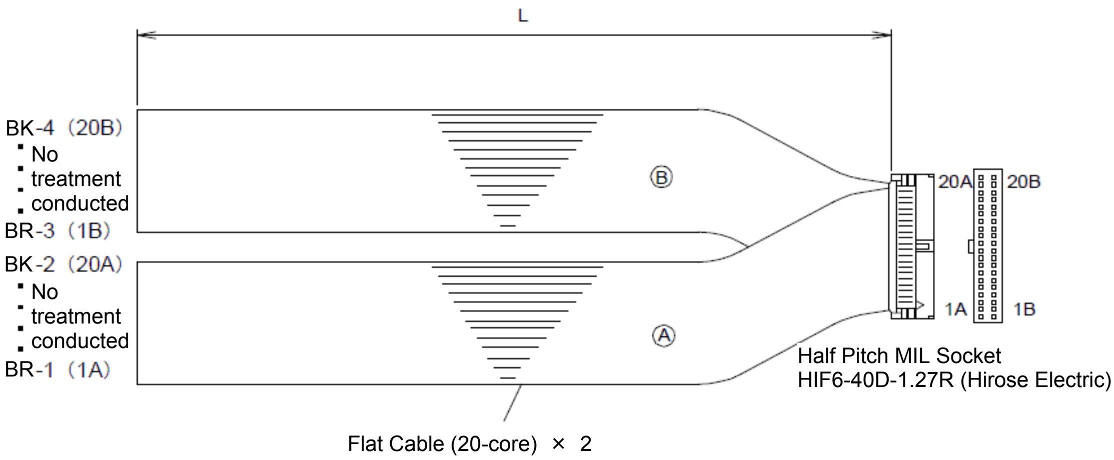


●PIO for MSEP-LC



"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

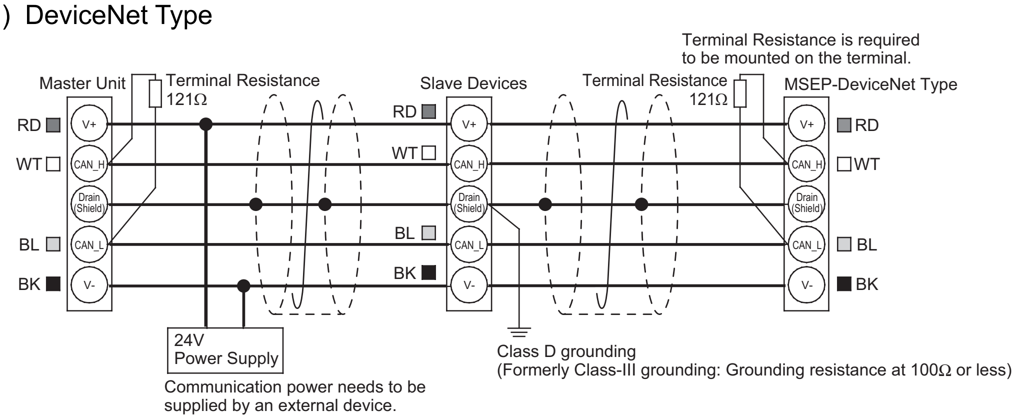
● Use the attached cable for the I/O connection.
Model : CB-PAC-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)



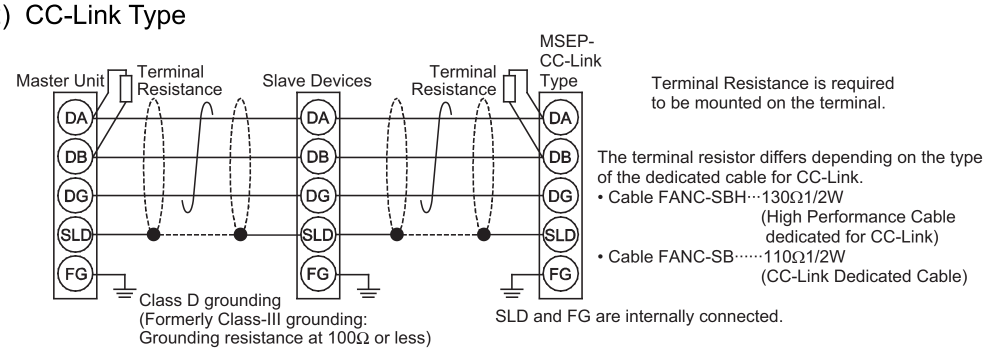
[8] Wiring Layout for Fieldbus (for Fieldbus Type)

Follow the instruction manual of the master unit for each Fieldbus and the constructing PLC for the details of how to connect the cables.

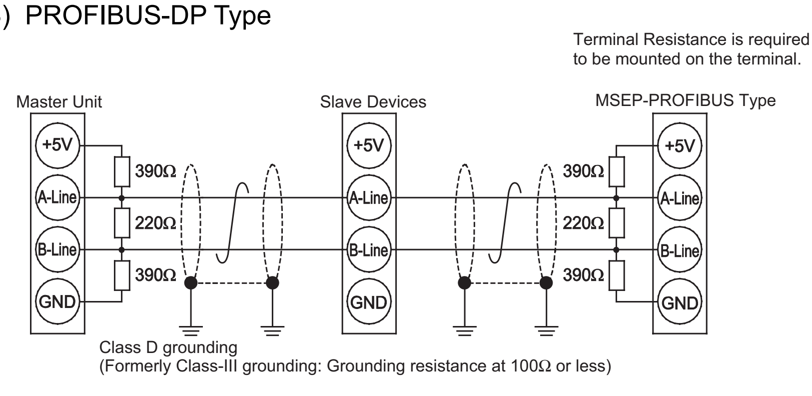
1) DeviceNet Type



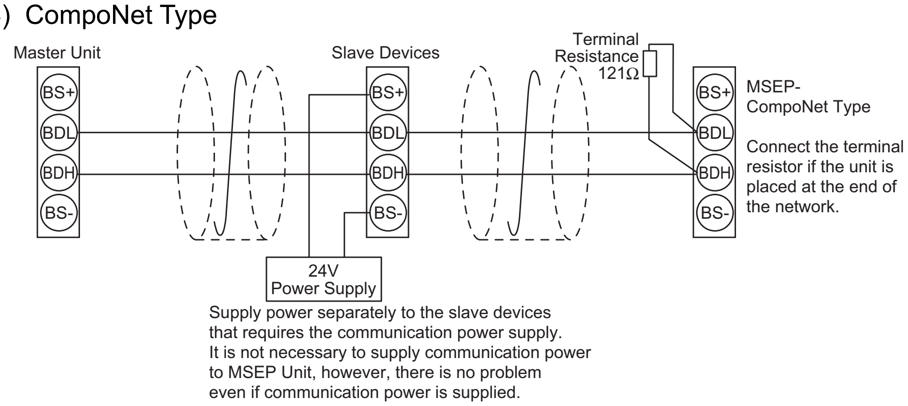
2) CC-Link Type



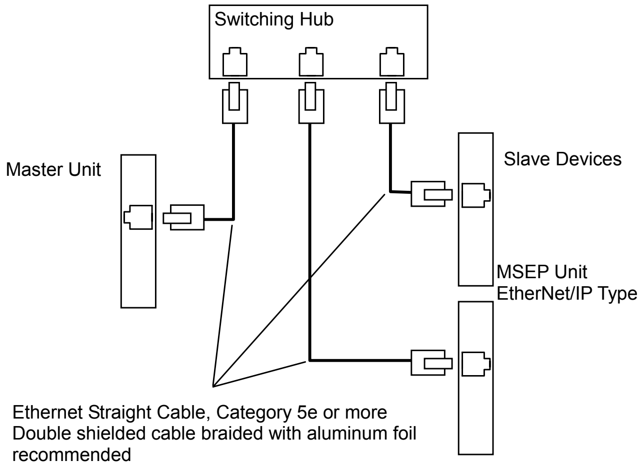
3) PROFIBUS-DP Type



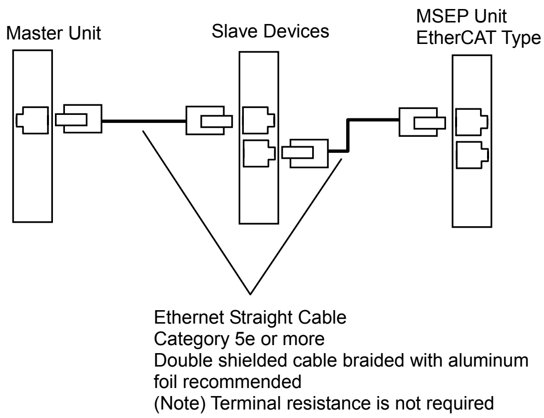
4) CompoNet Type



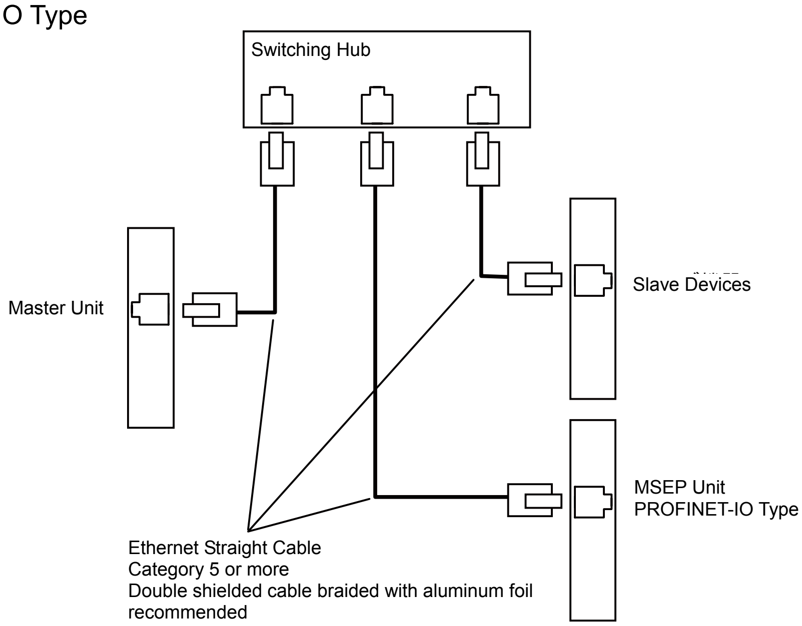
5) EtherNet/IP Type



6) EtherCAT Type



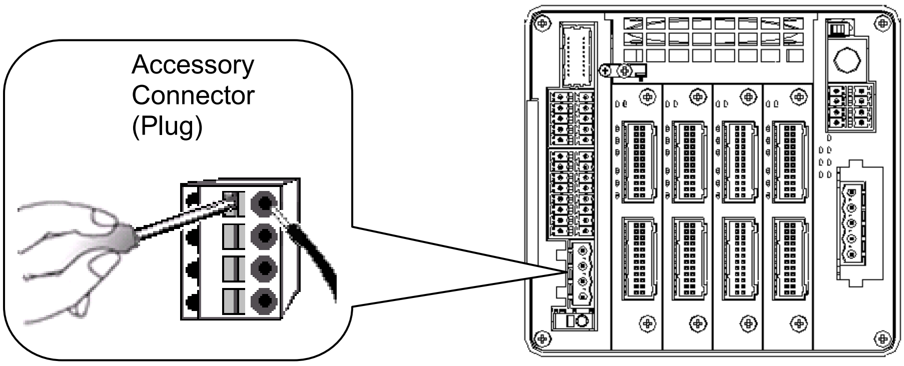
7) PROFINET-IO Type

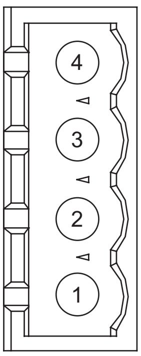


2.4 Wiring Method

2.4.1 Connection to Power Input Connector

The wire of the power supply is to be connected to the enclosed connector (plug).
Strip the sheath of the applicable wires for 10mm and insert them to the connector. Push a protrusion beside the cable inlet with a small slotted screwdriver to open the inlet. Once the cable is inserted, take the slotted screwdriver OFF the protrusion to fix the cable to the terminal.





Front view of connector on controller side

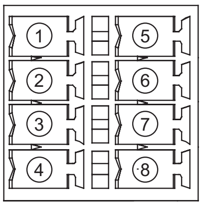
Connector Name	Power Line Input Connector	
Cable Side	FKC2.5HC/4-ST-5.08	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MSTBA2.5HC/4-G-5.08	

Pin No.	Signal Name	Description	Applicable cable diameter
1	0V	Power Input for Control (24V DC ±10%)	KIV0.3mm^2 (AWG22)
2	CP+24V		
3	0V	Power Input for Motor Drive (24V DC ±10%)	KIV2.5 to 0.5mm^2 (AWG12 to 20) Select the cable thickness allowable for the current figured out in the power capacity(*). * It is no problem to calculate the current consumption using the rated value.
4	MP+24V		

(Note) If supplying power with using a 24V DC, having it turned ON/OFF, keep the 0V connected and have the +24V supplied/cut (cut one side only).

2.4.2 Wiring Layout of System I/O Connector

The connector consists of the emergency stop input for the whole controller, changeover of the operation modes (AUTO/MANU) externally and the external regenerative resistor connection terminals.
Insert the wires to the enclosed connector (plug). Strip the sheath of the applicable wires for 10mm and insert them to the connector. Push a protrusion beside the cable inlet with a small slotted screwdriver to open the inlet. Once the cable is inserted, take the slotted screwdriver OFF the protrusion to fix the cable to the terminal.



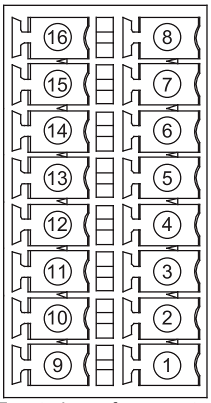
Front view of connector on controller side

Connector Name	System I/O Connector	
Cable Side	FMCD1.5/4-ST-3.5	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MCDN1.5/4-G1-3.5P26THR	

Pin No.	Signal Name	Description	Applicable cable diameter
1	EMG+24V	+24V power output for emergency stop	KIV0.5 to 0.2mm (AWG20 to 24)
2	S2	For external emergency stop signal input	
3	S1	For external emergency stop signal output	
4	EMG-	Emergency Stop Input (available for all the slots)	
5	AUTO/MANU+	For operation mode (AUTO/MANU) switchover	
6	AUTO/MANU-	Operation mode (AUTO/MANU) switchover signal input	
7	RB+	Regenerative resistor connection +	Dedicated regenerative resistor connection
8	RB-	Regenerative resistor connection -	

2.4.3 Connection of Drive Cutoff/Emergency Stop Input Connector

Insert wires if an emergency stop input is desired individually for each slot or drive cutoff for each slot. Unless it is desired, the controller can be used in the condition that the enclosed short-circuit line is connected.
Insert the wires to the enclosed connector (plug). Strip the sheath of the applicable wires for 10mm and insert them to the connector. Push a protrusion beside the cable inlet with a small slotted screwdriver to open the inlet. Once the cable is inserted, take the slotted screwdriver OFF the protrusion to fix the cable to the terminal.



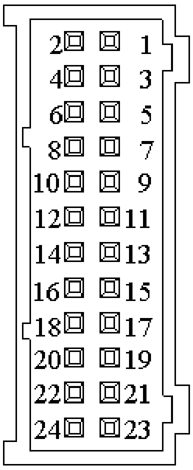
Front view of connector on controller side

Connector Name	Drive Cutoff/Emergency Stop Input Connector	
Cable Side	FMCD1.5/8-ST-3.5	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MCDN1.5/8-G1-3.5P26THR	

Pin No.	Signal Name	Description	Applicable cable diameter
1	MPOSLOT1	For motor power output slot 1 (Axis No. 2 and 3)	KIV1.25 to 0.5mm^2 (AWG16 to 20) Select the cable thickness allowable for the current figured out in the power capacity.
2	MPISLOT1	For motor power input slot 1 (Axis No. 2 and 3)	
3	MPOSLOT0	For motor power output slot 0 (Axis No. 0 and 1)	
4	MPISLOT0	For motor power input slot 0 (Axis No. 0 and 1)	
5	EMG+24VSLOT1	For emergency stop power output slot 1 (Axis No. 2 and 3)	KIV0.5 to 0.2mm (AWG20 to 24)
6	EMGINSLOT1	For emergency stop power input slot 1 (Axis No. 2 and 3)	
7	EMG+24VSLOT0	For emergency stop power output slot 0 (Axis No. 0 and 1)	
8	EMGINSLOT0	For emergency stop power input slot 0 (Axis No. 0 and 1)	
9	MPOSLOT3	For motor power output slot 3 (Axis No. 6 and 7)	KIV1.25 to 0.5mm^2 (AWG16 to 20) Select the cable thickness allowable for the current figured out in the power capacity.
10	MPISLOT3	For motor power input slot 3 (Axis No. 6 and 7)	
11	MPOSLOT2	For motor power output slot 2 (Axis No. 4 and 5)	
12	MPISLOT2	For motor power input slot 2 (Axis No. 4 and 5)	
13	EMG+24VSLOT3	For emergency stop power output slot 3 (Axis No. 6 and 7)	KIV0.5 to 0.2mm (AWG20 to 24)
14	EMGINSLOT3	For emergency stop power input slot 3 (Axis No. 6 and 7)	
15	EMG+24VSLOT2	For emergency stop power output slot 2 (Axis No. 4 and 5)	
16	EMGINSLOT2	For emergency stop power input slot 2 (Axis No. 4 and 5)	

2.4.4 Connecting with Actuator

Connect the relay cables to the actuator connectors.
Check in the instruction manual of each actuator for the details of the relay cables.



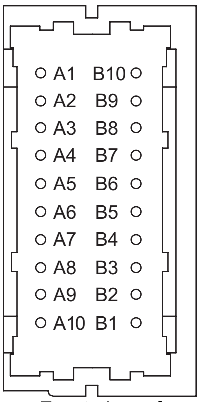
Front view of connector on controller side

Connector Name	Actuator Connector	
Cable Side	PADP-24V-1-S	
Controller Side	S24B-PADSS-1	

Pin No.	Signal Name	Description	Applicable cable diameter
1	ϕA	Motor Driving A-phase	Cable dedicated for IAI products
2	VMM	Motor Power	
3	ϕB	Motor Driving B-phase	
4	VMM	Motor Power	
5	ϕ/A	Motor Driving /A-phase	
6	ϕ/B	Motor Driving /B-phase	
7	LS+	Limit Switch Positive Side	
8	LS-	Limit Switch Negative Side	
9	BK+	Brake Release Positive Side	
10	BK-	Brake Release Negative Side	
11	NC	Not to be used (pulse motor)	
	Z+	Encoder Z-phase differential + input (Servo motor)	
	A+	Encoder A-phase differential + input (Brushless DC electric motor)	
12	NC	Not to be used (pulse motor)	
	Z-	Encoder Z-phase differential - input (Servo motor)	
	A-	Encoder A-phase differential - input (Brushless DC electric motor)	
13	A+	Encoder A-phase differential + input (Pulse / Servo motor)	
	B+	Encoder B-phase differential + input (Brushless DC electric motor)	
14	A-	Encoder A-phase differential - input (Pulse / Servo motor)	
	B-	Encoder B-phase differential - input (Brushless DC electric motor)	
15	B+	Encoder B-phase differential + input (Pulse / Servo motor)	
	HS1	Hall IC Input	
16	B-	Encoder B-phase differential - input (Pulse / Servo motor)	
	HS2	Hall IC Input	
17	5V	Encoder Power Supply	
18	/PS	Encoder Line Driver Enable Output	
19	GND	Ground	
20	LSGND	Ground for Limit Switch	
21	NC	Disconnected	
22	NC	Disconnected	
23	NC	Disconnected	
24	FG	Grounding	

2.4.5 Connection of Absolute Battery Connector

Connect the absolute battery unit to the controller for Simple Absolute Type.



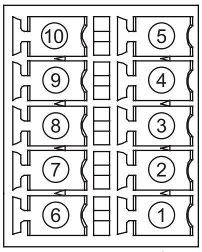
Front view of connector on controller side

Connector Name	Absolute Battery Connector	
Cable Side	CZHR-20V-S	
Controller Side	S20B-CZWHS-B-1	

Pin No.	Signal Name	Description	Applicable cable diameter
A1	GND	0V	Cable dedicated for IAI products
A2	BATTMP AXIS No.0	Axis No.0 Absolute Battery Temperature Sensor	
A3	BATTMP AXIS No.1	Axis No.1 Absolute Battery Temperature Sensor	
A4	BATTMP AXIS No.2	Axis No.2 Absolute Battery Temperature Sensor	
A5	BATTMP AXIS No.3	Axis No.3 Absolute Battery Temperature Sensor	
A6	GND	0V	
A7	BATTMP AXIS No.4	Axis No.4 Absolute Battery Temperature Sensor	
A8	BATTMP AXIS No.5	Axis No.5 Absolute Battery Temperature Sensor	
A9	BATTMP AXIS No.6	Axis No.6 Absolute Battery Temperature Sensor	
A10	BATTMP AXIS No.7	Axis No.7 Absolute Battery Temperature Sensor	
B10	GND	0V	
B9	BAT AXIS No.0	Axis No.0 Absolute Battery	
B8	BAT AXIS No.1	Axis No.1 Absolute Battery	
B7	BAT AXIS No.2	Axis No.2 Absolute Battery	
B6	BAT AXIS No.3	Axis No.3 Absolute Battery	
B5	GND	0V	
B4	BAT AXIS No.4	Axis No.4 Absolute Battery	
B3	BAT AXIS No.5	Axis No.5 Absolute Battery	
B2	BAT AXIS No.6	Axis No.6 Absolute Battery	
B1	BAT AXIS No.7	Axis No.7 Absolute Battery	

2.4.6 Connection of External Brake Connector

Connection needs to be established when an external brake release is required for the actuator. The brake can be released if the power (24V DC 150mA/axis) is supplied to this connector even without the main power supplied to the controller.



Front view of connector on controller side

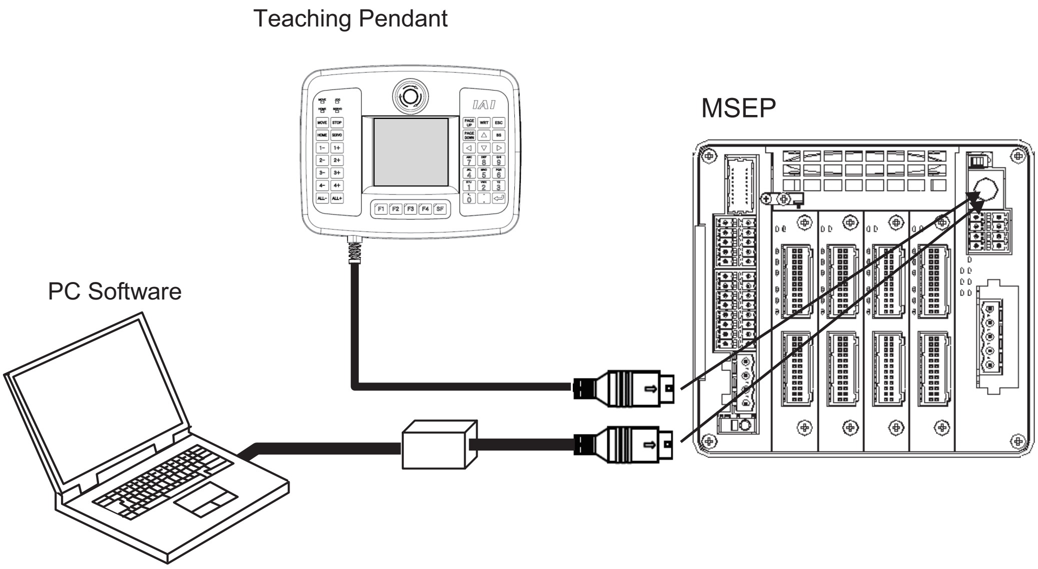
Connector Name	System I/O Connector	
Cable Side	FMCD1.5/5-ST-3.5	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	MCDN1.5/5-G1-3.5P26THR	

Pin No.	Signal Name	Description	Applicable cable diameter
1	BKRLS AXIS No.3	Axis No.3 Brake Release Input	KIV0.5 to 0.2mm (AWG20 to 24)
2	BKRLS AXIS No.2	Axis No.2 Brake Release Input	
3	BKRLS AXIS No.1	Axis No.1 Brake Release Input	
4	BKRLS AXIS No.0	Axis No.0 Brake Release Input	
5	GND	0V	
6	BKRLS AXIS No.7	Axis No.7 Brake Release Input	
7	BKRLS AXIS No.6	Axis No.6 Brake Release Input	
8	BKRLS AXIS No.5	Axis No.5 Brake Release Input	
9	BKRLS AXIS No.4	Axis No.4 Brake Release Input	
10	GND	0V	

2.4.7 Connection of SIO Connector

Connect an teaching tool such as the PC software.

(Note) Do not attempt connect the device to the same SIO network as the CON related controllers such as PCON.



Connector Name	SIO Connector	
Cable Side	miniDIN 8-pin	
Controller Side	TCS7587-0121077	

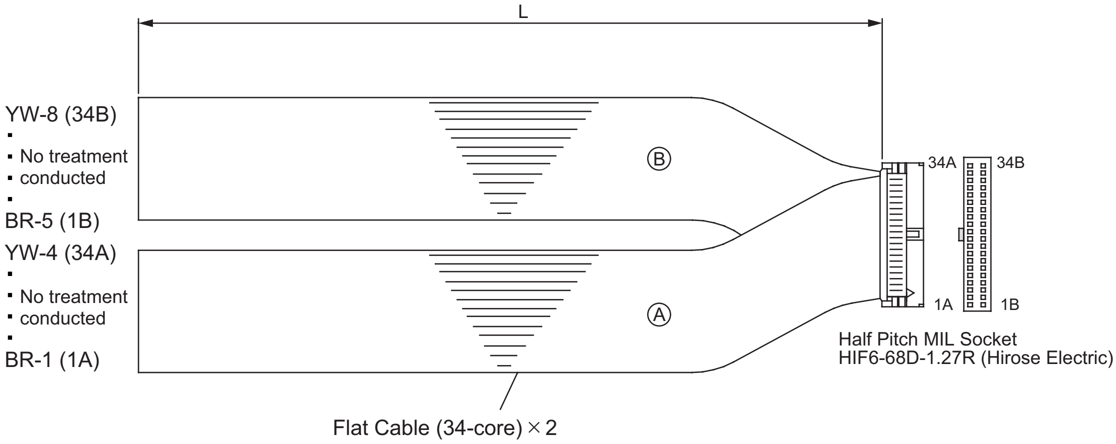
Pin No.	Signal Name	Description	Applicable cable diameter
1	SGA	Teaching Tool Signal +	Cable dedicated for IAI products
2	SGB	Teaching Tool Signal -	
3	5V	Power supply for teaching tool	
4	ENB	Enable signal input	
5	EMGA	Emergency Stop Signal A	
6	24V	Power supply for teaching tool	
7	0V	0V	
8	EMGB	Emergency Stop Signal B	
Shell	0V	0V	

2.4.8 Connection of PIO (for PIO Type)

The connection of I/O to the controller is to be carried out using the dedicated I/O cable. The cable length is shown in the model code of the controller. There are 2m for standard, 3m and 5m as an option. 10m is also applicable at maximum if purchased separately. [Refer to 1.1.5 How to read the model]
Also, the end of the cable harness to be connected to the host controller (PLC, etc.) is just cut and no treatment is conducted so the wiring layout can be performed freely.

[1] MSEP-C

Model : CB-MSEP-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)

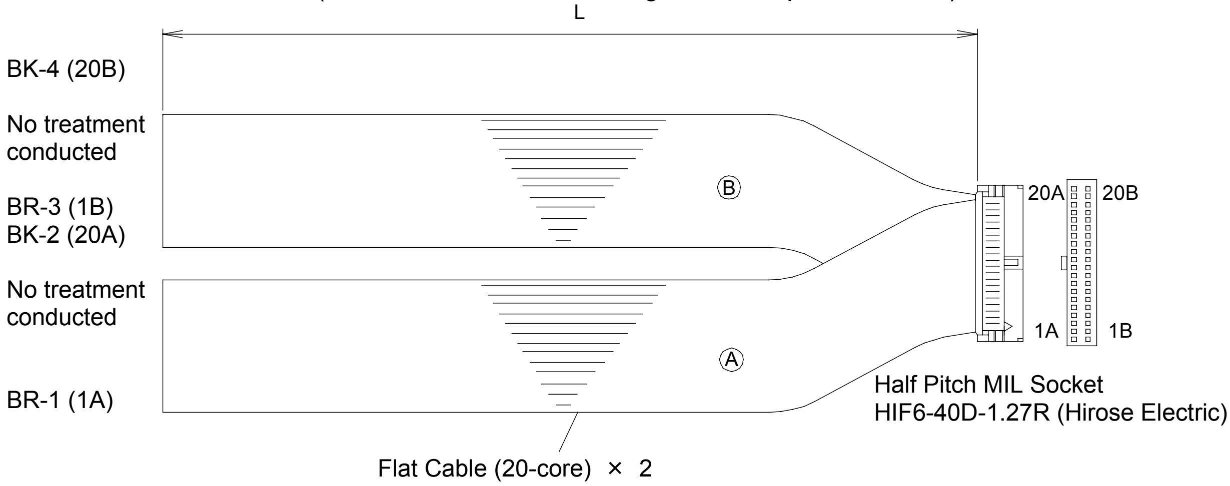


No.	Cable Color	Wiring	No.	Cable Color	Wiring
1A	BR-1	Flat Cable Ⓐ (Press Welding) AWG28	1B	BR-5	Flat Cable Ⓑ (Press Welding) AWG28
2A	RD-1		2B	RD-5	
3A	OR-1		3B	OR-5	
4A	YW-1		4B	YW-5	
5A	GN-1		5B	GN-5	
6A	BL-1		6B	BL-5	
7A	PL-1		7B	PL-5	
8A	GY-1		8B	GY-5	
9A	WT-1		9B	WT-5	
10A	BK-1		10B	BK-5	
11A	BR-2		11B	BR-6	
12A	RD-2		12B	RD-6	
13A	OR-2		13B	OR-6	
14A	YW-2		14B	YW-6	
15A	GN-2		15B	GN-6	
16A	BL-2		16B	BL-6	
17A	PL-2		17B	PL-6	
18A	GY-2		18B	GY-6	
19A	WT-2		19B	WT-6	
20A	BK-2		20B	BK-6	
21A	BR-3		21B	BR-7	
22A	RD-3		22B	RD-7	
23A	OR-3		23B	OR-7	
24A	YW-3		24B	YW-7	
25A	GN-3		25B	GN-7	
26A	BL-3		26B	BL-7	
27A	PL-3		27B	PL-7	
28A	GY-3		28B	GY-7	
29A	WT-3		29B	WT-7	
30A	BK-3		30B	BK-7	
31A	BR-4		31B	BR-8	
32A	RD-4		32B	RD-8	
33A	OR-4		33B	OR-8	
34A	YW-4		34B	YW-8	

[Allocation is Refer 2.3. [7] section]

[2] MSEP-LC

Model : CB-PAC-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)



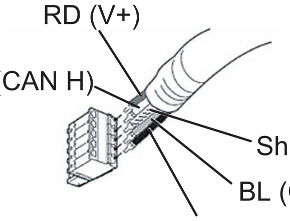
No.	Cable Color	Wiring	No.	Cable Color	Wiring
1A	BR-1	Flat Cable A (Press Welding) AWG28	1B	BR-3	Flat Cable B (Press Welding) AWG28
2A	RD-1		2B	RD-3	
3A	OR-1		3B	OR-3	
4A	YW-1		4B	YW-3	
5A	GN-1		5B	GN-3	
6A	BL-1		6B	BL-3	
7A	PL-1		7B	PL-3	
8A	GY-1		8B	GY-3	
9A	WT-1		9B	WT-3	
10A	BK-1		10B	BK-3	
11A	BR-2		11B	BR-4	
12A	RD-2		12B	RD-4	
13A	OR-2		13B	OR-4	
14A	YW-2		14B	YW-4	
15A	GN-2		15B	GN-4	
16A	BL-2		16B	BL-4	
17A	PL-2		17B	PL-4	
18A	GY-2		18B	GY-4	
19A	WT-2		19B	WT-4	
20A	BK-2		20B	BK-4	

[Allocation is Refer 2.3. [7] section]

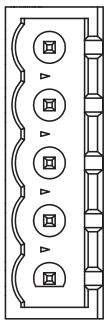
2.4.9 Wiring Layout of Fieldbus Connector

Check the instruction manuals for each Fieldbus master unit and mounted PLC for the details.

1) DeviceNet Type



Connector Name	DeviceNet Connector	
Cable Side	[MSEP-C]MSTB2.5/5-ST-5.08 ABGY AU [MSEP-LC]MSTB2.5/5-STF-5.08 AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	[MSEP-C]MSTBA2.5/5-G-5.08 ABGY AU [MSEP-LC]MSTBA2.5/5-GF-5.08 AU	

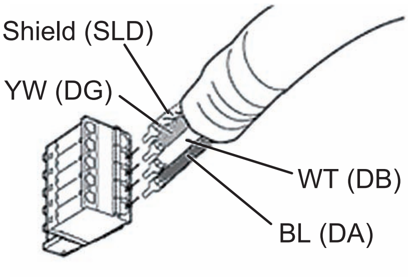


Front view of connector on controller side

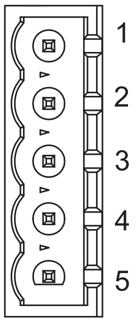
Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	V- (BK)	Power Supply Cable Negative Side	Dedicated cable for DeviceNet
2	CAN L (BL)	Communication Data Low Side	
3	Shield (None)	Shield	
4	CAN H (WT)	Communication Data High Side	
5	V+ (RD)	Power Supply Cable Positive Side	

Note Connect a terminal resistor (121Ω) between CAN L and CAN H if the unit comes to the end of the network. [Refer to 2.3 [8] Wiring Layout for Fieldbus (for Fieldbus Type).]

2) CC-Link Type



Connector Name	CC-Link Connector	
Cable Side	[MSEP-C]MSTB2.5/5-ST-5.08 ABGY AU [MSEP-LC]MSTB2.5/5-STF-5.08 AU	Enclosed in standard package Manufactured by PHOENIX CONTACT
Controller Side	[MSEP-C]MSTBA2.5/5-G-5.08 AU [MSEP-LC]MSTBA2.5/5-GF-5.08 AU	



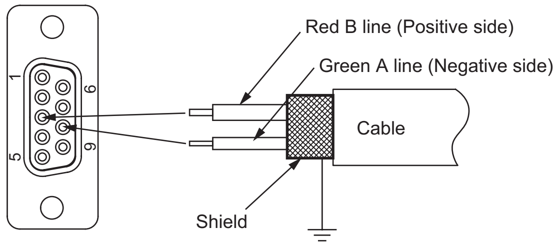
Front view of connector on controller side

Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	DA (BL)	Communication Line A	Dedicated cable for CC-Link
2	DB (WT)	Communication Line B	
3	DG (YW)	Digital GND	
4	SLD	Connect the shield of the shielded cable (Connect the FG of the 5 pins and controller FG internally)	
5	FG	Frame Ground (Connect the SLD of the 4 pins and controller FG internally)	

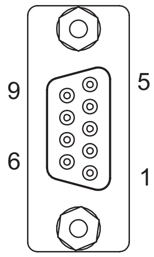
Note Connect a terminal resistor between DA and DB if the unit comes to the end of the network. [Refer to 2.3 [8] Wiring Layout for Fieldbus (for Fieldbus Type).]

3) PROFIBUS-DP Type

Use the type A cable for PROFIBUS-DP (EN5017).



Connector Name	PROFIBUS-DP Connector	
Cable Side	9-pin D-sub Connector (Male)	Please prepare separately
Controller Side	9-pin D-sub Connector (Female)	

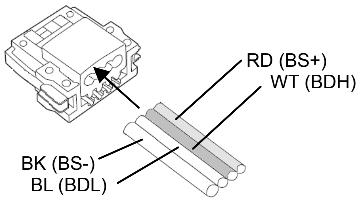


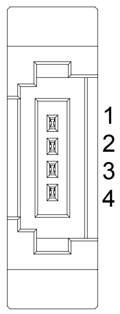
Front view of connector on controller side

Pin No.	Signal Name	Description	Applicable cable diameter
1	NC	Disconnected	PROFIBUS-DP Dedicated Cable
2	NC	Disconnected	
3	B-Line	Communication Line B (RS485)	
4	RTS	Request for Sending	
5	GND	Signal GND (Insulation)	
6	+5V	+5V Output (Insulation)	
7	NC	Disconnected	
8	A-Line	Communication Line A (RS485)	
9	NC	Disconnected	

Note Connect a terminal resistor (220Ω) between A-line and B-line if the unit comes to the end of the network. [Refer to 2.3 [8] Wiring Layout for Fieldbus (for Fieldbus Type).]

4) CompoNet Type





Front view of connector on controller side

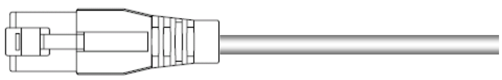
Connector Name	CompoNet Connector	
Cable Side	Prepare a connector complied with CompoNet standards.	
Controller Side	XW7D-PB4-R	Produced by OMRON

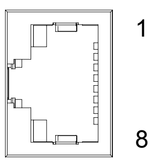
Pin No.	Signal Name (Color)	Description	Applicable cable diameter
1	BS+ (RD)	Communication Power Supply + (Note 1)	CompoNet Dedicated Cable
2	BDH (WT)	Signal line H side	
3	BDL (BL)	Signal line L side	
4	BS- (BK)	Communication Power Supply - (Note 1)	

Note 1 It is not necessary to supply the communication power. (Internal power source is used.)
If conducting multi power supply to other slave devices via communication cables, there is no problem with connecting the power supply to BS+ and BS- terminals.

Note 2 Connect a terminal resistor (121Ω) between BDH and BDL if the unit comes to the end of the network. [Refer to 2.3 [8] Wiring Layout for Fieldbus (for Fieldbus Type).]

5) EtherNet/IP Type



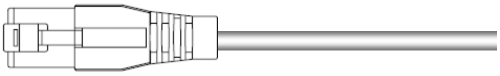


Front view of connector on controller side

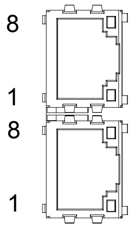
Connector Name	EtherNet/IP Connector	
Cable Side	8P8C Modular Plug	
Controller Side	8P8C Modular Jack	

Pin No.	Signal Name	Description	Applicable cable diameter
1	TD+	Data sending +	For Ethernet cable, use a straight STP cable that possesses the performance of Category 5e or more.
2	TD-	Data sending -	
3	RD+	Data receiving +	
4	–	Disconnected	
5	–	Disconnected	
6	RD-	Data receiving -	
7	–	Disconnected	
8	–	Disconnected	

6) EtherCAT Type



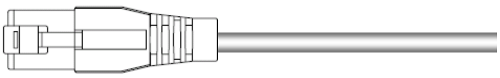
Connector Name	EtherCAT Connector
Cable Side	8P8C Modular Plug
Controller Side	8P8C Modular Jack



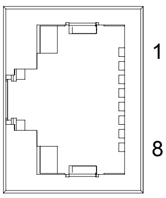
Front view of connector on controller side

Pin No.	Signal Name	Description	Applicable cable diameter
1	TD+	Data sending +	For EtherCAT cable, use a straight STP cable that possesses the performance of Category 5e or more.
2	TD-	Data sending -	
3	RD+	Data receiving +	
4	–	Disconnected	
5	–	Disconnected	
6	RD-	Data receiving -	
7	–	Disconnected	
8	–	Disconnected	

7) PROFINET-IO Type



Connector Name	PROFINET Connector
Cable Side	8P8C Modular Plug
Controller Side	8P8C Modular Jack



Front view of connector on controller side

Pin No.	Signal Name	Description	Applicable cable diameter
1	TD+	Data sending +	For Ethernet cable, use a straight STP cable that possesses the performance of Category 5 or more.
2	TD-	Data sending -	
3	RD+	Data receiving +	
4	–	Disconnected	
5	–	Disconnected	
6	RD-	Data receiving -	
7	–	Disconnected	
8	–	Disconnected	

Chapter 3 Operation

> ⚠ Caution : When starting up this controller, have the initial settings established by using Gateway Parameter Setting Tool and RC PC Software. [Refer to 3.1.2 or 3.2.2 Initial Setting.]

3.1 Operation of MSEP-C

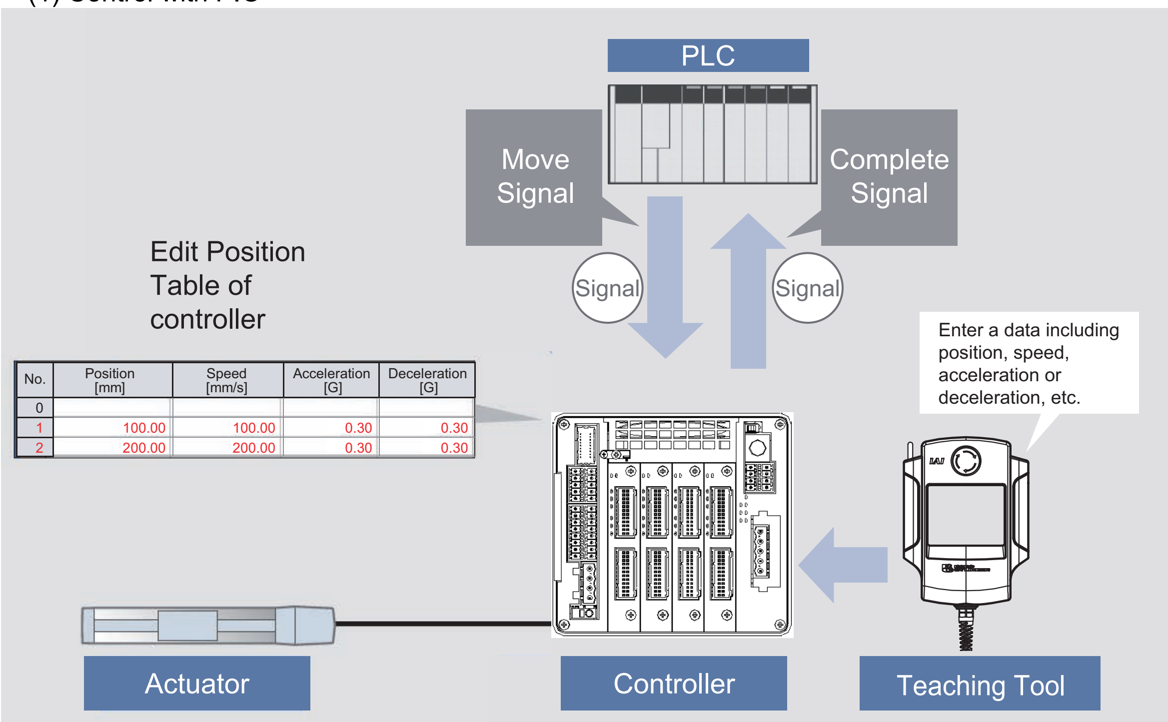
(Note) Refer to 3.2 for MPEP-LC Type

3.1.1 Basic Operation Methods

There are two types of methods for operation, one to control with PIO and the other to control wit fieldbus. Check the model code indicated on the model code card attached on the front panel of the body to see which method should be applied for your product. [Refer to Section 1.1.5]

There are various types for the actuators such as slider type, rod type, rotary type, gripper type and so on. Unless otherwise specified in this manual, the method of operation control is the same.

(1) Control with PIO



No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]
0				
1	100.00	100.00	0.30	0.30
2	200.00	200.00	0.30	0.30

1) Conduct the settings for the target position (such as forward position or backward position), speed and acceleration/deceleration data that are necessary to be filled in the position table using a teaching tool such as PC software.

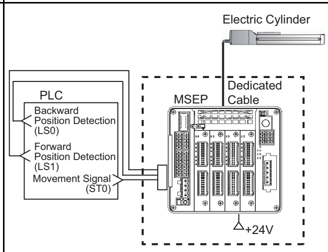
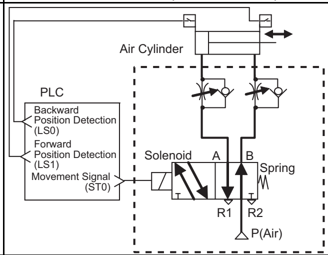
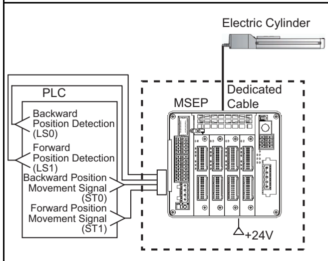
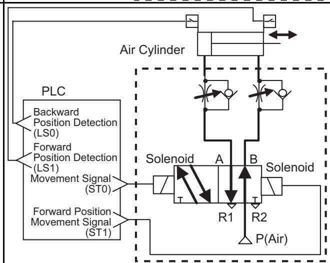
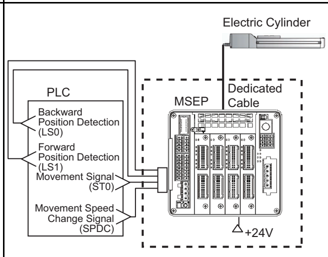
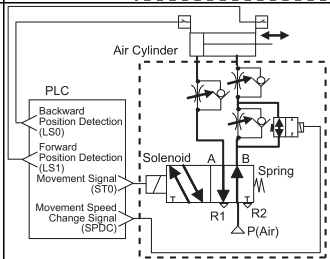
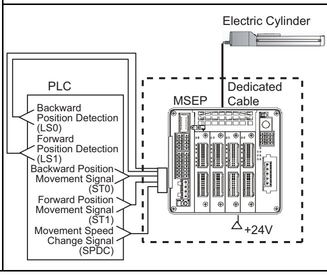
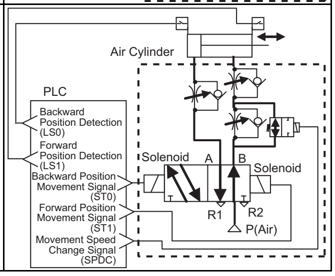
2) Turn ON the movement signal of the target position from PLC.

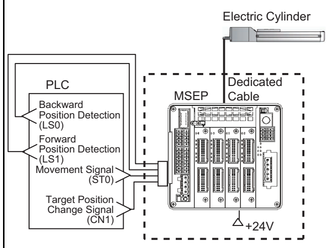
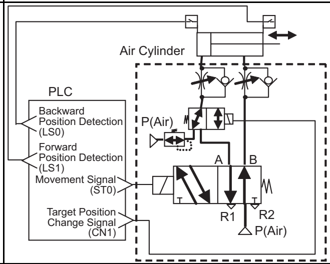
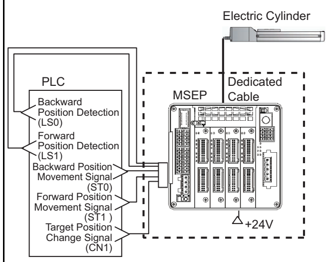
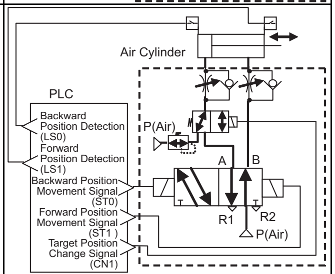
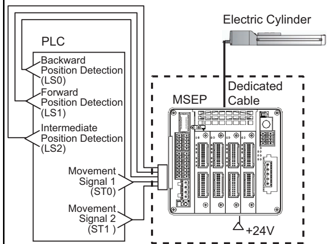
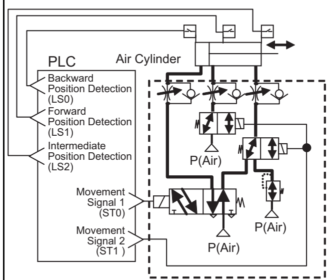
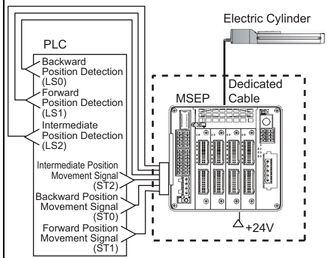
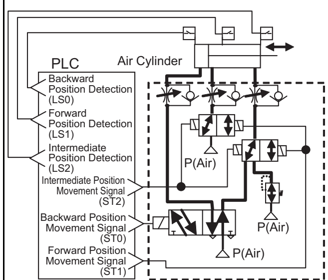
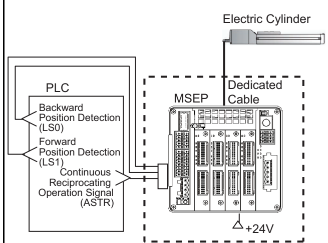
3) The actuator is placed at the proper coordinate value according to the positioning information in the specified target position.

4) The complete signal or position detection signal is output once the positioning is complete.

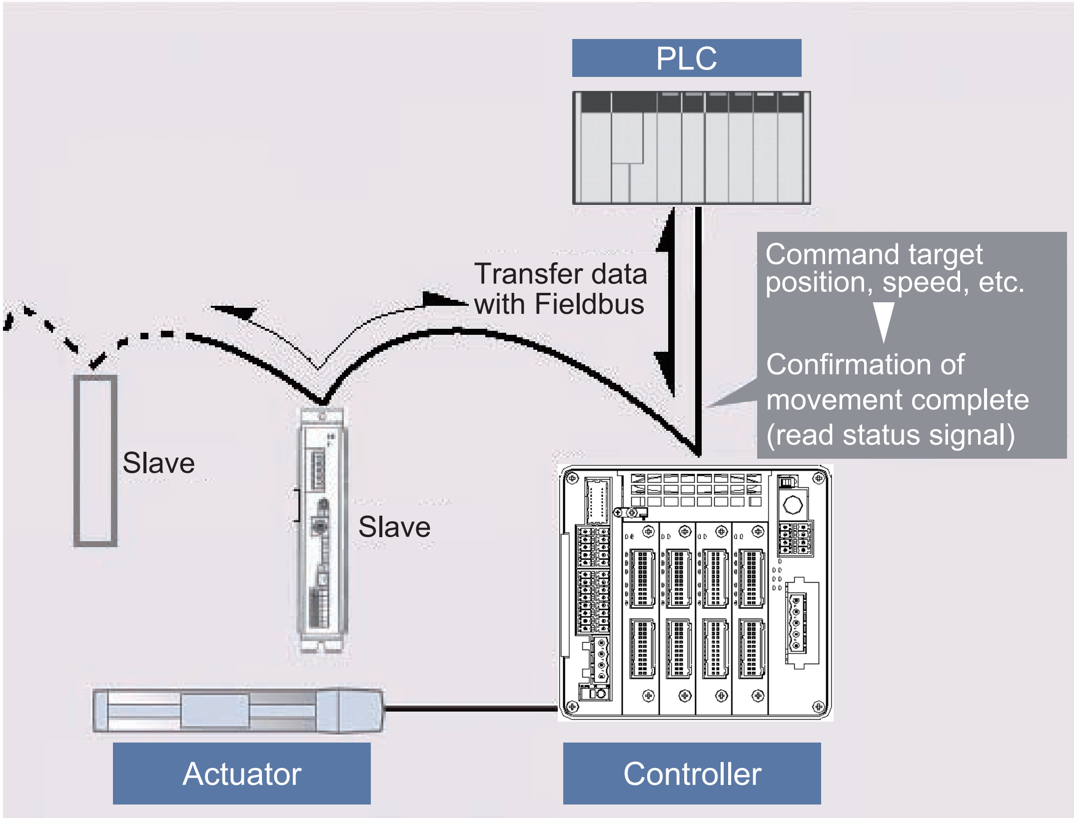
That is all for the basic operation method to control with PIO.

●Operation Mode Available in PIO Type
6 types of operation modes (PIO Patterns) are available to select from.
Explained below is the outline. Also, in the table below, provides the relevant air cylinder circuit for reference.

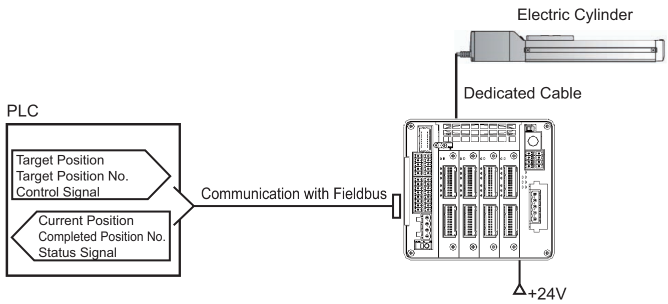
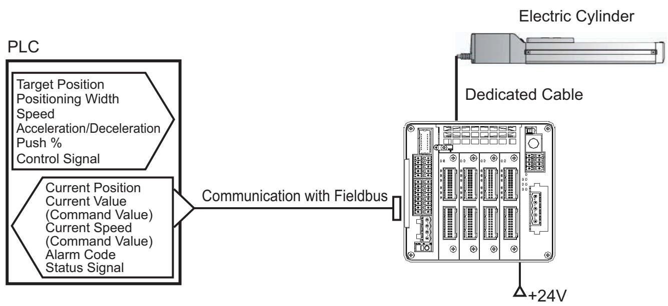
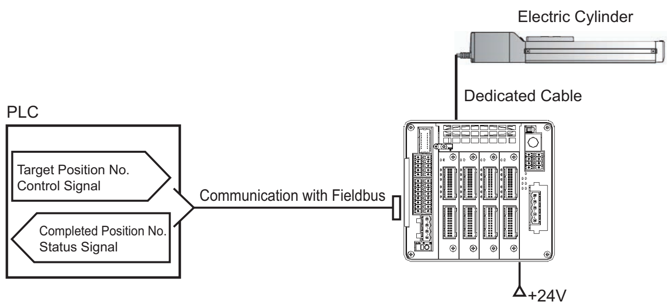
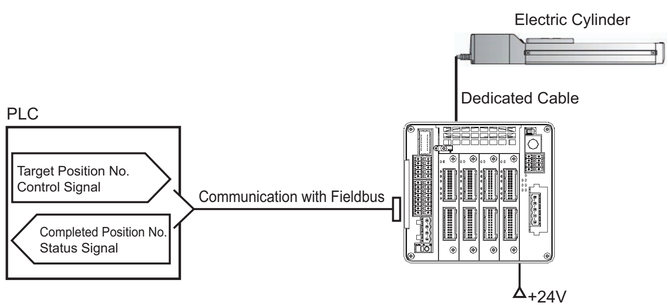
Operation Pattern	Description	Example for Electric Cylinder Connection	Example for Air Cylinder Connection (Reference)
PIO Pattern 0 Single Solenoid System (Standard Point-to-Point Movement)	The actuator point-to-point movement is available using the same control function as for the air cylinder. The target position setting (forward position and backward position) is available. Speed and acceleration settings in the actuator movement are available. The pressing operation is available.		
PIO Pattern 0 Double Solenoid System (Standard Point-to-Point Movement)			
PIO Pattern 1 Single Solenoid System (Point-to-Point Movement, Movement Speed Setting)	The actuator point-to-point movement is available using the same control function as for the air cylinder. The movement speed can be changed while the actuator is moving if the movement speed change signal is input. The target position setting (forward position and backward position) is available. Speed and acceleration settings in the actuator movement are available. The pressing operation is available.		
PIO Pattern 1 Double Solenoid System (Point-to-Point Movement, Movement Speed Setting)			

<table>
<tr><th>Operation Pattern</th><th>Description</th><th>Example for Electric Cylinder Connection</th><th>Example for Air Cylinder Connection (Reference)</th></tr>
<tr><td>PIO Pattern 2
Single Solenoid System
(Point-to-Point Movement, Target Position Setting (Position Data) Change)</td><td rowspan="2">The actuator point-to-point movement is available using the same control function as for the air cylinder.
The target position and operation condition can be changed while the actuator is moving if the target position change signal is input.
The target position setting (forward position and backward position) is available.
Speed and acceleration settings in the actuator movement are available.
The pressing operation is available.</td><td>
</td><td>
</td></tr>
<tr><td>PIO Pattern 2
Double Solenoid System
(Point-to-Point Movement, Target Position Setting (Position Data) Change)</td><td>
</td><td>
</td></tr>
<tr><td>PIO Pattern 3
(2-Input, 3-Point Movement)</td><td>The actuator 3-Point Movement is available using the same control function as for the air cylinder.
The target position setting (forward position, backward position and intermediate position) is available.
Speed and acceleration settings in the actuator movement are available.
Pressing operation is available at the points except for the intermediate point.</td><td>
</td><td>
</td></tr>
<tr><td>PIO Pattern 4
(3-Input, 3-Point Movement)</td><td>The actuator 3-Point Movement is available using the same control function as for the air cylinder.
The target position setting (forward position, backward position and intermediate position) is available.
Speed and acceleration settings in the actuator movement are available.
Pressing operation is available at the points except for the intermediate point.</td><td>
</td><td>
</td></tr>
<tr><td>PIO Pattern 5
(Continuous Reciprocating Operation)</td><td>The actuator's point-to-point reciprocating operation is performed between the forward position and backward position.
The target position setting (forward position and backward position) is available.
Speed and acceleration settings in the actuator movement are available.
The pressing operation is available.</td><td>
</td><td></td></tr>
</table>

(2) Fieldbus Type



●Operation Mode Available in Fieldbus Type
6 types of operation modes are available to select from.
Explained below is the outline.

Operation Pattern	Description	Overview
Positioner 1 Mode	In Positioner 1 Mode, 256 points of position data can be registered at the maximum and is able to stop at the registered positions. Monitoring of the current position is also available.	
Simple Direct Mode	In Simple Direct Mode, the target position can be indicated directly by inputting a value. Monitoring of the current position is also available.	
Direct Numeric Specification Mode	The target position, speed acceleration/deceleration and pressing current limit can be indicated with inputting a number. Monitoring of not only the current position, but also the current speed and indicated current are available.	
Positioner 2 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available This mode is that the transferred data is reduced from Positioner 1 Mode.	
Positioner 3 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available. This is the mode to control with the minimized number of signals to perform the positioning operation by reducing the amount of sent and received data from Positioner 2 Mode.	
SEP I/O	The same control as PIO is available.	Refer to PIO type

[Basic Operation Steps]

[1] Establish the driver parameters with using a teaching tool such as PC software.
1) If using SEP I/O Mode in the operation modes [refer to the next page], set the operation pattern in the initial setting. [Refer to 3.1.2 for details.]
2) Establish such settings as the zone (Parameter No.21 to 24) and the soft limit (Parameter No.15) considering the system to be used.
[Refer to chapter 5 I/O Parameter for details.]

↓

[2] Initial Setting [Refer to 3.1.2 and 3.9.]
Establish the settings such as the slave addresses for the field network using Gateway Parameter Setting Tool. Set operation modes for all the connected axes.
1) Establish the settings by following the steps stated in Section 3.1.2.
2) Set the gateway parameters considering the system to be used.
Establish such settings as whether to use the calendar function (clock setting) and the speed unit change during Direct Indication Mode.

↓

[3] Setting of Position Data [Refer to 3.3.]
(Note) Setting is not necessary for Direct Indication Mode.
Set the information such as the target position and speed to be used in the position data.

↓

[4] Field Network Settings [Refer to 3.4.1 and 3.4.2.]
Assign MSEP as the PLC (Master Unit).
[Refer to the instruction manuals of the master unit and PLC.]

↓

[5] Link to Network
1) Set the operation mode setting switch on the front panel of MSEP to AUTO side, and reboot the power. (Field network line becomes valid by setting the switch to AUTO)
2) Once the link with the PLC (Master Unit) is established (Note 1), turn ON MON signal in the gateway control signals (Note 2). <u>While MON Signal is ON, control from field network is available.</u>

Note 1 Confirm the communication is established in normal condition by referring to Display of Field Network LEDs shown in the section of Name and Function of Each Component in earlier pages of this manual.

Note 2 Refer to 3.4.3 Gateway Control Signals.

↓

[6] Operation Control with Each Operation Mode [Refer to 3.4.4 to 3.5.]
1) Send the information of the target position, speed, acceleration/deceleration, etc. from PLC (Master Unit) to MSEP.
2) The actuator follows the received information of the target position, speed, acceleration/deceleration, etc. to perform a positioning at the specific coordinates.
3) Confirm the status of positioning complete.

3.1.2 Initial Setting

For this controller, it is necessary to have the initial setting and Gateway operation mode setting done in the axes one by one.

The initial setting is to be performed using RC PC Software (Note) or touch panel teaching (TB-01, CON-PTA (Note)). And the operation mode is to be set using Gateway Parameter Setting Tool (Ver. 1.1.0.0 or later).

(Note) See the instruction manuals of the RC PC software and the touch panel teaching for the applicable version.

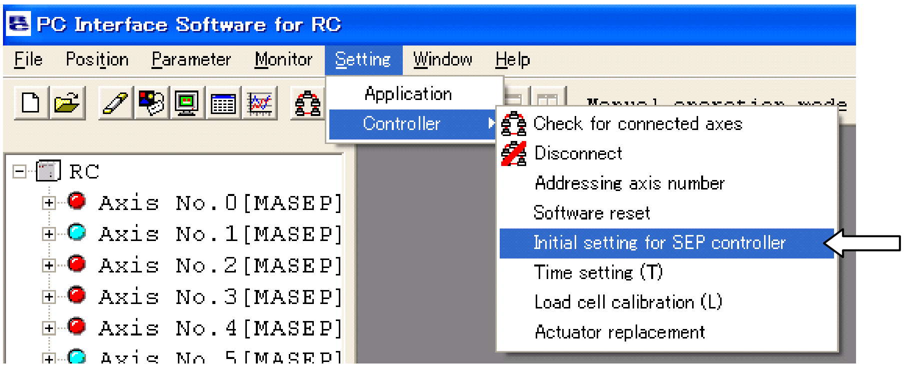
Shown below is the process for the setup. Follow the instruction to conduct the setting properly.

[Preparation] Install RC PC Software and Gateway Parameter Setting Tool. For Gateway Parameter Setting Tool, install the file stored in the CD-ROM for PC software, or download from our website, intelligentactuator.com.
[Refer to the instruction manual of the PC software for the details of the PC software.]

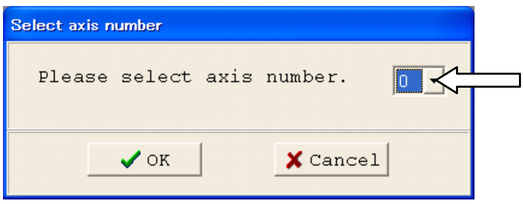
Make sure the power, system I/O connector wires and operation mode setting switch are in MANU condition when having the setting done.

[Step 1] Connect the PC and SIO connector on MSEP with using the cable enclosed in RC PC Software and start up the PC software.

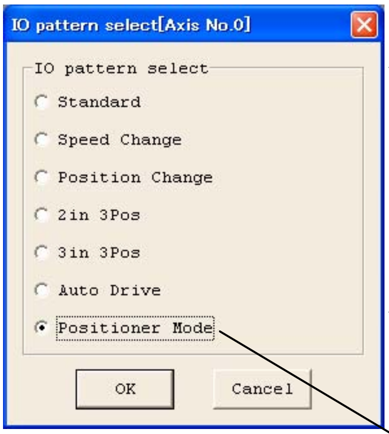
[Step 2] Select the initial setting of SEP from the controller menu.

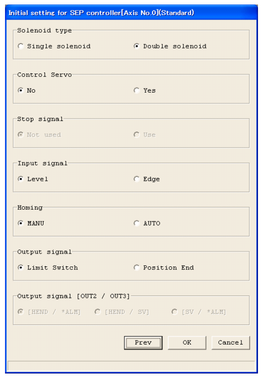


[Step 3] Select the axis number which the setting is to be conducted.



[Step 4] Select the operation pattern. [Refer to 3.1.1 Basic Operation Methods.]
There are Operation Patterns 0 to 5 available for PIO Type.
Select Operation Pattern 6 if Fieldbus Type and a mode other than SEP I/O Mode.
Select either of Operation Patterns 0 to 5 (PIO Patterns 0 to 5) if Fieldbus Type and SEP I/O Mode since control is the same as PIO Type.
By pressing OK after the selection is made, the display proceeds to the next step for Operation Patterns 0 to 5, and the initial setting data is sent to the controller for Operation Pattern 6.

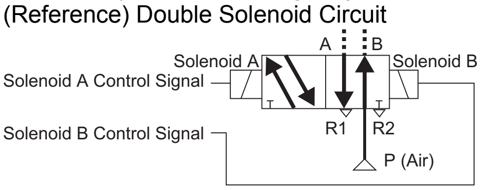




For Operation Pattern 0 to 5
[Refer to Step 5 for the details]

For Operation Pattern 6

[Step 5] (Note) For Operation Pattern 6, proceed to Step 7.
If the operation pattern is either of 0 to 5, have the following setting. The items to set vary depending on the operation pattern you have chosen, and will be some items that are not shown.
Set the displayed item and click on OK button.
Statement in a bracket is the setting at the delivery.

No.	Setting Item	Setting Range (Set in delivery)	Description	Operation Pattern (○ : Available for Setting) 0	1	2	3	4	5
1	Solenoid System	Single/Double (Double)	Single : Actuator is operated with a control same as Single Solenoid. Double: Actuator is operated with a control same as Double Solenoid System.	○	○	○			
2	Stop Signal	Use/ Not to Use (Not to Use)	This is available only if Single is selected in No.1. When the PAUSE signal (*STP) is used, select "Use".	○	○	○			○
3	Input Signal System	Continuous Operation Type /Momentary Operation Type (Continuous Operation Type)	This is available only if Double is selected in No.1. For the signal sent from PLC to MSEP, select "Continuous Operation" (level signal) or "Momentary Operation" (edge signal). (Reference) Double Solenoid Circuit 	○	○	○		○	

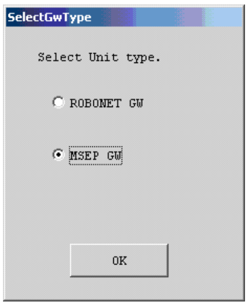
<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Setting Item</th><th rowspan="2">Setting Range
(Set in delivery)</th><th rowspan="2">Description</th><th colspan="6">Operation Pattern
(○ : Available for Setting)</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>4</td><td>Intermediate Stop System</td><td>Both Solenoid ON/
Both Solenoid OFF
(Both Solenoid OFF)</td><td>This is available only if Operation Pattern 3 is selected. Select whether to have the movement to the intermediate point performed with the forward end movement command and backward end movement command both being turned OFF or both turned ON.
In the case the same use procedure as for 5-port 3-position electromagnetic valve is applied, select “Both Solenoid OFF”.
In the case that the same use procedure as the time when two units of the 3-port single solenoid electromagnetic valve, are used, select “Both Solenoid ON”.</td><td></td><td></td><td></td><td>○</td><td></td><td></td></tr>
<tr><td>5</td><td>Servo Control</td><td>Use/
Not to Use
(Not to Use)</td><td>When “Not to Use” is selected, the servo-motor is automatically turned ON after the power input.
When “Use” is selected, servo is turned ON only while CON signal of the input IN3 is ON.</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>6</td><td>Home Position Operation</td><td>AUTO/MANU
(MANU)</td><td>If AUTO is selected, the home-return operation is started automatically when the servo is turned for the first time after the power is supplied.
“MANU” is selected, the home return operation is performed with the first movement signal (ST0) input.</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>7</td><td>Output Signal Type</td><td>Limit Switch Output/
Completed Position Output
(Limit Switch)</td><td>Select the output system for the positioning complete signal.
• Limit Switch Output
After home return operation, it turns ON when in the range of forward/intermediate/backward positioning width no matter of servo ON/OFF or the movement if there is ore there is not.
Intermediate Point is reached : LS2 ON
Forward End is reached. : LS1 ON
Backward End is reached. : LS0 ON
• Completed Position Output
When the actuator reaches the target position, it is turned ON. This signal turns OFF with the servo being OFF. When the servo-motor is turned ON again and the current position is within the positioning width, it is turned ON.
Intermediate Point is reached : PE2 ON
Forward End is reached. : PE1 ON
Backward End is reached. : PE0 ON
(Note) It becomes OFF before home return operation no matter which output method.
[Refer to Section 3.8.2 for the details.]</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
</table>

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Setting Item</th><th rowspan="2">Setting Range
(Set in delivery)</th><th rowspan="2">Description</th><th colspan="6">Operation Pattern
(○ : Available for Setting)</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>8</td><td>Output Signal Selection</td><td>0 to 2
(0)</td><td>If “Use” is selected in No. 5 Servo Control, select the combination of the used output signals considering the operation pattern.
Select 0 if “Not to Use” is selected.
• For Operation Patterns 0 to 2 and 5, select from the combinations 0 to 2 below.
0 : OUT2 = HEND
OUT3 = *ALM
(No servo-on signal output)
1 : OUT2 = SV
OUT3 = *ALM
2 : OUT2 = HEND
OUT3 = SV
• For Operation Patterns 3 and 4, select from the combinations 0 and 1 below.
0 : OUT3 = *ALM
(No servo-on signal output)
1 : OUT3 = SV
[Refer to Section 3.8.2 for the details.]</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
</table>

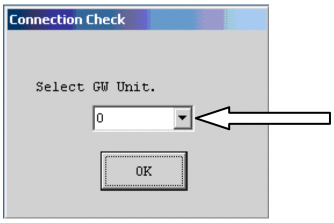
[Step 6] The confirmation window for controller reboot opens. Click “Yes”.

[Step 7] The initial setting needs to be held on all the MSEP composition axes. In the case that multiple axes are connected, repeat the Steps 2 to 6.
Once the setting on all the connected axes is finished, close RC PC Software.
We now move on the Gateway operation mode setting.

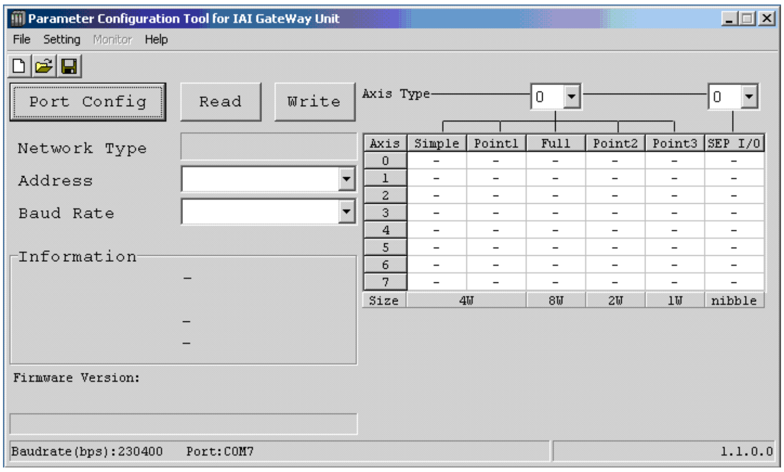
[Step 8] Start up Gateway Parameter Setting Tool.
The following window appears. Select MSEP GW and click OK.



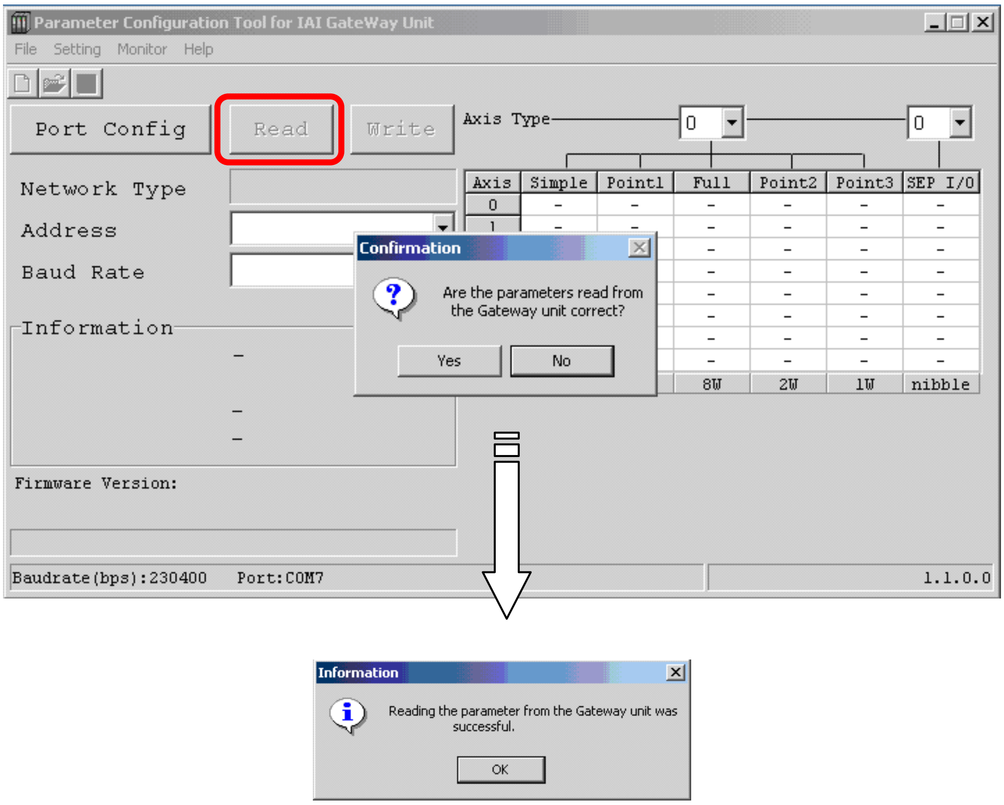
[Step 9] The connected MSEP (unit number) becomes available to select. Select the unit number to be connected and click on the OK button.



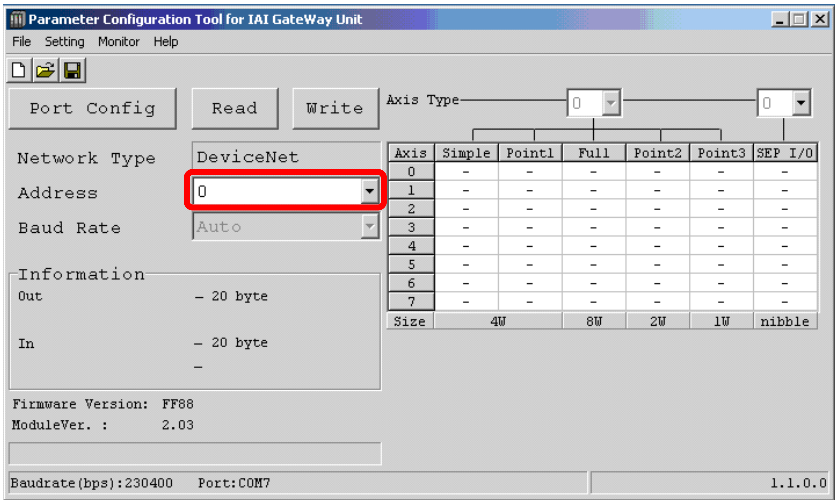
[Step 10] Main Window is displayed.



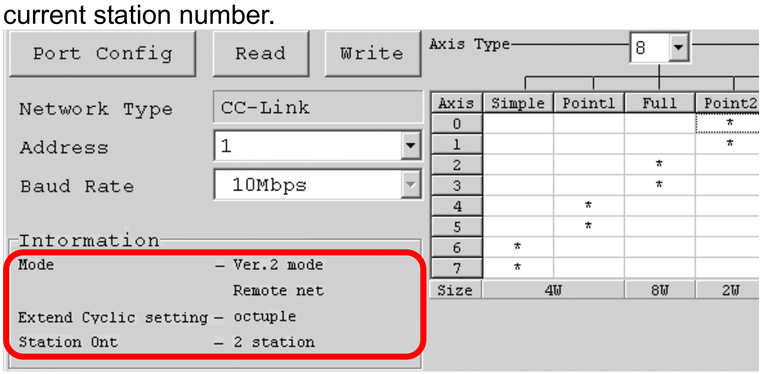
[Step 11] Reading is started from MSEP to PC. Click on the “Read” button and a confirmation window appears. Click on the “Yes” button.
Once the parameter reading is completed in normal condition, the reading complete window opens. Click OK.



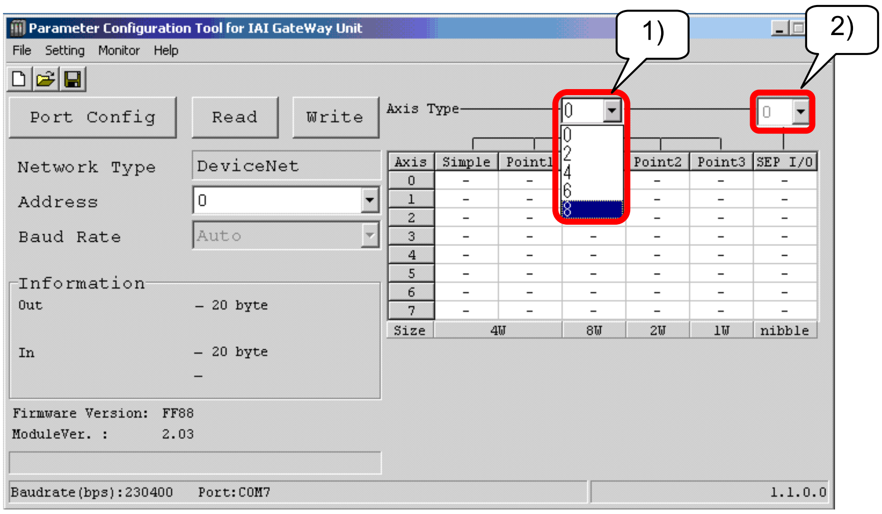
[Step 12] For PIO Type, proceed to Step 13.
The parameters input to MSEP are listed as shown below. Indicate the node address (station) of MSEP on field network in Address.



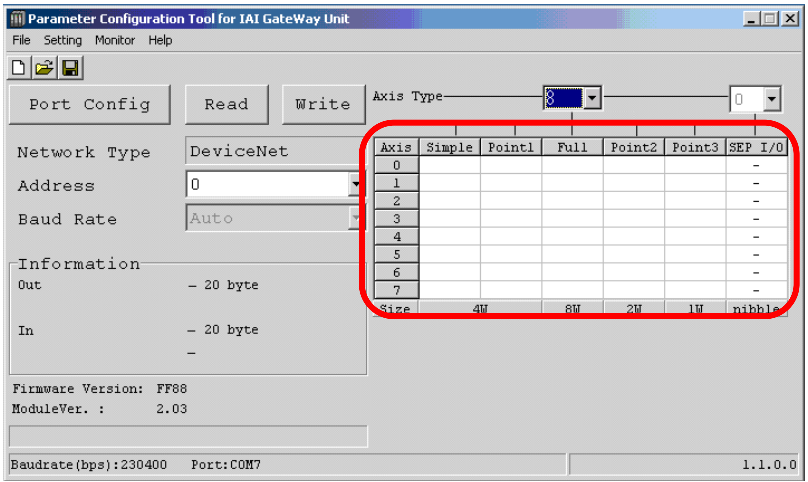
Caution for CC-Link Type station setting
In the following slave, set the value the number of occupied station is added to the current station number.



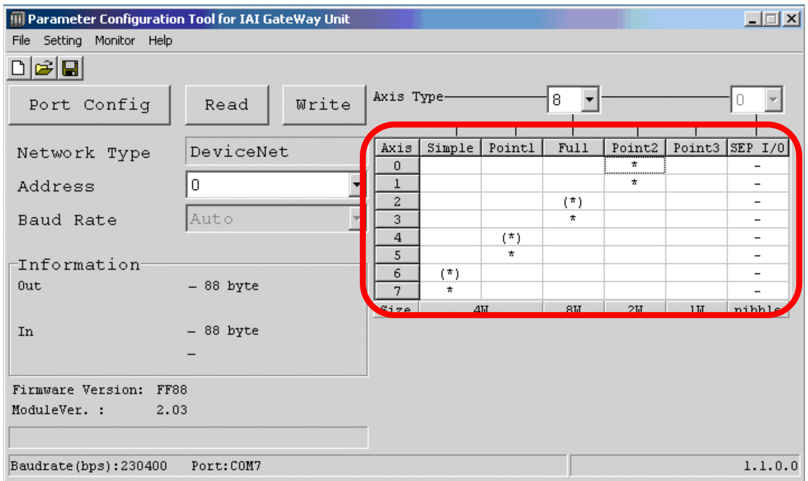
[Step 13] Set the number of axes (two axes in unit) used in each operation mode. If the system is used in Positioner Modes 1 to 3, Simple Direct Mode or Positioning Mode, input the total number of the axes in 1) in the figure below. Input the total number of axes in 2) if using in SEP I/O Mode. Note that 1) and 2) cannot be used at the same time.



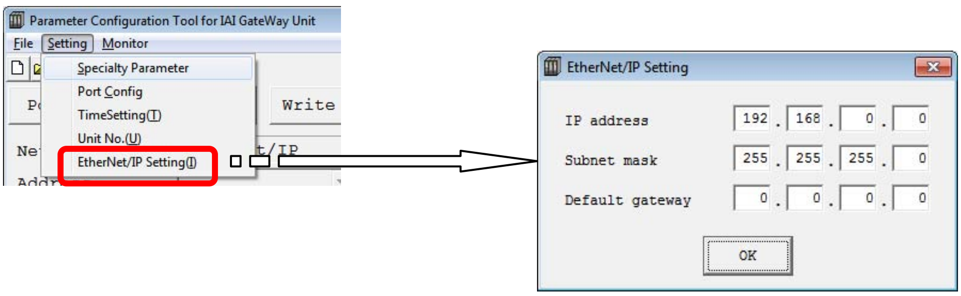
[Step 14] Once the setting of the number of axes is done, the cells for the operation mode settable to each axis turn to blank in response. For PIO Type and SEP I/O Mode, "*" is displayed for a number equals to the number of set axis.



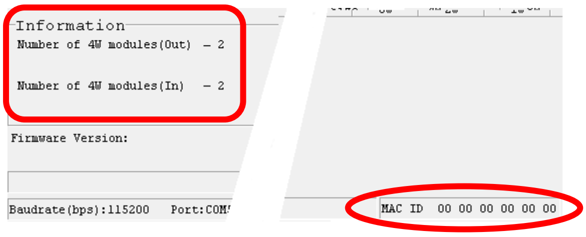
[Step 15] Click on a blank cell and "*" shows up. "*" mark means that an operation mode is selected for each axis.
Select an operation mode [refer to top in Chapter 3] for 2 axes in a unit. If clicking on a cell, "*" shows up for 2 axes together. If clicking a cell showing "*", the mark turns to "(*)". "(*)" means it is a reserved axis, which is to be set when not using even though the actuator is connected.
If clicking on a cell with "(*)" mark for the reserved axes shown on the two axes, the cell turns back to blank.
(Note) Even if the total number of the used axes is an odd number, make the last axis in reservation to get an even number.



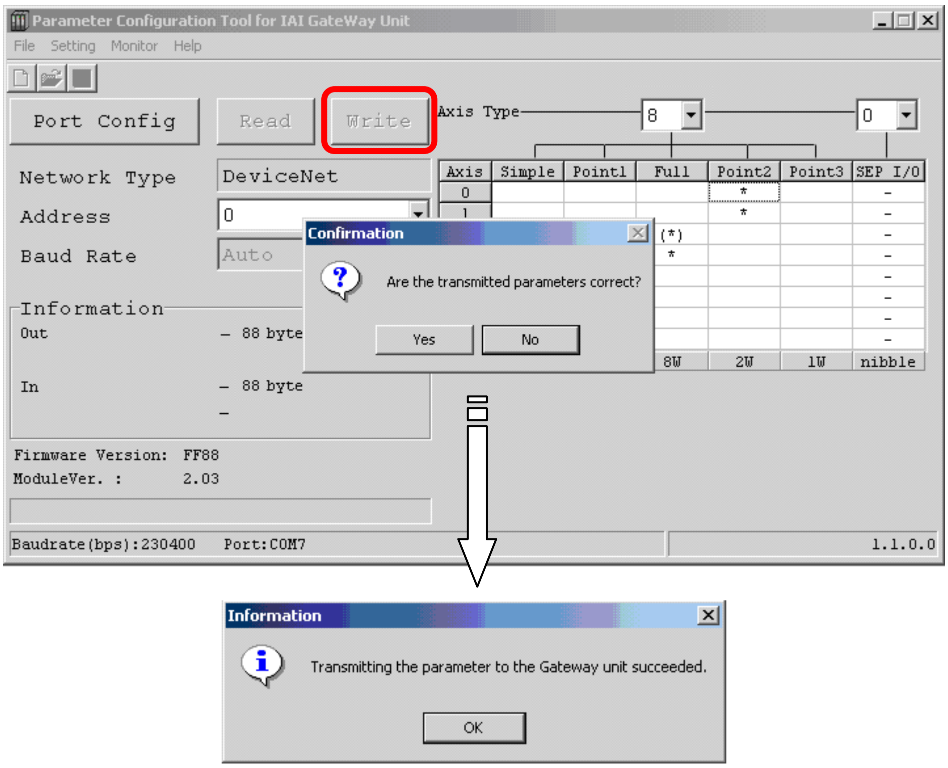
[Step 16] To be conducted only for EtherNet/IP type (If not applied, go to Step 17)
Click on Setting in the menu and select EtherNet/IP Setting, and the setting window of the IP addresses, subnet mask and default gateway. Establish the setting that suits to your use.



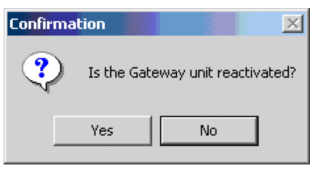
[Step 17] To be check only for PROFINET-IO type (If not applied, go to Step 18)
In PROFINET-IO Type, if parameters are read from MSEP to the PC (Step 11), the occupation information will be shown in the left middle of the main screen and MAC address in the right bottom. Establish the setting of the upper master with these values.



[Step 18] Write the edited operation mode setting parameters to MSEP. Click on the “Write” button shown below and a confirmation window pops up. Click on the “Yes” button.
If the writing is finished in normal condition, writing complete window appears. Click OK.



[Step 19] A confirmation window for Gateway Unit reboot opens. Click “Yes” to accept the reboot.



[Step 20] After rebooting, a confirmation window for parameter reading appears for confirmation of the written contents. Click “Yes” to accept the reading.
Once the reading process is complete, confirm that the written contents are reflected.
If not written properly, do the process again from Step 1.

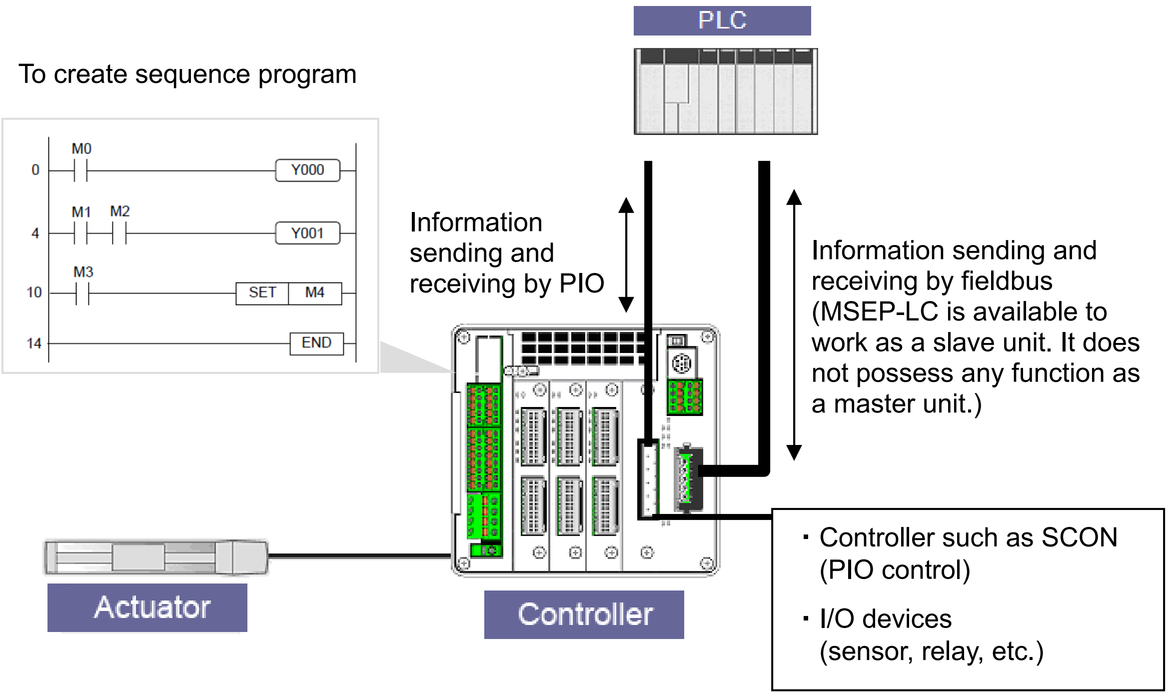
> Reference:
> The settings are conducted in the special parameters for the process of communication error, change in pressing method for Fieldbus Type and speed unit change for Direct Indication Mode. Refer to 3.9 About Gateway Parameter Setting Tool for the details.

3.2 Operation of MSEP-LC

(Note) Refer to 3.1 for MSEP-C Type

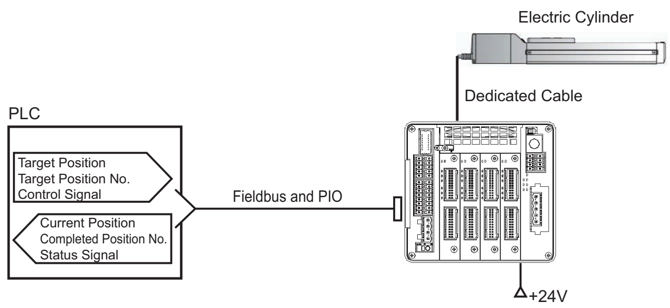
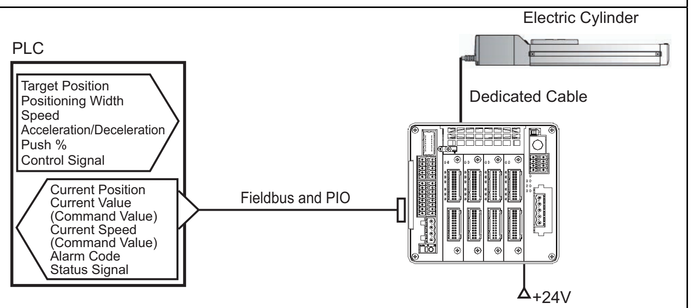
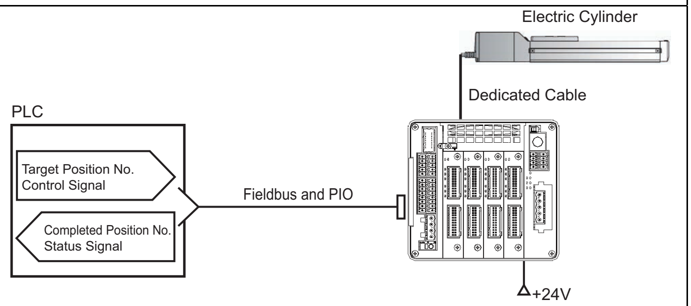
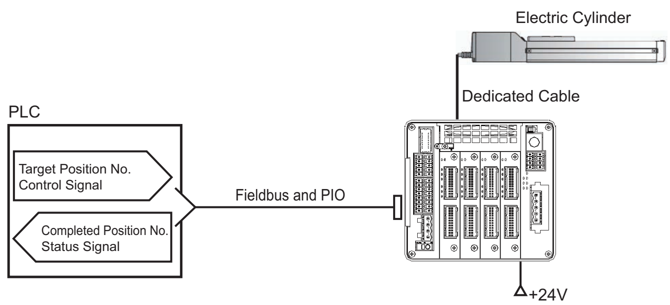
3.2.1 Basic Operation Methods

MSEP-LC possesses the sequence control function.
By creating the sequence program, communication is conducted with external devices by PIO or fieldbus, which enables to have such operations as to operate the actuator based on the communicated information or to operate the actuator alone (by itself).
There are various types for the actuators such as slider type, rod type, rotary type, gripper type and so on. Unless otherwise specified in this manual, the method of operation control is the same.



●Operation Mode Available in Fieldbus Type

5 types of operation modes are available to select from.
Explained below is the outline.

Operation Pattern	Description	Overview
Positioner 1 Mode	In Positioner 1 Mode, 256 points of position data can be registered at the maximum and is able to stop at the registered positions. Monitoring of the current position is also available.	
Simple Direct Mode	In Simple Direct Mode, the target position can be indicated directly by inputting a value. Monitoring of the current position is also available.	
Direct Numeric Specification Mode	The target position, speed acceleration/deceleration and pressing current limit can be indicated with inputting a number. Monitoring of not only the current position, but also the current speed and indicated current are available.	
Positioner 2 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available This mode is that the transferred data is reduced from Positioner 1 Mode.	
Positioner 3 Mode	This is the operation mode of the position data of 256 points at maximum set in the position table. The monitoring of the current position is not available. This is the mode to control with the minimized number of signals to perform the positioning operation by reducing the amount of sent and received data from Positioner 2 Mode.	

[Basic Operation Steps]

[1] Establish the driver parameters with using a teaching tool such as PC software.
1) Confirm that 6: "Positioner Mode" is selected in Operation Pattern Select in the initial setting. [Refer to Section 3.2.2 for detail]
2) Establish such settings as the zone (Parameter No.21 to 24) and the soft limit (Parameter No.15) considering the system to be used.
[Refer to chapter 5 I/O Parameter for details.]

⇩

[2] Deciding Operation Mode
Select an operation mode from five types. The selected operation mode is to be used by declaration of DFC Command in the sequence program.

⇩ Select either Positioner * or Simple Direct Mode ⇩

⇩ Select Direct Indication Mode ⇩

[3] Setting of Position Data [Refer to 3.3.]
(Note) Setting is not necessary for Direct Indication Mode.
Set the information such as the target position and speed to be used in the position data.

⇩

If all of them described below are true, proceed to this one.
1) Fieldbus is not used
2) Calendar function is not used
3) Direct Indication Mode is not used

[4] Fieldbus Settings [Refer to 3.2.2 and 3.9]
Use Gateway Parameter Setting Tool to establish the settings such as for the fieldbus slave address.
1) Establish the settings by following Section 3.2.2.
2) Set the gateway parameter considering the system to be used.
Establish the settings of such as calendar function (clock setting) and speed unit in Direct Indication Mode and so on in Special Parameter Setting.

⇩

[5] Creating Sequence Program [Refer to ME0329 MSEP-LC Programming Manual provided separately]
(Note 1) Refer to Section 3.4 for the details of the memory assignment in each operation mode and the commands.
(Note 2) The gateway control and the domains in gateway condition are not used.
Those assigned by DFC0 to 5 are the connected axis control areas described in Section 3.4.1.
Those assigned by DFC6 are the domains of n + 3 to n + 6 in MSEP gateway control area described in Section 3.4.1.

⇩

[6] Sequence Program Debugging (Operation)

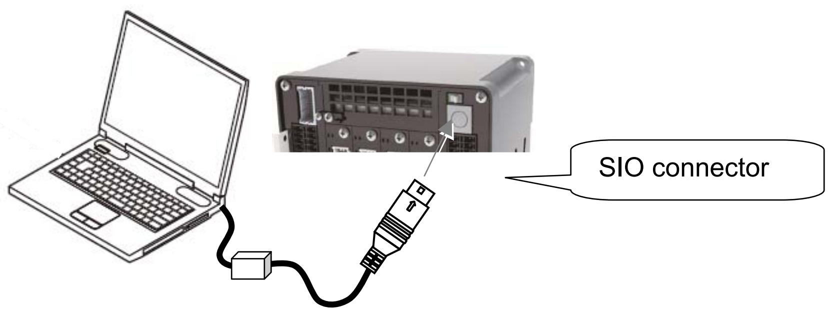
3.2.2 Initial Setting

For this controller, it is necessary to check the initial setting **for each connected** axis. Also when the fieldbus is to be used, when the calendar function is to be used, or when the same pressing operation as CON system controller is to be made in Direct Indication Mode, it is necessary to establish the setting of the gateway.
The initial setting is to be performed using RC PC Software (Note) or touch panel teaching (TB-01, CON-PTA (Note)). Also, the setting of the gateway is to be conducted on Gateway Parameter Setting Tool (Ver. 1.2.10.0 or later).
(Note) See the instruction manuals of the RC PC software and the touch panel teaching for the applicable version.
Shown below is the process for the setup. Follow the instruction to conduct the setting properly.

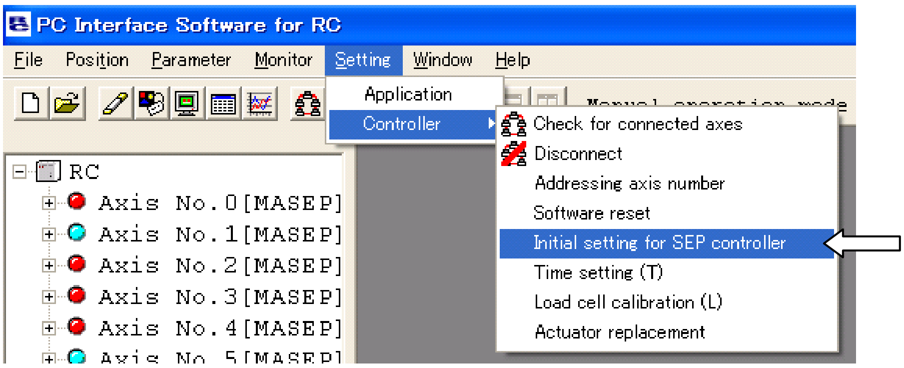
[Preparation] Install RC PC Software and Gateway Parameter Setting Tool. For Gateway Parameter Setting Tool, install the file stored in the CD-ROM for PC software, or download from our website, intelligentactuator.com.
[Refer to the instruction manual of the PC software for the details of the PC software.]

Make sure the power, system I/O connector wires and operation mode setting switch are in MANU condition when having the setting done.

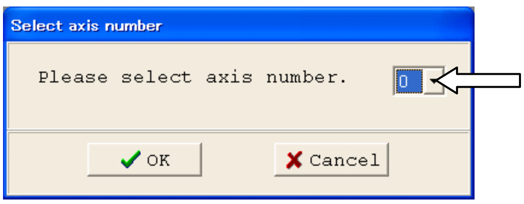
[Step 1] Connect the PC and SIO connector on MSEP with using the cable enclosed in RC PC Software and start up the PC software.



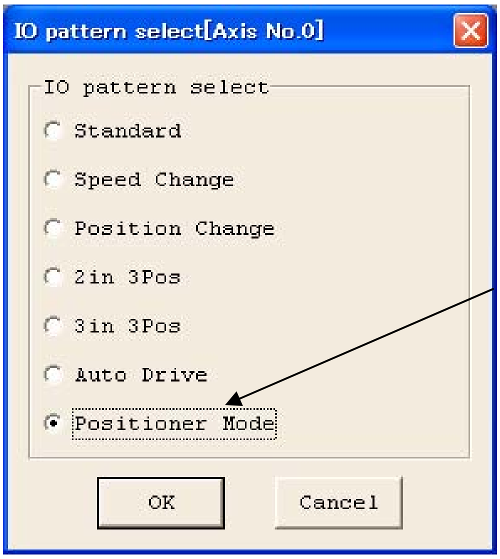
[Step 2] Select the initial setting of SEP from the controller menu.



[Step 3] Select the axis number which the setting is to be conducted.



[Step 4] Confirm that the operation pattern is set to 6.
When the operation pattern is not set to 6, select 6
Press OK after all the selection is made, and the initial setting gets transferred to the controller.

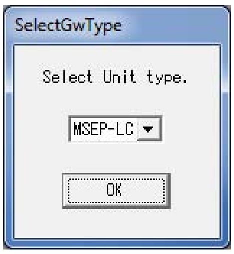


For Operation Pattern 6

[Step 5] Make sure that all the axes to construct MSEP are set to 6. In the case that multiple axes are connected, repeat the Steps 2 to 4.
Once the setting on all the connected axes is finished, close RC PC Software.

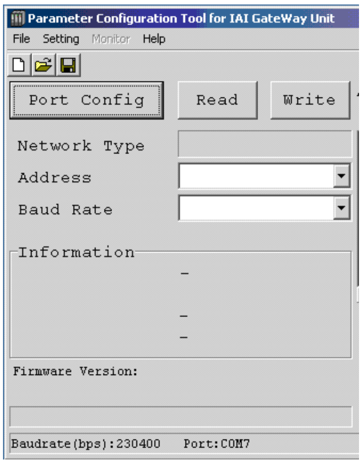
★ Establish the gateway setting if any of them below is true.
1) Connection is made with fieldbus
2) Calendar function is to be used
3) Change is to be made on the operation speed unit in Direct Indication Mode
4) Pressing system is to be set the same as CON system controller in Direct Indication Mode

[Step 1] Start up Gateway Parameter Setting Tool.
The following window appears. Select MSEP-LC and click OK.

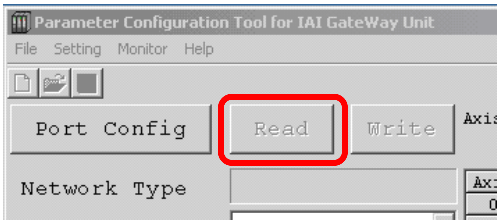


[Step 2] The connected MSEP-LC (unit number) becomes available to select. Select the unit number to be connected and click on the OK button.

[Step 3] Main Window is displayed.

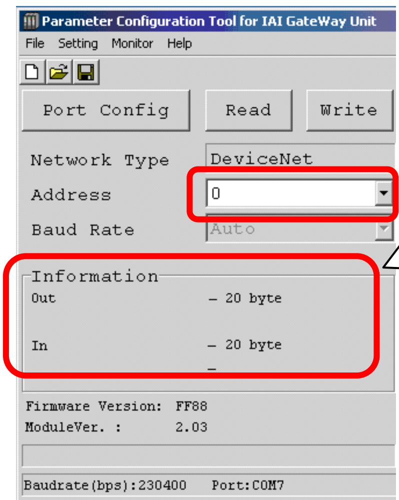


[Step 4] Reading is started from MSEP to PC. Click on the “Read” button and a confirmation window appears. Click on the “Yes” button.
Once the parameter reading is completed in normal condition, the reading complete window opens. Click OK.



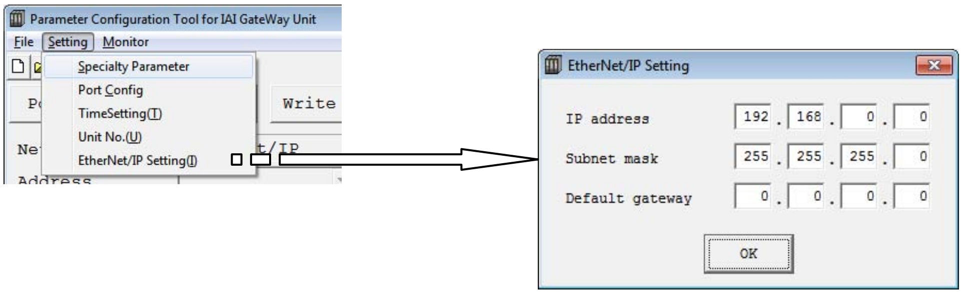
(Note) For the steps below, conduct them only when applicable. If not, go ahead to the next step.

[Step 5] When Connecting to Fieldbus
The parameter that MSEP is input is displayed as shown below once reading is conducted. Set the address or baud rate if necessary. (A box will be shown in white when setting can be adjusted.) Indicate the node address (station number) of MSEP on the fieldbus to the address.

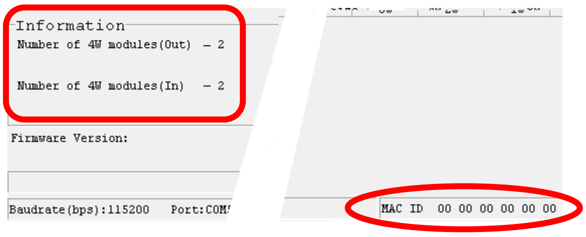


Caution for CC-Link Type station setting
In the following slave, set the value the number of occupied station is added to the current station number.

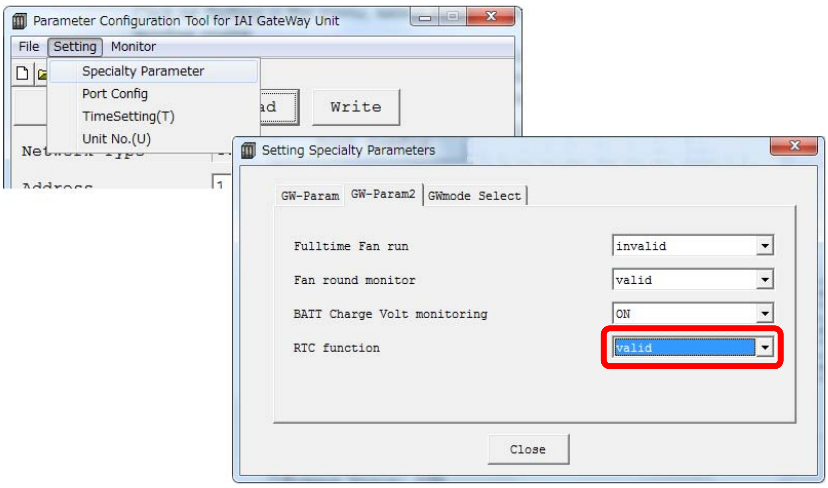
[Step 6] To be conducted only for EtherNet/IP type
Click on Setting in the menu and select EtherNet/IP Setting, and the setting window of the IP addresses, subnet mask and default gateway. Establish the setting that suits to your use.



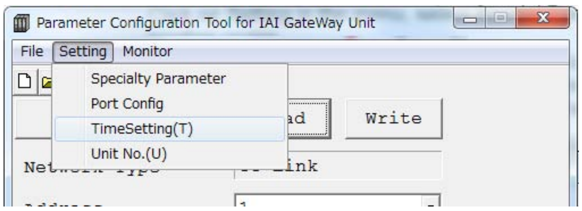
[Step 7] To be conducted only for PROFINET-IO type
If parameters are read from MSEP (Step 4), the occupation information will be shown in the middle of the main screen and MAC address in the right bottom. Establish the setting of the upper master with these values.



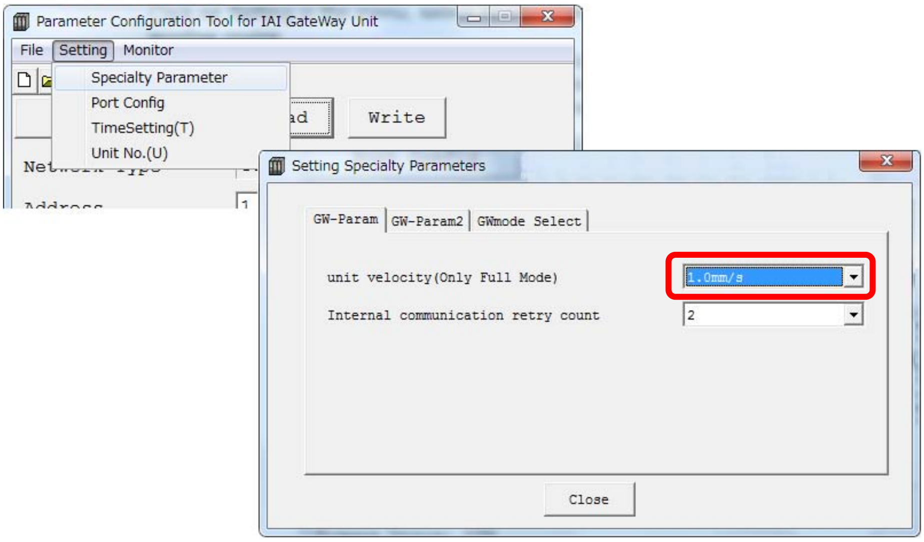
[Step 8] Use Calendar Function
Click on Setting in the menu, select Speciality Parameter, and Setting Speciality Parameter window opens.
Select GW Parameter 2 to valid the calendar function.
Once Setting Speciality Parameter window is closed, a parameter transfer confirmation window will show up. Press “Yes” to transfer the data, and then reboot MSEP-LC.



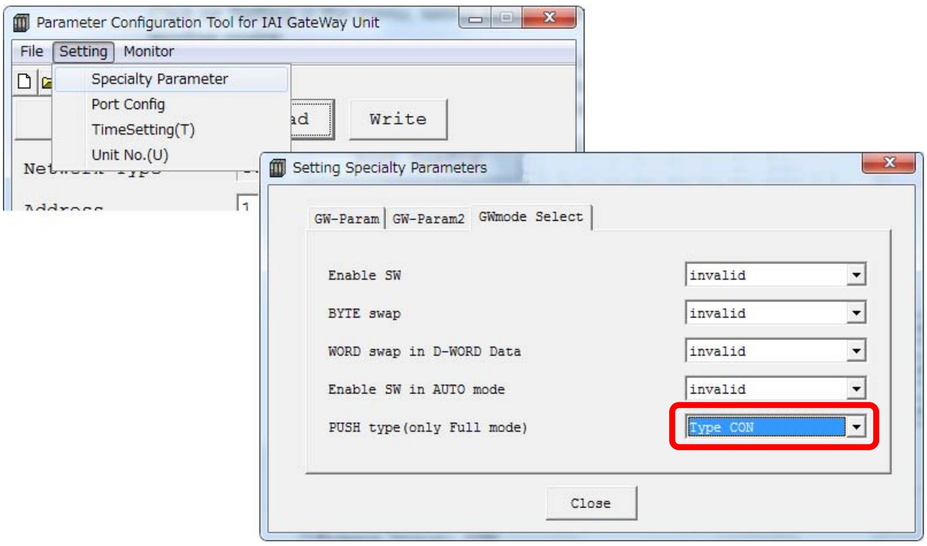
To set time, click on Setting in the menu and conduct in Time Setting.



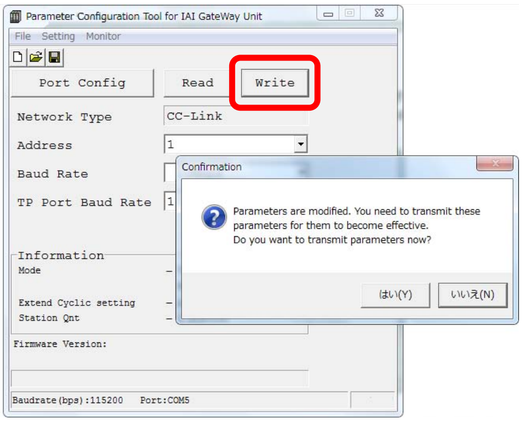
[Step 9] Change Unit of Operation Velocity in Direct Indication Mode
The unit of the velocity indication can be changed from 1.0mm/s to 0.1mm/s in Only Full Mode.
Click on Setting in the menu, select Speciality Parameter, and Setting Speciality Parameter window opens.
Select GW Parameter to change the unit velocity.
Once Setting Speciality Parameter window is closed, a parameter transfer confirmation window will show up. Press "Yes" to transfer the data, and then reboot MSEP-LC.



[Step 10] Change Push Type in Direct Indication Mode
The push type can be set the same as that of CON system such as for PCON controllers or SEP system such as for PSEP. [Refer to 3.8.1 (16) Push-motion specification]
Click on Setting in the menu, select Speciality Parameter, and Setting Speciality Parameter window opens.
Select GW Mode Select to change the push type in Direct Indication Mode.
Once Setting Speciality Parameter window is closed, a parameter transfer confirmation window will show up. Press "Yes" to transfer the data, and then reboot MSEP-LC.



[Step 11] Write the edited setting parameters to MSEP.
A confirmation window appears once “Write” button shown in the figure below is pressed.
Press the “Yes” button
Once the parameters are written in normal condition, a reboot confirmation window will show up. Press “Yes” to for a reboot.

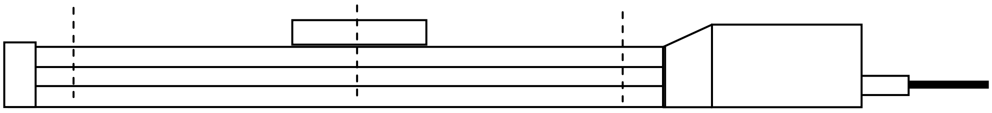


[Step 12] After rebooting, a confirmation window for parameter reading appears for confirmation of the written contents. Click “Yes” to accept the reading.
Once the reading process is complete, confirm that the written contents are reflected.
If not written properly, do the process again from Step 1.

3.3 Setting of Position Data

PIO Type makes an operation based on the position data (position, speed, etc.) set in advance in the position table. Set the target position (forward end, backward end and intermediate point (Note)) first.

(Note) The setting may not be made for some operation modes.



The values in the position table can be set as shown below.

[1] Settings in common for all operation patterns

For Operation Patterns 1 and 2, there are additional settings to be conducted separately in [2] and [3] to be referred for the setting process.

Example for Position Table Setting (when Operation Patterns 0 to 5 and Operation Pattern 6 of SEP I/O Mode)

1) Position Name	2) Position [mm]	3) Speed [mm/s]	4) Pressing Force [%]	5) Pressing Width [mm]	6) Acceleration [G]	7) Deceleration [G]	8) Energy-Saving Setting
Backward End Position	0.00	50.00	0	0	0.1	0.1	0
Forward End Position	200.00	50.00	70	1.00	0.1	0.1	1
Intermediate Point Position	100.00	50.00	0	0	0.1	0.1	0

Example for Position Table Setting (when Operation Pattern 6 and except for SEP I/O Mode)

1) Position Name	2) Position [mm]	3) Speed [mm/s]	4) Pressing Force [%]	5) Pressing Width [mm]	6) Acceleration [G]	7) Deceleration [G]	8) Energy-Saving Setting
0	0.00	50.00	0	0	0.1	0.1	0
1	50.00	50.00	70	1.00	0.1	0.1	1
2	100.00	50.00	0	0	0.1	0.1	0
⋮							
255							

⚠ Caution: The input value is treated as the angle for the rotary actuator and lever type gripper.
Therefore;
[mm] →[deg]⋯⋯ 1.2 = 1.2deg
[mm/s]→[deg/s]⋯⋯ 100 = 100deg/s
They are treated as above.
Please note that the display on the screen of a teaching tool such as the PC software is in [mm].

1) Position Name (No.) ····· It shows the position the actuator moves towards.

2) Position [mm] ·············· It is the coordinate value for positioning. Input the position from the home position.

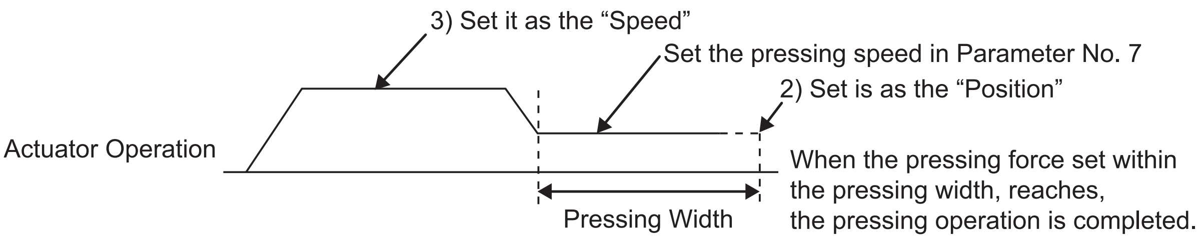
> ⚠ Caution: (1) For gripper type
> Setting is to be conducted with the basis on one finger. Set the value for the movement of one finger from the home position. Stroke information in the specification is shown in the total value of movement distance of the two fingers.
> Therefore, the stroke is 1/2 of what is described in the specifications.
> (2) For rotary type
> Set the coordinates from the home position in angle.

3) Speed [mm/s] ·············· Set the speed in the operation.
Do not attempt to input a value more than the maximum speed [refer to the caution note below] or minimum speed (Note 1).
(Note 1) The minimum speed differs depending on the type of the actuator. Refer to the values stated in the Chapter 7 appendix or the following for the calculation.
Minimum speed [mm/s] = Lead length [mm] / No. of Encoder Pluses / 0.001 [s]

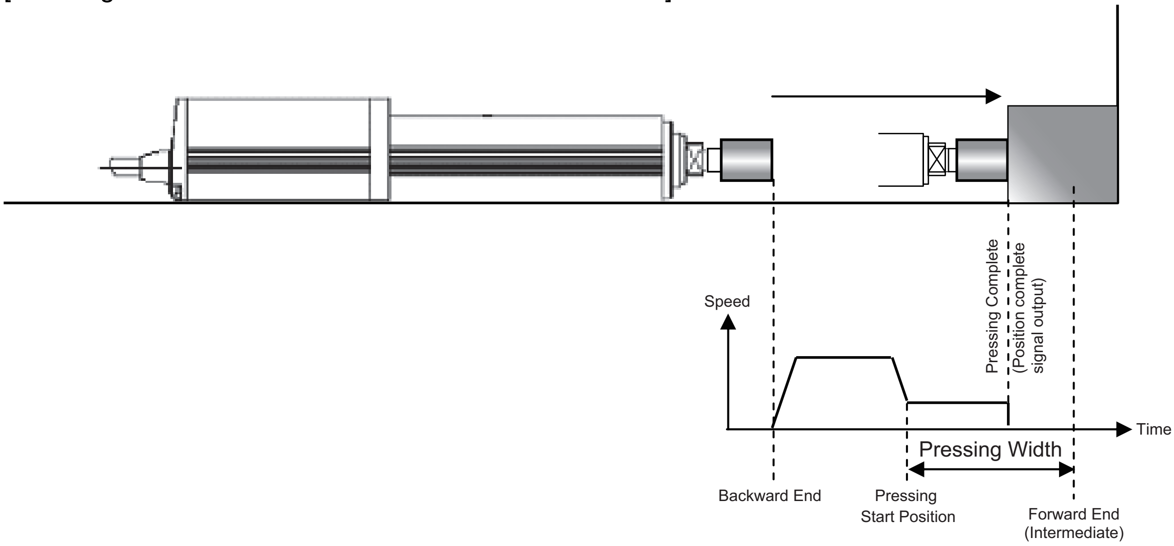
4) Pressing Force [%] ······· Set a value other than 0 here and the pressing operation is available. Set a pressing torque (limit current value) in %. The setting range differs depending on the actuator. Refer to the instruction manual of each actuator or the section for pressing force and current limit in the appendix for the details. If the value is set to 0, the normal positioning operation is performed.
The speed for the pressing operation is set in Parameter No.7.
If the setting of 3) is lower than the pressing speed, the pressing process will be conducted with the speed of 3).

> ⚠ Caution: If the pressing speed is changed, the pressing force may differ from that specified in 7.3 List of Specifications of Connectable Actuators.
> When the pressing speed is changed, make sure to measure the actual pressing force before start using.

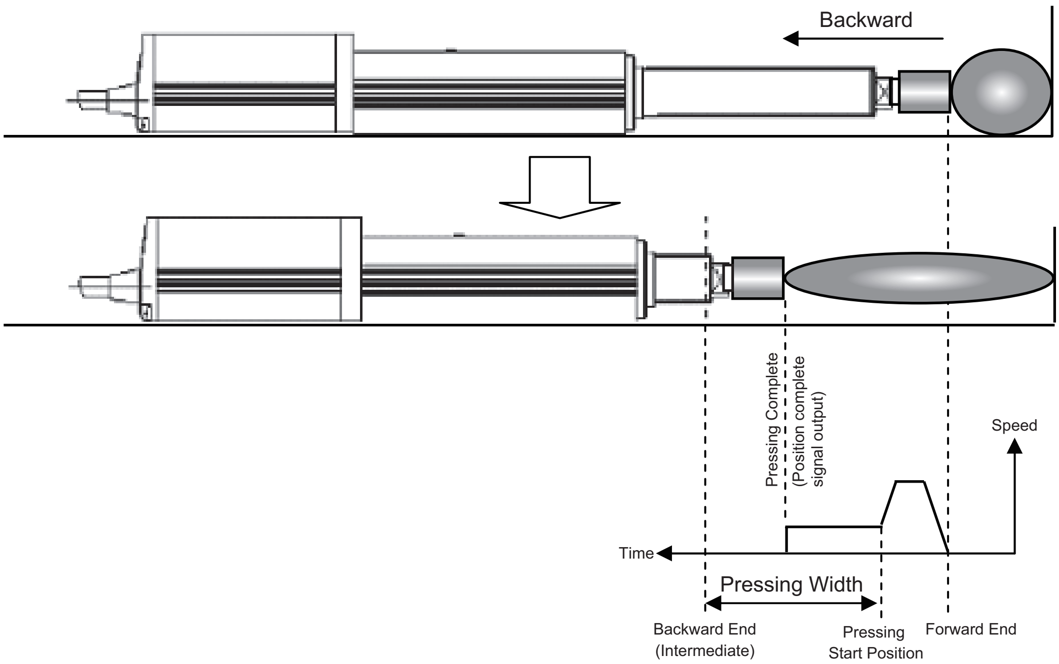
5) Pressing Width [mm] ···· Set the width for the pressing operation.
The amount of the pressing width in front of the movement target position (forward end and backward end) is the point to start pressing operation.



[Pressing towards Forward End or Intermediate Position]



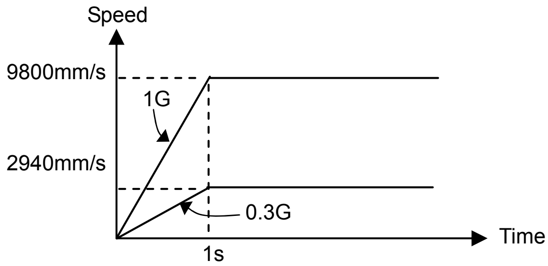
[Pressing towards Backward End or Intermediate Position = Pulling Action]



6) Acceleration [G]·········· Set the acceleration at operation.

7) Deceleration [G] ········· Set the deceleration at stop.

(Reference) How to set the acceleration is described below. The same idea can be applied to the deceleration.
1G=9800mm/s^2: Acceleration capable to accelerate up to 9800mm/s per second
0.3G: Acceleration capable to accelerate up to 9800mm/s × 0.3 = 2940mm/s per second



⚠ Caution: (1) Set the speed, acceleration and deceleration so that they do not exceed the rating values described in the brochure or the instruction manual of the actuator. The setting that exceeds the rated acceleration/deceleration speed may shorten the actuator life remarkably.
(2) Consider to lower the acceleration/deceleration speed when a shock or vibration is applied to the actuator or work. In such cases, do not continue the use of the actuator, otherwise the product life may be shortened extremely fast.
(3) For the gripper type, have the setting done for the speed and acceleration/deceleration in the basis of one finger. Therefore, note that the relative speed and acceleration/deceleration speed become twice as it is set for the two fingers.

8) Energy-Saving Setting ·· Set this to 1 (effective) and the servo is turned OFF automatically in a certain time after the positioning is completed for power saving. The time setting is to be conducted in Parameter No.10 Automatic Servo-OFF Delay Time, and the time setting can be selected from 1 to 9999 [sec.].

Setting	Operation after Positioning Complete	Parameter No.
0	Keep the servo ON	–
1	Automatic servo-OFF in a certain time	10

⚠ Caution: • No retaining torque is provided in automatic servo OFF. Pay sufficient attention to the setting because the actuator may be moved by external force applied to it.
• Do not use the automatic servo OFF in pressing. If used, the pressing force is lost.
• Automatic Servo OFF would not function in the operation with teaching mode of PC software.

[2] Additional Setting Items for Operation Pattern 1
Set the position and speed for the speed change as well as the position data.

Example for Position Table Setting

Position Name		9) Speed Change Position [mm]	10) Changed Speed [mm/s]
Backward End Position		60.00	Input changed speed
Forward End Position		40.00	Input changed speed

9) Speed Change Position [mm] ···· It is the coordinates to change the speed during the movement to the forward end or backward end, which the value is to be input from the home position.

10) Changed Speed [mm/s] ·········· Set the speed after change.

[3] Additional Setting Items for Operation Pattern 2
Forward End Position 2 and Backward End Position 2 after the target position change can be additionally set.

Example for Position Table Setting

1) Position Name	2) Position [mm]	3) Speed [mm/s]	4) Pressing Force [%]	5) Pressing Width [mm]	6) Acceleration [G]	7) Deceleration [G]	8) Energy-Saving Setting
Backward End Position 1	0.00	50.00	0	0.00	0.10	0.10	1
Forward End Position 1	200.00	50.00	70	30.00	0.10	0.10	0
11) Backward End Position 2	10.00	50.00	0	0.00	0.10	0.10	1
12) Forward End Position 2	100.00	50.00	60	10.00	0.10	0.10	0

11) 12) Backward End Position 2, Forward End Position 2
············· The target position changes as shown below depending on ON/OFF of the target position changeover signal (CN1).

	Target Position Change Signal (CN1)	
	ON	OFF
At movement towards forward end	Forward End Position 2	Forward End Position 1
At movement towards backward end	Backward End Position 2	Backward End Position 1

3.4 Fieldbus Type Address Map

3.4.1 PLC Address Construction by each Operation Mode

The PLC address domain to be occupied differs depending on the operation mode.
Refer to the example in Section 3.4.2 for the assignment. [Refer to 3.4.2 [5] for MSEP-LC]

• PLC Output → MSEP Input (n is PLC output top word address to MSEP) (Note 1)

<table>
<tr><th colspan="2">PLC Output Area</th><th>Simple Direct Mode</th><th>Positioner 1 Mode</th><th>Direct Indication Mode</th><th>Positioner 2 Mode</th><th>Positioner 3 Mode</th><th>SEP I/O Mode (Note 2)</th><th>Details</th></tr>
<tr><td rowspan="8">MSEP Gateway Control Area</td><td>n</td><td colspan="6">Gateway Control 0</td><td rowspan="2">3.4.3</td></tr>
<tr><td>n+1</td><td colspan="6">Gateway Control 1</td></tr>
<tr><td>n+2</td><td colspan="6">Demand Command</td><td rowspan="6">3.4.9</td></tr>
<tr><td>n+3</td><td colspan="6">Data 0</td></tr>
<tr><td>n+4</td><td colspan="6">Data 1</td></tr>
<tr><td>n+5</td><td colspan="6">Data 2</td></tr>
<tr><td>n+6</td><td colspan="6">Data 3</td></tr>
<tr><td>n+7</td><td colspan="6">Occupied Domain (Note 3)</td></tr>
<tr><td rowspan="10">Connected Axes Control Area</td><td>n+8</td><td rowspan="2">Target Position (Axis No.0)</td><td rowspan="2">Occupied Domain (Note 3)</td><td rowspan="2">Target Position (Axis No.0)</td><td>Specified Position No. (Axis No.0)</td><td>Control Signal/ Position No. (Axis No.0)</td><td rowspan="2">Each axis input port number 0 to 4 (Axis No.0 to 7)</td><td rowspan="10">3.4.4 to 3.4.8</td></tr>
<tr><td>n+9</td><td>Control Signal (Axis No.0)</td><td>Assignment Domain for Axis No.1</td></tr>
<tr><td>n+10</td><td>Specified Position No. (Axis No.0)</td><td>Specified Position No. (Axis No.0)</td><td rowspan="2">Positioning Width (Axis No.0)</td><td rowspan="2">Assignment Domain for Axis No.1</td><td rowspan="6">Assignment Domain for Axis No.2 to 7</td><td rowspan="8"></td></tr>
<tr><td>n+11</td><td>Control Signal (Axis No.0)</td><td>Control Signal (Axis No.0)</td></tr>
<tr><td>n+12</td><td rowspan="4">Assignment Domain for Axis No.1</td><td rowspan="2">Occupied Domain (Note 3)</td><td>Speed (Axis No.0)</td><td rowspan="6">Assignment Domain for Axis No.2 and later</td></tr>
<tr><td>n+13</td><td>Acceleration/ Deceleration (Axis No.0)</td></tr>
<tr><td>n+14</td><td rowspan="2">Assignment Domain for Axis No.1</td><td>Pressing Current Limit (Axis No.0)</td></tr>
<tr><td>n+15</td><td>Control Signal (Axis No.0)</td></tr>
<tr><td>n+16 to n+23</td><td rowspan="2">Assignment Domain for Axis No.2 and later</td><td rowspan="2">Assignment Domain for Axis No.2 and later</td><td>Assignment Domain for Axis No.1</td><td rowspan="2"></td></tr>
<tr><td>n+24 to n+71</td><td>Assignment Domain for Axis No.2 and later</td></tr>
</table>

Note 1 For CC-Link, n and n+1 are for input and output bit addresses, and n+8 is for the top address of data register.
Note 2 SEP I/O Mode occupies 10 words no matter how many axes are connected.
Note 3 This is the domain occupied unconditionally. Therefore, this domain cannot be used for any other purpose.

> ⚠ Caution:
> • The mode can be selected for each slot, however, SEP I/O Mode cannot used together with other modes.
> • For CompoNet, only Positioner 3 Mode and SEP I/O Mode are available for selection.
> • The construction of MSEP-LC differs from shown above. Refer to 3.4.2 [5] for MSEP-LC for detail.

• MSEP Output → PLC Input (n is PLC input top word address from MSEP) (Note 1)

<table>
<tr><th colspan="2">PLC Intput Area</th><th>Simple Direct Mode</th><th>Positioner 1 Mode</th><th>Direct Indication Mode</th><th>Positioner 2 Mode</th><th>Positioner 3 Mode</th><th>SEP I/O Mode (Note 2)</th><th>Details</th></tr>
<tr><td rowspan="8">MSEP Gateway Response Area</td><td>n</td><td colspan="6">Gateway Status 0</td><td rowspan="2">3.4.3</td></tr>
<tr><td>n+1</td><td colspan="6">Gateway Status 1</td></tr>
<tr><td>n+2</td><td colspan="6">Response Command</td><td rowspan="6">3.4.9</td></tr>
<tr><td>n+3</td><td colspan="6">Data 0</td></tr>
<tr><td>n+4</td><td colspan="6">Data 1</td></tr>
<tr><td>n+5</td><td colspan="6">Data 2</td></tr>
<tr><td>n+6</td><td colspan="6">Data 3</td></tr>
<tr><td>n+7</td><td colspan="6">Occupied Domain (Note 3)</td></tr>
<tr><td rowspan="10">Connected Axes Response Area</td><td>n+8</td><td colspan="2" rowspan="2">Current Position (Axis No.0)</td><td rowspan="2">Current Position (Axis No.0)</td><td>Completed Position No./ Simple Alarm ID (Axis No.0)</td><td>Status Signal/ Completed Position No. (Axis No.0)</td><td rowspan="2">Each axis output port number 0 to 4 (Axis No.0 to 7)</td><td rowspan="10">3.4.4 to 3.4.8</td></tr>
<tr><td>n+9</td><td>Status Signal (Axis No.0)</td><td>Assignment Domain for Axis No.1</td></tr>
<tr><td>n+10</td><td colspan="2">Completed Position No./ Simple Alarm ID (Axis No.0)</td><td rowspan="2">Command Current (Axis No.0)</td><td rowspan="2">Assignment Domain for Axis No.1</td><td rowspan="6">Assignment Domain for Axis No.2 to 7</td><td rowspan="8"></td></tr>
<tr><td>n+11</td><td colspan="2">Status Signal (Axis No.0)</td></tr>
<tr><td>n+12</td><td colspan="2" rowspan="4">Assignment Domain for Axis No.1</td><td>Current Speed (Axis No.0)</td><td rowspan="6">Assignment Domain for Axis No.2 and later</td></tr>
<tr><td>n+13</td><td>Occupied Domain (Axis No.0)</td></tr>
<tr><td>n+14</td><td>Alarm Code (Axis No.0)</td></tr>
<tr><td>n+15</td><td>Status Signal (Axis No.0)</td></tr>
<tr><td>n+16 to n+23</td><td colspan="2" rowspan="2">Assignment Domain for Axis No.2 and later</td><td>Assignment Domain for Axis No.1</td><td rowspan="2"></td></tr>
<tr><td>n+24 to n+71</td><td>Assignment Domain for Axis No.2 and later</td></tr>
</table>

Note 1 For CC-Link, n and n+1 are for input and output bit addresses, and n+8 is for the top address of data register.
Note 2 SEP I/O Mode occupies 10 words no matter how many axes are connected.
Note 3 This is the domain occupied unconditionally. Therefore, this domain cannot be used for any other purpose.

> ⚠ Caution:
> • The mode can be selected for each slot, however, SEP I/O Mode cannot used together with other modes.
> • For CompoNet, only Positioner 3 Mode and SEP I/O Mode are available for selection.
> • The construction of MSEP-LC differs from shown above. Refer to 3.4.2 [5] for MSEP-LC for detail.

3.4.2 Example for each Fieldbus Address Map

(Note)Refer to 3.4.2 [5] for MSEP-LC
Shown below is an example for the address map by the combination of operation modes for each Fieldbus.
Refer to it for the address assignment.
The examples for the address map constructions shown below are provided for each field network, however is described together (Note) for the networks of the same address assignment.

Note Order of address maps for each field network
1) DeviceNet and CompoNet (Note 1)
2) CC-Link
3) PROFIBUS, EtherNet/IP, EtherCAT
4) PROFNET-IO

Note 1 For CompoNet, only Positioner 3 Mode and SEP I/O Mode are available for selection.

◎ For CC-Link
Station Type and Extended Cyclic Setting/Occupied Station Number Settings:
Register the setting displayed on Gateway Parameter Setting Tool to the host. [Refer to 3.1.2 or 3.2.2 Initial Setting]
(Connection cannot be established with other ways)

⚠ Caution:
- If SEP I/O Mode is selected, all the axes connected to MSEP-C are involved in SEP I/O Mode.
- This controller is able to control 2 axes with one driver board (1 slot), however, different operation mode cannot be selected in the same driver board.
  Example Set the 1st axis in Slot 1 to Positioner 1 Mode and 2nd to Simple Direct Mode
- Even if only one axis is used in the two axes on the same slot, it requires the address space for 2 axes.

[1] Address Map with Combination of Simple Direct Mode and Direct Indication Mode

In the table below, shows the address map when eight axes of MSEP-C are operated with a combination of Simple Direct Mode and Direct Indication Mode in four types of construction for each Fieldbus as an example. [Refer to 3.4.2 [5] for MSEP-LC]

Combination Example	Number of Simple Direct Mode Axes	Number of Direct Indication Mode Axes
1	8	0
2	6	2
3	2	6
4	0	8

1) DeviceNet (CompoNet is not applicable for this mode)

[Combination Example 1] When number of Simple Direct Mode axes is 8 and number of Direct Indication Mode 0
(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15	Axis No.1 Control Information	n+12 to n+15	Axis No.1 Status Information
n+16 to n+19	Axis No.2 Control Information	n+16 to n+19	Axis No.2 Status Information
n+20 to n+23	Axis No.3 Control Information	n+20 to n+23	Axis No.3 Status Information
n+24 to n+27	Axis No.4 Control Information	n+24 to n+27	Axis No.4 Status Information
n+28 to n+31	Axis No.5 Control Information	n+28 to n+31	Axis No.5 Status Information
n+32 to n+35	Axis No.6 Control Information	n+32 to n+35	Axis No.6 Status Information
n+36 to n+39	Axis No.7 Control Information	n+36 to n+39	Axis No.7 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 2
(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15	Axis No.1 Control Information	n+12 to n+15	Axis No.1 Status Information
n+16 to n+19	Axis No.2 Control Information	n+16 to n+19	Axis No.2 Status Information
n+20 to n+23	Axis No.3 Control Information	n+20 to n+23	Axis No.3 Status Information
n+24 to n+27	Axis No.4 Control Information	n+24 to n+27	Axis No.4 Status Information
n+28 to n+31	Axis No.5 Control Information	n+28 to n+31	Axis No.5 Status Information
n+32 to n+35	Axis No.6 Control Information	n+32 to n+35	Axis No.6 Status Information
n+36 to n+39		n+36 to n+39	
n+40 to n+43	Axis No.7 Control Information	n+40 to n+43	Axis No.7 Status Information
n+44 to n+47		n+44 to n+47	

[Combination Example 3] When number of Simple Direct Mode axes is 2 and number of Direct Indication Mode 6
(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15	Axis No.1 Control Information	n+12 to n+15	Axis No.1 Status Information
n+16 to n+19	Axis No.2 Control Information	n+16 to n+19	Axis No.2 Status Information
n+20 to n+23		n+20 to n+23	
n+24 to n+27	Axis No.3 Control Information	n+24 to n+27	Axis No.3 Status Information
n+28 to n+31		n+28 to n+31	
n+32 to n+35	Axis No.4 Control Information	n+32 to n+35	Axis No.4 Status Information
n+36 to n+39		n+36 to n+39	
n+40 to n+43	Axis No.5 Control Information	n+40 to n+43	Axis No.5 Status Information
n+44 to n+47		n+44 to n+47	
n+48 to n+51	Axis No.6 Control Information	n+48 to n+51	Axis No.6 Status Information
n+52 to n+55		n+52 to n+55	
n+56 to n+59	Axis No.7 Control Information	n+56 to n+59	Axis No.7 Status Information
n+60 to n+63		n+60 to n+63	

[Combination Example 4] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 8
(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+11	Axis No.0 Control Information	n+8 to n+11	Axis No.0 Status Information
n+12 to n+15		n+12 to n+15	
n+16 to n+19	Axis No.1 Control Information	n+16 to n+19	Axis No.1 Status Information
n+20 to n+23		n+20 to n+23	
n+24 to n+27	Axis No.2 Control Information	n+24 to n+27	Axis No.2 Status Information
n+28 to n+31		n+28 to n+31	
n+32 to n+35	Axis No.3 Control Information	n+32 to n+35	Axis No.3 Status Information
n+36 to n+39		n+36 to n+39	
n+40 to n+43	Axis No.4 Control Information	n+40 to n+43	Axis No.4 Status Information
n+44 to n+47		n+44 to n+47	
n+48 to n+51	Axis No.5 Control Information	n+48 to n+51	Axis No.5 Status Information
n+52 to n+55		n+52 to n+55	
n+56 to n+59	Axis No.6 Control Information	n+56 to n+59	Axis No.6 Status Information
n+60 to n+63		n+60 to n+63	
n+64 to n+67	Axis No.7 Control Information	n+64 to n+67	Axis No.7 Status Information
n+68 to n+71		n+68 to n+71	

2) CC-Link

[Combination Example 1] When number of Simple Direct Mode axes is 8 and number of Direct Indication Mode 0
(Extended Cyclic Setting/Number of Occupied Stations: 4 times/2 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Cannot be used.	RX 70 to 7F	Cannot be used.
RY 80 to BF	Cannot be used.	RX 80 to BF	Cannot be used.
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07	Axis No.1 Control Information	RWr 04 to 07	Axis No.1 Status Information
RWw 08 to 0B	Axis No.2 Control Information	RWr 08 to 0B	Axis No.2 Status Information
RWw 0C to 0F	Axis No.3 Control Information	RWr 0C to 0F	Axis No.3 Status Information
RWw 10 to 13	Axis No.4 Control Information	RWr 10 to 13	Axis No.4 Status Information
RWw 14 to 17	Axis No.5 Control Information	RWr 14 to 17	Axis No.5 Status Information
RWw 18 to 1B	Axis No.6 Control Information	RWr 18 to 1B	Axis No.6 Status Information
RWw 1C to 1F	Axis No.7 Control Information	RWr 1C to 1F	Axis No.7 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 2
(Extended Cyclic Setting/Number of Occupied Stations: 8 times/2 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 000 to 01F	Gateway Control	RX 000 to 01F	Gateway Status
RY 020 to 06F	Demand Command	RX 020 to 06F	Response Command
RY 070 to 07F	Cannot be used.	RX 070 to 07F	Cannot be used.
RY 080 to 17F	Cannot be used.	RX 080 to 17F	Cannot be used.
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07	Axis No.1 Control Information	RWr 04 to 07	Axis No.1 Status Information
RWw 08 to 0B	Axis No.2 Control Information	RWr 08 to 0B	Axis No.2 Status Information
RWw 0C to 0F	Axis No.3 Control Information	RWr 0C to 0F	Axis No.3 Status Information
RWw 10 to 13	Axis No.4 Control Information	RWr 10 to 13	Axis No.4 Status Information
RWw 14 to 17	Axis No.5 Control Information	RWr 14 to 17	Axis No.5 Status Information
RWw 18 to 1B	Axis No.6 Control Information	RWr 18 to 1B	Axis No.6 Status Information
RWw 1C to 1F		RWr 1C to 1F	
RWw 20 to 23	Axis No.7 Control Information	RWr 20 to 23	Axis No.7 Status Information
RWw 24 to 27		RWr 24 to 27	
RWw 28 to 2B	Cannot be used.	RWr 28 to 2B	Cannot be used.
RWw 2C to 2F	Cannot be used.	RWr 2C to 2F	Cannot be used.
RWw 30 to 33	Cannot be used.	RWr 30 to 33	Cannot be used.
RWw 34 to 37	Cannot be used.	RWr 34 to 37	Cannot be used.
RWw 38 to 3B	Cannot be used.	RWr 38 to 3B	Cannot be used.
RWw 3C to 3F	Cannot be used.	RWr 3C to 3F	Cannot be used.

[Combination Example 3] When number of Simple Direct Mode axes is 2 and number of Direct Indication Mode 6
(Extended Cyclic Setting/Number of Occupied Stations: 8 times/2 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 000 to 01F	Gateway Control	RX 000 to 01F	Gateway Status
RY 020 to 06F	Demand Command	RX 020 to 06F	Response Command
RY 070 to 07F	Cannot be used.	RX 070 to 07F	Cannot be used.
RY 080 to 17F	Cannot be used.	RX 080 to 17F	Cannot be used.
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07	Axis No.1 Control Information	RWr 04 to 07	Axis No.1 Status Information
RWw 08 to 0B	Axis No.2 Control Information	RWr 08 to 0B	Axis No.2 Status Information
RWw 0C to 0F		RWr 0C to 0F	
RWw 10 to 13	Axis No.3 Control Information	RWr 10 to 13	Axis No.3 Status Information
RWw 14 to 17		RWr 14 to 17	
RWw 18 to 1B	Axis No.4 Control Information	RWr 18 to 1B	Axis No.4 Status Information
RWw 1C to 1F		RWr 1C to 1F	
RWw 20 to 23	Axis No.5 Control Information	RWr 20 to 23	Axis No.5 Status Information
RWw 24 to 27		RWr 24 to 27	
RWw 28 to 2B	Axis No.6 Control Information	RWr 28 to 2B	Axis No.6 Status Information
RWw 2C to 2F		RWr 2C to 2F	
RWw 30 to 33	Axis No.7 Control Information	RWr 30 to 33	Axis No.7 Status Information
RWw 34 to 37		RWr 34 to 37	
RWw 38 to 3B	Cannot be used.	RWr 38 to 3B	Cannot be used.
RWw 3C to 3F	Cannot be used.	RWr 3C to 3F	Cannot be used.

[Combination Example 4] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 8
(Extended Cyclic Setting/Number of Occupied Stations: 8 times/2 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 000 to 01F	Gateway Control	RX 000 to 01F	Gateway Status
RY 020 to 06F	Demand Command	RX 020 to 06F	Response Command
RY 070 to 07F	Cannot be used.	RX 070 to 07F	Cannot be used.
RY 080 to 17F	Cannot be used.	RX 080 to 17F	Cannot be used.
RWw 00 to 03	Axis No.0 Control Information	RWr 00 to 03	Axis No.0 Status Information
RWw 04 to 07		RWr 04 to 07	
RWw 08 to 0B	Axis No.1 Control Information	RWr 08 to 0B	Axis No.1 Status Information
RWw 0C to 0F		RWr 0C to 0F	
RWw 10 to 13	Axis No.2 Control Information	RWr 10 to 13	Axis No.2 Status Information
RWw 14 to 17		RWr 14 to 17	
RWw 18 to 1B	Axis No.3 Control Information	RWr 18 to 1B	Axis No.3 Status Information
RWw 1C to 1F		RWr 1C to 1F	
RWw 20 to 23	Axis No.4 Control Information	RWr 20 to 23	Axis No.4 Status Information
RWw 24 to 27		RWr 24 to 27	
RWw 28 to 2B	Axis No.5 Control Information	RWr 28 to 2B	Axis No.5 Status Information
RWw 2C to 2F		RWr 2C to 2F	
RWw 30 to 33	Axis No.6 Control Information	RWr 30 to 33	Axis No.6 Status Information
RWw 34 to 37		RWr 34 to 37	
RWw 38 to 3B	Axis No.7 Control Information	RWr 38 to 3B	Axis No.7 Status Information
RWw 3C to 3F		RWr 3C to 3F	

3) PROFIBUS-DP, EtherNet/IP, EtherCAT

[Combination Example 1] When number of Simple Direct Mode axes is 8 and number of Direct Indication Mode 0
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31	Axis No.1 Control Information	n+24 to n+31	Axis No.1 Status Information
n+32 to n+39	Axis No.2 Control Information	n+32 to n+39	Axis No.2 Status Information
n+40 to n+47	Axis No.3 Control Information	n+40 to n+47	Axis No.3 Status Information
n+48 to n+55	Axis No.4 Control Information	n+48 to n+55	Axis No.4 Status Information
n+56 to n+63	Axis No.5 Control Information	n+56 to n+63	Axis No.5 Status Information
n+64 to n+71	Axis No.6 Control Information	n+64 to n+71	Axis No.6 Status Information
n+72 to n+79	Axis No.7 Control Information	n+72 to n+79	Axis No.7 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 2
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31	Axis No.1 Control Information	n+24 to n+31	Axis No.1 Status Information
n+32 to n+39	Axis No.2 Control Information	n+32 to n+39	Axis No.2 Status Information
n+40 to n+47	Axis No.3 Control Information	n+40 to n+47	Axis No.3 Status Information
n+48 to n+55	Axis No.4 Control Information	n+48 to n+55	Axis No.4 Status Information
n+56 to n+63	Axis No.5 Control Information	n+56 to n+63	Axis No.5 Status Information
n+64 to n+71	Axis No.6 Control Information	n+64 to n+71	Axis No.6 Status Information
n+72 to n+79		n+72 to n+79	
n+80 to n+87	Axis No.7 Control Information	n+80 to n+87	Axis No.7 Status Information
n+88 to n+95		n+88 to n+95	

[Combination Example 3] When number of Simple Direct Mode axes is 2 and number of Direct Indication Mode 6
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31	Axis No.1 Control Information	n+24 to n+31	Axis No.1 Status Information
n+32 to n+39	Axis No.2 Control Information	n+32 to n+39	Axis No.2 Status Information
n+40 to n+47		n+40 to n+47	
n+48 to n+55	Axis No.3 Control Information	n+48 to n+55	Axis No.3 Status Information
n+56 to n+63		n+56 to n+63	
n+64 to n+71	Axis No.4 Control Information	n+64 to n+71	Axis No.4 Status Information
n+72 to n+79		n+72 to n+79	
n+80 to n+87	Axis No.5 Control Information	n+80 to n+87	Axis No.5 Status Information
n+88 to n+95		n+88 to n+95	
n+96 to n+103	Axis No.6 Control Information	n+96 to n+103	Axis No.6 Status Information
n+104 to n+111		n+104 to n+111	
n+112 to n+119	Axis No.7 Control Information	n+112 to n+119	Axis No.7 Status Information
n+120 to n+127		n+120 to n+127	

[Combination Example 4] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 8
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+23	Axis No.0 Control Information	n+16 to n+23	Axis No.0 Status Information
n+24 to n+31		n+24 to n+31	
n+32 to n+39	Axis No.1 Control Information	n+32 to n+39	Axis No.1 Status Information
n+40 to n+47		n+40 to n+47	
n+48 to n+55	Axis No.2 Control Information	n+48 to n+55	Axis No.2 Status Information
n+56 to n+63		n+56 to n+63	
n+64 to n+71	Axis No.3 Control Information	n+64 to n+71	Axis No.3 Status Information
n+72 to n+79		n+72 to n+79	
n+80 to n+87	Axis No.4 Control Information	n+80 to n+87	Axis No.4 Status Information
n+88 to n+95		n+88 to n+95	
n+96 to n+103	Axis No.5 Control Information	n+96 to n+103	Axis No.5 Status Information
n+104 to n+111		n+104 to n+111	
n+112 to n+119	Axis No.6 Control Information	n+112 to n+119	Axis No.6 Status Information
n+120 to n+127		n+120 to n+127	
n+128 to n+135	Axis No.7 Control Information	n+128 to n+135	Axis No.7 Status Information
n+136 to n+143		n+136 to n+143	

4) PROFINET-IO

[Combination Example 1] When number of Simple Direct Mode axes is 8 and number of Direct Indication Mode 0

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
4	Axis No.1 Control Information	4	Axis No.1 Status Information
5	Axis No.2 Control Information	5	Axis No.2 Status Information
6	Axis No.3 Control Information	6	Axis No.3 Status Information
7	Axis No.4 Control Information	7	Axis No.4 Status Information
8	Axis No.5 Control Information	8	Axis No.5 Status Information
9	Axis No.6 Control Information	9	Axis No.6 Status Information
10	Axis No.7 Control Information	10	Axis No.7 Status Information

[Combination Example 2] When number of Simple Direct Mode axes is 6 and number of Direct Indication Mode 2

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
4	Axis No.1 Control Information	4	Axis No.1 Status Information
5	Axis No.2 Control Information	5	Axis No.2 Status Information
6	Axis No.3 Control Information	6	Axis No.3 Status Information
7	Axis No.4 Control Information	7	Axis No.4 Status Information
8	Axis No.5 Control Information	8	Axis No.5 Status Information
9	Axis No.6 Control Information	9	Axis No.6 Status Information
10		10	
11	Axis No.7 Control Information	11	Axis No.7 Status Information
12		12	

[Combination Example 3] When number of Simple Direct Mode axes is 2 and number of Direct Indication Mode 6

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
4	Axis No.1 Control Information	4	Axis No.1 Status Information
5	Axis No.2 Control Information	5	Axis No.2 Status Information
6		6	
7	Axis No.3 Control Information	7	Axis No.3 Status Information
8		8	
9	Axis No.4 Control Information	9	Axis No.4 Status Information
10		10	
11	Axis No.5 Control Information	11	Axis No.5 Status Information
12		12	
13	Axis No.6 Control Information	13	Axis No.6 Status Information
14		14	
15	Axis No.7 Control Information	15	Axis No.7 Status Information
16		16	

[Combination Example 4] When number of Simple Direct Mode axes is 0 and number of Direct Indication Mode 8

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
4		4	
5	Axis No.1 Control Information	5	Axis No.1 Status Information
6		6	
7	Axis No.2 Control Information	7	Axis No.2 Status Information
8		8	
9	Axis No.3 Control Information	9	Axis No.3 Status Information
10		10	
11	Axis No.4 Control Information	11	Axis No.4 Status Information
12		12	
13	Axis No.5 Control Information	13	Axis No.5 Status Information
14		14	
15	Axis No.6 Control Information	15	Axis No.6 Status Information
16		16	
17	Axis No.7 Control Information	17	Axis No.7 Status Information
18		18	

[2] Address Map for Positioner 2 Mode

Shown below is the address map for each Fieldbus when eight axes of MSEP-C are operated in Positioner 2 Mode. [Refer to 3.4.2 [5] for MSEP-LC]

1) DeviceNet (CompoNet is not applicable for this mode)
(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8 to n+9	Axis No.0 Control Information	n+8 to n+9	Axis No.0 Status Information
n+10 to n+11	Axis No.1 Control Information	n+10 to n+11	Axis No.1 Status Information
n+12 to n+13	Axis No.2 Control Information	n+12 to n+13	Axis No.2 Status Information
n+14 to n+15	Axis No.3 Control Information	n+14 to n+15	Axis No.3 Status Information
n+16 to n+17	Axis No.4 Control Information	n+16 to n+17	Axis No.4 Status Information
n+18 to n+19	Axis No.5 Control Information	n+18 to n+19	Axis No.5 Status Information
n+20 to n+21	Axis No.6 Control Information	n+20 to n+21	Axis No.6 Status Information
n+22 to n+23	Axis No.7 Control Information	n+22 to n+23	Axis No.7 Status Information

2) CC-Link
(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Cannot be used.	RX 70 to 7F	Cannot be used.
RWw 00 to 01	Axis No.0 Control Information	RWr 00 to 01	Axis No.0 Status Information
RWw 02 to 03	Axis No.1 Control Information	RWr 02 to 03	Axis No.1 Status Information
RWw 04 to 05	Axis No.2 Control Information	RWr 04 to 05	Axis No.2 Status Information
RWw 06 to 07	Axis No.3 Control Information	RWr 06 to 07	Axis No.3 Status Information
RWw 08 to 09	Axis No.4 Control Information	RWr 08 to 09	Axis No.4 Status Information
RWw 0A to 0B	Axis No.5 Control Information	RWr 0A to 0B	Axis No.5 Status Information
RWw 0C to 0D	Axis No.6 Control Information	RWr 0C to 0D	Axis No.6 Status Information
RWw 0E to 0F	Axis No.7 Control Information	RWr 0E to 0F	Axis No.7 Status Information

3) PROFIBUS-DP, EtherNet/IP, EtherCAT
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+19	Axis No.0 Control Information	n+16 to n+19	Axis No.0 Status Information
n+20 to n+23	Axis No.1 Control Information	n+20 to n+23	Axis No.1 Status Information
n+24 to n+27	Axis No.2 Control Information	n+24 to n+27	Axis No.2 Status Information
n+28 to n+31	Axis No.3 Control Information	n+28 to n+31	Axis No.3 Status Information
n+32 to n+35	Axis No.4 Control Information	n+32 to n+35	Axis No.4 Status Information
n+36 to n+39	Axis No.5 Control Information	n+36 to n+39	Axis No.5 Status Information
n+40 to n+43	Axis No.6 Control Information	n+40 to n+43	Axis No.6 Status Information
n+44 to n+47	Axis No.7 Control Information	n+44 to n+47	Axis No.7 Status Information

4) PROFINET-IO

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
	Axis No.1 Control Information		Axis No.1 Status Information
4	Axis No.2 Control Information	4	Axis No.2 Status Information
	Axis No.3 Control Information		Axis No.3 Status Information
5	Axis No.4 Control Information	5	Axis No.4 Status Information
	Axis No.5 Control Information		Axis No.5 Status Information
6	Axis No.6 Control Information	6	Axis No.6 Status Information
	Axis No.7 Control Information		Axis No.7 Status Information

[3] Address Map for Positioner 3 Mode

Shown below is the address map for each Fieldbus when eight axes of MSEP-C are operated in Positioner 3 Mode. [Refer to 3.4.2 [5] for MSEP-LC]

1) DeviceNet, CompoNet

(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8	Axis No.0 Control Information	n+8	Axis No.0 Status Information
n+9	Axis No.1 Control Information	n+9	Axis No.1 Status Information
n+10	Axis No.2 Control Information	n+10	Axis No.2 Status Information
n+11	Axis No.3 Control Information	n+11	Axis No.3 Status Information
n+12	Axis No.4 Control Information	n+12	Axis No.4 Status Information
n+13	Axis No.5 Control Information	n+13	Axis No.5 Status Information
n+14	Axis No.6 Control Information	n+14	Axis No.6 Status Information
n+15	Axis No.7 Control Information	n+15	Axis No.7 Status Information

2) CC-Link

(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Cannot be used.	RX 70 to 7F	Cannot be used.
RWw 0	Axis No.0 Control Information	RWr 00	Axis No.0 Status Information
RWw 01	Axis No.1 Control Information	RWr 01	Axis No.1 Status Information
RWw 02	Axis No.2 Control Information	RWr 02	Axis No.2 Status Information
RWw 03	Axis No.3 Control Information	RW 03	Axis No.3 Status Information
RWw 04	Axis No.4 Control Information	RWr 04	Axis No.4 Status Information
RWw 05	Axis No.5 Control Information	RWr 05	Axis No.5 Status Information
RWw 06	Axis No.6 Control Information	RWr 06	Axis No.6 Status Information
RWw 07	Axis No.7 Control Information	RW 07	Axis No.7 Status Information
RWw 08 to 0F	Cannot be used.	RWr 08 to 0F	Cannot be used.

3) PROFIBUS-DP, EtherNet/IP, EtherCAT
(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16, n+17	Axis No.0 Control Information	n+16, n+17	Axis No.0 Status Information
n+18, n+19	Axis No.1 Control Information	n+18, n+19	Axis No.1 Status Information
n+20, n+21	Axis No.2 Control Information	n+20, n+21	Axis No.2 Status Information
n+22, n+23	Axis No.3 Control Information	n+22, n+23	Axis No.3 Status Information
n+24, n+25	Axis No.4 Control Information	n+24, n+25	Axis No.4 Status Information
n+26, n+27	Axis No.5 Control Information	n+26, n+27	Axis No.5 Status Information
n+28, n+29	Axis No.6 Control Information	n+28, n+29	Axis No.6 Status Information
n+30, n+31	Axis No.7 Control Information	n+30, n+31	Axis No.7 Status Information

4) PROFINET-IO

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No.0 Control Information	3	Axis No.0 Status Information
	Axis No.1 Control Information		Axis No.1 Status Information
	Axis No.2 Control Information		Axis No.2 Status Information
	Axis No.3 Control Information		Axis No.3 Status Information
4	Axis No.4 Control Information	4	Axis No.4 Status Information
	Axis No.5 Control Information		Axis No.5 Status Information
	Axis No.6 Control Information		Axis No.6 Status Information
	Axis No.7 Control Information		Axis No.7 Status Information

[4] Address Map for SEP I/O Mode

Shown below is the address map for each Fieldbus when eight axes of MSEP-C are operated in SEP I/O Mode. [This mode connot be used in MSEP-LC.]

1) DeviceNet, CompoNet

(n is the top channel number for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
CH No.	Description	CH No.	Description
n to n+1	Gateway Control	n to n+1	Gateway Status
n+2 to n+7	Demand Command	n+2 to n+7	Response Command
n+8	Axis No.0 to 7 Control Information	n+8	Axis No.0 to 7 Status Information

2) CC-Link

(Extended Cyclic Setting/Number of Occupied Stations: 1 times/4 stations)

PLC → MSEP		MSEP → PLC	
Address	Description	Address	Description
RY 00 to 1F	Gateway Control	RX 00 to 1F	Gateway Status
RY 20 to 6F	Demand Command	RX 20 to 6F	Response Command
RY 70 to 7F	Cannot be used.	RX 70 to 7F	Cannot be used.
RWw 00	Axis No.0 to 7 Control Information	RWr 00	Axis No.0 to 7 Status Information
RWw 01 to 0F	Cannot be used.	RWr 01 to 0F	Cannot be used.

3) PROFIBUS-DP, EtherNet/IP, EtherCAT

(n is the top node address for each PLC input and output between MSEP and PLC)

PLC → MSEP		MSEP → PLC	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+3	Gateway Control	n to n+3	Gateway Status
n+4 to n+15	Demand Command	n+4 to n+15	Response Command
n+16 to n+19	Axis No.0 to 7 Control Information	n+16 to n+19	Axis No.0 to 7 Status Information

4) PROFINET-IO

PLC → MSEP		MSEP → PLC	
4-word Number of Module	Description	4-word Number of Module	Description
1	Gateway Control, Demand Command, Data 0	1	Gateway Status, Response Command, Data 0
2	Data 1 to 3	2	Data 1 to 3
3	Axis No. 0 to 7 Control Information (for first 2 words) (Note) The last 2 words cannot be used	3	Axis No. 0 to 7 Status Information (for first 2 words) (Note) The last 2 words cannot be used

[5] Address Assignment for MSEP-LC

4 words of each input and output can be occupied in the fieldbus domain in 1 unit of MSEP-LC. (For CC-Link, it should be fixed at 1 time for 1 station of the remote device stations)

As the input and output domain assigned in the fieldbus is for general purpose, assign necessary signals in the sequence program.

• Master Unit ⇔ MSEP-LC (n is the top word address of PLC output to MSEP)

		Simple Direct Mode	Positioner 1 Mode	Direct Indication Mode	Positioner 2 Mode	Positioner 3 Mode
Input Area	n	General-Purposed Input				
	n+1	General-Purposed Input				
	n+2	General-Purposed Input				
	n+3	General-Purposed Input				
Output Area	n+4	General-Purposed Output				
	n+5	General-Purposed Output				
	n+6	General-Purposed Output				
	n+7	General-Purposed Output				

1) DeviceNet, CompoNet
(n is the top channel number for every host controller input and output between MSEP and the master unit)

Master Unit → MSEP-LC		MSEP-LC → Master Unit	
CH No.	Description	CH No.	Description
n	General-Purposed Input	n	General-Purposed Output
n+1	General-Purposed Input	n+1	General-Purposed Output
n+2	General-Purposed Input	n+2	General-Purposed Output
n+3	General-Purposed Input	n+3	General-Purposed Output

2) CC-Link
(Extended cyclic setting / number of occupied stations: 1 time / 1 station)

Master Unit → MSEP-LC		MSEP-LC → Master Unit	
Address	Description	Address	Description
RY 00 to 0F	General-Purposed Input	RX 00 to 0F	General-Purposed Output
RY 10 to 1F	Cannot be used.	RX 10 to 1F	Cannot be used.
RWw 00	General-Purposed Input	RWr 00	General-Purposed Output
RWw 01	General-Purposed Input	RWr 01	General-Purposed Output
RWw 02	General-Purposed Input	RWr 02	General-Purposed Output
RWw 03	General-Purposed Input	RWr 03	General-Purposed Output

3) PROFIBUS-DP, EtherNet/IP, EtherCAT
(n is the top node address for every host controller input and output between MSEP and the master unit)

Master Unit → MSEP-LC		MSEP-LC → Master Unit	
Node Address (Byte Address)	Description	Node Address (Byte Address)	Description
n to n+1	General-Purposed Input	N to n+1	General-Purposed Output
n+2 to +3	General-Purposed Input	n+2 to n+3	General-Purposed Output
n+4, n+5	General-Purposed Input	n+4, n+5	General-Purposed Output
n+6, n+7	General-Purposed Input	n+6, n+7	General-Purposed Output

4) PROFINET-IO

Master Unit → MSEP-LC		MSEP-LC → Master Unit	
4-word Number of Module	Description	4-word Number of Module	Description
1	General-Purposed Input	1	General-Purposed Output
	General-Purposed Input		General-Purposed Output
	General-Purposed Input		General-Purposed Output
	General-Purposed Input		General-Purposed Output

3.4.3 Gateway Control Signals (in common for all operation modes for MSEP-C)

When operating the system with Fieldbus, the axes are controlled via Gateway of MSEP. The top 2 words of input and output in each operation mode are the signals Gateway control and status monitoring.

(n is the top word address for each PLC input and output between MSEP and PLC)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Control Signal 0	n	Status Signal 0	n
Control Signal 1	n+1	Status Signal 1	n+1

(1) PLC I/O Signal

PLC Output

1 word = 16 bit

Address n

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 0	MON	–	RTE	–	–	–	–	–	–	–	–	–	–	–	–	–

RTE: Signal to cancel the remained condition of communication error (ERR-T/ERR-C) during an operation

MON: Signal to activate operation control by communication

Address n+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

PLC Input

1 word = 16 bit

Address n

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 0	RUN	LERC	ERRT	MOD	ALMH	ALML	–	SEMG	ALMC 128	ALMC64	ALMC32	ALMC16	ALMC8	ALMC4	ALMC2	ALMC1

b15–b0: Each type of control status monitoring output signals

Address n+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 1	MNT7	MNT6	MNT5	MNT4	MNT3	MNT2	MNT1	MNT0	LNK7	LNK6	LNK5	LNK4	LNK3	LNK2	LNK1	LNK0

b15–b8: Output of alarm-issued axis number

b7–b0: Output of communication available axis number

(2) List for Input and Output Signal

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Output	Control signal 0	b15	MON	Operation control with communication is available while it is ON	–
		b14	–	Cannot be used.	–
		b13	RTE	Retained condition of ERR-T or ERR-C during an operation is cancelled if it is ON It is the cancel signal when ERR-T or ERR-C occurrence is set to latch in Gateway Parameter Setting Tool	–
		b12	–	Cannot be used.	–
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			
	Control signal 1	b15	–	Cannot be used.	–
		b14			
		b13			
		b12			
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Description	Details
PLC Input	Control signal 0	b15	RUN	This signal turns ON when Gateway is in normal operation.	–
		b14	LERC	This signal turns ON if the ERR-T or ERR-C occurred during an operation is retained and turns OFF if cancel signal RTE is turn ON. It is effective when ERR-T or ERR-C occurrence is set to latch in Gateway Parameter Setting Tool.	–
		b13	ERRT	This signal turns ON when a communication error is detected between the Gateway and each axis.	–
		b12	MOD	This signal turns ON if the operation mode switch on the front of the unit is selected to be on MANU side, and turns OFF if on AUTO side.	–
		b11	ALMH	This signal turns ON when an error caused by the Gateway that requires a reboot is occurred. (A wrong setting in the parameters can be considered. Check the parameters settings.)	–
		b10	ALML	This signal turns ON when a light error caused by the Gateway is occurred. (It is considered that there shall be a loss of the calendar data. Check the parameters settings.)	–
		b9	–	Cannot be used.	–
		b8	SEMG	This signal turns ON when EMGIN input of the system I/O connector is OFF (emergency stop). When this bit is turned ON, all the connected axes get in the emergency stop.	–
		b7	ALMC1 to 128	It is an output of an alarm code caused by the Gateway. [Refer to Gateway alarm codes in Chapter 6. Troubleshooting for details.]	–
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			
	Control signal 1	b15	MNT7	The bit of an axis number that a light error alarm is generated turns ON. Axis No.0 = MNT0 to Axis No.7 = MNT7	–
		b14	MNT6		
		b13	MNT5		
		b12	MNT4		
		b11	MNT3		
		b10	MNT2		
		b9	MNT1		
		b8	MNT0		
		b7	LNK7	The bit of the axis number identified as effective by the Gateway turns ON. Axis No.0 = LNK0 to Axis No.7 = LNK7	–
		b6	LNK6		
		b5	LNK5		
		b4	LNK4		
		b3	LNK3		
		b2	LNK2		
		b1	LNK1		
		b0	LNK0		

3.4.4 Control Signals for Positioner 1/Simple Direct Mode

⚠ Caution: This mode is not applicable for CompoNet.

To select the mode, use Gateway Parameter Setting Tool. All the modes can be used only by indicating a position number.

Positioner 1 Mode : Operation is performed by indicating a position number from the operation modes of the position data set in the position table.
Simple Direct Mode : This is a mode to operate with inputting the target position for positioning directly. Except for the target position, the operation follows the position data set in the indicated position number.

The settable No. of position data items is max 256 points.
The main functions of ROBO Cylinder capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled		Remarks
	Positioner 1 Mode	Simple Direct Mode	
Home-return operation	○		
Positioning operation	△	○	Positioner 1 Mode : These items must be set in the position data table. Simple Direct Mode : For those other than the target position, it is necessary to set the position data.
Speed and acceleration/ deceleration setting	△		These items must be set in the position data table.
Pitch feed (incremental)	△		These items must be set in the parameters.
Pressing operation	△		These items must be set in the position data table.
Speed change during movement	△		
Operation at different acceleration and deceleration	△		
Pause	○		
Zone signal output	△		Zones are set using parameters.
PIO pattern selection	×		

(1) PLC Address Composition
(m is PLC input and output top word address for each axis number)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Target Position (Note 1)	m to m+1	Current Position	m to m+1
Specified Position No.	m+2	Completed Position No. (Simple Alarm Code)	m+2
Control Signal	m+3	Status Signal	m+3

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

Note 1 For Positioner 1 Mode, it is unnecessary to indicate the target position with a value. It will be disregarded even if written in.

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 4-word for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.

> ⚠ Caution:
> • Set the position data in the range of the soft stroke (0 to effective stroke length) of the actuator.
> • It is not necessary to have this setting done for Positioner 1 Mode.

- For the indicated position number and complete position number, 1-word (16-bit) binary data is available and values from 0 to 255 can be used.

> ⚠ Caution:
> Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word = 16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified Position No.	–	–	–	–	–	–	–	–	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	–	–	–	–	–	–	JOG+	JOG-	–	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number)

1 word = 16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two’s complement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	–	–	–	–	–	–	–	–	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE1	ZONE2	–	–	–	MEND	ALML	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Output	Target Position	32 bits Data	–	32-bit signed integer indicating the current position Unit: 0.01mm Available range for Setting: -999999 to 999999 Set the target position with the value from the home position. (Example) If +25.40mm, input $000009EC_H$ (2540 in decimal system). (Note) Input the negative value using a compliment of 2.	3.8.1 (21)
	Specified Position No.	16 bits Data	PC1 to PC128	16-bit integer Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 “Position Data Error”.	3.8.1 (21)
	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.8.1 [15]
		b14	–	Cannot be used.	–
		b13			
		b12			
		b11			
		b10			
		b9			
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.8.1 [12]
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	–	Cannot be used.	–
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.8.1 [14]
		b4	SON	Servo ON command ON: Servo ON, OFF: Servo OFF	3.8.1 [5]
		b3	RES	Reset A reset is performed when this signal turns ON.	3.8.1 [4]
		b2	STP	Pause ON: Pause, OFF: Pause release	3.8.1 [10]
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [6]
		b0	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [7]

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Input	Current Position	32 bits	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If +10.23mm, input 000003FF$_H$ (1023 in decimal system). (Note) Negative numbers are two’s implement.	3.8.1 (21)
	Completed Position No. (Simple Alarm Code)	16 bits	PM1 to PM128	16-bit integer The positioning complete position number is output in a binary number once getting into the positioning width after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, “0” is output. Read it by turning PEND Signal ON after movement. The simple alarm code (refer to Chapter 6 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.8.1 (21)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.8.1 [2]
		b14	CRDY	This signal turns ON when the controller is standing by.	3.8.1 [1]
		b13	ZONE2	“ON” for the current position within the zone 2 set range The zone range setting is necessary for the parameter.	3.8.1 [11]
		b12	ZONE1	“ON” for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	
		b11	–	Cannot be used.	–
		b10			
		b9			
		b8	MEND	This signal turns ON at either of positioning complete, home return complete, pressing complete or pressing failure, and turns OFF at movement start. It is OFF before movement.	3.8.1 [19]
		b7	ALML	Light error alarm output It turns ON when a message level error is issued.	3.8.1 [20]
		b6	–	Cannot be used.	–
		b5	PSFL	“ON” for pressing and a miss	3.8.1 [18]
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.8.1 [5]
		b3	ALM	This signal is ON while an alarm is generated.	3.8.1 [3]
		b2	MOVE	This signal is ON while in movement.	3.8.1 [8]
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.8.1 [6]
		b0	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.8.1 [9]

3.4.5 Control Signals for Direct Indication Mode

⚠ Caution: This mode is not applicable for CompoNet.

This is an operation mode to indicate directly with values for the target position, positioning width, speed, acceleration/deceleration and pressing current.
Set a value to each input and output data register. Set to the parameters when using the zone signals.
The main functions of ROBO Cylinder capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/ deceleration setting	○	
Pitch feed (inching)	○	
Pressing operation	○	Selection can be made from the pressing method same as CON type such as PCON and that same as SEP type such as PSEP.
Speed change during movement	○	
Operation at different acceleration and deceleration	×	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Target Position	m to m+1	Current Position	m to m+1
Positioning Width	m+2 to m+3	Command Current	m+2 to m+3
Command Speed	m+4	Current Speed	m+4
Acceleration/ Deceleration	m+5	Cannot be used.	m+5
Pressing Current Limit	m+6	Alarm Code	m+6
Control Signal	m+7	Status Signal	m+7

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 8-word for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the target position and current position, 2-word (32-bit) binary data is available and values from -999999 to +999999 (unit: 0.01mm) can be used. Negative numbers are to be dealt with two's complement.

> ⚠ Caution:
> • Set the position data in the range of the soft stroke (0 to effective stroke length) of the actuator.

- Set the positioning width. The positioning width is expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01mm) can be set in PLC.
- The command speed is expressed using 1-word (16 bits) binary data. The figures from 1 to +65535 (Unit: 1.0mm/sec or 0.1mm/sec) can be set in PLC. A change of the unit is to be conducted on Gateway Parameter Setting Tool.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 to 100% (0 to FF_H) can be set in PLC.

Set Value	0	127_H (50 in decimal system)	FF_H (255 in decimal system)
Pressing current Limit	0%	50%	100%

> ⚠ Caution:
> Have the setting with values available in the range of for speed, acceleration/deceleration and pressing current of the actuator. (Refer to the catalog or instruction manual of the actuator.)
> Otherwise, it may cause an abnormal condition of the servo or a malfunction of the actuator such as the alarm codes 0A3 "Position Command Information Data Error", 0C0 "Excess Actual Speed", 0C8 "Overcurrent", 0CA "Overheated" or 0E0 "Overloaded".

- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 1-word (16 bits) binary data (Unit: 1.0mm/sec or 0.1mm/sec).
  The unit is the one set in the command speed. A positive number is output when the revolution of the driving motor is in CCW, while a negative number when CW. Negative numbers are output with two's complement.
  For Slider and Rod Types of actuators, a negative number is output when a movement is made towards the motor side, while a positive number when against the motor side. For Reversed Motor Type, it is the other way around. For Gripper Type, a positive number is output when fingers are closed. For Rotary Type, a positive number is output when rotating clockwise.
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC Output (m is PLC output top word address for each axis number)

1 word = 16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+5

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ Deceleration	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1

Address m+6

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Pressing Current Limit	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1

Address m+7

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	INC	DIR	PUSH	–	–	–	JOG+	JOG-	–	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number)

1 word = 16 bit

Address m

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Lower word)																

Address m+1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (Upper word)																

(Note) If the target position is a negative value, it is indicated by a two's complement.

Address m+2

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

Address m+3

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command Current (Upper word)	–	–	–	–	–	–	–	–	–	–	–	–	524,288	262,144	131,072	65,536

Address m+4

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed																

(Note) If the current speed is a negative value, it is indicated by a two's complement.

Address m+5

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

Address m+6

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																

Address m+7

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE2	ZONE1	–	–	–	MEND	ALML	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Output	Target Position	32 bits Data	–	32-bit signed integer indicating the current position Unit: 0.01mm Available range for Setting: -999999 to 999999 Set the target position with the value from the home position. (Example) If +25.40mm, input 000009EC$_H$ (2540 in decimal system). (Note) Input the negative value using a compliment of 2.	3.8.1 (22)
PLC Output	Positioning Width	32 bits Data	–	32-bit integer Unit: 0.01mm Available range for Setting: 0 to 999999 (Example) If 25.40mm, input 000009EC$_H$ (2540 in decimal system). This register value has two meanings depending on the operation type. 1) Positioning operation ⇒ Range for positioning complete against the target position 2) Pressing operation ⇒ Pressing width (Pressing operation distance) A pressing operation is performed when PUSH Signal in the control signals is ON.	3.8.1 (22)
PLC Output	Command Speed	16 bits Data	–	16-bit integer Unit: 1.0mm/sec or 0.1mm/sec (It is set to 1.0mm/sec in the initial setting.) A change of the unit is to be conducted on Gateway Parameter Setting Tool. Available range for Setting: 1 to 65535 Specify the speed at which to move the actuator. (Example) If 254.0mm/sec, input 09EC$_H$ (2540 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value more than the maximum speed of the actuator.	3.8.1 (22)
PLC Output	Acceleration/ Deceleration	16 bits Data	–	16-bit integer Unit: 0.01G Available range for Setting: 1 to 300 Specify the acceleration/deceleration at which to move the actuator. The acceleration and deceleration will be the same value. (Example) If 0.30G, input 001E$_H$ (30 in decimal system). It may cause an alarm or a malfunction if executing a movement command with 0 or a value exceeding the maximum acceleration/deceleration of the actuator.	3.8.1 (22)
PLC Output	Pressing Current Limit	16 bits Data	–	16-bit integer Unit: % Available range for Setting: 0 to FF$_H$ 7F$_H$=50%, FF$_H$=100% Indicate the current value for pressing operation. (Example) When setting to 50%, indicate FF$_H$ * 50% = 255 * 50% = 127 (Decimal Number) = 007F$_H$. The pressing range available for indication differs depending on the actuator (Refer to the catalogue or instruction manual for the actuator). It may cause an alarm or a malfunction if executing a movement command with a value more than the maximum pressing current.	3.8.1 (22)

Signal Type		Bit	Symbol	Description	Details
PLC Output	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.8.1 [15]
		b14	INC	Absolute position commands are issued when this signal is OFF, and incremental position commands are issued when the signal is ON.	3.8.1 [13]
		b13	DIR	Push direction specification ON: Movement against home position, OFF: Movement toward home position (Note) This signal is effective when the pressing method of CON type is selected.	3.8.1 [17]
		b12	PUSH	Push-motion specification ON: Pressing operation, OFF: Positioning operation	3.8.1 [16]
		b11	–	Cannot be used.	–
		b10			
		b9			
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.8.1 [12]
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	–	Cannot be used.	–
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.8.1 [14]
		b4	SON	Servo ON command ON: Servo ON, OFF: Servo OFF	3.8.1 [5]
		b3	RES	Reset A reset is performed when this signal turns ON.	3.8.1 [4]
		b2	STP	Pause ON: Pause, OFF: Pause release	3.8.1 [10]
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [6]
		b0	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [7]

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Input	Current Position	32 bits Data	–	32-bit signed integer indicating the current position Unit: 0.01mm (Example) If 10.23mm, input $000003FF_H$ (1023 in decimal system). (Note) Negative numbers are two’s implement.	3.8.1 (22)
	Command Current	32 bits Data	–	32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. This resistor makes an output in hexadecimal numbers. (Example) Reading: $000003FF_H$ = 1023 (Decimal number) = 1023mA	3.8.1 (22)
	Current Speed	16 bits Data	–	16-bit integer The current speed is indicated. Unit: 1.0mm/sec or 0.1mm/sec. A change of the unit is to be conducted on Gateway Parameter Setting Tool. (Example) Reading: $03FF_H$ = 1023 (Decimal number) = 1023mm/sec (Note) Negative numbers are two’s implement.	3.8.1 (22)
	Alarm Code	16 bits Data	–	16-bit integer The alarm code (refer to Chapter 6 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.8.1 (22)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.8.1 [2]
		b14	CRDY	This signal turns ON when the controller is standing by.	3.8.1 [1]
		b13	ZONE2	“ON” for the current position within the zone 2 set range The zone range setting is necessary for the parameter.	3.8.1 [11]
		b12	ZONE1	“ON” for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	
		b11	–	Cannot be used.	–
		b10			
		b9			
		b8	MEND	This signal turns ON at either of positioning complete, home return complete, pressing complete or pressing failure, and turns OFF at movement start. It is OFF before movement.	3.8.1 [19]
		b7	ALML	Light error alarm output It turns ON when a message level error is issued.	3.8.1[20]
		b6	–	Cannot be used.	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.8.1 [18]
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.8.1 [5]
		b3	ALM	This signal is ON while an alarm is generated.	3.8.1 [3]
		b2	MOVE	This signal is ON while in movement.	3.8.1 [8]
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.8.1 [6]
		b0	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.8.1 [9]

3.4.6 Control Signals for Positioner 2 Mode

⚠ Caution: This mode is not applicable for CompoNet.

It is an operation mode to operate with indicating a position number. The operation is to be made with the position data set in the position table. This is a mode that the indication of the target position and the monitoring of the current value are removed from Positioner 1 Mode. The settable No. of position data items is max 256 points.
The main functions of ROBO Cylinder capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/ deceleration setting	△	These items must be set in the position data table.
Pitch feed (inching)	×	
Pressing operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using parameters.
PIO pattern selection	×	

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Specified Position No.	m	Completion Position No. (Simple Alarm Code)	m
Control Signal	m+1	Status Signal	m+1

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 2-word for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- For the indicated position number and complete position number, 1-word (16-bit) binary data is available and values from 0 to 255 can be used.

> ⚠ Caution:
> Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".

PLC Output (m is PLC output top word address for each axis number)

1 word = 16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified Position No.	–	–	–	–	–	–	–	–	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal	BKRL	–	–	–	–	–	–	JOG+	JOG-	–	JISL	SON	RES	STP	HOME	CSTR

PLC Input (m is PLC input top word address for each axis number)

1 word = 16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	–	–	–	–	–	–	–	–	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

Address m+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal	EMGS	CRDY	ZONE1	ZONE2	–	–	–	MEND	ALML	–	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignment

(ON = Applicable bit is "1", OFF = Applicable bit is "0")

Signal Type		Bit	Symbol	Description	Details
PLC Output	Specified Position No.	16 bits Data	PC1 to PC128	16-bit integer Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 "Position Data Error".	3.8.1 (23)
	Control Signal	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.8.1 [15]
		b14	–	Cannot be used.	–
		b13			
		b12			
		b11			
		b10			
		b9			
		b8	JOG+	+Jog ON: Movement against home position, OFF: Stop	3.8.1 [12]
		b7	JOG-	-Jog ON: Movement toward home position, OFF: Stop	
		b6	–	Cannot be used.	–
		b5	JISL	Jog/inching switching ON: Inching, OFF: Jog	3.8.1 [14]
		b4	SON	Servo ON command ON: Servo ON, OFF: Servo OFF	3.8.1 [5]
		b3	RES	Reset A reset is performed when this signal turns ON.	3.8.1 [4]
		b2	STP	Pause ON: Pause, OFF: Pause release	3.8.1 [10]
		b1	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [6]
		b0	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [7]

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Output	Completed Position No. (Simple Alarm Code)	16 bits	PM1 to PM128	16-bit integer The positioning complete position number is output in a binary number once getting into the positioning width after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, “0” is output. Read it by turning PEND Signal on after movement. The simple alarm code (refer to Chapter 6 Troubleshooting) is output while an alarm is issued (ALM of Status Signal is ON).	3.8.1 (23)
	Status Signal	b15	EMGS	This signal turns ON during an emergency stop	3.8.1 [2]
		b14	CRDY	This signal turns ON when the controller is standing by.	3.8.1 [1]
		b13	ZONE2	“ON” for the current position within the zone 2 set range The zone range setting is necessary for the parameter.	3.8.1 [11]
		b12	ZONE1	“ON” for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	
		b11	–	Cannot be used.	–
		b10			
		b9			
		b8	MEND	This signal turns ON at either of positioning complete, home return complete, pressing complete or pressing failure, and turns OFF at movement start. It is OFF before movement.	3.8.1 [19]
		b7	ALML	Light error alarm output It turns ON when a message level error is issued.	3.8.1 [20]
		b6	–	Cannot be used.	–
		b5	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.8.1 [18]
		b4	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.8.1 [5]
		b3	ALM	This signal is ON while an alarm is generated.	3.8.1 [3]
		b2	MOVE	This signal is ON while in movement.	3.8.1 [8]
		b1	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.8.1 [6]
		b0	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.8.1 [9]

3.4.7 Control Signals for Positioner 3 Mode

This is the operation mode with the position No. set up. The operation is to be made with the position data set in the position table. This is the mode with the minimum amount of input and output signals and the sent and received data in 1-word.
The settable No. of position data items is max 256 points.
The main functions of ROBO Cylinder capable to control in this mode are as described in the following table.

ROBO cylinder function	○: Direct control △: Indirect control ×: Disabled	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration/ deceleration setting	△	These items must be set in the position data table.
Pitch feed (inching)	×	
Pressing operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using parameters.

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Control Signal/ Specified Position No.	m	Status Signal/ Completion Position No.	m

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 1-word for each I/O bit register.

- The control signals and status signals are ON/OFF signals in units of bit.
- Binary data of 8 bits for the specified position number and complete position number and values from 0 to 255 can be used.

> ⚠ Caution:
> Set the operational condition in advance with using a teaching tool such as PC software in the position number to be used. Selecting a position number with no setting conducted will generate the alarm code 0A2 “Position Data Error”.

PLC Output (m is PLC output top word address for each axis number)

1 word = 16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal/ Specified Position No.	BKRL	–	–	SON	RES	STP	HOME	CSTR	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1
	Control Signal								Specified Position No.							

PLC Input (m is PLC input top word address for each axis number)

1 word = 16 bit

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal/ Completed Position No.	EMGS	ZONE1	PSFL	SV	ALM	MOVE	HEND	PEND	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1
	Status Signal								Completed Position No.							

(3) I/O signal assignment

(ON = Applicable bit is “1”, OFF = Applicable bit is “0”)

Signal Type		Bit	Symbol	Description	Details
PLC Input	Control Signal/ Specified Position No.	b15	BKRL	Brake release ON: Brake release, OFF: Brake activated	3.8.1 [15]
		b14	–	Cannot be used.	–
		b13			
		b12	SON	Servo ON command ON: Servo ON, OFF: Servo OFF	3.8.1 [5]
		b11	RES	Reset A reset is performed when this signal turns ON.	3.8.1 [4]
		b10	STP	Pause ON: Pause, OFF: Pause release	3.8.1 [10]
		b9	HOME	Home return Home-return command with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [6]
		b8	CSTR	Positioning start Movement command executed with this signal ON, command carried on till complete even if the signal is turned OFF on the way	3.8.1 [7]
		b7	PC7	8 bits binary data Available range for Setting: 0 to 255 To operate, it is necessary to have the position data that the operation conditions are already set in advance with a teaching tool such as the PC software. In this register, indicate the position number the data is input with a binary number. Indicating a value out of the range or operating with a position number with no setting conducted will generate the alarm code 0A2 “Position Data Error”.	3.8.1 (23)
		b6	PC6		
		b5	PC5		
		b4	PC5		
		b3	PC4		
		b2	PC3		
		b1	PC2		
		b0	PC1		
PLC Output	Status Signal/ Completed Position No.	b15	EMGS	This signal turns ON during an emergency stop	3.8.1 [2]
		b14	ZONE1	“ON” for the current position within the zone 1 set range The zone range setting is necessary for the parameter.	3.8.1 [11]
		b13	PSFL	This signal turns ON when the actuator missed the load in push-motion operation.	3.8.1 [18]
		b12	SV	This signal turns ON when operation standby is complete (Servo is ON).	3.8.1 [5]
		b11	ALM	This signal is ON while an alarm is generated.	3.8.1 [3]
		b10	MOVE	This signal is ON while in movement.	3.8.1 [8]
		b9	HEND	This signal turns ON at home return complete and is kept unless the home position is lost due to a fact such as an alarm.	3.8.1 [6]
		b8	PEND	This signal turns ON at positioning complete and is kept ON during a stop with the servo ON, but does not turn ON when pressing operation is failed.	3.8.1 [9]
		b7	PM128	8 bits binary data The positioning complete position number is output in a binary number once getting into the positioning width after moving to the target position. In the case that the position movement has not been performed at all, or during the movement, “0” is output. Read it by turning PEND Signal ON after movement.	3.8.1 (23)
		b6	PM64		
		b5	PM32		
		b4	PM16		
		b3	PM8		
		b2	PM4		
		b1	PM2		
		b0	PM1		

3.4.8 Control Signals for SEP I/O Mode

This is an operation mode same as when using PIO (24V input and output).
Set the position data from a teaching tool such as the RC PC software.
The number of movement points available in the operation depends on the operation pattern (PIO pattern) input in the initial setting.
The I/O specifications for the operation pattern are described as follows

PIO Pattern	Operation Details	I/O Type
0	Point-to-Point Movement	2 positioning points, pause available
1	Movement Speed Setting	2 positioning points, pause available Speed setting can be changed during a movement between the two types already registered
2	Target Position Change	2 positioning points, pause available Target position can be changed for an operation
3	2-Input, 3-Point Movement	3 positioning points, no pause available Specify the movement position with a combination of two signals
4	3-Input, 3-Point Movement	3 positioning points, no pause available Specify the movement position with a combination of three signals
5	Automatic Back and Forth Operation	2 positioning points, pause available Movement is made repeatedly between 2 points.
6	Cannot be used.	

The ROBO Cylinder functions capable to control in this mode are as described in the table below.

ROBO cylinder function	Operation Pattern (PIO Pattern)					
	0	1	2	3	4	5
	Point-to-Point Movement	Movement Speed Setting	Target Position Change	2-Input, 3-Point Movement	3-Input, 3-Point Movement	Automatic Back and Forth Operation
Home-return operation	○(Note 1)					
Positioning operation	○					
Speed and acceleration/decelerati-on setting	○					
Pitch feed (inching)	×					
Pressing operation	○					
Speed change during movement	×	○	×	×	×	×
Operation at different acceleration and deceleration	○					
Pause	○	○	○	×	×	○
Zone signal output	×					
Target position change	×	×	○	×	×	×

(Note1) Home-return operation is performed at the first movement (ST0) if MANU is selected in the initial setting. Home-return operation is performed at the first servo-on after the power is turned ON if AUTO is selected.

(1) PLC Address Composition

(m is PLC input and output top word address for each axis number)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
A2 to A17	m	A18 to A33	m
B2 to B17	m+1	B18 to B33	m+1

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Input and Output Signal Assignment for each Axis

The I/O signals for each axis consists of 1-word for each I/O bit register.

- The I/O bit register is controlled using the ON/OFF signal in units of bit.
  (ON = Applicable bit is “1”, OFF = Applicable bit is “0”)
- Pin Numbers A2 to A33 and B2 to B33 are assigned for each bit signal, which are equivalent to the case when using PIO, because the contents of signals vary depending on the selection of PIO pattern.
  [Refer to 3.5 Control Signals for PIO Operation for the relation between pin numbers and signals.]

PLC Output (m is PLC input and output top word address for each axis number)

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Controller Input Port (Pin) No.	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2

PLC Input (m is PLC input and output top word address for each axis number)

1 word = 16 bit

Address m+1	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller Input Port (Pin) No.	B17	B16	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2

Address m	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Controller Output Port No.	A33	A32	A31	A30	A29	A28	A27	A26	A25	A24	A23	A22	A21	A20	A19	A18

Address m+1	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller Output Port No.	B33	B32	B31	B30	B29	B28	B27	B26	B25	B24	B23	B22	B21	B20	B19	B18

3.4.9 About Commands (Position Data Read/Write and Alarm Axis Read)

By sending a specific code to a specific address, the position data reading and writing, and the reading of the axis number that an alarm was issued and the alarm code can be performed.
(Note) It is not necessary to use commands in Simple Indication Mode because no position data is to be used in it.

> ⚠ Caution: It is not necessary to use commands in Simple Direct Mode because no position data is to be used in it.

Shown below is the table to indicate the assignment of each signal.

(1) PLC Address Composition

(n is PLC input and output top address.)

PLC → MSEP (PLC Output)		MSEP → PLC (PLC Input)	
Demand Command	n+2	Response Command	n+2
Data 0	n+3	Data 0	n+3
Data 1	n+4	Data 1	n+4
Data 2	n+5	Data 2	n+5
Data 3	n+6	Data 3	n+6

[Refer to Section 3.4.2 for the address maps for each Fieldbus.]

(2) Demand Command List

Class	Code	Description
Handshaking	0000_H	Demand command cleared
Write Position Data	1000_H	Writing of target position
	1001_H	Writing of pressing width
	1002_H	Writing of speed
	1003_H	Cannot be used.
	1004_H	
	1005_H	Writing of acceleration
	1006_H	Writing of deceleration
	1007_H	Writing current limit at pressing
	1008_H	Cannot be used.
Read Position Data	1040_H	Reading of target position
	1041_H	Reading of pressing width
	1042_H	Reading of speed
	1043_H	Cannot be used.
	1044_H	
	1045_H	Reading of acceleration
	1046_H	Reading of deceleration
	1047_H	Reading of current limit at pressing
	1048_H	Cannot be used.
Error Information Monitoring	4000_H	Error Information Monitoring
	4001_H	Acquiring alarm-issued axis

(3) Details of Commands

The input and output signals are consist of 5-word for each input and output data register.

- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from –999999 to +999999 (Unit: 0.01mm) can be set in PLC. Negative numbers are to be dealt with two's complement.
- Binary data of 2-word (32 bits) for the pressing band and values from -999999 to +999999 (unit: 0.01mm) in PLC can be used. Negative numbers are to be dealt with two's complement.

⚠ Caution: • Set the position data of the actuator, such as the target position and pressing band, in the range of the soft stroke (0 to effective stroke length).

- Binary data of 2-word (32 bits) for the speed and values from 1 to +999999 (unit: 1.0mm/s or 0.1mm/s) in PLC can be used. A change of the unit is to be conducted on Gateway Parameter Setting Tool.
- The Acceleration and Deceleration are expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 255 (100%) can be set in PLC.
- Binary data of 1-word (16 bits) for the axis numbers and values from 0 (No.0) to 7 (No.7) in PLC can be used.
- Binary data of 1-word (16 bits) for the position numbers and values from 0 (No.0) to 255 (No.255) in PLC can be used.
- The alarm code is expressed using 1-word (16 bits) binary data.

⚠ Caution: Have the setting with values available in the range of for speed, acceleration/deceleration and pressing current of the actuator. (Refer to the catalog or instruction manual of the actuator.) Otherwise, it may cause an abnormal condition of the servo or a malfunction of the actuator such as the alarm codes 0A3 "Position Command Information Data Error", 0C0 "Excess Actual Speed", 0C8 "Overcurrent", 0CA "Overheated" or 0E0 "Overloaded".

1) Demand command cleared
PLC Output (Address n is the input and output top address for MSEP.)
(Note) Response command does not return.

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Demand command cleared	n+2 Demand Command [0000h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2) Writing of Target Position
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command.
If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Target Position	n+2 Demand Command [1000h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Target Position (Lower word)]																
	n+5 Data 2 [Target Position (Upper word)]																
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

3) Writing of Pressing Width
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Pressing Width	n+2 Demand Command [1001h]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Width (Lower word)]																
	n+5 Data 2 [Pressing Width (Upper word)]																
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

4) Writing of Speed
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Speed	n+2 Demand Command [1002h]	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Speed (Lower word)]	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [Speed (Upper word)]	–	–	–	–	–	–	–	–	–	–	–	–	524288	262144	131072	65536
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

5) Writing of Acceleration
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Acceleration	n+2 Demand Command [1005h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Acceleration]	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

6) Writing of Deceleration
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Deceleration	n+2 Demand Command [1006h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Deceleration]	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

7) Writing of Pressing Current Limit
PLC Output (Address n is the input and output top address for MSEP.)
(Note) If the writing is finished in normal condition, the same content as the demand command is returned to the response command. If an error is generated, an error response is returned. [Refer to this Section 16).]

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Writing of Pressing Current Limit	n+2 Demand Command [1007h]	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Current Limit]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

8) Reading of Target Position
PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Bit / Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Target Position	n+2 Demand Command [1040h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Bit / Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Target Position	n+2 Response Command [1040h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Target Position (Lower word)]																
	n+5 Data 2 [Target Position (Upper word)]																
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

9) Reading of Pressing Width

PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Width	n+2 Demand Command [1041h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Width	n+2 Response Command [1041h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Width (Lower word)]																
	n+5 Data 2 [Pressing Width (Upper word)]																
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

10) Reading of Speed
PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Speed	n+2 Demand Command [1042h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Speed	n+2 Response Command [1042h]	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Speed (Lower word)]	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [Speed (Upper word)]	–	–	–	–	–	–	–	–	–	–	–	–	524288	262144	131072	65536
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

11) Reading of Acceleration
PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Acceleration	n+2 Demand Command [1045h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Acceleration	n+2 Response Command [1045h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1
	n+3 Data 0 [Position No.]	-	-	-	-	-	-	-	-	128	64	32	16	8	4	2	1
	n+4 Data 1 [Acceleration]	-	-	-	-	-	-	-	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	-	-	-	-	-	-	-	-	-	-	-	-	-	4	2	1

12) Reading of Deceleration

PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Deceleration	n+2 Demand Command [1046h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Deceleration	n+2 Response Command [1046h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Deceleration]	–	–	–	–	–	–	–	256	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

13) Reading of Pressing Current Limit
PLC Output (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Current Limit	n+2 Demand Command [1047h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Pressing Current Limit	n+2 Response Command [1047h]	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1
	n+3 Data 0 [Position No.]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Pressing Current Limit]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

14) Reading of Alarm-issued Axis Number

PLC Output (Address n is the input and output top address for MSEP.)

(Note) If this command is sent, the response command updates with the latest information until the demand command clear is sent.

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm-issued Axis Number	n+2 Demand Command [4000h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm-issued Axis Number	n+2 Response Command [4000h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+3 Data 0 [0]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n+4 Data 1 [Alarm-issued Axis Number] 1: Alarm 2: Normal	-	-	-	-	-	-	-	-	Status of 7th Axis	Status of 6th Axis	Status of 5th Axis	Status of 4th Axis	Status of 3rd Axis	Status of 2nd Axis	Status of 1st Axis	Status of 0th Axis
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

15) Reading of Alarm Code

PLC Output (Address n is the input and output top address for MSEP.)

(Note) If this command is sent, the response command updates with the latest information until the demand command clear is sent.

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm Code	n+2 Demand Command [4001h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+4 Data 1 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

PLC Input (Address n is the input and output top address for MSEP.)

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Reading of Alarm Code	n+2 Response Command [4001h]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	n+3 Data 0 [0]	–	–	–	–	–	–	–	–	128	64	32	16	8	4	2	1
	n+4 Data 1 [Alarm Code]																
	n+5 Data 2 [0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	n+6 Data 3 [Axis No.]	–	–	–	–	–	–	–	–	–	–	–	–	–	4	2	1

16) Error Response Command

PLC Output (Address n is the input and output top address for MSEP.)

In the case that the command did not complete in normal condition, this error response command is returned.

1 word = 16 bit

	Address \ Bit	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Error Response Command	n+2 Demand Command	1	The values are those with the bit 15 of the demand command code being 1.														
	n+3 Data 0 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	n+4 Data 1 [Error Detail]	0101_H: Incorrect Axis Number 0102_H: Incorrect Position Number 0103_H: Incorrect Command 0104_H: Communication error 0105_H: Controller Execution Impossible															
	n+5 Data 2 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
	n+6 Data 3 [Undefined]	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

3.5 Control Signals for PIO Operation

[1] MSEP-C

The contents of the signals for the input and output ports vary depending on the setting of the operation mode.
Set the position data from a teaching tool such as the RC PC software.
The number of movement points available in the operation depends on the operation pattern (PIO pattern) input in the initial setting.
The I/O specifications for the operation pattern are described as follows.

PIO Pattern	Operation Details	I/O Type
0	Point-to-Point Movement	2 positioning points, pause available
1	Movement Speed Setting	2 positioning points, pause available Speed setting can be changed during a movement between the two types already registered
2	Target Position Change	2 positioning points, pause available Target position can be changed for an operation
3	2-Input, 3-Point Movement	3 positioning points, no pause available Specify the movement position with a combination of two signals
4	3-Input, 3-Point Movement	3 positioning points, no pause available Specify the movement position with a combination of three signals
5	Automatic Back and Forth Operation	2 positioning points, pause available Movement is made repeatedly between 2 points.
6	Cannot be used.	

The ROBO Cylinder functions capable to control in this mode are as described in the table below.

ROBO cylinder function	Operation Pattern (PIO Pattern)					
	0	1	2	3	4	5
	Point-to-Point Movement	Movement Speed Setting	Target Position Change	2-Input, 3-Point Movement	3-Input, 3-Point Movement	Automatic Back and Forth Operation
Home-return operation	○(Note 1)					
Positioning operation	○					
Speed and acceleration/decelerati-on setting	○					
Pitch feed (inching)	×					
Pressing operation	○					
Speed change during movement	×	○	×	×	×	×
Operation at different acceleration and deceleration	○					
Pause	○	○	○	×	×	○
Zone signal output	×					
Target Position Change	×	×	○	×	×	×

(Note1) Home-return operation is performed at the first movement (ST0) if MANU is selected in the initial setting. Home-return operation is performed at the first servo-on after the power is turned ON if AUTO is selected.

I/O signal assignment

Pin No.	Category	PIO Functions	Operation Pattern (PIO pattern)									
			0		1		2		3	4	5	
			Point-to-Point Movement		Movement speed setting		Target position change		2-Input, 3-Point Movement	3-Input, 3-Point Movement	Continuous reciprocating operation	Fieldbus connection
	Input	Number of positioning points	2 points		2 points		2 points		3 points	3 points	2 points	
		Home return signal	× (Home-return operation at the power-on or the first movement operation)									
		Servo ON signal	○ (Automatic servo-on is also available at the power-on)									
		Movement speed setting	×		○		×		×	×	×	
		Target position change	×		×		○		×	×	×	
	Output	Servo ON signal	○ (Selection available in the initial setting whether to use)									
		Homing completion signal	○ (Selection available in the initial setting whether to use)						×	○ (Selection available in the initial setting whether to use)		
		Zone signal, Position zone signal	×		×		×		×	×	×	
		Solenoid system	Single	Double	Single	Double	Single	Double	–	Double	–	
A1	–	COM	24V									
A2	Input (Axis No.0)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	Refer to 3.4 Fieldbus Type Address Map
A3		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A4		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A5		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A6	Input (Axis No.1)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A7		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A8		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A9		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A10	Input (Axis No.2)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A11		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A12		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A13		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A14	Input (Axis No.3)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
A15		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
A16		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
A17		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
A18	Output (Axis No.0)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A19		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A20		OUT2	HEND/SV		HEND/SV		HEND/SV		LS2/PE2	LS2/PE2	HEND/SV	
A21		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A22	Output (Axis No.1)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A23		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A24		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A25		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A26	Output (Axis No.2)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A27		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A28		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A29		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A30	Output (Axis No.3)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
A31		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
A32		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
A33		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
A34	–	COM	0V									

(Note) "*" in codes above shows the signal of the active low.
(Note 1) It is invalid before home-return operation.
(Note 2) The description in the brackets shows the condition before the home return operation.

Pin No.	Category	PIO Functions	Operation Pattern 0 Point-to-Point Movement		1 Movement speed setting		2 Target position change		3 2-Input, 3-Point Movement	4 3-Input, 3-Point Movement	5 Continuous reciprocating operation	6 Fieldbus connection
		Solenoid system	Single	Double	Single	Double	Single	Double	–	Double	–	
B1	–	COM	24V									
B2	Input (Axis No.4)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	Refer to 3.4 Fieldbus Type Address Map
B3		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B4		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B5		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B6	Input (Axis No.5)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B7		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B8		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B9		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B10	Input (Axis No.6)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B11		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B12		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B13		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B14	Input (Axis No.7)	IN0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ST0	ASTR	
B15		IN1	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	*STP	ST1 (Note 1)	ST1 (Note 1)	ST1 (Note 1)	*STP	
B16		IN2	RES		SPDC(RES) (Note 2)		CN1(RES) (Note 2)		RES	ST2(RES) (Note 2)	RES	
B17		IN3	–/SON		–/SON		–/SON		–/SON	–/SON	–/SON	
B18	Output (Axis No.4)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B19		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B20		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B21		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B22	Output (Axis No.5)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B23		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B24		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B25		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B26	Output (Axis No.6)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B27		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B28		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B29		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B30	Output (Axis No.7)	OUT0	LS0/PE0		LS0/PE0		LS0/PE0		LS0/PE0	LS0/PE0	LS0/PE0	
B31		OUT1	LS1/PE1		LS1/PE1		LS1/PE1		LS1/PE1	LS1/PE1	LS1/PE1	
B32		OUT2	HEND/SV		HEND/SV		HEND/SV		HEND/SV	LS2/PE2	LS2/PE2	
B33		OUT3	*ALM/SV		*ALM/SV		*ALM/SV		*ALM/SV	*ALM/SV	*ALM/SV	
B34	–	COM	0V									

(Note) Change the output and class considering the initial setting.
Note 1 It is invalid before home-return operation.
Note 2 The description in the brackets shows the condition before the home return operation.

(Reference) Signal of Active Low
Signal with "*" expresses the signal of active low. A signal of active low is a signal that the input signal is processed when it is turned OFF, output signal is ordinary on while the power is ON, and turns OFF when the signal is output.

[2] MSEP-LC

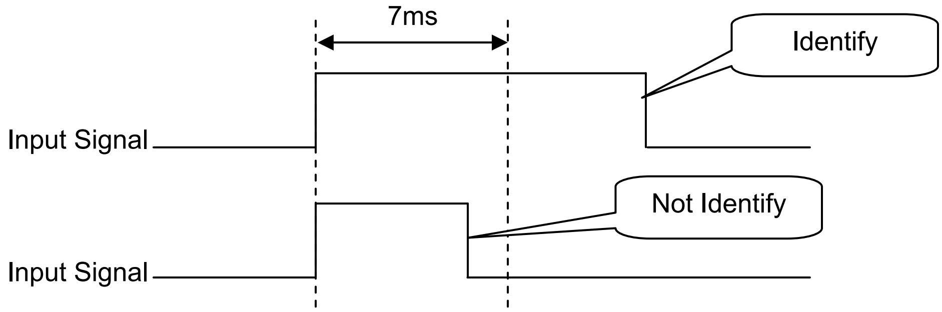
It is equipped with 32 points of the standard I/O and extended I/O in total for each input and output port.
Shown below is the relation between each port and internal memory assignment of MSEP-LC.

Pin No.	PIO Functions	Operation Pattern (PIO pattern)				
		0 to 5	6			
			Standard I/O		Extended I/O	
			Signal Name	Destination to Assign Memory	Signal Name	Destination to Assign Memory
A1	COM	24V				
A2						
A3						
A4						
A5	General-Purposed Input	N/A	IN0	X000	IN16	X010
A6			IN1	X001	IN17	X011
A7			IN2	X002	IN18	X012
A8			IN3	X003	IN19	X013
A9			IN4	X004	IN20	X014
A10			IN5	X005	IN21	X015
A11			IN6	X006	IN22	X016
A12			IN7	X007	IN23	X017
A13			IN8	X008	IN24	X018
A14			IN9	X009	IN25	X019
A15			IN10	X00A	IN26	X01A
A16			IN11	X00B	IN27	X01B
A17			IN12	X00C	IN28	X01C
A18			IN13	X00D	IN29	X01D
A19			IN14	X00E	IN30	X01E
A20			IN15	X00F	IN31	X01F
B1	General-Purposed Output		OUT0	Y000	OUT16	Y010
B2			OUT1	Y001	OUT17	Y011
B3			OUT2	Y002	OUT18	Y012
B4			OUT3	Y003	OUT19	Y013
B5			OUT4	Y004	OUT20	Y014
B6			OUT5	Y005	OUT21	Y015
B7			OUT6	Y006	OUT22	Y016
B8			OUT7	Y007	OUT23	Y017
B9			OUT8	Y008	OUT24	Y018
B10			OUT9	Y009	OUT25	Y019
B11			OUT10	Y00A	OUT26	Y01A
B12			OUT11	Y00B	OUT27	Y01B
B13			OUT12	Y00C	OUT28	Y01C
B14			OUT13	Y00D	OUT29	Y01D
B15			OUT14	Y00E	OUT30	Y01E
B16			OUT15	Y00F	OUT31	Y01F
B17						
B18						
B19	COM	0V				
B20						

3.6 Control of Input and Output Signal

3.6.1 PIO Input Signal Process

The input signal of this controller has the input time constant of 7ms considering the prevention of wrong operation by chattering and noise.
Therefore, input each input signal for 7ms or more continuously. The signal cannot be identified if it is less than 7ms.



3.6.2 Input and Output Signal Process for Fieldbus Type

(1) I/O Signal Timings

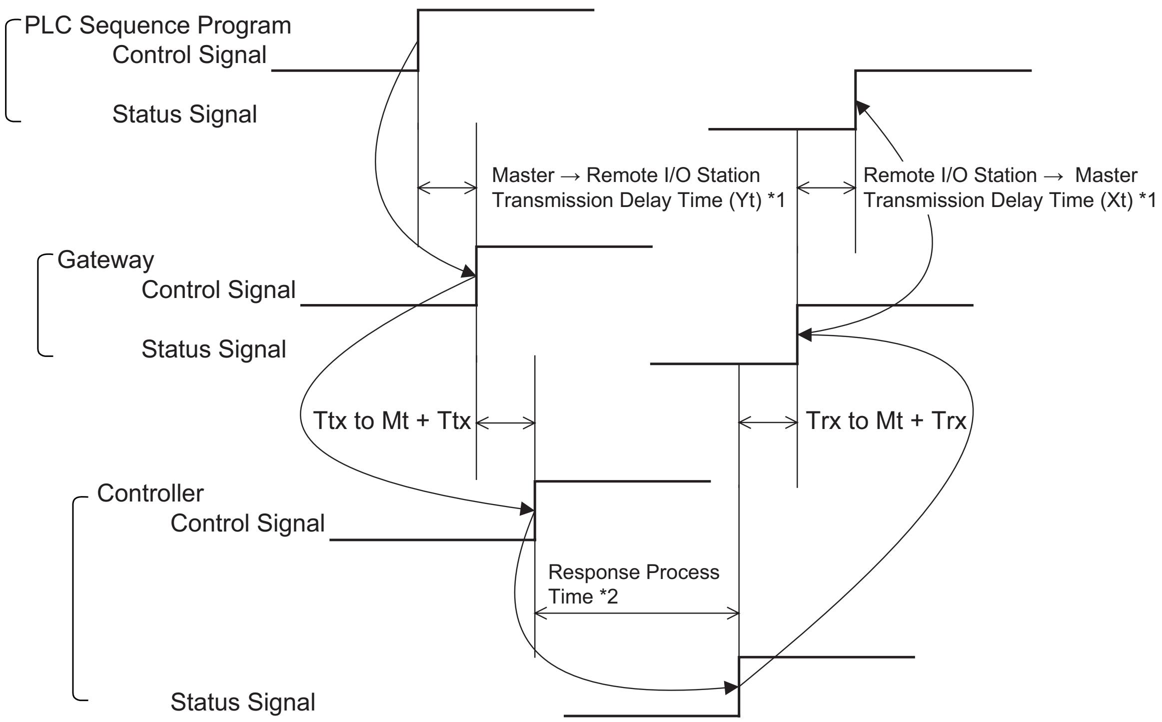
When any of the control signal is turned ON to perform the operation of the ROBO cylinder using the PLC's sequence program, the response (status) is returned to the PLC. The maximum response time is expressed using the following formula.
The value is constant regardless the number of composition axes.

Max. response time (msec.) = Yt + Xt + (3 × Mt) + Response process time (operation time, etc.)

Yt : Master Station → Slave Transmission Delay Time
Xt : Slave → Master Station Transmission Delay Time
(Yt and Xt: Field Network Transmission Delay Time)

Mt = MSEP internal communication sending time (Ttx) + MSEP internal communication receiving time (Trx)

Refer to the instruction manual of the mounted PLC for the master station → slave transfer delay time (Yt) and the slave → master station transfer delay time (Xt).



*1 Refer to PLC Manual
*2 Varies depending on the content of control

Mt = 7.2 to 10ms

(2) Command Sending and Receiving Timing (Reading and Writing of Position Data and Reading of Alarm Axis)

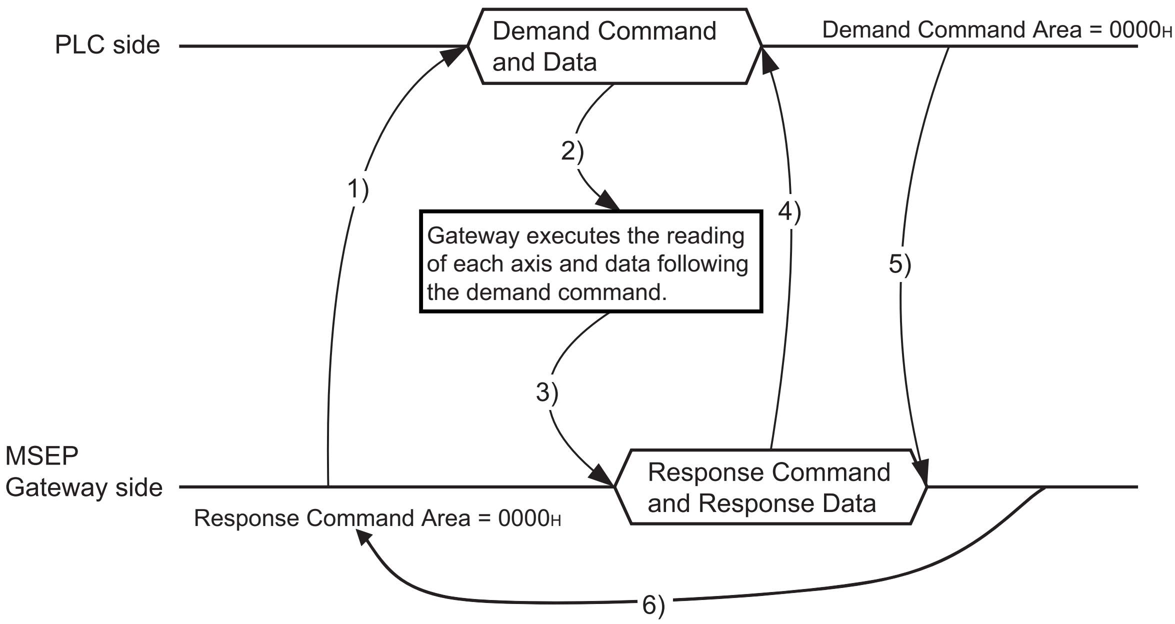
By writing and reading the specified commands to the area of 5-word next to Gateway control/status area, reading and writing of the position data and reading of alarm axis can be conducted.

Gateway executes the demand command ever time the control/status data exchange finishes for all the axes. [Refer to Section 3.4.9 About Command.]

● Step

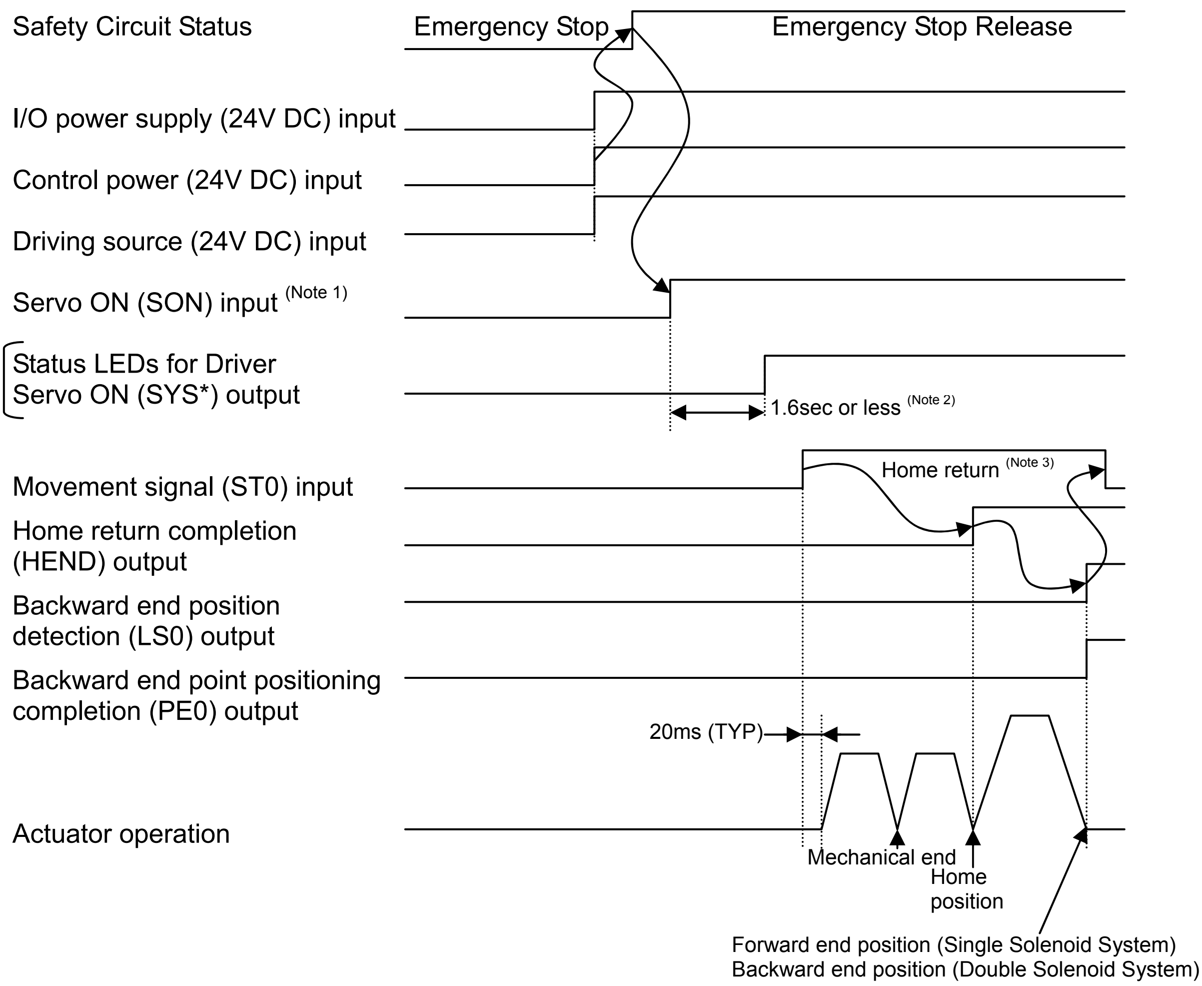
1) PLC confirms the area of response command is 0.
2) PLC sets the necessary demand commands and data to the indicated area and send them.
3) Gateway detects that the area of the demand command has become other than 0, and rewrites the appropriate axis data if it is the writing command, and reads the requirement data from the appropriate axis if reading command.
4) Gateway output the response result to PLC once the command is executed.
5) Once PLC has confirmed the response result, clear the area for the demand command to 0.
6) Gateway clears the response command area to 0 and waits for the next command after it detects the demand command is cleared.

The procedures from 1) to 6) are repeated when continuously used.



3.7 Power Supply

Follow the steps below to turn ON the power to the controller.
1) Supply I/O power, control power and the drive (24V DC).
2) Cancel the emergency stop condition or make the motor drive power supply available to turn ON.
3) If using the servo-on signal, input the signal from the host side.
4) Input the home return signai (HEND) or movement signal (ST0) from the host side. (Positioning is performed at ST0 after the home return.)



Note 1 When the servo control is set to “Use” in the initial setting, the servo is turned ON by means of inputting the SON signal.

Note 2 Input the movement command after having a delay time of 1.6sec or more for the magnetic pole phase detection of the motor at the first servo-on input after the power is turned ON. In the second time or later, make the delay time of 60ms or more.

Note 3 If the mode is set to “MANU” for the home position operation in the initial setting, the home-return operation is performed when the movement command (ST0) is turned ON first and positioning at ST0 with the signal afterwards.
If the home operation is set to “AUTO”, the actuator performs automatic home return after the servo is turned ON.

⚠ Warning: Executing a servo ON when the actuator is position very close to a mechanical end may cause the magnetic pole phase detection operation to malfunction and reporting of the magnetic pole unconfirmed or excitation detection errors. Always move the actuator physical position away from the mechanical end before executing the servo ON command.

3.8 I/O Signal Controls and Function

3.8.1 Input and Output Signals of MSEP-C Fieldbus Type except for SEP I/O Mode and MSEP-LC

In this section, explains the signals of the fieldbus type of MSEP-C except for SEP I/O mode and PIO operation and MSEP-LC. The applicable bit is “1” when the signal is ON and “0” when it is OFF.

(1) Controller ready (CRDY) PLC Input Signal

When the controller can control the system after the power injection, it is turned “ON”.
■ Function
Regardless of the alarm or servo conditions, when the controller initialization is completed normally after the power injection and the controller can control the system, it is turned “ON”. Even in the alarm condition, when the controller can control the system, it is turned “ON”.

(2) Emergency stop (EMGS) PLC Input Signal

When the controller is stopped in an emergency, it is turned “ON”.
■ Function
When the controller is stopped in an emergency (motor driving power is cut off), it is turned “ON”. When the emergency stop status is cleared, it is turned “OFF”.

(3) Alarm (ALM) PLC Input Signal

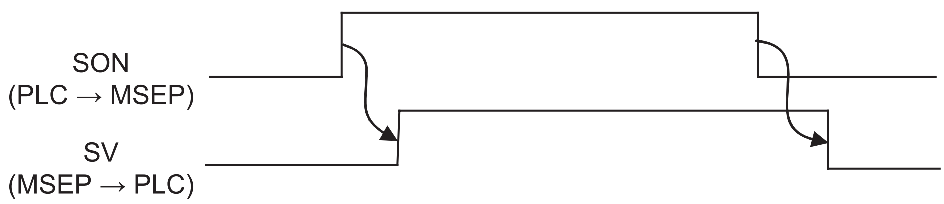
When any error is detected using the controller protection circuit (function), it is turned “ON”.
■ Function
When any error is detected and the protection circuit (function) is activated, this signal is turned “ON”. When the cause of the alarm is eliminated and the reset (RES) signal is turned “ON”, the alarm is turned “OFF” in the case that it is the alarm with the operation cancellation level. (In the case of the alarm with the cold start level, re-injection of the power is required.)

(4) Reset (RES) PLC Output Signal

This signal has two functions. It can reset the controller alarm and cancel the reminder for planned movements during pause conditions.
■ Function
1) When this signal is turned ON from OFF condition after eliminating the cause of the alarm during the alarm output, the alarm (ALM) signal can be reset. (In the case of the alarm with the cold start level, re-injection of the power is required.)
2) When this signal is turned ON from OFF condition during the pause condition, the reminder of the planned movement left can be cancelled.

(5) Servo ON command (SON) PLC Output Signal
Operation ready (SV) PLC Input Signal

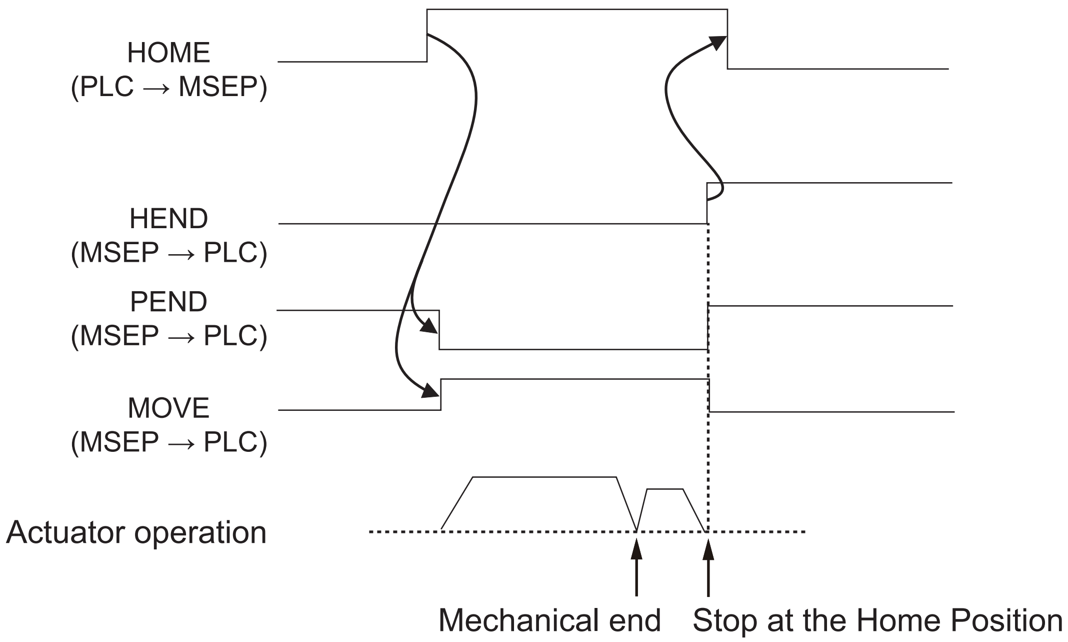
When the SON signal is turned ON, the servo will turn ON.
When the servo-motor is turned ON, the Status Indicator LED (SYS*) on the front surface of the controller illuminates in green.
The “SV” signal is synchronized with this LED.
■ Function
Using the “SON” signal, the turning ON/OFF of the controller is available.
While the “SV” signal is ON, the controller's servo-motor is turned “ON” and the operation becomes available.
The relationship between the “SON” signal and “SV” signal is as follows.



3.8 I/O Signal Controls and Function

(6) Home return (HOME) PLC Output Signal
Home return completion (HEND) PLC Input Signal

When the “HOME” signal is turned “ON”, this command is processed at the startup (ON edge), and the homing operation is performed automatically.
When the data home return is completed, the HEND signal is turned “ON”.
Once the “HEND” signal is turned “ON”, it can not be turned “OFF” until the power is turned “OFF” or the “HOME” signal is input again.
Even after the completion of the homing operation, when the “HOME” signal is turned “ON”, the homing operation can be performed.

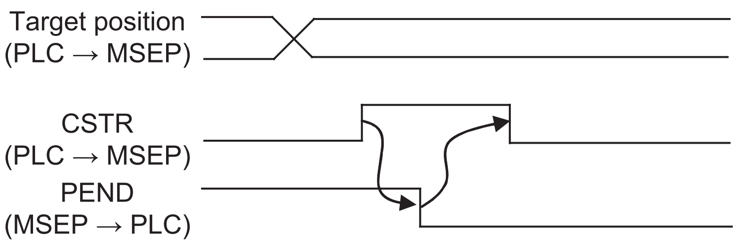


> Caution: In the Positioner 1/Simplified Direct Value Mode, when the positioning command is issued without performing the homing operation after the power injection, the positioning is performed after the automatic homing operation.
> Exercise caution that in the direct numeric specification mode, issuing a positioning command to a given position following the power on, without performing a home return first, will generate an alarm “Error Code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed)” (operation-reset alarm).

(7) Positioning start (CSTR) PLC Output Signal

This signal is processed at the startup (ON edge) and the positioning is performed to the target position with the specified position No. or set using the PLC's target position register.

If a movement command is issued when the first home return is not yet completed after the power is turned ON (HEND signal OFF), home return will be performed automatically to establish the coordinates first, after which the actuator will move to the target position.
Turn "OFF" this signal after confirming that the Positioning Completion Signal (PEND) signal has been turned "OFF".

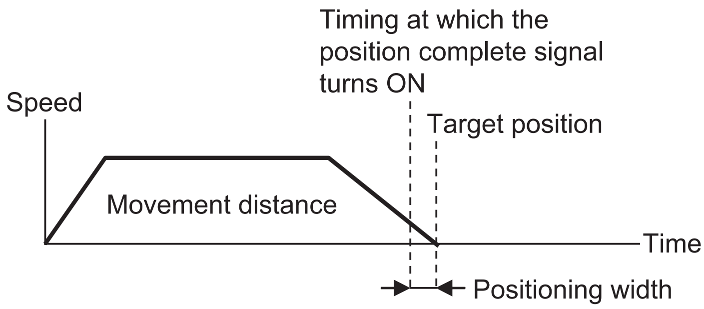


(8) Moving signal (MOVE) PLC Input Signal

This signal is turned ON while the actuator's slider or rod is moving. (Including the pressing or jog operation after the homing operation.)
After the completion of the positioning, homing or pressing operation, or during the pause condition, this signal is turned "OFF".

(9) Positioning completion signal (PEND) PLC Input Signal

This signal is turned "ON" when the actuator is moved to the target position and reaches the positioning width and the pressing is completed.



When the servo-motor is turned ON from OFF condition, the positioning is performed with the position set as the target position. Accordingly, this signal is turned "ON" and after that, when the positioning operation is started with the home return (HOME) signal and positioning start (CSTR) signal, this signal is turned "OFF".

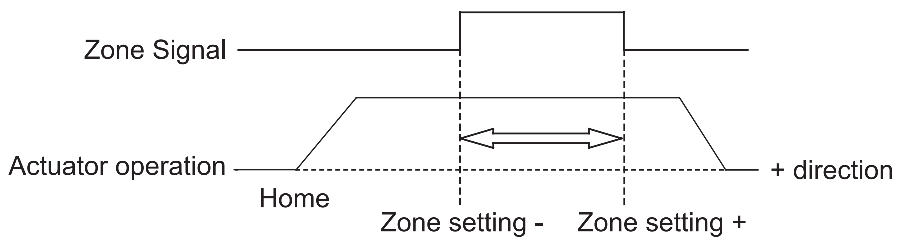
⚠ Caution:	When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the PEND signal is turned "OFF" temporarily. Then, when the servo-motor is turned "ON" and the actuator is within the positioning width, the PEND signal is turned "ON" again. <u>When the positioning is completed with the CSTR signal turned "ON", the PEND signal is not turned "ON".</u>

(10) Pause (STP) PLC Output Signal

When this signal is turned "ON", the actuator movement is decelerated and stopped. When it is turned "OFF", the actuator movement is restarted.
The acceleration in the operation restart or the deceleration in stopping operation, is expressed as the value for the acceleration/deceleration for the position No. set using the specified position No. resister in the Positioner 1/Simplified Direct Value Mode, and as the value set in the acceleration/deceleration register in the Direct Numeric Specification Mode.

(11) Zone 1 (ZONE1) PLC Input Signal
Zone 2 (ZONE2) PLC Input Signal

These signals are turned ON when the current position of the actuator is within the set domain and turned OFF when the current position is out of the set domain.
The zone is set using the user parameters.
The Zone 1 Signal is set using the parameter No.21 "Zone Positive Boundary 1 "+" Side" and No.22 "Zone Negative Boundary 1 "–" Side".
The Zone 2 Signal is set using the parameter No.23 "Zone Positive Boundary 2 "+" Side" and No.24 "Zone Negative Boundary 2 "–" Side".
The Zone 1 Signal and Zone 2 Signal become effective when the homing operation is completed.After that, even during the servo OFF, it is effective.



(12) + Jog (JOG+) PLC Output Signal
- Jog (JOG-) PLC Output Signal

This signal is the command for the jog operation startup or inching operation startup.
If a + command is issued, the actuator will operate in the direction opposite home. When a - command is issued, the actuator will operate in the direction of home.

1) Jog operation
Jog operation can be performed when the jog/inch switching (JISL) signal is OFF.
While the "JOG+" is turned "ON", the movement direction is to the opposite of the home and when it is turned "OFF", the actuator is decelerated and stopped.
While the "JOG-" is "ON", the actuator will operate in the direction of home and when it is turned "OFF", it is decelerated to a stop.
The operation is performed based on the set values.

- The speed for an operation is provided with the value set in Parameter No.2 "JOG Speed".
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals are turned "ON", the actuator is decelerated and stopped.

2) Inching operation
The inching operation is available while the JISL signal is turned “ON”.
Once it is turned “ON”, the actuator is moved as much as the inching distance.
When the JOG+ is turned “ON”, the movement is to the opposite of the home and when the JOG- is turned “ON”, the movement is to the home.
The operation is performed based on the set values.

- The speed for an operation is provided with the value set in Parameter No.2 “JOG Speed”.
- The movement distance for an operation is provided with the value set in Parameter No.25 “PIO Inching Distance”.
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).

During the normal operation, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the normal operation is continued. (The Jog signal is ignored.)
In the pause condition, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the actuator is not moved.

(Note) Because the software stroke limit is disabled before the homing operation, the actuator might run against the mechanism end. Take the greatest care.

(13) Incremental Command (INC) PLC Output Signal

If this signal is ON and a movement command is executed, the actuator moves for the distance set in the target position register from the current position.

(14) Jog/inching switching (JISL) PLC Output Signal

This signal changes over the jog operation and the inching operation.
JISL = OFF : Jog operation
JISL = ON : Inching operation
When the JISL signal is turned “ON” (for inching operation) during the jog operation, the actuator is decelerated and performs the inching operation.
When the JISL signal is turned “OFF” (jog) while the actuator is moving by inching, the actuator will complete the movement and then switch to the jog function.

	Jog operation	Inching operation
JISL	OFF	ON
Speed	Parameter No.2, “Jog speed”	Parameter No.2, “Jog speed”
Movement distance	—	Parameter No.25, “PIO Inch distance”
Acceleration/ deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
Operation	When the JOG +/JOG – signal is ON.	Upon detection of the leading (ON edge) of the JOG +/JOG – signal.

(15) Brake release (BKRL) PLC Output Signal

Turning this signal "ON" can release the brake forcibly.

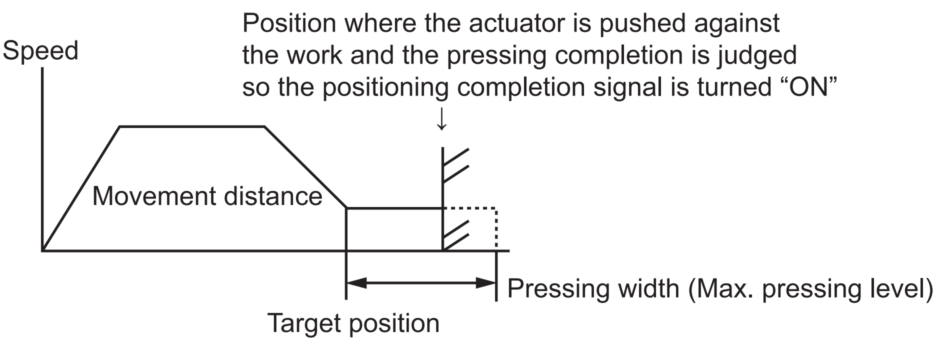
(16) Push-motion specification (PUSH) PLC Output Signal

When the movement command signal is output after this signal is turned ON, the pressing operation is performed.
When this signal is set to "OFF", the normal positioning operation is performed.
In Direct Indication Mode, the same pressing type as CON related models such as PCON Controller or the same pressing type as SEP related models such as PSEP can be selected for the pressing type in Gateway Parameter Setting Tool.

[Pressing Operation CON Method]

After reaching the target position (Note 1) from the current position, the actuator moves with the pressing speed for the distance set as the pressing band width.
The positioning complete signal (PEND) turns ON if the work piece hits and pressing is judged as completed while in the pressing operation.

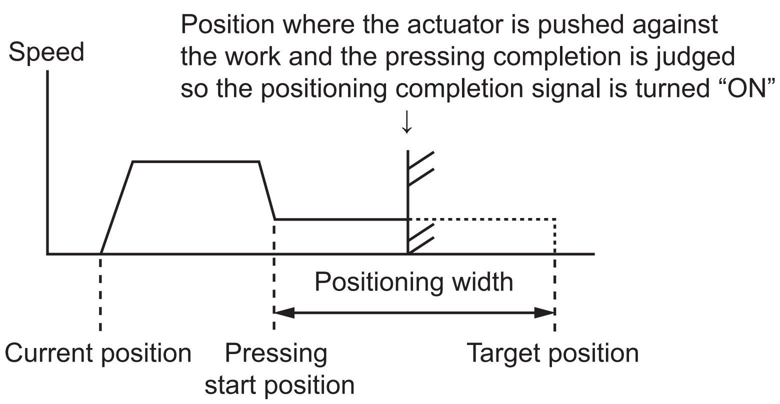
(Note 1) In Direct Indication Mode, it is the value input in the target position register.
(Note 2) It is a function limited for Direct Indication Mode. Select SEP System and CON System in the special parameter setting in Gateway Parameter Setting Tool.



[Pressing Operation SEP Method]

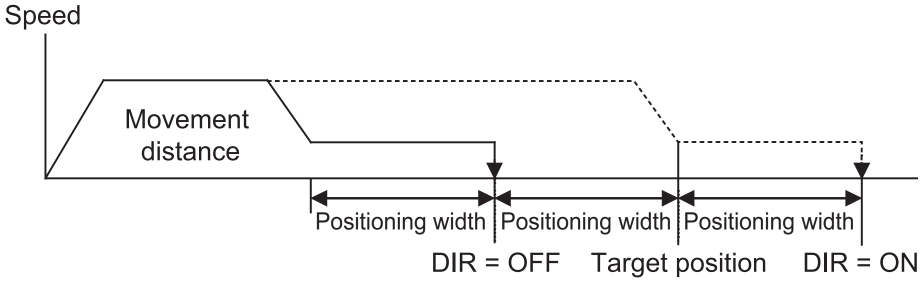
The pressing operation is performed with the start position set at the point in front of the target position (Note 1) for the width of the positioning width (for Direct Indication Mode), or the point set in the pressing width (for Positioner 1/Simplified Direct Value Mode).
The positioning complete signal (PEND) turns ON if the work piece hits and pressing is judged as completed while in the pressing operation.

(Note 1) The value is that set as the position in the position data for Positioner 1 Mode, and that input in the target position register for Simple Direct and Direct Indication Modes.
(Note 2) Pulling operation cannot be performed.



(17) Push direction specification (DIR) PLC Output Signal

This signal specifies the pressing direction.
When this signal is turned "OFF", the pressing operation is performed to the direction of the value determined by adding the positioning width to the target position.
Pressing operation starts towards the position where the positioning width is added to the target position if this signal is turned ON.
When the normal positioning operation or SEP method pressing operation is selected, this signal is ineffective.



(18) Pressing and a miss (PSFL) PLC Input Signal

In the case that the pressing operation was performed, and the actuator moved the travel distance set in the controller position table positioning width or set using the PLC's positioning width register, but it was not pushed against the work, this signal is turned "ON".

(19) Positioning completion signal (MEND) PLC Input Signal

This signal turns ON when the actuator has moved to the target position and reached the positioning width or finished pressing operation (complete or pressing error).

⚠ Caution:	When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the MEND signal is turned "OFF" temporarily. The signal will not be turned ON even in the next time the servo turns back ON. When the positioning is completed with the CSTR signal turned "ON", the MEND signal is not turned "ON".

(20) Light error alarm (ALML) PLC Input Signal

This signal turns ON when a message level alarm is generated.
For the message level alarm, refer to the section for the troubleshooting.

(21) Operation for Positioner 1/Simple Direct Modes

(Note) Even though MSEP-LC relies on the sequence program, the timing of the basic signals in actuator operation is the same as that for MSEP-C.

If the position data is written to the target position register (for Simple Direct Mode) or the target position is set in the position data of MSEP (for Positioner 1 Mode), the operation shall be made with other information, such as the speed, acceleration/deceleration, pressing width, pressing force, etc., set to the position data.

● Example of operation (Normal Positioning Operation with Simple Direct Mode)

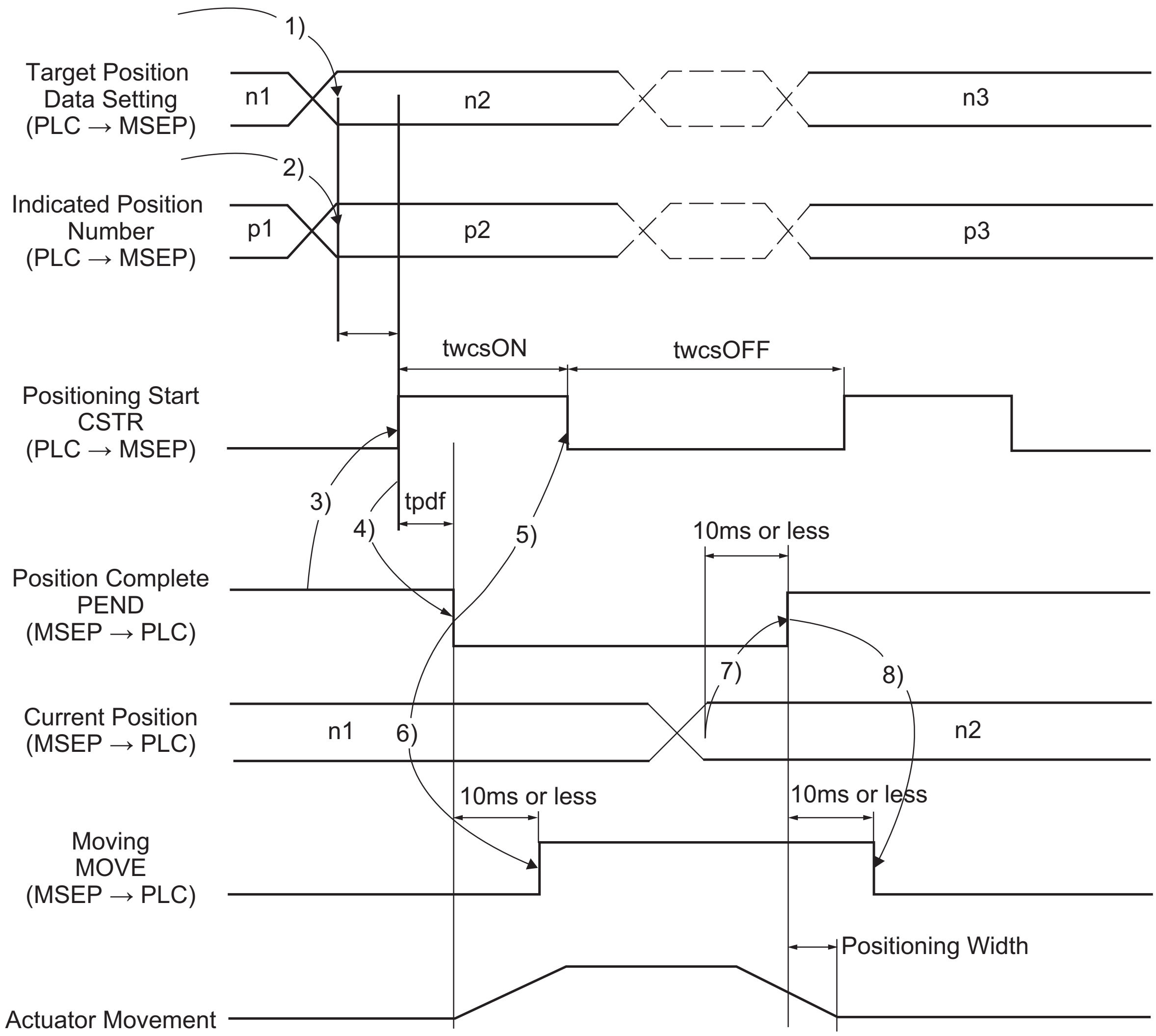
(Preparation) Set the axis numbers to be used in Simple Direct Mode with Gateway Parameter Setting Tool. [Refer to 3.1.2 and 3.2.2 Initial Setting.]
Set the position data items (speed, acceleration/deceleration, pressing width, etc)except for the target position item, in the position table.

1) Set the target position data in the target position register.
2) Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
3) In the condition where the positioning completion (PEND) signal is turned "ON" or under movement signal (MOVE) is turned "OFF", turn "ON" the positioning command (CSTR) signal.
   The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal.
4) After the CSTR signal is turned "ON", the PEND signal is turned OFF after tpdf.
5) After confirming that the PEND signal is turned "OFF" or MOVE signal is turned "ON", turn "OFF" the CSTR signal. Do not change the value in the target position register until the CSTR signal is turned "OFF".
6) At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
7) The current position data is continuously updated. When the remaining travel distance becomes within the range of the positioning width set in the position data, and the CSTR signal is turned "OFF", the PEND signal is turned "ON". Then, the completed position No. is output to the completed position No. register.
   Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned "ON".
   The current position data might be changed slightly even when the system is stopped.
8) MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.

(Reference) The target position data can be changed during the actuator movement.
In order to change the target position, change the target data and turn ON the CSTR signal after the time longer than the PLC scanning time has passed.

● Example of operation (Pressing operation)

For the pressing operation, set the current limit to the pressing force box and pressing width to the pressing width box in the position data at the stage of (Standard). By conducting a positioning operation towards the set position number, the actuator performs a pressing operation.



To turn ON twcsON, have an interval of time more than tpdf.
To turn OFF twcsOFF, have an interval of time more than tpdf.
tpdf = Yt + 10 + Xt (minimum value) to Yt + 10 + Xt + 20 (maximum value)

(22) Operation for Direct Indication Mode

(Note) Even though MSEP-LC relies on the sequence program, the timing of the basic signals in actuator operation is the same as that for MSEP-C.

It is operated with the data set in the PLC's target position register, positioning width register, setup speed register, acceleration/deceleration register and pressing current limit setup register.

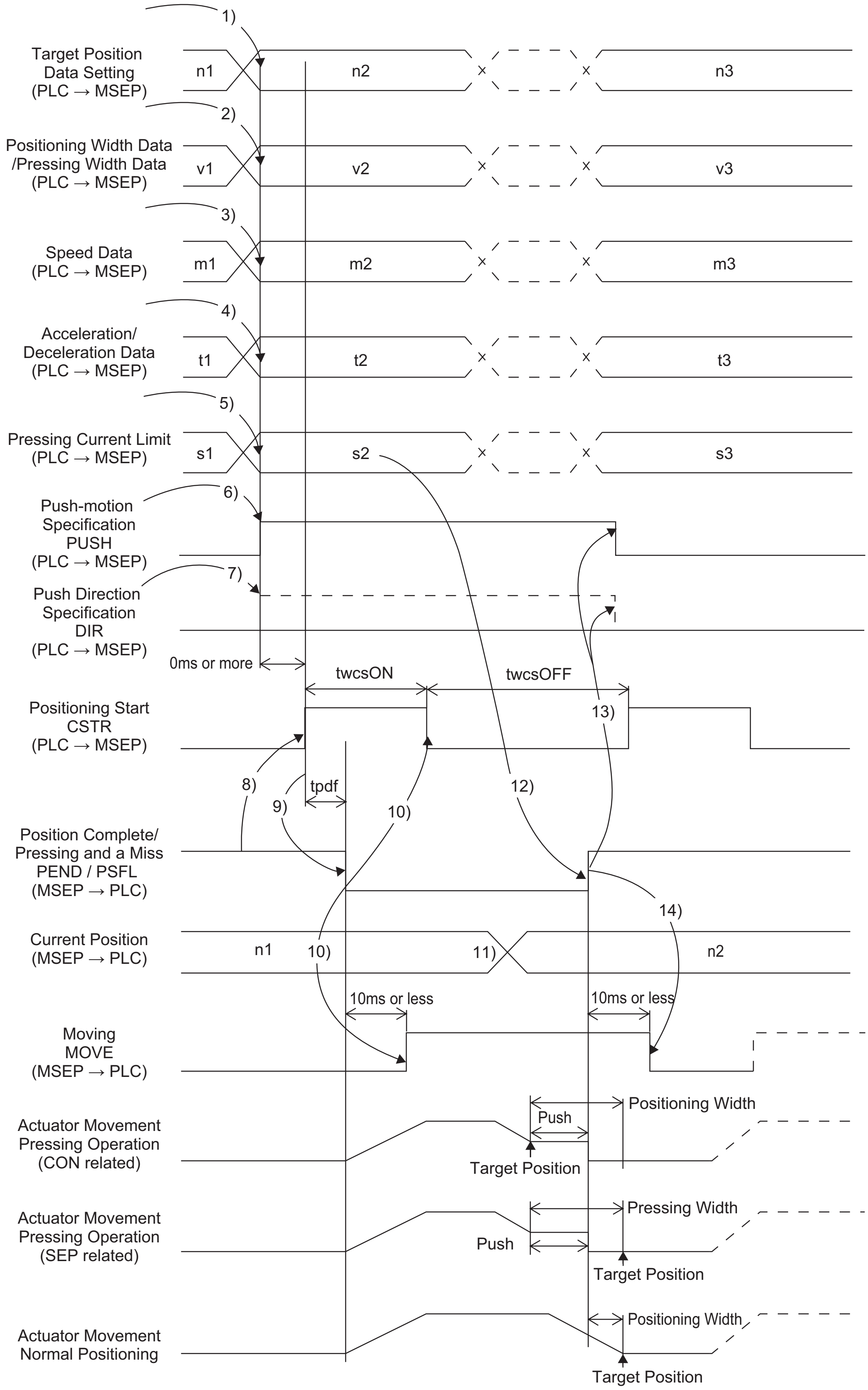
● Example of operation (Pressing operation)

(Preparation) Set the axis numbers to be used in Direct Indication Mode with Gateway Parameter Setting Tool. Also, select the pressing method from CON and SEP. [Refer to 3.1.2 and 3.2.2 Initial Setting.]

1) Set the target position data in the target position register.
2) Set the positioning width (pressing width) data in the positioning width register.
3) Set the speed data to the speed register.
4) Set the acceleration/deceleration data to the acceleration/deceleration register.
5) Set the pressing current limit data in the pressing current limit value register.
6) Turn “ON” the pressing setup (PUSH) signal.
7) Specify the pressing direction using the pressing direction setup (DIR) signal. (Unnecessary for SEP pressing method)
8) In the condition where the positioning completion (PEND) signal is turned “ON” or under movement signal (MOVE) is turned “OFF”, turn “ON” the positioning start (CSTR) signal. The data items set in Steps 1) through 5) are read in the controller at the startup (ON edge) of the CSTR signal.
9) After the CSTR signal is turned “ON”, the PEND signal is turned OFF after tpdf.
10) After confirming that the PEND signal is turned “OFF” or MOVE signal is turned “ON”, turn “OFF” the CSTR signal. Do not change any value in each register until the CSTR signal has been turned “OFF”.
11) The current position data is continuously updated.
12) When the CSTR signal is turned “OFF” and the motor current reaches the current limit value set in Step 5), the PEND signal is turned “ON”. (Pressing complete)
    Even when the positioning width (pressing width) set in Step 2) is reached, in the case that the current does not reach the motor current limit value set in Step 5), the pressing and a miss (PSEL) signal is turned “ON”. In this case, the PEND signal is not turned “ON” (pressing and a miss). (Pressing and a miss)
13) After the PEND signal or PSFL signal is turned “ON”, turn “OFF” the PUSH signal.
14) MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.

● Example of operation (Normal positioning operation)

For the general positioning operation, set the signal in Step 6) to “OFF”.
When the remaining travel distance becomes within the range of the positioning width set in the position data, and the CSTR signal is turned “OFF”, the PEND signal is turned “ON”.



To turn ON twcsON, have an interval of time more than tpdf.
To turn OFF twcsOFF, have an interval of time more than tpdf.
tpdf = Yt + 10 + Xt (minimum value) to Yt + 10 + Xt + 20 (maximum value)

(23) Operation Timings for Positioner 2 and Positioner 3 Modes

(Note) Even though MSEP-LC relies on the sequence program, the timing of the basic signals in actuator operation is the same as that for MSEP-C.

The operation is to be made with the target position, speed, acceleration/deceleration, pressing width and pressing force set in the position data of MSEP.

● Example of operation (Positioning operation)

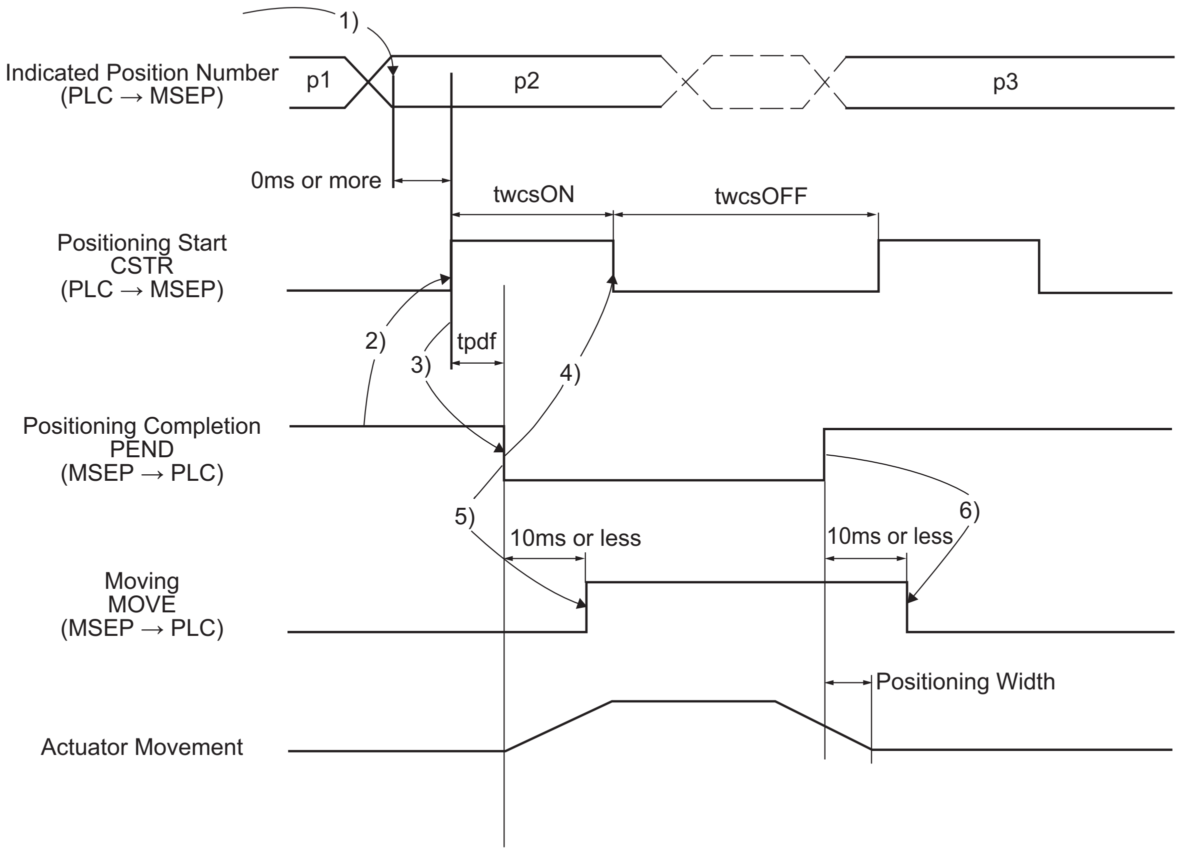
(Preparation) Set the axis numbers to be used in Positioner 2 or Positioner 3 Mode with Gateway Parameter Setting Tool. [Refer to 3.1.2 and 3.2.2 Initial Setting.]
Set the position data (target position, speed, acceleration/deceleration, etc.) to the position table.

(Note) If Positioner 3 Mode, have 1) and 2) at the same time.

1) Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
2) In the condition where the positioning completion (PEND) signal is turned “ON” or under moving signal (MOVE) is turned “OFF”, turn “ON” the positioning start (CSTR) signal.
   The data items set in Step 1) is read in the controller at the startup (ON edge) of the CSTR signal.
3) After the CSTR signal is turned “ON”, the PEND signal is turned OFF after tpdf.
4) After confirming that the PEND signal is turned “OFF” or MOVE signal is turned “ON”, turn “OFF” the CSTR signal. Do not change the value in the target position register until the CSTR signal is turned “OFF”.
5) At the same time when the PEND signal is turned “OFF”, the MOVE signal is turned “ON”.
6) Once the remaining movement amount of the actuator gets into the range of the positioning width set in the parameter, PEND signal turns ON if CSTR signal is OFF, and the complete position number is output to the complete position number register.
   Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned “ON”.
   MOVE signal turns OFF at the same time as or within 10ms after PEND signal turns ON.

● Example of operation (Pressing operation)

For the pressing operation, set the current limit to the pressing box and pressing width to the pressing width box in the position data at the stage of (Standard). By conducting a positioning operation towards the set position number, the actuator performs a pressing operation.



To turn ON twcsON, have an interval of time more than tpdf.
To turn OFF twcsOFF, have an interval of time more than tpdf.
tpdf = Yt + 10 + Xt (minimum value) to Yt + 10 + Xt + 20 (maximum value)

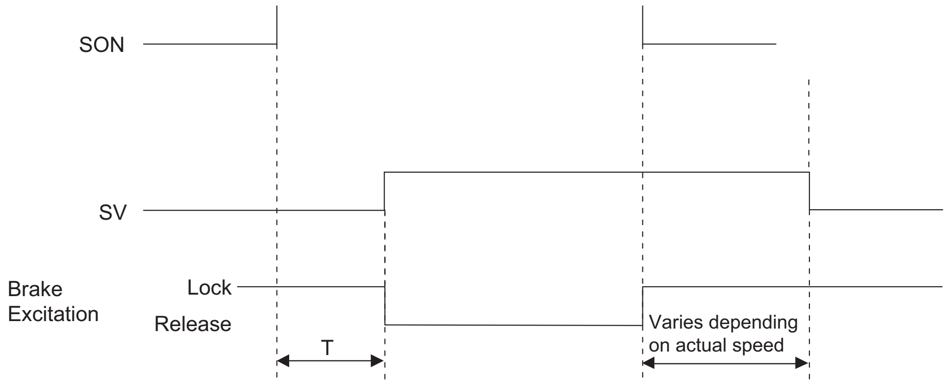
3.8.2 SEP I/O Mode of Fieldbus Type and PIO Operation of MSEP-C

[1] Servo ON (SON, SV)

PIO Signal	Input	Output
	SON	SV
All Operation Patterns	○	○

○ : Available, ×: Unavailable

1) Servo ON signal SON is the input signal making the servo motor of the actuator operable.
2) If the servo-on is performed to enable operation, the SV output signal is turned ON.
3) With the power being supplied, then controller cannot be operated while the SV signal remains OFF. If SON Signal is turned OFF during the actuator operation, the actuator decelerates and stops with the maximum torque for RCP* and emergency stop torque for RCA* and RCL, and then servo is turned OFF and the motor gets into Free-run Mode. The brake (actuator option) is of release-in-excitation type. Therefore, making the excitation ON will release the brake while making it OFF will lock the brake.



T (before detecting excitation (Note)) = SON signal identification (7ms) + Excitation detection time (Parameter No.36=0 : 170ms, No.36=1 or 2 : 220ms) × Number of retry (10 times Max.) + Servo ON delay time (20 (Pulse motor), 50 (Servo motor) ms)

T (after detecting excitation (Note)) = SON signal identification (7ms) + Servo ON delay time (20 (Pulse motor), 50 (Servo motor) ms)

(Note) Excitation check operation is performed at the first servo-on process after the power is turned ON, or when the home return is completed for the simple absolute type to identify the magnetic poles of the motor.

[2] Alarm, Alarm Reset (*ALM, RES)

PIO Signal	Input	Output
	RES	*ALM
All Operation Patterns	○	○

○ : Available, ×: Unavailable

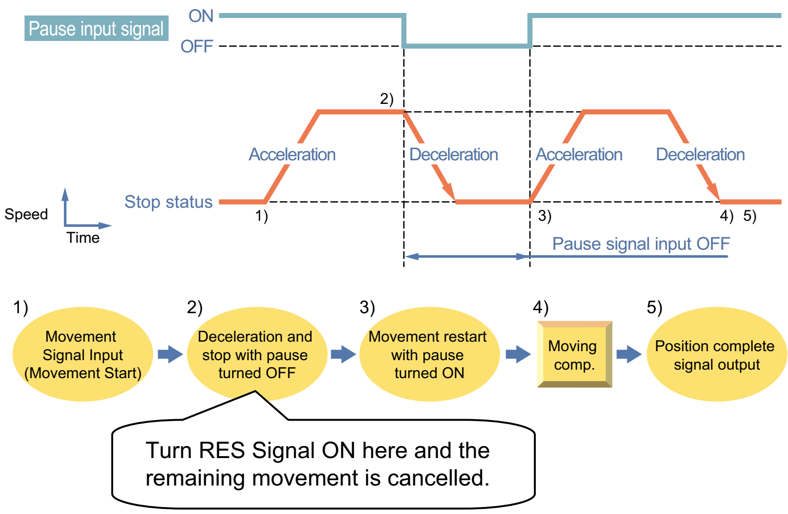
1) Alarm signal *ALM is set to ON in the normal status but turned OFF at the occurrence of an alarm at a level equal to or higher than the operation release level.
2) Turning reset signal RES ON under occurrence of an alarm at the operation release level allows the alarm(Note 1) to be released. The action is taken at the rising edge (ON edge).
3) The alarm reset should be done after the cause of the alarm is confirmed and removed. If alarm reset and restart are repeated many times without removal of the cause, a severe failure such as motor burnout may occur.

(Note 1) Check the 6.4 Alarm List for details of alarms.

[3] Pause and Operation Interruption (*STP, RES)

PIO Signal	Input	
	*STP	RES
Operation Pattern 0 and 5	○	○
Operation Pattern 1 to 4	○	×

○ : Available, ×: Unavailable



■ Control method

Pause is possible during movement. In addition, the remaining moving distance can be cancelled to interrupt the operation.
The pause signal is an input signal always set to ON. So, it is normally used to remain ON. Use this function for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If pause signal *STP is turned OFF during operation of the actuator, the actuator is decelerated to a stop. The deceleration is defined by the value set in the position table.
2) If pause signal *STP is returned to ON, the actuator continues the remaining movement. The acceleration is the value set in the position table.
3) Turning reset signal RES ON during pause (*STP being ON) allows the remaining movement to be canceled to interrupt the operation.

⚠ Caution: At occurrence of an alarm in the release level (Note 1), RES can reset the alarm. Confirm that no alarm is issued when cancelling the remaining movement.

(Note 1) Check the 6.4 Alarm List for details of alarms.

[4] Movement Command and Positioning Complete Signal (ST0 to ST2, PE0 to PE2)

○ : Yes, × : No

PIO Signal	ST0	ST1	ST2	PE0	PE1	PE2
Operation Pattern 0 to 2	○	○	×	○	○	×
Operation Pattern 3	○	○	×	○	○	○
Operation Pattern 4	○	○	○	○	○	○
Operation Pattern 5	×	×	×	○	○	×

■ Control method

1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position.
2) Current Position No. PE* of the commanded position turns ON once the positioning is complete.
3) Once PE* Signal turns ON, turn OFF ST* Signal.
4) Current Position No. PE* turns ON if the remaining movement amount is in the range of the positioning width.The current position number PE* Signal will be kept on once it is turned ON unless the start signal ST* is turned back ON, servo is turned OFF or the actuator is out of the positioning width width range. When the pause signal *STP is turned OFF in this condition, the current position number PE* Signal will also be turned OFF.

⚠ Caution: (1) If the ST* signal is turned ON for the position after completion of positioning, both the PE* and PEND signals remain ON.
(2) The PE* signals is set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
(3) Interlock should be taken so that two or more ST* signals aren't set to ON simultaneously.
- Entering the ST* signal of another position during positioning is invalid. If the ST* signal of another position is turned ON during positioning, the operation is terminated after the completion of the positioning being operated.

[5] Positioning (ST0 to ST2, LS0 to LS2)

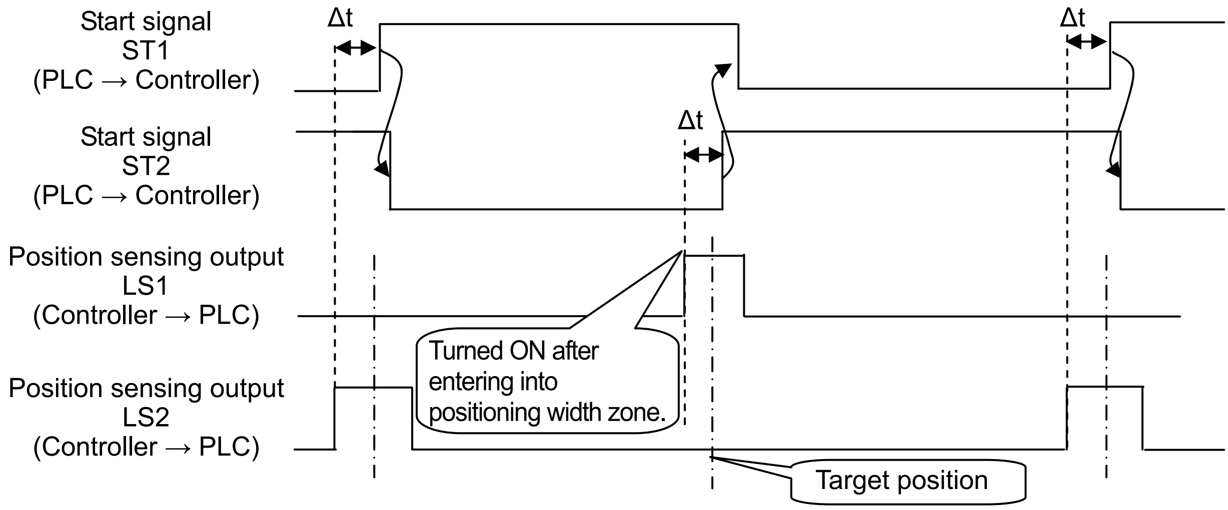
○ : Yes, × : No

PIO Signal	ST0	ST1	ST2	LS0	LS1	LS2
Operation Pattern 0 to 2	○	○	×	○	○	×
Operation Pattern 3	○	○	×	○	○	○
Operation Pattern 4	○	○	○	○	○	○
Operation Pattern 5	×	×	×	○	○	×

■ Control method

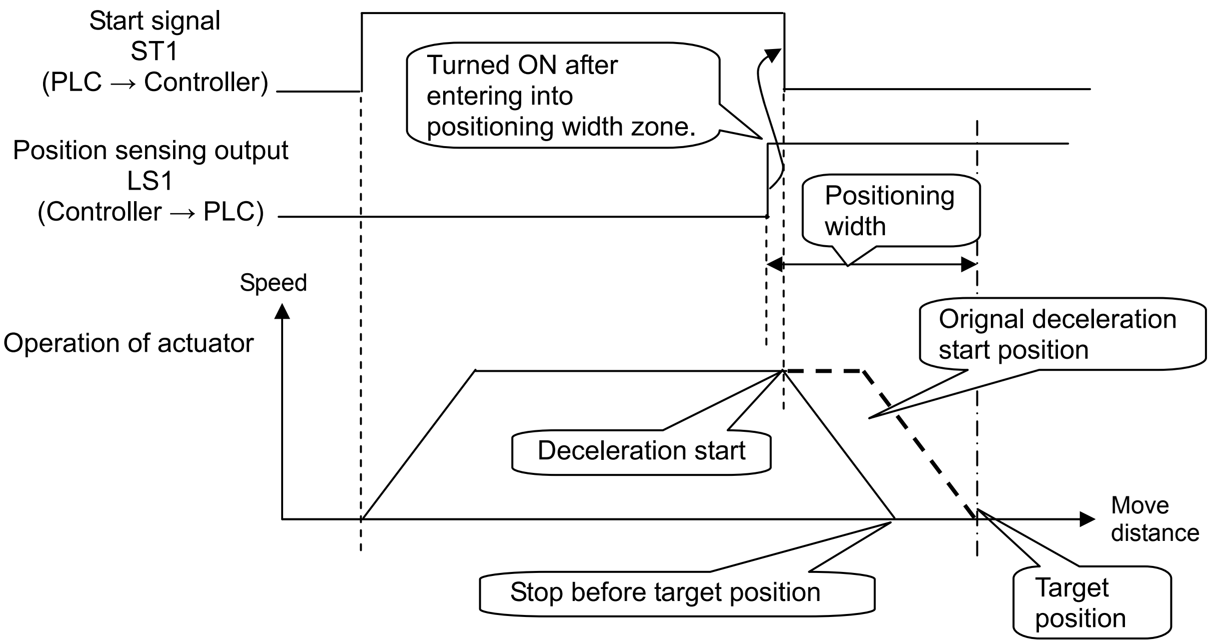
1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position.
2) At the completion of positioning, position detection output LS* of the specified position is turned ON.
3) Position detection output LS* is turned ON if the remaining moving distance enters into the positioning width. LS* is set to ON if the current position is located within the positioning width zone or OFF if the current position is located out of the positioning width zone (the same situation occurs in the servo OFF status).
4) If the input signal method is set to continuous power supply in the initial setting, keep ST* Signal ON until the actuator moves to another position, and turn it OFF at next ST* Signal. If it is turned OFF with LS* Signal, the actuator decelerates and stops from the point where it gets into the positioning width range, thus may not reach the target position. In continuous operation, turn ON the next ST* signal by setting the positioning width within the required precision range or setting the period taken from detection of the LS* signal to reaching the target position.

(Example) Repetition of ST1 → ST2 → ST1 → …
Insert timer Δt if necessary.



Δt: Time required to certainly reach the target position after the position sensing output LS1 or 2 is turned ON.

[Example of stop position when the ST* signal is turned OFF by the LS* signal]
If the positioning width is set at a position before the original deceleration start position, the actuator cannot reach the target position.

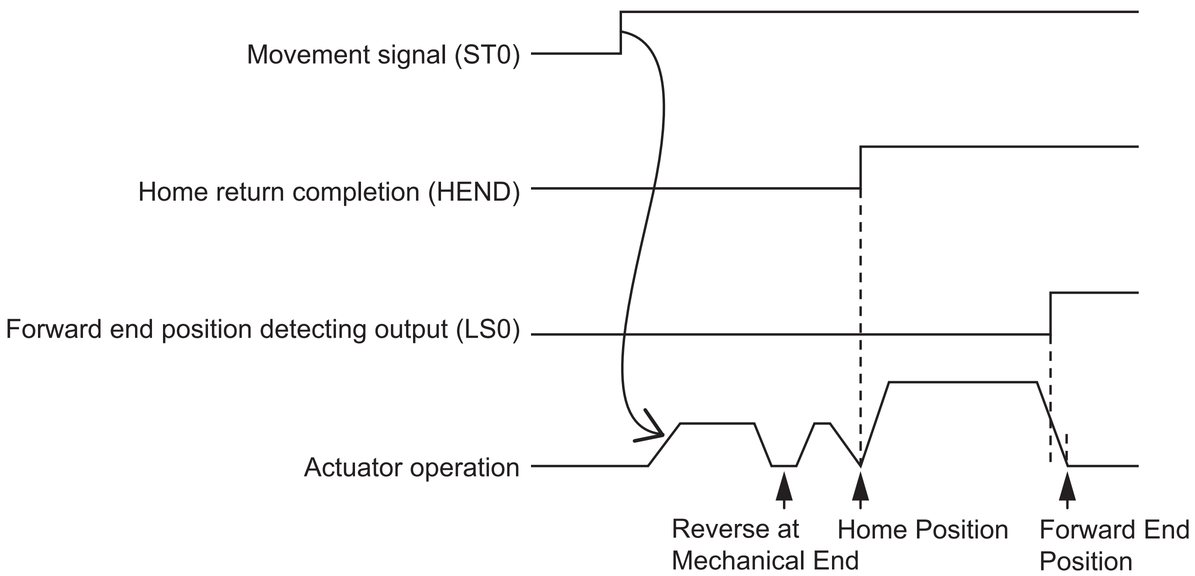


> ⚠ Caution: (1) If the ST* signal for the position is turned ON after the completion of positioning, the LS* signal remains ON.
> (2) Both the LS* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
> (3) LS* signal would not be output if the positioning width is set less than the minimum resolution.

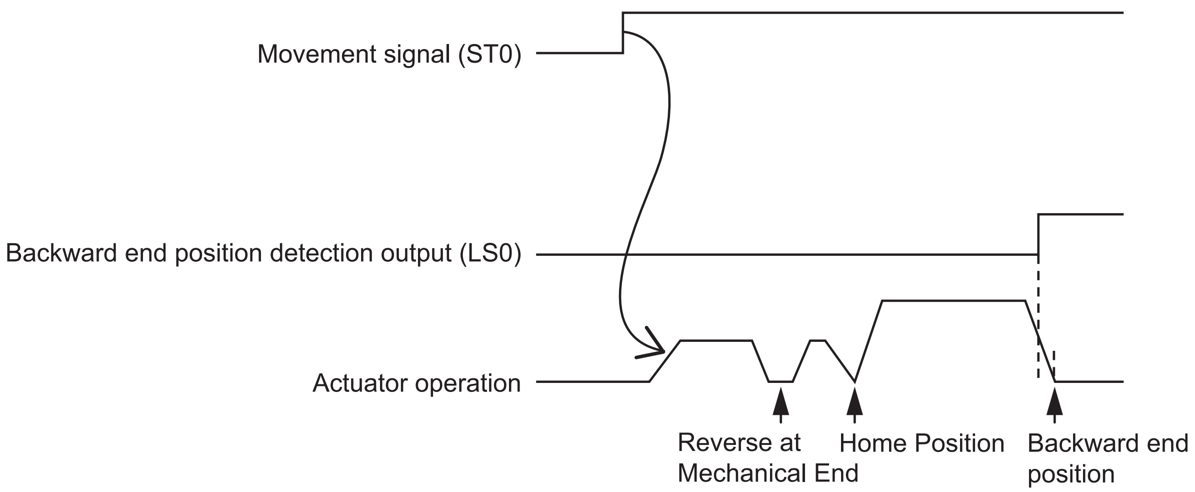
[6] Home Return

Home-return operation is performed when turning the movement signal (ST0) on if the home return has not yet done since the power is turned ON.

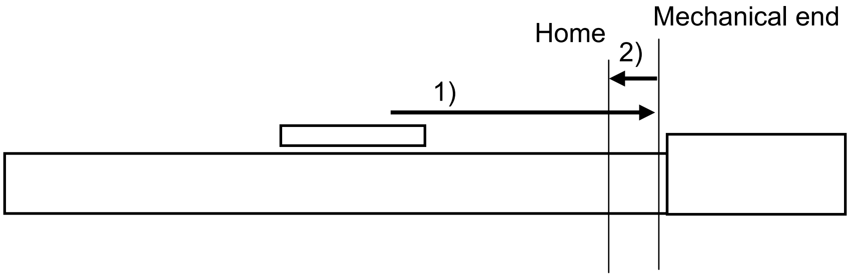
1) If the operation pattern is “Point-to-Point Movement (Single Solenoid)”
   If the home return is not conducted on the operation panel yet, the first movement signal (ST0) will bring the actuator to the home position. After home return operation, it moves to the forward position and stops (for positioning).



2) If the operation pattern is “Point-to-Point Movement (Double Solenoid) and 3-Point Movement”
   After returning to home position, the actuator stops at the backward position (for positioning) (Home-return complete).
   Movement signal to the forward end (ST0) is invalid till the home-return operation is complete.



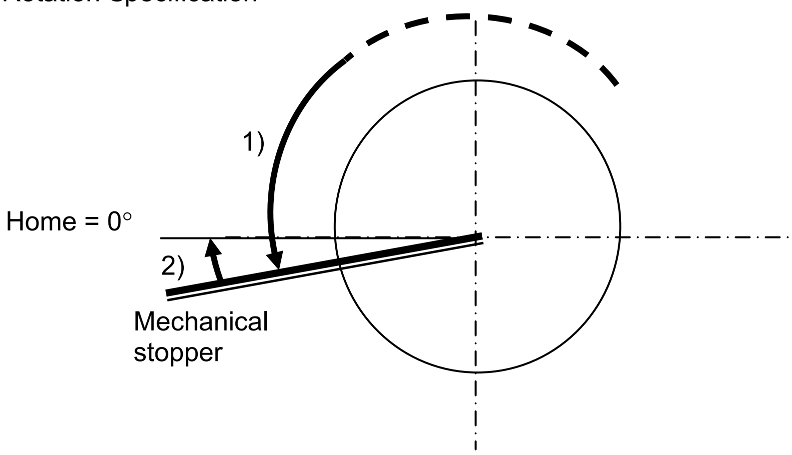
[Operation of Slider Type/Rod-Type Actuator]



1) The actuator moves toward the mechanical end at the home return speed.
   The moving speed is 20mm/s for most actuators but less than 20mm/s for some actuators.
   Refer to the instruction manual of each actuator.
2) The actuator is turned at the mechanical end and stopped at the home position. The movement amount at this time is determined for each actuator and cannot be changed.

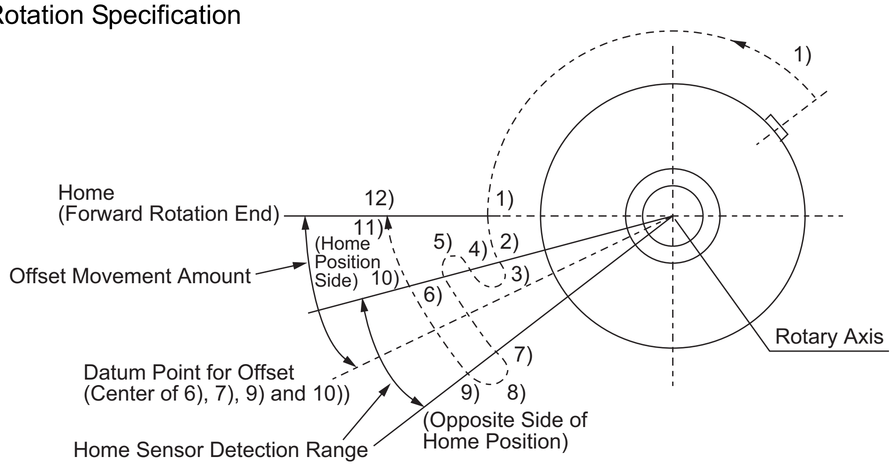
⚠ Caution: In the home reverse specification, the actuator moves in the reverse direction.

[Operation of Rotary Actuator]
(1) 330° Rotation Specification



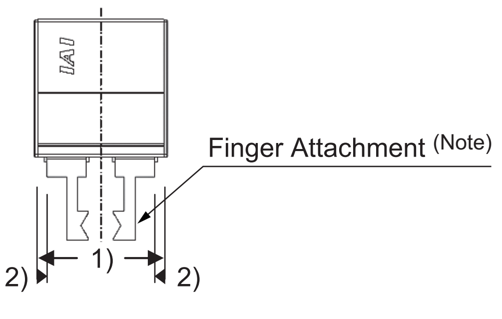
1) The actuator rotates in CCW (counterclockwise) direction from the view point of the load side. The speed is either 20deg/s.
2) It reverses at the mechanical stopper and stops at the home position. The movement amount at this time is determined for each actuator and cannot be changed.

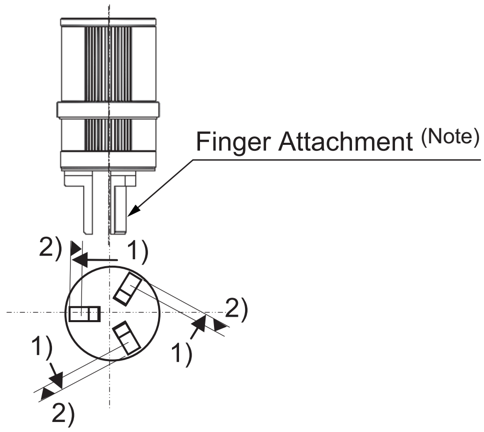
(2) 360° Rotation Specification



1) Once the home-return operation is started, the rotary part turns in CCW (counterclockwise) from the view of the load side. The speed is either 20deg/s.
2) Home sensor turns ON.
3) Starts reversed rotation.
4) Goes back to a point exceeded the home sensor detection range, and confirms the home sensor is turned OFF.
5) Starts reversed rotation.
6) Confirms the home sensor gets turned on again.
7) Goes to a point exceeded the home sensor detection range on the opposite side of the home position, and confirms the home sensor is turned OFF.
8) Starts reversed rotation.
9) Confirms the home sensor turns ON.
10) Goes to a point exceeded the home sensor detection range on the home position side, and confirms the home sensor is turned OFF.
11) Based on the result gained from 6), 7), 9) and 10), the center of the home sensor detection range is calculated.
12) The actuator moves in a certain amount for each actuator from the position of 11) and stops at the home position.

[For Gripper]





1) The actuator moves toward the mechanical end (to end side) at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The movement amount at this time is determined for each actuator and cannot be changed.

(Note) Finger attachment is not included in the actuator package. Please prepare separately.

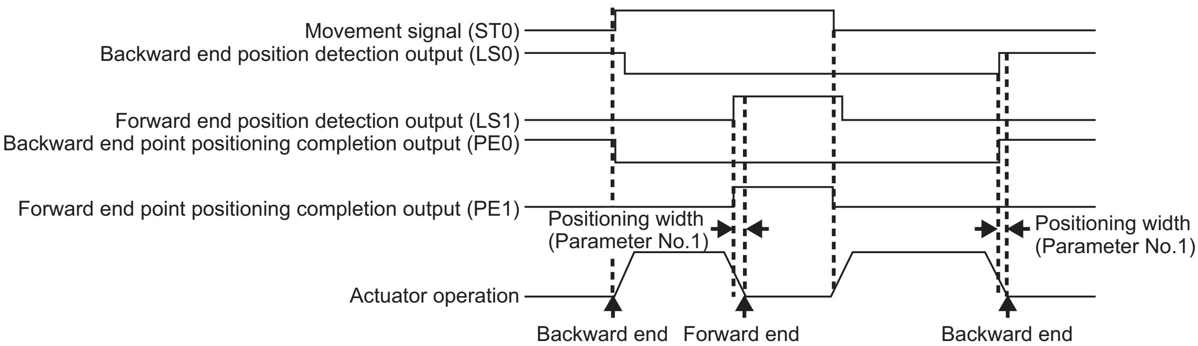
[7] Absolute Reset (conducted for Absolute Type)

When the power to the machine is turned ON for the first time (actuator operation), perform the Absolute Reset.

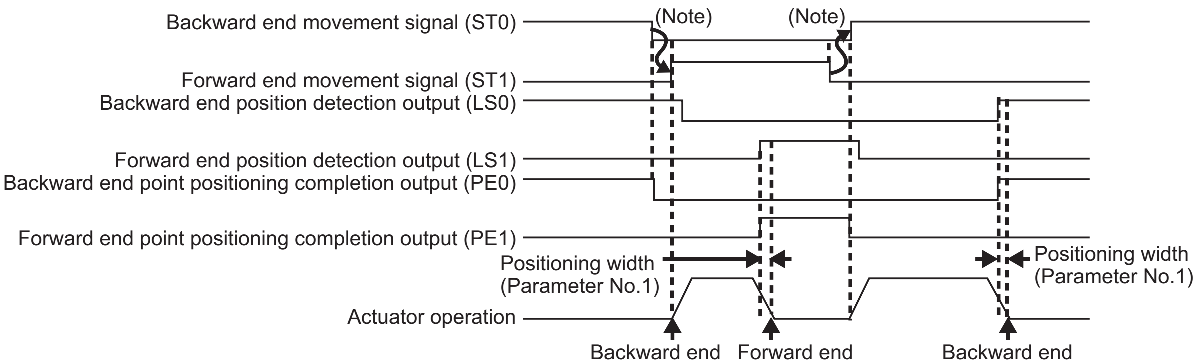
1) Absolute Encoder Failure Detection Error is issued at the power-on.
2) Turn RES Signal (IN2) ON or reset the alarm in the alarm screen on a teaching tool such as the PC software.
3) Issue the movement command to perform a home-return operation.

[8] Point-to-Point Movement = Operation Timing for Operation Patterns 0 to 2

(1) Single Solenoid System:
When the ST0 is turned "OFF", the positioning to the backward end is performed and when the ST0 is turned "ON", the positioning to the forward end is performed.



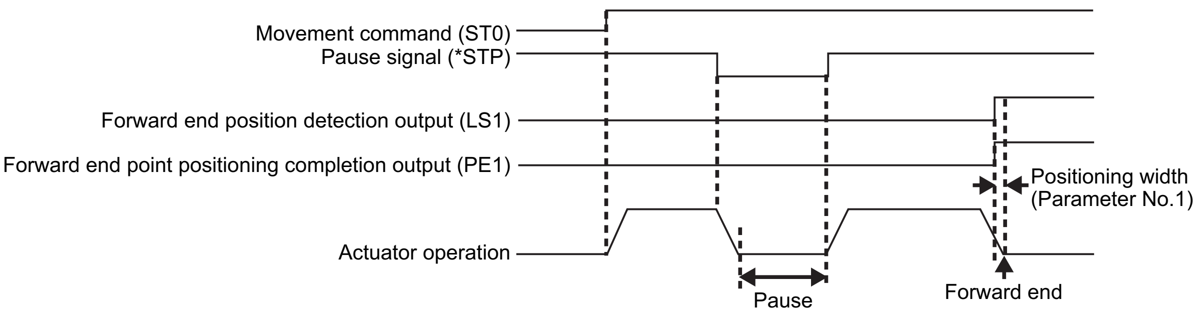
(2) Double Solenoid System:
With the combination of ST0 and ST1, the actuator performs a positioning at the target position.



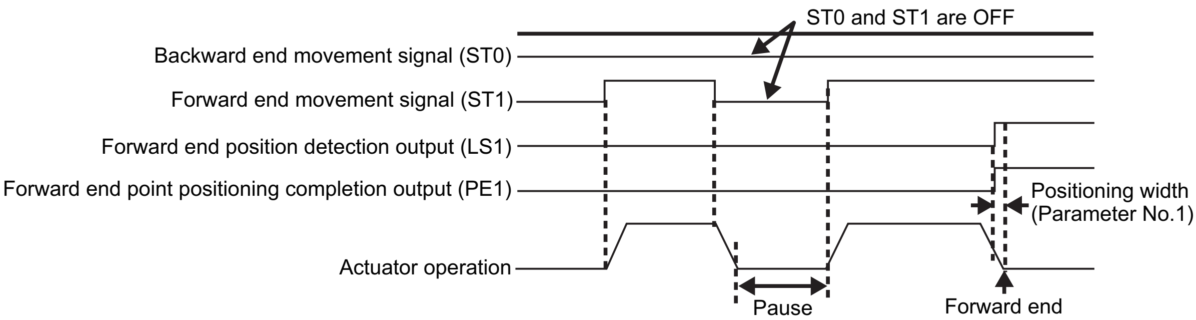
(Note) When having a movement command, make sure to turn OFF both ST0 and ST1 before issuing a movement command to the target position.
If it is set to the continuous operation type in the initial setting, and both ST0 and ST1 are turned OFF during a movement, the actuator decelerates and stops on the spot.
If both ST0 and ST1 turn ON during a movement, the signal that came ON first becomes effective.

[9] Pause during Movement = Operation Timing for Operation Patterns 0 to 2

(1) Single Solenoid System:
With the input of the pause signal (*STP), the actuator pauses its operation. Shown below is an example for the forward end position movement.

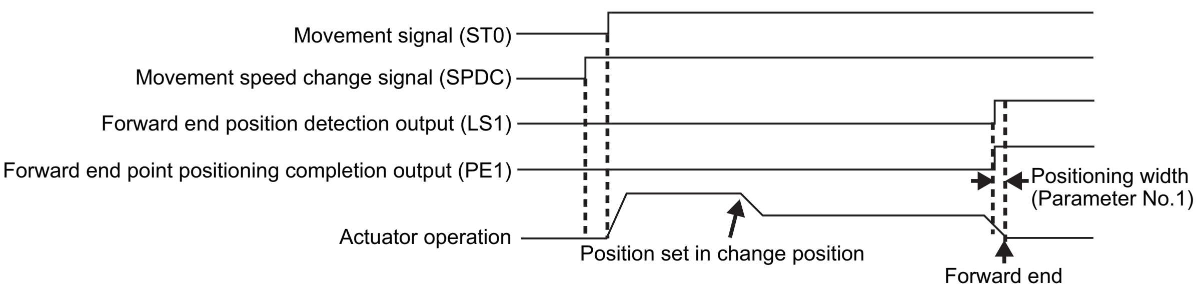


(2) Double Solenoid System:
By turning both ST0 and ST1 OFF, the operation of the actuator is paused. Shown below is an example for the forward end position movement.

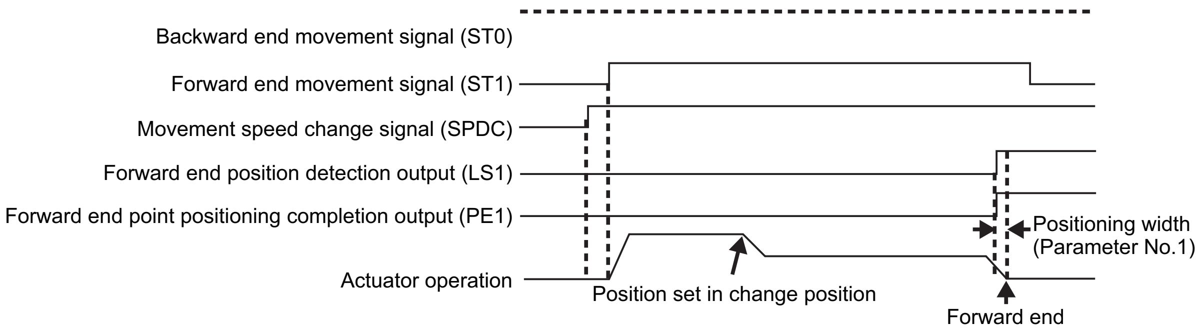


[10] Speed Change during Movement = Operation Timing for Operation Patterns 1

(1) Single Solenoid System:
With the movement speed change signal (SPDC) turned ON, the actuator is operated with the changed speed from the position set as the change position in the position data. Shown below is an example for the forward end position movement.

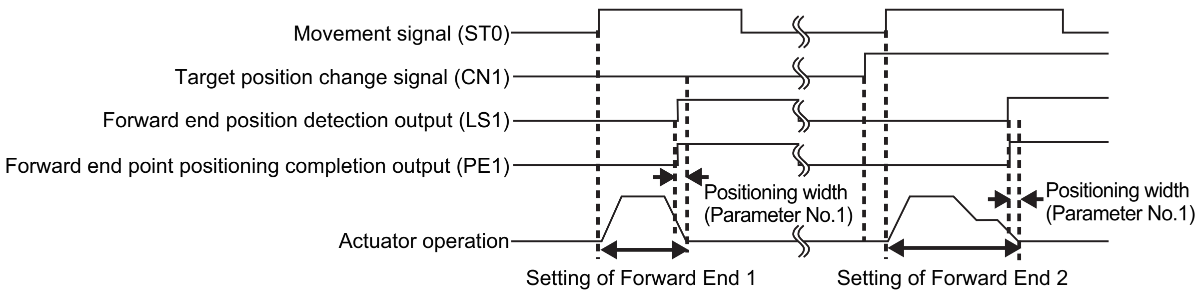


(2) Double Solenoid System:
With the movement speed change signal (SPDC) turned ON, the actuator is operated with the changed speed from the position set as the change position in the position data. Shown below is an example for the forward end position movement.

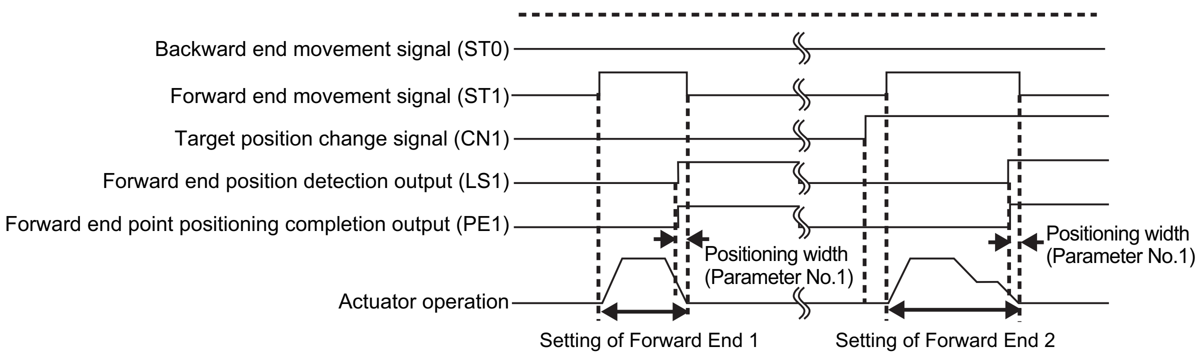


[11] Target Position Change = Operation Timing for Operation Patterns 2

(1) Single Solenoid System:
With the target position change signal (CN1) turned ON, the operation is made with the setting of Forward End 2 in the position data when moving towards the forward end. The actuator operates with the setting of Backward End 2 in the position data when moving towards the backward end. Shown below is an example for the forward end position movement.

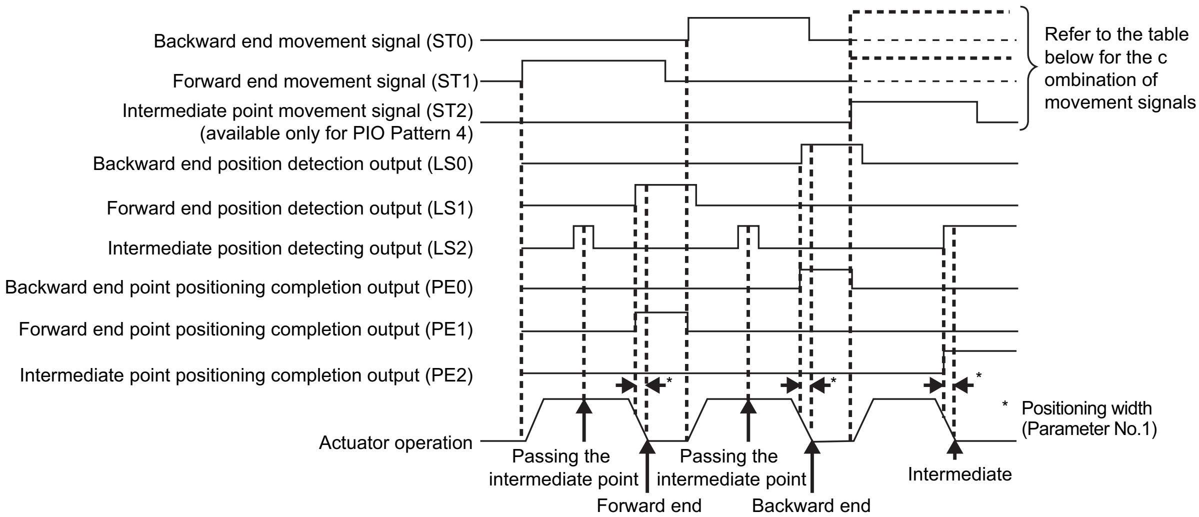


(2) Double Solenoid System:
With the target position change signal (CN1) turned ON, the operation is made with the setting of Forward End 2 in the position data when moving towards the forward end. The actuator operates with the setting of Backward End 2 in the position data when moving towards the backward end. Shown below is an example for the forward end position movement.



[12] 3-Point Movement = Operation Timing for Operation Patterns 3 and 4

With the combination of ST0 and ST1, the actuator moves to the target position.



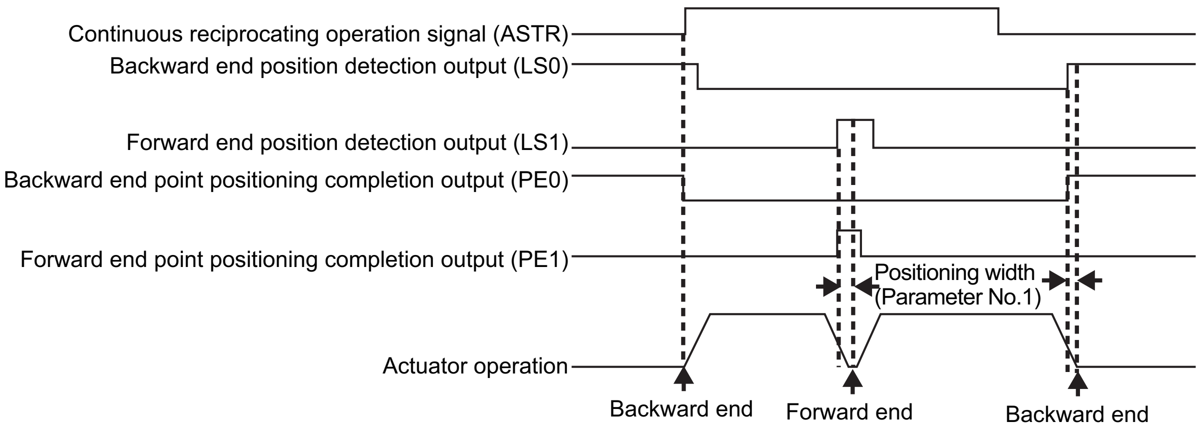
Following table shows the combination of the movement signals by each PIO pattern and the destination determined by it.

PIO Pattern 3			
Input Signal	Forward end movement	Backward end movement	Intermediate point movement
ST0	OFF	ON	Both being ON or both OFF (selected in the initial setting)
ST1	ON	OFF	

PIO Pattern 4			
Input Signal	Forward end movement	Backward end movement	Intermediate point movement
ST0	OFF	ON	OFF
ST1	ON	OFF	OFF
ST2	OFF	OFF	ON

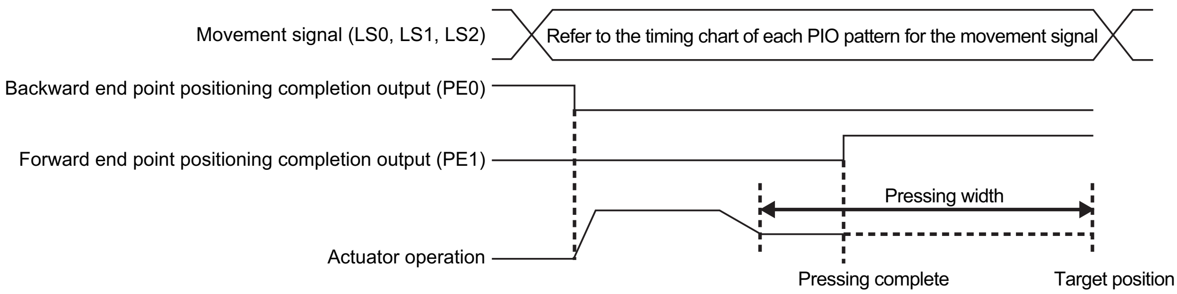
[13] 2-Point Repeated Back and Forth Operation = Operation Timing for Operation Patterns 5

While the repeated back and forth operation signal (ASTR) is ON, the actuator moves back and for the repeatedly between the forward end and the backward end.
Once ASTR signal is turned OFF, the actuator positions at the current target position and stops.



[14] Timing for Pressing Operation = All Operation Patterns

If the settings of pressing force and pressing width is conducted in the position data and operate the actuator, the actuator performs a pressing operation towards the target position.
Shown below is an example for the forward end position movement.



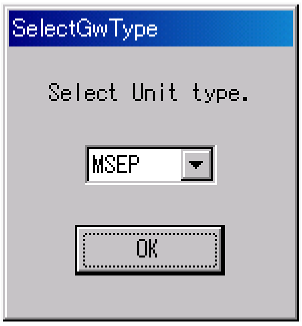
⚠ Caution: For the pressing operation, use the positioning complete signal (PE*).
Even the operation finishes with a miss-pressing and reaches the end point, PE* signal will turn ON. Set the pressing width wider when miss-pressing detection is required and identify with a timer.

3.9 About Gateway Parameter Setting Tool

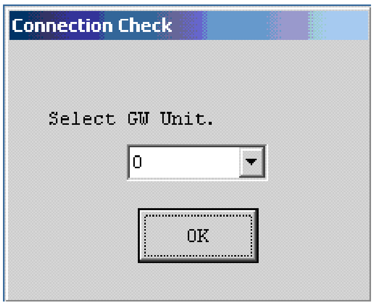
This tool is necessary for the initial setting process such as MSEP operation mode select.
Shown below is how to use the tool.
(Note) The design of the screen may differ depending on the operation system of your PC.

3.9.1 Startup of Tool

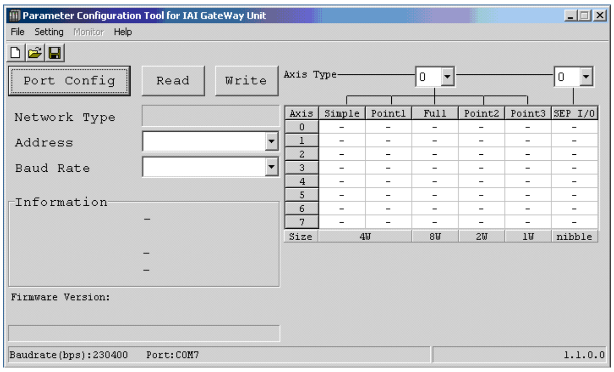
1) Boot the Gateway Parameter Setting Tool after the power to MSEP is turned ON, and the window shown below appears. Select “MSEP GW” if MSEP is connected and click OK. Select the model name that is connected and press OK.



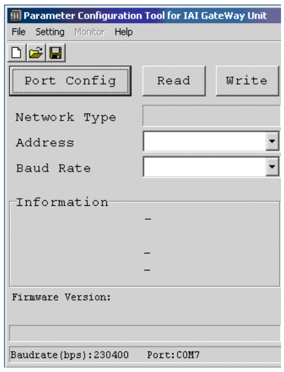
2) Once MSEP is detected the detected unit numbers become available to select. Select the unit number to be connected and click the “OK” button.



3) The main window opens. The main window opens even when MSEP could not be detected. Click on the "Read" button in this window and the parameters start to be read from MSEP. Parameter transfer starts if the "Write" button is clicked. However, note that the transfer cannot be made if there is a blank like Address and Baud Rate in the figure below.



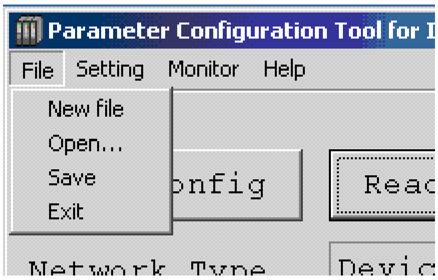
Main Window for MSEP-C
(Initial Condition)



Main Window for MSEP-LC
(Initial Condition)

3.9.2 Explanation of each Menu

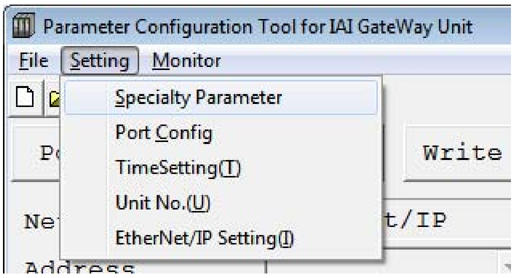
1) File Menu



In the main window, click on the file menu on the top left corner and the menu list pops up as shown in the figure above.

- New file : Create new network parameters and operation mode parameters.
- Open… : Open the saved parameter files to show on the main window.
- Save : Save the parameter remained in the tool as a file.
- Exit : Close the tool.

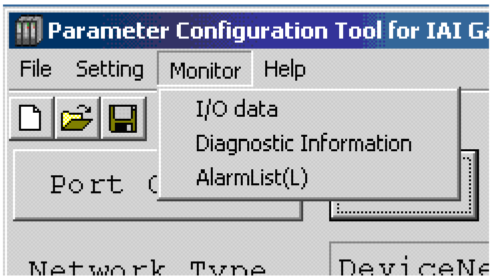
2) Setting Menu



Click on the “Setting” menu on the top left corner in the main window and the setting menu list pops up.

- Specialty Parameter : Set the parameters related to the process of Gateway area in MSEP. [Refer to 3.9.3 1), 2) and 3) GW Param */GWmode Select.]
- Port Config : Set the communication speed between the tool and PC and COM port number.
- TimeSetting(T) : Set the clock retained in MSEP. [Refer to 3.9.3 4) TimeSetting.]
- Unit No.(U) : Set the unit number of MSEP and top axis number in that unit. [Refer to 3.9.3 5) Unit No.]
- EherNet/IP Setting : For EtherNet/IP type, this menu is displayed. Set IP address etc. [Refer to 3.9.3 6) EherNet/IP Setting.]

3) Monitor Menu



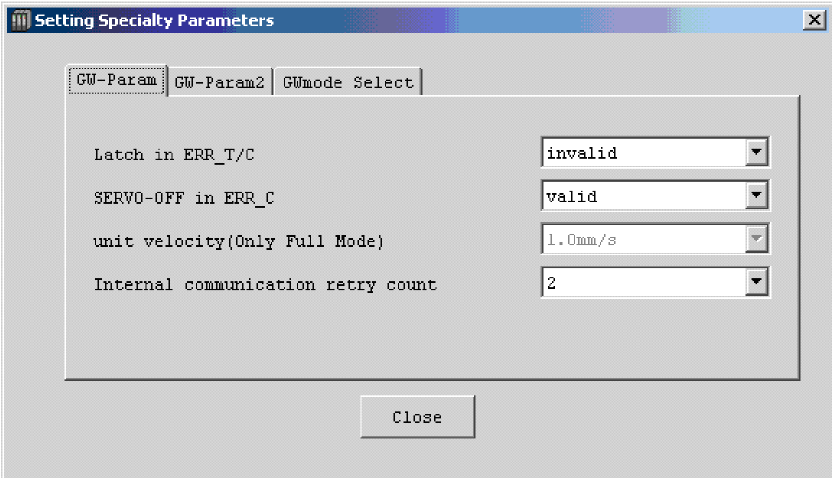
Click on the “Monitor” menu on the top left corner in the main window and the monitor menu list pops up.
(Note) “Monitor” cannot be selected before reading a parameter.

- I/O data : Show the details of the host PLC and MSEP data. [Refer to 3.9.3 6) I/O Data]
- Diagnostic Information : Show the number of ERRT and ERRC occurrence, emergency stops and scan time. [Refer to 3.9.3 7) Diagnostic Information]
- AlarmList(L) : Read and show the alarm list retained in MSEP. [Refer to 3.9.3 8) AlarmList(L)]

3.9.3 Description of Functions

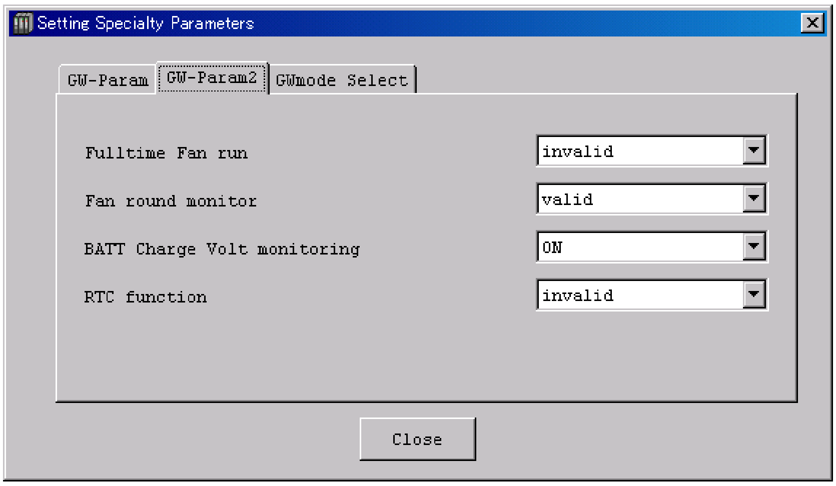
(Note) The applicable functions differ for each model. Even if shown in the explanation below, the functions that are not applicable will not be shown.

1) GW-Param



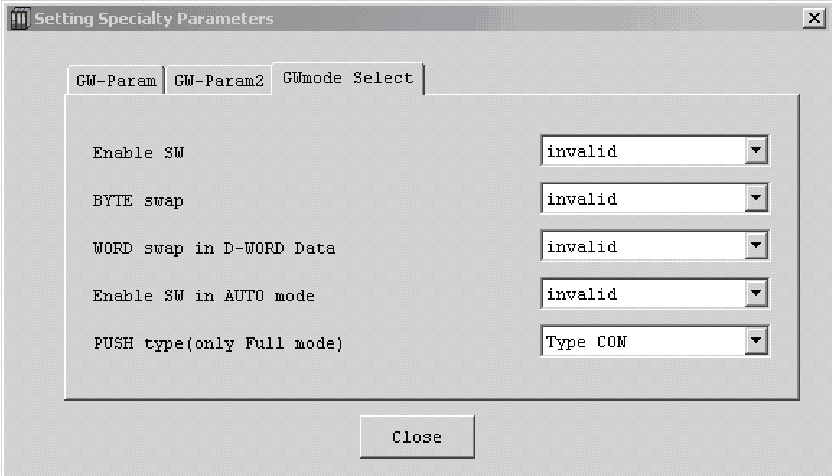
- Latch in ERR_T/C : Select whether to continue the error even in recoverable condition after ERRT and ERRC are issued.
- SERVO-OFF in ERR_C : Select whether to turn the servo OFF on the connected axes when ERRC is occurred.
- unit velocity (Only Full Mode) : Select the unit for speed from 1.0mm/s and 0.1mm/s.
- Internal communication retry count : Set the number of communication retries with the connected axes in AUTO mode.

2) GW-Param2



- Fulltime Fan run : Select whether to always drive the fan even in AUTO mode.
- Fan round monitor : Select whether to/not to monitor the fan rotation speed with the monitor function.
- BATT Charge Volt monitoring : Select whether to/not to monitor the absolute battery charge voltage.
- RTC function : Select whether to use the calendar function.

3) GWmode Select



- Enable SW : Select whether to activate/inactivate the enable switch in TP.
- BYTE swap : Set the byte swap. [Refer to 3)-1 in this section.]
- WORD swap in D-WORD Data : Set whether to swap the W-word sized data with word size [Refer to 3)-2 in this section.]
- Enable SW in AUTO mode : Select whether to activate/inactivate the enable switch in AUTO mode
- PUSH type (only Full mode) : Select the pressing method from SEP and CON methods

3)-1 BYTE swap : Swap the upper and lower in the sent and received data in byte unit. Set this considering the connected host system if necessary.

● = ON, ○ = OFF

MSEP Input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	●	○	●	○	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: RWwnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

MSEP Output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	●	○	●	○	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: RWrnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

3)-2 WORD swap in D-WORD Data

: Swap the upper and lower in the W-word sized sent and received data in word unit.
Set this considering the connected host system if necessary.

● = ON, ○ = OFF

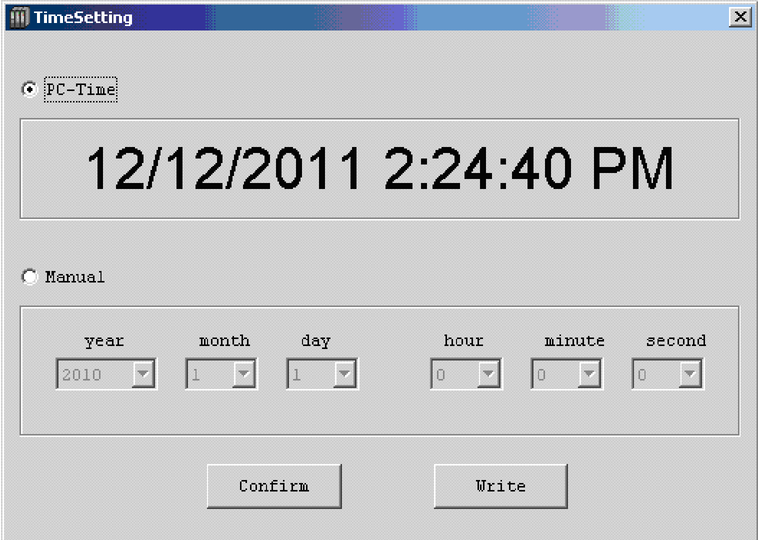
MSEP Input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: RWwnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

MSEP Output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: RWrnn	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

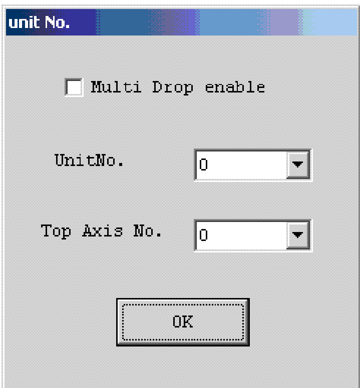
4) TimeSetting



By selecting Time on PC, the current time on the PC is acquired and set to MSEP. If Set Manually is selected, desired time set in the clock edit in the window can be set in MSEP. Click “Write”, and the time setting is transferred to MSEP and the data is written in. Clicking on the ”Confirm” button and the clock data currently retained in MSEP can be read and displayed.

⚠ Caution: The clock (calendar) function in MSEP can be retained for approximately 10 days (reference) after the power to MSEP is turned OFF. Once the clock data is lost, the time passed since the power is turned back ON as 2000/1/1 0:00:00 is displayed as the current time.

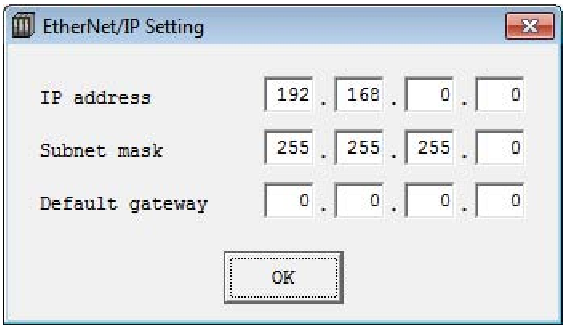
5) Unit No.



This setting is to be conducted when 2 units of MSEP are to be connected to the PC software at the same time.
(It is not necessary to have this setting done for 1 unit of MSEP.)

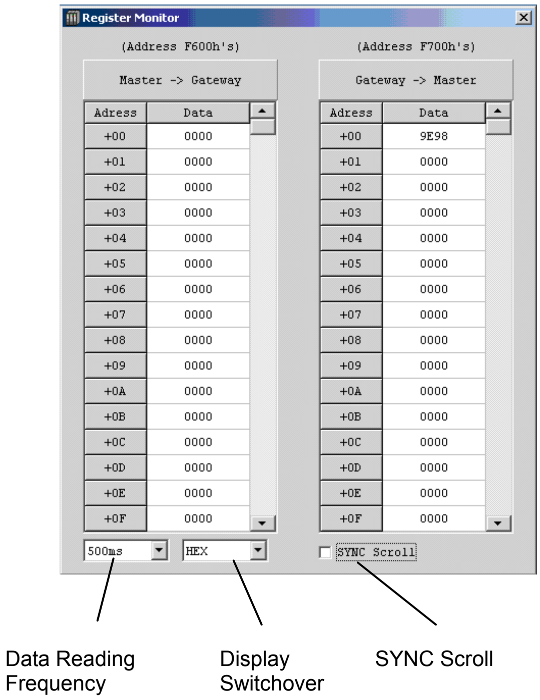
- Multi Drop enable : Tick in the box if the setting in this window is to be activated.
- UnitNo. : Set the unit number of MSEP
- Top Axis No. : Set the top axis number of MSEP composition axes

6) EtherNet/IP Setting (Setting to be established for EtherNet/IP type)



- IP address : Set IP address for MSEP
- Subnet mask : Set subnet mask
- Default gateway : Set default gateway

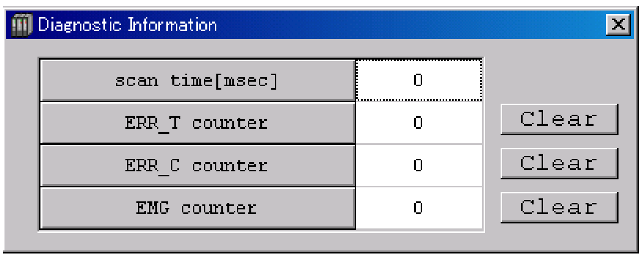
7) Register Monitor



In this register monitor window, shows the data that Gateway Unit has received from the host (master) and the data sent back to the host (master).

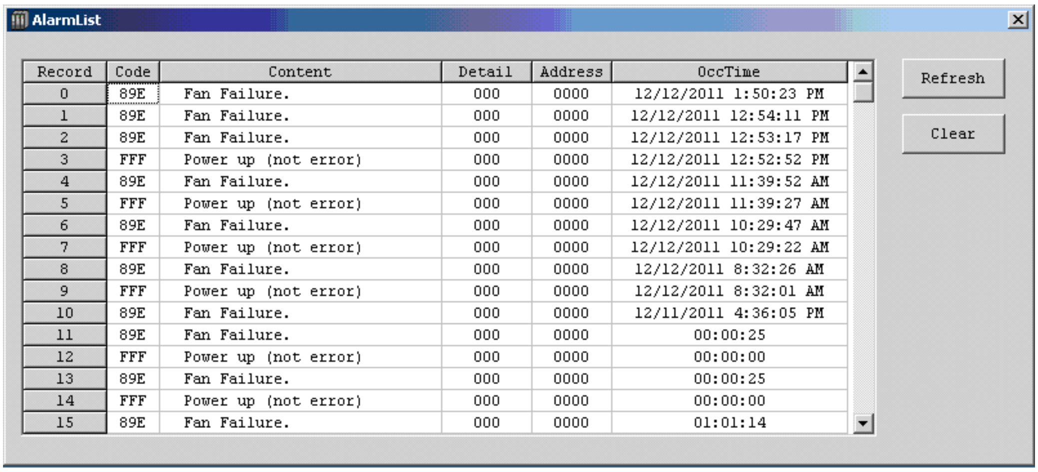
- Data Reading Frequency : Select the frequency of displayed data update from 100 to 500ms
- Display Switchover : Select from binary and hexadecimal for the display
- SYNC Scroll : Tick in the box to make the list of the sent and received data scrolled together

8) Diagnostic Information



The number of the communication error (ERR_C and ERR_T) occurrence and number of the emergency stop (EMG) detection can be counted.

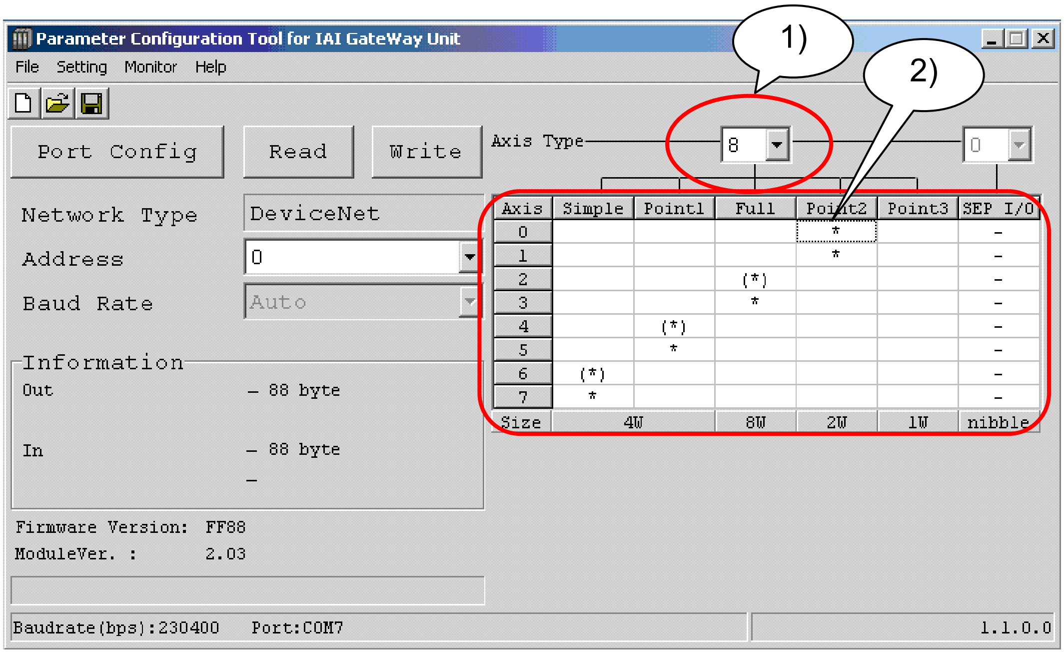
9) Alarm List



Record	Code	Content	Detail	Address	OccTime
0	89E	Fan Failure.	000	0000	12/12/2011 1:50:23 PM
1	89E	Fan Failure.	000	0000	12/12/2011 12:54:11 PM
2	89E	Fan Failure.	000	0000	12/12/2011 12:53:17 PM
3	FFF	Power up (not error)	000	0000	12/12/2011 12:52:52 PM
4	89E	Fan Failure.	000	0000	12/12/2011 11:39:52 AM
5	FFF	Power up (not error)	000	0000	12/12/2011 11:39:27 AM
6	89E	Fan Failure.	000	0000	12/12/2011 10:29:47 AM
7	FFF	Power up (not error)	000	0000	12/12/2011 10:29:22 AM
8	89E	Fan Failure.	000	0000	12/12/2011 8:32:26 AM
9	FFF	Power up (not error)	000	0000	12/12/2011 8:32:01 AM
10	89E	Fan Failure.	000	0000	12/11/2011 4:36:05 PM
11	89E	Fan Failure.	000	0000	00:00:25
12	FFF	Power up (not error)	000	0000	00:00:00
13	89E	Fan Failure.	000	0000	00:00:25
14	FFF	Power up (not error)	000	0000	00:00:00
15	89E	Fan Failure.	000	0000	01:01:14

Click on the “Refresh” button and the alarm list is read again from MSEP.
Click on the “Clear” button and the alarm list retained in MSEP are all deleted.
Refer to Chapter 6. Troubleshooting for the details of the alarms.

3.9.4 Operation Mode Setting

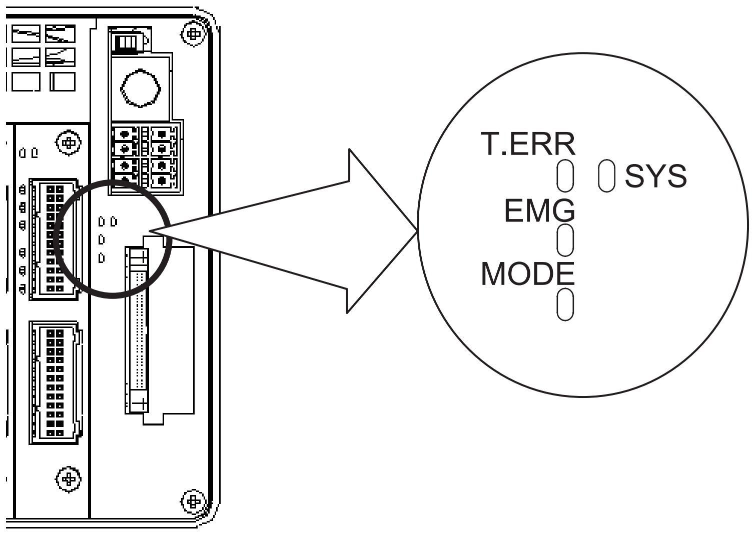


When selecting the operation mode, select the axis number in the pull down menu circled as 1). By selecting the number, the cells in 2) become blank in response. Click the cell for the mode to be set in each axis.
If clicking on a blank cell, "*" will appear. "*" indicates that the mode is selected.
Set the same operation mode to two axes in pair for the driver board unit (for each slot) for MSEP. If clicking on a cell, "*" is displayed for two axes at the same time. Any blank cell can be selected as long as it is in two axes unit.
Click on a cell with "*"shown in, the mark is changed to "(*)". "(*)" means it is a reserved axis, which is to be set when not using and when ineffective axis even though the actuator is connected.
If clicking on a cell with both axes in reservation "(*)", the cell returns to blank.

Note 1 SEP I/O Mode cannot be set together with other modes.
Note 2 MSEP is to be set in two axes in unit (for each slot) as the basis. If the number of used axes is an odd number, make it inactivated in Final Parameter No.33 Active/Inactive axis select.

3.10 Status LED

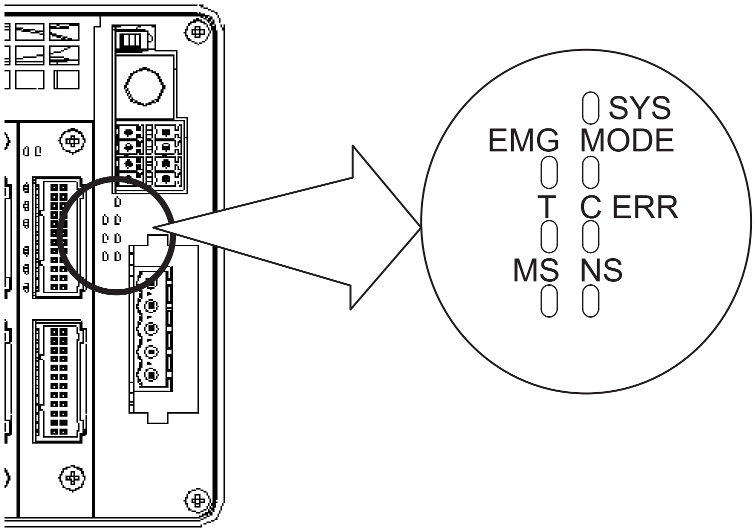
1) MSEP-C PIO Type



○: Illuminating, ×: OFF

Symbol	Lamp Condition	Color	Description
SYS (System Status)	○	Green	Ready
	○	Orange	Alarm generated
	×	–	Power is OFF or in initializing
EMG (Emergency Stop Status)	○	Red	Emergency stop
	×	–	Normal
MODE (AUTO/MANU Status)	○	Green	AUTO Mode
	×	–	MANU Mode
T ERR (Controller internal communication status)	○	Orange	Controller internal communication error
	×	–	Normal

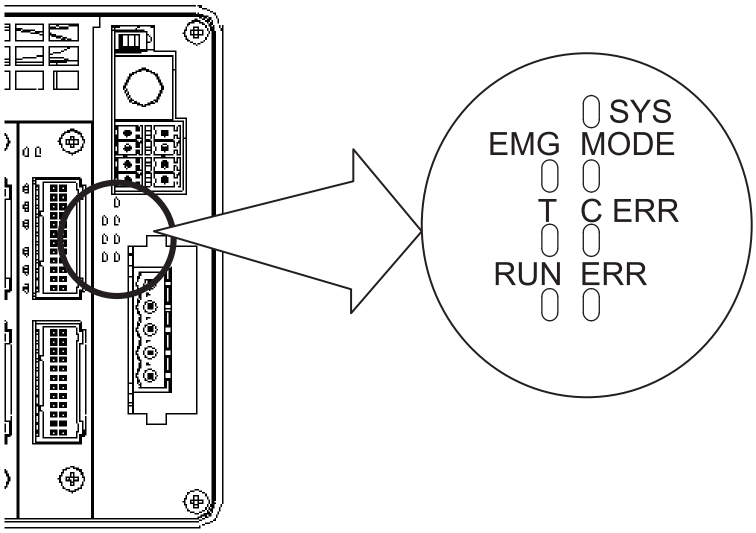
2) For Fieldbus Type DeviceNet



○: Illuminating, ×: OFF, ☆: Flashing

Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Emergency stop
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	NS	○	Green	Online (Normal)
		☆	Green	Online (Even though the network is established normally, the master does not identify as MSEP)
		○	Orange	An error occurs.
		☆	Orange	No response returned from another slave device
		☆	Green/Orange (Blink by turn)	In self-checking process.
	MS	○	Green	Communication in normal condition
		☆	Green	Parameter setting error
		○	Orange	It is caused by the hardware breakdown.
		☆	Orange	Light malfunction
		☆	Green/Orange (Blink by turn)	In self-checking process.

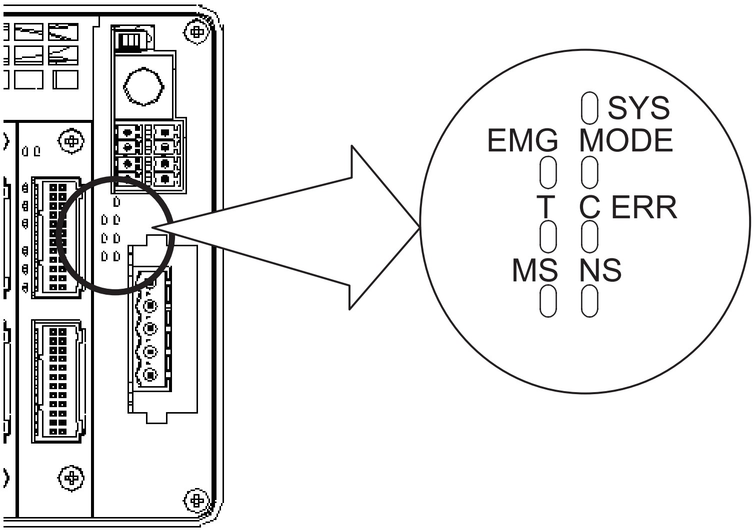
3) For Fieldbus Type CC-Link



○: Illuminating, ×: OFF, ☆: Flashing

Symbol	Lamp Condition	Color	Description
SYS (System status)	○	Green	Ready
	○	Orange	Alarm generated
	×	–	Power is OFF or in initializing
EMG (Emergency stop status)	○	Red	Emergency stop
	×	–	Normal
MODE (AUTO/MANU status)	○	Green	AUTO Mode
	×	–	MANU Mode
T ERR (Controller internal communication status)	○	Orange	Controller internal communication error
	×	–	Normal
C ERR (Fieldbus communication status)	○	Orange	Fieldbus communication error
	×	–	Normal
Fieldbus status: ERR	○	Orange	An error occurs. (CRC error, station No. setting error or baud rate setting error)
	☆	Orange	Station number or baud rate changed after the power-on
	×	–	Normal
Fieldbus status: RUN	○	Green	Communication in normal condition

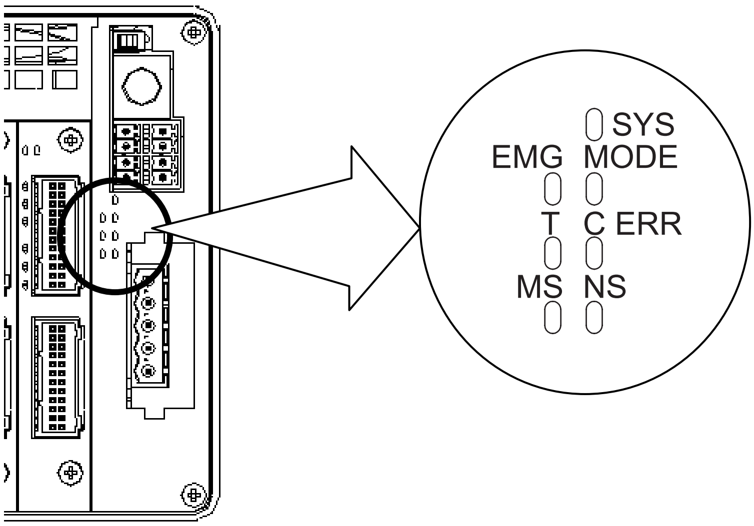
4) For Fieldbus Type PROFIBUS-DP



○: Illuminating, ×: OFF, ☆: Flashing

Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Emergency stop
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	NS	○	Green	Online (Normal)
		☆	Green	Online (Even though the network is established normally, the master does not identify as MSEP)
		○	Orange	An error occurs. (Parameter error or initializing error)
	MS	○	Green	Initializing is completed.
		☆	Green	Initializing completed and in self-checking process
		○	Orange	An error occurs. (Exceptional error)

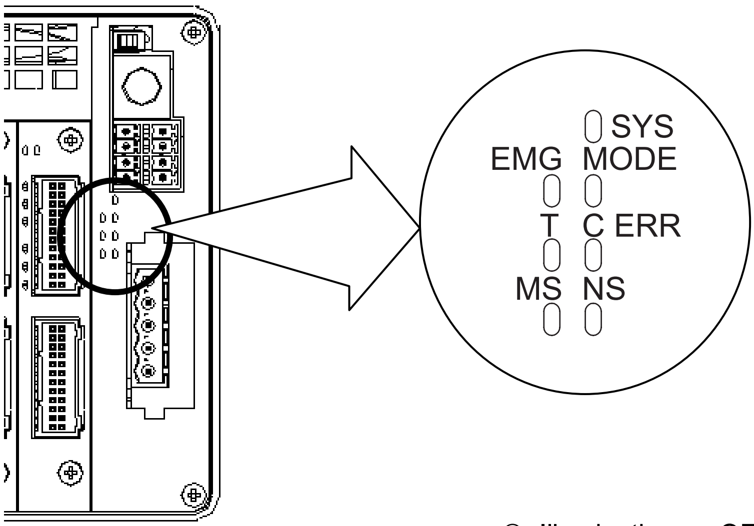
5) For Fieldbus Type CompoNet



○: Illuminating, ×: OFF, ☆: Flashing

Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Alarm generated
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	NS	○	Green	Online (Normal)
		☆	Green	Online (Even though the network is established normally, awaiting for being identified as MSEP by master)
		○	Orange	Node address duplication error, slave address wrongly established
		☆	Orange	No response returned from another slave device
		×	–	Power is OFF, under reset operation, under initializing process
	MS	○	Green	Communication in normal condition
		○	Orange	Malfunction of hardware
		☆	Orange	EEPROM reading failed in initializing process
		×	–	Power is not ON, under reset operation

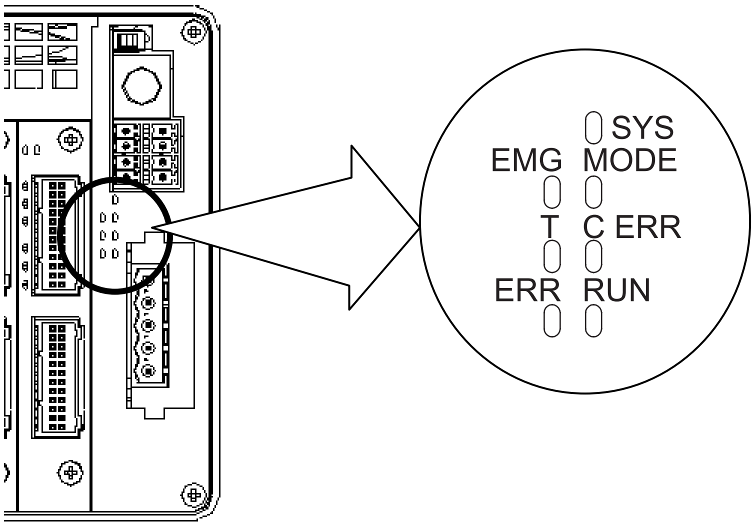
6) For Fieldbus Type EtherNet/IP



○: Illuminating, ×: OFF, ☆: Flashing

Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Alarm generated
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	NS	○	Green	Online (Communication in normal condition)
		☆	Green	Online (Even though the network is established normally, the master does not identify as MSEP)
		○	Orange	Communication error (such as IP address duplication)
		☆	Orange	Communication error (Communication timeout has been detected)
		×	–	Power is OFF or IP address not established
	MS	○	Green	Communication in normal condition
		☆	Green	Construction information setting is incomplete, or scanner (master) is in idling condition
		○	Orange	Malfunction of hardware (board replacement required)
		☆	Orange	Initializing error, light error such as setting violation, recoverable with rebooting
		×	–	Power is OFF

7) For Fieldbus Type EtherCAT



○: Illuminating, ×: OFF, ☆: Flashing

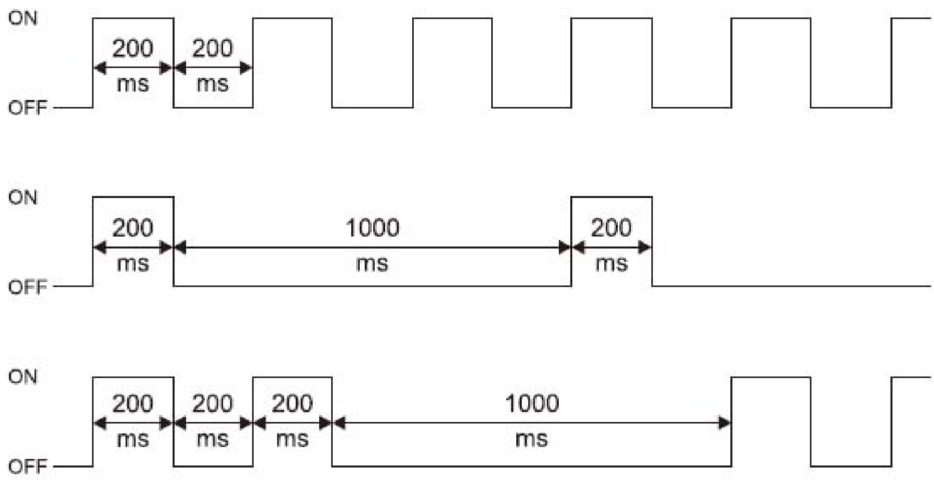
Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Alarm generated
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	ERR	○	Orange	Communication component (module) error
		☆	Orange (Note 1) (ON : 200ms/ OFF : 200ms)	Construction information (settings) error (Information received from the master cannot be set)
		☆	Orange (Note 3)	Communication section circuit error (Watchdog timer timeout)
		×	–	No abnormality or the power is OFF
	RUN	○	Green	Normal communication (OPERATION) condition
		☆	Green (Note 1)	PRE-OPERATION condition
		☆	Green (Note 2)	SAFE-OPERATION condition
		○	Orange	Communication component (module) error
		×	–	Initializing (INIT) condition or Power is OFF

• Timing of LED flashing

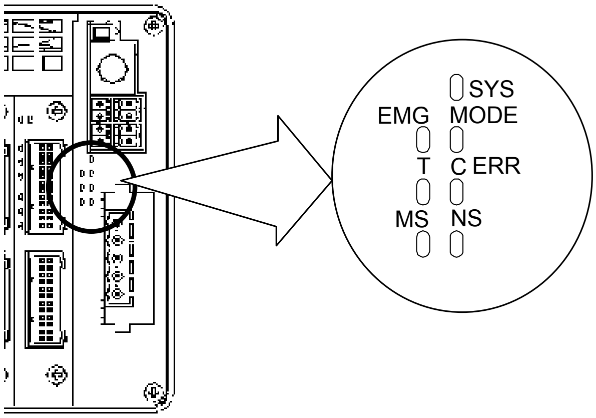
(Note 1) blinking

(Note 2) single flash

(Note 3) double flash



8) For Fieldbus Type PROFINET-IO

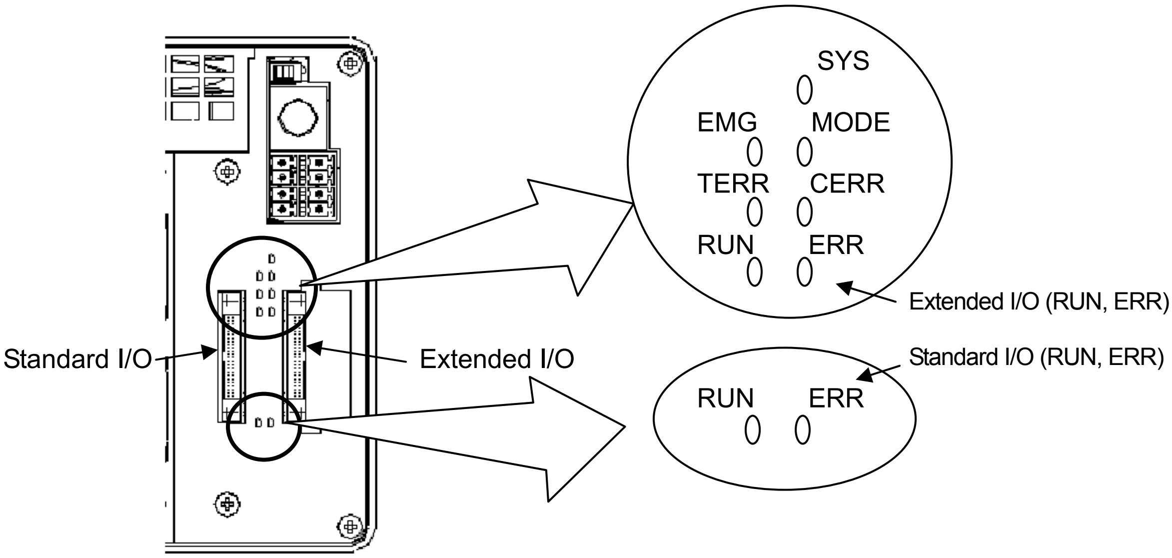


○: Illuminating, ×: OFF, ☆: Flashing

Symbol		Lamp Condition	Color	Description
SYS (System status)		○	Green	Ready
		○	Orange	Alarm generated
		×	–	Power is OFF or in initializing
EMG (Emergency stop status)		○	Red	Alarm generated
		×	–	Normal
MODE (AUTO/MANU status)		○	Green	AUTO Mode
		×	–	MANU Mode
T ERR (Controller internal communication status)		○	Orange	Controller internal communication error
		×	–	Normal
C ERR (Fieldbus communication status)		○	Orange	Fieldbus communication error
		×	–	Normal
Fieldbus status	NS	○	Green	Online (Communication in normal condition : RUN status)
		☆	Green	Online (Not identified by master : STOP status)
		×	–	The power is OFF or there is no connectable MSEP.
	MS	○	Green	In the normal operation
		☆1	Green	Network under diagnosis
		☆2	Green	Engineering tool identifying nodes
		○	Red	Exception error generated (Hardware malfunction)
		☆1	Red	Settings and actual network construction do not match
		☆2	Red	IP address not established
		☆3	Red	Station name not established
		☆4	Red	Internal error occurred
		×	–	Power is OFF or in initialization

Note MSLED continues to flash for number of times stated beside the star mark (☆) in every 0.25sec.

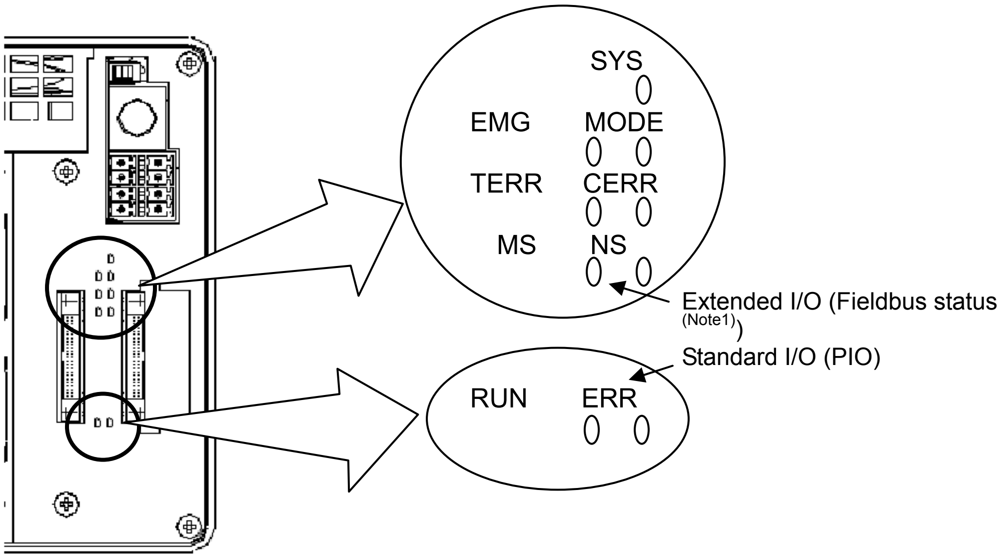
9) Mount PIO to both slots in MSEP-LC



○: Illuminating, ×: OFF

Symbol	Lamp Condition	Color	Description
SYS (System Status)	○	Green	Ready
	○	Orange	Alarm generated
	×	–	Power is OFF or in initializing
EMG (Emergency Stop Status)	○	Red	In emergency stop
	×	–	Normal
MODE (AUTO/MANU Status)	○	Green	AUTO Mode
	×	–	MANU Mode
T ERR (Controller internal communication status)	○	Orange	Controller internal communication error
	×	–	Normal
C ERR (Fieldbus communication status)	×	–	Not to be used
RUN	○	Green	In normal condition
ERR	○	Orange	Voltage drop in PIO power supply (24V DC)

10) Mount PIO to standard I/O and fieldbus to extended I/O in MSEP-LC



○: Illuminating, ×: OFF, ☆: Flashing

Symbol	Lamp Condition	Color	Description
SYS (System Status)	○	Green	Ready
	○	Orange	Alarm generated
	×	–	Power is OFF or in initializing
EMG (Emergency Stop Status)	○	Red	In emergency stop
	×	–	Normal
MODE (AUTO/MANU Status)	○	Green	AUTO Mode
	×	–	MANU Mode
T ERR (Controller internal communication status)	○	Orange	Controller internal communication error
	×	–	Normal
C ERR (Fieldbus communication status)	○	Orange	Fieldbus communication error
	×	–	Normal
Fieldbus status (Note1)	Note1 Symbols (NS, MS, RUN, ERR), colors and details differ in each mounted fieldbus. Refer to the section of fieldbus status in 2) to 8) in this section.		

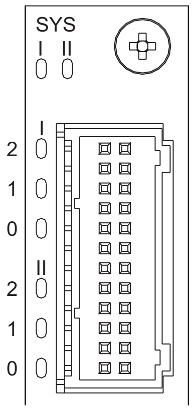
Chapter 4 Absolute Reset and Absolute Battery

4.1 Absolute Reset

The controller for Simple Absolute Type retains the encoder position information with the battery backup. Also, connecting the battery-less absolute type controller to an actuator enables to retain the encoder position information without any battery. For those types, it is not necessary to have a home-return operation in every startup.
To retain the encoder position information, it is necessary to register (absolute reset) the home position.
It can be checked on the status LEDs for the driver whether the absolute reset is necessary.
Have an absolute reset completed if the status LEDs for the driver shows the absolute reset is incomplete.
(Note) For battery-less absolute type, conduct an absolute reset after motor replacement.

[1] Status LEDs for Driver

Driver status (condition) and absolute status can be displayed for each axis to be connected.
There is no absolute status display for the incremental type.



<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>SYS I</td><td>Driver for upper connector connection axes numbers (0, 2, 4 and 6 Axis)
System status
Green Light is turned ON. : Servo ON
Red Light is turned ON. : Alarm generated
OFF : Servo OFF</td></tr>
<tr><td>I–2</td><td rowspan="2">Absolute Status 1 for driver for upper connector connection axes numbers (0, 2, 4 and 6 Axis)
The current absolute status is expressed of the patterns of the light in I-0 and I-1.
<table>
<tr><td></td><td colspan="2">I–1</td></tr>
<tr><td>I–0</td><td>Green Light is turned ON.</td><td>Red Light is turned ON.</td></tr>
<tr><td>Green Light is turned ON.</td><td>Absolute reset complete</td><td>Absolute reset incomplete</td></tr>
<tr><td>Red Light is turned ON.</td><td colspan="2">Alarm generated</td></tr>
</table></td></tr>
<tr><td>I–1</td></tr>
<tr><td>I–0</td><td>Absolute Status 2 for driver for upper connector connection axes numbers (0, 2, 4 and 6 Axis)
Green Light is turned ON. : Battery fully charged
Orange Light is turned ON. : Battery charging operation
Red Light is turned ON. : Battery disconnected</td></tr>
<tr><td>SYS II</td><td>Driver for lower connector connection axes numbers (1, 3, 5 and 7 Axis)
Green Light is turned ON. : Servo ON
Red Light is turned ON. : Alarm generated
OFF : Servo OFF</td></tr>
<tr><td>II–2</td><td rowspan="2">Absolute Status 1 for driver for lower connector connection axes numbers (1, 3, 5 and 7 Axis)
The current absolute status is expressed of the patterns of the light in II II-0 and II-1.
<table>
<tr><td></td><td colspan="2">II–1</td></tr>
<tr><td>II–0</td><td>Green Light is turned ON.</td><td>Red Light is turned ON.</td></tr>
<tr><td>Green Light is turned ON.</td><td>Absolute reset complete</td><td>Absolute reset incomplete</td></tr>
<tr><td>Red Light is turned ON.</td><td colspan="2">Alarm generated</td></tr>
</table></td></tr>
<tr><td>II–1</td></tr>
<tr><td>II–0</td><td>Absolute Status 2 for driver for lower connector connection axes numbers (1, 3, 5 and 7 Axis)
Green Light is turned ON. : Battery fully charged
Orange Light is turned ON. : Battery charging operation
Red Light is turned ON. : Battery disconnected</td></tr>
</table>

The absolute reset is to be done with using a teaching tool such as the PC software. Shown below are the steps.

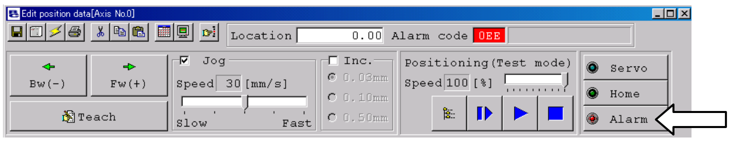
[2] Absolute reset procedure from teaching tool

1) Connect the controller with the actuator. [Refer to Chapters 1 and 2.]
2) For Simple Absolute Type, connect the absolute battery box and the controller with the dedicated cable. [Refer to Chapters 1 and 2.]
3) Connect a teaching tool and turn ON the power supply to controller.
4) The absolute encoder error appears on the teaching tool. Perform alarm reset.
5) Perform home-return operation. Once the home return is complete, the point of origin is memorized at the same time the origin point is established.

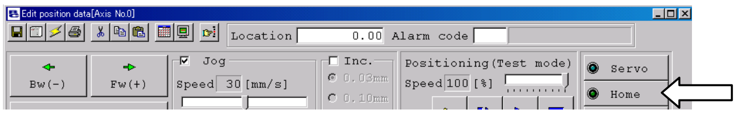
In below explains the procedure using each teaching tool:

(1) For PC software

1) Select position data on the main screen and click the Alarm button.

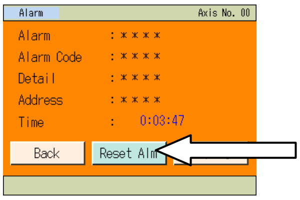


2) Select position data on the main screen and click the Home button.



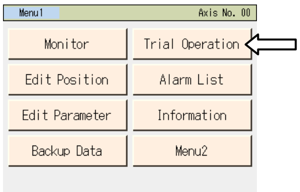
(2) For CON-PTA/PDA/PGA and TB-01

1)



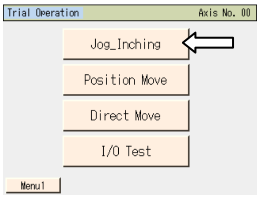
Press Reset Alm.

2)



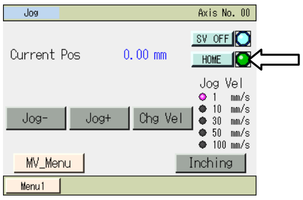
Press Trial Operation on the Menu 1 screen.

3)



Press Jog_Inching on Trial screen.

4)



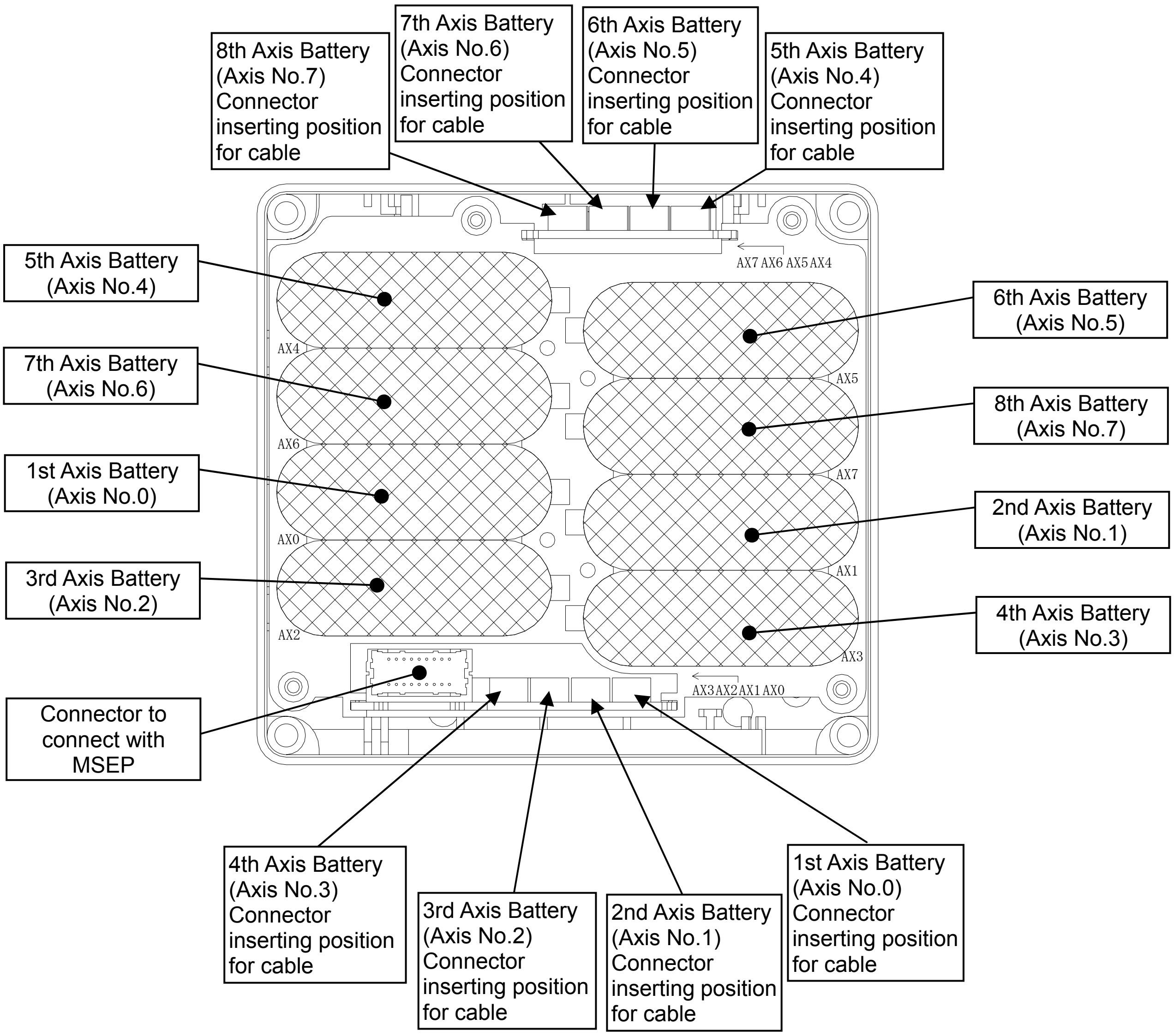
Press Home on Job/Inching screen.

4.2 Absolute Battery (for Simple Absolute Type)

Absolute battery and absolute battery box are enclosed in the simple absolute type controllers. The absolute battery is used to back up the absolute data.

The absolute battery has a specified position for each axis number. Refer to the figure below to insert the batteries to the absolute battery box. There is also an instruction for the connector inserting positions for the absolute battery cable. Connect it properly following the figure shown below.

● Front View of Absolute Battery Unit with Cover Removed



4.2.1 Absolute encoder backup specifications

Item	Specifications
Battery model	AB-7
Quantity	1 pc/axis (8 units max. / 8 axes)
Battery voltage	3.6V
Current capacity	3300mAH
Nominal	3.6V 3700mAH
Reference for battery replacing timing(Note 1)	Approx. 3 years (It varies significantly by the effects of the usage condition)

Note 1 Replace the battery regularly.

4.2.2 Absolute Battery Charge

Please have the battery charged for more than 72 hours before using for the first time or after replacing with a new one. The battery gets charged while the controller is supplied with 24V power.

Data holding time (Reference time when battery is new)

Parameter No.19 setting	Upper limit of encoder revolution at power-off [rpm]		Reference for battery retaining time [days]	Holding time per hour of battery charge time (reference) [H]
	When the connected actuator is a model other than RCA2-***N;	When the connected actuator is RCA2-***N;		
0	100	75	20	6.6
1	200	150	15	5.0
2	400	300	10	3.3
3	800	600	5	1.6

Leaving the controller power OFF for more than the data holding time will lead to a loss of the data. Have the battery charged as early as possible.
There is life to the battery and the duration for data holding will decrease. Replace the battery with a new one if the retaining time is remarkably dropped even with enough charging time.

(Example) From Monday to Friday : charge for 8 hours per day, discharge for 16 hours,
Saturday and Sunday : When using with discharge
Connected axis : Any model except for RCA2-***N

1) If parameter No.19 = 3 setting;
Total charge amount : Operation hours per day 8 [H] × Retaining time per charge for 1 hour 1.6 [H] × Weekday 5 [days] = 64 [H]
Total discharge amount : Stopped time during night 16 [H] x Weekday 5 [days] + Stopped time on Saturday and Sunday 48 [H] = 128 [H]
Total discharge amount : 16 [h] × 5 [day] + 48 [h] = 128 [h]
→ If starting on Monday with a full-charge, the total amount of the discharge in a week exceeds total amount of battery charge in 64 [H], thus the fully charged storage decreases by 64 [H]. Therefore, it is necessary to have the battery fully charged in every 10-day period.

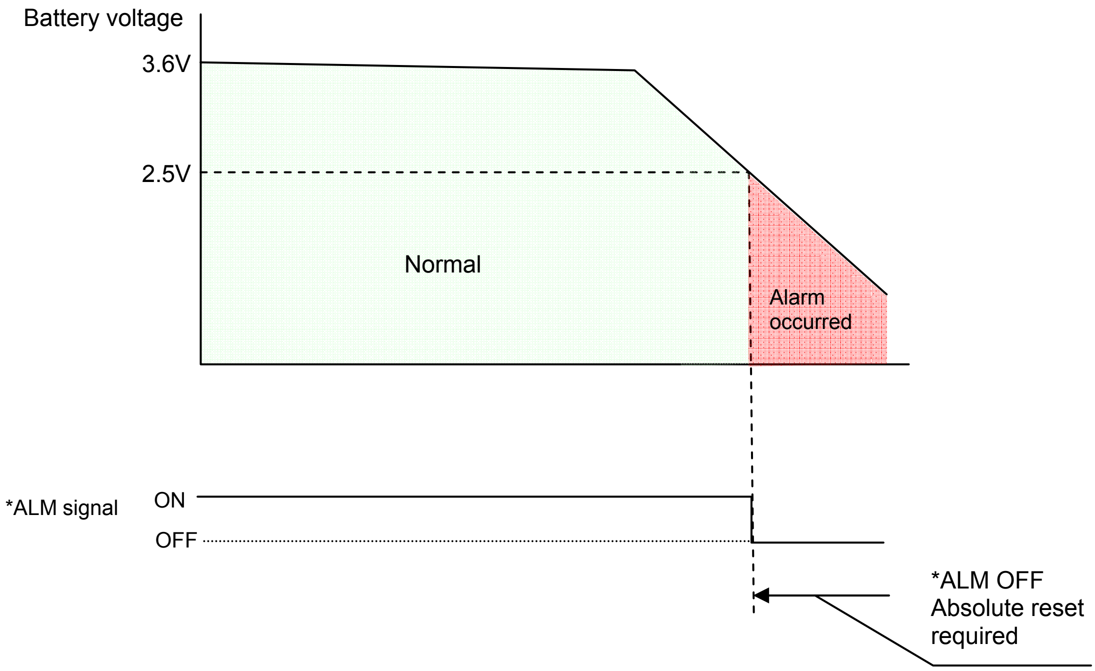
2) If parameter No.19 = 2 setting;
Total charge amount : Operation hours per day 8 [H] × Retaining time per charge for 1 hour 3.3 [H] × Weekday 5 [days] = 132 [H]
Total discharge amount : Stopped time during night 16 [H] x Weekday 5 [days] + Stopped time on Saturday and Sunday 48 [H] = 128 [H]
→ If starting on Monday, because the total amount of charge has exceeded the total amount of discharge, it is not necessary to have a continuous full charge. 4-hour charge is stored every week.

4.2.3 Absolute Battery Voltage Drop Detection

If the voltage of the absolute battery is dropped, the error detection responding to the voltage is held.

Voltage	PIO Signals	Alarm
2.5V ±8% or less	Alarm signal *ALM(Note 1) OFF	0EE Absolute Encoder Error Detection 2 or 0EF Absolute Encoder Error Detection 3

Note 1 *ALM are the signals of active low.
After the power is supplied to the controller, they are usually ON and turned OFF when an error is detected. If the alarm is generated, it will be necessary to absolute reset after the battery replacement. (The controller checks the battery voltage at the time the power is supplied. The controller would not detect it even if the battery voltage is decreased to the alarm level while it is on.)



Chapter 5 I/O Parameter

Parameter Settings
Parameter data should be set appropriately according to the applicaiton requirements.

(Example)
Software Stroke Limit : Set a proper operation range for definition of the stroke end, preventionof interferences with peripherals and safety.
Zone Output : Set to require signal outputs in an arbitrary position zone within theoperation zone.

Parameters should be set to meet the use of the controller prior to operation. Once set, they may not set every operation.
When a change is required to the parameters, make sure to back up the data before the change so the settings can be returned anytime.
With using PC software, it is able to store the backup to the PC. Take a note if using a teaching pendant such as the touch panel teaching.
For a quick data recovery after such works as investigation on malfunction and replacement of controller, it is also recommended to back up or take a note on the parameter after the setting change.
The change to the parameters will be activated after they are edited, written to the flash FeRAM, then either software reset or reboot of the power. It will not be active only with writing on the teaching tool.

⚠ Warning: Parameter setting has great influences on operations of the controller.
Incorrect parameter setting may not only cause malfunction or failure of the controller to occur but also people and assets to be exposed to risk.
The controller is configured to be applicable to normal operation at shipment.
Understand very well about the control logic of controller if making a change or performing a setting suitable to the system.
Please contact us if you have anything unclear.
Do not attempt to turn OFF the power to the controller while writing the parameters.

5.1 I/O Parameter List

The categories in the table below indicate whether parameters should be set or not. There are five categories as follows:

A : Check the settings before use.
B : Use parameters of this category depending on their uses.
C : Use parameters of this category with the settings at shipments leaving unchanged as a rule. Normally they may not be set.
D : Parameters of the category are set at shipment in accordance with the specification of the actuator. Normally they may not be set.

Category do not appear on the teaching tool.
Also, the unused parameter numbers are not mentioned in the list.

No.	Category	Name	Symbol	Unit (Note 1)	Input Range	Default factory setting	Applicable Motor Type (Note 3)			Relevant sections
							A	P	D	
1	A	Positioning width	INP	mm [deg]	0.01 to 999.99	In accordance with actuator (Note 2)	○	○	○	5.2 [1]
2	B	Jog speed	JOGV	mm/s [deg/s]	0.01 to In accordance with actuator	In accordance with actuator (Note 2)	○	○	○	5.2 [2]
3	C	Servo gain number	PLGO	–	For servo motor 0 to 15 For pulse/brushless DC electric motor 0 to 31	In accordance with actuator (Note 2)	○	○	○	5.2 [3]
4	C	Torque filter time constant	TRQF	–	0 to 2500	In accordance with actuator (Note 2)	○	○	○	5.2 [4]
5	C	Speed loop proportional gain	VLPG	–	1 to 27661	In accordance with actuator (Note 2)	○	○	○	5.2 [5]
6	C	Speed loop integral gain	VLPT	–	1 to 217270	In accordance with actuator (Note 2)	○	○	○	5.2 [6]
7	C	Press speed	PSHV	mm/s [deg/s]	1 to actuator's max. pressing speed	In accordance with actuator (Note 2)	○	○	○	5.2 [7]
8	C	Press & hold stop judgment period	PSWT	msec	0 to 9999	255	○	○	○	5.2 [8]
9	C	Current limit value at stopping due to miss-pressing	PSFC	–	0: 1)Current limit during movement for servo /brushless DC electric motor 2)Current limit during stop for pulse motor 1: Current limit value during pressing	0	○	○	○	5.2 [9]
10	B	Auto servo-motor OFF delay time	ASO1	sec	0 to 9999	1	○	○	○	5.2 [10]
11	B	Stop mode selection	SMOD	–	0: Full stop 1: Servo stop	0	–	○	–	5.2 [11]
12	B	Current-limiting value at standstill during positioning	SPOW	%	1 to 70	In accordance with actuator (Note 2)	–	○	–	5.2 [12]
13	C	Current-limiting value during home return	ODPW	%	Pulse motor: 0 to 100 Servo motor: 0 to 300	In accordance with actuator (Note 2)	○	○	○	5.2 [13]
14	B	Automatic positioning execution waiting time	ADWT	sec	0.010 to 60.000	0.01	○	○	○	5.2 [14]
15	A	Soft limit	LIMM	mm [deg]	0.01 to 9999.99	Actual stroke on + side (Note 2)	○	○	○	5.2 [15]
16	C	Home return offset level	OFST	mm [deg]	0.00 to 9999.99	In accordance with actuator (Note 2)	○	○	○	5.2 [16]
17	D	Home return direction	ORG	–	0: Reverse, 1: Normal	In accordance with actuator (Note 2)	○	○	○	5.2 [17]
18	B	Simple absolute unit	ETYP	–	0: Enabled (Incremental) 1: Disabled (Simple Absolute Type)	In accordance with specification at order accepted	○	○	–	5.2 [18]

No.	Category	Name	Symbol	Unit (Note 1)	Input Range	Default factory setting	Applicable Motor Type (Note 3) A	P	D	Relevant sections
19	A	Absolute battery retention time	AIP	days	0: 20 days 1: 15 days 2: 10 days 3: 5 days	0	○	○	–	5.2 [19]
20	B	Position data change password	PASS	–	0000 to 9999	0000	○	○	○	5.2 [20]
21	B	Zone Positive Boundary 1+	ZNM1	mm [deg]	-9999.99 to 9999.99	Actual stroke on + side (Note 2)	○	○	○	5.2 [21]
22	B	Zone Positive Boundary 1-	ZNL1	mm [deg]	-9999.99 to 9999.99	Actual stroke on - side (Note 2)	○	○	○	5.2 [21]
23	B	Zone Positive Boundary 2+	ZNM2	mm [deg]	-9999.99 to 9999.99	Actual stroke on + side (Note 2)	○	○	○	5.2 [21]
24	B	Zone Positive Boundary 2-	ZNL2	mm [deg]	-9999.99 to 9999.99	Actual stroke on - side (Note 2)	○	○	○	5.2 [21]
25	B	PIO inch distance	IOID	mm [deg/s]	0.01 to 1.00	0.1	○	○	○	5.2 [22]
26	B	Total movement count threshold	TMCT	times	0 to 999999999	0 (Disabled)	○	○	○	5.2 [23]
27	B	Total operated distance threshold	ODOT	m	0 to 999999999	0 (Disabled)	○	○	○	5.2 [24]
28	B	High Output Setting	BUEN	-	0(Enabled) 1(Disabled)	In accordance with actuator (Note 2)	–	○ (Note 4)	–	5.2 [25]
29	B	BU Speed loop proportional gain	BUPC	-	1 to 10000	In accordance with actuator (Note 2)	–	○ (Note 4)	–	5.2 [26]
30	B	BU Speed loop integral gain	BUIC	-	1 to 100000	In accordance with actuator (Note 2)	–	○ (Note 4)	–	5.2 [27]
31	B	Overload level ratio	OLWL	%	50 to 100	100	○	○	○	5.2 [28]
32	B	Light error alarm output select	OALL	–	0: Output when overload warning 1: Overload warning and message level alarm output	0	○	○	○	5.2 [29]
33	B	Active/Inactive axis select	EFCT	–	0 (Enabled) 1 (Disabled)	0	○	○	○	5.2 [30]
34	B	Default movement direction for excitation-phase signal detecting movement	PHSP	–	0: Reverse 1: Forward	In accordance with actuator (Note 2)	○	○	–	5.2 [31]
35	B	Exicitation-phase signal detection time	PHSP	msec	1 to 999	In accordance with actuator (Note 2)	○	○	–	5.2 [32]
36	B	Excitation detection type	PHSP	–	0: Conventional method 1: New method 1 2: New method 2	0	○	○	–	5.2 [33]

(Note 1) The unit [deg] is for rotary actuator and lever type gripper. It is displayed in [mm] in the teaching tools.
(Note 2) The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.
(Note 3) P : Pulse Motor Connection, A : Servo Motor Connection, D : Brushless DC Electric Motor Connection
(Note 4) Valid only for high output type driver board

5.2 Detail Explanation of Parameters

> ⚠ Caution: • If parameters are changed, provide software reset or reconnect the power to reflect the setting values.
> • The unit [deg] is for rotary actuator and lever type gripper. Pay attention that it is displayed in [mm] in the teaching tools.

[1] Positioning width (in-position) (Parameter No.1)

No.	Name	Symbol	Unit	Input Range	Default factory setting
1	Default positioning width	INP	mm [deg]	0.01(Note) to 999.99	In accordance with actuator

If the remaining movement amount gets into this width, the positioning complete signal is output.

> ⚠ Caution: • Positioning width of servo motor L = Actuator lead length / Number of encoder pulse
> • Positioning width of pulse motor L = Actuator lead length / Number of encoder pulse × 3
> [Refer to the appendix in the last pages for the number of encoder pulse.]

[2] Jog speed (Parameter No.2)

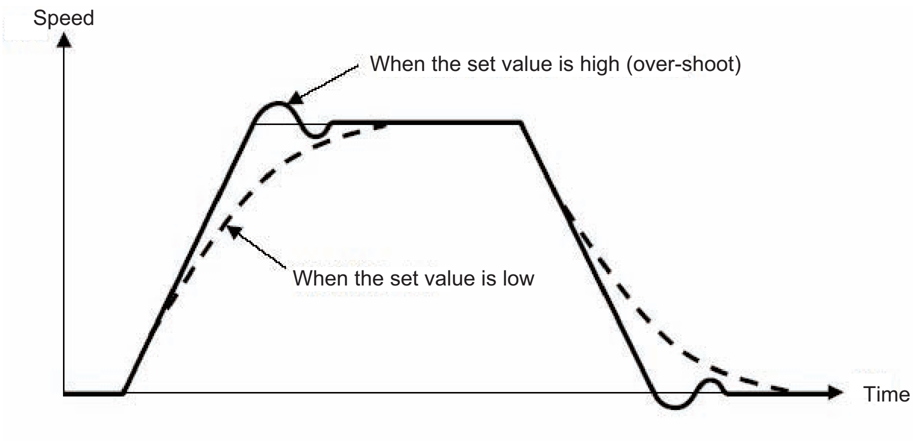
No.	Name	Symbol	Unit	Input Range	Default factory setting
2	Jog speed	JOGV	mm/s [deg/s]	0.01 to Actuator's max. speed	In accordance with actuator

This is the setting of the operation speed with the JOG input command. Set the appropriate value considering how the system is to be used.
(Note) The maximum speed is limited to 250mm/s.

[3] Servo gain number (Parameter No.3)

No.	Name	Symbol	Unit	Input Range	Default factory setting
3	Servo gain number	PLGO	–	For servo motor 0 to 15 For pulse/brushless DC electric motor 0 to 31	In accordance with actuator

The servo gain is also called position loop gain or position control system proportion gain. The parameter defines the response when a position control loop is used. Increasing the set value improves the tracking performance with respect to the position command. However, increasing the parameter value excessively increases the chances of overshooting.
When the set value is too low, the follow-up ability to the position command is degraded and it takes longer time to complete the positioning.
For a system of low mechanical rigidity or low natural frequency (every object has its own natural frequency), setting a large servo gain number may generate mechanical resonance, which then cause not only vibrations and/or noises but also overload error to occur.



[4] Torque filter time constant (Parameter No.4)

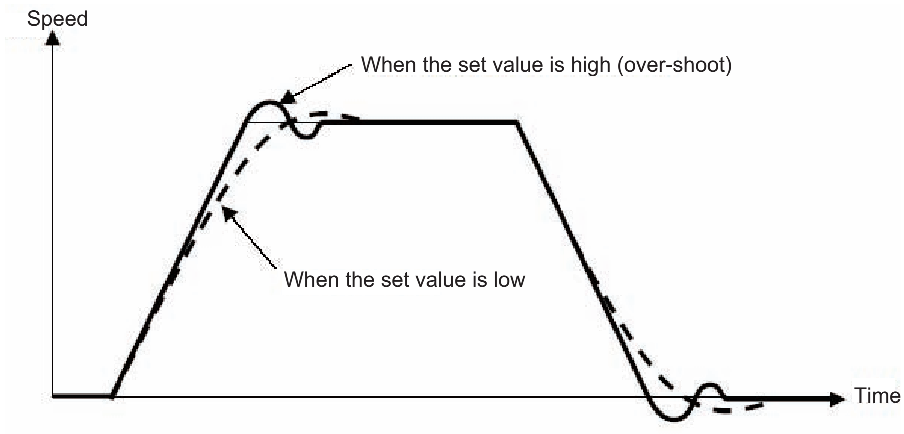
No.	Name	Symbol	Unit	Input Range	Default factory setting
4	Torque filter time constant	TRQF	–	0 to 2500	In accordance with actuator

This parameter decides the filter time constant for the torque command. When vibrations and/or noises occur due to mechanical resonance during operation, this parameter may be able to suppress the mechanical resonance. This function is effective for torsion resonance of ball screws (several hundreds Hz).

[5] Speed loop proportional gain (Parameter No.5)

No.	Name	Symbol	Unit	Input Range	Default factory setting
5	Speed loop proportional gain	VLPG	–	1 to 27661	In accordance with actuator

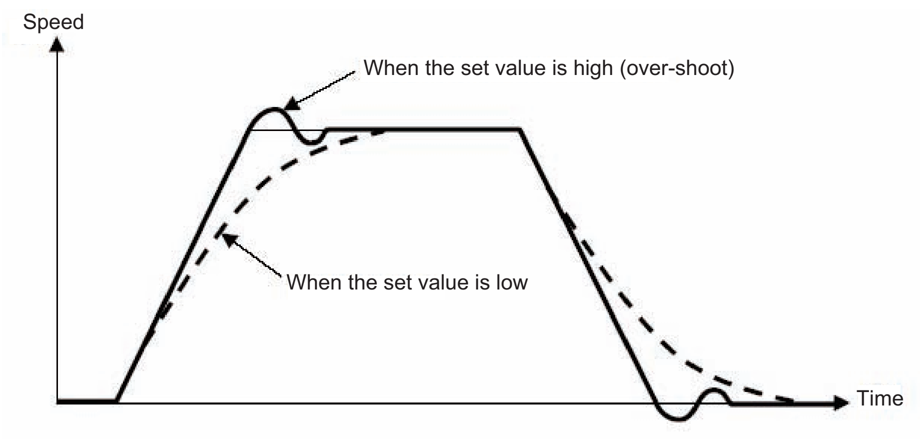
This parameter determines the response of the speed control loop. When the set value is increased, the follow-up ability to the speed command becomes better (the servo-motor rigidity is enhanced). The higher the load inertia becomes, the larger the value should be set. However, excessively increasing the setting will cause overshooting or oscillation, which facilitates producing the vibrations of the mechanical system.



[6] Speed loop integral gain (Parameter No.6)

No.	Name	Symbol	Unit	Input Range	Default factory setting
6	Speed loop integral gain	VLPT	–	1 to 217270	In accordance with actuator

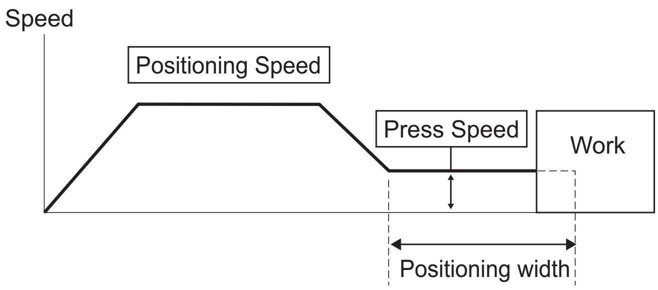
Any machine produces friction. This parameter is intended to cope with deviation generated by external causes including friction. Increasing the setting value improves the reactive force against load change. That is, the servo rigidity increases. However, increasing the parameter value excessively may make the gain too high, which then cause the machine system to be vibrated due to over-shoot or shaking.
Tune it to obtain the optimum setting by watching the speed response.



[7] Press speed (Parameter No.7)

No.	Name	Symbol	Unit	Input Range	Default factory setting
7	Press speed	PSHV	mm/s [deg/s]	1 to actuator's max. pressing speed	In accordance with actuator

This is the parameter to set the speed in pressing operation.
The setting is done considering the actuator type when the product is delivered. [Refer to List of Connectable Actuator Specifications in the last pages.]
If a change to the setting is required, make sure to have the setting below the maximum pressing speed of the actuator. Setting it fast may disable to obtain the specified pressing force. Also when setting at a low speed, take 5mm/s as the minimum.



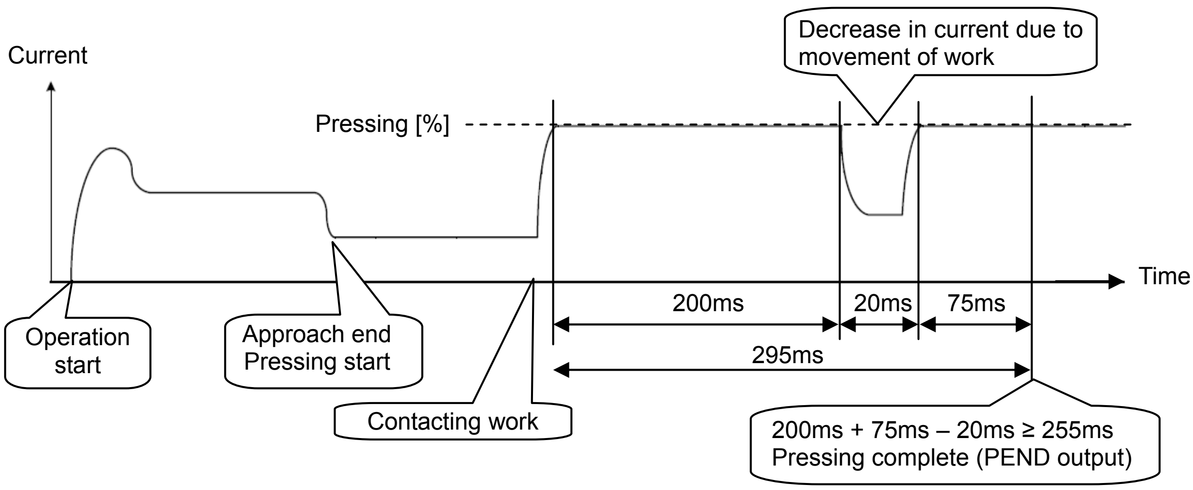
⚠Caution: If the speed of the positioning of the position table is set below this parameter, the pressing speed will become the same as the positioning speed.

[8] Press & hold stop judgment period (Parameter No.8)

No.	Name	Symbol	Unit	Input Range	Default factory setting
8	Press & hold stop judgment period	PSWT	msec	0 to 9999	255

Judging completion of pressing operation

This function monitors the torque (current limit) set in % in “Pressing” or “Pressing Force” in the position table, and turns the pressing complete signal PEND ON when the load current during a pressing operation meets the condition shown in the diagram below. PEND is turned ON at satisfaction of the condition if the work is not stopped.
(Accumulated time in which current reaches pressing value [%])
– (accumulated time in which current is less than pressing value [%]) ≥ 255 ms



[9] Current limit value at stopping due to miss-pressing (Parameter No.9)

No.	Name	Symbol	Unit	Input Range	Default factory setting
9	Current limit value at stopping due to miss-pressing	PSFC	–	0: 1) Current limit during movement for servo /brushless DC electric motor 2) Current limit during stop for pulse motor 1: Current limit value during pressing	0

This parameter defines the restricted current value at stopping due to miss-pressing.
This restricted current value locks the servo till the next moving command.

[10] Auto servo motor OFF delay time (Parameter No.10)

No.	Name	Symbol	Unit	Input Range	Default factory setting
10	Auto servo motor OFF delay time	AS01	sec	0 to 9999	1

If "Power Saving Function" is set effective in the position table, the servo automatically turns OFF after a certain time that was set in this parameter has passed after the positioning is completed.

[11] Stop mode selection (Parameter No.11) …Pulse motor type only

No.	Name	Symbol	Unit	Input Range	Default factory setting
11	Stop mode selection	PHSP	–	0: Full stop 1: Servo stop	0

If 0 is selected, the current passion is retained with the torque set in Parameter No.12 after the positioning process. If 1 is selected, the current position is retained with the servo control.

[12] Current-limiting value at standstill during positioning (Parameter No.12) …
Pulse motor type only

No.	Name	Symbol	Unit	Input Range	Default factory setting
12	Current-limiting value at standstill during positioning	SPOW	%	1 to 70	In accordance with actuator

It is enabled when the Parameter No.11 is set to "0".
When the value is increased, the stop holding torque is increased.
Even though it is generally unnecessary to change this setting, setting the value larger is necessary in the case a large external force is applied during stop. Please contact IAI.

[13] Current-limiting value during home return (Parameter No.13)

No.	Name	Symbol	Unit	Input Range	Default factory setting
13	Current-limiting value during home return	ODPW	%	Pulse motor: 0 to 100 Servo motor: 0 to 300 Brushless DC Motor: 0 to 300	In accordance with actuator

The factory setting conforms to the standard specification of the actuator.
Increasing this setting will increase the home return torque.
Normally this parameter need not be changed. If the home return should be completed before the correct position depending on the affixing method, load condition or other factors when the actuator is used in a vertical application, the setting value must be increased. Please contact IAI.

[14] Continuous Operation Position Execution Waiting Time (Parameter No.14)

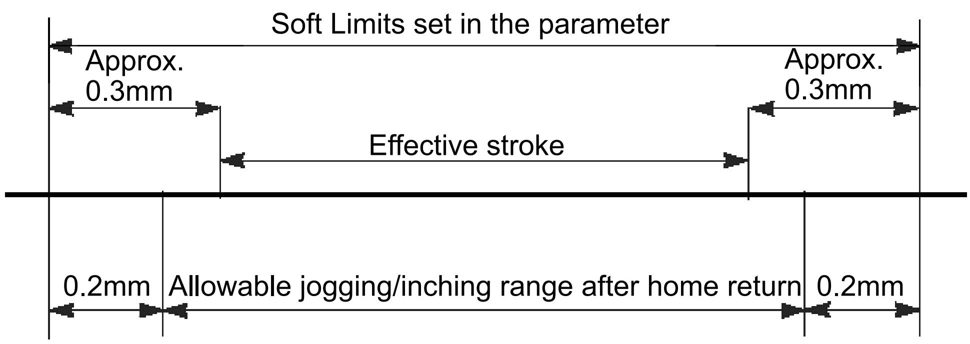
No.	Name	Symbol	Unit	Input Range	Default factory setting
14	Continuous Operation Position Execution Waiting Time	ADWT	sec	0.010 to 60.000	0.010

This is effective when the operation pattern in PIO or SEP I/O is set to Operation Pattern 5 "2-Point Back and Forth Movement".
Set the duration after reaching the target position and before the movement starts toward the next target when the automatic operation signal (ASTR) is ON.

[15] Soft limit (Parameter No.15)

No.	Name	Symbol	Unit	Input Range	Default factory setting
15	Soft limit	LIMM	mm [deg]	0.01 to 9999.99	Actual stroke on + side

The effective stroke of the actuator is already set at the factory. Change the setting if necessary in such cases as when avoiding a crash to an interfering object or using the actuator beyond the effective stroke.
An incorrect soft limit setting will cause the actuator to collide into the mechanical end, so exercise sufficient caution.
The minimum setting unit is 0.01mm.
Example) Set the effective stroke to between 0mm and 80mm
Parameter No.15 = 80.0



The operational range of JOG or Inching after a home-return operation is 0.1mm (deg) outside the set area.
Alarm Code 0D9 "Soft Limit Over Error" is issued when exceeded the setting of this parameter.

[16] Home return offset level (Parameter No.16)

No.	Name	Symbol	Unit	Input Range	Default factory setting
16	Home return offset level	OFST	mm [deg]	0.00 to 9999.99	In accordance with actuator

An adjustment is available for the following cases.
1) Want to match the actuator home position and the mechanical origin of the system.
2) Want to set a new home after reversing the factory-set home direction.
3) Want to eliminate a slight deviation from the previous home position generated after replacing the actuator.

[Adjustment Process]
1) Homing execution
2) Offset check
3) Parameter setting change
4) After the setting, repeat home return several times to confirm that the actuator always returns to the same home position.

⚠ Caution: If the home return offset has been changed, the soft limit parameters must also be adjusted accordingly.
Do not set a smaller value than the initial setting value for Home Return Offset. Normal excitation detection cannot be performed, and there may be a risk of generating the excitation detection error or causing abnormal noise.
In case the there is a necessity of setting a value less than the initial setting, contact IAI.

[17] Home return direction (Parameter No.17)

No.	Name	Symbol	Unit	Input Range	Default factory setting
17	Home return direction	ORG	–	0: Reverse 1: Forward	In accordance with actuator

Unless there is a request of Home Reversed Type (option), the home-return direction is on the motor side for the line axis, counterclockwise side for the rotary axis and outer (open) side for the gripper. [Refer to the coordinate system of the actuator.]
If it becomes necessary to reverse the home direction after the actuator is installed on the machine, change the setting.

⚠ Caution:
- The home direction cannot be changed for the rod type actuators.
- The home position will be slightly changed if the home return direction of the actuator has been changed in the rotary type.

[18] Simple absolute unit (Parameter No.18)

No.	Name	Symbol	Unit	Input Range	Default factory setting
18	Simple absolute unit	ETYP	–	0: Enabled (Incremental) 1: Disabled (Simple Absolute Type)	0

For Simple Absolute and Battery-less Absolute Types, set 1. For others, set 0.
Reference: set 0 when battery-less absolute is used in incremental.

[19] Absolute battery retention time (Parameter No.19)

No.	Name	Symbol	Unit	Input Range	Default factory setting
19	Absolute battery retention time	AIP	days	0: 20 dayes 1: 15 dayes 2: 10 dayes 3: 5 dayes	0

For simple absolute type, set how long the encoder position information is to be retained after the power to the controller is turned OFF. The setting can be selected from 4 phases and as the motor rotation speed gets slower, the time to retain the position information gets longer. In the case that there is a possibility that the slide or the rod of the actuator that transports the work may be moved by an external force, follow the table below and calculate (Note 1) the number of rotation from the moved speed and set this parameter to the value faster than this value. If the motor rotation setting value exceeds the set value, the position information will be lost.

Parameter No.19 setting	Upper limit of encoder revolution at power-off [rpm]		Reference for battery retaining time [days]
	When the connected actuator is a model other than RCA2-***N;	hen the connected actuator is RCA2-***N;	
0	100	75	20
1	200	150	15
2	400	300	10
3	800	600	5

Note 1 Motor rotation [rpm] = Moved speed [mm/s] / Lead length [mm] × 60

[20] Position data change password (Parameter No.20)

No.	Name	Symbol	Unit	Input Range	Default factory setting
20	Position data change password	PASS	–	0000 to 9999	0000

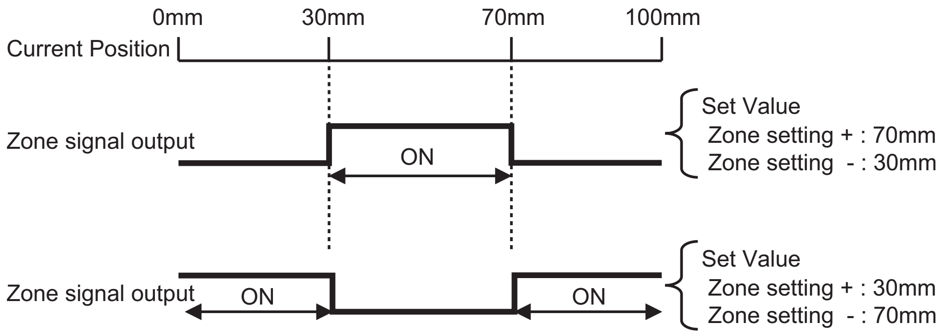
When “0000” is set, the password input is not required.

[21] Zone Positive Boundary 1+, Zone Positive Boundary 1- (Parameter No.21, No.22) Zone Positive Boundary 2+, Zone Positive Boundary 2- (Parameter No.23, No.24)

No.	Name	Symbol	Unit	Input Range	Default factory setting
21	Zone Positive Boundary 1+	ZONM	mm [deg]	-9999.99 to 9999.99	Actual stroke on + side
22	Zone Positive Boundary 1-	ZONL1	mm [deg]	-9999.99 to 9999.99	Actual stroke on - side
23	Zone Positive Boundary 2+	ZNM2	mm [deg]	-9999.99 to 9999.99	Actual stroke on + side
24	Zone Positive Boundary 2-	ZNL2	mm [deg]	-9999.99 to 9999.99	Actual stroke on - side

Set the area where thzone signals (ZONE1 and ZONE2) turn ON.
The minimum setting unit is 0.01mm [deg].
If a specific value is set to both zone setting + and zone setting -, the zone signal is not output.
A setting sample is shown below.

[Example of linear axis]



> ⚠ Caution: The signal cannot be output unless the range of the zone detection is set to a value greater than that of the minimum resolution (actuator lead length/encoder resolution).

[22] PIO inch distance (Parameter No.25)

No.	Name	Symbol	Unit	Input Range	Default factory setting
25	PIO inch distance	IOID	mm	0.01 to 1.00	0.1

The inching distance to the inching input command from PLC is set.
(Note) The maximum allowable value is 1 mm.

[23] Total movement count threshold (Parameter No.26)

No.	Name	Symbol	Unit	Input Range	Default factory setting
26	Total movement count threshold	TMCT	times	0 to 999999999	0 (Disabled)

An alarm is generated when the total movement count exceeds the value set to this parameter.
The judgment would not be made if the value is set to 0.

[24] Total operated distance threshold (Parameter No.27)

No.	Name	Symbol	Unit	Input Range	Default factory setting
27	Total operated distance threshold	ODOT	m	0 to 999999999	0 (Disabled)

An alarm is generated when the total operation distance exceeds the value set to this parameter.
The judgment would not be made if the value is set to 0.

[25] High Output Setting（Parameter No.28）

No.	Name	Symbol	Unit	Input Range	Default factory setting
28	High Output Setting	BUEN	–	0 : Disabled 1 : Enabled	In accordance with actuator

Set whether to use the high output function. However, it is necessary to connect an actuator applicable for high output (Note 1).
(Note 1) High output applicable actuator : RCP4 and RCP5 Series

[26] BU Speed loop proportional gain（Parameter No.29）

No.	Name	Symbol	Unit	Input Range	Default factory setting
29	BU Speed loop proportional gain	BUPC	–	1 to 10000	In accordance with actuator

When High Output Setting (Parameter No. 28) is set enabled, this parameter becomes valid for the speed loop proportional gain.
Refer to 5.2 [5] Speed loop proportional gain for details.

[27] BU Speed loop integral gain（Parameter No.30）

No.	Name	Symbol	Unit	Input Range	Default factory setting
30	BU Speed loop integral gain	BUIC	–	1 to 100000	In accordance with actuator

When High Output Setting (Parameter No. 28) is set enabled, this parameter becomes valid for the speed loop integral gain.
Refer to 5.2 [6] Speed loop integral gain for details.

[28] Overload level ratio (Parameter No.31)

No.	Name	Symbol	Unit	Input Range	Default factory setting
31	Overload level ratio	OLWL	%	50 to 100	100

It is a feature dedicated for the servo motor. Setting the motor temperature of when the motor is operated at the rating as 100%, a message alarm (overload warning) is output (ALML Signal) when the motor temperature has exceeded the ratio set in this parameter. The judgment would not be made if the value is set to 100%.

[29] Light error alarm output select (Parameter No.32)

No.	Name	Symbol	Unit	Input Range	Default factory setting
32	Light error alarm output select	OALL	%	0: Overload alarm 1: Light error	0

If 0 is selected, ALML is output when the rated current ratio exceeds the value set in Parameter No.31 “Overload level ratio”.
If 1 is selected, even a message level alarm such as maintenance information error is output as well as the result of the overload level ratio.

[30] Active/Inactive Axis Select (Parameter No.33)

No.	Name	Symbol	Unit	Input Range	Default factory setting
33	Active/Inactive Axis Select	EFCT	–	0: Enabled 1: Disabled	0

In the case an operation is desired to be made with less axes than what were purchased, by setting this parameter to ineffective, the axes can be identified as the ineffective axes, and an alarm would not be generated.
It is useful when connecting specific axes for operation at the startup or can be reserved for an extension in the future.

[31] Default movement direction for excitation-phase signal detection (Parameter No.34)

No.	Name	Symbol	Unit	Input Range	Default factory setting
34	Default movement direction for excitation-phase signal detection	PHSP	–	0: Reverse 1: Forward	In accordance with actuator

Excitation detection (Note) starts when the servo is turned ON for the first time after the power is supplied. Detection direction at this time is determined.
Even though it is generally unnecessary to change this setting, set this to the direction which the motor is easy to move when the actuator interferes with the mechanical end or peripheral object at the time the power is supplied.
If the direction not interfering is the same direction as the home return direction, set the same values as set to Parameter No.17 Home Return Direction. If the direction in opposite, set the other values from Parameter No.17. (If No.17 is 0, set 1. If No.17 is 1, set 0.)
(Note) In Simple Absolute Type, the excitation phase signal detection is executed at the home-return operation complete.

[32] Exicitation-phase signal detection time (Parameter No.35)

No.	Name	Symbol	Unit	Input Range	Default factory setting
35	Exicitation-phase signal detection time	PHSP	msec	1 to 999	In accordance with actuator

Excitation detection (Note) starts when the servo is turned ON for the first time after the power is supplied. Detection direction at this time is determined.
Even though it is generally unnecessary to change this setting, changing the setting of this parameter may be effective when excitation error is generated or abnormal operation is confirmed.
Please contact us in the case a change is necessary to this parameter.
(Note) In Simple Absolute Type, the excitation phase signal detection is executed at the home-return operation complete.

[33] Excitation Detection Type (Parameter No.36)

No.	Name	Symbol	Unit	Input Range	Default factory setting
36	Excitation Detection Type	PHSP	–	0: Conventional method 1: New method 1 (For vertical mount installation) 2: New method 2 (For horizontal mount in stallation)	0

Excitation detection (Note) is executed at the first servo-on after the power is supplied, and in the new method, we succeeded to make this operation smoother and quieter than ever (if compared with our existing products).
In the case the new method 2 (horizontal mount installation) is set and the actuator is mounted vertically, the slider or the rod may drop at the excitation operation. Follow the instructed orientation to install. If the slide or rod drops with the mentioned way of installation, set with the current setting.

5.3 Servo Adjustment

The parameters are preset at the factory before shipment so that the actuator operates stably within the rated (maximum) transportable weight.
However, the preset setting cannot always be the optimum load condition in the actual use. In such cases, servo adjustment may be required.
This section describes the basic servo adjustment method.

> ⚠ Caution: Rapid and excessive settings are dangerous. They may devices including the actuator to be damaged and/or people to be injured. Take sufficient note on the setting.
> Record settings during servo adjustment so that prior settings can always be recovered.
> When a problem arises and the solution cannot be found, please contact IAI.

5.3.1 Adjustment of Pulse Motor and Servo Motor

No.	Situation that requires adjustment	How to Adjust
1	Takes time to finish positioning Positioning accuracy is not appropriate Shorter takt time is desired	• Increase the value of Parameter No.3 “Servo gain number”. By setting a larger value, the follow-up ability to the position command becomes better. Set the value to any of 3 to 10 roughly or up to 15 at the maximum. If the value is too large, an overshoot is caused easily and may cause noise or vibration. If the value of Parameter No.3 “Servo gain number” is increased, also adjust the Parameter No.5 “Speed loop proportional gain” in increasing direction to ensure the stability in the control system. To increase the value of Parameter No.5 “Speed loop proportional gain” by about 20% of the default. Prior to the setting, adjust Parameter No.3 “Servo gain number”.
2	Vibration is generated at acceleration/deceleration	• The cause of the problem is excessive “acceleration/deceleration setting” or vulnerable structure of the unit on which the actuator is installed. If possible, reinforce the unit itself, first. • Decrease the values of “acceleration/deceleration setting”. • Decrease the number of Parameter No.3 “Servo gain number”. • If the Parameter No.3 “Servo gain number” is too low, it takes long time to finish the positioning.
3	Speed is uneven during the movement Speed accuracy is not appropriate	• Increase the value of Parameter No.5 “Speed loop proportional gain”. By setting a larger value, the follow-up ability to the speed command becomes better. Setting too large value makes the mechanical components easy to vibrate. As a reference for the setting, increase the value little by little by 20% from the initial setting.

No.	Situation that requires adjustment	How to Adjust
4	Abnormal noise is generated. Especially, when stopped state and operation in low speed (less than 50mm/sec), comparatively high noise is generated.	• Input the Parameter No.4 “Torque Filter Time Constant”. Try to increase by 50 as a reference for the setting. If the setting is too large, it may cause a loss of control system stability and lead the generation of vibration. [Important] Prior to Adjustment: This phenomenon is likely to occur when the stiffness of the mechanical components is not sufficient. The actuator itself may also resonate if its stroke is over 600mm or it is belt-driven type. Before having an adjustment, check if: 1) The value for Parameter No.3 “Servo gain number”, Parameter No.5 “Speed loop proportional gain”, or Parameter No.6 “Speed loop integral gain” are excessive. 2) The stiffness of the load is sufficient as much as possible, or the attachments are not loosened. 3) The actuator unit is mounted securely with a proper torque. 4) There is no waviness on the actuator mounting surface.
5	Trace precision is desired to be improved. Equi-speed performance is desired to be improved. Response is desired to be improved.	• Make the condition optimized with Parameter No.3 “Servo gain number” and Parameter No.5 “Speed loop proportional gain” adjusted by referring to the way to adjust stated in No.1 to 3 in the previous page. [Reference] The most important factor is to select the actuator (motor). The servo is extremely sensitive to the inertia of the load. If the inertia moment of the load is too large in comparison with the inertia moment of the servo motor itself, the motor is highly affected by the load. This may cause the actuator to be controlled unstably. Therefore, to improve the precisions of the trace, position, speed and response of the actuator, the load inertia ratio must be made small. For high trace precision, equi-speed performance, and response of the actuator in such a use as application, it is better to use ball screws with small leads in the actuator as much as possible and an actuator of motor capacity higher by at least one level. The best method is to calculate the load inertia to select the proper actuator.

5.3.2 Adjustment of Brushless DC Electric Motor

<table>
<tr><th>No.</th><th>Situation that requires adjustment</th><th>How to Adjust</th></tr>
<tr><td>1</td><td>Hunching occurs at positioning stop</td><td rowspan="3">Set the parameter in the following steps, and check the operation.
If an improvement is confirmed in operation, finish the adjustment.
It is not necessary to proceed to the next step.</td></tr>
<tr><td rowspan="2">2</td><td>Fluctuation in speed occur during operation</td></tr>
<tr><td>Speed is inaccurate</td></tr>
<tr><td></td><td></td><td>Procedure 1 : Change Parameter No. 6 “Velocity Loop Integrated Gain”
Set the five types of values below in order, and check the operation.
<table>
<tr><th>Setting Order</th><th>Velocity Loop Integrated Gain Setting</th></tr>
<tr><td>1</td><td>411</td></tr>
<tr><td>2</td><td>592</td></tr>
<tr><td>3</td><td>925</td></tr>
<tr><td>4</td><td>1645</td></tr>
<tr><td>5</td><td>3700</td></tr>
</table>
Go onto Procedure 2 if there is no improvement in operation.

Procedure 2 : Change Parameter No. 5 “Velocity Loop Proportional Gain” and Parameter No. 6 “Velocity Loop Integrated Gain”
Set the six types of values below in order, and check the operation.
<table>
<tr><th colspan="3">●Load of 0.2kg or less</th></tr>
<tr><th>Setting Order</th><th>Velocity Loop Proportional Gain Setting</th><th>Velocity Loop Integrated Gain Setting</th></tr>
<tr><td>1</td><td>42</td><td>382</td></tr>
<tr><td>2</td><td>42</td><td>520</td></tr>
<tr><td>3</td><td>42</td><td>749</td></tr>
<tr><td>4</td><td>42</td><td>1171</td></tr>
<tr><td>5</td><td>42</td><td>2081</td></tr>
<tr><td>6</td><td>42</td><td>4683</td></tr>
</table>
<table>
<tr><th colspan="3">●Load over 0.2kg</th></tr>
<tr><th>Setting Order</th><th>Velocity Loop Proportional Gain Setting</th><th>Velocity Loop Integrated Gain Setting</th></tr>
<tr><td>1</td><td>32</td><td>231</td></tr>
<tr><td>2</td><td>32</td><td>315</td></tr>
<tr><td>3</td><td>32</td><td>453</td></tr>
<tr><td>4</td><td>32</td><td>708</td></tr>
<tr><td>5</td><td>32</td><td>1259</td></tr>
<tr><td>6</td><td>32</td><td>2833</td></tr>
</table>
Contact IAI if there is no improvement in operation.</td></tr>
<tr><td>3</td><td>Abnormal noise is generated / Especially, when stop or operation in low speed (less than 20mm/sec), comparatively high noise is generated.</td><td>Change the values for Parameter No. 5 “Velocity Loop Proportional Gain” and Parameter No. 6 “Velocity Loop Integrated Gain” to the following.
Speed loop proportional gain : 32
Speed loop integral gain : 231</td></tr>
</table>

Chapter 6 Troubleshooting

6.1 Action to Be Taken upon Occurrence of Problem

Upon occurrence of a problem, take an appropriate action according to the procedure below in order to ensure quick recovery and prevent recurrence of the problem.

1) Status LEDs and PIO Check on Controller

LED			Operation status	Status of PIO Output Signal
SYS	SYS I	SYS II		*ALM output (Note 1)
(Orange Light is turned ON.)	(Green Light is turned ON.)	(Green Light is turned ON.)	Alarm generated due to Gateway (Fieldbus error, etc.)	ON
(Green Light is turned ON.)	(Red Light is turned ON.)	(Green Light is turned ON.)	Alarm generated on either Axis No.0, 2, 4 or 6 (depending on slot the driver board is inserted)	ON
(Green Light is turned ON.)	(Green Light is turned ON.)	(Red Light is turned ON.)	Alarm generated on either Axis No.1, 3, 5 or 7 (depending on slot the driver board is inserted)	ON
(Orange Light is turned ON.)	(Red and green by turn)	(Red and green by turn)	In initializing at startup	OFF

2) Check whether an alarm occurs on the host controller (PLC, etc.).
3) Check the voltage of the main power supply (24V DC).
4) Voltage check of PIO power supply (24V DC) or Fieldbus power supply
5) Check the voltage (24V DC) of the power supply for brake (for the actuator with the brake).
6) Alarm Check(Note1)
   Check the alarm code on the teaching tool such as PC software.
7) Check the connectors for disconnection or connection error.
8) Check the cables for connection error, disconnection or pinching.
   Cut off the main power of the system which this controller is installed in and remove the cables around the measurement point (to avoid conductivity through the surrounding circuit) before checking the conductivity.
9) Check the I/O signals.
   Using the host controller (PLC, etc.) or a teaching tool such as PC software, check the presence of inconsistency in I/O signal conditions.
10) Check the noise elimination measures (grounding, installation of power line filter, etc.).
11) Check the events leading to the occurrence of problem (Note 1), as well as the operating condition at the time of occurrence.
12) Analyze the cause.
13) Treatment

Note 1 The time of alarm generated can be recorded if the clock is set to the current time on Gateway Parameter Setting Tool.
If the current time is set, the data is remained for approximately 10 days under the condition that the power to the controller is OFF. If the setting is not conducted or the time data is lost, it will be the time passed since 2000/1/1, 00:00:00 when the power is turned ON. Even if the date and time data is lost, the generated error code is retained.
Alarms subject to this function only include those in 6.4 Alarm but do not include errors in the teaching tool such as PC software.

> Notice: In troubleshooting, exclude normal portions from suspicious targets to narrow down the causes. Check 1) to 11) described above before contacting us.

6.2 Fault Diagnosis

This section describes faults largely divided into four types as follows:
(1) Impossible operation of controller
(2) Positioning and speed of poor precision (incorrect operation)
(3) Generation of noise and/or vibration
(4) Communication not established

6.2.1 Impossible operation of controller

Situation	Possible cause	Check/Treatment
SYSLED or SYS I/SYS II LED on driver board turn ON in red when power is supplied	(1) Occurrence of alarm. (2) During emergency-stop. 1) Was the emergency-stop switch released? 2) EMG- on the system I/O connector is not connected.	(1) Check the error code with the teaching tool being connected and remove the cause by referring the alarm list. [Refer to 6.4 Alarm List.] (2) 1) Release the emergency stop switch. 2) Check the connection of the system I/O connector (EMG-). [Refer to 2.3 [1] Power Supply and Emergency Stop]
Both position No. and start signal are input to the controller, but the actuator does not move.	1) Servo OFF condition. 2) The pause signal is OFF. 3) Positioning command is issued to a stop position. 4) There is no positioning data set to the commanded position number. 5) Writing the information in a wrong area for Direct Indication Mode.	1) Are SYS I/SYS II LEDs on the driver board that the operated axes are connected turned ON? [Refer to Name for Each Parts and Their Functions] Turn ON the servo-on signal SON. 2) Operation is available when pause signal *STP is ON and pause when it is OFF. Turn it ON. 3) Check the sequence or the settings of the position table. 4) It will generate Alarm Code 0A2 "Position Data Error". Conduct the position table setting.
Connected the teaching tool and supplied the motor and control power to controller, but operation would not start. (the emergency stop switch is released on the teaching tool)	Cable treatment or mode selection. 1) Emergency stop condition 2) Servo OFF condition 3) In pause	1) Supply 24V DC to EMG- terminal of the system I/O connector. ⚠ Warning If the process of 1) is conducted, put back the setting as soon as the adjustment work is finished. Starting the operation without putting it back may cause a serious accident since the emergency stop is set invalid. 2) 3) Put the operation mode switch on the front panel of the controller to "MANU" side, and select the teach mode on the teaching tool.

6.2.2 Positioning and speed of poor precision (incorrect operation)

Situation	Possible cause	Check/Treatment
Completion of operation on the way to home return	In the home return of our standard specification, the actuator is first pressed to the mechanical end, moved oppositely, and subject to positioning stop at the home position. Therefore, the product may judge as the mechanical end even though it is still on the way when the load is large and interfere with surrounding object. 1) A load exceeding its rating weight is installed on the actuator. 2) It is touched to interference in the way of the run. 3) Torsion stress is applied to guide due to improper fixing method of the actuator or uneven fastening of bolts. 4) The sliding resistance of the actuator itself is large.	1) Reduce the load. 2) Remove the interference. 3) Loosen the fixing bolts once and check whether the slider can move smoothly. If the slider can move smoothly, check if there is a deformation on the attached surface, and install the actuator again following the instructions stated in Instruction Manual. 4) Please contact IAI.
Shocks at start and/or stop.	Acceleration/deceleration is set too high.	Decrease the settings of acceleration/deceleration.
Overshoot during deceleration to stop.	The load inertia is large.	Decrease the setting of deceleration.
Positioning of poor precision	[Refer to 5.3 Servo Adjustment.]	
Uneven speed during movement		
Acceleration/deceleration not smooth (bad speed response)		
Positioning at a position different from that of commanded position No.	1) For PIO Type, the start signal CSTR after the position number command is too early, or input at the same timing. (Note) Inputting at the same timing is available for Fieldbus Type. 2) The correct position No. is not specified due to PIO signal disconnection or poor connector contact.	1) The stop position may be set for another purpose. Make sure to complete the reading of the position numbers to this controller before inputting the start signal. 2) Check the input signal on I/O monitor on the teaching tool.
Complete signal PEND is not output even though positioning process is completed.	Start signal CSTR is not turned OFF.	Make the start signal CSTR turned OFF before completing the positioning process by the turn-off of positioning complete signal PEND after starting operation, and so on.

6.2.3 Generation of noise and/or vibration

Situation	Possible cause	Check/Treatment
Generation of noise and/or vibration from actuator itself	Noise and vibration are generated by many causes including the status of load, the installation of the actuator, and the rigidity of the unit on which the actuator is installed.	Servo adjustment may improve the situation. [Refer to 5.3 Servo Adjustment.]
Vibrations of load	1) Acceleration/deceleration is set too high. 2) The installation structure and/or the installed load are easily affected by acceleration/deceleration.	1) Decrease the settings of acceleration/deceleration.

6.2.4 Impossible Communication

Situation	Possible cause	Check/Treatment
Not connectable with host machine	1) Communication rates do not match. 2) The machine number (station number) is set to be duplicate with that of another unit or out of the range. 3) Poor wiring or disconnection of communication cable	1) Set the communication rate to match that of the host machine. [Refer to the Instruction Manual of the host unit.] 2) Correct the unit number (station number) setting. Machine numbers (station numbers) vary depending on communication modes. Refer to 3.4 Fieldbus Type Address Map and the instruction manuals for the host devices for the details. 3) Review the wiring again. Check if termination resistances are connected to network terminals with correct values. Check if the communication power supply is established properly for DeviceNet Type. [Refer to the Instruction Manual of the host unit.]

6.3 Alarm Level

The alarms are classified to 3 types of levels by the content of the error.

Alarm level	ALM lamp	*ALM signal	Status when an error occurred	Cancellation method
Message	OFF	No output	No stop	Alarm of maintenance output such as battery voltage drop or the teaching tool such as PC software [Refer to Instruction Manual of each tool for details.]
Operation release	ON	Output	Servo OFF after deceleration to stop	Reset the alarm by the PIO or teaching tool.
Cold start	ON	Output	Servo OFF after deceleration to stop	Software reset or power reconnection by teaching tool. Home return is required for any actuators of other than simple absolute specification.

⚠ Caution: Reset each alarm after identifying and removing the cause.
If the cause of the alarm cannot be removed or when the alarm cannot be reset after removing the cause, please contact IAI.
If the same error occurs again after resetting the alarm, it means that the cause of the alarm has not been removed.

6.4 Alarm List

6.4.1 Gateway Alarm Codes

The alarm codes are read into b7 to b0 in Gateway Status Signal 0.

(Note) The alarm code shown on Gateway Parameter Setting Tool is applied with “8” on the top of the alarm codes listed below. (Example) If the alarm code is 43, it will be shown as 843.

Alarm Code	Alarm Name	Cause/Treatment
43	Absolute Battery Charge Voltage Drop	Cause : The voltage of the absolute battery charger has dropped. Treatment : Check the voltage of the 24V DC power supply. Check the wire layout between the absolute battery box and MSEP controller.
48	Decrease in Fan Revolution	Cause : The fan rotation speed has decreased for the cooling fan on the main unit. Treatment : It is considered that it is the end of the product life of the fan (approximately 3 years). Replace the fan.
49	Time Notification Error	Cause : It is an internal communication error of MSEP. The clock data transfer from Gateway board to the driver board has failed. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
4A	Real Time Clock Operation Stop Detection	Cause : Clock data has lost. The clock data can be remained for approximately 10 days after the power to the controller is turned OFF. Treatment : Have the clock setting done from the Gateway Parameter Setting Tool again.
4B	Real Time Clock Access Error	Cause : It is an internal error of MSEP. The clock data failed to be acquired internally. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
50	Fieldbus Communication Error (ERR-C)	Cause : It is a Fieldbus link error. If the flip-flop is set in Gateway Parameter Setting Tool during this error, the actuator is stopped in the condition of the error and any command is ignored until it receives a release signal. Treatment : Check the settings for Fieldbus (node addresses, communication speed, etc.) and wiring layout.
60	Master-Slave Axes Communication Error (ERR-T)	Cause : It is an internal error of MSEP. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : It is considered that the driver board is not inserted or there is a failure in the connection (connector is not inserted deep enough).
61	Master-Slave Axes Communication Internal Error (Sending)	Cause : It is an internal error of MSEP. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
62	Master-Slave Axes Communication Internal Error (Receiving)	Cause : It is an internal error of MSEP. The communication with the driver board to connect each axis of the actuators was not able to be established. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
6A	Driver Board Operation Pattern Error	Cause : Operation modes which cannot be used together are indicated. Treatment : Set the operation modes again on Gateway Parameter Setting Tool.
80	GW Parameter Error	Cause : There is an error in Gateway parameters. Treatment : Check the settings such as the number of connected axes and operation mode on Gateway Parameter Setting Tool.
81	Parameter Check Sum Error	Cause : There is a possibility that the memory data inside MSEP has destroyed. Treatment : Establish all the settings again on Gateway Parameter Setting Tool or write the backup data if it exists.

Alarm Code	Alarm Name	Cause/Treatment
90	Driver Board Mount Error	Cause : The number of axes (number of driver boards) set in Gateway Parameter Setting Tool does not match with the number of the actually connected axes. Treatment : Match the numbers of the axes.
9C	Fieldbus Module Not Detected	Cause : Communication board for Fieldbus was not detected. 1) Communication board is not inserted. 2) Malfunction of communication board Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
9E	Fan Error	Cause : A Fan error was detected. Treatment : It is considered that it is the end of the product life of the fan (approximately 3 years). Replace the fan.
A0	Control Power Overvoltage	Cause : Control power voltage reached beyond the overvoltage threshold (120% of 24V DC = 28.8V). 1) The voltage of 24V DC power supply is high. 2) A faulty part inside the controller 3) Turning the servo ON at acceleration/deceleration spends a huge current consumption transiently. Using the remote sensing function with a power supply with no enough current capacity may cause overvoltage responding to the current change. Treatment : 1) 2) Check the voltage of the input power supply. 3) Think to use a power supply with enough current capacity or not to use the remote sensing function. If the voltage is normal, please contact IAI.
A1	Control Power Voltage Drop	Cause : The control power voltage dropped less than the voltage drop threshold (70% of 24V DC = 16.8V). 1) The voltage of 24V DC power is low 2) A faulty part inside the controller Treatment : Check the power voltage. If the voltage is normal, please contact IAI.
A2	Overvoltage on motor power	Cause : 1) Motor power input voltage (input to MPI terminal) is too large (38V or more) Turning the servo ON at acceleration/deceleration spends a huge current consumption transiently. Using the remote sensing function with a power supply with no enough current capacity may cause overvoltage responding to the current change. 2) Overcurrent is generated on the motor power supply line Treatment : 1) Check the power voltage input to MPI terminal. Think to use a power supply with enough current capacity or not to use the remote sensing function. 2) Check the wire layout between the actuator and controller.
A6	Encoder Voltage Drop	Cause : The power voltage for the encoder has dropped below the allowable range. Treatment : Check the connection between the actuator and MSEP.
AA	Regenerative Electric Discharge Circuit Error	Cause : There is an error in the regenerative discharge circuit inside the controller. Treatment : Turn the power OFF and reboot. If the same error occurs again, please contact IAI.
AB	Assumed Regenerative Discharge Excessive Power	Cause : The regenerative electric power exceeded what can be dealt with the regenerative resistor. Treatment : Decrease the acceleration/deceleration speed, revise the operation interval or connect an external optional regenerative resistor (RER-1).
AC	Continuous Regenerative Excessive Discharge	Cause : The regenerative electric power exceeded what can be dealt with the regenerative resistor. Treatment : Decrease the acceleration/deceleration speed, revise the operation interval or connect an external optional regenerative resistor (RER-1).
FF	Power-on Log	It is the log at the power being on (it is not an error).

6.4.2 Simple Alarm Code

Simple alarm codes are read into the complete position register (PM8 to PC1) in Positioner 1/Simplified Direct Value Mode when an alarm is generated.

○: ON ●: OFF

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
○	●	●	●	●	–	Normal
●	●	●	○	●	2	Software reset during servo ON (090) Position number error during teaching (091)
●	●	●	○	○	3	Move command during servo OFF (080) Position command in incomplete home return (082) Absolute position move command when home return is not yet completed (083) Movement command during home return operation (084) Position No. error during movement (085) Position command information data error (0A3) Command deceleration error (0A7)
●	●	○	●	●	4	Mismatched PCB (0F4)
●	●	○	●	○	5	Motor drive source line connection error (0AA)
●	●	○	○	●	6	Parameter data error (0A1) Position data error (0A2) Position command data error (0A3) Unsupported motor/encoder type (0A8)
●	●	○	○	○	7	Z-phase position error (0B5) Z-phase detection time out (0B6) Magnetic pole indeterminacy (0B7) Excitement detection error (0B8) Home sensor non-detection (0BA) Home return timeout (0BE)

(Note) *ALM Signal is an active low signal. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

○: ON ●: OFF

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
●	○	●	●	●	8	Actual speed excessive (0C0)
●	○	●	●	○	9	Overcurrent (0C8) Overvoltage (0C9) Overheat (0CA) Drive source error (0D4)
●	○	●	○	○	11	Deviation overflow (0D8) Software stroke limit exceeded (0D9) Pressing motion range over error (0DC)
●	○	○	●	●	12	Electric angling mismatching (0B4) Servo error (0C1) Motor power source voltage excessive (0D2) Overload (0E0) Driver logic error (0F0)
●	○	○	●	○	13	Encoder receipt error (0E5) Encoder Counter Error (0E6) A-, B- and Z-phase wire breaking (0E7) A and B-phase wire breaking (0E8) Absolute encoder error detection 1 (0ED) Absolute encoder error detection 2 (0EE) Absolute encoder error detection 3 (0EF)
●	○	○	○	●	14	CPU error (0FA) Logic error (0FC)
●	○	○	○	○	15	Nonvolatile memory write verify error (0F5) Nonvolatile memory write timeout (0F6) Nonvolatile memory data destroyed (0F8)

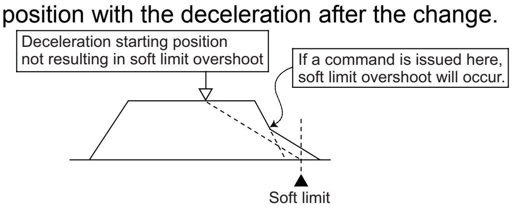
(Note) *ALM Signal is an active low signal. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

6.4.3 Alarm Codes for Driver Board (Each Axis)

(Note) In the shaded alarm code columns in the table below, the applicable driver board type is shown with symbols. The alarm codes not shaded are in common for all the driver board.

P : Standard Pulse Motor (not applicable for high output)・・RCP2, RCP3, RCP4 and RCP5 Series
PA : Pulse Motor applicable for High Output・ ・RCP4 and RCP5 Series
A : Servo motort・ ・RCA, RCA2 and RCL Series
D : Pulse/brushless DC electric motor・ ・RCD Series

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
048 Only for PA, A and D drivers	Message	Driver overload alarm	Cause : There is a risk of overload with the current operation condition. This alarm keeps its status until a reset is conducted. Treatment : Lower the setting of acceleration/deceleration. Also, increase the frequency of pause.
04E		Exceeded movement count threshold	Cause : The total number of the operation times exceeded the value set in Parameter No.26 “Total Movement Count Threshold”.
04F		Exceeded operated distance threshold	Cause : The total number of the operation distance exceeded the value set in Parameter No.27 “Total Operated Distance Threshold”.
06B		Maintenance information data error	Cause : The maintenance information (total movement count, total operated distance) is lost. Treatment : Please contact IAI.
080	Operation release	Move command in servo OFF	Cause : A move command was issued when the servo is OFF. Treatment : Issue a movement command after confirming the servo is ON (servo ON signal (SV) or position complete signal (PEND) is ON).
082		Position command in incomplete home return	Cause : A position move command was issued before home return was completed. Treatment : Issue a command after confirming that home return has been completed (HEND) is ON.
083		Numerical command in incomplete home return	Cause : An absolute position command was issued by numerical specification before home return was completed (direct command from Field Network). Treatment : Issue a numeric specification after performing home return operation and confirming the complete signal (HEND).
084		Absolute position move command when home return is not yet completed	Cause : A move command was issued when home return was still in progress. Treatment : Issue a movement command after performing home return operation and confirming the complete signal (HEND).
085		Position No. error during movement	Cause : A non-existing (invalid) position number was specified in the positioner mode. Treatment : Check the position table again and indicate an effective position number.
090		Software reset command in servo-ON condition	Cause : A software reset command was issued when the servo was ON. Treatment : Issue a software reset command after confirming that the servo is OFF (SV signal is 0).
091		Position No. error in teaching	Cause : The position number out of the available range was selected in the teaching. Treatment : Select the position number from 255 or smaller.
0A1	Cold start	Parameter data error	Cause : The data input range in the parameter area is not appropriate. Treatment : Change the value to the appropriate one.

<table>
<tr><th>Alarm Code</th><th>Alarm Level</th><th>Alarm Name</th><th>Cause/Treatment</th></tr>
<tr><td>0A2</td><td rowspan="3">Operation release</td><td>Position data error</td><td>Cause : 1) A move command was input when no target position was set in the “Position” field of a position No. in the position table.
2) The value of the target value in the “Position” field exceeded the value set in Parameter No. 15 “Soft limit 9”.
Treatment : 1) Set the target position.
2) Change the target position value to the one within the soft limit set value.</td></tr>
<tr><td>0A3</td><td>Position command data error</td><td>Cause : The command value during direct numeric specification exceeded the maximum set value.
Treatment : Table to input a proper value.
* The code for the excess command item is displayed in “Detailed Address”.
<table><tr><th>Detailed Address (Command Item Code)</th><th>Command Item</th></tr><tr><td>0</td><td>Target Position</td></tr><tr><td>2</td><td>Command Speed</td></tr><tr><td>4</td><td>Acceleration</td></tr><tr><td>6</td><td>Deceleration</td></tr><tr><td>8</td><td>Positioning Width</td></tr><tr><td>C</td><td>Pressing Current Limit</td></tr><tr><td>D</td><td>Control Signal</td></tr></table></td></tr>
<tr><td>0A7</td><td>Command deceleration error</td><td>Cause : Because there is not enough deceleration distance when the deceleration is changed to a lower setting during the operation, the actuator exceeded the soft limit when deceleration was made from the current position with the deceleration after the change.


The cause is that the timing to make the next movement command when the speed was changed during the operation was late.
Treatment : Make the timing earlier for the movement command for the deceleration speed change.</td></tr>
<tr><td>0A8</td><td rowspan="2">Cold start</td><td>Unsupported motor/encoder types</td><td>Cause : A motor or encoder not applicable for this controller is connected, and the motor or encoder cannot be classified.
Treatment : Contact us in case this alarm is issued with the applicable actuator or occurs again even after the power is rebooted.</td></tr>
<tr><td>0B4
Only for A drivers</td><td>Electric angling mismatching</td><td>Cause : The position deviation counter is over-flown.
Treatment : This error occurs when an actuator cannot operate. Confirm about the load conditions, that the work does not interfere with any object nearby or the brake has been released, etc.
If the error occurs even when the servo is ON, the cable breakage or disconnection is considered. Check the cable connection. Please contact IAI if there is no failure in the cable and connector connections.</td></tr>
<tr><td>0B5
Only for A drivers</td><td>Operation release</td><td>Z-phase position error</td><td>The point where Z-phase was detected in home-return operation was out of the specified area.
Cause : Encoder error
Treatment : Please contact IAI.</td></tr>
</table>

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0B6 Only for A drivers	Operation release	Z-phase detection time out	Cause : This indicates the Z-phase could not be detected at the first servo-on or home-return operation after the power is turned ON in Simple Absolute type. 1) Connector connection error or wire breakage on an actuator cable. 2) Brake cannot be released on a controller equipped with a brake. 3) Detection of the motor is not performed properly because an external force is applied. 4) The slide resistance of the actuator itself is large. Treatment : 1) Check for the actuator cable wiring condition. 2) Check the wiring condition of the brake cable, and also turn on/off the brake release switch to see if the brake makes a “clicking” sound. If the brake is not making any noise, check if the power is supplied to the brake properly. 3) Check if there is any abnormality in the parts assembly condition. 4) It the transportation weight is in the acceptable range, cut off the power to check the slide resistance manually by moving with hand. If the actuator itself is suspected to be the cause, please contact IAI.
0B7 Only for A drivers	Cold start	Magnetic pole indeterminacy	Cause : It shows the magnetic pole phase could not be detected after a certain time being passed even though the process for the magnetic pole phase detection was executed at the first servo-on after the power is turned ON. 1) Connector connection error or wire breakage on an actuator cable. 2) Brake cannot be released on a controller equipped with a brake. 3) Detection of the motor is not performed properly because an external force is applied. 4) The slide resistance of the actuator itself is large. Treatment : 1) Check for the actuator cable wiring condition. 2) Check the wiring condition of the brake cable, and also turn on/off the brake release switch to see if the brake makes a “clicking” sound. If the brake is not making any noise, check if the power is supplied to the brake properly. 3) Check if there is any abnormality in the parts assembly condition. 4) It the transportation weight is in the acceptable range, cut off the power to check the slide resistance manually by moving with hand. If the actuator itself is suspected to be the cause, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0B8 Only for P and PA drivers	Cold start	Excitement detection error	Cause : The magnetic pole phase detection is not completed after a certain time being passed even though the detection process was executed at the first servo-on after the power is turned ON. 1) Connection error or wire breakage on an actuator cable. 2) Brake is not released (when equipped with a brake). 3) Load to the motor is high due to external force. 4) Power was turned ON while touching to the mechanical end. 5) The resistance in the actuator sliding operation is large. Treatment : 1) Check the wiring condition of the actuator cables. 2) If an improvement can be confirmed when 24V DC, 150mA is supplied to BKRLS terminal in the external brake input connector, a malfunction of the controller can be considered. Please contact IAI. 3) Confirm that there is no error in the mechanical part assembly condition. 4) Move the slider or the rod to a point where it would not hit the mechanical end and reboot the system. 5) If the loaded weight is within the allowable range, turn the power OFF and check the resistance in sliding operation by moving the slider with hand.
0BA	Operation release	Home sensor non-detection	Cause : This indicates that the home-return operation of the actuator equipped with origin sensor (option for those except for rotary actuator) is not completed in normal condition. 1) The work piece has interfered with the peripherals during the home-return operation. 2) The resistance in the actuator sliding operation is large. 3) Attachment error, malfunction or wire breakage of origin sensor. Treatment : If there is no interference of the work piece confirmed with the peripherals, 2) or 3) can be considered as a cause. Please contact IAI.
0BE	Operation release	Home return timeout	Cause : Home return does not complete after elapse of a certain period after the start of home return. Treatment : This error does not occur in normal operation. The combination of the controller and actuator may be incorrect. Please contact IAI.
0C0	Operation release	Actual speed excessive	Cause : This indicates the number of motor rotation exceeded the number of allowable rotation. 1) The slide resistance of the actuator is locally high. 2) The load is increased too much due to a external force. With the reasons above, it can be considered a sudden speed increase has occurred before detecting the servo error. Treatment : Even though this would not occur in normal operation, check if there is any abnormality in the parts assembly condition. Also check if there is a possibility that an external force may be applied in the direction of the actuator movement.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0C1 Only for P and PA drivers	Operation release	Servo error	Cause : It indicates 2 seconds has passed without making a move since a move command was received. 1) Connection error or wire breakage on an actuator cable 2) Brake is not released (when equipped with a brake). 3) Load to the motor is high due to external force. 4) The resistance in the actuator sliding operation is large. Treatment : 1) Check the wiring condition of the actuator cables. 2) If an improvement can be confirmed when 24V DC, 150mA is supplied to BKRLS terminal in the external brake input connector, a malfunction of the controller can be considered. Please contact IAI. 3) Confirm that there is no error in the mechanical part assembly condition. 4) Move the slider or the rod to a point where it would not hit the mechanical end and reboot the system.
0C8	Cold start	Overcurrent	Cause : The output current in the power circuit section is increased abnormally. Treatment : This alarm will not be generated in normal operation. Degradation in insulation of motor coil or malfunction controller can be considered. Please contact IAI.
0C9 Only for PA drivers		Overvoltage	Cause : The voltage on the power regenerative circuit exceeded the threshold. Treatment : Malfunction of the controller can be concerned. Please contact IAI.
0CA		Overheat	Cause : This indicates overheat (90°C or more) of the components inside the controller. 1) Operation is performed with the load condition exceeding the specified range. 2) High temperature around the controller. 3) Load to the motor is high due to external force. 4) A faulty part inside the controller. Treatment : 1) Revise the operation condition such as decreasing the acceleration/deceleration speed. 2) Lower the ambient temperature of the controller. 3) Confirm that there is no error in the mechanical part assembly condition. (Note) This error would not normally occur. If it occurs, confirm there is not (1) to (3) above. If the same problem occurs again even with the process above, malfunction of controller can be considered. Please contact IAI.
0CB Only for PA, A and D drivers		Current sensor offset adjustment error	Cause : An error was found to the sensor in the status check of the current detection sensor conducted at the initializing process in the startup. 1) A breakdown of the current detection sensor or peripheral component is supposed. 2) An error in the offset adjustment is supposed. Treatment : A work (PC board) change or offset adjustment is required. Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0D2 Only for A and D drivers	Operation cancellation	Motor power source voltage excessive	Cause : A malfunction of a component inside the controller can be considered. Treatment : If this error occurs often, there is a concern of a controller malfunction. Please contact IAI.
0D4	Cold start	Drive source error	Cause : 1) Motor power input voltage (input to MPI terminal) is too large During acceleration/deceleration and servo-on, the current consumption rises transiently. Using the remote sensing function with a power supply with no enough current capacity may cause overvoltage responding to the current change. 2) Overcurrent is generated on the motor power supply line. Treatment : 1) Check the power voltage input to MPI terminal. Think to use a power supply with enough current capacity or not to use the remote sensing function. 2) Check the wire layout between the actuator and controller. Please report the environment of use and condition of operation in case this error occurs often.
0D8	Operation cancellation	Deviation overflow	Cause : This alarm indicates that the position deviation counter has overflowed. 1) The speed dropped or the actuator stopped due to the effect of external force or overload. 2) The excited-phase detection operation following the power-on is unstable. Treatment : 1) This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 2) Overload can be concerned. Revise the transportable weight and redo the home-return operation.
0D9		Software stroke limit exceeded	Cause : The current position of the actuator exceeds the software stroke limit. Treatment : Return the actuator to be within the range of the software stroke limit.
0DC		Pressing motion range over error	Cause : 1) After the pressing operation has complete, the force to push back is too large and the pushed back to the pressing start position. 2) The actuator touched the work during the approach movement before the pressing movement. Treatment : 1) Revise the setting and adjust it so the force to push back gets smaller. 2) Set the “Position” setting in front in the position table to shorten the approach distance.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0E0 Only for PA, A and D drivers	Cold start	Overload	Cause : 1) The work weight exceeds the rated weight, or an external force is applied and the load increased. 2) If the actuator is equipped with a brake, the brake is not released. 3) The slide resistance of the actuator is locally high. Treatment : 1) Check the work and its surrounding area to remove the cause. 2) If an improvement can be confirmed when 24V DC, 150mA is supplied to BKRLS terminal in the external brake input connector, a malfunction of the controller can be considered. Please contact IAI. If the error cannot be cancelled, malfunction of brake, cable breakage or controller malfunction can be considered. Please contact IAI. 3) In the case that the work can be moved by hand, move it. Then, check that there is no location where a sliding resistant is too large. Check if the installation face is distorted. When the error occurs in operation of the actuator only, Please contact IAI. ⚠ Caution Restart the operation after making sure to remove the cause. If you cannot determine that the cause is removed completely, wait for at least 30 minutes before turning ON the power to prevent the motor coil from burning.
0E5 Only for P, PA and A drivers		Encoder receipt error	Cause : This indicates that the data was not received to the controller in the normal condition from the simple absolute area. 1) Connector connection error (If the detail code in the error list of the teaching tool is 0002H.) 2) Effect of noise (If the detail code in the error list of the teaching tool is 0001H.) 3) Malfunction of component (communication part) inside the controller. 4) Initialization of battery-less absolute encoder is incomplete Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. 2) Interrupt the power to the peripheral equipment and activate only the this actuator and actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. 3) It is necessary to replace the actuator (motor part) or controller. If the cause cannot be specified, please contact IAI.
0E6 Only for P and PA drivers		Encoder Counter Error	Cause : It is in a condition the encoder cannot detect the position information properly. 1) Breakage on encoder relay cable, actuator enclosed cable or improper connector connection 2) Malfunction of encoder itself 3) Error status was received in initial communication with battery-less absolute encoder Treatment : 1) Check if any breakage of cable at connectors and the condition of connections. Malfunction of the encoder can be concerned if there is no suspected point on the cables. Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0E7 Only for A drivers	Cold start	A-, B- and Z-phase wire breaking	Cause : Encoder signals cannot be detected correctly. 1) Wire breakage or connector connection error on an actuator cable or cable enclosed in an actuator. 2) Malfunction of encoder itself. Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. If the cables are in the normal condition, the malfunction of the encoder can be considered. Please contact IAI.
0E8 Only for P, PA and D drivers	Cold start	A- and B-phase wire breaking	Cause : Encoder signals cannot be detected correctly. 1) Wire breakage or connector connection error on an actuator cable or cable enclosed in an actuator. 2) Malfunction of encoder itself. Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. If the cables are in the normal condition, the malfunction of the encoder can be considered. Please contact IAI.
0EC Only for D drivers	Cold start	PS-phase wire breaking	Cause : Encoder signals cannot be detected correctly. 1) Wire breakage or connector connection error on an actuator cable or cable enclosed in an actuator. 2) Malfunction of encoder itself. Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. If the cables are in the normal condition, the malfunction of the encoder can be considered. Please contact IAI.
0ED Only for P, PA and A drivers	Operation release	Absolute encoder error detection 1	Cause : The current position has changed while controller was reading the absolute data or saving files. Treatment : Avoid a condition that gives vibration to the actuator.
0EE Only for P, PA and A drivers	Operation release	Absolute encoder error detection 2	Cause : The position data cannot be detected properly in the Simple absolute type encoder. 1) When the power is supplied for the first time to Simple absolute type (before executing absolute reset) 2) Voltage drop of absolute battery. (If the detail code in the error list of the teaching tool is 0001H.) 3) Wire breakage or connector connection error on an actuator cable or cable enclosed in an actuator or connector being removed and inserted. (If the detail code in the error list of the teaching tool is 0002H.) 4) Changed the parameters of controller. Treatment : 2) Supply the power for 72 hours or more and after charging the battery enough, perform the absolute reset operation. If the same failure occurs often even with enough battery charge, it is considered the end of the battery life. Replace the battery. Conduct an absolute reset for 1), 2) and 4). [Refer to Chapter 4. Absolute Reset and Absolute Battery]

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0EF Only for P, PA and A drivers	Operation release	Absolute encoder error detection 3	The encoder for the Simple absolute type cannot detect the position information properly. (Encoder over speed error) Cause : The current position changed with a speed more than the rotation speed setting by an external cause during the power shutoff. Treatment : Set the rotation speed to a higher speed than what currently is. If the same failure occurs again, it is necessary to have an absolute reset. [Refer to Chapter 4. Absolute Reset and Absolute Battery]
0F0 Only for A and D drivers	Cold start	Driver logic error	Cause : Exceeded load, parameter (motor type) mismatched, noise, malfunction of controller, etc. Treatment : Please contact IAI.
0F4		Mismatched PCB	The PCB is not applicable for the connected motor in the startup check. Cause : There is a possibility of mismatch between the actuator and controller. Check the model codes. Treatment : Should this error occur, please contact IAI.
0F5	Operation release	Nonvolatile memory write verify error	It is verified at the data writing process to the non-volatile memory that the data inside the memory and the data to be written are matched. There was a mismatch detected in this process. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F6	Cold start	Nonvolatile memory write timeout	There is no response in the specified time duration during the data writing to the non-volatile memory. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F8		Nonvolatile memory data destroyed	Abnormal data was detected during the nonvolatile memory check after starting. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0FA		CPU error	The CPU operation is not normal. Cause : 1) Faulty CPU. 2) Malfunction due to noise. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0FC		Logic error (Component error in controller)	The controller is not operating properly. Cause : 1) Malfunction due to the effect of noise, etc. 2) Malfunction of peripheral circuit components. Treatment : Turn the power OFF and reboot. If the error occurs again, check for presence of noise. Also, if you have another controller, replace it and try. A recurring error with the spare controller suggests presence of noise. If the cause cannot be identified, please contact IAI.
100 to 1FF	Message	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
200 to 2FF	Operation release	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
300 to 3FF	Cold start	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]

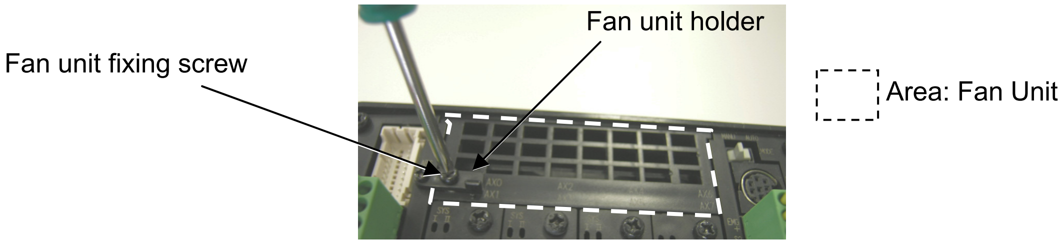
Chapter 7 Appendix

7.1 Fan Replacement

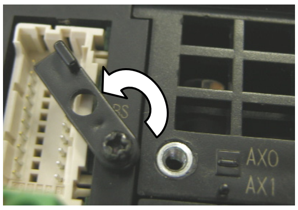
If an error is detected on the fan, replace the fan unit by following the process stated below.
Note 1: When there is an error on the fan, an alarm code will be output to the gateway status signal or the gateway parameter setting tool.

	Alarm Code	Alarm Name
b7 to b0 in Gateway Status Signal 0	48	Decrease in Fan Revolution
	9E	Fun error
Parameter Configuration tool	848	Decrease in Fan Revolution
	89E	Fun error

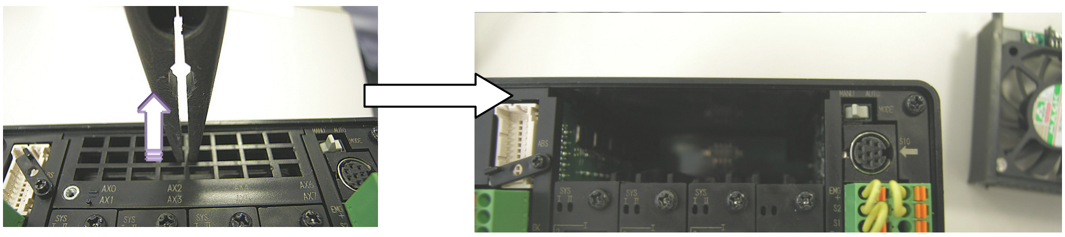
[Step 1] Prepare a new fan unit and remove the screw holding the fan unit.



[Step 2] Rotate the fan unit holder till it goes out of the fan unit interference.



[Step 3] Grab the lattice* on the fan unit with a tool such as needle-nose plier, and pull out the fan unit.
*The lattice on the fan unit is disposable.



[Step 4] The new fan unit is to be pushed in to be settled. At this time, make sure the fan unit is pushed in down to become flush with the peripheral.

[Step 5] Rotate the fan unit holder so the fan unit fixing screw can be tightened.

7.2 Replacement of Driver Board

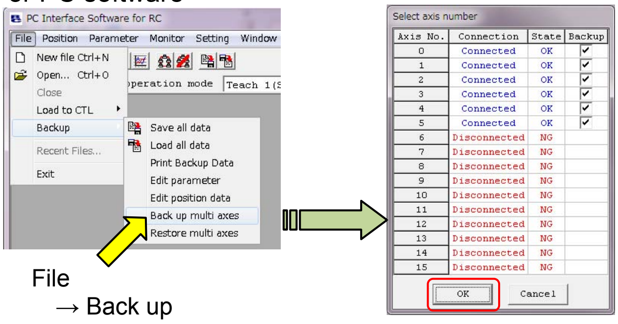
Have the driver board replaced by following the procedures below.
In this section, explains the procedures of PC software and teaching pendant (TB-01).

[Thing to be Prepared]

- PC software (enclosed cable) or teaching pendant (TB-01) and Secure Digital card
- Driver board for replacement

[Step 1] Connect the PC software or teaching pendant, set the operation mode setting switch to MANU and turn on the power to MSEP.
Back up all of the current settings and parameters. (For TB-01, back up the data of all axes applicable to the driver board to be replaced one by one.)

For PC software



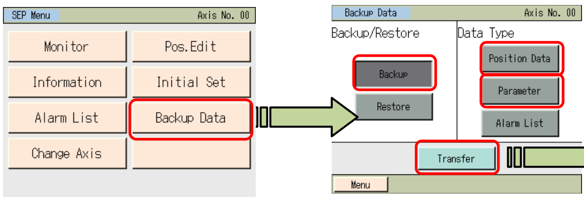
File
→ Back up
→ Back up multi axes

(PC Software)
Put a check mark to the axis numbers applicable to the driver board to be replaced, and click OK.

- Slot 0 (AX0, AX1) ⇒ Axis No. 0, 1
- Slot 1 (AX2, AX3) ⇒ Axis No. 2, 3
- Slot 2 (AX4, AX5) ⇒ Axis No. 4, 5
- Slot 3 (AX6, AX7) ⇒ Axis No. 6, 7

(TB-01)
Back up is to be held on the data of all axes applicable to the driver board to be replaced one by one.

For TB-01

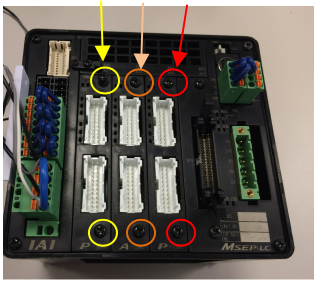


Input a file name
→ touch Save

Select Position Data and Parameter.

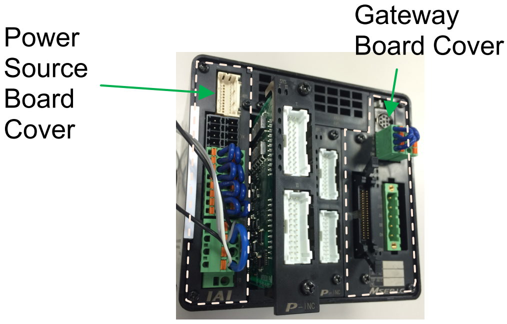
[Step 2] After turning off the power to MSEP, loosen the fixing screws (2 places) on the driver board so they will come up from the board. (The screws will not drop as they get stuck on the place on the driver board.)

Slot
0 1 2



The figure shows the 6-axis type. (Slot 3 is located beside Slot 2 for 7 and 8-axis types.)

[Step 3] Pick the screw heads popping up off the board to pull up the driver board, and pull it out slowly from the main body.

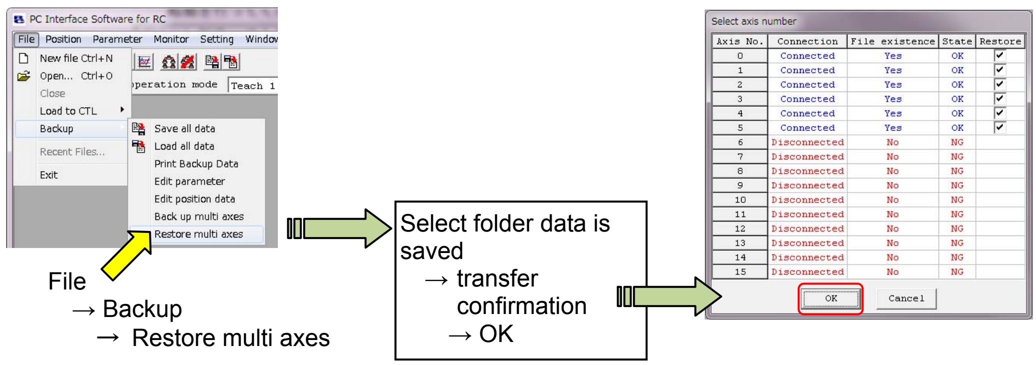


Caution:
- To detach Slot 0, take off the power source board cover on the left side.
- To detach Slot 3 (Slot 2 for LC type), take off the gateway board cover on the right side.

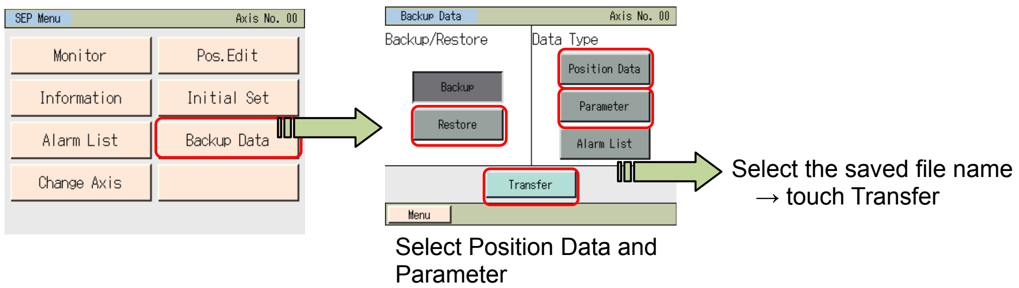
[Step 4] Insert the driver board for replacement that has already been prepared. Push it in till the end even though it gets tough at insertion to the connector. Make sure to push it in till the top side reaches to the same level with surrounding.
After insertion, affix it with the fixing screws (2 places).

[Step 5] Connect the PC software or teaching pendant to MSEP, and turn on the power to MSEP. Restore the data backed up in Step 1. Select the folder that the backup data was saved and click OK to transfer the data. Reboot the controller after data transfer.

For PC software



For TB-01



[Step 6] Check that the position data is as it was before procedures.

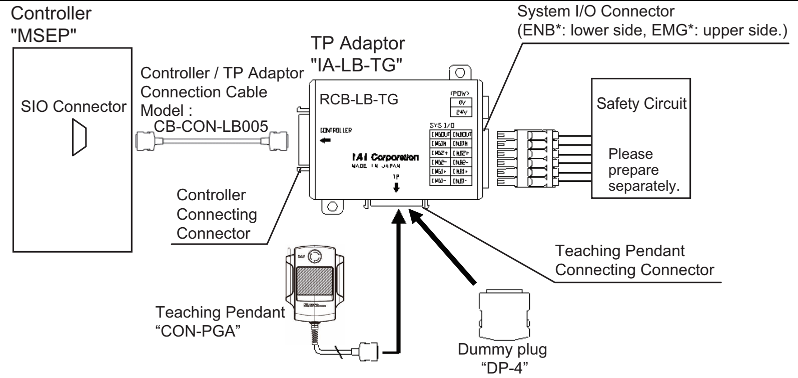
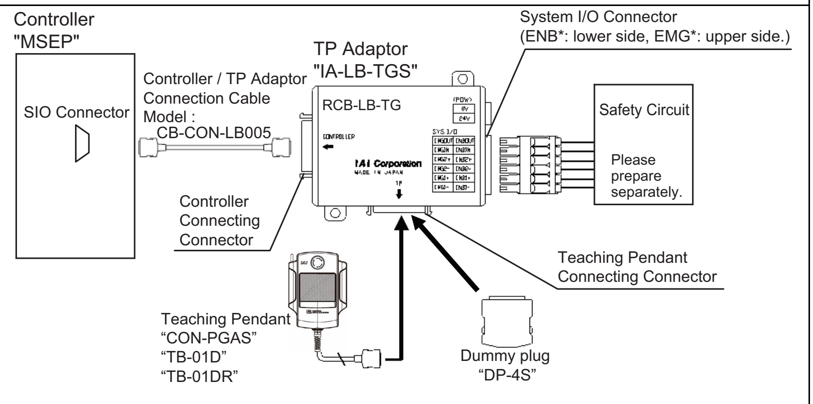
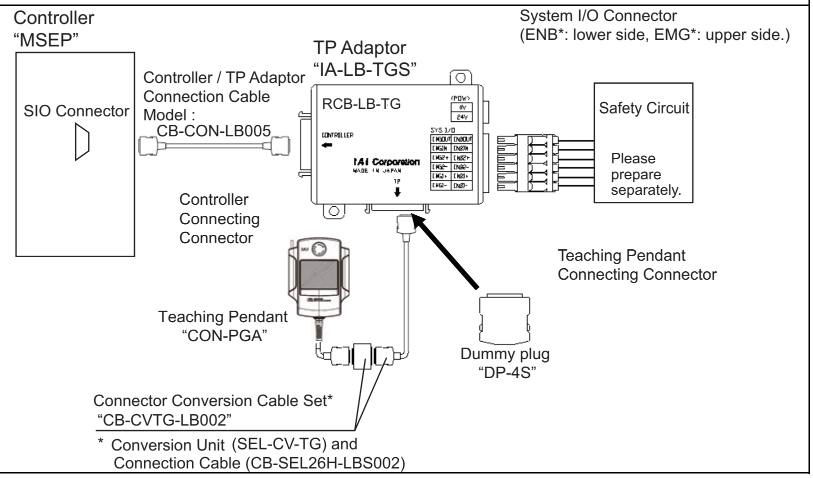
[Step 7] Turn off the power to MSEP and set the operation setting switch to AUTO. Detach the PC software or teaching pendant.

7.3 Conformity to Safety Category

In this section shows an example of a circuit using the dedicated teaching pendant. However, it is not possible for us to check the conformity of our product to the condition of your system. Therefore, it is necessary that the user construct the circuit considering the condition of use and the categories to be applied.

[1] System Configuration

When it is necessary to construct a system that complies with Safety Category (ISO12100-1), use a teaching pendant (from either of the model codes: TB-01D, TB-01DR, CON-PGAS, CON-PGA).
Also, TP adapter (Model : RCB-LB-TGS or RCB-LB-TG) is required.
The system can conform to up to safety category B to 4 (ISO12100-1) by changing connections of system I/O connectors.
Caution: The required cables and dummy plugs differ depending on the model codes of the TP adapter and the teaching pendant.

<table>
<tr>
<td>• TP Adaptor
(RCB-LB-TG)
• Combination of Teaching Pendant (CON-PGA)</td>
<td>
</td>
</tr>
<tr>
<td>• TP Adaptor
(RCB-LB-TGS)
• Combination of Teaching Pendant (TB-01D, TB-01DR, CON-PGAS)</td>
<td>
</td>
</tr>
<tr>
<td>• TP Adaptor
(RCB-LB-TGS)
• Combination of Teaching Pendant (CON-PGA)</td>
<td>
</td>
</tr>
</table>

[2] Wiring and setting of safety circuit

(1) Power supply

To use safety relays and/or contactors of 24V DC specification in the safety circuit, the control power supply should be used only for the circuit as much as possible. (Do not use the same power source as the driving power supply for this controller.)
It is the risk prevention treatment preparing for the cases such as the operation error of the safety circuit caused by not enough power capacity.

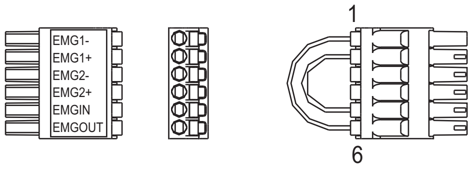
(2) Specification of system I/O connector for TP adapter

Connector Name		System I/O Connector		Applicable Wire
Upper side (EMG side)	Cable side	FMC1.5/6-ST-3.5(Note 1)	Phoenix Contact	AWG24 to 16 (0.2 to 1.25m^2)
	TP adapter side	MCDN1.5/6-G1-3.5P26THR		
Lower side (ENB side)	Cable side	FMC1.5/6-ST-3.5(Note 1)		
	TP adapter side	MCDN1.5/6-G1-3.5P26THR		

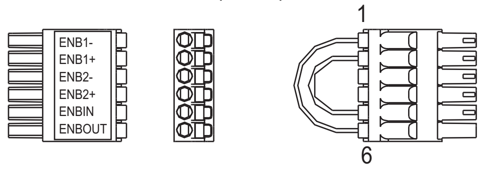
	Pin No.	Signal name	Description
Upper side (EMG side)	1	EMG1-	Emergency stop contact 1 (30V DC or less, 100mA or less)
	2	EMG1+	
	3	EMG2-	Emergency stop contact 2 (30V DC or less, 100mA or less)
	4	EMG2+	
	5	EMGIN	Emergency stop detection input
	6	EMGOUT	24V power supply output for emergency stop detection input
Lower side (ENB side)	7	ENB1-	Enable contact 1 (30V DC or less, 100mA or less)
	8	ENB1+	
	9	ENB2-	Enable contact 2 (30V DC or less, 100mA or less)
	10	ENB2+	
	11	ENBIN	Enable detection input
	12	ENBOUT	24V power supply output for enable detection input

Note 1 Connectors on the cable side are attached under conditions where initial wiring has been conducted.
In order to support each category, remove the initial wiring and wire your safety circuit.

● Upper side (EMG) connector

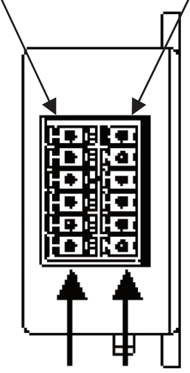


● Lower side (ENB) connector



Wiring	Color	Signal	No.
AWG24	YW	EMG1-	1
	YW	EMG1+	2
	—	EMG2-	3
	—	EMG2+	4
	YW	EMGIN	5
	YW	EMGOUT	6

Wiring	Color	Signal	No.
AWG24	YW	ENB1-	1
	YW	ENB1+	2
	—	ENB2-	3
	—	ENB2+	4
	YW	ENBIN	5
	YW	ENBOUT	6

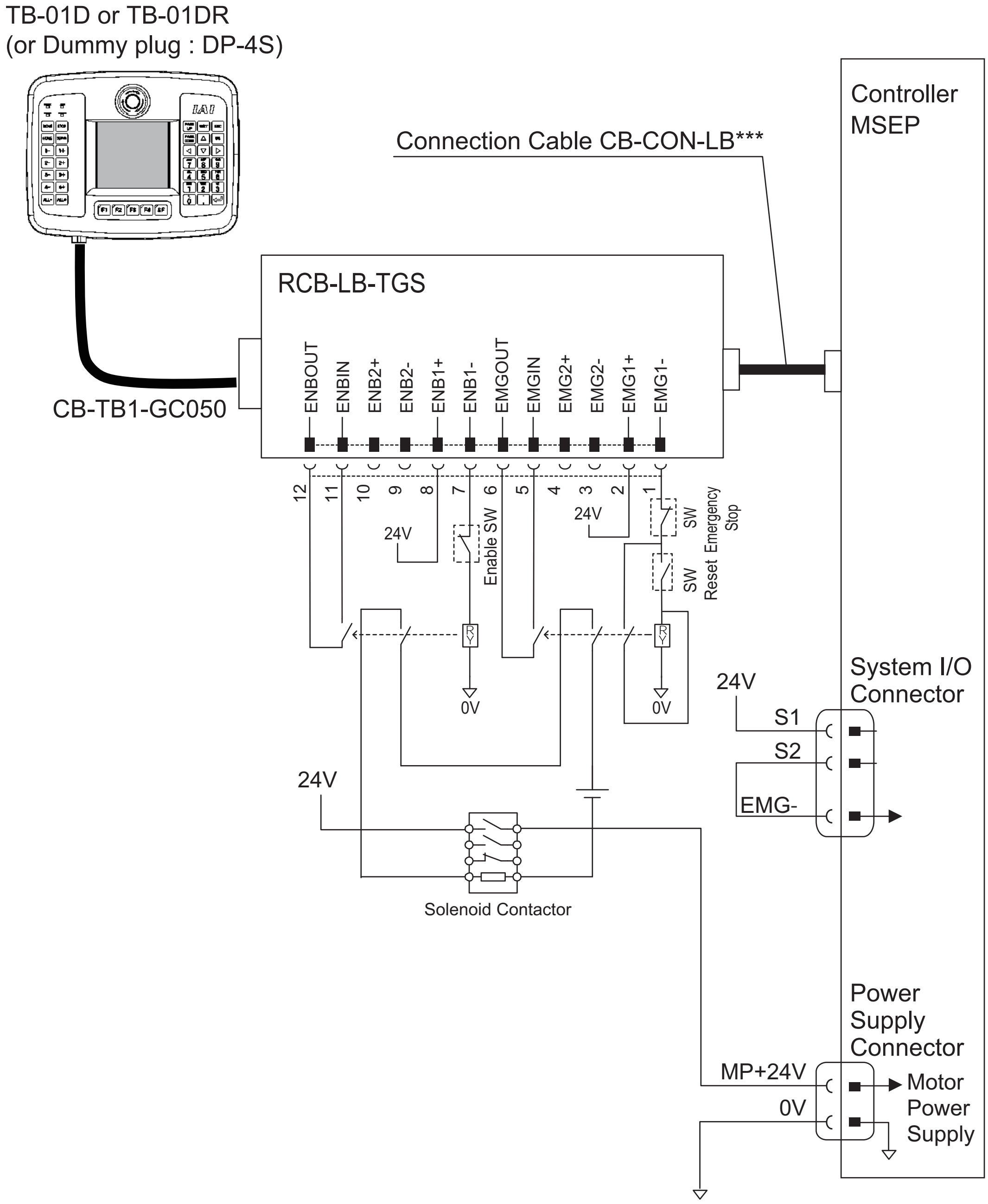


TP Adapter Side View

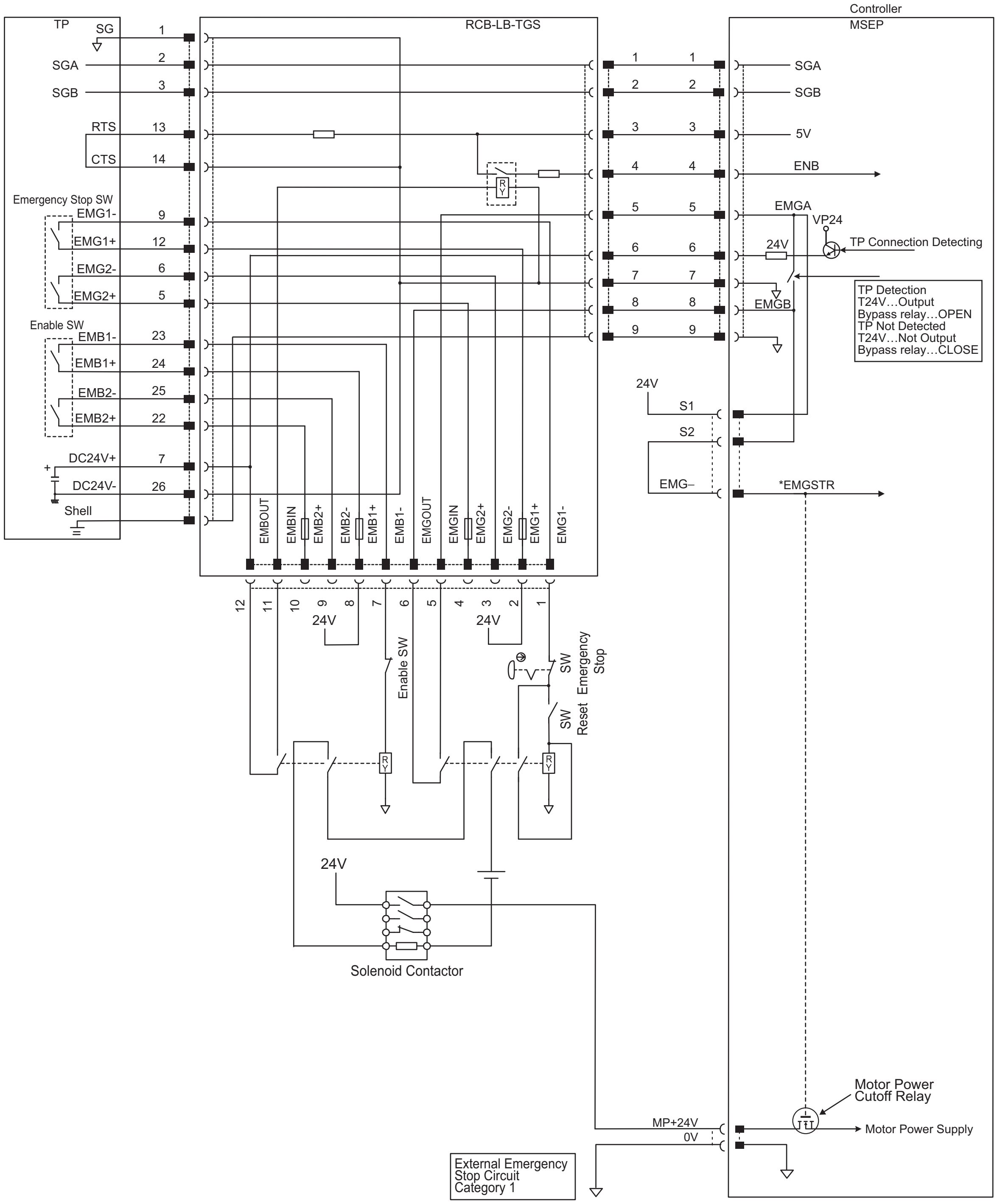
(3) Connection of dummy plug of TP adapter
When operating the controller with AUTO Mode, make sure to connect the enclosed dummy plug to TP Connector. [Refer to [1] System Construction in this section for the model code of the dummy plug.]

[3] Examples of safety circuits

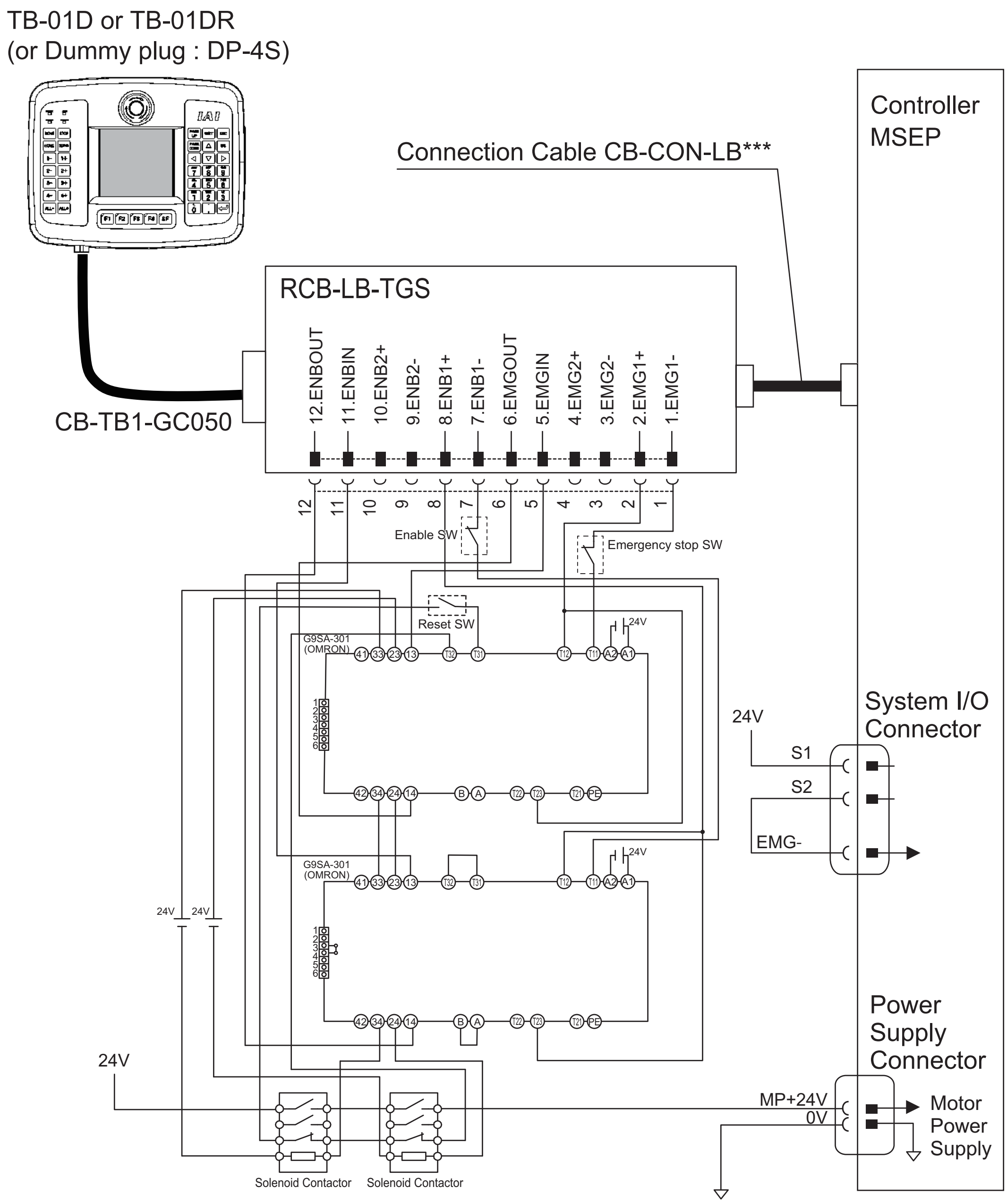
1) In case of category 1



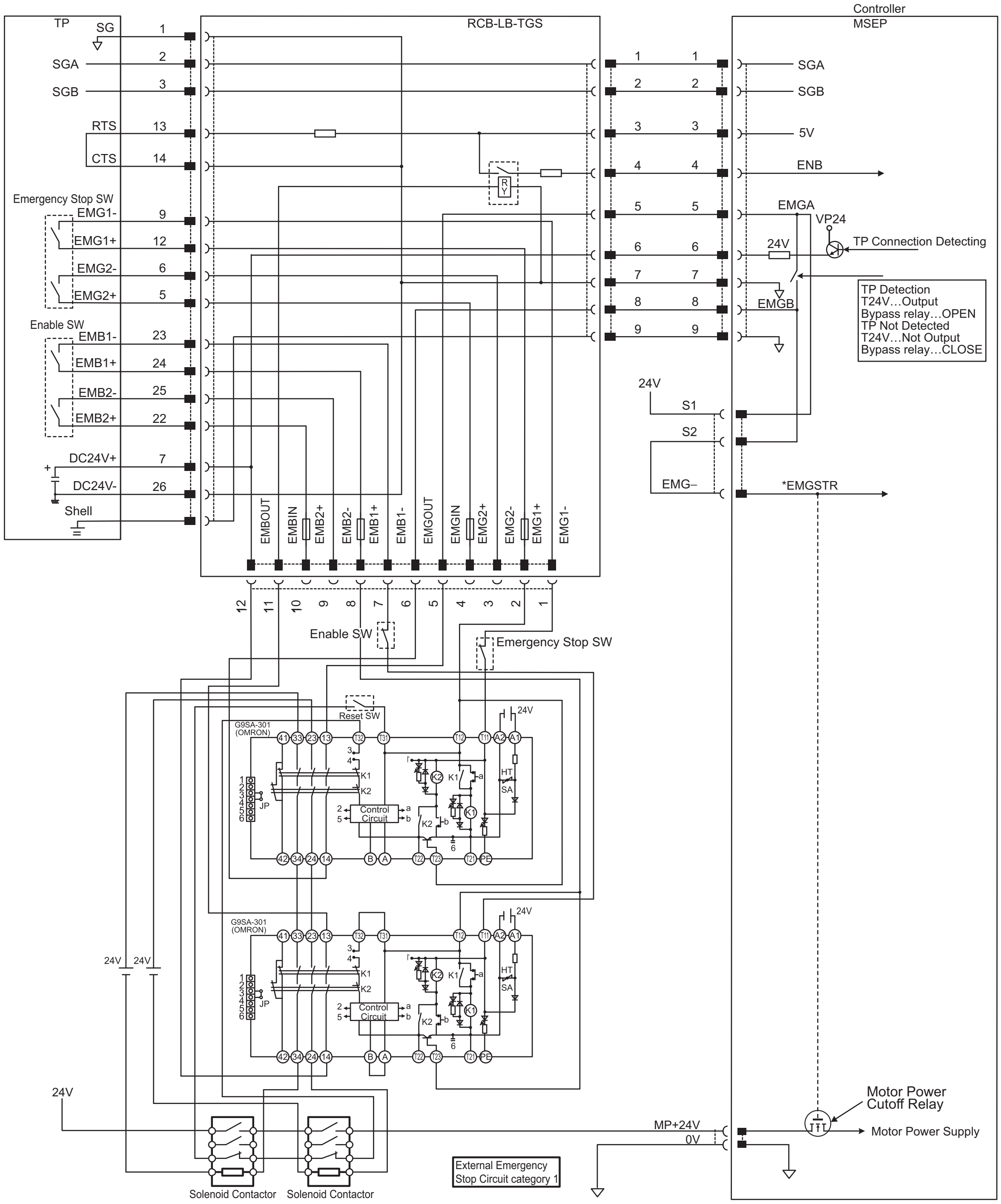
- Detailed category 1 circuit example



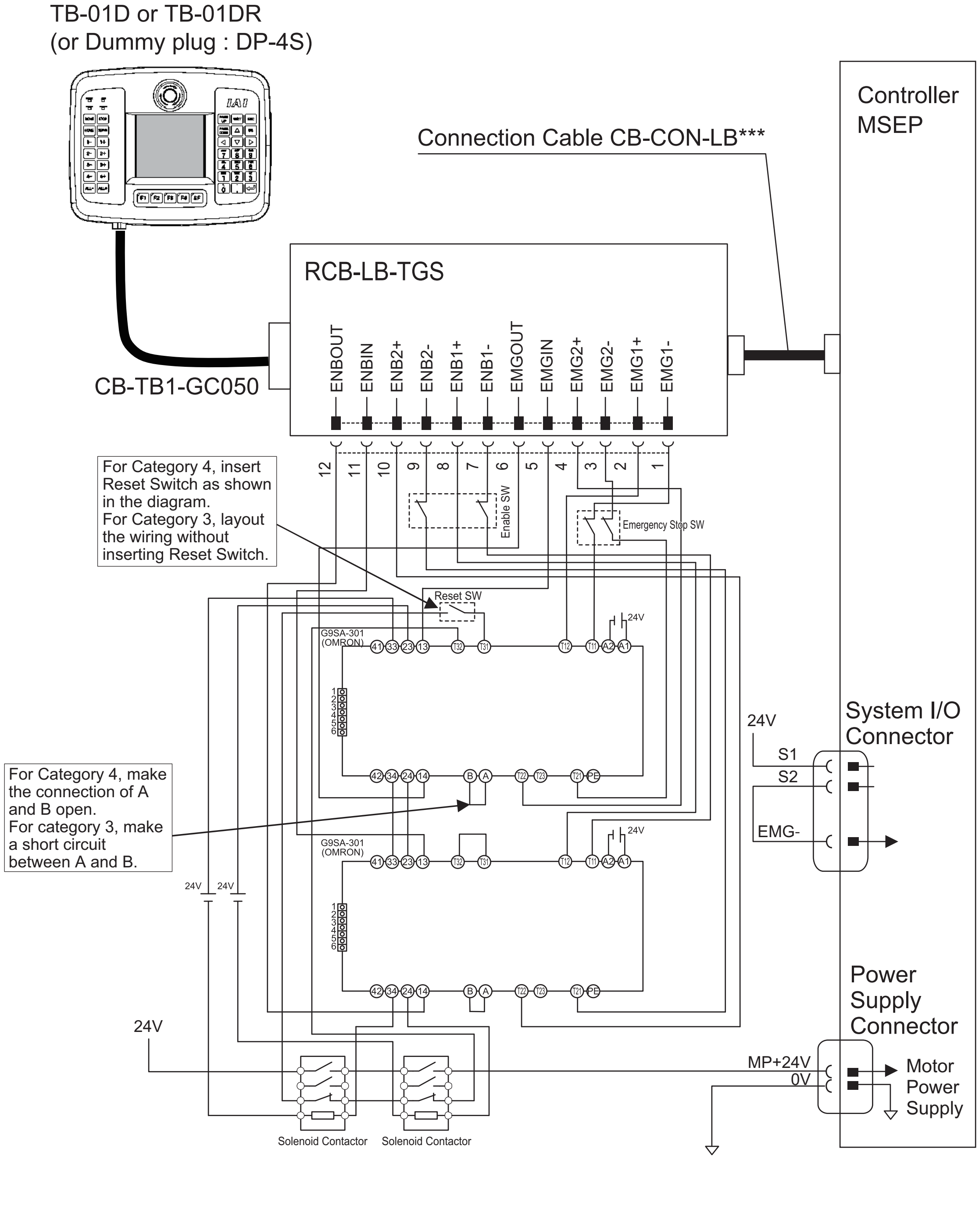
2) In case of category 2



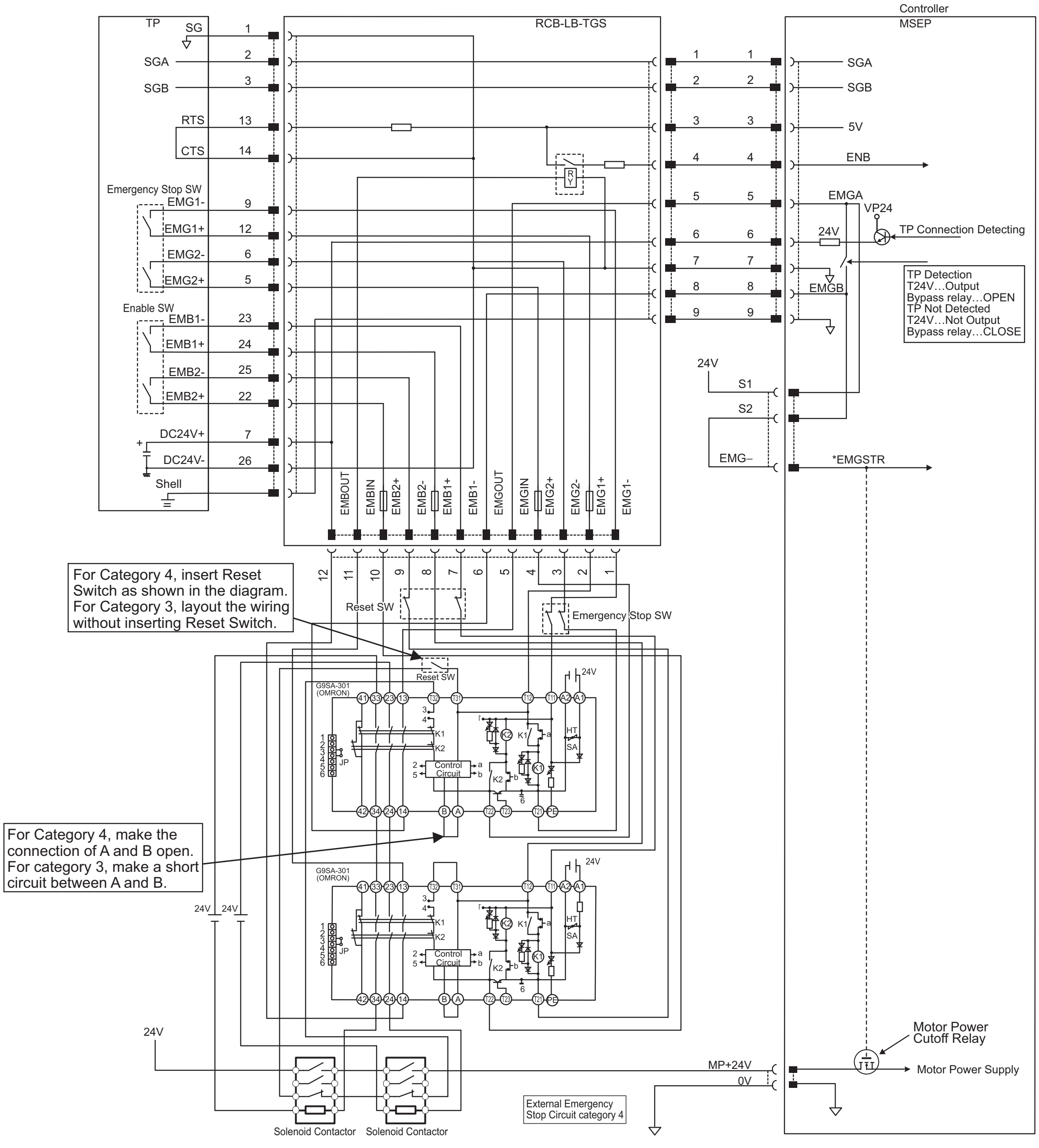
- Detailed category 2 circuit example



3) In case of category 3 or 4

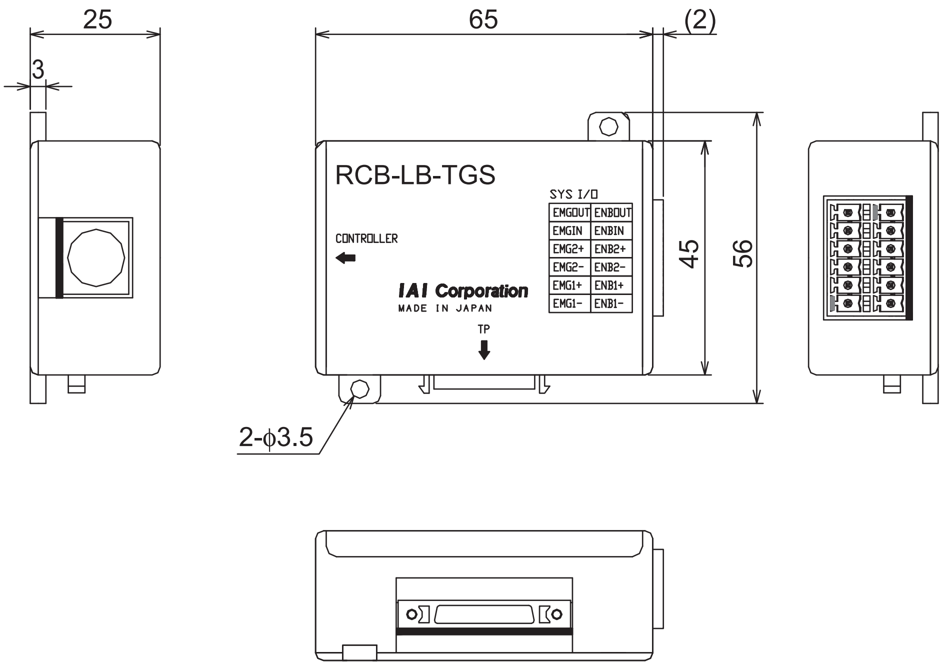


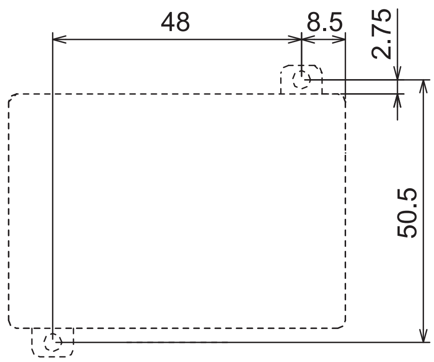
- Detailed category 3 or 4 circuit example



[4] TP adapter and accessories

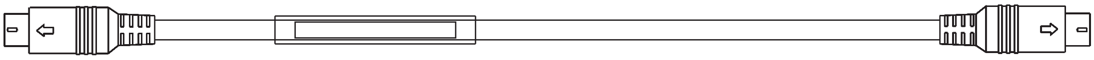
1) TP adapter external dimensions





2) Connection Cable

- Controller/TP Adaptor Connection Cable
  Use this cable to connect the controller and TP adapter.
  Model : CB-CON-LB005 (standard cable length : 0.5m)
  Maximum cable length : 2.0m



CB-CON-LB＊＊＊

CN1

Color	Signal	No.
BR	SGA	1
YW	SGB	2
RD	5V	3
OR	ENBL	4
BL	EMGA	5
GN	24V	6
PL	GND	7
GY	EMGB	8
Shield	FG	

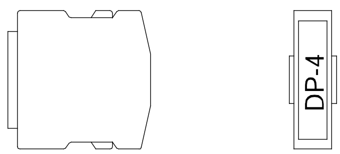
8PIN MIN DIN Connector (overmolded)

CN2

No.	Signal	Color
1	SGA	BR
2	SGB	YW
3	5V	RD
4	ENBL	OR
5	EMGA	BL
6	24V	GN
7	GND	PL
8	EMGB	GY
	FG	Shield

8PIN MIN DIN Connector (overmolded)

3) Dummy plug
Connect a dummy plug to the teaching pendant connecting connector.
Make sure to connect a dummy plug if the AUTO mode is specified.
Without the connection, it will be the emergency stop condition.
Model : DP-4S (when TP adapter is RCB-LB-TGS)
DP-4 (when TP adapter is RCB-LB-TG)



Plug
- HDR-E26MSG1
(when TP adapter is RCB-LB-TGS)
- TX20A-26PH1-D2P1-D1E (JAE)
(when TP adapter is RCB-LB-TG)

Signal	No.
GND	1
EMGS	2
VCC	3
DTR	4
EMGOUT2	5
EMGIN2	6
NC	7
RSVCC	8
EMGIN1	9
NC	10
NC	11
EMGOUT1	12
RTS	13
CTS (GND)	14
TXD	15
RXD	16
DSR	17
NC	18
NC	19
RSVTBX1	20
RSVTBX2	21
ENBVCC2	22
ENBTBX1	23
ENBVCC1	24
ENBTBX2	25
GND	26

Short-circuit processing.

7.4 List of Specifications of Connectable Actuators

The specifications included in this list are limited to those needed to set operating conditions and parameters. For other detailed specifications, refer to the catalog or operation manual for your actuator.

7.4.1 Specifications for Servo Motor Type Actuator

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RA3C	Ball screw	20	800	10	Horizontal /vertical	12.5	500	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					5	Horizontal /vertical	6.25	250	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					2.5	Horizontal /vertical	3.12	125	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
	RGS3C	Ball screw	20	800	10	Horizontal /vertical	12.5	500	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					5	Horizontal /vertical	6.25	250	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					2.5	Horizontal /vertical	3.12	125	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
	RGD3C	Ball screw	20	800	10	Horizontal /vertical	12.5	500	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					5	Horizontal /vertical	6.25	250	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					2.5	Horizontal /vertical	3.12	125	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
	RA3D	Ball screw	20	800	10	Horizontal /vertical	12.5	500	0.3	–	–	–
										–	–	–
					5	Horizontal /vertical	6.25	250	0.3	–	–	–
										–	–	–
					2.5	Horizontal /vertical	3.12	125	0.2	–	–	–
										–	–	–
	RGS3D	Ball screw	20	800	10	Horizontal /vertical	12.5	500	0.3	–	–	–
										–	–	–
					5	Horizontal /vertical	6.25	250	0.3	–	–	–
										–	–	–
					2.5	Horizontal /vertical	3.12	125	0.2	–	–	–
										–	–	–
	RGD3D	Ball screw	20	800	10	Horizontal /vertical	12.5	500	0.3	–	–	–
										–	–	–
					5	Horizontal /vertical	6.25	250	0.3	–	–	–
										–	–	–
					2.5	Horizontal /vertical	3.12	125	0.2	–	–	–
										–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RA3R	Ball screw	20	800	10	Horizontal /vertical	12.5	500	0.3	–	–	–
										–	–	–
					5	Horizontal /vertical	6.25	250	0.3	–	–	–
										–	–	–
					2.5	Horizontal /vertical	3.12	125	0.2	–	–	–
										–	–	–
	RGD3R	Ball screw	20	800	10	Horizontal /vertical	12.5	500	0.3	–	–	–
										–	–	–
					5	Horizontal /vertical	6.25	250	0.3	–	–	–
										–	–	–
					2.5	Horizontal /vertical	3.12	125	0.2	–	–	–
										–	–	–
	RA4C	Ball screw	20	800	12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
			30		12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
	RGS4C	Ball screw	20	800	12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
			30		12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
	RGD4C	Ball screw	20	800	12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–
			30		12	Horizontal /vertical	15	600	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	300	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	150	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RA4D	Ball screw	20	800	12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
			30		12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
	RGS4D	Ball screw	20	800	12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
			30		12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
	RGD4D	Ball screw	20	800	12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
			30		12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
	RA4R	Ball screw	20	800	12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
			30		12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RGD4R	Ball screw	20	800	12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
			30		12	Horizontal /vertical	15	600	0.3	–	–	–
										–	–	–
					6	Horizontal /vertical	7.5	300	0.3	–	–	–
										–	–	–
					3	Horizontal /vertical	3.75	150	0.2	–	–	–
										–	–	–
	SRA4R	Ball screw	20	800	5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
	SRGS4R	Ball screw	20	800	5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
	SRGD4R	Ball screw	20	800	5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
RCA (slider type)	SA4C	Ball screw	20	800	10	Horizontal /vertical	12.5	665	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0			
					5	Horizontal /vertical	6.25	330	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 1.0			
					2.5	Horizontal /vertical	3.12	165	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2			
	SA4D	Ball screw	20	800	10	Horizontal /vertical	12.5	665	0.3	–	–	–
					5	Horizontal /vertical	6.25	330	0.3	–	–	–
					2.5	Horizontal /vertical	3.12	165	0.2	–	–	–
	SA4R	Ball screw	20	800	10	Horizontal /vertical	12.5	665	0.3	–	–	–
					5	Horizontal /vertical	6.25	330	0.3	–	–	–
					2.5	Horizontal /vertical	3.12	165	0.2	–	–	–
	SA5C	Ball screw	20	800	20	Horizontal	25	1300	Energy-saving spec.: 0.3	–	–	–
						Vertical		800	High acc/dec spec.: 0.8	–	–	–
					12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st)	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 0.8			
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	Energy-saving spec.: 0.3	–	–	–
									High acc/dec spec.: 0.8			
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st)	Energy-saving spec.: 0.2	–	–	–
									High acc/dec spec.: 0.2			
	SA5D	Ball screw	20	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–
	SA5R	Ball screw	20	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (slider type)	SA6C	Ball screw	30	800	20	Horizontal	25	1300 (at 50 to 500st) 1160 (at 550st) 990 (at 600st)	Energy-saving spec.: 0.3	–	–	–
						Vertical		800	High acc/dec spec.: 0.8	–	–	–
					12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	–	–	–
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	–	–	–
	SA6D	Ball screw	30	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–
	SA6R	Ball screw	30	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
					3	Horizontal /vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–
	SS4D	Ball screw	20	800	10	Horizontal /vertical	12.5	665	0.3	–	–	–
					5	Horizontal /vertical	6.25	330	0.3	–	–	–
					2.5	Horizontal /vertical	3.12	165	0.2	–	–	–
	SS5D	Ball screw	20	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	–	–	–
					3	Horizontal /vertical	3.25	200 (at 50 to 450st) 190 (at 500st)	0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (slider type)	SS6D	Ball screw	30	800	12	Horizontal /vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	–	–	–
					6	Horizontal /vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	–	–	–
					3	Horizontal /vertical	3.25	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	–	–	–
RCA (arm type)	A4R	Ball screw	20	800	10	Horizontal /vertical	12.5	330	0.2	–	–	–
					5		6.25	165	0.2	–	–	–
	A5R	Ball screw	20	800	12	Horizontal /vertical	15	400	0.2	–	–	–
					6		7.5	200	0.2	–	–	–
	A6R	Ball screw	30	800	12	Horizontal /vertical	15	400	0.2	–	–	–
					6		7.5	200	0.2	–	–	–
RCA2 (rod type)	RA2AC	Ball screw	5	800	4	Horizontal /vertical	5	180 (at 25st) 200 (at 50 to 100st)	0.3	–	–	–
					2		2.5	100	0.3	–	–	–
					1		1.25	50	0.3	–	–	–
	RA2AR	Ball screw	5	800	4	Horizontal /vertical	5	180 (at 25st) 200 (at 50 to 100st)	0.3	–	–	–
					2		2.5	100	0.3	–	–	–
					1		1.25	50	0.3	–	–	–
	RN3N RN3NA	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2			
					2	Horizontal	1.90	100	0.3			
						Vertical			0.2			
					1	Horizontal	0.95	50	0.2			
						Vertical			0.2			
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			
	RP3N RP3NA	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2			
					2	Horizontal	1.90	100	0.3			
						Vertical			0.2			
					1	Horizontal	0.95	50	0.2			
						Vertical			0.2			
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			
	GS3N GS3NA	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2			
					2	Horizontal	1.90	100	0.3			
						Vertical			0.2			
					1	Horizontal	0.95	50	0.2			
						Vertical			0.2			
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			
	GD3N GD3NA	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2			
					2	Horizontal	1.90	100	0.3			
						Vertical			0.2			
					1	Horizontal	0.95	50	0.2			
						Vertical			0.2			
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (rod type)	SD3N SD3NA	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2			
					2	Horizontal	1.90	100	0.3			
						Vertical			0.2			
					1	Horizontal	0.95	50	0.2			
						Vertical			0.2			
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			
	RN4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (rod type)	RP4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	GS4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	GD4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	SD4N	Ball screw	20	1048	6	Horizontal	5.72	240 (at 25st) 300 (at 50 to 75st)	0.3	–	–	–
						Vertical		200 (at 25st) 300 (at 50 to 75st)	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	200 (at 25st) 300 (at 50 to 75st)	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
RCA2 (slider type)	SA2AC	Ball screw	5	800	4	Horizontal	5	180 (at 25st) 200 (at 50 to 75st)	0.3	–	–	–
						Vertical			0.3	–	–	–
					2	Horizontal	2.5	100	0.3	–	–	–
						Vertical			0.3	–	–	–
					1	Horizontal	1.25	50	0.3	–	–	–
						Vertical			0.3	–	–	–
	SA2AR	Ball screw	5	800	4	Horizontal	5	180 (at 25st) 200 (at 50 to 100st)	0.3	–	–	–
						Vertical			0.3	–	–	–
					2	Horizontal	2.5	100	0.3	–	–	–
						Vertical			0.3	–	–	–
					1	Horizontal	1.25	50	0.3	–	–	–
						Vertical			0.3	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (slider type)	SA3C	Ball screw	10	800	6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	5	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	2.5	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	SA3R	Ball screw	10	800	6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	5	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	2.5	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	SA4C	Ball screw	20	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100 to 500st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
	SA4R	Ball screw	20	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100 to 500st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (slider type)	SA5C	Ball screw	20	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.3	–	–	–
						Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.2	–	–	–
					12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150 to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					6	Horizontal	7.5	300 (at 50 to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150 (at 50 to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	–	–	–
						Vertical			0.2	–	–	–
	SA5R	Ball screw	20	800	12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150 to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					6	Horizontal	7.5	300 (at 50 to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150 (at 50 to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	–	–	–
						Vertical			0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (slider type)	SA6C	Ball screw	30	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.3	–	–	–
						Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.2	–	–	–
					12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150 to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					6	Horizontal	7.5	300 (at 50 to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150 (at 50 to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	–	–	–
						Vertical			0.2	–	–	–
	SA6R	Ball screw	30	800	12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150 to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					6	Horizontal	7.5	300 (at 50 to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150 (at 50 to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	–	–	–
						Vertical			0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (table type)	TCA3NA TCA3N TC3N	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.3	–	–	–
						Vertical			0.2	–	–	–
					1	Horizontal	0.95	50	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2	–	–	–
					1		0.95	50	0.2	–	–	–
	TWA3NA TWA3N TW3N	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.3	–	–	–
						Vertical			0.2	–	–	–
					1	Horizontal	0.95	50	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2	–	–	–
					1		0.95	50	0.2	–	–	–
	TFA3NA TFA3N TF3N	Ball screw	10	1048	4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.3	–	–	–
						Vertical			0.2	–	–	–
					1	Horizontal	0.95	50	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw	10	1048	4	Horizontal /vertical	3.81	200	0.2	–	–	–
					2		1.90	100	0.2			
					1		0.95	50	0.2			
	TCA4NA	Ball screw	20	1048	6	Horizontal	5.72	270 (at 30st) 300 (at 50st)	0.3	–	–	–
						Vertical		220 (at 30st) 300 (at 50st)	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw	20	1048	6	Horizontal /vertical	3.81	200	0.2	–	–	–
					4		1.90	100	0.2			
					2		0.95	50	0.2			
	TCA4N TC4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	TWA4NA	Ball screw	20	1048	6	Horizontal	5.72	270 (at 30st) 300 (at 50st)	0.3	–	–	–
						Vertical		220 (at 30st) 300 (at 50st)	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal /vertical	3.81	220	0.2	–	–	–
					4		1.90	100	0.2	–	–	–
					2		0.95	50	0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (table type)	TWA4N TW4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	TFA4NA	Ball screw	20	1048	6	Horizontal	5.72	270 (at 30st) 300 (at 50st)	0.3	–	–	–
						Vertical		220 (at 30st) 300 (at 50st)	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal /vertical	3.81	220	0.2	–	–	–
					4		1.90	100	0.2	–	–	–
					2		0.95	50	0.2	–	–	–
	TFA4N TF4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	–	–	–
						Vertical		220	0.2	–	–	–
					4	Horizontal	3.81	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
		Lead screw			6	Horizontal	5.72	220	0.2	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	3.81	200	0.2	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	1.90	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA4C	Ball screw	10	800	6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	5	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	2.5	100	0.2	–	–	–
						Vertical			0.2	–	–	–

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (table type)	TA4R	Ball screw	10	800	6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					4	Horizontal	5	200	0.3	–	–	–
						Vertical			0.2	–	–	–
					2	Horizontal	2.5	100	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA5C	Ball screw	20	800	10	Horizontal	12.5	465	0.3	–	–	–
						Vertical		400	0.2	–	–	–
					5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA5R	Ball screw	20	800	10	Horizontal	12.5	465	0.3	–	–	–
						Vertical		400	0.2	–	–	–
					5	Horizontal	6.25	250	0.3	–	–	–
						Vertical			0.2	–	–	–
					2.5	Horizontal	3.12	125	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA6C	Ball screw	20	800	12	Horizontal	15	560	0.3	–	–	–
						Vertical		500	0.2	–	–	–
					6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA6R	Ball screw	20	800	12	Horizontal	15	560	0.3	–	–	–
						Vertical		500	0.2	–	–	–
					6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA7C	Ball screw	30	800	12	Horizontal	15	600	0.3	–	–	–
						Vertical		580	0.2	–	–	–
					6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150	0.2	–	–	–
						Vertical			0.2	–	–	–
	TA7R	Ball screw	30	800	12	Horizontal	15	600	0.3	–	–	–
						Vertical		580	0.2	–	–	–
					6	Horizontal	7.5	300	0.3	–	–	–
						Vertical			0.2	–	–	–
					3	Horizontal	3.75	150	0.2	–	–	–
						Vertical			0.2	–	–	–
RCL	RA1L	Linear	–	715	–	Horizontal /vertical	42	300	2	0.75	2	2
	RA2L			855		Horizontal /vertical	42	340	2	1.5	4	4
	RA3L			1145		Horizontal /vertical	42	450	2	3	8	8
	SA1L			715		Horizontal	42	420	2	–	–	–
	SA2L			855		Horizontal	42	460	2	–	–	–
	SA3L			1145		Horizontal	42	600	2	–	–	–
	SA4L			715		Horizontal	42	1200	2	–	–	–
	SM4L			715		Horizontal	42	1200	2	–	–	–
	SA5L			855		Horizontal	42	1400	2	–	–	–
	SM5L			855		Horizontal	42	1400	2	–	–	–
	SA6L			1145		Horizontal	42	1600	2	–	–	–
	SM6L			1145		Horizontal	42	1600	2	–	–	–
RCD	RA1D	Lead screw	3	400	2	Horizontal /vertical	2.5	300	1	0.41	5.98	5
	RA1DA			480								
	GRSN	Lead screw	3	400	2	Horizontal /vertical	2.5	67	1	2.1	10.0	5
	GRSNA			480								

7.4.2 Specifications for Pulse Motor Type Actuator

⚠ Caution:
- The push force is based on the rated push speed (factory setting) indicated in the list, and provides only a guideline.
- Make sure the actual push force is equal to or greater than the minimum push force. If not, the push force will not stabilize.
- If, among the operating conditions, the positioning speed is set to a value equal to or smaller than the push speed, the push speed will become the set speed and the specified push force will not generate.

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (rod type)	RA2C	Ball screw	800	1	Horizontal /vertical	1.25	25	0.05	50	100	3
	RA3C	Ball screw	800	5	Horizontal /vertical	6.25	187	0.2	21	73.5	20
				2.5	Horizontal /vertical	3.12	114		50	156.8	
	RGD3C	Ball screw	800	5	Horizontal /vertical	6.25	187	0.2	21	73.5	20
				2.5	Horizontal	3.12	114		50	156.8	
					Vertical		93				
	RA4C	Ball screw	800	10	Horizontal /vertical	12.5	458 (at to 250st) 350 (at 300st)	0.2	30	150	20
				5	Horizontal /vertical	6.25	250 (at 50 to 200st) 237 (at 250st) 175 (at 300st)		75	284	
				2.5	Horizontal	3.12	125 (at 50 to 200st) 118 (at 250st) 87 (at 300st)		150	358	
					Vertical		114				
	RGS4C	Ball screw	800	10	Horizontal /vertical	12.5	458 (at to 250st) 350 (at 300st)	0.2	30	150	20
				5	Horizontal /vertical	6.25	250 (at 50 to 200st) 237 (at 250st) 175 (at 300st)		75	284	
				2.5	Horizontal	3.12	125 (at 50 to 200st) 118 (at 250st) 87 (at 300st)		150	358	
					Vertical		114				

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (rod type)	RGD4C	Ball screw	800	10	Horizontal /vertical	12.5	458 (at to 250st) 350 (at 300st)	0.2	30	150	20
				5	Horizontal /vertical	6.25	250 (at 50 to 200st) 237 (at 250st) 175 (at 300st)		75	284	
				2.5	Horizontal	3.12	125 (at 50 to 200st) 118 (at 250st) 87 (at 300st)		150	358	
					Vertical		114				
	RA6C	Ball screw	800	16	Horizontal	20	450	0.2	75	240	20
					Vertical		400				
				8	Horizontal /vertical	10	210		130	470	
				4	Horizontal /vertical	5	130		300	800	
	RGS6C	Ball screw	800	16	Horizontal	20	450	0.2	75	240	20
					Vertical		400				
				8	Horizontal /vertical	10	210		130	470	
				4	Horizontal /vertical	5	130		300	800	
	RGD6C	Ball screw	800	16	Horizontal	20	450	0.2	75	240	20
					Vertical		400				
				8	Horizontal /vertical	10	210		130	470	
				4	Horizontal /vertical	5	130		300	800	
	SRA4R	Ball screw	800	5	Horizontal /vertical	6.25	250	0.3	26	90	20
				2.5	Horizontal Vertical	3.12	125	0.2	50	170	
	SRGS4R	Ball screw	800	5	Horizontal /vertical	6.25	250	0.3	26	90	20
				2.5	Horizontal Vertical	3.12	125	0.2	50	170	
	SRGD4R	Ball screw	800	5	Horizontal /vertical	6.25	250	0.3	26	90	20
				2.5	Horizontal Vertical	3.12	125	0.2	50	170	
RCP2W (rod type)	RA4C	Ball screw	800	10	Horizontal	12.5	450(at 50～250st) 350(at 300st)	0.2	30	150	20
					Vertical		250				
				5	Horizontal /vertical	6.25	190(at 50～250st) 175(at 300st)		75	284	
				2.5	Horizontal	3.12	125(at 50～200st) 115(at 250st) 85(at 300st)		150	358	
					Vertical		115(at 50～250st) 85(at 300st)				
	RA6C	Ball screw	800	16	Horizontal	20	320	0.2	75	240	20
					Vertical		265				
				8	Horizontal /vertical	10	200		130	470	
				4	Horizontal /vertical	5	100		300	800	

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (slider type)	SA5C	Ball screw	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 550st) 980 (at 600st) 850 (at 650st) 740 (at 700st) 650 (at 750st) 580 (at 800st)	0.7	11	39	20
					Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 600st) 740 (at 700st) 650 (at 750st) 580 (at 800st)	0.2			
				12	Horizontal	15	300 (at 50st) 460 (at 100st) 600 (at 150 to 550st) 540 (at 600st) 460 (at 650st) 400 (at 700st) 360 (at 750st) 300 (at 800st)	0.7	40	115	
					Vertical			0.3			
				6	Horizontal	7.5	295 (at 50st) 300 (at 100 to 550st) 270 (at 600st) 230 (at 650st) 200 (at 700st) 180 (at 750st) 150 (at 800st)	0.7	70	210	
					Vertical			0.3			
				3	Horizontal	3.75	150 (at to 550st) 135 (at 600st) 115 (at 650st) 100 (at 700st) 90 (at 750st) 75 (at 800st)	0.7	140	330	
					Vertical			0.3			
	SA5R	Ball screw	800	12	Horizontal	15	300 (at 50st) 460 (at 100st) 600 (at 150 to 550st) 540 (at 600st) 460 (at 650st) 400 (at 700st) 360 (at 750st) 300 (at 800st)	0.3	–	–	–
					Vertical			0.2			
				6	Horizontal	7.5	295 (at 50st) 300 (at 100 to 550st) 270 (at 600st) 230 (at 650st) 200 (at 700st) 180 (at 750st) 150 (at 800st)	0.3	–	–	–
					Vertical			0.2			
				3	Horizontal	3.75	150 (at to 550st) 135 (at 600st) 115 (at 650st) 100 (at 700st) 90 (at 750st) 75 (at 800st)	0.2	–	–	–
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (slider type)	SA6C	Ball screw	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 550st) 980 (at 600st) 850 (at 650st) 740 (at 700st) 650 (at 750st) 580 (at 800st)	0.7	11	39	20
					Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 600st) 740 (at 700st) 650 (at 750st) 580 (at 800st)	0.2			
				12	Horizontal	15	300 (at 50st) 460 (at 100st) 600 (at 150 to 550st) 540 (at 600st) 460 (at 650st) 400 (at 700st) 360 (at 750st) 300 (at 800st)	0.7	40	115	
					Vertical			0.3			
				6	Horizontal	7.5	295 (at 50st) 300 (at 100 to 550st) 270 (at 600st) 230 (at 650st) 200 (at 700st) 180 (at 750st) 150 (at 800st)	0.7	70	210	
					Vertical			0.3			
				3	Horizontal	3.75	150 (at to 550st) 135 (at 600st) 115 (at 650st) 100 (at 700st) 90 (at 750st) 75 (at 800st)	0.7	140	330	
					Vertical			0.3			
	SA6R	Ball screw	800	12	Horizontal	15	300 (at 50st) 460 (at 100st) 600 (at 150 to 550st) 540 (at 600st) 460 (at 650st) 400 (at 700st) 360 (at 750st) 300 (at 800st)	0.3	–	–	–
					Vertical			0.2			
				6	Horizontal	7.5	295 (at 50st) 300 (at 100 to 550st) 270 (at 600st) 230 (at 650st) 200 (at 700st) 180 (at 750st) 150 (at 800st)	0.3	–	–	–
					Vertical			0.2			
				3	Horizontal	3.75	150 (at to 550st) 135 (at 600st) 115 (at 650st) 100 (at 700st) 90 (at 750st) 75 (at 800st)	0.2	–	–	–
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (slider type)	SA7C	Ball screw	800	16	Horizontal	20	380 (at 50st) 470 (at 100st) 533 (at 150 to 750st) 480 (at 800st)	0.3	90	250	20
					Vertical			0.2			
				8	Horizontal	10	266 (at 50 to 700st) 240 (at 800st)	0.3	150	500	
					Vertical			0.2			
				4	Horizontal	5	133 (at 50 to 700st) 120 (at 800st)	0.2	280	800	
					Vertical			0.2			
	SA7R	Ball screw	800	16	Horizontal	20	380 (at 50st) 470 (at 100st) 533 (at 150 to 750st) 480 (at 800st)	0.3	–	–	–
					Vertical		400	0.2			
				8	Horizontal	10	266 (at 50 to 700st) 240 (at 800st)	0.3	–	–	–
					Vertical			0.2			
				4	Horizontal	5	133 (at 50 to 700st) 120 (at 800st)	0.2	–	–	–
					Vertical			0.2			
	SS7C	Ball screw	800	12	Horizontal	15	600 (at 50 to 500st) 470 (at 600st)	0.3	40	120	20
					Vertical			0.2			
				6	Horizontal	7.5	300 (at 50 to 500st) 230 (at 600st)	0.3	75	220	
					Vertical			0.2			
				3	Horizontal	3.75	150 (at 50 to 500st) 115 (at 600st)	0.2	140	350	
					Vertical			0.2			
	SS7R	Ball screw	800	12	Horizontal	15	600 (at 50 to 500st) 470 (at 600st)	0.3	–	–	–
					Vertical		440 (at 50 to 500st) 440 (at 600st)	0.2			
				6	Horizontal	7.5	250 (at 50 to 500st) 230 (at 600st)	0.3	–	–	–
					Vertical			0.2			
				3	Horizontal	3.75	105 (at 50 to 500st) 105 (at 600st)	0.2	–	–	–
					Vertical			0.2			
	SS8C	Ball screw	800	20	Horizontal	25	666 (at 50 to 800st) 625 (at to 900st) 515 (at to 1000st)	0.3	50	180	20
					Vertical		600 (at 50 to 800st) 600 (at to 900st) 515 (at to 1000st)	0.2			
				10	Horizontal	12.5	333 (at 50 to 800st) 310 (at to 900st) 255 (at to 1000st)	0.3	95	320	
					Vertical		300 (at 50 to 800st) 300 (at to 900st) 255 (at to 1000st)	0.2			
				5	Horizontal	6.25	165 (at 50 to 800st) 155 (at to 900st) 125 (at to 1000st)	0.2	180	630	
					Vertical		150 (at 50 to 800st) 150 (at to 900st) 125 (at to 1000st)	0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP2 (slider type)	SS8R	Ball screw	800	20	Horizontal	25	600 (at 50 to 800st) 600 (at to 900st) 515 (at to 1000st)	0.3	–	–	–
					Vertical		333 (at 50 to 800st) 333 (at to 900st) 333 (at to 1000st)	0.2			
				10	Horizontal	12.5	300 (at 50 to 800st) 300 (at to 900st) 255 (at to 1000st)	0.3	–	–	–
					Vertical		250 (at 50 to 800st) 250 (at to 900st) 250 (at to 1000st)	0.2			
				5	Horizontal	6.25	160 (at 50 to 800st) 155 (at to 900st) 125 (at to 1000st)	0.2	–	–	–
					Vertical		140 (at 50 to 800st) 140 (at to 900st) 140 (at to 1000st)	0.2			
RCP2 (belt type)	BA6/ BA6U	Belt	800	Equivalent to 54	Horizontal	67.5	1000	0.5	–	–	–
	BA7/ BA7U	Belt	800	Equivalent to 54	Horizontal	67.5	1500	0.5	–	–	–
RCP2 (gripper type)	GRSS	–	800	1.57	–	1.96	78	–	4	14	5
	GRLS	–	800	12	–	15 (deg/s)	600 (deg/s)	–	1.8	6.4	5 (deg/s)
	GRS	–	800	1	–	1.25	33.3	–	9	21	5
	GRM	–	800	1.1	–	1.37	36.7	–	23	80	5
	GRST	–	800	1.05	–	1.31	34	–	15	40	5
		–	800	2.27	–	2.83	75	–	7.5	20	5
	GR3LS	–	800	12	–	15 (deg/s)	200 (deg/s)	–	5	18	5 (deg/s)
	GR3LM	–	800	12	–	15 (deg/s)	200 (deg/s)	–	15	51	5 (deg/s)
	GR3SS	–	800	2.5	–	3.12	40	–	7	22	5
	GR3SM	–	800	3	–	3.75	50	–	30	102	5
	GRHM	–	800	2	–	2.5	100	–	25	125	5
	GRHB	–	800	2	–	2.5	100	–	60	200	5
RCP2W (gripper type)	GRSS	–	800	1.57	–	1.96	78	–	4	14	5
	GRLS	–	800	12	–	15 (deg/s)	600 (deg/s)	–	1.8	6.4	5 (deg/s)
RCP2 (rotary type)	RTBS	–	800	Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
		–		Gear ratio: 1/45	–	10 (deg/s)	266 (deg/s)	–	–	–	–
	RTCS	–	800	Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
		–		Gear ratio: 1/45	–	10 (deg/s)	266 (deg/s)	–	–	–	–
	RTB	–	800	Gear ratio: 1/20	–	22.5 (deg/s)	600 (deg/s)	–	–	–	–
		–		Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
	RTC	–	800	Gear ratio: 1/20	–	22.5 (deg/s)	600 (deg/s)	–	–	–	–
		–		Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
	RTBB	–	800	Gear ratio: 1/20	–	22.5 (deg/s)	600 (deg/s)	–	–	–	–
		–		Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
	RTCB	–	800	Gear ratio: 1/20	–	22.5 (deg/s)	600 (deg/s)	–	–	–	–
		–		Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (rod type)	RA2AC	Lead screw	800	4	Horizontal /vertical	5	180 (at 25st) 200 (at 50 to 100st)	0.2	0.9	16.1	5
				2		2.5	100		1.9	28.3	
				1		1.25	50		3.8	39.5	
		Ball screw Standard type	800	4	Horizontal	5	180 (at 25st) 200 (at 50 to 100st)	0.3	3.6	20.9	5
					Vertical			0.2			
				2	Horizontal	2.5	100	0.3	7.2	42.0	
					Vertical			0.2			
				1	Horizontal	1.25	50	0.3	14.4	82.8	
					Vertical			0.2			
		Ball screw High thrust type		4	Horizontal	5	180 (at 25st) 200 (at 50 to 100st)	0.3	6.6	35.7	5
					Vertical			0.2			
				2	Horizontal	2.5	100	0.3	13.2	70.6	
					Vertical			0.2			
				1	Horizontal	1.25	50	0.3	26.4	142.9	
					Vertical			0.2			
	RA2BC	Lead screw	800	6	Horizontal /vertical	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.2	0.6	11.9	5
				4		5	180 (at 25st) 200 (at 50 to 150st)		0.9	16.1	
				2		2.5	100		1.9	28.3	
		Ball screw Standard type	800	6	Horizontal	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.3	1.8	14.3	5
					Vertical			0.2			
				4	Horizontal	5	180 (at 25st) 200 (at 50 to 150st)	0.3	3.6	20.9	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.3	7.2	42.0	
					Vertical			0.2			
				1	Horizontal	1.25	50	0.3	14.4	82.8	
					Vertical			0.2			
		Ball screw High thrust type		6	Horizontal	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.3	4.4	24.1	5
					Vertical			0.2			
				4	Horizontal	5	180 (at 25st) 200 (at 50 to 150st)	0.3	6.6	35.7	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.3	13.2	70.6	
					Vertical			0.2			
				1	Horizontal	1.25	50	0.3	26.4	142.9	
					Vertical			0.2			
	RA2AR	Lead screw	800	4	Horizontal /vertical	5	180 (at 25st) 200 (at 50 to 150st)	0.2	0.9	16.1	5
				2		2.5	100		1.9	28.3	
				1		1.25	50		3.8	39.5	
	RA2BR	Lead screw	800	6	Horizontal /vertical	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.2	0.6	11.9	5
				4		5	180 (at 25st) 200 (at 50 to 150st)		0.9	16.1	
				2		2.5	100		1.9	28.3	

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (slider type)	SA2AC	Lead screw	800	4	Horizontal	5	180 (at 25st) 200 (at 50 to 100st)	0.2	–	–	–
				2		2.5	100				
				1		1.25	50				
	SA2BC	Lead screw	800	6	Horizontal	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.2	–	–	–
				4		5	180 (at 25st) 200 (at 50 to 150st)				
				2		2.5	100				
	SA2AR	Lead screw	800	4	Horizontal	5	180 (at 25st) 200 (at 50 to 100st)	0.2	–	–	–
				2		2.5	100				
				1		1.25	50				
	SA2BR	Lead screw	800	6	Horizontal	7.5	180 (at 25st) 280 (at 50st) 300 (at 75 to 150st)	0.2	–	–	–
				4		5	180 (at 25st) 200 (at 50 to 150st)				
				2		2.5	100				
	SA3C	Ball screw	800	6	Horizontal	7.5	300	0.3	9	15	20
					Vertical			0.2			
				4	Horizontal	5	200	0.3	14	22	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.2	27	44	
					Vertical			0.2			
	SA3R	Ball screw	800	6	Horizontal	7.5	300	0.3	9	15	–
					Vertical			0.2			
				4	Horizontal	5	200	0.3	14	22	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.2	27	44	
					Vertical			0.2			
	SA4C	Ball screw	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100st to 500st)	0.7	20	34	20
					Vertical			0.3			
				5	Horizontal	6.25	250	0.7	40	68	
					Vertical			0.3			
				2.5	Horizontal	3.12	125	0.7	82	136	
					Vertical			0.3			
	SA4R	Ball screw	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100st to 500st)	0.3	20	34	–
					Vertical			0.2			
				5	Horizontal	6.25	250	0.3	40	68	
					Vertical			0.2			
				2.5	Horizontal	3.12	125	0.2	82	136	
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (slider type)	SA5C	Ball screw	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.7	17	28	20
					Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.2			
				12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.7	28	47	
					Vertical			0.3			
				6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.7	57	95	
					Vertical			0.3			
				3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.7	113	189	
					Vertical			0.3			
	SA5R	Ball screw	800	12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	30	47	20
					Vertical			0.2			
				6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	112	189	
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (slider type)	SA6C	Ball screw	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.7	17	28	20
					Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.2			
				12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.7	28	47	
					Vertical			0.3			
				6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.7	57	95	
					Vertical			0.3			
				3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.7	113	189	
					Vertical			0.3			
	SA6R	Ball screw	800	12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)	0.3	30	47	20
					Vertical			0.2			
				6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	0.2	112	189	
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (table type)	TA3C	Ball screw	800	6	Horizontal	7.5	300	0.3	5.4	9	20
					Vertical		200	0.2			
				4	Horizontal	5	200	0.3	8.4	14	
					Vertical		133	0.2			
				2	Horizontal	2.5	100	0.2	16.8	28	
					Vertical		67	0.2			
	TA3R	Ball screw	800	6	Horizontal	7.5	300	0.3	5.4	9	20
					Vertical		200	0.2			
				4	Horizontal	5	200	0.3	8.4	14	
					Vertical		133	0.2			
				2	Horizontal	2.5	100	0.2	16.8	28	
					Vertical		67	0.2			
	TA4C	Ball screw	800	6	Horizontal	7.5	300	0.3	9	15	20
					Vertical			0.2			
				4	Horizontal	5	200	0.3	13.2	22	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.2	26.4	44	
					Vertical			0.2			
	TA4R	Ball screw	800	6	Horizontal	7.5	300	0.3	9	15	20
					Vertical			0.2			
				4	Horizontal	5	200	0.3	13.2	22	
					Vertical			0.2			
				2	Horizontal	2.5	100	0.2	26.4	44	
					Vertical			0.2			
	TA5C	Ball screw	800	10	Horizontal	12.5	465	0.3	20	34	20
					Vertical		400	0.2			
				5	Horizontal	6.25	250	0.3	40	68	
					Vertical			0.2			
				2.5	Horizontal	3.12	125	0.2	82	136	
					Vertical			0.2			
	TA5R	Ball screw	800	10	Horizontal	12.5	465	0.3	20	34	20
					Vertical		400	0.2			
				5	Horizontal	6.25	250	0.3	40	68	
					Vertical			0.2			
				2.5	Horizontal	3.12	125	0.2	82	136	
					Vertical			0.2			
	TA6C	Ball screw	800	12	Horizontal	15	560	0.3	30	47	20
					Vertical		500	0.2			
				6	Horizontal	7.5	300	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150	0.2	112	189	
					Vertical			0.2			
	TA6R	Ball screw	800	12	Horizontal	15	560	0.3	30	47	20
					Vertical		500	0.2			
				6	Horizontal	7.5	300	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150	0.2	112	189	
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (table type)	TA7C	Ball screw	800	12	Horizontal	15	600	0.3	30	47	20
					Vertical		580	0.2			
				6	Horizontal	7.5	300	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150	0.2	112	189	
					Vertical			0.2			
	TA7R	Ball screw	800	12	Horizontal	15	600	0.3	30	47	20
					Vertical		580	0.2			
				6	Horizontal	7.5	300	0.3	58	95	
					Vertical			0.2			
				3	Horizontal	3.75	150	0.2	112	189	
					Vertical			0.2			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (slider type)	SA3C	Ball screw	800	6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 420	1.0	16	58	20
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 280	1.0	25	86	
					Vertical			0.5			
				2	Horizontal	2.5	(Note) It is the value when high–thrust function is effective. 140	1.0	49	173	
					Vertical			0.5			
	SA5C	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 1440 (at 50 to 500st) 1225 (at 550st) 1045 (at 600st) 900 (at 650st) 785 (at 700st) 690 (at 750st) 610 (at 800st)	1.0	16	56	20
					Vertical		(Note) It is the value when high–thrust function is effective. 1280 (at 50 to 500st) 1225 (at 550st) 1045 (at 600st) 900 (at 650st) 785 (at 700st) 690 (at 750st) 610 (at 800st)	0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 900 (at 50 to 450st) 795 (at 500st) 665 (at 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 375 (at 750st) 330 (at 800st)	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450 (at 50 to 450st) 395 (at 500st) 335 (at 550st) 285 (at 600st) 245 (at 650st) 215 (at 700st) 185 (at 750st) 165 (at 800st)	0.1	53	185	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 450st) 195 (at 500st) 165 (at 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	1.0	106	370	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (slider type)	SA5R	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 1440 (at 50 to 500st) 1225 (at 550st) 1045 (at 600st) 900 (at 650st) 785 (at 700st) 690 (at 750st) 610 (at 800st)	1.0	16	56	20
					Vertical		(Note) It is the value when high–thrust function is effective. 1120 (at 50 to 550st) 1045 (at 600st) 900 (at 650st) 785 (at 700st) 690 (at 750st) 610 (at 800st)	0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 900 (at 50 to 450st) 785 (at 500st) 665 (at 550st) 570 (at 600st). 490 (at 650st). 425 (at 700st). 375 (at 750st) 330 (at 800st)	1.0	26	93	
					Vertical		(Note) It is the value when high–thrust function is effective. 800 (at 50 to 550st) 785 (at 500st) 665 (at 550st) 570 (at 600st) 490 (at 650st) 425 (at 700st) 375 (at 750st) 330 (at 800st)	0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450 (at 50 to 450st) 395 (at 500st) 335 (at 550st) 285 (at 600st) 245 (at 650st) 215 (at 700st) 185 (at 750st) 168 (at 800st)	1.0	53	185	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 450st) 195 (at 500st) 165 (at 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	1.0	106	370	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (slider type)	SA6C	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 1440 (at 50 to 500st) 1230 (at550st) 1045 (at600st) 905 (at650st) 785 (at700st) 690 (at750st) 615 (at800st)	1.0	16	56	20
					Vertical		(Note) It is the value when high–thrust function is effective. 1280 (at 50 to 500st) 1230 (at 550st) 1045 (at 600st) 905 (at 650st) 785 (at 700st) 690 (at 750st) 615 (at 800st)	0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 900 (at 50 to 450st) 795 (at 500st) 670 (at 550st) 570 (at 600st) 490 (at 650st) 430 (at 700st) 375 (at 750st) 335 (at 800st)	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450 (at 50 to 450st) 395 (at 500st) 335 (at 550st) 285 (at 600st) 245 (at 650st) 215 (at 700st) 185 (at 750st) 165 (at 800st)	1.0	53	185	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 450st) 195 (at 500st) 165 (at 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	1.0	106	370	
					Vertical			0.5			
	SA6R	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 128 (at 50 to 500st) 1230 (at 550st) 1045 (at 600st) 905 (at 650st) 785 (at 700st) 690 (at 750st) 615 (at 800st)	1.0	16	56	20
					Vertical			0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 900 (at 50 to 450st) 795 (at 500st) 670 (at 550st) 570 (at 600st) 490 (at 650st) 430 (at 700st) 375 (at 750st) 335 (at 800st)	1.0	26	93	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (slider type)	SA6R	Ball screw	800	6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450 (at 50 to 450st) 395 (at 500st) 335 (at 550st) 285 (at 600st) 245 (at 650st) 215 (at 700st) 185 (at 750st) 165 (at 800st)	1.0	53	185	20
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 450st) 195 (at 500st) 165 (at 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	1.0	106	370	
					Vertical			0.5			

<table>
<tr><th>Actuator series</th><th>Type</th><th>Feed screw</th><th>No. of encoder pulses</th><th>Lead
[mm]</th><th>Mounting direction</th><th>Minimum speed
[mm/s]</th><th>Maximum speed
[mm/s]</th><th>Maximum acceleration/ deceleration
[G]</th><th>Minimum push force
[N]</th><th>Maximum push force
[N]</th><th>Rated push speed
[mm/s]</th></tr>
<tr><td rowspan="12">RCP4
(slider type)</td><td rowspan="8">SA7C</td><td rowspan="8">Ball screw</td><td rowspan="8">800</td><td rowspan="2">24</td><td>Horizontal</td><td rowspan="2">30</td><td rowspan="2">(Note) It is the value when high–thrust function is effective.
1200 (at 50 to 600st)
1155 (at 650st)
1010 (at 700st)
890 (at 750st)
790 (at 800st)</td><td>1.0</td><td rowspan="2">32</td><td rowspan="2">112</td><td rowspan="8">20</td></tr>
<tr><td>Vertical</td><td>0.5</td></tr>
<tr><td rowspan="2">16</td><td>Horizontal</td><td rowspan="2">20</td><td>(Note) It is the value when high–thrust function is effective.
980 (at 50 to 550st)
865 (at 600st)
750 (at 650st)
655 (at 700st)
580 (at 750st)
515 (at 800st)</td><td>1.0</td><td rowspan="2">48</td><td rowspan="2">168</td></tr>
<tr><td>Vertical</td><td>(Note) It is the value when high–thrust function is effective.
840 (at 50 to 600st)
750 (at 650st)
655 (at 700st)
580 (at 750st)
515 (at 800st)</td><td>0.5</td></tr>
<tr><td rowspan="2">8</td><td>Horizontal</td><td rowspan="2">10</td><td rowspan="2">(Note) It is the value when high–thrust function is effective.
490 (at 50 to 550st)
430 (at 600st)
375 (at 650st)
325 (at 700st)
290 (at 750st)
255 (at 800st)</td><td>1.0</td><td rowspan="2">96</td><td rowspan="2">336</td></tr>
<tr><td>Vertical</td><td>0.5</td></tr>
<tr><td rowspan="2">4</td><td>Horizontal</td><td rowspan="2">5</td><td>(Note) It is the value when high–thrust function is effective.
245 (at 50 to 550st)
185 (at 650st)
160 (at 700st)
145 (at 750st)
125 (at 800st)</td><td>1.0</td><td rowspan="2">192</td><td rowspan="2">673</td></tr>
<tr><td>Vertical</td><td>(Note) It is the value when high–thrust function is effective.
210 (at 50 to 600st)
185 (at 650st)
160 (at 700st)
145 (at 750st)
125 (at 800st)</td><td>0.5</td></tr>
<tr><td rowspan="4">SA7R</td><td rowspan="4">Ball screw</td><td rowspan="4">800</td><td rowspan="2">24</td><td>Horizontal</td><td rowspan="2">30</td><td rowspan="2">(Note) It is the value when high–thrust function is effective.
1000 (at 50 to 700st)
890 (at 750st)
790 (at 800st)</td><td>1.0</td><td rowspan="2">32</td><td rowspan="2">112</td><td rowspan="4">20</td></tr>
<tr><td>Vertical</td><td>0.5</td></tr>
<tr><td rowspan="2">16</td><td>Horizontal</td><td rowspan="2">20</td><td>(Note) It is the value when high–thrust function is effective.
840 (at 50 to 600st)
750 (at 750st)
655 (at 700st)
580 (at 750st)
515 (at 800st)</td><td>1.0</td><td rowspan="2">48</td><td rowspan="2">168</td></tr>
<tr><td>Vertical</td><td>(Note) It is the value when high–thrust function is effective.
700 (at 50 to 650st)
655 (at 700st)
580 (at 750st)
515 (at 800st)</td><td>0.5</td></tr>
</table>

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (slider type)	SA7R	Ball screw	800	8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 490 (at 50 to 550st) 430 (at 600st) 375 (at 650st) 325 (at 700st) 290 (at 750st) 255 (at 800st)	1.0	96	336	20
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 210 (at 50 to 600st) 185 (at 700st) 160 (at 700st) 145 (at 750st) 125 (at 800st)	1.0	192	673	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (rod type)	RA3C	Ball screw	800	16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 1120	1.0	15	36	20
					Vertical			0.5			
				10	Horizontal	12.5	(Note) It is the value when high–thrust function is effective. 700	1.0	16	57	
					Vertical			0.5			
				5	Horizontal	6.25	(Note) It is the value when high–thrust function is effective. 350	1.0	33	114	
					Vertical			0.5			
				2.5	Horizontal	3.12	(Note) It is the value when high–thrust function is effective. 175	1.0	65	229	
					Vertical			0.5			
	RA5C	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 800	1.0	16	56	20
					Vertical			0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 700	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450	1.0	53	185	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225	1.0	106	370	
					Vertical			0.5			
	RA5R	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 800	1.0	16	56	20
					Vertical			0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 700	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective 450	1.0	53	185	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225	1.0	106 370 When motor type is 42SP	370 750 When motor type is 42SP	
					Vertical			0.5			
	RA6C	Ball screw	800	24	Horizontal	30	(Note) It is the value when high–thrust function is effective. 800	1.0	52	182	20
					Vertical		(Note) It is the value when high–thrust function is effective. 600	0.5			
				16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 700	1.0	78	273	
					Vertical		(Note) It is the value when high–thrust function is effective. 560	0.5			
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 420	1.0	156	547	
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 210	1.0	312	1094	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4 (rod type)	RA6R	Ball screw	800	24	Horizontal	30	(Note) It is the value when high–thrust function is effective. 800	1.0	52	182	20
					Vertical		(Note) It is the value when high–thrust function is effective. 600	0.5			
				16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 700	1.0	78	273	
					Vertical		(Note) It is the value when high–thrust function is effective. 560	0.5			
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 420	1.0	156	547	
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 210	1.0	312	1094	
					Vertical			0.5			
RCP4 (gripper type)	GRSML	–	800	1.88	–	2.35	(Note) It is the value when high–thrust function is ineffective. 94	0.3	25	87	5
	GRSLL	–	800	2.52	–	3.15	(Note) It is the value when high–thrust function is ineffective. 125	0.3	40	140	5
	GRSWL	–	800	3.14	–	3.93	(Note) It is the value when high–thrust function is ineffective. 157	0.3	50	220	5
	GRLM	–	800	12	–	15 (deg/s)	(Note) It is the value when high–thrust function is ineffective. 600 (deg/s)	0.3	10	35	5
	GRLL	–	800	12	–	15 (deg/s)	(Note) It is the value when high–thrust function is ineffective. 600 (deg/s)	0.3	10	60	5
	GRLW	–	800	12.86	–	16.08 (deg/s)	(Note) It is the value when high–thrust function is ineffective. 643 (deg/s)	0.3	23	90	5

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4W (slider type)	SA5C	Ball screw	800	10	Horizontal	12.5	(Note) It is the value when high–thrust function is effective. 330	0.6	38.2	66.9	20
				5	Horizontal	6.25	(Note) It is the value when high–thrust function is effective. 165	0.6	42.3	147.9	
	SA6C	Ball screw	800	12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 400	0.6	35.5	82.8	20
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 200	0.6	51.3	179.5	
	SA7C	Ball screw	800	16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 530	0.6	46.3	161.9	20
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 265	0.6	96.5	337.9	
RCP4W (rod type)	RA6C	Ball screw	800	12	Horizontal	15	(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 500 (at 50st) 560 (at 100 to 400st)	1.0	40	107	20
					Vertical		(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 500	0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. ((Note) It could differ depending on ambient temperature. 360	1.0	79	227	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 180	1.0	159	478	
					Vertical			0.5			
	RA6C (42SP motor)	Ball screw	800	3	Vertical	3.75	(Note) It is the value when high–thrust function is effective. 70	0.5	354	768	20

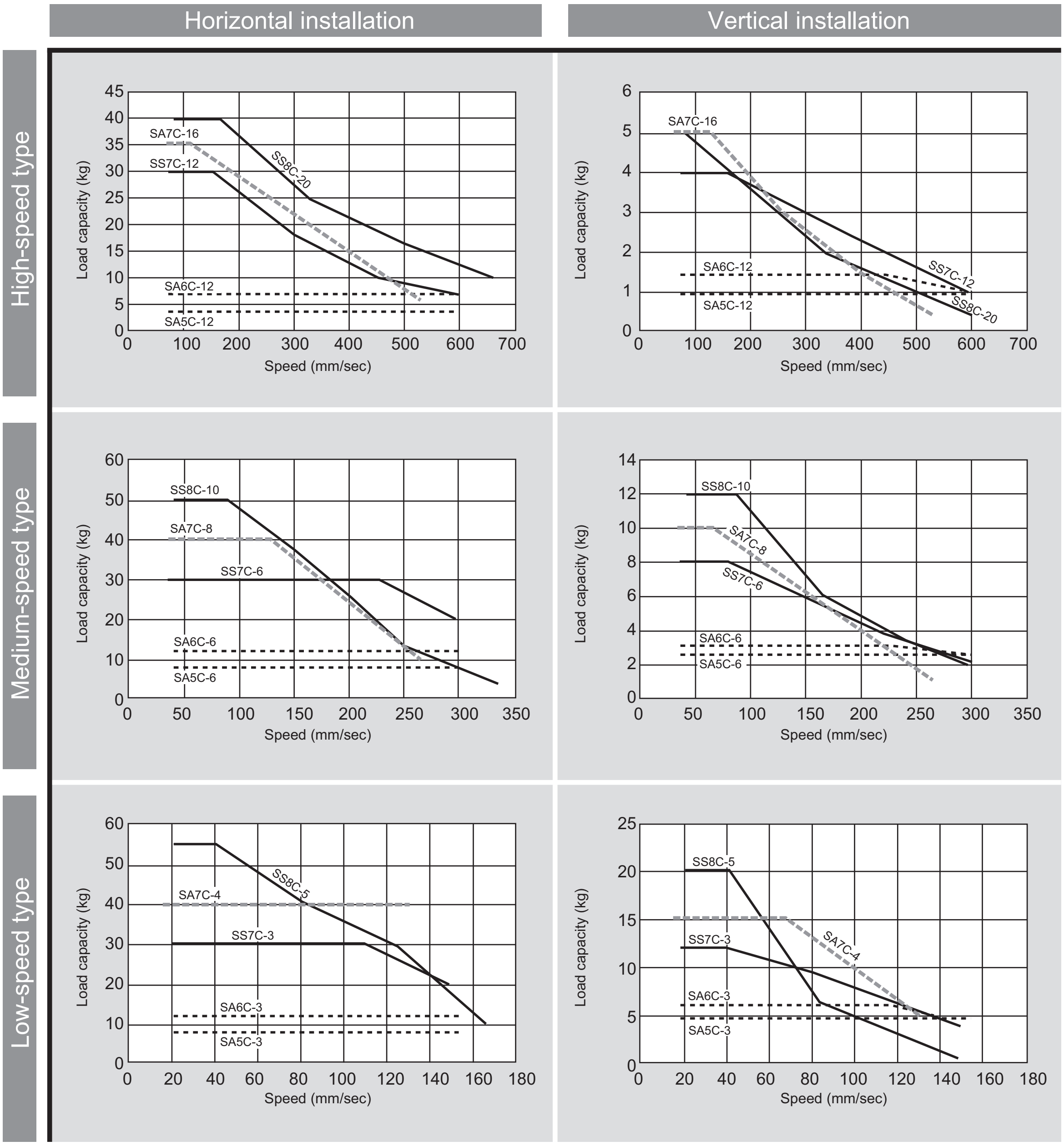
Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP4W (rod type)	RA7C	Ball screw	800	16	Horizontal	20	(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 500 (at 50st) 560 (at 100 to 500st)	1.0	94	330	20
					Vertical		(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 400	0.5			
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 340	1.0	187	670	
					Vertical		(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 280	0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 170	1.0	375	1326	
					Vertical		(Note) It is the value when high–thrust function is effective. (Note) It could differ depending on ambient temperature. 140	0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP5 (slider type)	SA4C	Ball screw	800	16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 1260 (at 50 to 400st) 1060 (at 450st) 875 (at 500st)	1.0	21	48	20
					Vertical			0.5			
				10	Horizontal	12.5	(Note) It is the value when high–thrust function is effective. 785 (at 50 to 400st) 675 (at 450st) 555 (at 500st)	1.0	22	77	
					Vertical			0.5			
				5	Horizontal	6.25	(Note) It is the value when high–thrust function is effective. 390 (at 50 to 400st) 330 (at 450st) 275 (at 500st)	1.0	44	155	
					Vertical			0.5			
				2.5	Horizontal	3.12	(Note) It is the value when high–thrust function is effective. 195 (at 50 to 400st) 165 (at 450st) 135 (at 500st)	1.0	88	310	
					Vertical			0.5			
	SA6C	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 1440 (at 50 to 450st) 1335 (at 500st) 1130 (at 550st) 970 (at 600st) 840 (at 650st) 735 (at 700st) 650 (at 750st) 575 (at 800st)	1.0	16	56	20
					Vertical		(Note) It is the value when high–thrust function is effective. 1280 (at 50 to 500st) 1130 (at 550st) 970 (at 600st) 840 (at 650st) 735 (at 700st) 650 (at 750st) 575 (at 800st)	0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 900 (at 50 to 400st) 885 (at 450st) 735 (at 500st) 620 (at 550st) 535 (at 600st) 460 (at 650st) 405 (at 700st) 335 (at 750st) 315 (at 800st)	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450 (at 50 to 400st) 435 (at 450st) 365 (at 500st) 305 (at 550st) 265 (at 600st) 230 (at 650st) 200 (at 700st) 175 (at 750st) 155 (at 800st)	1.0	53	185	
					Vertical			0.5			

Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP5 (slider type)	SA6C	Ball screw	800	3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 400st) 215 (at 450st) 180 (at 500st) 150 (at 550st) 130 (at 600st) 115 (at 650st) 100 (at 700st) 85 (at 750st) 75 (at 800st)	1.0	106	370	20
					Vertical			0.5			
	SA7C	Ball screw	800	24	Horizontal	30	(Note) It is the value when high–thrust function is effective. 1220 (at 50 to 600st) 1145 (at 650st) 1000 (at 700st) 885 (at 750st) 785 (at 800st)	1.0	32	112	20
					Vertical			0.5			
				16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 980 (at 50 to 550st) 875 (at 600st) 755 (at 650st) 660 (at 700st) 585 (at 750st) 520 (at 800st)	1.0	48	168	
					Vertical		(Note) It is the value when high–thrust function is effective. 840 (at 50 to 600st) 755 (at 650st) 660 (at 700st) 585 (at 750st) 520 (at 800st)	0.5			
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 490 (at 50 to 550st) 430 (at 600st) 375 (at 650st) 325 (at 700st) 290 (at 750st) 255 (at 800st)	1.0	96	336	
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 245 (at 50 to 550st) 215 (at 600st) 185 (at 650st) 160 (at 700st) 140 (at 750st) 125 (at 800st)	1.0	192	673	
					Vertical		(Note) It is the value when high–thrust function is effective. 215 (at 50 to 600st) 185 (at 650st) 160 (at 700st) 140 (at 750st) 125 (at 800st)	0.5			

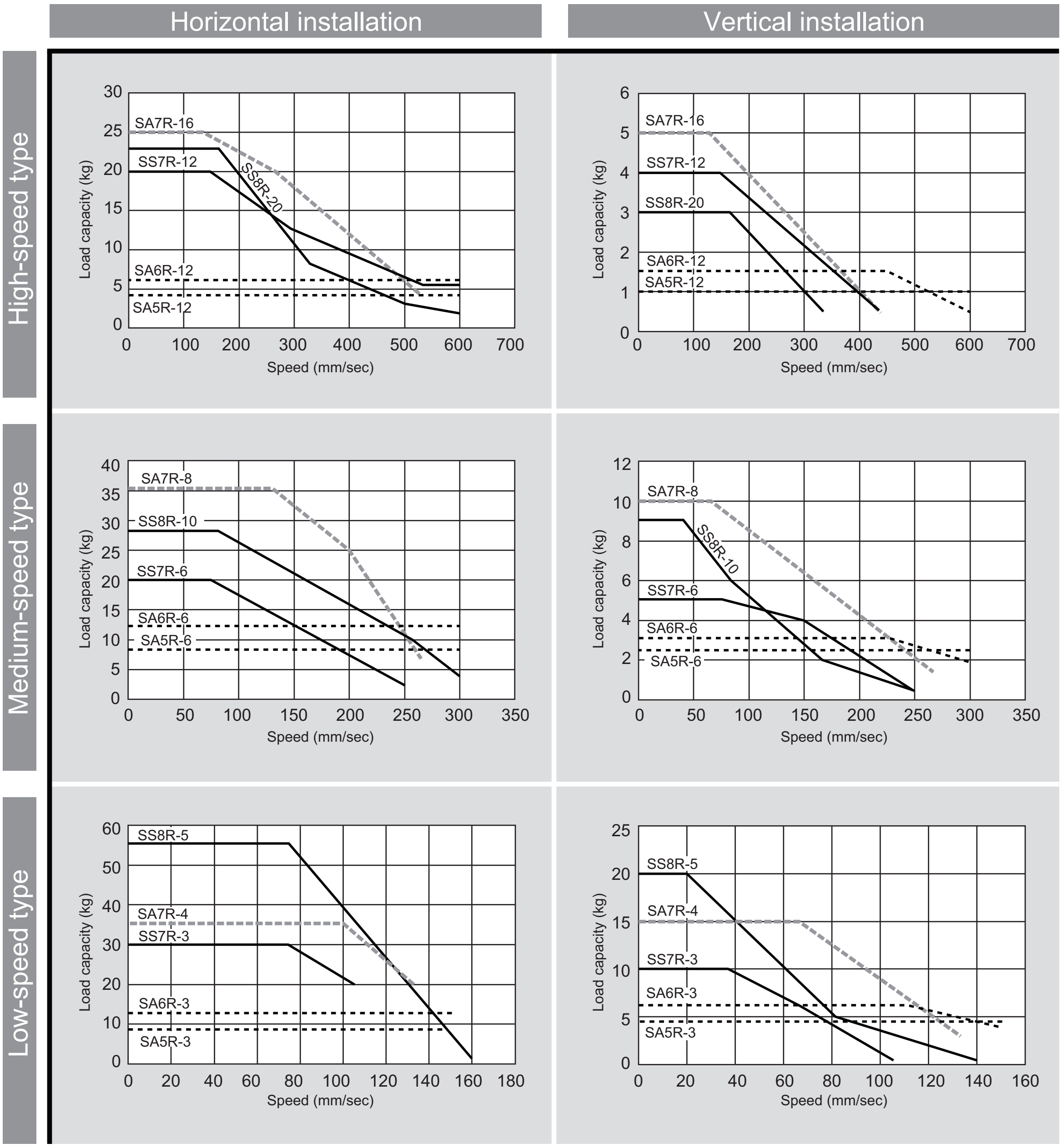
Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP5 (rod type)	RA4C	Ball screw	800	16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 1120 (at 50 to 360st) 1080 (at 410st)	1.0	21	48	20
					Vertical			0.5			
				10	Horizontal	12.5	(Note) It is the value when high–thrust function is effective. 700 (at 50 to 360st) 685 (at 410st)	1.0	22	77	
					Vertical			0.5			
				5	Horizontal	6.25	(Note) It is the value when high–thrust function is effective. 350 (at 50 to 360st) 340 (at 410st)	1.0	44	155	
					Vertical			0.5			
				2.5	Horizontal	3.12	(Note) It is the value when high–thrust function is effective. 175 (at 50 to 360st) 170 (at 410st)	1.0	88	310	
					Vertical			0.5			
	RA6C	Ball screw	800	20	Horizontal	25	(Note) It is the value when high–thrust function is effective. 800	1.0	16	56	20
					Vertical			0.5			
				12	Horizontal	15	(Note) It is the value when high–thrust function is effective. 700	1.0	26	93	
					Vertical			0.5			
				6	Horizontal	7.5	(Note) It is the value when high–thrust function is effective. 450	1.0	53	186	
					Vertical			0.5			
				3	Horizontal	3.75	(Note) It is the value when high–thrust function is effective. 225 (at 50 to 360st) 220 (at 410st)	1.0	106	370	
					Vertical			0.5			
	RA7C	Ball screw	800	24	Horizontal	30	(Note) It is the value when high–thrust function is effective. 800	1.0	52	182	20
					Vertical		(Note) It is the value when high–thrust function is ineffective. 600	0.5			
				16	Horizontal	20	(Note) It is the value when high–thrust function is effective. 700	1.0	78	273	
					Vertical		(Note) It is the value when high–thrust function is effective. 560	0.5			
				8	Horizontal	10	(Note) It is the value when high–thrust function is effective. 420	1.0	156	547	
					Vertical			0.5			
				4	Horizontal	5	(Note) It is the value when high–thrust function is effective. 210	1.0	312	1094	
					Vertical			0.5			

Correlation diagram of speed and loading capacity for the RCP2 slider type



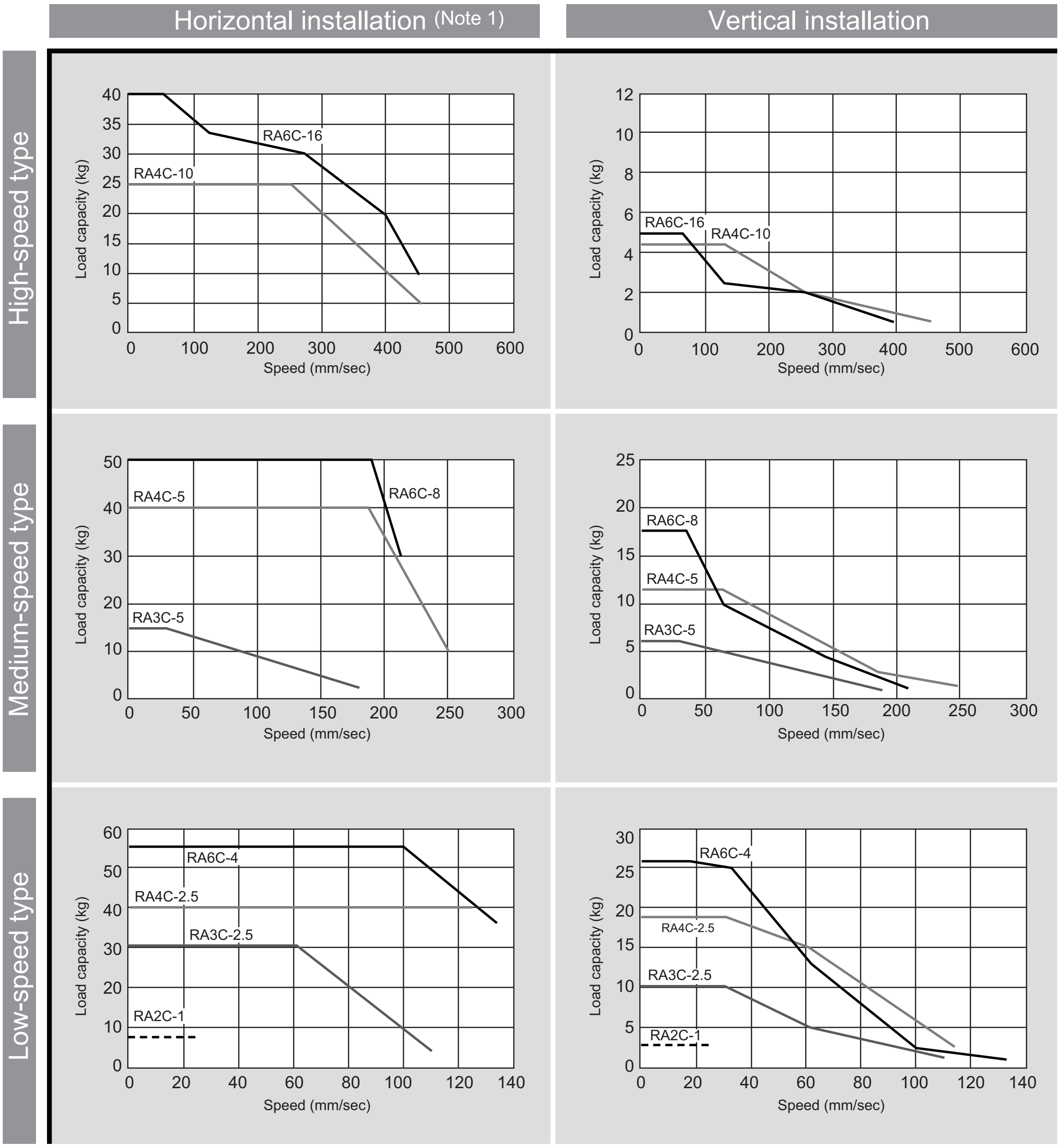
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the RCP2 slider type (motor-reversing type)



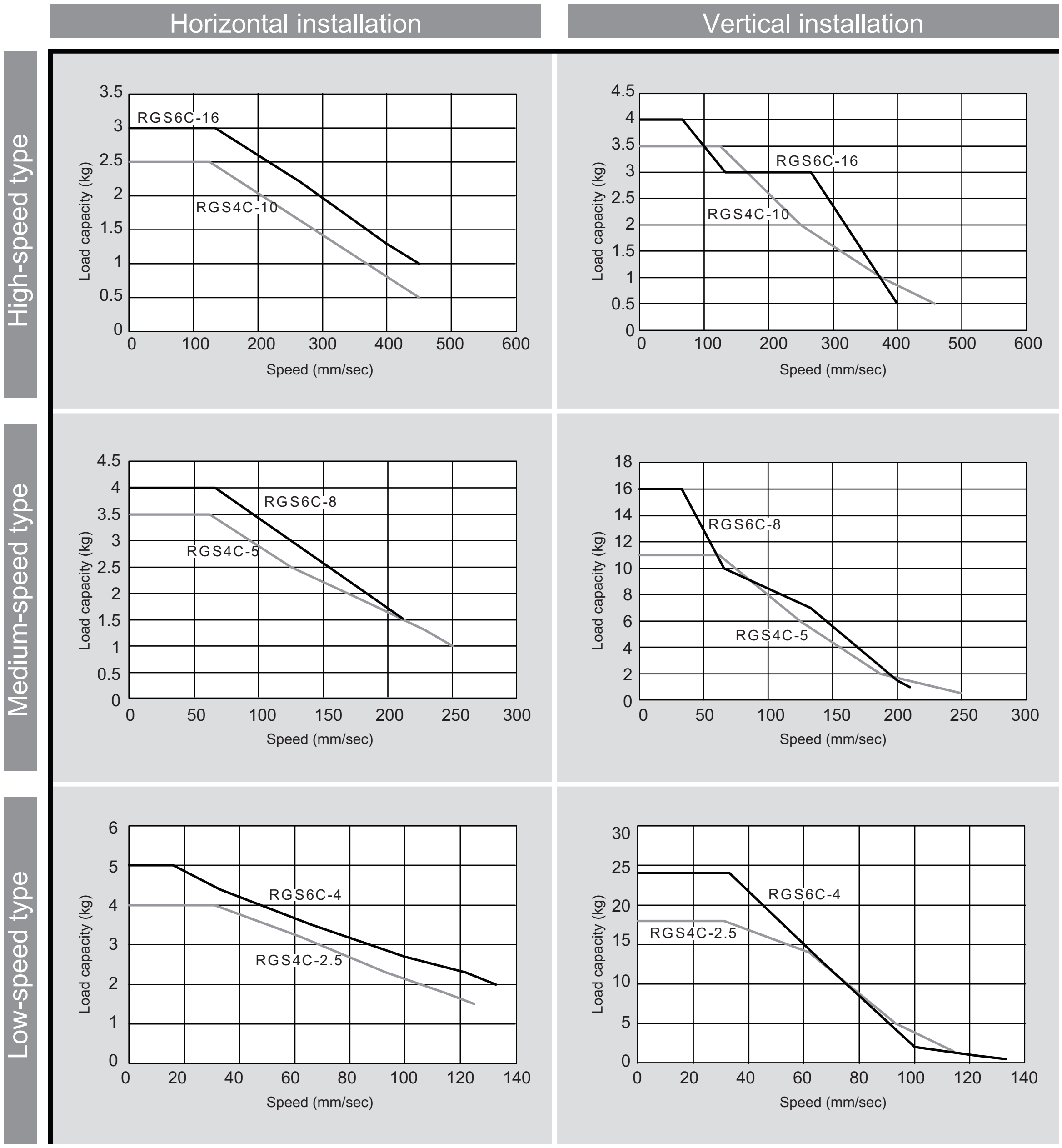
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the standard RCP2 rod type



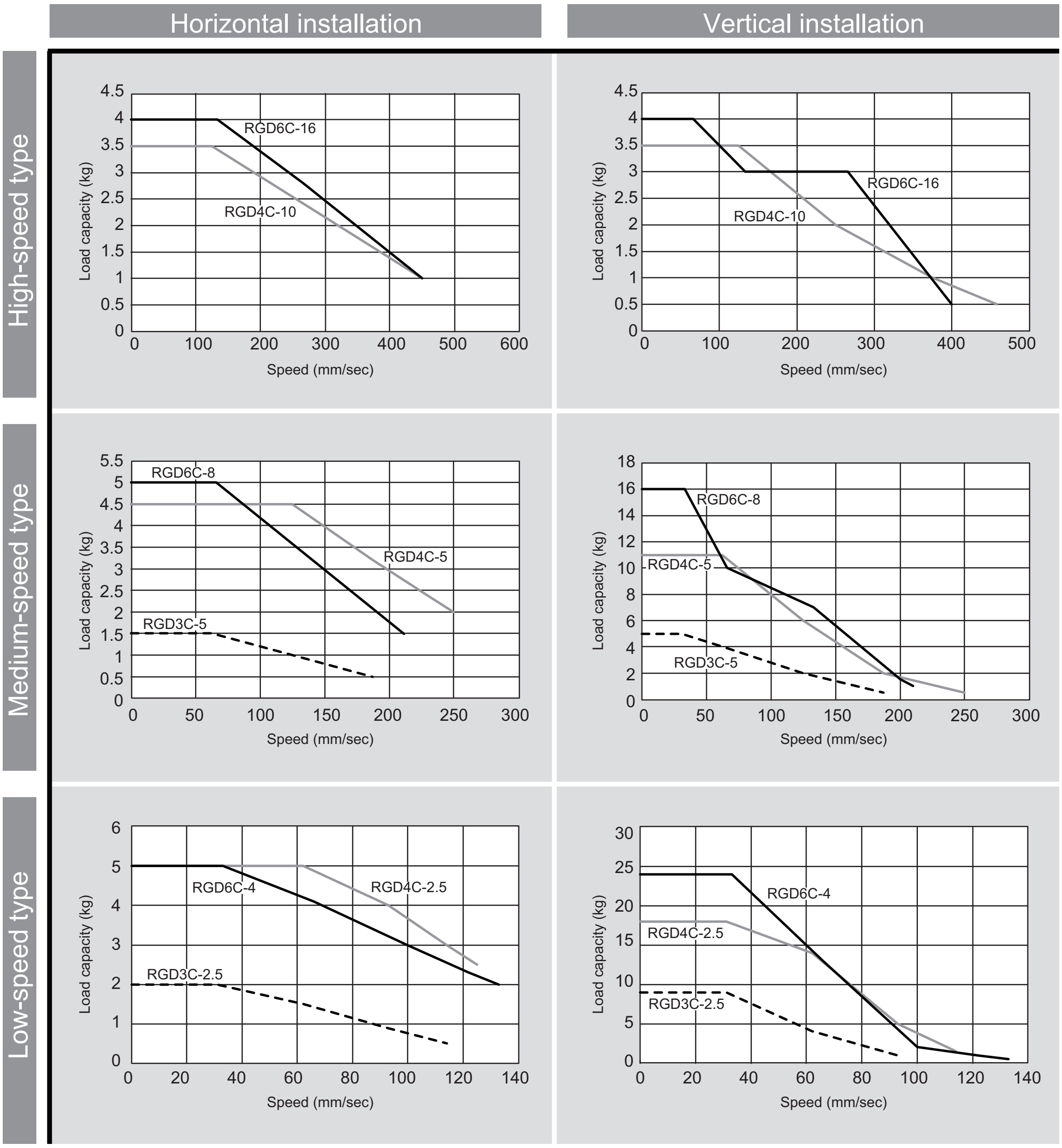
(Note) In the above graphs, the number after the type code indicates the lead.
(Note 1) The figures for horizontal installation assume use of an external guide.

Correlation diagram of speed and loading capacity for RCP2 single-guide type



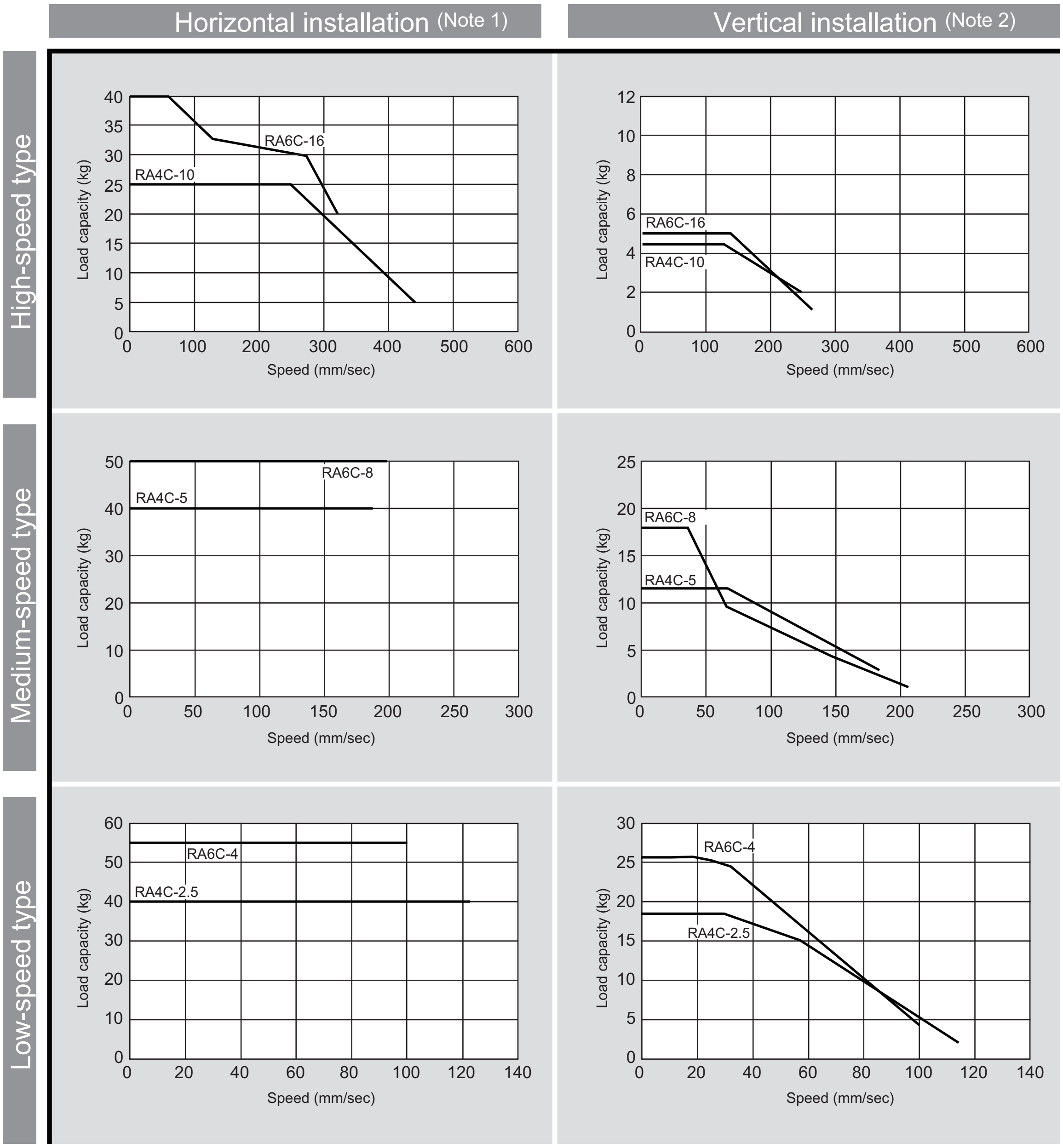
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the RCP2 double-guide type



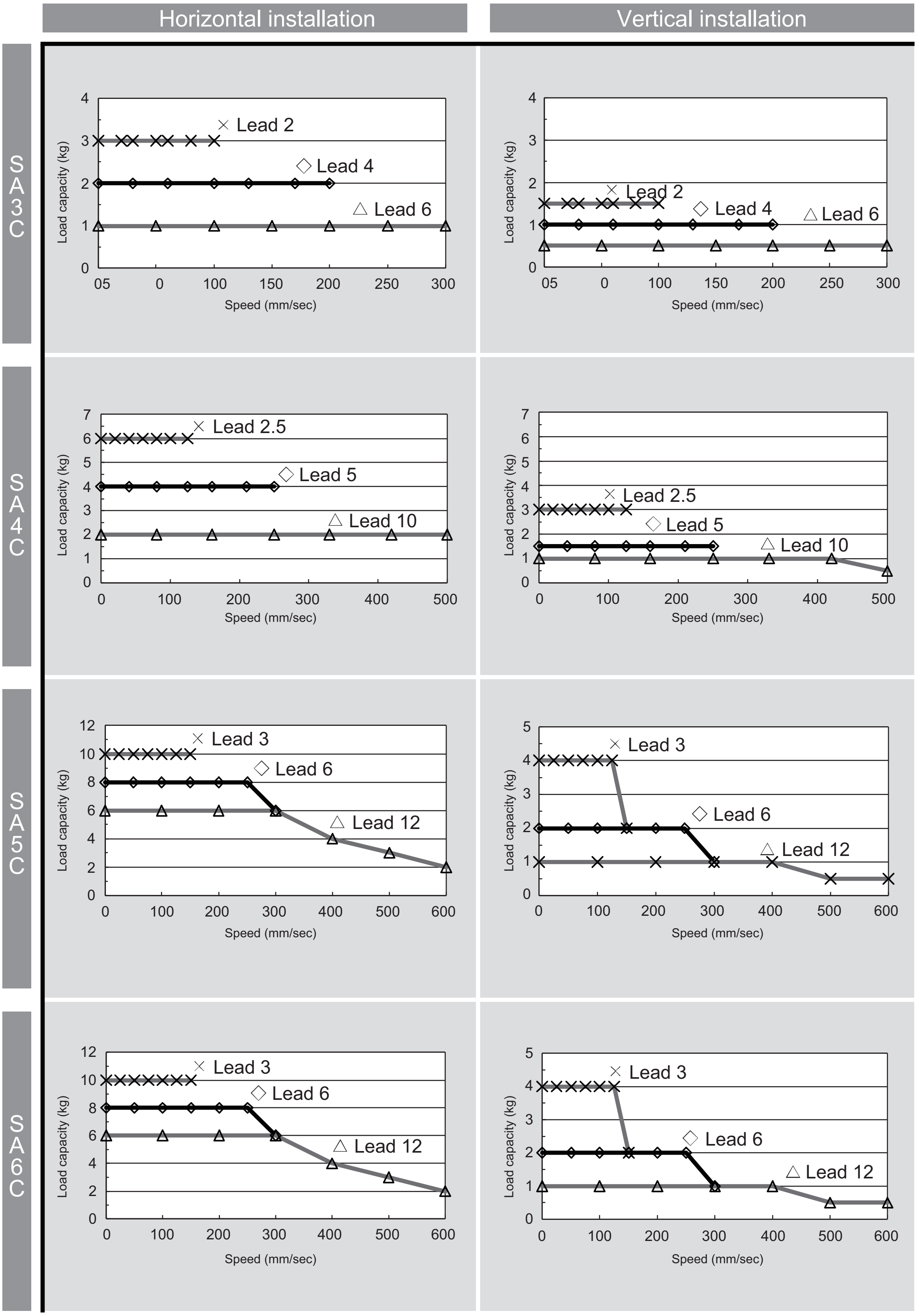
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the RCP2 dustproof/ splash-proof type

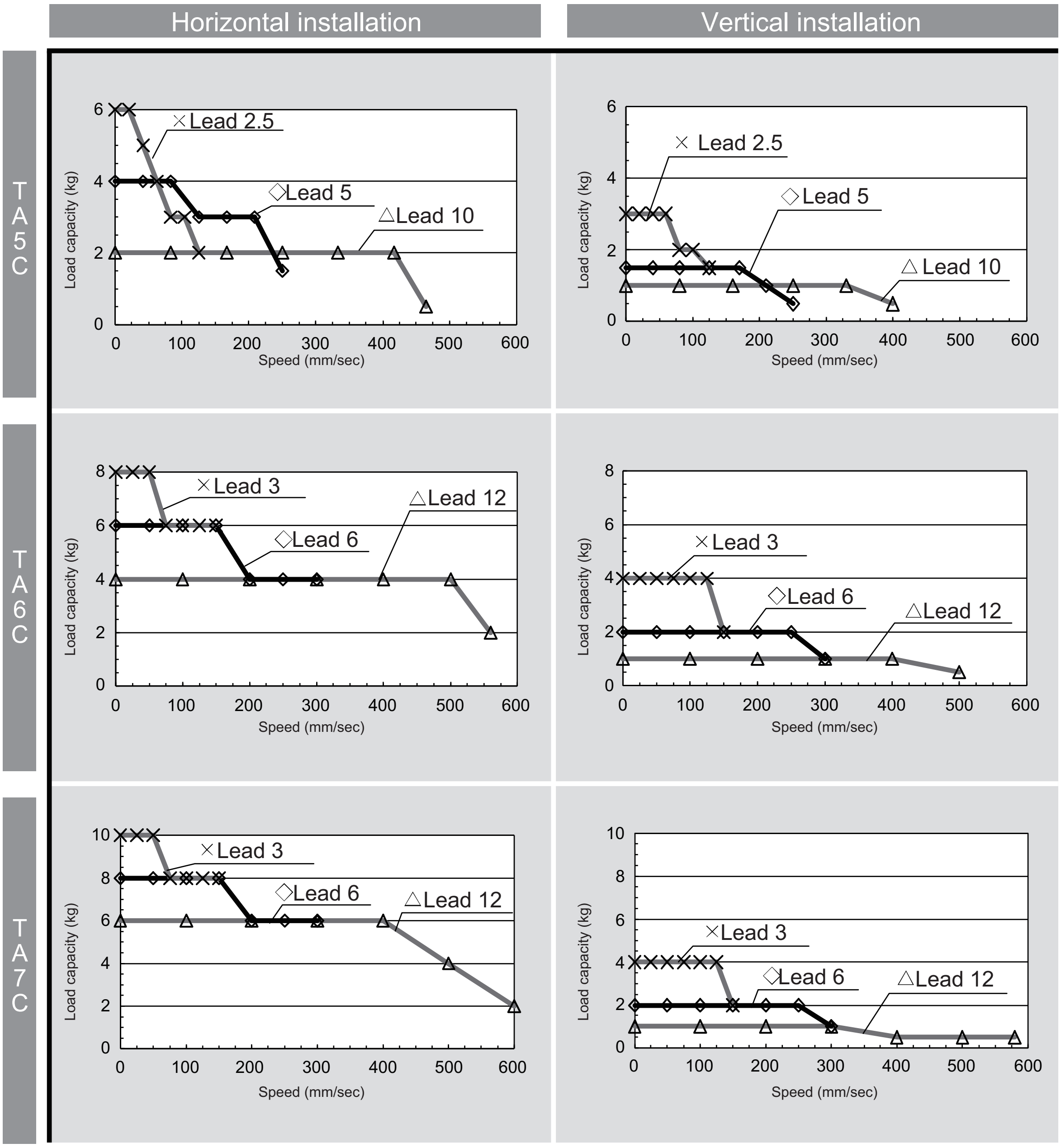


(Note) In the above graphs, the number after the type code indicates the lead.
(Note 1) The figures for horizontal installation assume use of an external guide.
(Note 2) Use of the actuator at the maximum loading capacity corresponding to the applicable speed may cause vibration/overshooting. Select an appropriate model that provides an allowance of approx. 70%.

Correlation diagram of speed and loading capacity for the RCP3 slider type



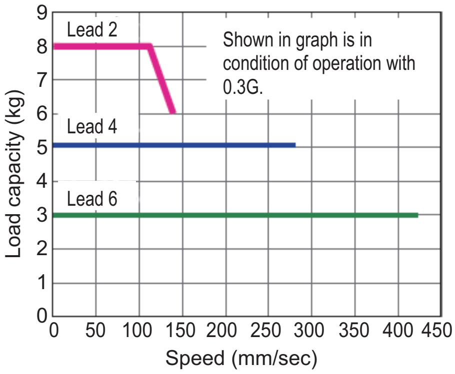
Correlation diagram of speed and loading capacity for the RCP3 table type

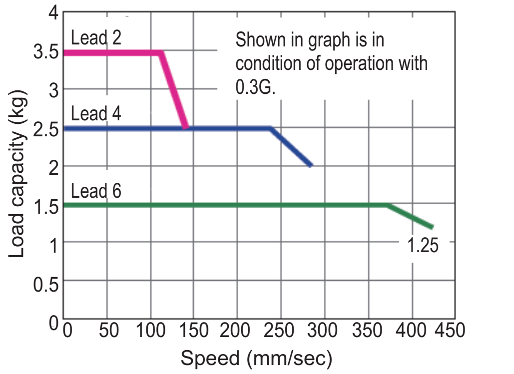


Correlation diagram of speed and loading capacity for the RCP4 slider type (High output invalid)

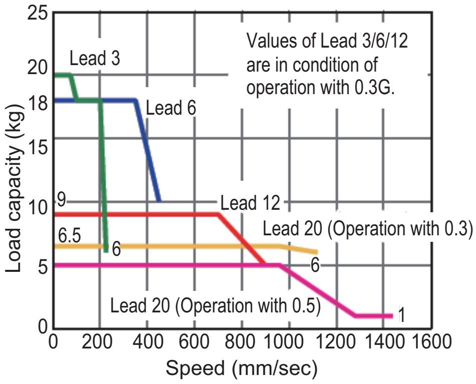
Horizontal installation | Vertical installation

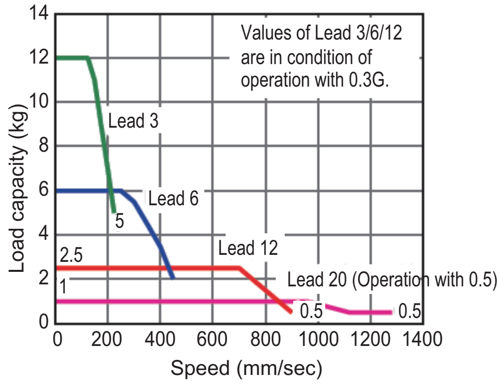
SA3C



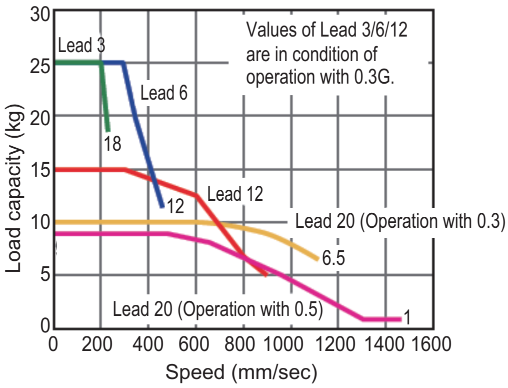


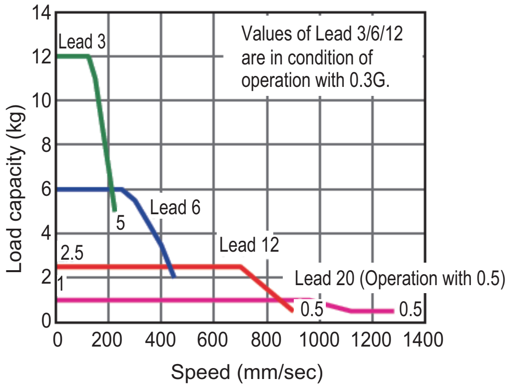
SA5C



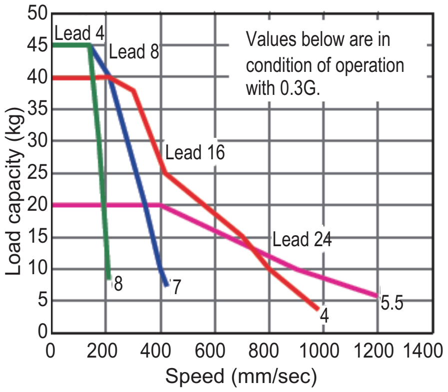


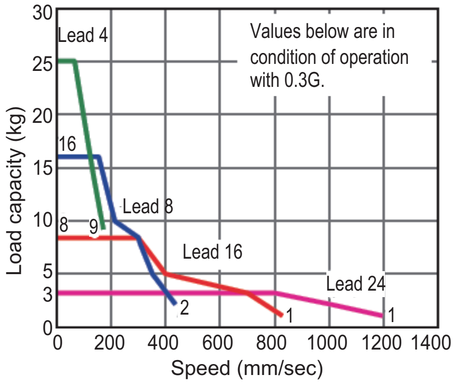
SA6C





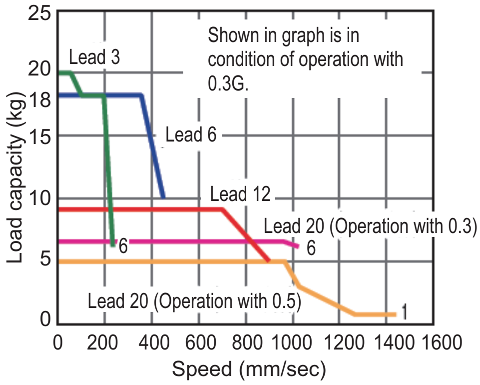
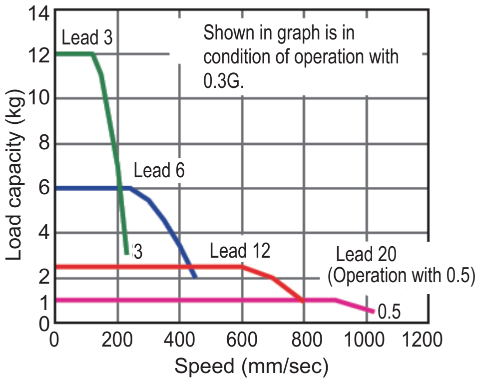
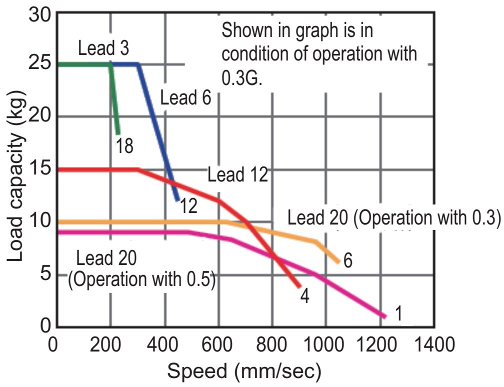
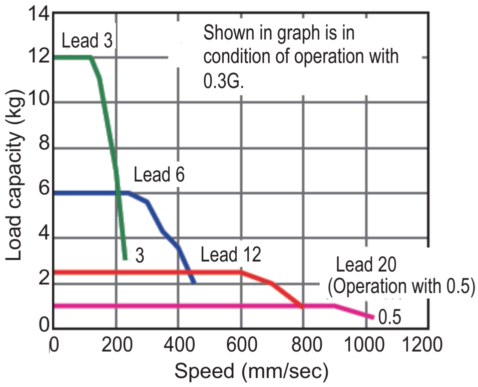
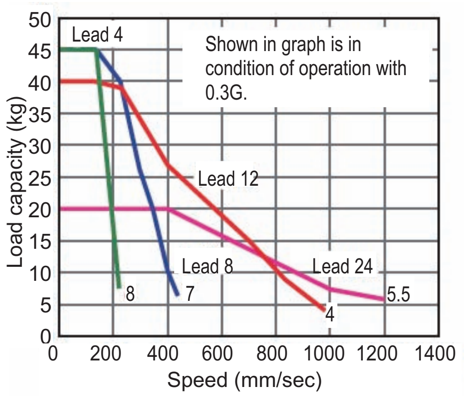
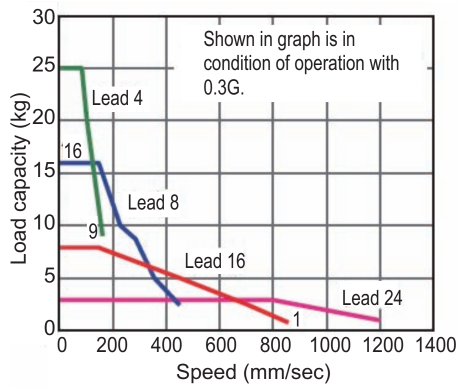
SA7C



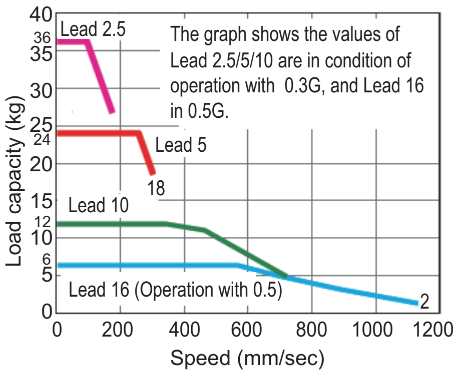
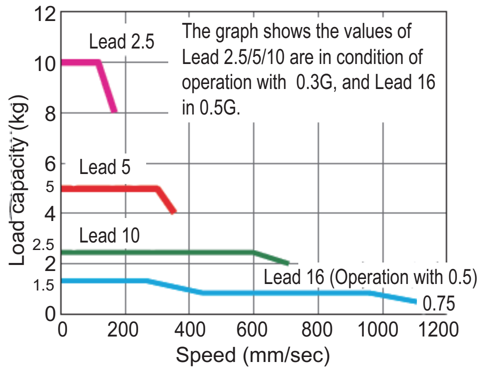
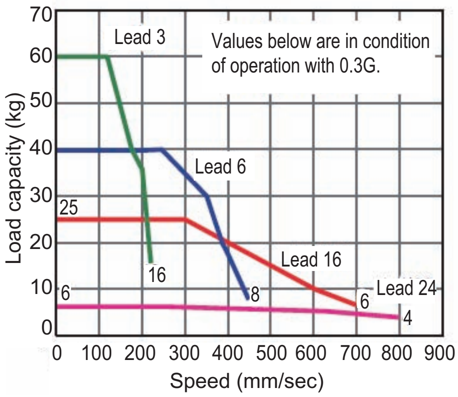
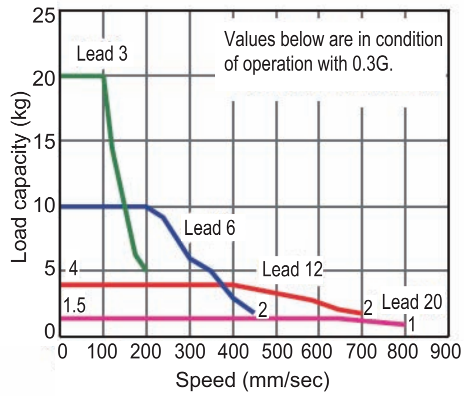
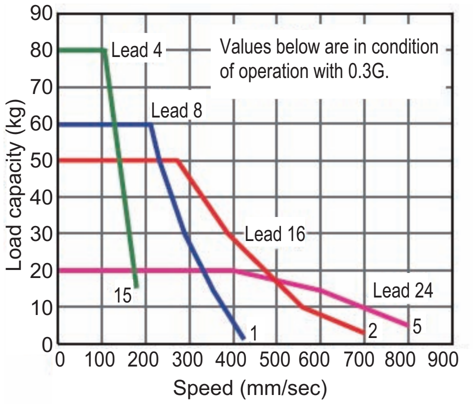
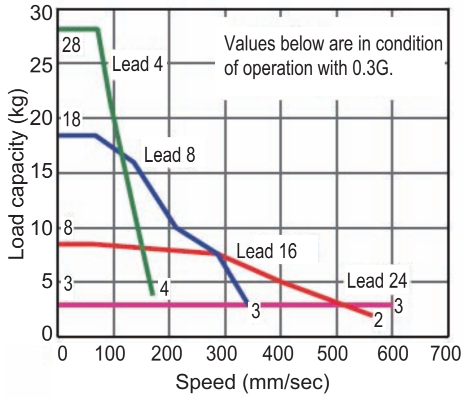


Chapter 7 Appendix

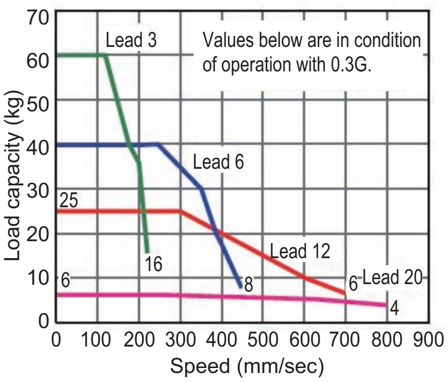
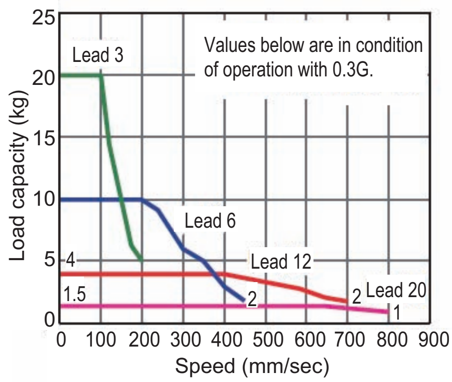
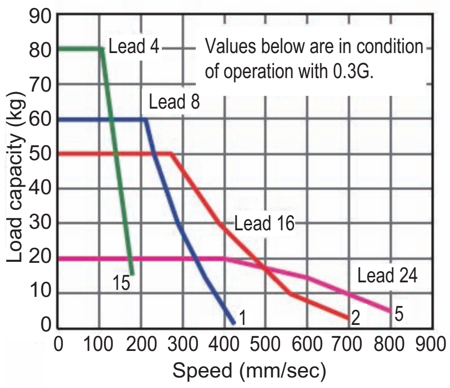
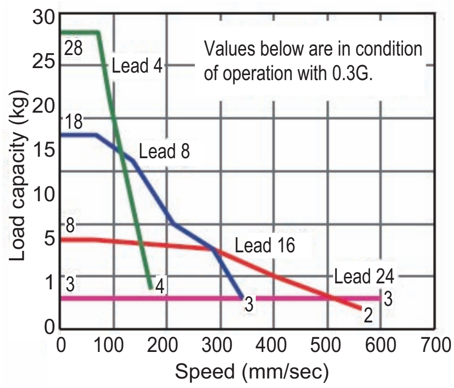
Correlation diagram of speed and loading capacity for the RCP4 slider type (High output invalid)

	Horizontal installation	Vertical installation
SA5R		
SA6R		
SA7R		

Correlation diagram of speed and loading capacity for the RCP4 rod type (High output invalid)

	Horizontal installation	Vertical installation
RA3C		
RA5C		
RA6C		

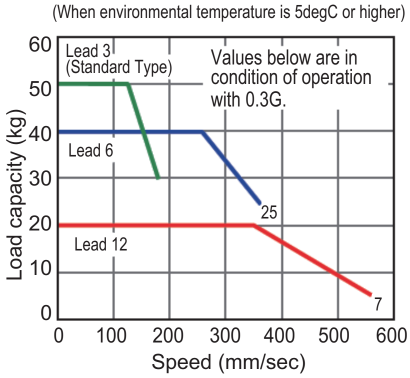
Correlation diagram of speed and loading capacity for the RCP4 rod type (High output invalid)

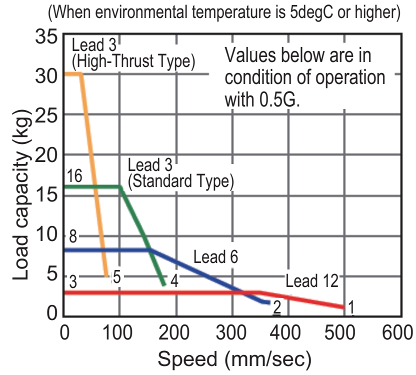
	Horizontal installation	Vertical installation
RA5R		
RA6R		

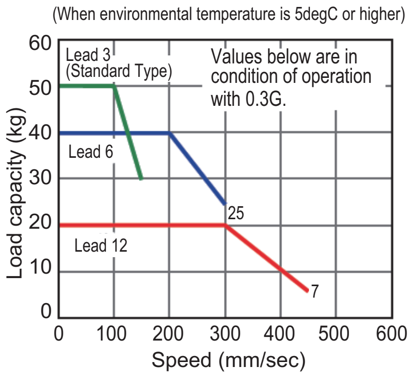
Correlation diagram of speed and loading capacity for the RCP4W rod type (High output invalid)

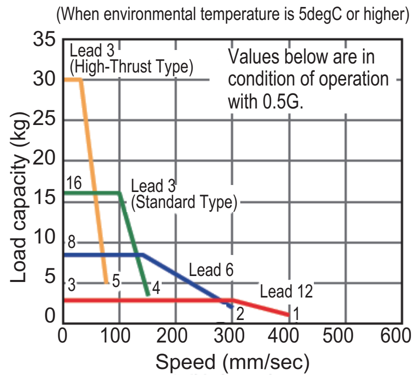
	Horizontal installation	Vertical installation

RA6C

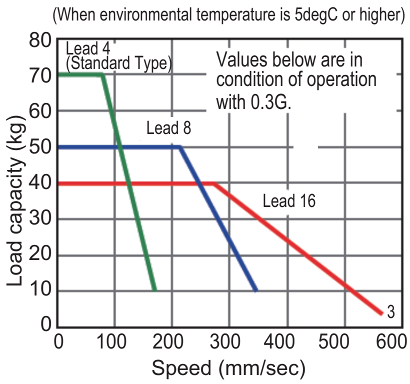


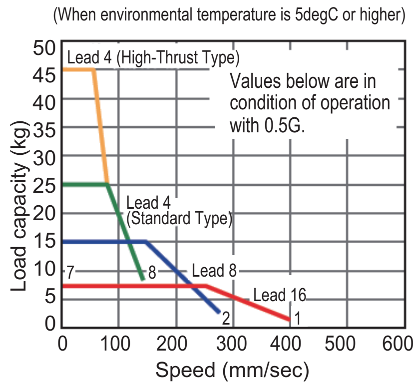


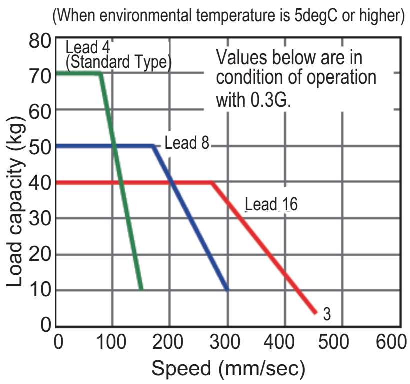


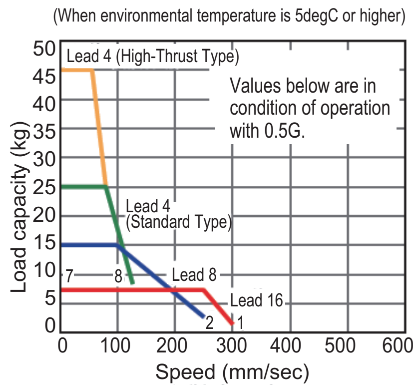


RA7C





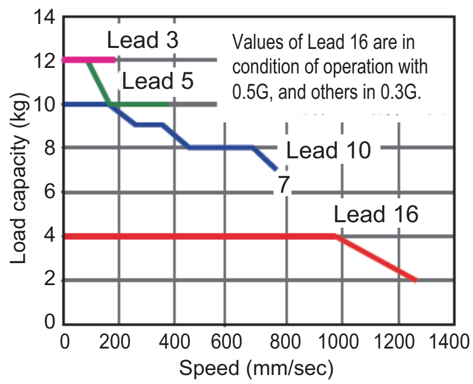


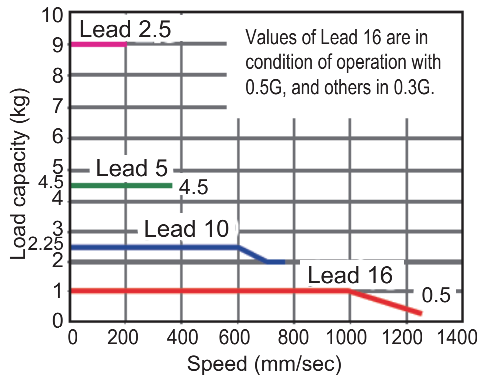


Correlation diagram of speed and loading capacity for the RCP5 slider type (High output invalid)

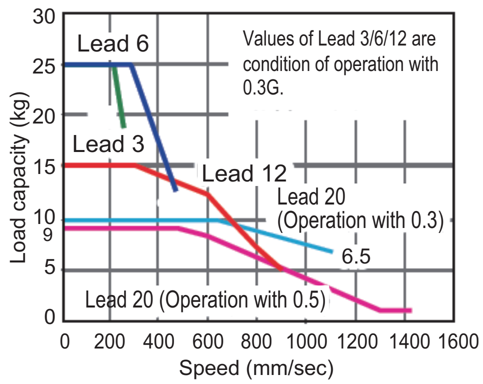
	Horizontal installation	Vertical installation

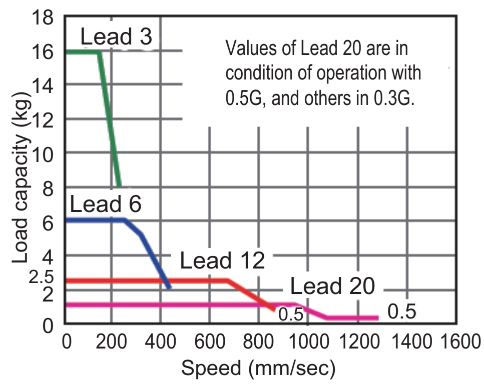
SA4C



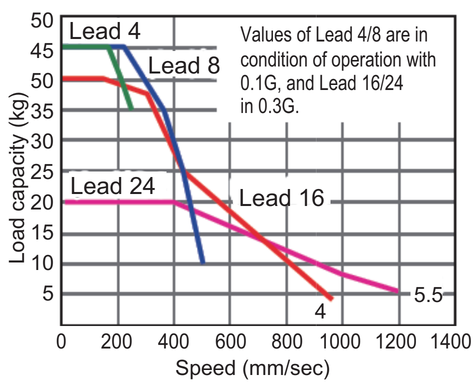


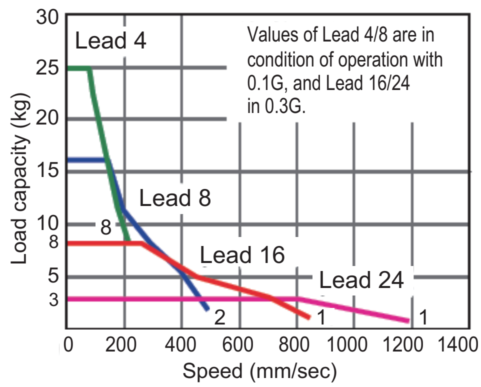
SA6C





SA7C

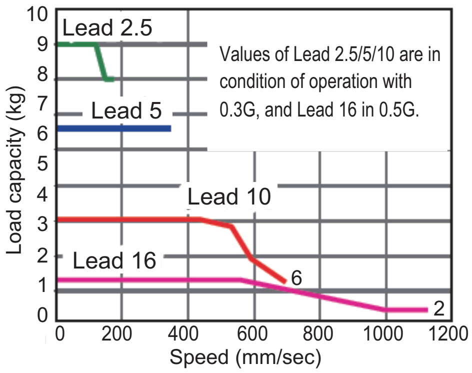


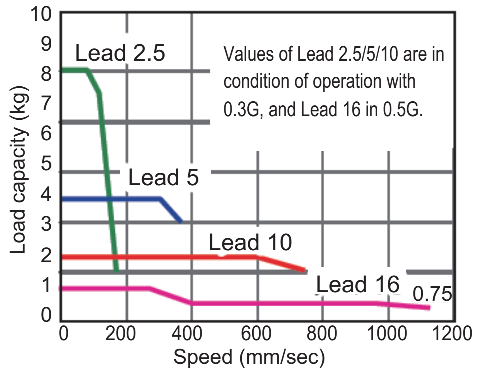


Correlation diagram of speed and loading capacity for the RCP5 slider type (High output invalid)

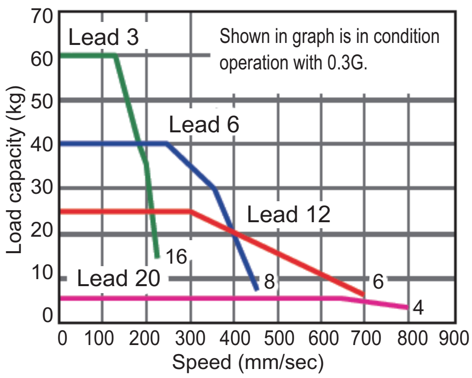
Horizontal installation | Vertical installation

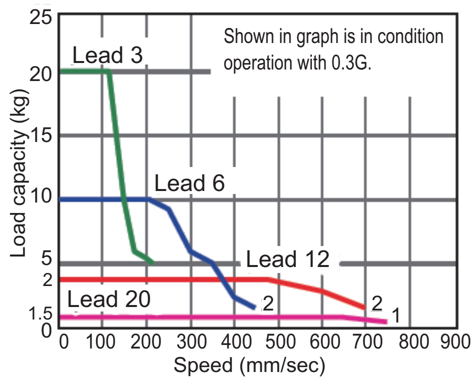
RA4C



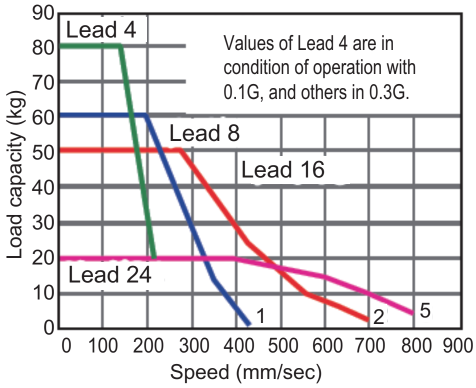


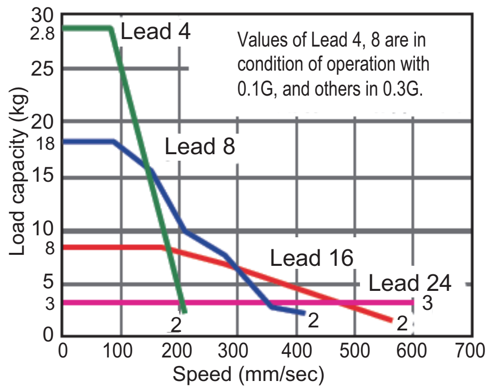
RA6C





RA7C





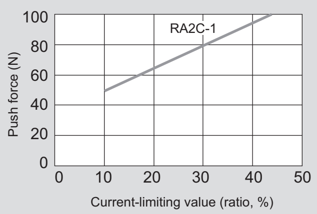
Pressing Force and Current Limit Value

Caution

- The correlation of the pressing force and the current limit value is the rated pressing speed (in the setting at the delivery) and is a reference value.
- Use the actuator with the setting above the minimum pressing force value. The pressing force will be unstable if it is below the minimum pressing force value.
- If the positioning speed setting in the operation condition is made lower than the pressing speed, the pressing speed will follow that speed, thus cannot perform the expected pressing force.

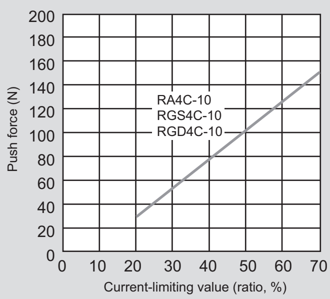
RCP2 Series Rod Type

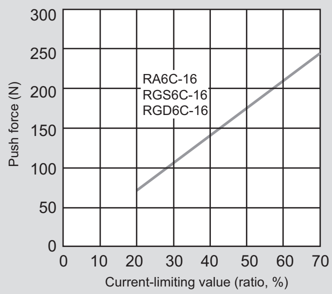
RA2C Type



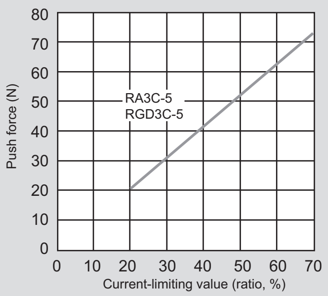
RA3C/RGD3C | RA4C/RGS4C/RGD4C | RA6C/RGS6C/RGD6C

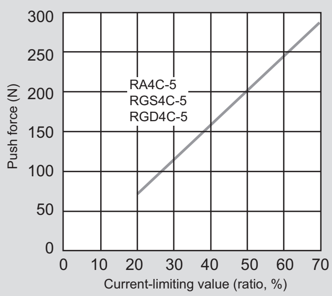
High-speed type

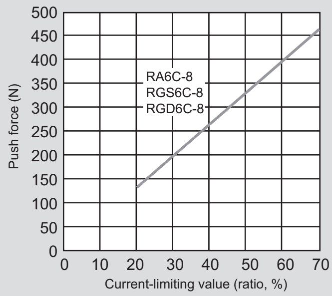




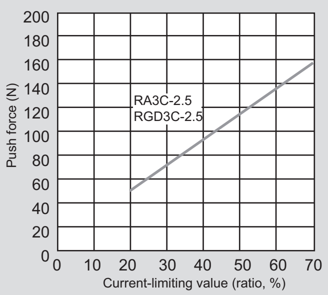
Medium-speed type

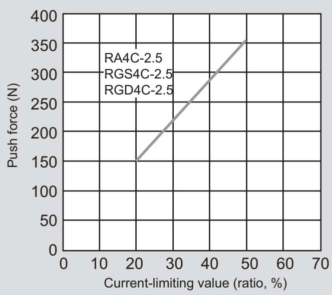


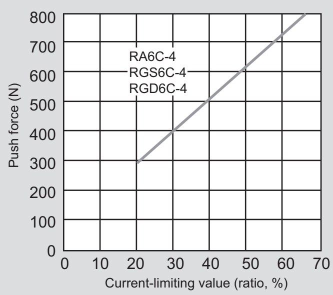




Low-speed type

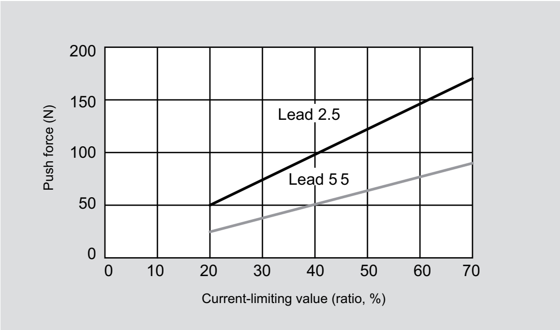






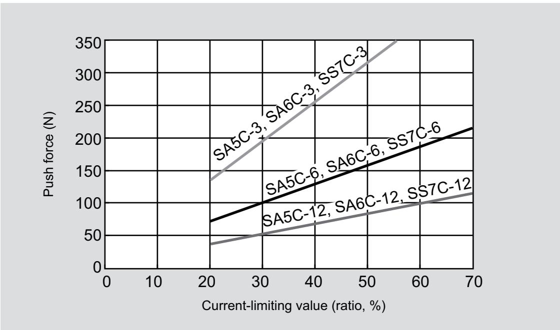
RCP2 Series Short Type

SRA4R/SRGS4R/SRGD4R

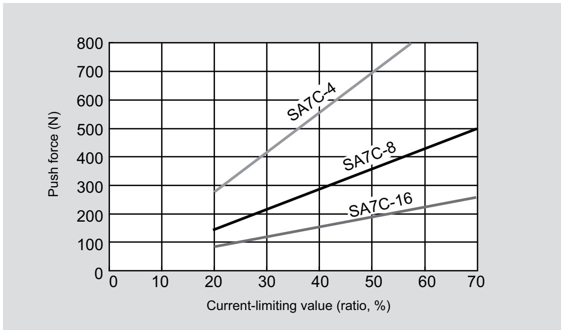


RCP2 Series Slider Type

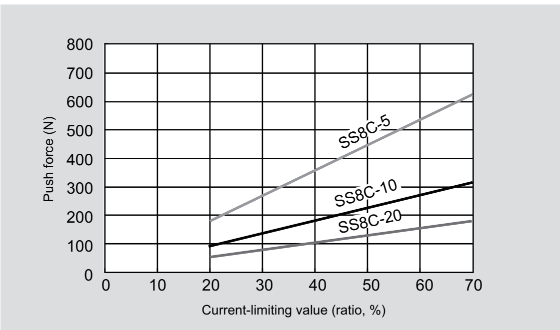
SA5C/SA6C/SA7C Type



SA7C Type

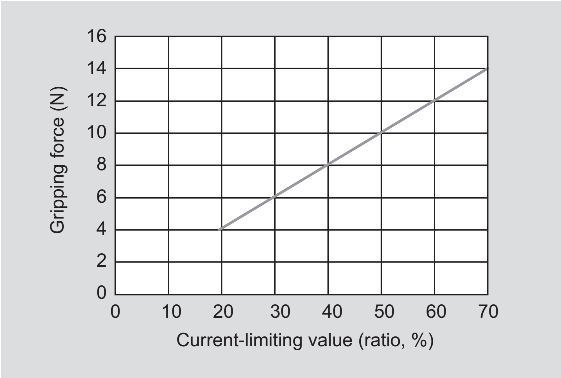


SS8C Type

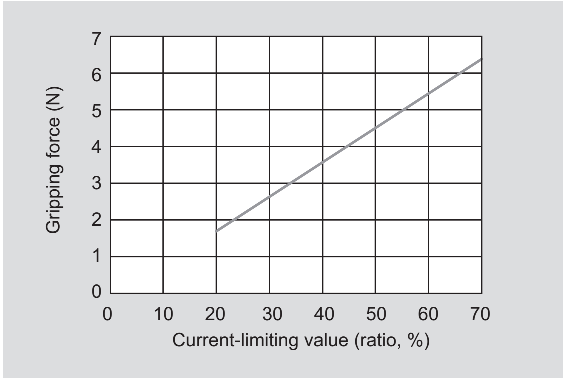


RCP2 Series Gripper

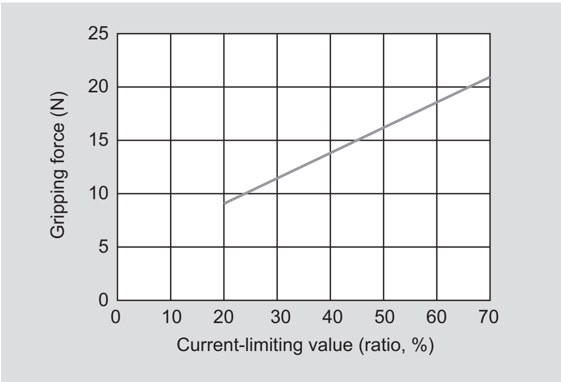
GRSS



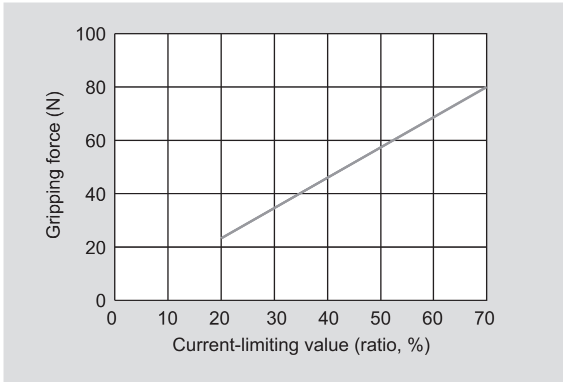
GRLS



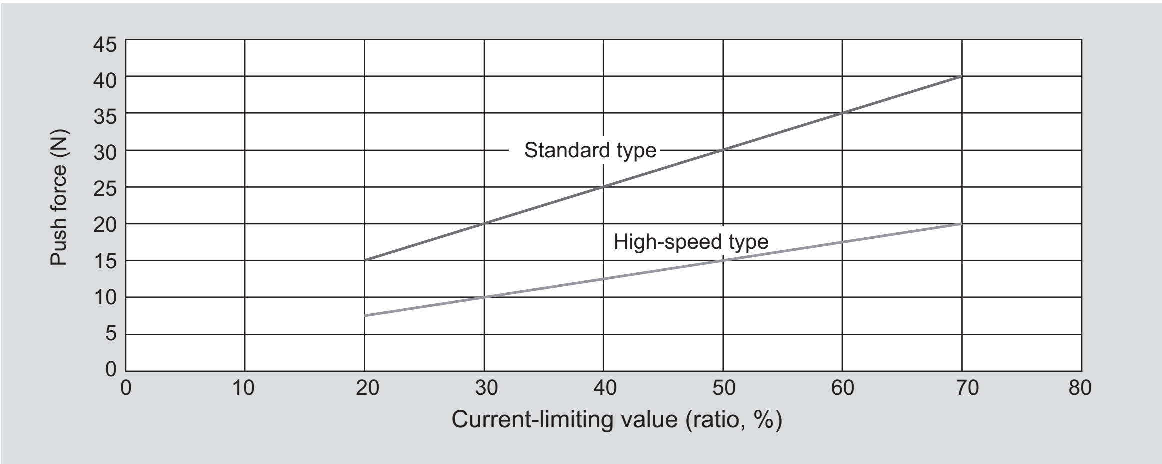
GRS



GRM

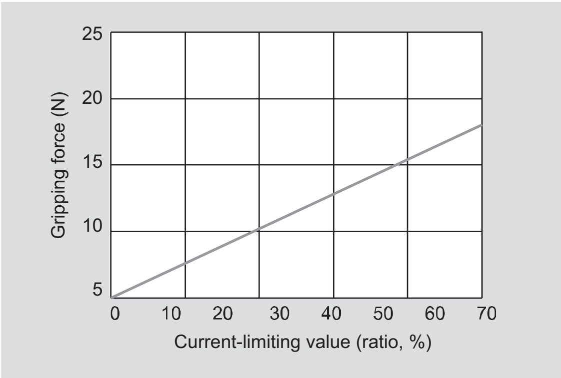


GRST

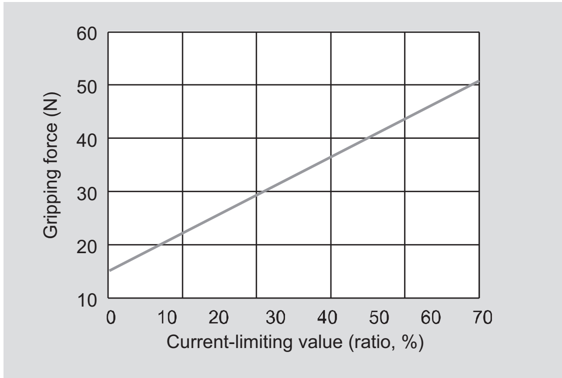


RCP2 Series 3-finger Gripper

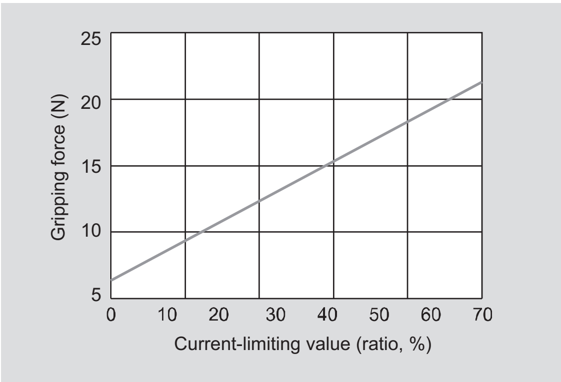
GR3LS



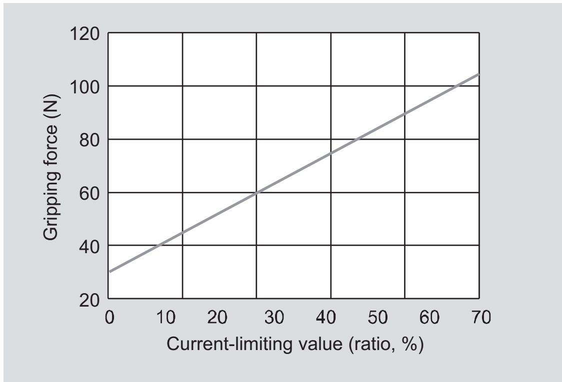
GR3LM



GR3SS

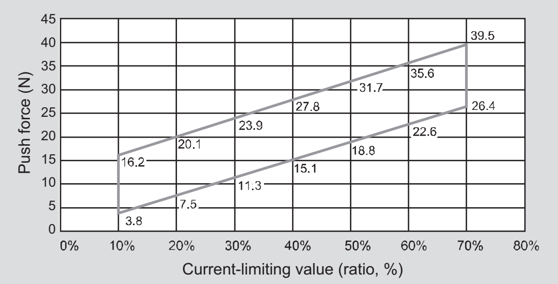


GR3SM

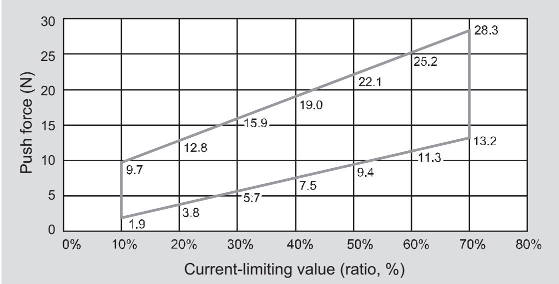


RCP3 Series | Slim, Compact Rod Type | * Inside the red box is the specification value

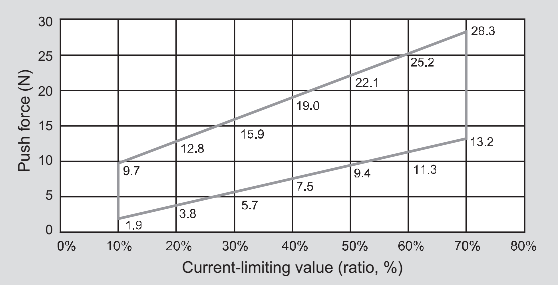
RA2AC/RA2AR Lead 1



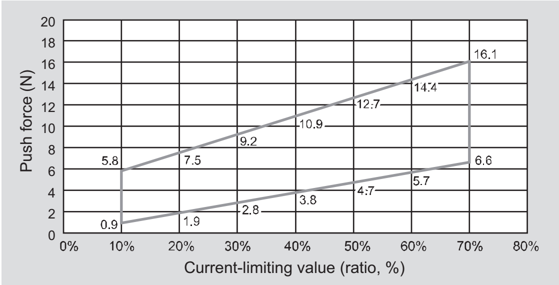
RA2BC/RA2BR Lead 2



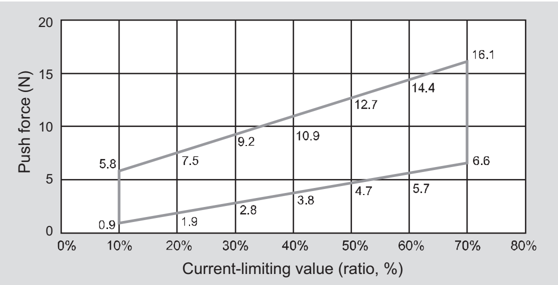
RA2AC/RA2AR Lead 2



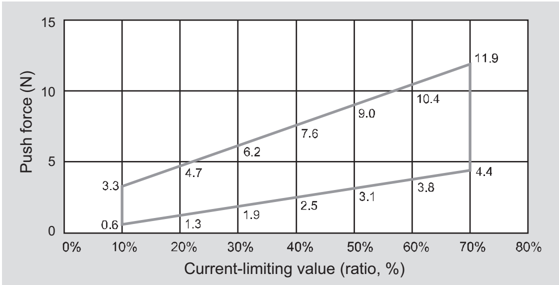
RA2BC/RA2BR Lead 4



RA2AC/RA2AR Lead 4

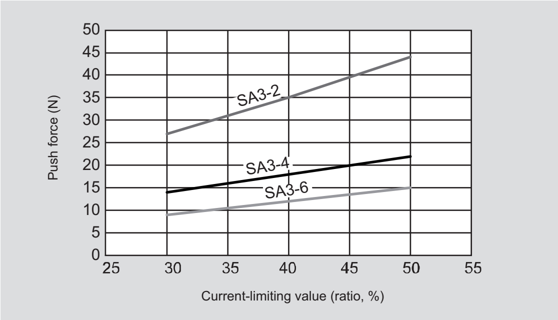


RA2BC/RA2BR Lead 6

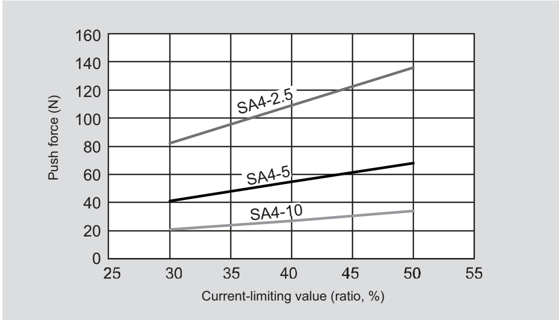


RCP3 Series Slider Type

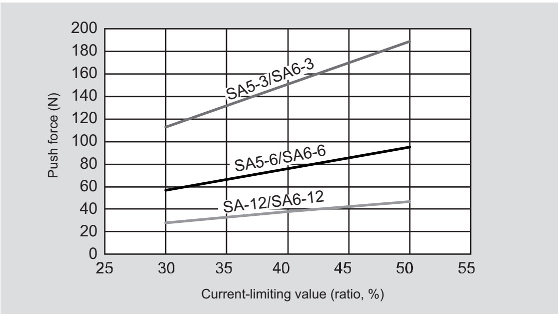
SA3C Type



SA4C Type

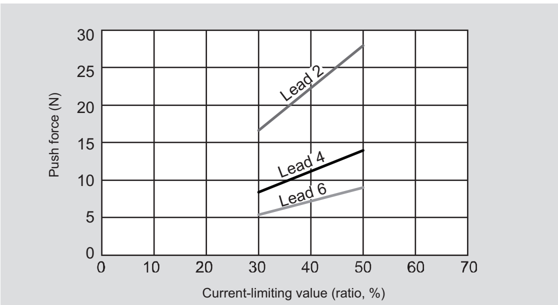


SA5C/SA6C Type

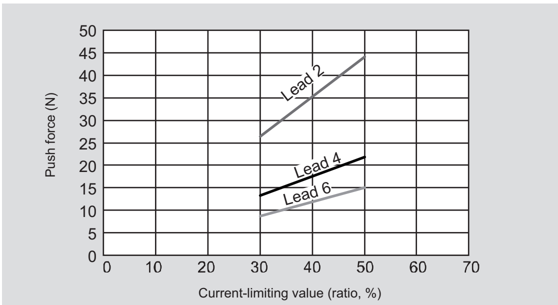


RCP3 Series Slim, Compact Table Type

TA3C/TA3R Type

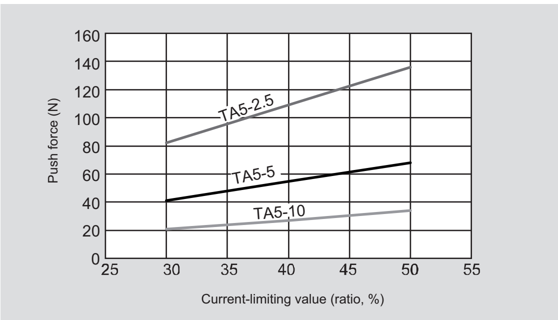


TA4C/TA4R Type

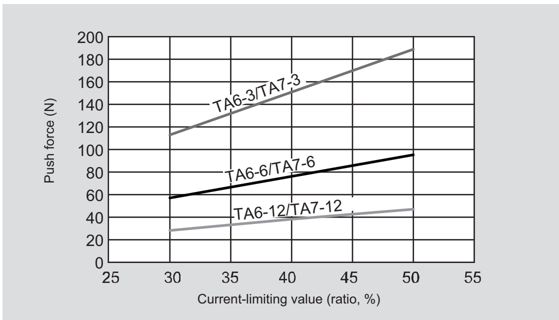


RCP3 Series Table Type

TA5C Type

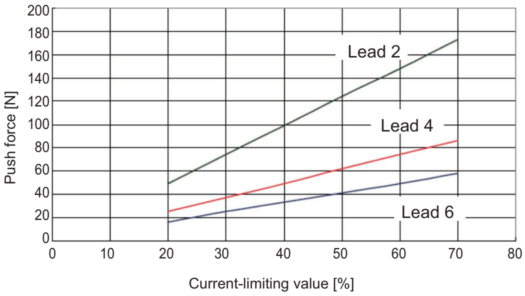


TA6C/TA7C Type

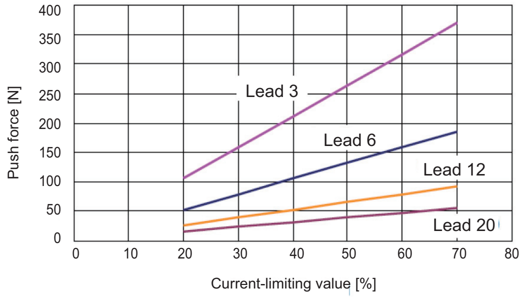


RCP4 Series Slider Type

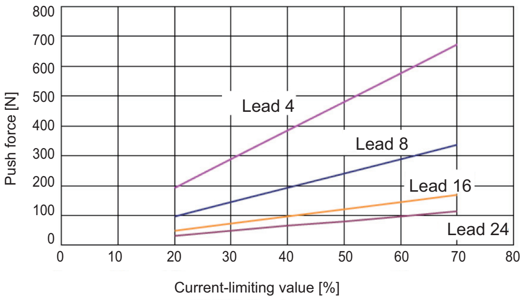
SA3C Type



SA5C/SA6C/SA5R/SA6R Type

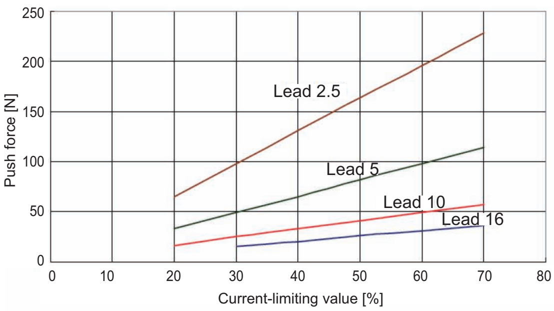


SA7C/SA7R Type

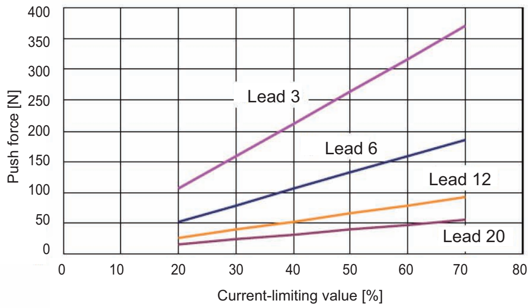


RCP4 Series Rod Type

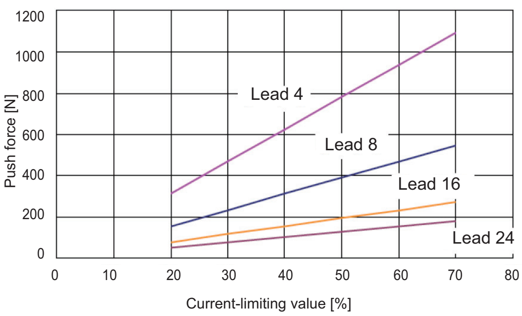
RA3C Type



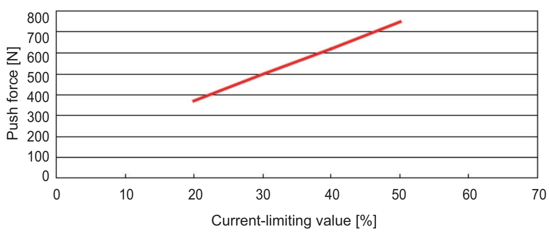
SA5C/RA5R Type



SA6C/SA6R Type

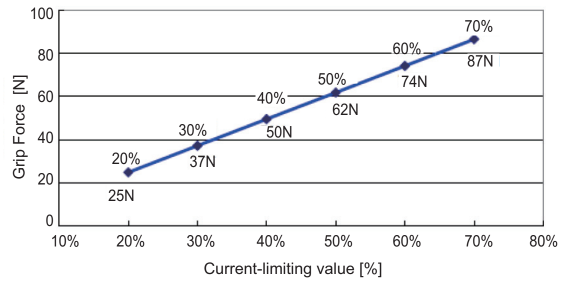


SA5C Type (42SP Motor)

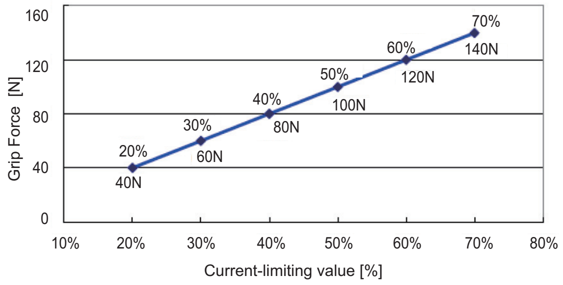


RCP4 Series Gripper Type

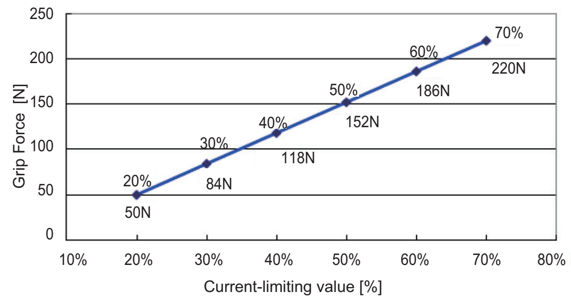
GRSML Type



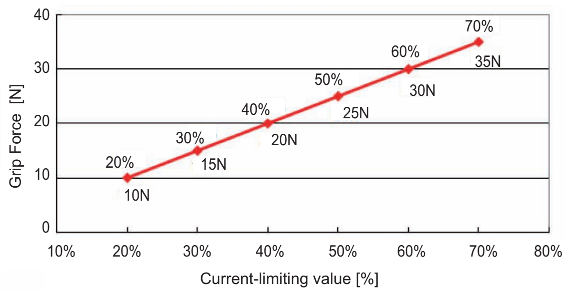
GRSLL Type



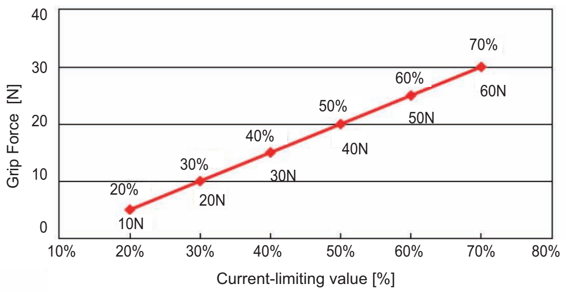
GRSWL Type



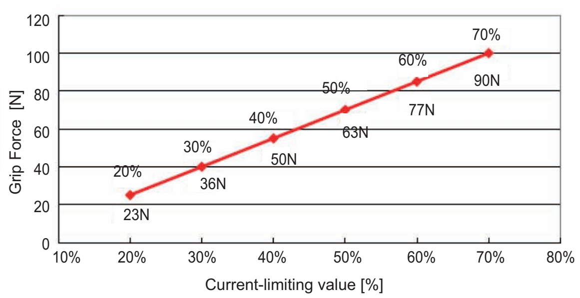
GRLM Type



GRLL Type

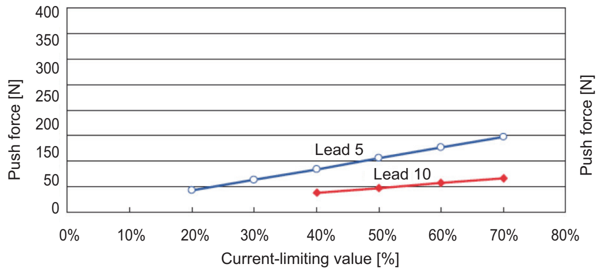


GRLW Type

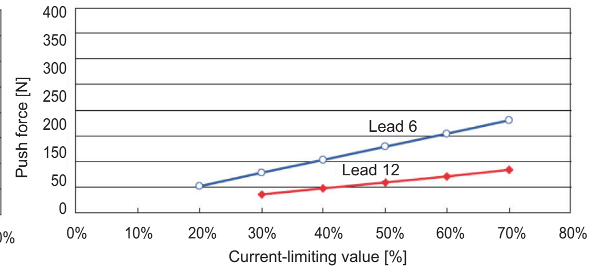


RCP4 Series Slider Type

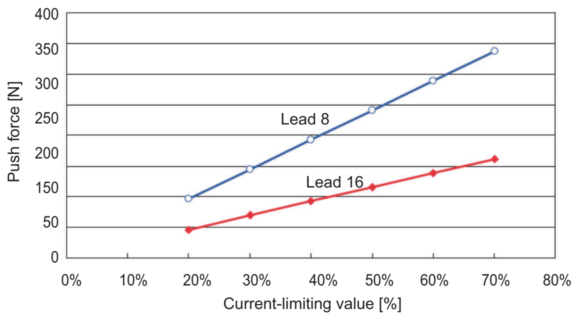
SA5C Type



SA6C Type



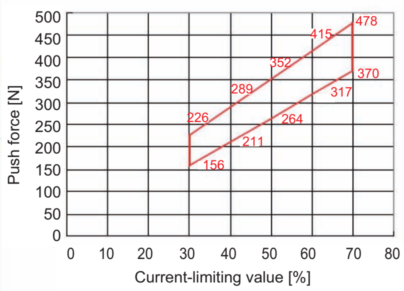
SA7C Type



RCP4W Series Rod Type

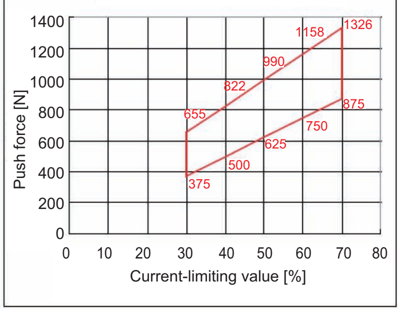
RA6C Lead 3

[RA6C Lead 3 Pressing Force Specification Value]



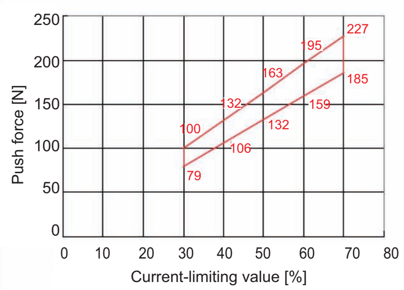
RA7C Lead 4

[RA7C Lead 4 Pressing Force Specification Value]



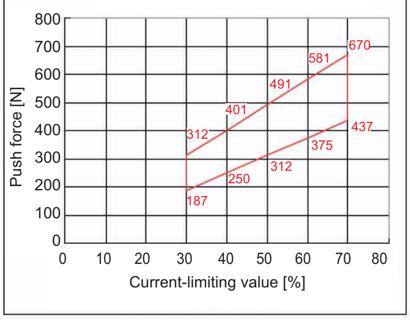
RA6C Lead 6

[RA6C Lead 6 Pressing Force Specification Value]



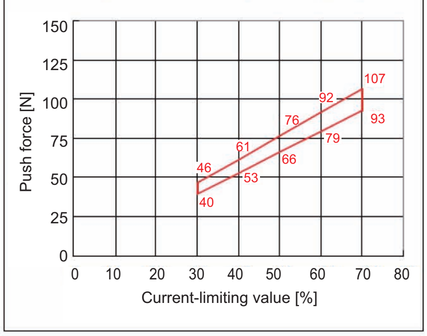
RA7C Lead 8

[RA7C Lead 8 Pressing Force Specification Value]



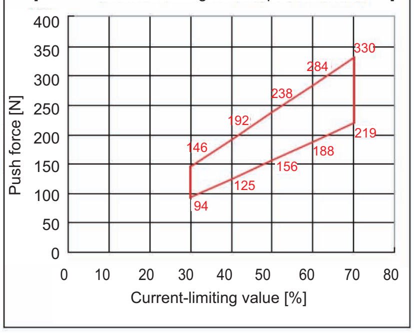
RA6C Lead 12

[RA6C Lead 12 Pressing Force Specification Value]



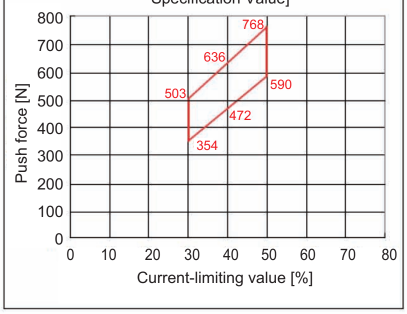
RA7C Lead 12

[RA7C Lead 12 Pressing Force Specification Value]



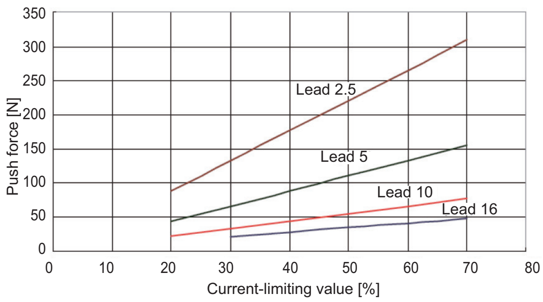
RA6C Lead 3 (High-Thrust Type : 42SP)

[RA6C Lead 3 High-Thrust Pressing Force Specification Value]

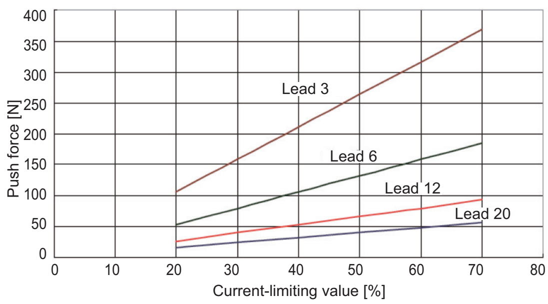


RCP5 Series Slider Type

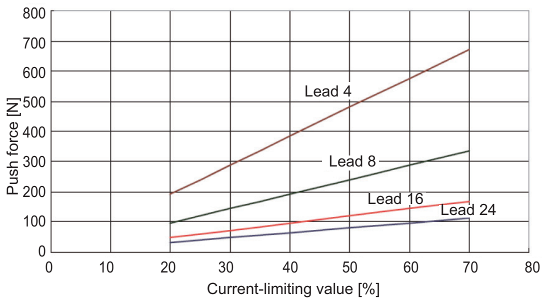
SA4C Type



SA6C Type

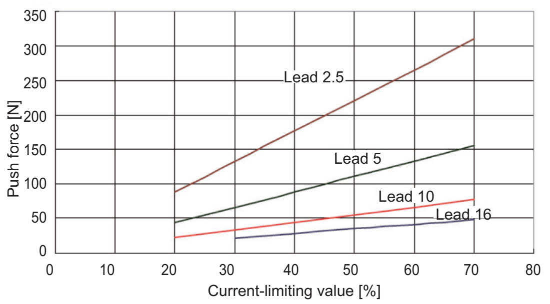


SA7C Type

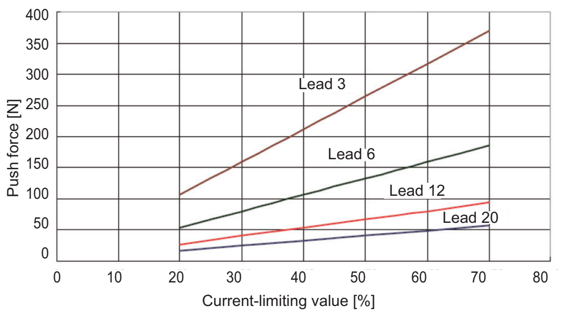


RCP5 Series Rod Type

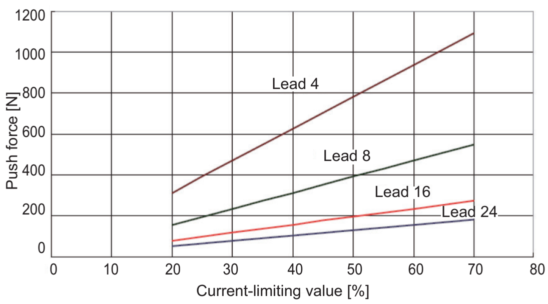
RA4C Type



RA6C Type



RA7C Type



Chapter 8 Warranty

8.1 Warranty Period

One of the following periods, whichever is shorter:
- 18 months after shipment from our company
- 12 months after delivery to the specified location

8.2 Scope of the Warranty

Our products are covered by warranty when all of the following conditions are met. Faulty products covered by warranty will be replaced or repaired free of charge:

(1) The breakdown or problem in question pertains to our product as delivered by us or our authorized dealer.

(2) The breakdown or problem in question occurred during the warranty period.

(3) The breakdown or problem in question occurred while the product was in use for an appropriate purpose under the conditions and environment of use specified in the operation manual and catalog.

(4) The breakdown of problem in question was caused by a specification defect or problem, or by a quality issue with our product.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:

[1] Anything other than our product
[2] Modification or repair performed by a party other than us (unless we have approved such modification or repair)
[3] Anything that could not be easily predicted with the level of science and technology available at the time of shipment from our company
[4] A natural disaster, man-made disaster, incident or accident for which we are not liable
[5] Natural fading of paint or other symptoms of aging
[6] Wear, depletion or other expected result of use
[7] Operation noise, vibration or other subjective sensation not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

8.3 Honoring the Warranty

As a rule, the product must be brought to us for repair under warranty.

8.4 Limited Liability

(1) We shall assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
(2) We shall not be liable for any program or control method created by the customer to operate our product or for the result of such program or control method.

8.5 Conditions of Conformance with Applicable Standards/Regulations, Etc., and Applications

(1) If our product is combined with another product or any system, device, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc. In such a case we will not be liable for the conformance of our product with the applicable standards, etc.

(2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications. Contact us if you must use our product for any of these applications:

[1] Medical equipment pertaining to maintenance or management of human life or health
[2] A mechanism or mechanical equipment intended to move or transport people (such as a vehicle, railway facility or aviation facility)
[3] Important safety parts of mechanical equipment (such as safety devices)
[4] Equipment used to handle cultural assets, art or other irreplaceable items

(3) Contact us at the earliest opportunity if our product is to be used in any condition or environment that differs from what is specified in the catalog or operation manual.

8.6 Other Items Excluded from Warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

[1] Guidance for installation/adjustment and witnessing of test operation
[2] Maintenance and inspection
[3] Technical guidance and education on operating/wiring methods, etc.
[4] Technical guidance and education on programming and other items related to programs

Change History

Revision Date	Revision Description
2012.02	First Edition
2012.03	Second Edition Note corrected
2012.04	Third Edition Complied with CompoNet, MECHATROLINK, EtherCAT and EtherNet/IP.
2012.10	Fourth Edition Command availability in MECHATROLINK added and corrections made
2013.11	Fifth Edition Complied with UL, explanation added in section of International Standards Compliances
2014.01	Sixth Edition LC Type and high output driver added
2014.03	Edition 6B Note corrected
2014.05	Edition 6C Description revised for control current
2014.07	Seventh Edition PROFINET-IO Type added
2015.01	Edition 7C P29 Omron master unit model coded deleted P260 Driver board replacement procedure added P274~ RCP5 etc. added in connectable actuator specifications list

Manual No.: ME0299-7C (January 2015)

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