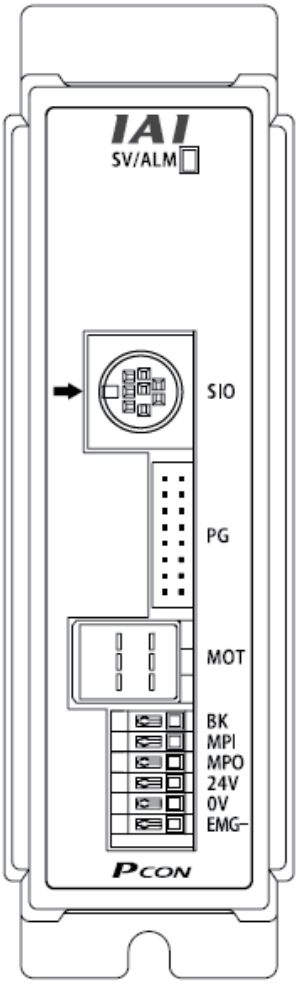
PCON

PCON-SE Controller
Serial Communication Type

Operation Manual Sixteenth Edition



IAI America Inc.

Please Read Before Use

Thank you for purchasing our product.

This Operation Manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.
The CD or DVD that comes with the product contains operation manuals for IAI products.
When using the product, refer to the necessary portions of the applicable operation manual by printing them out or displaying them on a PC.

After reading the Operation Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This Operation Manual is original.
- The product cannot be operated in any way unless expressly specified in this Operation Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Operation 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.
- Using or copying all or part of this Operation Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

PCON	CAUTION

1. Use Environment

ACON controllers can be used in an environment of pollution degree 2 or equivalent.

2. Models of Teaching Pendants and PC Software

New functions have been added to the whole PCON Controller Series.
Since the communication protocol is accordingly changed to the general Modbus method (compatible), the PC software and teaching pendants used in conventional RCP2 controllers are not compatible.
When using this controller, prepare the following models:

	Model	Remark
PC software (with RS232C-compatible cables)	RCM-101-MW	Can also be connected to conventional RCP2 controllers
PC software (with USB-compatible communication cables)	RCM-101-USB	
Teaching pendant	RCM-T, RCM-TD	
Simple teaching pendant	RCM-E	
Data setter	RCM-P	

3. Recommendation for Backing Up Latest Data

This product uses nonvolatile memory to store t he position table and parameters. Normally the memory will retain the stored data even after the power is disconnected. However, the data may be lost if the nonvolatile memory becomes faulty.
We strongly recommend that the latest position table and parameter data be backed up so that the data can be restored quickly when the controller must be replaced for a given reason.
The data can be backed up using the following methods:

[1] Save to a storage medium such as a hard disk using PC software.
[2] Create a position table sheet or parameter sheet and keep a written record of backup.

4. Using a Rotary Actuator in the Multi-rotation Specification

Rotary actuators that support the multi-rotation specification let you specify multi-rotation operation or limited-rotation operation.

4.1 Notes

Pay attention to the setting of the PIO pattern parameter for the controllers listed below.
On the following types of controllers, relative coordinate specification cannot be used in the PIO patterns specified:

[1] PCON-C/CG: PIO pattern = 5 (User parameter No. 25)
[2] PCON-CY: PIO pattern = 0 (User parameter No. 25)

4.2 Applicable Models

Actuator	RCP2-RTBL-I-28P-20-360*	Controller	PCON-C-28PI-*
	RCP2-RTBL-I-28P-30-360*		PCON-CG-28PI-*
	RCP2-RTCL-I-28P-20-360*		PCON-CY-28PI-*
	RCP2-RTCL-I-28P-30-360*		PCON-SE-28PI-*

5. Examples of Modbus Protocol

You can download the manual containing examples of using the Modbus protocol from the manual download page of IAI’ s website:

http://www.iai-robot.co.jp/download/index.html

If you are interested in the brochure, please contact your IAI sales representative.

CE Marking

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

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 operation 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 Operation 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 operation 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 Operation 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

1. Overview

1.1 Introduction

The PCON Series controllers are specifically designed for the RCP2, RCP3 actuators, and adopt new functions to further enhance convenience and safety by reducing the size and cost while following the functions of the RCP2 controller.
In addition, the power-saving considered function has been adopted, with awareness of energy conservation raised.

Among the PCON series controllers, this product is designed to operate the actuator via position number specification or direct numeric specification by means of serial communication.
The serial communication system can support the following two patterns as the serial communication system:

[1] The product can be used under the field network (DeviceNet, CC-Link, Profibus) such as a host PLC as the gateway unit.
[2] RS-232C serial communication is available with a PC or PLC using the SIO converter.

Before using this product, read this document together with the operation manual for your gateway unit and serial communication operation manual for your ROBO Cylinder series.
When actually starting the equipment or a failure occurs, refer to the operating manuals of the actuator, teaching pendant, PC software and other devices in addition to this document.

This Operation Manual does not completely cover all items other than normal operations or unexpected phenomena such as complicated signal changes by critical timing.
Therefore, interpret any items not covered by this manual as “impossible to do” in principle.

* We have made every effort to ensure precision of the information provided in this manual. Should you find an error, however, or if you have any comments, please contact IAI.
Keep this manual in a convenient place so it can be reread when necessary.

1.2 Main Features and Functions

(1) Control signals are input/output via serial communication RS485 (compatible with Modbus protocol).

(2) Positioning points: 64

(3) Setting of zone output boundary values
The zone output boundary values were previously fixedly set with parameters. Convenience has been enhanced since they can now be set in the position table (only in the operation by position number specification).
It can be used for the prevention of interference with peripheral equipment or reduction of tact time.

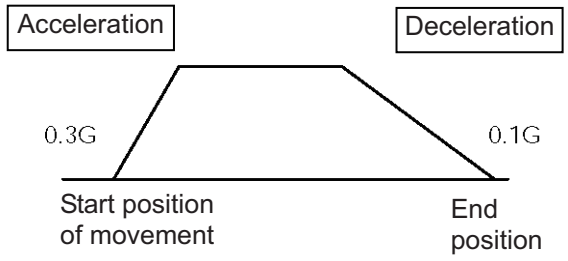
(4) Separate setting of acceleration and deceleration (only in the operation by position number specification)
The acceleration and deceleration can separately be set in the position table.
When you do not want to give impact or vibration during stop due to the material or shape of transferred work, gradual deceleration becomes available by reducing deceleration only.

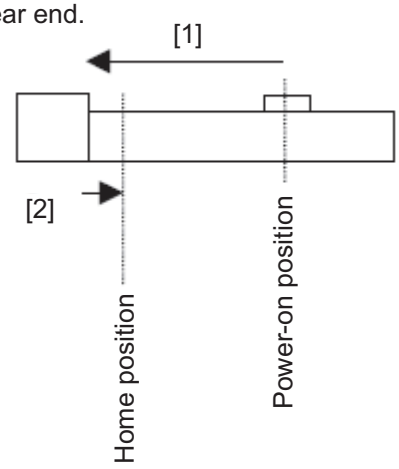
(5) Limitation of movement speed during trial run adjustment
The movement speed during trial run adjustment can be limited in terms of ensuring safety.

(6) Power-saving measure
In general, pulse motors require a higher holding current at standstill compared to AC servo motors. Accordingly, the power-saving mode can be utilized with pulse motors if they are used in applications where the actuator waits for a long time.

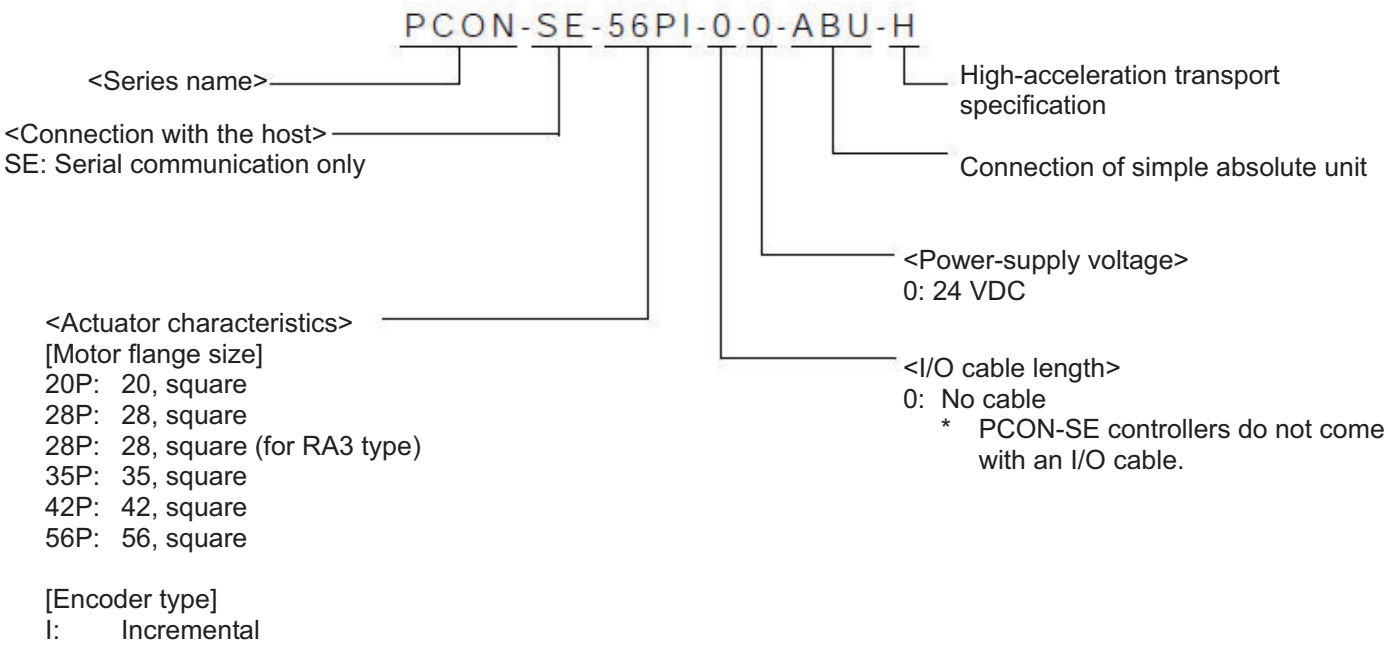
1.3 Differences from Air Cylinders in Control Functions

For those of you who have been using air cylinders and have never used motorized cylinders before, this section gives a brief explanation of how this controller is different from air cylinders.
Read the following information and implement controls appropriate for your system.

<table>
<tr><th>Item</th><th>Air cylinder</th><th>PCON-SE</th></tr>
<tr><td>Drive method</td><td>Air pressure by solenoid valve control.</td><td>Ball screw or timing belt drive using a pulse motor.</td></tr>
<tr><td>Target position setting</td><td>Mechanical stopper (including shock absorber).</td><td>[1] Position number specification mode
Entry of a coordinate value in the “Position” field of the position table.
A value can be entered by keying in a number from a PC/teaching pendant, or by moving the actuator to a desired position and then reading the achieved position directly.
Example) Example of entry of “400 mm” stroke
<table><tr><th>Position No.</th><th>Position</th></tr><tr><td>0</td><td>5 (mm)</td></tr><tr><td>1</td><td>400 (mm)</td></tr><tr><td>2</td><td>200 (mm)</td></tr></table>[2] Numeric specification mode Direct numerical specification</td></tr>
<tr><td>Target position detection</td><td>Installation of a reed switch or other external detection sensor.</td><td>Judgment based on internal coordinates determined by the position information received from the position detector (encoder).
No external detection sensor is required.</td></tr>
<tr><td>Speed setting</td><td>Adjustment by a speed controller.</td><td>[1] Entry of a feed speed in the “Speed” field of the position table (unit: mm/sec).
Note that the rated speed is set automatically as the default feed speed.
[2] Direct numeric specification</td></tr>
<tr><td>Acceleration/ deceleration setting</td><td>In accordance with the load, air supply volume, and speed controller/solenoid valve performance.</td><td>[1] Entry in the “Acceleration” and “Deceleration” fields of the position table (minimum setting unit: 0.01 G).
Reference: 1 G = Gravitational acceleration
Note that the rated acceleration and deceleration are set automatically as the default acceleration and deceleration.
[2] Direct numeric specification
Desired values can be set in fine steps to achieve gradual acceleration/deceleration curves.
 
The greater the set value, the steeper the curve becomes. On the other hand, the smaller the set value, the more gradual the curve becomes.</td></tr>
</table>

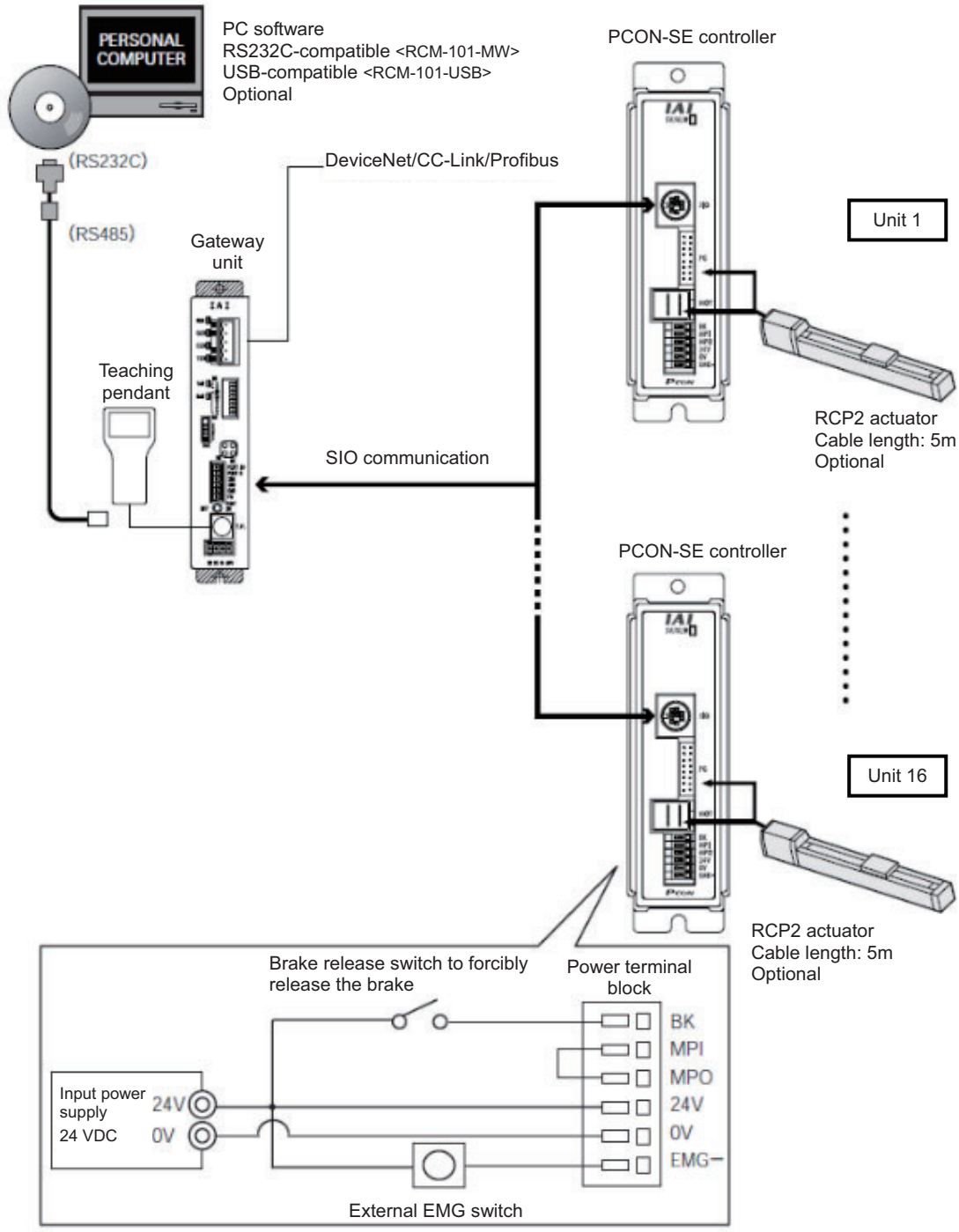
Item	Air cylinder	PCON-SE
Position check upon power on	Judgment using a reed switch or other external detection sensor.	When the power is turned on, mechanical coordinates are not stored in the controller and thus the current position is not yet determined. For this reason, a rear end move command must be executed after the power has been turned on, in order to establish coordinates. The actuator performs homing first, and then moves to the rear end.  [1] The actuator moves toward the mechanical end on the motor side at the homing speed. [2] The actuator contacts the mechanical end, reverses its direction, and stops temporarily at the home position. (Note) Make sure there is no obstacle along the homing path.

1.4 Model Number



1.5 System Configuration

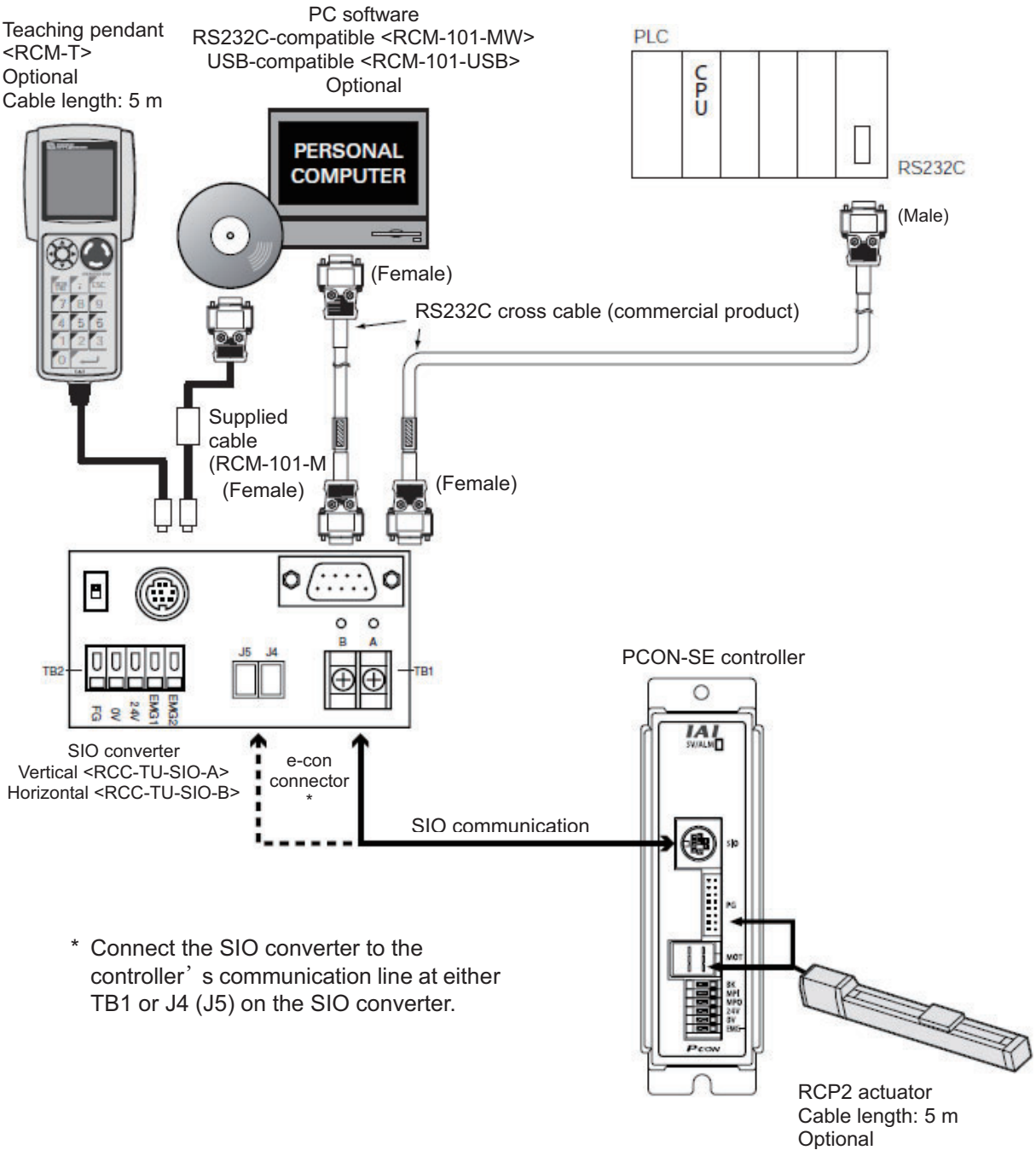
(1) When the gateway unit is used (supporting field network)



Caution: (1) If the actuator is not equipped with a brake, it is not required to connect the BK terminal. (2) Make the 0V of the gateway unit power supply and PCON-SE power supply in common.

(2) When the SIO converter is used (RS232C serial communication)

Connect the teaching pendant, PC or PLC using the SIO converter (RS232C/RS485 conversion) as shown below.



* Connect the SIO converter to the controller's communication line at either TB1 or J4 (J5) on the SIO converter.

⚠ Caution: Do not connect an equipment to the mini DIN connector and D-sub connector at the same time.
If an equipment is connected to both connectors at the same time, a communication error (message level) will generate.

1.6 Procedure from Unpacking to Trial Run Adjustment

When using this product for the first time, pursue work while paying attention to avoid check omission and incorrect wiring by referring to the procedure below.

1. Check of Packed Items

Should there be any incorrect model or insufficient item, contact your dealer.

- Controller PCON-SE
- Actuator
- Communication cable
- Motor cable CB-RCP2-MA***
- Encoder cable CB-RCP2-PA***
- Operation Manual

<Option>

- Teaching pendant
  RCM-T (standard)
  RCM-E (simple)
  RCM-P (data setting)
- PC software
  RS232C-compatible <RCM-101-MW>
  USB-compatible <RCM-101-USB>
  (including provided cables)

2. Installation

[1] After fixing the actuator, install the robot hand. → Refer to the operation manual on the applicable actuator.
[2] Install the controller. → 3. Installation and Wiring

3. Wiring and Connection

- Wiring of the 24 V power supply
- Wiring of the brake release switch to forcibly release the brake (when the actuator is equipped with a brake)
- Earth grounding
- Wiring of the emergency stop circuit and motor drive power supply
- Connection of the motor cable and encoder cable
- Connection of communication cable

4. Power Supply and Alarm Check

After confirming that the emergency stop circuit is not activated, supply the 24 V power.
The controller is normal if the monitor LED [SV/ALM] on the front panel of the controller illuminates in orange for the first 2 seconds and then changes to a steady green light.
If the [SV/ALM] illuminates in red, an alarm will be generated.
After connecting the PC or teaching pendant, check the alarm description and remove the cause by referring to “7. Troubleshooting.”

5. Check of Servo ON Condition

Confirm that the slider or rod is not contacting the mechanical end.
If the slider or rod is contacting the mechanical end, move it away in the opposite direction.
If the actuator is equipped with a brake, move the slider/rod after turning ON the brake release switch to forcibly release the brake. At this time, exercise caution not to allow work to drop suddenly due to its own weight. Your hand may be caught by the dropped work or the robot hand or work itself may be damaged.
It is normal if the actuator achieves servo lock and the monitor LED [SV/ALM] on the front of the controller illuminates in green.

6. Safety Speed Setting

The safety speed has been set to 100 mm/s at the time of shipment.
Change it if necessary. (Limited to 250 mm/s or less)

→ 5. Parameter Settings

7. Target Position Setting

Set desired positions in the [Position] field of the position table by using the teaching pendant or PC, or set numeric values directly.

* If you move the actuator without setting desired positions, the message “No movement data” will be displayed.
  Determine target positions while fine adjusting the transferred work and robot hand.
* Once the target positions have been set, default values are automatically set to the other items (speed, acceleration/deceleration, positioning band, etc.).

→ 4.1 Description of Position Table

8. Operational Check of Safety Circuit

Confirm that the drive signal shutdown circuit (or motor drive power shutoff circuit) normally operates.

→ 3. Installation and Wiring

9. Trial Run Adjustment

Input a movement command from PLC for positioning.
At this time, perform the following fine adjustments if necessary:

- If vibration or abnormal sound occurs due to the weight, material or shape of transferred work, reduce the speed, acceleration or deceleration.
- Prevention of interference with peripheral equipment, review of the boundary value of the zone output signal and positioning band to reduce tact time
- Selection of the optimum values for the current-limiting value, evaluation time and push speed during push & hold operation

→ 4.1 Description of Position Table

1.7 Warranty

1.7.1 Warranty Period

One of the following periods, whichever is shorter:

- 18 months after shipment from our factory
- 12 months after delivery to a specified location

1.7.2 Scope of 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 or problem in question was caused by a specification defect or problem, or by the poor quality of 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.

1.7.3 Honoring the Warranty

As a rule, the product must be brought to us for repair under warranty.

1.7.4 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.

1.7.5 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.

1.7.6 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:

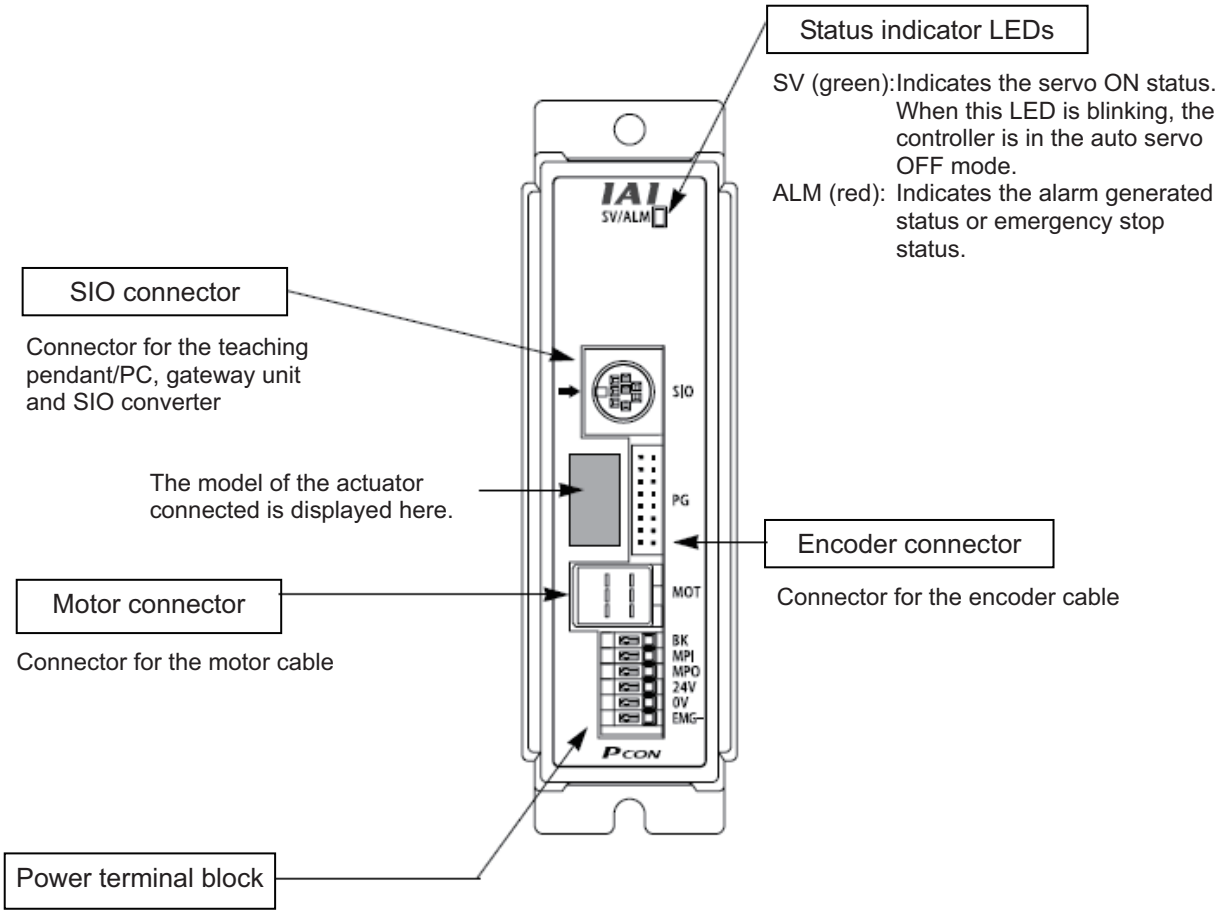
[1] Guidance for installation/adjustment and witnessing of test operation
[2] Maintenance and inspection
[3] Technical guidance and education on operating/wiring methods, etc.
[4] Technical guidance and education on programming and other items related to programs

2. Specifications

2.1 Basic Specifications

Specification item		Description
Model		PCON-SE
Number of controlled axes		1 axis per unit
Power-supply voltage		24 VDC ± 10%
Power-supply capacity		2 A max.
Control method		Field-weakening vector control (patent pending)
Encoder resolution		800 Pulse/rev
Positioning command		Position no. specification, numerical specification, simple direct value/position no. specification
Backup memory		Position table data and parameters are saved in nonvolatile memory. Serial EEPROM can be rewritten 100,000 times.
Positioner operation		Maximum 64 points
LED indicator		SV (green): Servo ON state, ALM (red): Alarm state
Serial communication		RS485 1 channel
Communication protocol		Modbus/RTU, Modbus/ASCII
Encoder interface		Incremental specification conforming to EIA RS-422A/423A
Forced release of electromagnetic brake		24 V applied to BK terminal on terminal block
Cable length		Actuator cable: 20 m or less
		Communication cable: Total cable length 100 m or less
Dielectric strength		500 VDC, 10 mΩ
Environment	Surrounding air temperature	0 to 40°C
	Surrounding humidity	85%RH or less (non-condensing)
	Surrounding environment	Refer to 3.1 Installation Environment
	Surrounding storage temperature	-10 to 65°C
	Surrounding storage humidity	90%RH or less (non-condensing)
	Vibration resistance	10 to 57 Hz in XYZ directions, Pulsating amplitude: 0.035 mm (continuous), 0.075 mm (intermittent)
Protection class		Air cooling without blower (IP20)
Weight		128 g or less
External dimensions		35 W × 120 H × 68 D mm

2.2 Name and Function of Each Part of the Controller



BK	Terminal for connecting the brake release switch to forcibly release the brake when the actuator is used with a brake option. Connect the opposite side of the switch to 24 V.
MPI, MPO	A contact for cutting off motor drive power supply with safety category 1 or equivalent considered. MPI and MPO represent the input side and output side of the motor power supply, respectively. (Short these terminals using a jumper wire if not used. The controller is shipped with MPI and MPO shorted.)
24 V	Positive side of the 24 VDC input power supply
0V	0V side of the 24 VDC input power supply
EMG–	Terminal for connecting the emergency stop circuit (motor drive signal shutdown). With the grounding common, connect the opposite side of the emergency stop switch (or contact) to the negative side of the 24 VDC input power supply.

■ Notation of the actuator type connected

The type name, ball screw lead length, and stroke of the actuator are indicated. Before connecting cables, confirm that the actuator is an appropriate one.

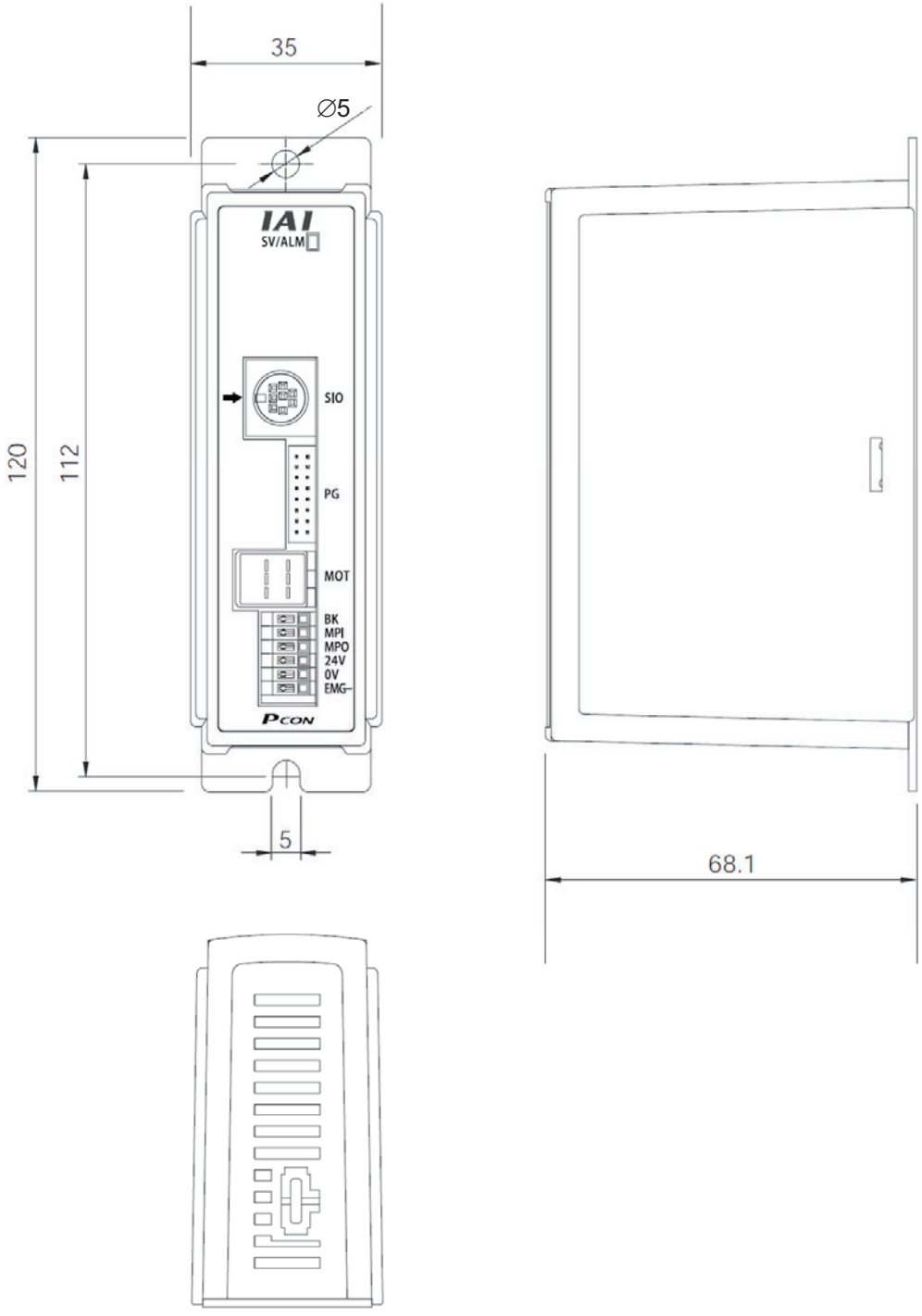
Notation example:

RA4C ← Indicates the actuator type is RA4C.
L: 5mm ← Indicates the ball screw lead length is 5mm.
ST: 200 ← Indicates the stroke is 200 mm.

MEMO

2.3 External Dimensions

An external view and dimensions of the product are shown below.

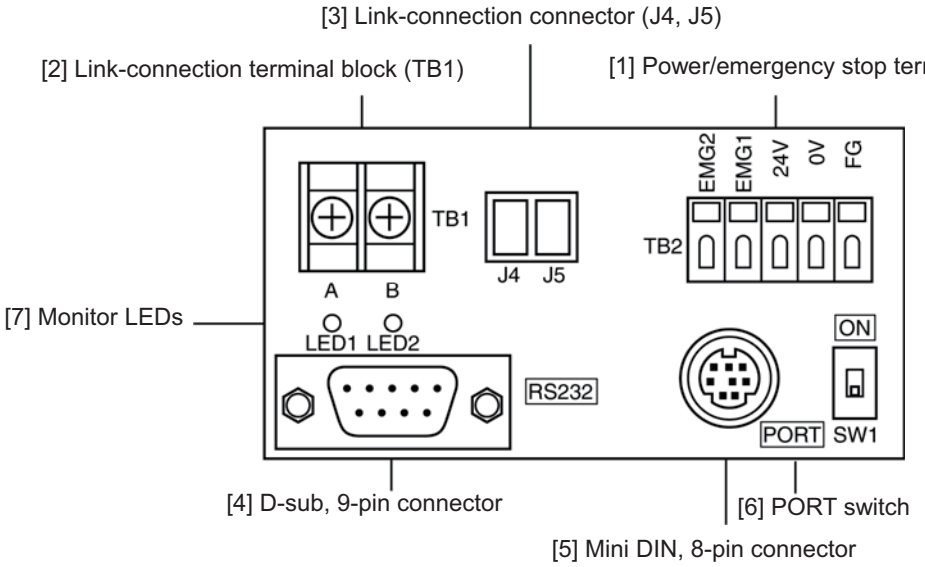


2.4 SIO Converter (Option)

Model: RCB-TU-SIO-A (vertical installation)
RCB-TU-SIO-B (horizontal installation)

This unit is a RS232C-RS485 converter.
If multiple controllers are linked, you can connect a teaching pendant to the mini DIN, 8-pin connector to move, or edit parameters, for all axes.

- Description of Functions



[1] Power/emergency stop terminal block (TB2)

EMG1, EMG2	Provide a contact output for the emergency-stop switch on the teaching pendant (RCM-T/E). EMG1 and EMG2 connect to the emergency-stop switch on the teaching pendant when the PORT switch is ON, or are shorted when the PORT switch is OFF. These terminals comprise an interlock with a safety circuit provided by the user.
24 V	Positive side of the 24 V power supply (power supply for the teaching pendant and conversion circuit, power consumption: 0.1A or less)
0V	Negative side of the 24 V power supply
FG	FG of the 24 V power supply

[2] Link-connection terminal block (TB1)

A connection port for linking the controller.
“A” on the left side connects to SGA (line color: orange/red 1) of the relay cable.
“B” on the right side connects to SGB (line color: orange/black 1) of the relay cable.
(Note) Be sure to use twisted pair wires for the above two connections (SGA/SGB).

[3] Link-connection connector (J4, J5)

An e-con connection port for linking the controller. The optional link cable (CB-RCB-CTL002) can be connected to this port directly. However, J4 and J5 allow only two-axis connection. When connecting three or more axes, use the terminal block of [2].

[4] D-sub, 9-pin connector (RS232C)
A connection port with the PLC's communication module. A PC can also be connected to this port. For the communication cable, use the RS232C cross cable specified below.

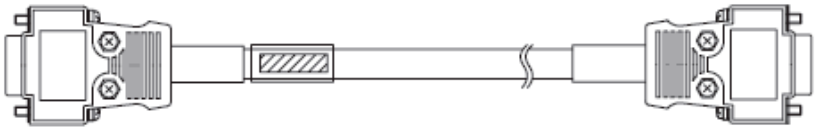
[5] Mini DIN, 8-pin connector (RS485)
A connection port with the teaching pendant or PC. For the communication cable, use the cable (with RS232C/RS485 converter) supplied with the PC software (RCM-101-MW).

[6] PORT switch
A switch for enabling/disabling the mini DIN connector. Set the switch to ON when an equipment is connected to the mini DIN connector, or OFF when no equipment is connected.

[7] Monitor LEDs
LED1 --- This LED illuminates while the controller is sending data.
LED2 --- This LED illuminates while the RS232 is sending data.

(Reference) Connection diagram of RS232C cross cable (commercial product)

SIO converter end PC end



D-sub, 9-pin female connector

Signal	No.
	1
RD	2
SD	3
DTR	4
SG	5
DSR	6
RS	7
CS	8
	9

D-sub, 9-pin connector

No.	Signal
1	
2	RD
3	SD
4	DTR
5	SG
6	DSR
7	RS
8	CS
9	

(Female if a PC is connected, or male if a PLC is connected)

3. Installation and Wiring

Pay sufficient attention to the installation environment of the controller.

3.1 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)

[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 3.3 Noise Elimination and Grounding]

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.

3.2 Power Supply

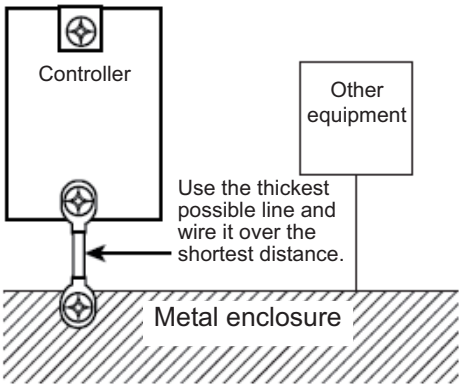
The power supply specification is 24 VDC ± 10%.
(Maximum power capacity: 2 A)

3.3 Noise Elimination and Grounding

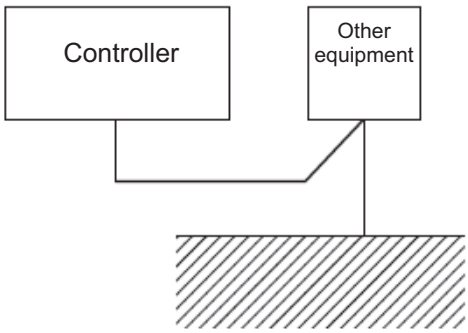
This section explains how to eliminate noise in the use of the controller.

(1) Wiring and power supply

[1] As for grounding, provide a dedicated class D grounding (former class 3 grounding). The grounding cable shall have a size of 2.0 ~ 5.5 mm^2 or larger.



Class D grounding
(Former class 3 grounding: Grounding resistance of 100 Ω or less)



Avoid using this method.

[2] Precautions regarding wiring method

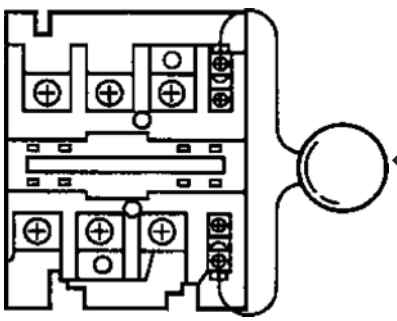
Use a twisted cable for connection to the 24 VDC external power supply.
Separate the controller cables from high-power lines such as a cable connecting to a power circuit. (Do not bundle together the controller cables with high-power lines or place them in the same cable duct.)
If you wish to extend the motor wiring or encoder wiring beyond the length of each cable supplied with the controller, consult IAI's Engineering Service or Sales Engineering Section.

(2) Noise sources and elimination

Among the numerous noise sources, solenoid valves, magnet switches and relays are of particular concern when building a system. Noise from these sources can be eliminated by implementing the measures specified below.

AC solenoid valves, magnet switches and relays

Action --- Install a surge absorber in parallel with the coil.

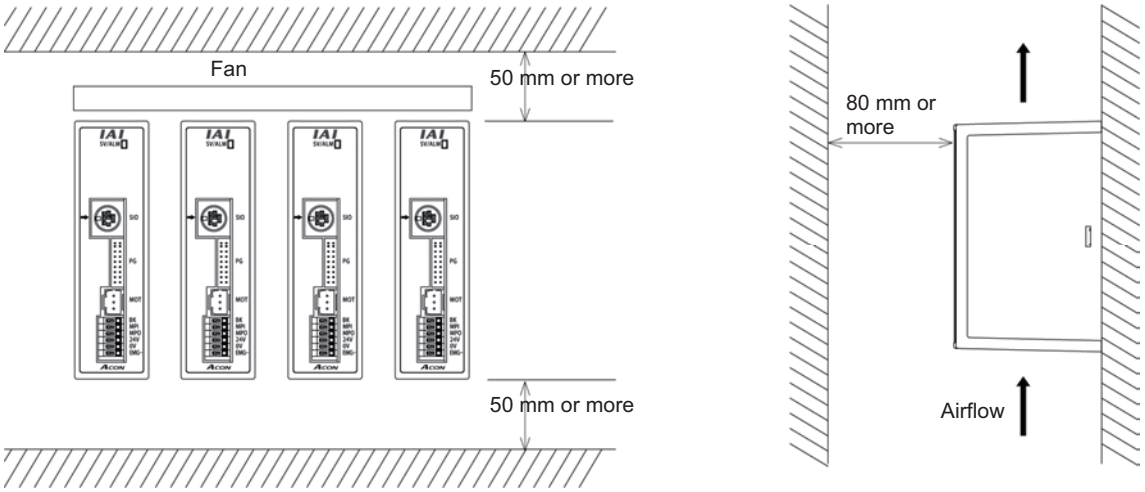


← Point

Install a surge absorber to each coil over a minimum wiring length. Installing a surge absorber to the terminal block or other part will be less effective because of a longer distance from the coil.

3.4 Heat Radiation and Installation

Design the control panel size, controller layout and cooling method in such a way that the temperature around the controller will not exceed 40°C.
Install the controller vertically on a wall, as shown below. Since cooling is provided by way of natural convection, always observe this installation direction and provide a minimum clearance of 50 mm above and below the controller to ensure sufficient natural airflows.
When installing multiple controllers side by side, providing a ventilation fan or fans above the controllers will help maintain a uniform temperature around the controllers.
Keep the front panel of the controller away from the wall (enclosure) by at least 80 mm.

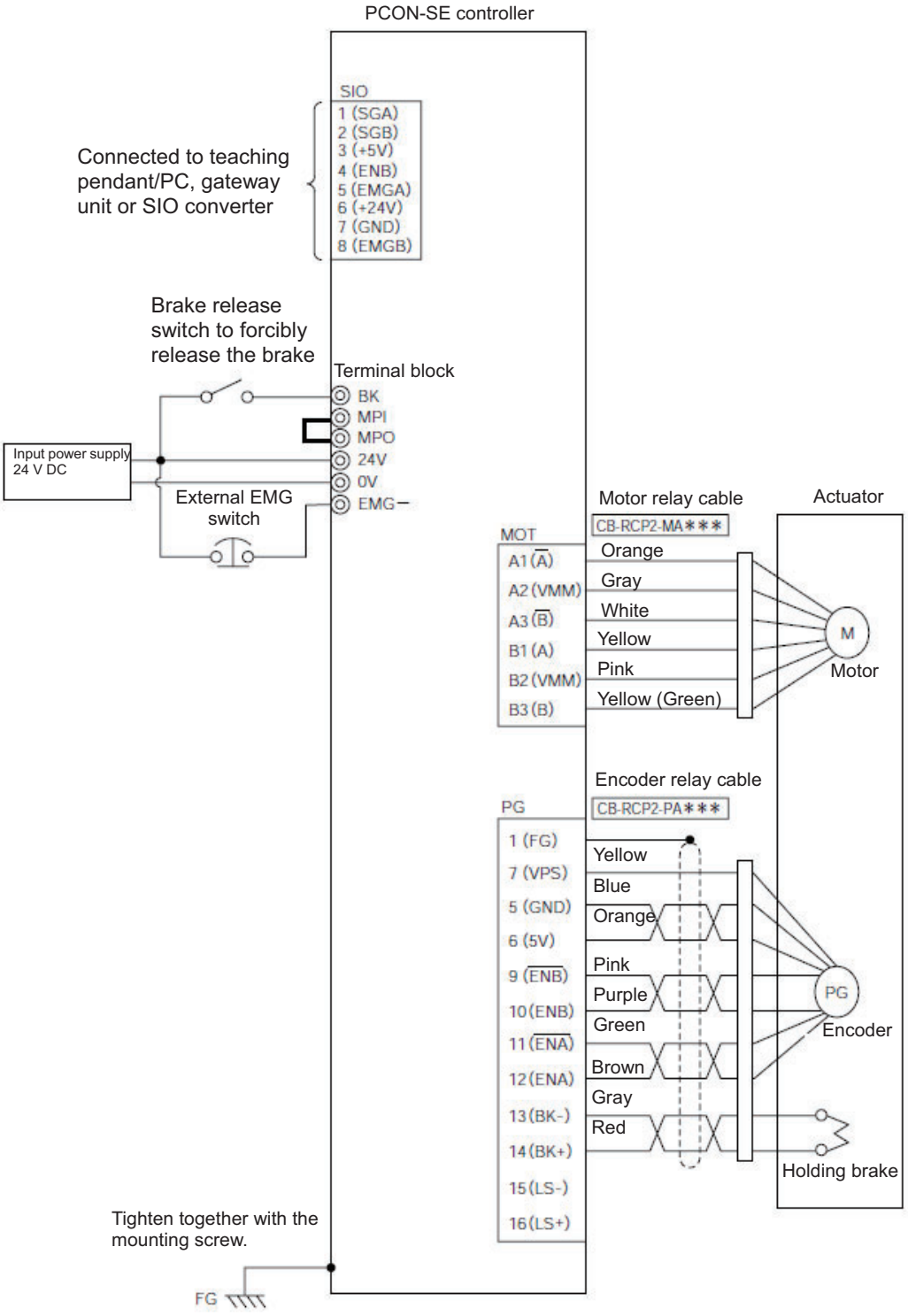


Regardless of whether your system consists of a single controller or multiple controllers, provide sufficient clearance around each controller so that it can be installed/removed easily.

3.5 External Connection Diagram

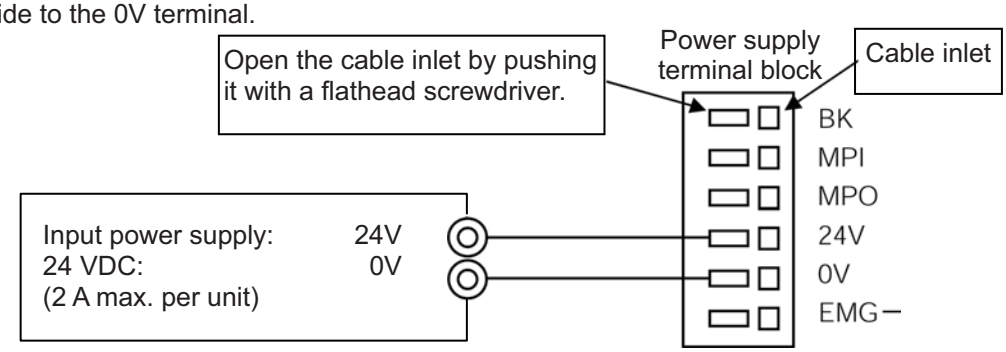
An example of standard wiring is shown below.

(Note) When encoder relay cables are of the robot cable specification, the line colors will be different, refer to “3.9.2 Encoder Relay Cables.”

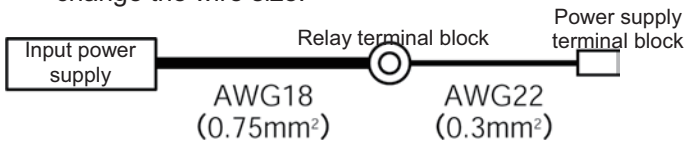
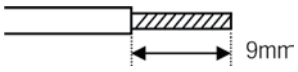


3.6 Wiring the Power Supply

Connect the +24 V side of the 24 VDC power supply to the 24 V terminal on the power supply terminal block and the 0V side to the 0V terminal.

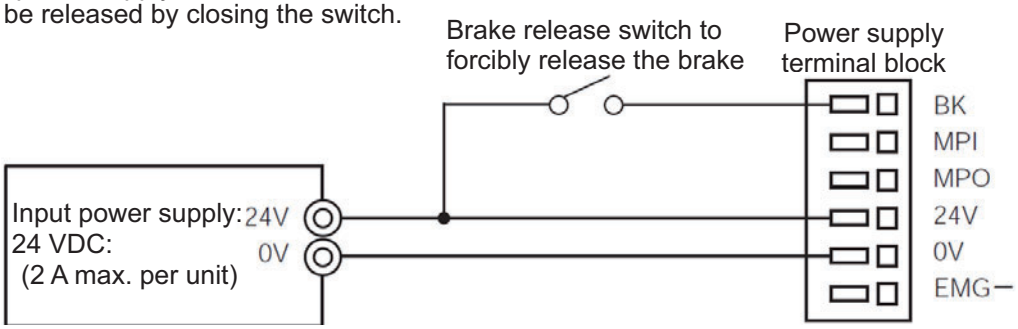


Use a power cable satisfying the following specifications:

Item	Description
Applicable wire	Twisted wire: AWG size 22 (0.3 mm^2) (copper wire) (Note) Pay attention to terminal treatment to avoid a short circuit resulting from chips. If the wire path is long, install a relay terminal block and change the wire size. 
Isolation sheath temperature rating	60°C or more
Stripped wire length	

3.7 Wiring the Brake Release Switch to Forcibly Release the Brake

If the actuator is equipped with a brake, install the brake release switch for resetting at startup adjustment or in an emergency.
The switch (24 VDC, contact capacity 0.2 A or more) must be prepared by the customer.
Connect one side of the switch to the positive side of the 24 VDC power supply and the other side to the BK terminal on the power supply terminal block.
The brake will be released by closing the switch.



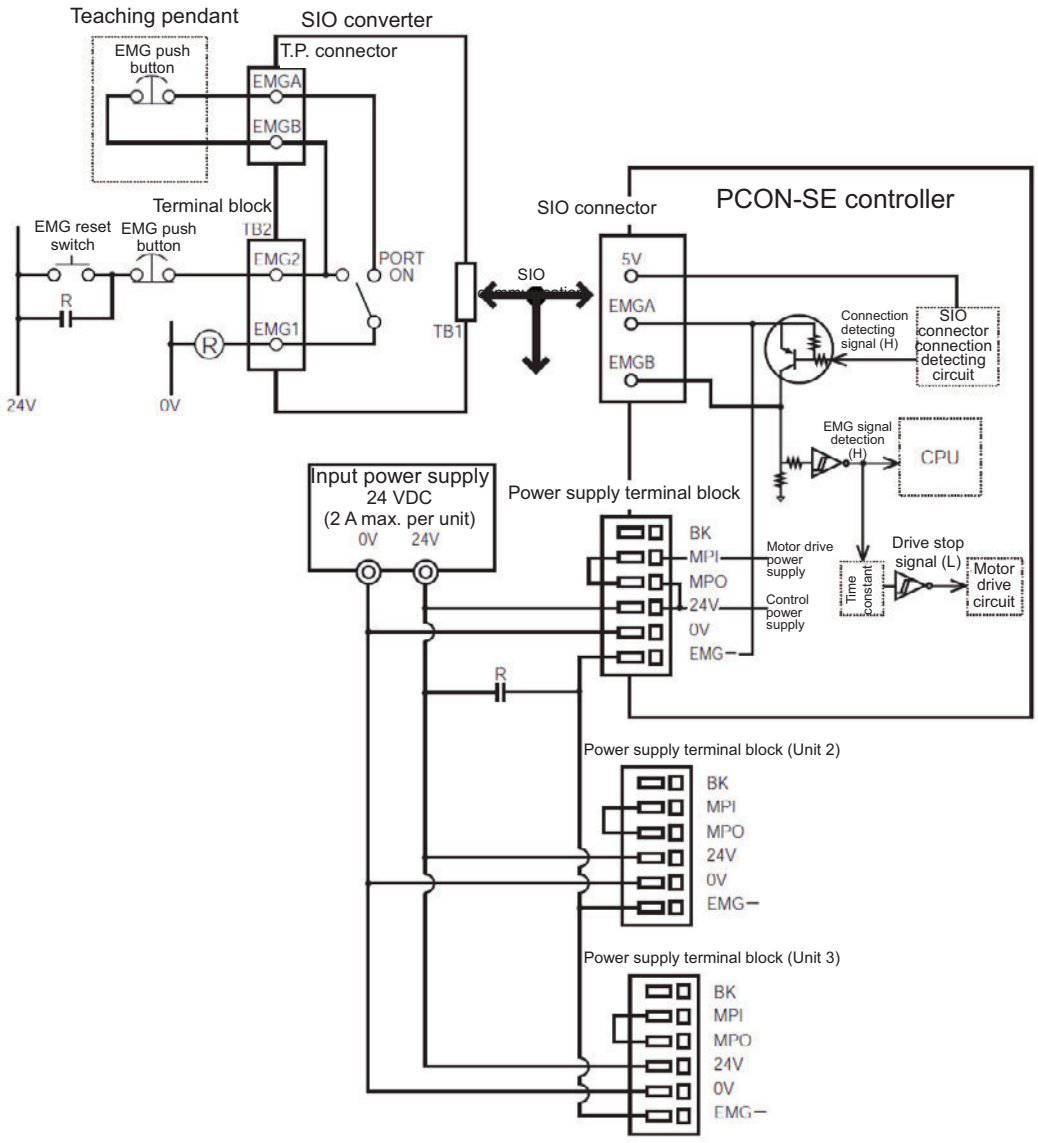
⚠ Danger: In the case of a vertical axis, release the brake while exercising caution to avoid hands from being caught and the robot hand or work from being damaged due to a sudden drop.

3.8 Wiring the Emergency Stop Circuit

3.8.1 Drive Signal Shutdown (Standard)

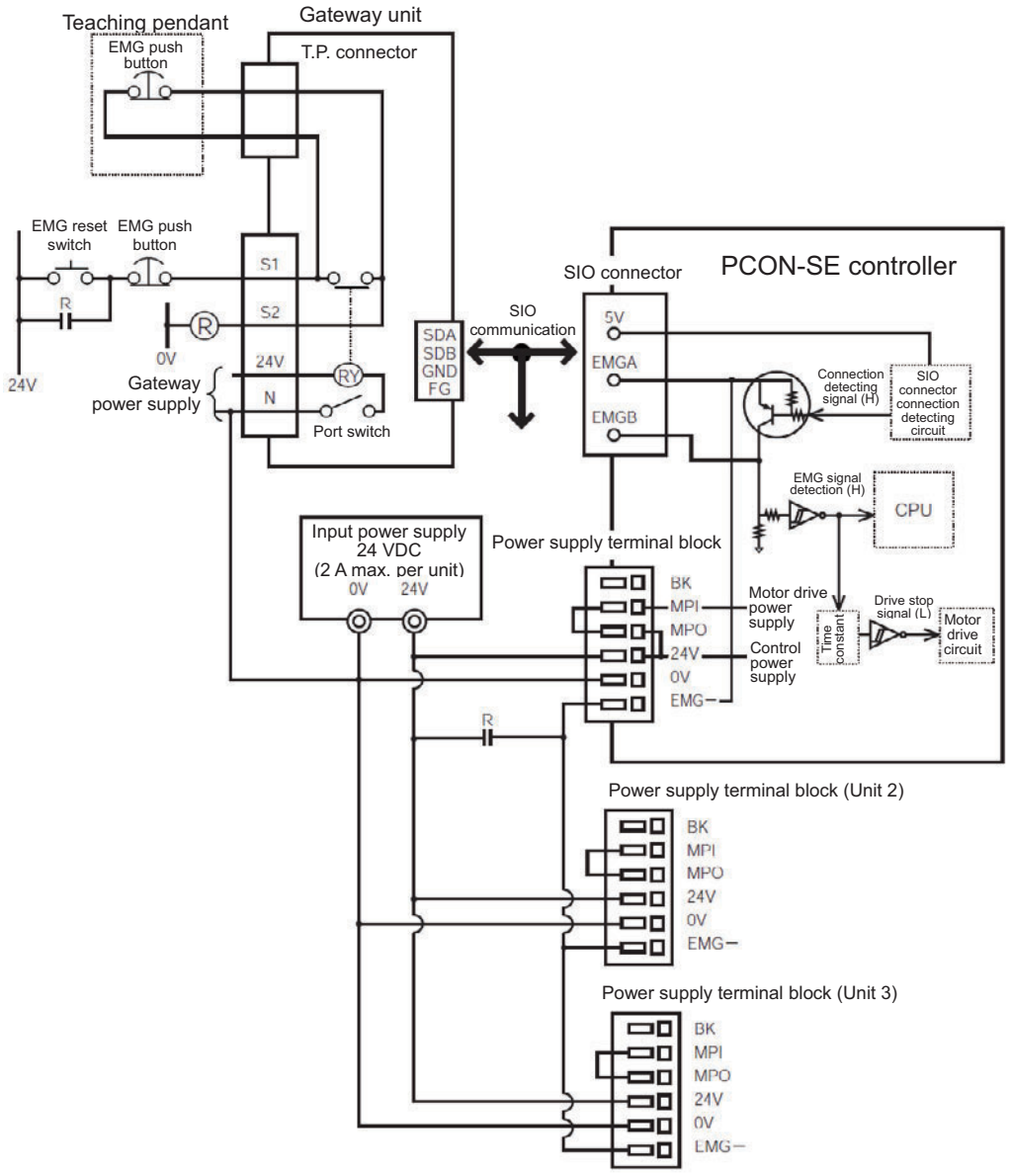
The motor drive is stopped by the controller internal circuit.
The motor drive power supply is not shut off.

(1) When the SIO converter is used



⚠ Caution: The input current to the EMG terminal of PCON-SE is 5 mA. When connecting the contact of the EMG relay R to the EMG terminals of multiple controllers, check the current capacity of the relay contact.

(2) When the gateway unit is used



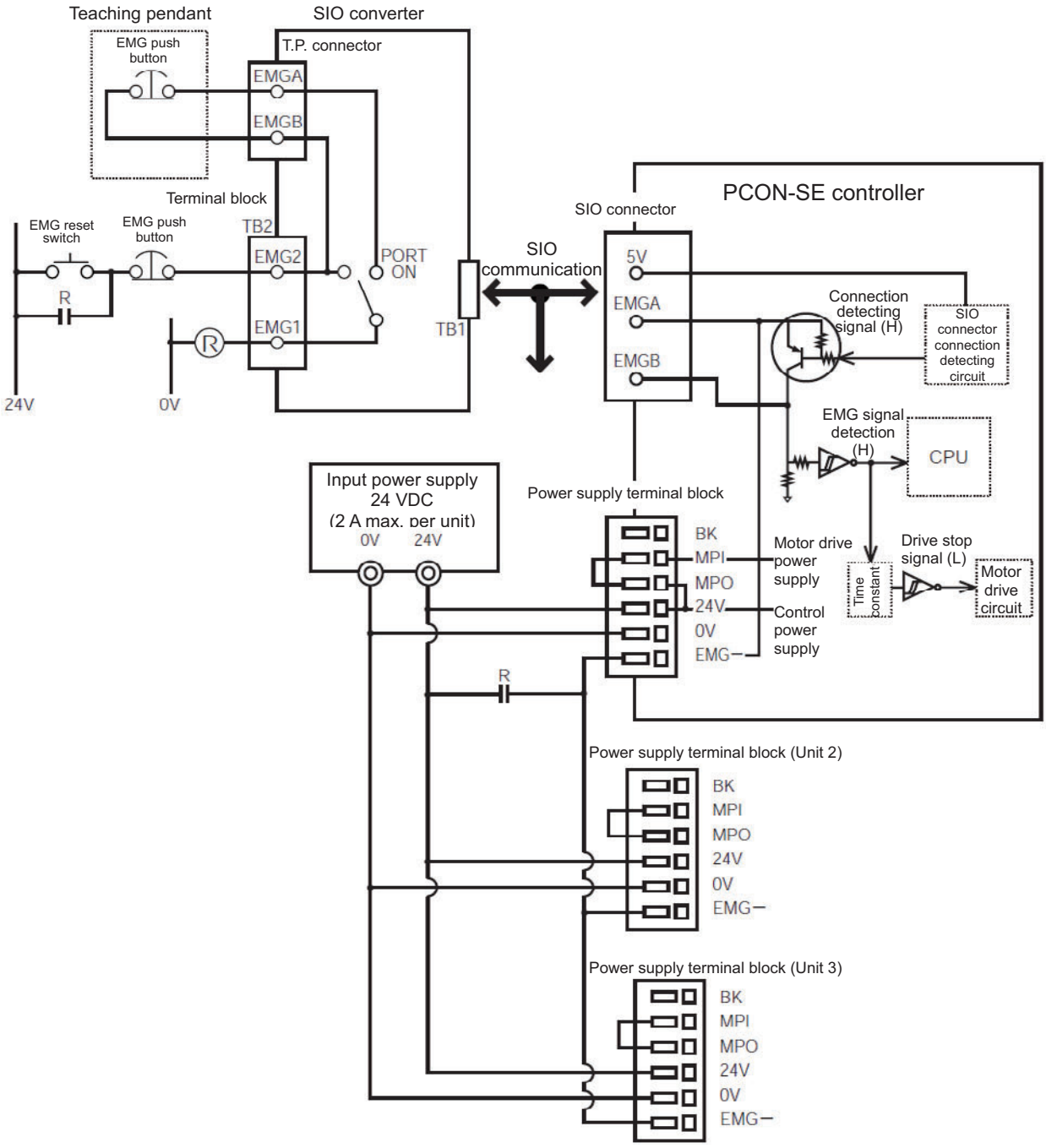
⚠ Caution: (1) The input current to the EMG terminal of PCON-SE is 5 mA. When connecting the contact of the EMG relay R to the EMG terminals of multiple controllers, check the current capacity of the relay contact.
(2) Make the 0V of the gateway unit power supply and PCON-SE power supply in common.

3.8.2 Cutting off the Motor Drive Power Supply

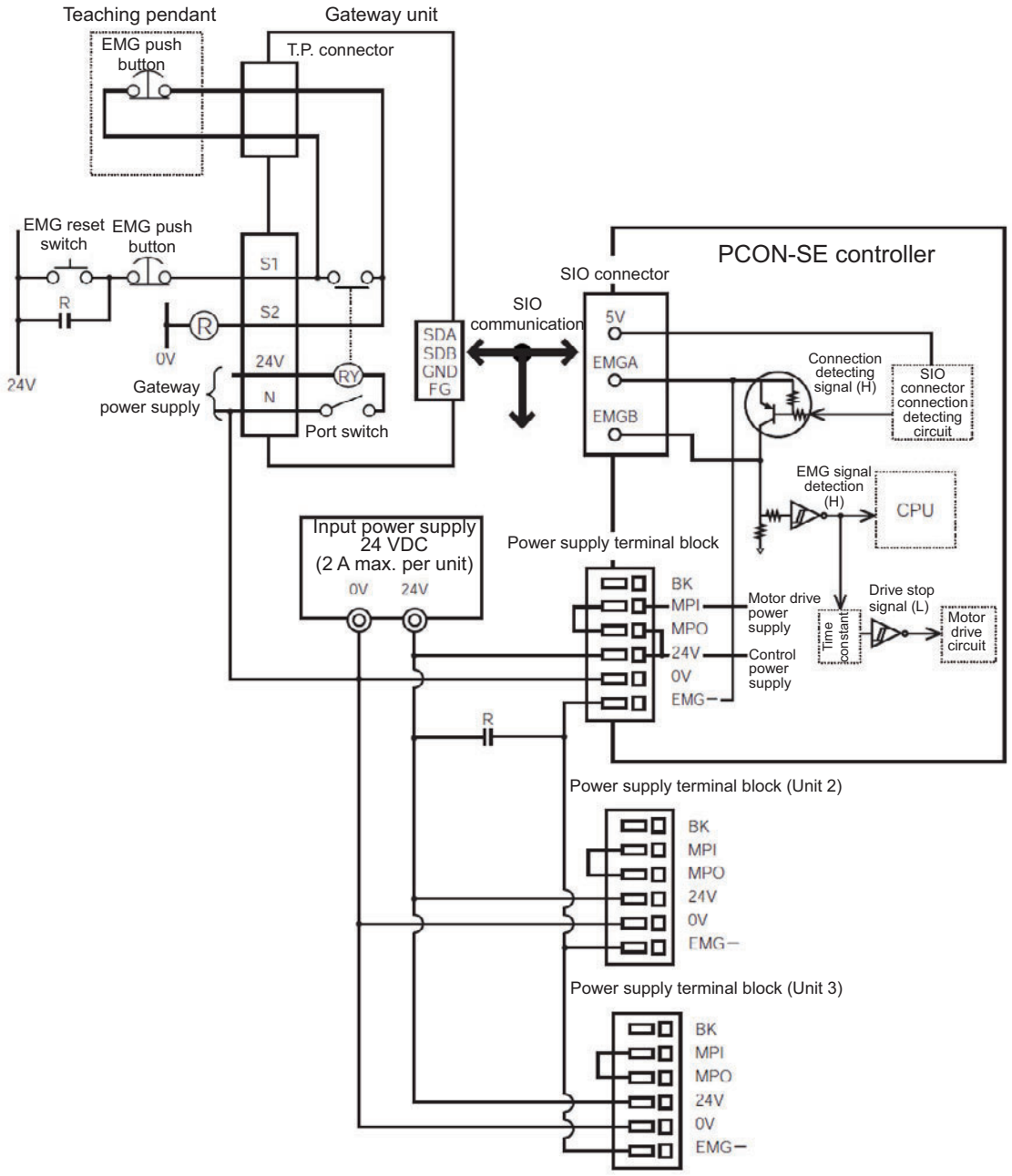
If the safety category of the entire equipment requires motor drive power cut off, connect the EMG relay contact between the MPI terminal and MPO terminal.
In addition, connect 24 V of the controller power supply to the EMG terminal.

(Note) Please pay sufficient attention that the EMG switch of the teaching pendant leads to motor drive signal shutdown and not motor drive power cutoff.

(1) When the SIO converter is used



(2) When the gateway unit is used



⚠ Caution: [1] The input current to the EMG terminal of PCON-SE is 5 mA. When connecting the contact of the EMG relay R to the EMG terminals of multiple controllers, check the current capacity of the relay contact.

[2] Make the 0V of the gateway unit power supply and PCON-SE power supply in common.

3.9 Connecting the Actuator

3.9.1 Motor Relay Cable

- Connect the motor relay cable to the MOT connector.

Signal table for controller-end connector (CN2)

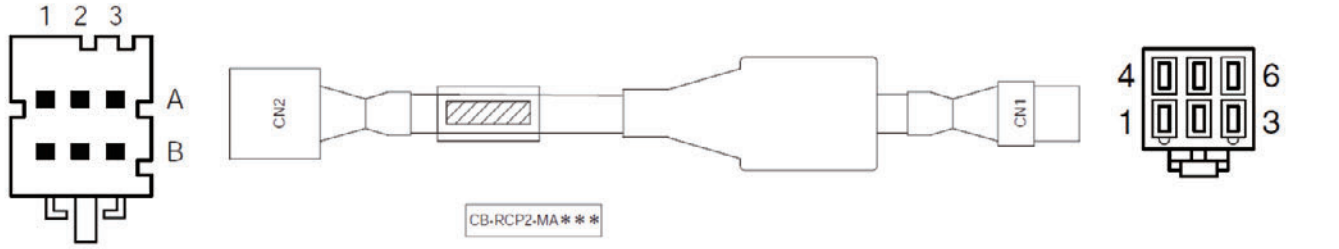
Pin No.	Signal	Wire color	Description
A1	A	Orange	Motor drive line (phase A-)
A2	VMM	Gray	Motor power line
A3	$\overline{B}$	White	Motor drive line (phase B-)
B1	A	Yellow	Motor drive line (phase A+)
B2	VMM	Pink	Motor power line
B3	B	Yellow (Green)	Motor drive line (phase B+)

Controller end

Pin arrangements of CN2

Actuator end

Pin arrangements of CN1



CN2

Cable color	Signal name	Pin No.
Orange	$\overline{A}$	A1
Gray	VMM	A2
White	$\overline{B}$	A3
Yellow	A	B1
Pink	VMM	B2
Yellow (Green)	B	B3

Housing: 1-1318119-3 (AMP)
Receptacle contact: 1318107-1

CN1

Pin No.	Signal name	Cable color
1	A	Yellow
2	VMM	Gray
3	$\overline{A}$	Orange
4	B	Yellow (Green)
5	VMM	Pink
6	$\overline{B}$	White

Housing: SLP-06V (JST)
Socket contact: BSF-21T-P1.4

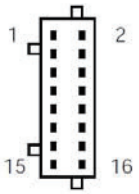
3.9.2 Encoder Relay Cable

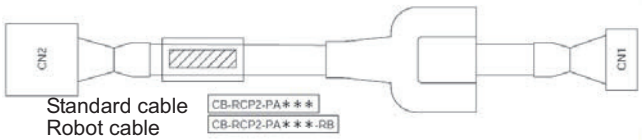
- Connect the encoder relay cable to the PG connector

Signal table for controller-end connector (CN2)

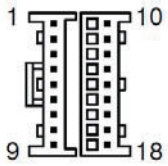
Pin No.	Signal name	Description
1	F.G	Shield wire
2	-	(Not used)
3	-	(Not used)
4	-	(Not used)
5	GND	Encoder power output
6	5V	
7	VPS	Encoder control signal output
8	-	(Reserved)
9	$\overline{ENB}$	Encoder differential signal phase B input
10	ENB	
11	$\overline{ENA}$	Encoder differential signal phase A input
12	ENA	
13	BK-	Brake power-
14	BK+	Brake power+
15	-	(Not used)
16	-	

Controller end
Pin arrangements of CN2





Actuator end
Pin arrangements of CN1



*** indicates the cable length (L) (up to 20 m).
Example) 080 = 8 m

CN2

Cable color		Signal name	Pin No.
Standard cable	Robot cable		
–	–	–	16
–	–	–	15
Purple	Red	BK+	14
White (paired with purple)	Gray	BK-	13
Blue	Brown	ENA	12
White (paired with blue)	Green	$\overline{ENA}$	11
Yellow	Purple	ENB	10
White (paired with yellow)	Pink	$\overline{ENB}$	9
–	–	(Reserved)	8
Green	Yellow	VPS	7
Red	Orange	5V	6
White (paired with red)	Blue	GND	5
–	–	–	4
–	–	–	3
–	–	–	2
Ground	Ground	F.G	1

Housing: PHDR-16VS (JST)
Contact: SPHD-001T-P0.5

CN1

Pin No.	Signal name	Cable color	
		Standard cable	Robot cable
1	ENA	Brown	Blue
2	$\overline{ENA}$	Green	White (paired with blue)
3	ENB	Purple	Yellow
4	$\overline{ENB}$	Pink	White (paired with yellow)
5	–	–	–
6	–	–	–
7	–	–	–
8	–	–	–
9	GND	Blue	White (paired with red)
10	5V	Orange	Red
11	VPS	Yellow	Green
12	–	–	–
13	–	–	–
14	–	–	–
15	–	–	–
16	BK+	Red	Purple
17	BK-	Gray	White (paired with purple)
18	F.G	Ground	Ground

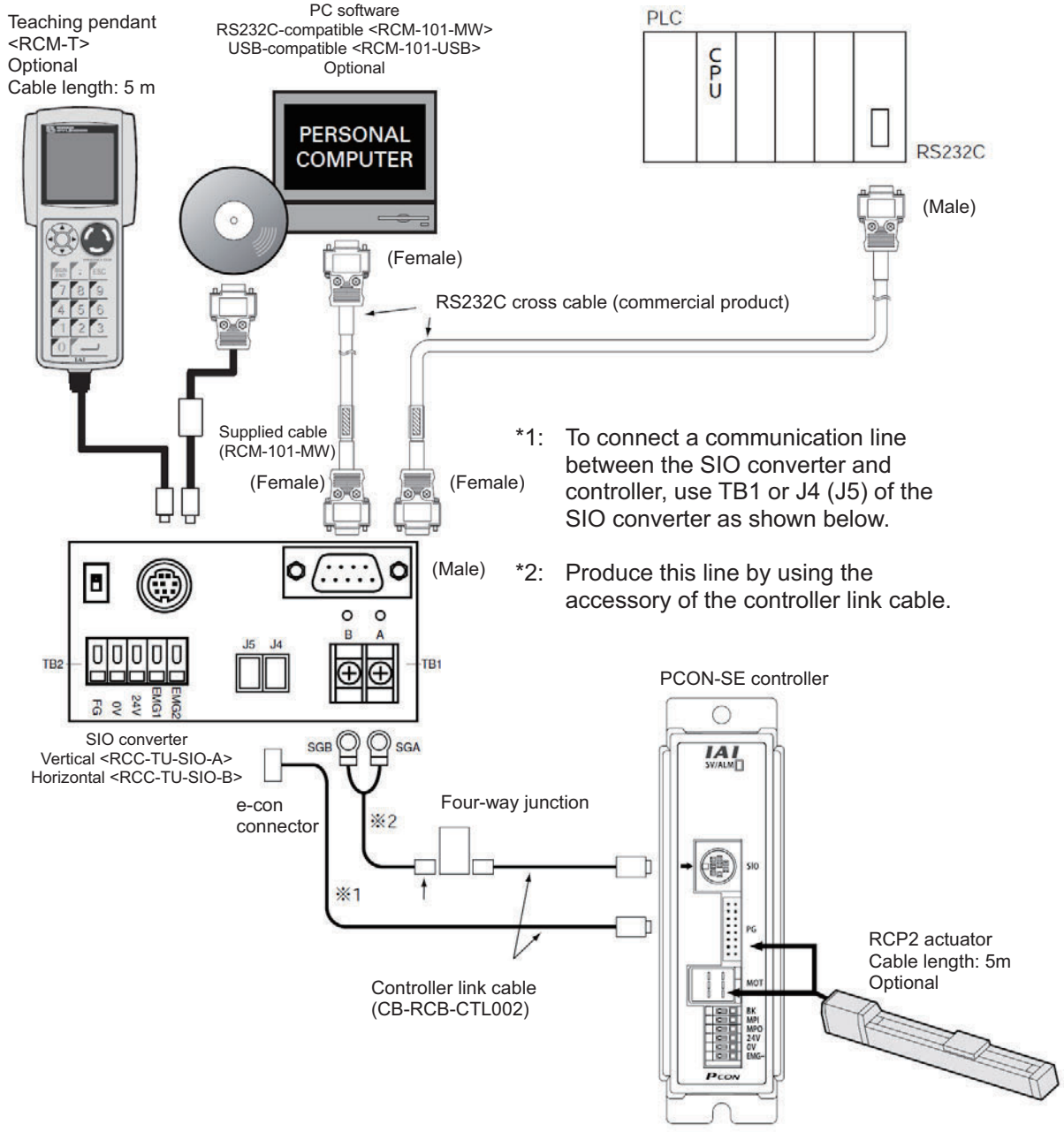
Housing: XMP-18VS (JST)
Contact: BXA-001T-P0.6
Retainer: XMS-09V

3.10 Connecting the SIO Communication

3.10.1 Connecting the RS232C Serial Communication

(1) Basic information

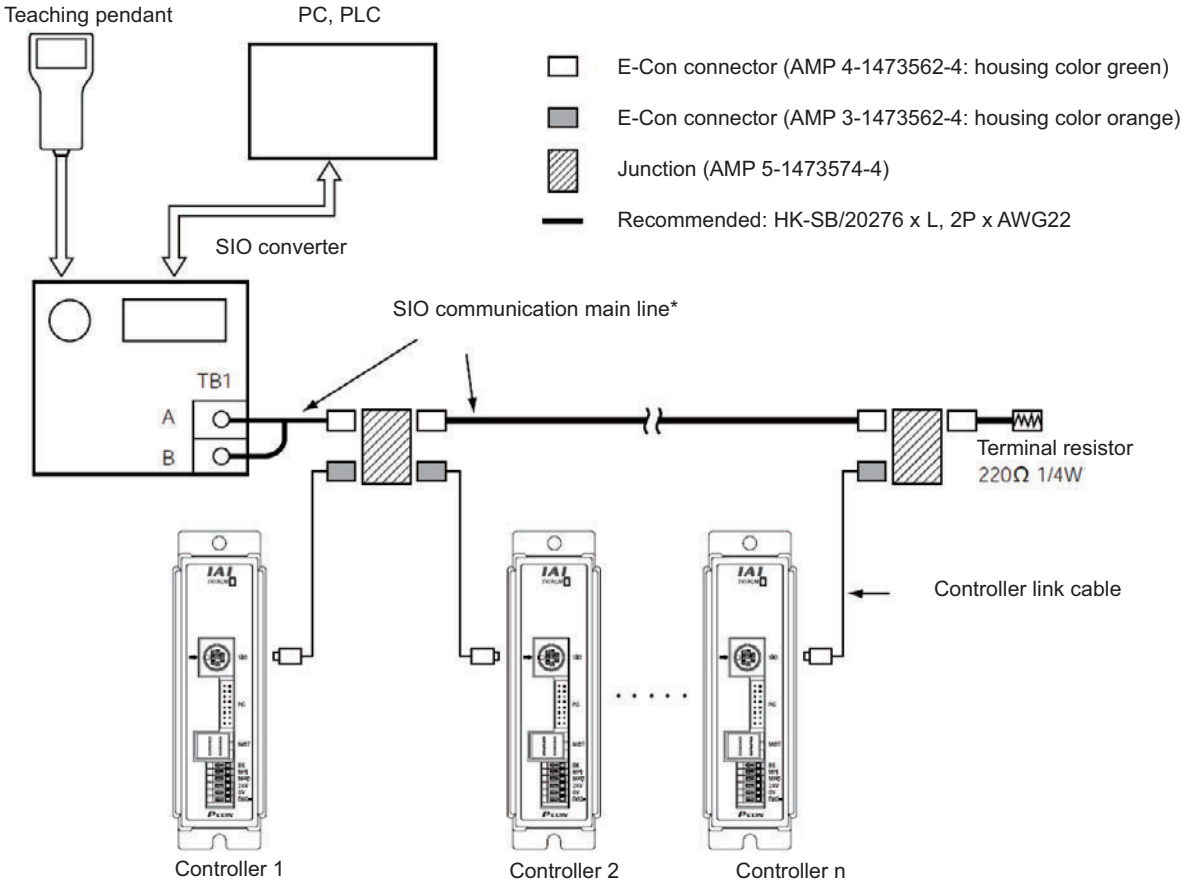
Connect the teaching pendant, PC or PLC, and controller using the SIO converter (RS232C/RS485 conversion) as shown below.



⚠ Caution:	Do not connect an equipment to the mini DIN connector and D-sub connector at the same time. If the both are connected at the same time, a communication error (message level) will occur. Make the 0V of the SIO converter and controller in common.

(2) Connecting the multiple axes

Item	Description
Maximum number of units that can be connected	16 axes max. (depending on the operation mode)
Communication cable length	Total cable length: 100 m or less
SIO communication main line	Twisted-pair shielded cable (AWG22) Recommended brand: Taiyo Electric Wire & Cable HK-SB/20276 x L, 2P x AWG22
Terminal resistor	220 Ω, 1/4 W

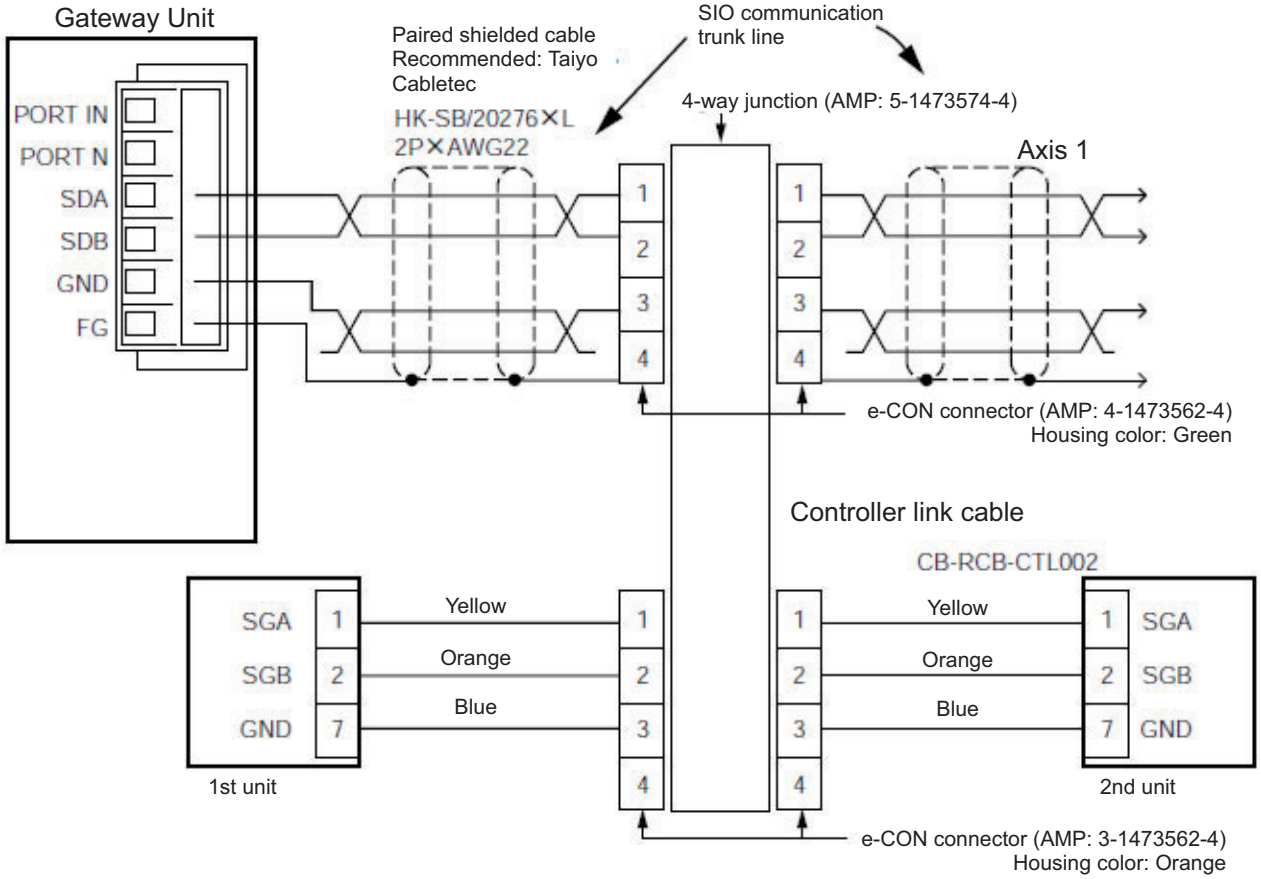


* The SIO communication main line must be prepared by the customer.
Each one unit of the junction, E-Con connector and terminal resistor are supplied with the controller link cable.

⚠ Caution: [Note 1] If normal communication cannot be performed with a communication error occurring when the total communication cable length is 10 m or more, connect the terminal resistor to the last axis.
[Note 2] For the power supplies of the SIO converter and all controllers, make 0V in common. When using the +24 V pin as the grounding point (+ common), confirm that the GND pin is not connected to ground.
Exercise caution particularly when connecting a PC. If the RS232C communication cable is connected directly, the +24-V power supply may be shorted because the GND and FG pins are connected inside the PC.
[Note 3] Connect a shielded cable to FG on an axis basis.
[Note 4] If the total link cable length is more than 30 m, use the wire size of 22AWG or larger.

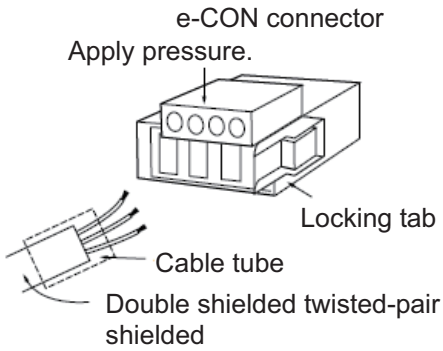
■ Detailed Connection Diagram

Connection details of SIO communication are shown below. The controller link cable is available as an option, but the communication trunk line must be prepared by the customer.

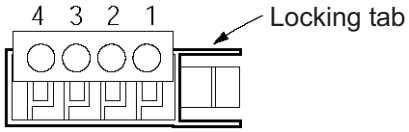


■ Preparation of Communication Main Line

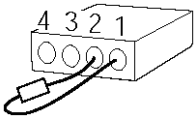
[1] Strip the sheath of a double shielded twisted-pair cable by approx. 15 to 20 mm.
[2] Place a cable protection tube over the cable.
[3] Insert the three wires into the cable insertion holes in the connector without stripping the core sheath.
[4] With the cable inserted in the press-fit cable housing, apply pressure from above to pressure-weld the core wires.
[5] Heat-treat the cable protection tube.



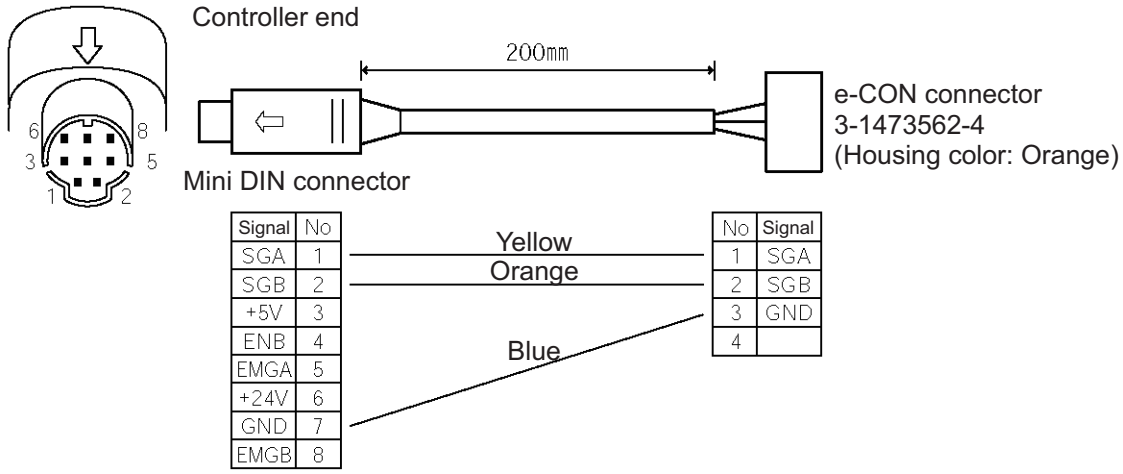
e-CON connector pin numbers



Be sure to insert a terminal resistor (220 Ω, 1/4 W) at the terminal end of the communication trunk line (between pins 1 and 2 of the e-CON connector)



■ Controller link cable (CB-RCB-CTL002)
*This cable is available as an option for each controller.



Signal	No
SGA	1
SGB	2
+5V	3
ENB	4
EMGA	5
+24V	6
GND	7
EMGB	8

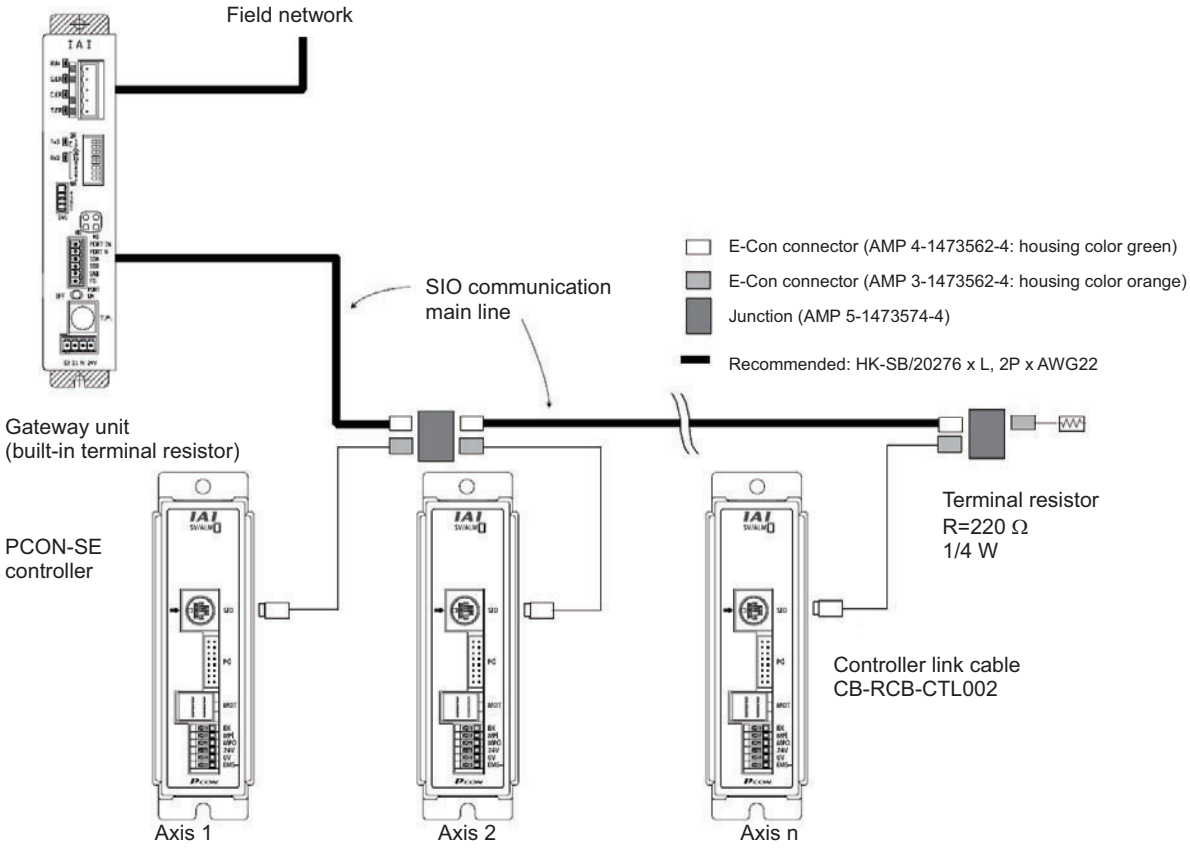
No	Signal
1	SGA
2	SGB
3	GND
4	

The following parts are supplied with the controller link cable.

[1] 4-way junction	Model: 5-1473574-4	by AMP	x 1 unit
[2] e-CON connector	4-1473562-4	by AMP	x 1 unit
	Outer diameter of applicable wire	1.35 to 1.6 mm	
[3] Terminal resistor	220 Ω 1/4 W	With e-CON connector	x 1 unit

3.11 Connection to Field Network

The gateway unit is used to connect the controllers to the field network of DeviceNet, CC-Link, or Profibus. The connection to the gateway unit is shown below.
The details are the same as those in 3.10.1 (2).



3.12 Assignment of Axis Number

If multiple controller axes are connected by means of RS232C serial communication or field network connection, an axis number must be assigned to each controller.
Connect a teaching pendant or PC (software) to the SIO connector of a desired controller based on 1:1 relationship. Overviews of operations using a teaching pendant and PC software are provided below.

- Overview of operation using a PC
  [1] Open the main screen → [2] Click Setting (S) → [3] Bring the cursor to Controller Setting (C) → [4] Bring the cursor to and click Assign Axis Number (N) → [5] Enter a desired number in the axis number table.
- Overview of operation using a teaching pendant RCM-T
  [1] Open the User Adjustment screen → [2] Use the ▼ key to bring the cursor to Assigned No. _ → [3] Enter a desired axis number and press the return key → [4] Enter “2” in Adjustment No. _ and press the return key.
- Overview of operation using a teaching pendant RCM-E
  [1] Open the User Adjustment screen → [2] Press the return key to open the Assigned No. _ screen → [3] Enter a desired axis number and press the return key → [4] Enter “2” in Adjustment No. _ and press the return key.

For the details of specific operating procedures, refer to each operation manual.

3.13 Setting the Baud Rate

When inter-connecting multiple controllers, baud rates of all controllers must be set to the same value.
The baud rate can be set using parameter No. 16.
Connect a teaching pendant or PC (software) on a 1-to-1 relationship to the SIO connector whose baud rate you wish to set, and set a desired baud rate.

4. Description of Operating Functions

The PCON-SE is a dedicated serial communication controller supporting 64 positions (positioning points). This controller does not support PIO patterns.
With PCON-SE controllers, the actuator can be operated in two ways: [1] “Operation by position number specification” where a position number is specified, and [2] “Operation by numeric specification” where values relating to a desired operation are specified directly.
To move the actuator to a specified position in the “operation by position number specification,” it is basically required to create a position table in advance and enter a target position in the “Position” field. For the target position, there are the absolute coordinate specification (Absolute) to enter a distance from the home position and the relative coordinate specification (Incremental) to enter a relative movement distance from the current position. When the target position is entered, the default value set with a parameter is automatically registered in the other field.
The default value varies depending on the actuator characteristics.
The PCON-SE can be operated in a field network environment or RS232C serial communication environment. Accordingly, also read the operation manual for your gateway unit and serial communication operation manual for your ROBO Cylinder series.
The key functions available in operation by position number specification and operation by numeric specification are summarized on the following page.
If the actuator is operated in the command specification mode via a gateway unit, the PIO pattern of any positioner operation axis (set by gateway control signals PPS0 to PPS2) becomes “0.”

List of PCON-SE Functions

○: Direct control △: Indirect control ×: Invalid

	Operation by position number specification		Operation by numeric specification						
	Serial communication	Gateway position number specification mode	Serial communication	DeviceNet gateway		CC-Link gateway			
				Direct numeric specification mode	Command specification mode	Position data limiting mode	Normal positioning mode	Push & hold enabled mode	Command specification mode
Home return operation	○	○	○	○	○	○	○	○	○
Positioning operation	△ Specify the position table no.	△ Same as at the left	○ Specify the position data directly.	○ Specify the position data directly.	○ Specify the position data directly. ○ Specify the position table no.	○ Specify the position data directly.	○ Specify the position data directly.	○ Specify the position data directly.	○ Specify the position data directly. ○ Specify the position table no.
Speed setting	△ Set it in the position table.	△ Same as at the left	○ Specify a numeric value directly.	○ Specify a numeric value directly.	△ Set it in the position table.	△ Set the parameter.	○ Specify a numeric value directly.	○ Specify a numeric value directly.	△ Set it in the position table.
Acceleration/deceleration setting	△ Set the acceleration and deceleration separately in the position table.	△ Same as at the left	○ Specify a numeric value as the acceleration/ deceleration.	○ Specify a numeric value as the acceleration/ deceleration.	△ Set the acceleration and deceleration separately in the position table.	○ Set the parameter as the acceleration/ deceleration.	○ Specify a numeric value as the acceleration/ deceleration.	○ Specify a numeric value as the acceleration/ deceleration.	△ Set it in the position table.
Operation at different acceleration/deceleration	△ Set the acceleration and deceleration separately in the position table.	△ Same as at the left	○ The acceleration/ deceleration data is accepted at positioning start time. Therefore, to specify the deceleration different from the acceleration, change the acceleration/ deceleration data during movement and restart the controller.	○ The acceleration/ deceleration data is accepted at positioning start time. Therefore, to specify the deceleration different from the acceleration, change the acceleration/ deceleration data during movement and restart the controller.	△ Set the acceleration and deceleration separately in the position table.	× Since parameter setting is performed as the acceleration/ deceleration, the acceleration and deceleration cannot be set separately.	○ The acceleration/ deceleration data is accepted at positioning start time. Therefore, to specify the deceleration different from the acceleration, change the acceleration/ deceleration data during movement and restart the controller.	○ The acceleration/ deceleration data is accepted at positioning start time. Therefore, to specify the deceleration different from the acceleration, change the acceleration/ deceleration data during movement and restart the controller.	△ Set the acceleration and deceleration separately in the position table.
Pitch (incremental) feeding	△ Set it in the position table.	△ Same as at the left	○ If bit 2 of the CTLF control flag is set to "1," incremental operation starts.	× Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	△ Set it in the position table.	× Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	× Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	× Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	△ Set it in the position table.
Push & hold operation	△ Set it in the position table.	△ Same as at the left	○	○ Specify a numeric value directly.	△ Set it in the position table.	×	×	○ Direct numeric specification	△ Set it in the position table.
Speed change during movement	△ Combine two or more position nos.	△ Same as at the left	○ The speed data is accepted at positioning start time. Therefore, to change the speed during movement, change the speed data during movement and restart the controller.	○ The speed data is accepted at positioning start time. Therefore, to change the speed during movement, change the speed data during movement and restart the controller.	△ Combine two or more position nos.	×	○ Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	○ Direct processing cannot be performed. Issue a position command by adding the same distance to or subtracting it from the current position with the host PLC.	△ Combine two or more position nos.
Pause	○	○	○	○	○	○	○	○	○
Zone signal	○ Set it in the position table or with the user parameter. Output signal: PZONE, ZONE1, ZONE2	○ Set it with the user parameter. Output signal: ZONE1, ZONE2	○ Set it with the user parameter. Output signal: ZONE1, ZONE2	×	Simple direct operation: × Positioner operation: ○	×	×	×	Simple direct operation: × Positioner operation: ○
Power saving mode	○ The power-saving mode for full-servo control can be selected using parameter 53. (The auto servo OFF mode cannot be selected.)	○ Same as at the left	○ Same as at the left	○ Same as at the left	○ Same as at the left	○ Same as at the left	○ Same as at the left	○ Same as at the left	○ Same as at the left
Position table	Required	Required	Not required	Not required	Required	Not required	Required	Required	Required

PCON

4.1 Description of Position Table

A position table is created by using the PC software or teaching pendant.
For its usage, refer to each operation manual.
In this section, a position table is explained by taking the PC software screens as examples.
(In the case of the teaching pendant, the display contents are different.)

No.	Position [mm]	Speed [mm/s]	Acceleration/deceleration [G]	Deceleration [G]	Push [%]	Threshold [%]	Positioning band [mm]
0	5.00	300.00	0.30	0.30	0	0	0.10
1	380.00	300.00	0.30	0.10	0	0	0.10
2	200.00	300.00	0.30	0.10	0	0	0.10

Zone + [mm]	Zone – [mm]	Acceleration mode	Incremental	Command mode	Stop mode	Comment
100.00	0.00	0	0	0	4	
400.00	300.00	0	0	0	0	
250.00	150.00	0	0	0	0	

(1) No.: Indicate the position data number.

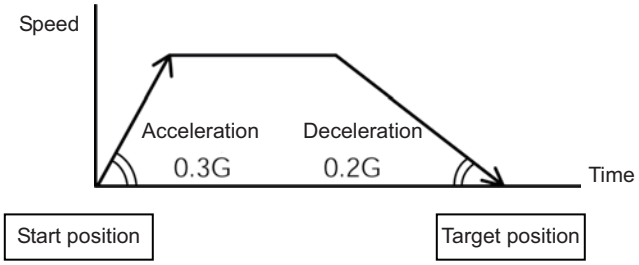
(2) Position: Enter the target position to move the actuator to, in [mm].
Absolute coordinate specification: Enter the distance to the target actuator position from the home.
Relative coordinate specification: Under the assumption of a constant pitch, a relative amount from the current position is indicated.

No.	Position [mm]	
0	5.00	Absolute coordinate specification: 5 mm from the home
1 =	10.00	Relative coordinate specification: +10 mm from the current position
2 =	-10.00	Relative coordinate specification: -10 mm from the current position

* Indicates the relative coordinate specification with the teaching pendant (RCM-T).

(3) Speed: Enter the speed at which the actuator will be moved, in [mm/sec].
The default value varies depending on the actuator type.

(4) Acceleration/deceleration: Enter the acceleration/deceleration at which the actuator will be moved, in [G].
Basically, use acceleration/deceleration within the catalog rated value range.
The input range allows larger value input than the catalog rated values, on the assumption that the tact time will be reduced if the transfer mass is significantly smaller than the rated value.
Make the numeric value smaller if transfer work vibrates and causes trouble during acceleration/deceleration.



The acceleration will become sudden if the numeric value is made larger, and it will become gradual if the numeric value is made smaller.

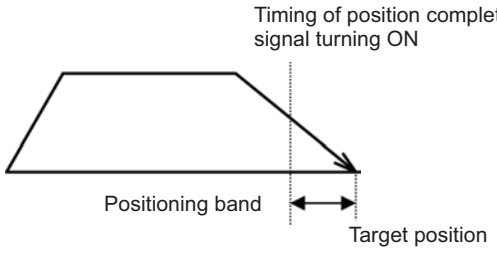
> ⚠ Caution: Enter appropriate values for the speed and acceleration/deceleration in such a way as to prevent excessive impact or vibration from being applied to the actuator in consideration of the installation conditions and the shape of transferred work by referring to the “List of Actuator Specifications” in the Appendix.
> Increasing such values largely relates to the transfer mass and the actuator characteristics vary depending on the model, consult IAI regarding the input-limiting values.

(5) Push: Select the positioning operation or push & hold operation.
The default value is “0.”
0: Normal positioning operation
Other than 0: Indicates the current-limiting value and indicates the push & hold operation.

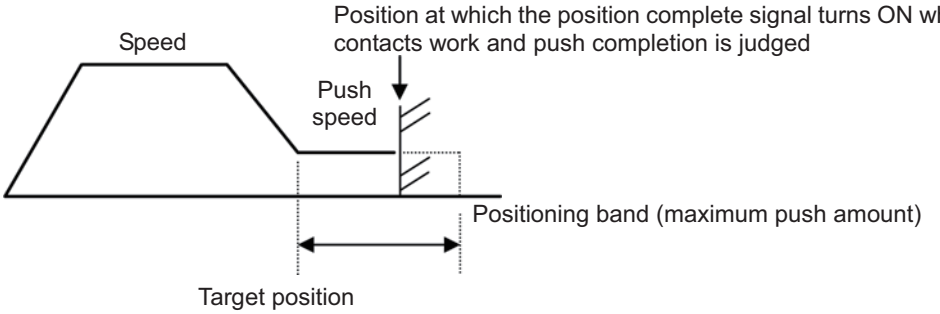
(6) Threshold: This field is invalid in the case of this controller.
The default value is “0.”

(7) Positioning band: The “positioning operation” and “push & hold operation” have different implications.

Positioning operation
It defines the distance to the target position from a position at which the position complete signal turns ON.
Since increasing the positioning band value hastens the next sequence operation, it becomes a factor for tact time reduction. Set the optimum value by considering a balance of the entire equipment.



Push & hold operation
It defines the maximum push amount from the target position in the push & hold operation.
Set the positioning band in such a way as to prevent positioning completion before the actuator contacts work by considering mechanical variations of work.

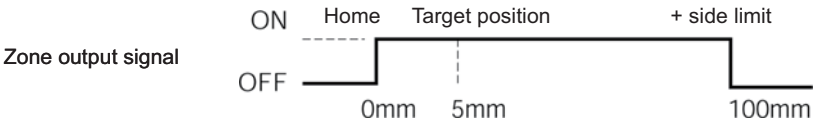


(8) Zone +/-:It defines the zone where the zone output signal turns ON.
For added flexibility, these parameters can be set separately for each target position.

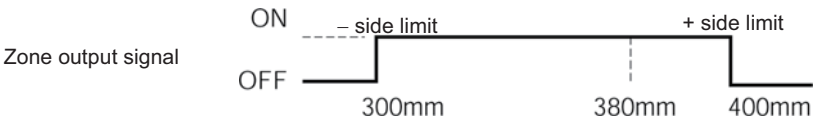
[Setting example]

No.	Position [mm]	Zone + [mm]	Zone – [mm]	Comment
0	5.00	100.00	0.00	
1	380.00	400.00	300.00	
2	200.00	250.00	150.00	

Movement command to position No. 0



Movement command to position No. 1



(9) Acceleration/deceleration mode: This field is not available for this controller.
The default value is 0.

(10) Incremental: It defines whether the specification is the absolute coordinate specification or relative coordinate specification.
The default value is 0.
0: Absolute coordinate specification
1: Relative coordinate specification

(11) Command mode: This field is invalid in this controller.
The default value is 0.

(12) Stop mode: This field is invalid in this controller.
The default value is 0.
Use parameter No. 53 to set the power-saving mode you wish to apply while the actuator is waiting.
The full-servo control mode can be selected by setting “4” in the parameter.

Full servo control mode

Holding current can be reduced by servo-controlling the pulse motor.

※ For details,refer to 4.4.10,"Power-saving Modes at Standby Positions."

4.2 Setting Data in Numeric Specification Mode

If operation is performed in the numeric specification mode, the position table will become invalid. Set the data related to operation (target position, speed, acceleration/deceleration, current-limiting value during push & hold operation, positioning band, etc.) directly via serial communication.
For details, refer to the Gateway Unit Operation Manual and ROBO Cylinder Series Serial Communication Operation Manual.

4.3 Control Signals, Control Data

In order to operate PCON-SE via serial communication, it is required to write/read the 16-bit internal memory (Modbus register, Modbus status) of the controller. The main signals and their symbol names handled at that time are shown below.
For details, refer to the serial communication operation manual for your ROBO Cylinder series.

(1) Controller Input Signals
(PLC → Controller)

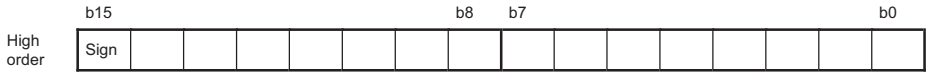
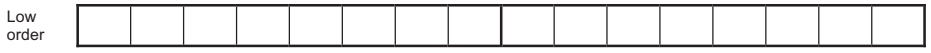
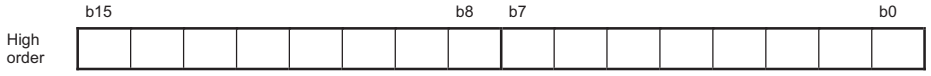
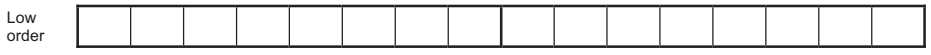
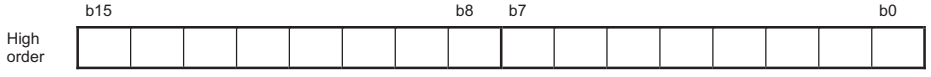
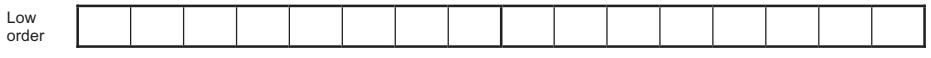
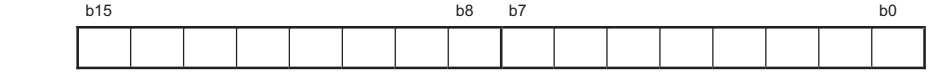
Register	Bit address	Bit position	Signal symbol	Signal name	Description
Device control register DRG1 Address 0D00H [Common] *1		15	—	—	—
	0401H	14	SFTY	Safety speed command	Safety speed set with the parameter 0: Invalid, 1: Valid
		13	—	—	—
	0403H	12	SON	Servo ON command	0: Servo OFF, 1: Servo ON
		11 – 9	—	—	—
	0407H	8	RES	Alarm reset	0: Normal, “0” → “1” rise edge: Alarm reset
		7	—	—	—
		6	—	—	—
	040AH	5	STP	Pause command	0: Normal, 1: Pause (deceleration stop)
	040BH	4	HOME	Home return command	“0” → “1” rise edge: Home return operation
	040CH	3	CSTR	Positioning start	0: Normal, “0” → “1” rise edge: Positioning start to the target position specified with the position no.
		2 – 0	—	—	—

*1 The meanings of [Common], [POS specification] and [Numeric specification] are as follows:
- [Common]: Used in common in both operation by position number specification and operation by numeric specification.
- [POS specification]: Used in the operation by position number specification
- Numeric specification]: Used in the operation by the numeric specification

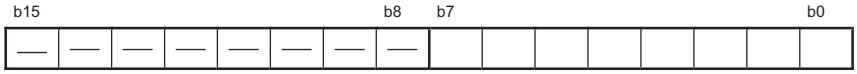
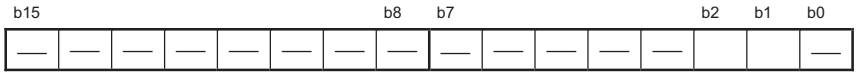
(PLC → Controller)

Register	Bit address	Bit position	Signal symbol	Signal name	Description
Position no. specification register POSR Address 0D03H *1 [POS specification]		15 – 6	—	—	—
	043AH	5	PC32	—	Specify the command position no. with the 6-bit binary code. Setting the position start signal CSTR to “1” starts positioning operation.
	043BH	4	PC16	—	
	043CH	3	PC8	—	
	043DH	2	PC4	—	
	043EH	1	PC2	—	
	043FH	0	PC1	—	
Position no. specification register POSR Address 9800H *1 [POS specification]	—	15 – 6	—	—	—
	—	5	PC32	—	The same description as the above. However, if the position number is specified in this register, positioning operation starts at the same time as writing. It is not required to set the start signal CSTR to “1.”
	—	4	PC16	—	
	—	3	PC8	—	
	—	2	PC4	—	
	—	1	PC2	—	
	—	0	PC1	—	

(PLC → Controller)

Register	Address	Description
PCMD Position data specification	9900H	
	9901H	
*1 [Numeric specification]		32-bit signed integer (unit: 0.01 mm) The setting range is FFF0BBC1H to 000F423FH (-999999 to 999999). • If a negative value is set, it is displayed as a 2's complement. Accordingly, the most significant bit becomes "1." When the low-order word (9901H) in this register is rewritten, positioning operation starts.
INP Position data specification	9902H	
	9903H	
*1 [Numeric specification]		32-bit integer (unit: 0.01 mm) The setting range is 0H to 000F423FH (0 to 999999). Specify the position-complete detection width for positioning operation. It becomes the set value of the push width for push & hold operation (required to specify with the CTLF flag).
VCMD Speed specification	9904H	
	9905H	
*1 [Numeric specification]		32-bit integer (unit: 0.01 mm/sec) The setting range is 0H to 000F423FH (0 to 999999). Specify the movement speed. When the lower-order word (9905H) in this register is rewritten, movement starts.
ACMD Acceleration/ deceleration	9906H	
*1 [Numeric specification]		16-bit integer (unit: 0.01G, setting range: 0 – 300) If a value exceeding the default acceleration/deceleration is set in parameter No. 9, an alarm will generate the moment the actuator starts moving. Actuator movement will start once this register is rewritten properly.

(PLC→ Controller)

Register	Address	Description
PPOW Current-limiting value during push & hold operation *1 [Numeric specification]	9907H	
		16-bit integer (unit: %, setting range: 00H – FFH/0 ~ 100%) *2 When this register is rewritten, movement starts.
CTLF Control flag *1 [Numeric specification]	9908H	
		Bit pattern to set operation [1] Bit 1 (b1) 0: Normal operation, 1: Push & hold operation [2] Bit 2 (b2) 0: The push & hold direction after completion of approach operation is forward. 1: The push & hold direction after completion of approach operation is reverse. [3] Bit 3 (b3) 0: Normal operation, 1: Incremental operation

*2 Set in a range of 20 to 70% (33H to B3H) according to the limitations of the actuator.

(2) Controller output signals

(Controller → PLC)

Register	Bit address	Bit position	Signal symbol	Signal name	Description
Device status register DSS1 Address 9005H	0100H	15	EMGS	Emergency stop status	1: Under emergency stop
	0101H	14	SFTY	Safety speed valid	1: Safety speed valid condition
	0102H	13	PWR	Controller ready	1: Controller preparation completed
	0103H	12	SV	Servo ready	1: Operation preparation completed (servo ON status)
	0104H	11	PSFL	Push & hold missing	1: Push & hold missing
	0105H	10	ALMH	Major failure status	1: Alarm indicating that continuous operation is impossible
	0106H	9	ALML	Minor failure status	1: Alarm indicating that continuous operation is impossible
		8 – 6	—	—	—
	010AH	5	STP	Pause commanding	1: Pause command being issued
	010BH	4	HEND	Home return completion	1: Home return completed
	010CH	3	PEND	Position complete	1: Positioning completed
[Common]*		2 – 0	—	—	—
Expansion device status register DSSE Address 9007H		15 – 12	—	—	—
	0124H	11	GHMS	Home returning	1: Home returning
	0123H	10	PUSH	Push & hold operating	1: Push & hold operating
		9 – 6	—	—	—
	012AH	5	MOVE	Moving	1: Moving (including home return, push & hold operation)
[Common]*		4 – 0	—	—	—

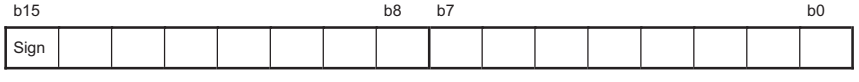
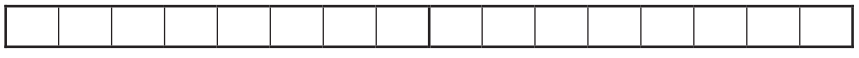
* The meanings of [Common], [POS specification] and [Numeric specification] in the Register field are as follows:

- [Common]: Used in common in both operation by position number specification and operation by numeric specification.
- [POS specification]: Used in operation by position number specification.
- [Numeric specification]: Used in operation by numeric specification.

(Controller → PLC)

Register	Bit address	Bit position	Signal symbol	Signal name	Description
Zone status register ZONS Address 9013H [Common]*		15 – 9	—	—	—
	0147H	8	PZONE	Position zone output	This signal becomes “1” when the current position is within the setting range if individual zone boundaries are set in the position table.
		7 – 2	—	—	—
	014EH	1	ZONE2	Zone output 2	This signal becomes “1” when the position is within the setting range of the parameter zone boundary 2.
	014FH	0	ZONE1	Zone output 1	This signal becomes “1” when the position is within the setting range of the parameter zone boundary 1.
Position no. status register POSS Address 9014H [POS specification]*		15 – 6	—	—	—
	013AH	5	PM32		The position complete position no. is output as a 6-bit binary code.
	013BH	4	PM16		
	013CH	3	PM8		
	013DH	2	PM4		
	013EH	1	PM2		
	013FH	0	PM1		

(Controller → PLC)

Register	Address	Description
PNOW Current position	9000H	
	9001H	
* [Numeric specification]		The current position is indicated as a 32-bit signed integer (unit: 0.01 mm). If a negative value is set, it is displayed as a 2’s complement. Accordingly, the most significant bit becomes “1.”

4.4 Operation Timings

4.4.1 Timing after Power ON

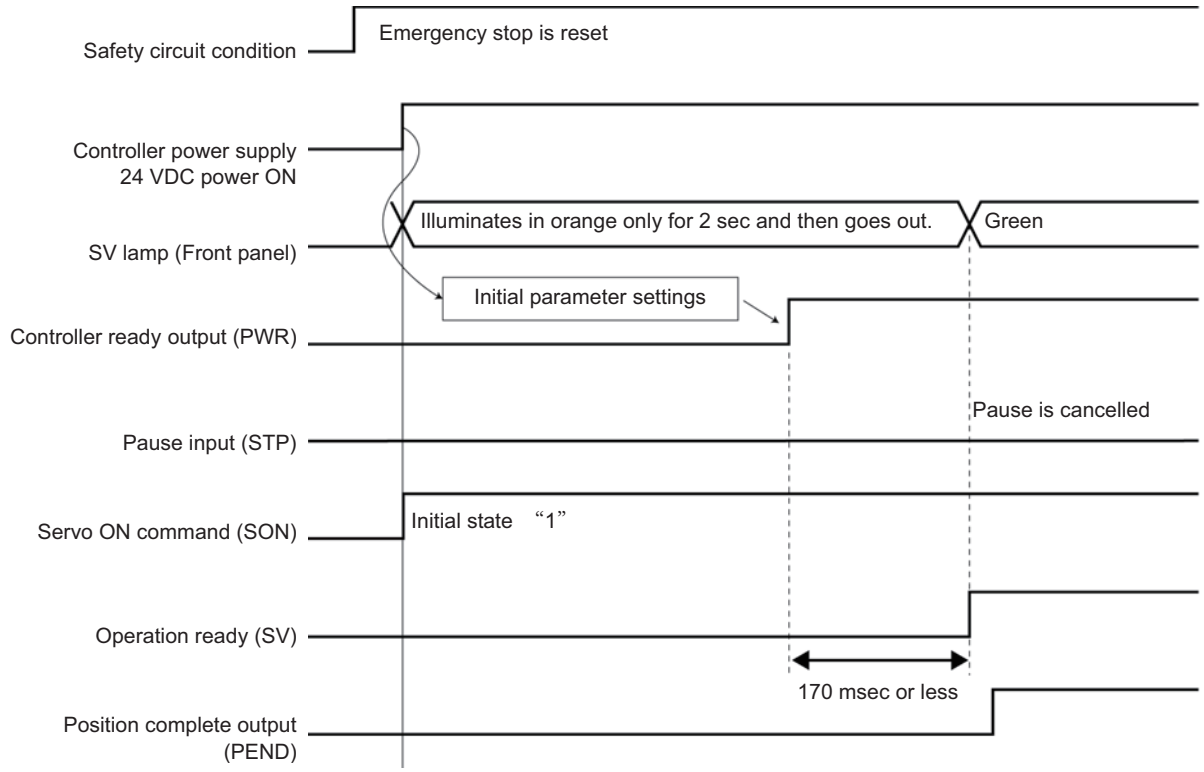
After conforming that the slider or rod is not contacting the mechanical end or transferred work is not interfering with peripheral equipment, start operation following the steps below.

[1] Reset the emergency stop condition or put the motor drive power into a current-accessible state.

[2] Supply of 24 VDC of controller power supply: 24 V terminal, 0V terminal on the power supply terminal block
When 24 VDC is supplied in an emergency stop reset state, the controller is automatically put into the servo ON condition internally.

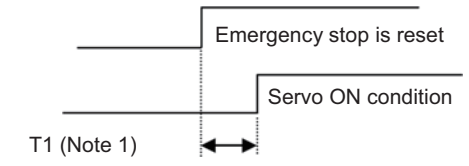
[3] Initial setting of parameters (min.)
(Example) • To change the feed speed during teaching:
Change the value of the parameter No. 35 (safety speed).

[4] Set the optimum values in the fields of “Position,” “Speed,” “Acceleration,” “Deceleration,” etc., with the PC or teaching pendant.



(Note 1) T1: Excited-pole detection time = 0.2 to 12 sec
Normally the detection of excited pole completes in approx. 0.2 sec, although the exact time varies from one actuator to another due to individual differences and also depending on the load condition. If the detection of excited pole has failed, the excited-pole detection operation will be continued for up to 12 sec.

⚠ Caution: For the timing of emergency stop reset after power-on from the emergency stop condition, the servo will be turned ON in T1 (Note 1) sec at maximum after emergency stop reset.



Warning:	Since a pulse motor is adopted as the driving motor, excited phase detection operation is performed when the servo is turned ON for the first time after the power has been input. What this means is that the actuator must be able to move when the servo is turned ON. If the slider or rod is at the mechanical end or the transferring load is contacting any surrounding device, excited phase detection cannot be completed successfully and the actuator may operate erroneously or an excitation detection error may generate. In this case, manually move the actuator to a position where it can move, before turning ON the servo. If the actuator has a brake, you must set the brake release switch to the ON side to forcibly release the brake. However, exercise caution not to let you hand pinched or robot hand or work damaged by the actuator dropping suddenly due to its dead weight. If the actuator cannot be moved by hand, changing the setting of parameter No. 28 (direction of excited phase signal detection) is an alternative solution. If you wish to change this parameter, consult IAI beforehand.

- Controller ready (PWR)
  This signal indicates whether the controller is controllable from the outside.
  0: Controller BUSY, 1: Controller READY
  The controller is not generally put into a BUSY status.

- Servo ON command (SON)
  When this signal becomes “1,” the servo ON status is made.
  Use this signal when the servo ON/OFF is required in constructing the safety circuit of the entire equipment.

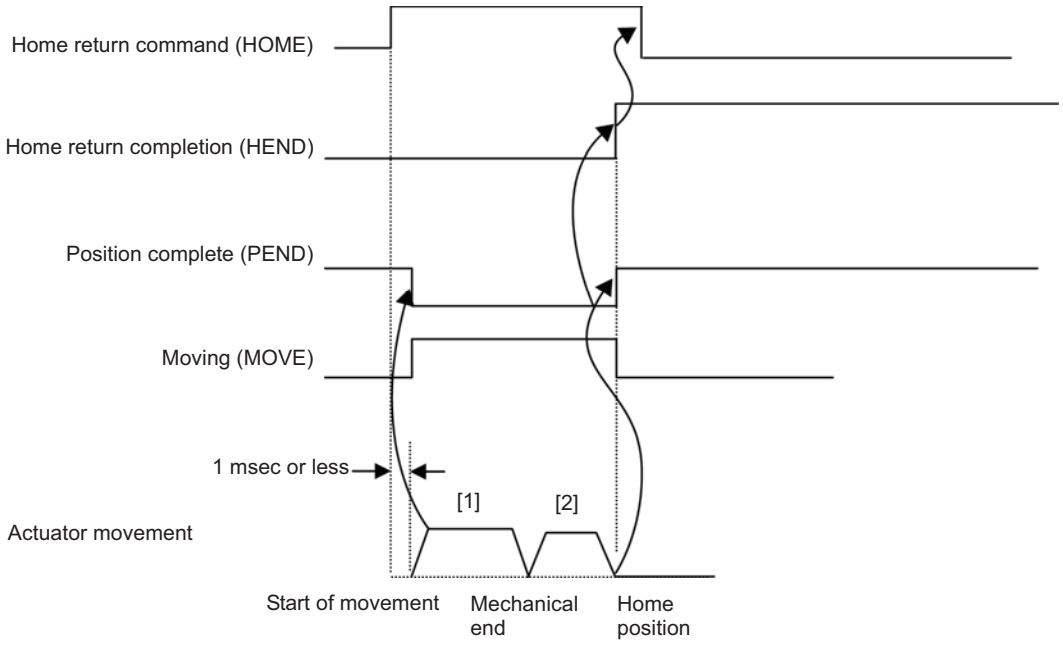
- Operation ready (SV)
  This signal is a monitor signal indicating that the servo is ON and the motor is ready after the servo ON command (SON) is input. The 1/0 status of this signal is synchronized with the lit/unlit status in green of the SV lamp on the front panel.

4.4.2 Home Return Operation

Since this controller adopts the incremental position detector (encoder), mechanical coordinates will be lost if the power is cut off.
Because of this, it is required to establish the mechanical coordinates by performing home return operation immediately after power-on.
To perform home return operation, input the home return command (HOME).

Operation timing

PLC processing 1: When the start button is pressed, the home return command signal (HOME) turns ON.
Operation: [1] The actuator starts to move to the mechanical end near the home.
[2] After hitting the mechanical end the actuator turns back, and stops temporarily at the home position.
→ The home return completion signal (HEND) turns ON.
PLC processing 2: The home return command signal (HOME) turns OFF.
PLC processing 3: Continuous operation starts.



⚠ Caution: When performing home return operation, pay attention to the following:
[1] Confirm that there is no obstacle located in the direction of home return.
[2] Should there be an obstacle in the direction of home return, temporarily move the actuator in the home direction and remove the obstacle.
[3] When the HOME signal is “1,” the PEND signal becomes “0” and the MOVE output signal becomes “1.”
Return the HOME signal to “0” after confirming that the HEND has become “1” while the HOME is “1.”

■ Home return command (HOME)

When the rise edge (0→1) of this signal is detected, home return operation starts.
Upon completion of home return, the home return completion (HEND) signal will be output.
The HOME signal can be input any number of times even after the completion of home return.

(Note) Home return operation is automatically performed during the first positioning operation (CSTR signal) without performing home return after power-on.

■ Home return completion (HEND)

This signal is “0” immediately after the power is input, and becomes “1” in either of the following two conditions:

[1] Home return operation by the HOME signal has been completed.
[2] Home return operation associated with the first positioning operation by the CSTR signal has been completed.

Once this signal has become “1,” it will not become “0” until the input power supply is cut off or the HOME signal is input again.
Use this signal as the interlock signal before home return.

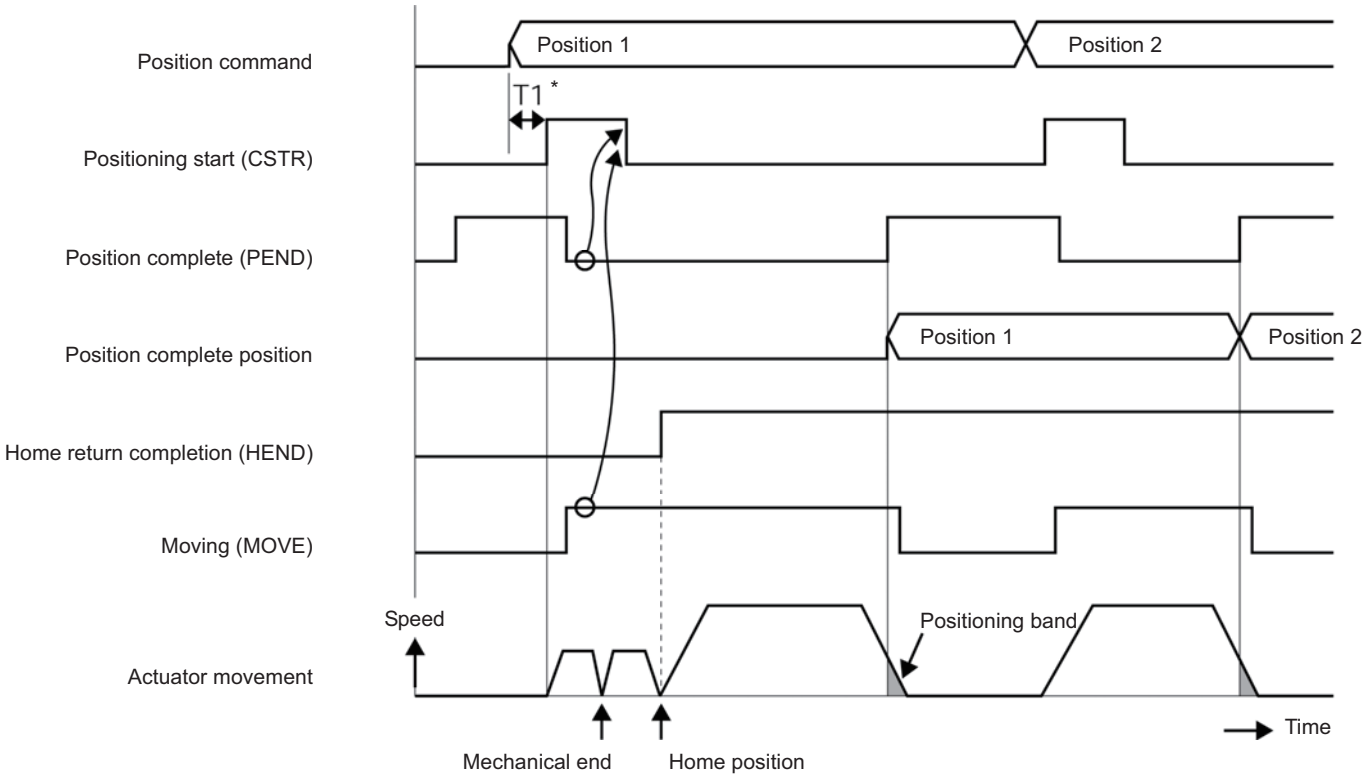
4.4.3 Positioning Operation

First, turn on the 24 VDC power supply and set the position complete signal (PEND) to “1” by referring to 4.4.2. Home return has not been completed immediately after the power is input. It is required to perform home return by issuing the home return command (HOME) as described in 4.4.3.
If positioning start (CSTR signal) is output by specifying a position (position no. specification or direct specification of position data), positioning will be performed to the specified position after performing home return operation.

Positioning operation is described below by taking the actuator with a stroke of 400 mm as an example.

Example of position table

No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]	Push [%]		Positioning band [mm]		Comment
1	5.00	300.00	0.30	0.30	0		0.10		
2	200.00	300.00	0.30	0.30	0		0.10		
3	380.00	300.00	0.30	0.30	0		0.10		



* T1: Set T1 to 0 msec or more in consideration of the scan time of the host controller.

Operational Description

[1] If operation becomes ready after the power is turned on, the operation ready (SV) and position complete (PEND) signals become “1.” After confirming that PEND is “1,” specify position 1 and set the positioning start signal (CSTR) to 1.
To specify a position, specify the position number as six bits from PC1 to PC32 or directly specify the numeric value in register PCMD.
→ Concurrently with the start of home return operation, PEND will become “0” and MOVE will become “1.”

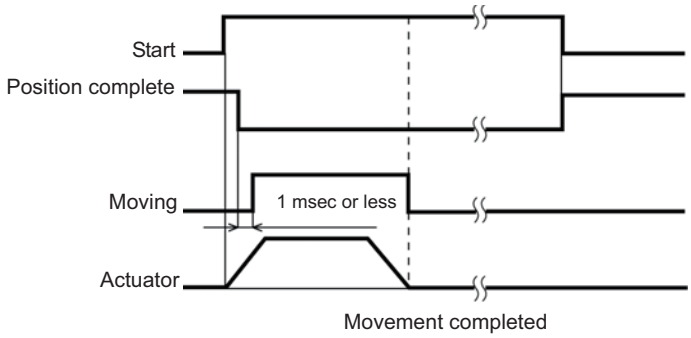
[2] After confirming that MOVE has become “1,” set CSTR to “0.”
→ Immediately after the completion of home return operation (HEND will become “1”), positioning operation to position 1 will start.

[3] When the set positioning band corresponding to the command value of position 1 is reached, PEND will become “1”, MOVE will become “0” and the completed position number will be output as six bits from PM1 to PM32 in register POSS.

[4] Then, specify position 2 and set CSTR to “1” in the same ways as [1]. Positioning operation to position 2 will start.

[5] Positioning to position 2 will be completed in the same way as [3].

⚠ Caution: When the start signal turns ON, the position complete output will turn OFF and the moving output will turn ON.
The start signal must be turned OFF with the confirmation that the moving output has turned ON (the position complete output has turned OFF) while the start signal remains ON.
If the start input remains ON as shown below, the position complete output will not turn ON even if the actuator movement has been completed.



■ Positioning start (CSTR)

Upon detecting a rise edge (0→1) of this signal, the controller will read the target position number as a binary code consisting of six bits from PC1 to PC32 (position no. specification register), and execute positioning to the target position of the corresponding position data.
Before issuing a start command, all operation data such as the target position and speed must be set in the position table using the PC or teaching pendant.
If this command is issued when home return operation has not been performed yet after the power input (the HEND output signal is OFF), the controller will automatically perform home return operation before positioning to the target position.

■ Moving (MOVE)

This signal is output while the servo is ON and the actuator is moving (also during home return, push & hold operation or jogging).
Use the MOVE signal together with the PEND signal to allow the PLC to determine the actuator status.
The MOVE signal will become “0” when home return is completed and during a pause after a judgment is made during push & hold operation that the work is being contacted as well as when positioning is completed.

■ Command position number (PC1 – PC32)

When a movement command is effected upon 0 → 1 of the CSTR signal, the six-bit binary code consisting of signals PC1 to PC32 will be read as the command position number.

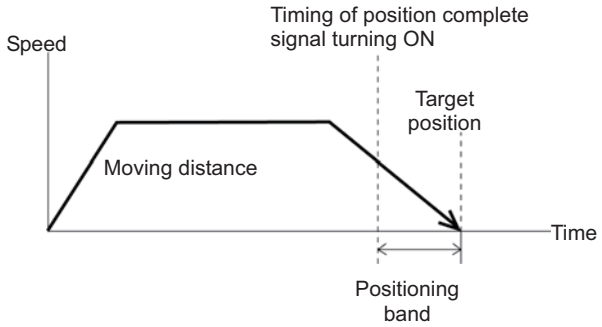
■ Completed position number (PM1 – PM32)

These signals can be used to check the completed position number when the PEND signal becomes “1.”
The signals are output as a binary code in the position no. status register.
Immediately after the power is input, all of the PM1 to PM32 signals are “0.”
All of PM1 to PM32 are also “0” when the actuator is moving.
As described above, this signal is output only when positioning is completed.
All of PM1 to PM32 will become “0” when the servo is turned OFF or an emergency stop is actuated. They will return to “1” when the servo is turned ON again, provided that the current position is inside the positioning band (INP) with respect to the target position. If the current position is outside the band, the signals will remain at “0.”
The signals will also become “1” when judgment is made as ON during push & hold operation or the work is not contacted.

■ Position Complete (PEND)

This signal indicates that the target position has been reached, and turns ON in the following condition:
[1] The operation ready signal (SV) is “1” and
[2] The current position deviation from each target position is within the positioning band or
[3] Work is contacted (not missed) during push & hold operation.

This signal is used as a trigger signal to peripheral equipment when the target position is reached.
Since making the positioning band value larger quickens a command to peripheral equipment by that amount, it is effective as a means to reduce the tact time of the entire system.



When the servo turns ON after the power is input, this signal will become “1” because that position becomes the target position. The signal will become “0” when positioning operation starts with the CSTR signal as “1.”

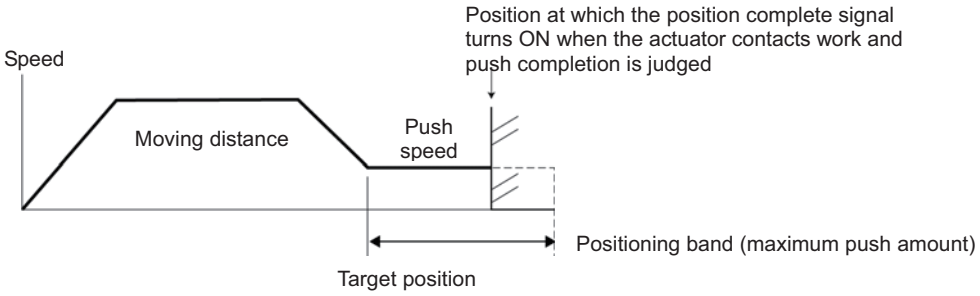
(Note) When the servo turns OFF or an emergency stop is actuated, PEND will become “0” once.
If the position deviation is within the positioning band when the servo is turned ON again, PEND will return to “1.” If CSTR remains “1,” PEND will not return to “1” even when the current position deviation falls within the positioning band and become “1” after CSTR becomes “0.”

4.4.4 Push & Hold Operation

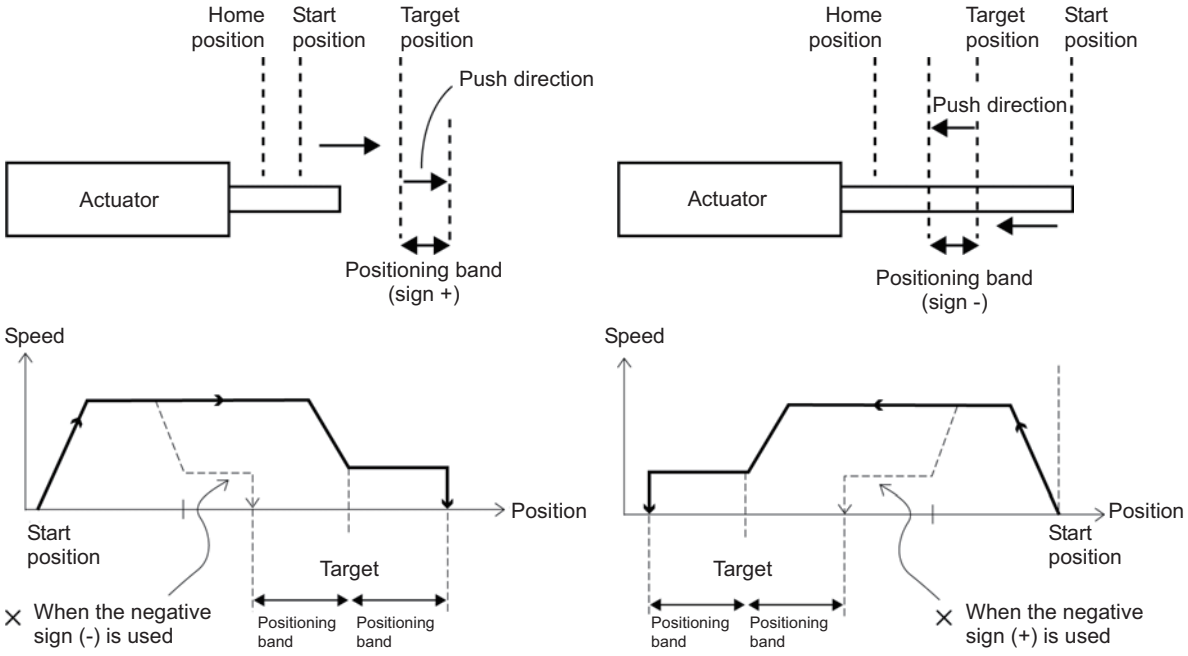
The actuator can continue to hold work in position while the rod end is pushing it, like an air cylinder. Therefore, it can be used in the operation of work clamping or press fit process.

(1) Basic operation

After moving to the target position set as shown below, the actuator will move at the set push speed and push work by the push amount set as the maximum.
When a push force reaches a certain value in the middle of push & hold operation, the position complete signal will become “1” because push completion is judged with work being contacted.



- Concept of push direction



When work is pushed in the direction which increases the coordinate value from the start position toward the target position as shown above, the push direction will be positive (+). On the other hand, when work is pushed in the direction which decreases the coordinate value, the push direction will be negative (-). If the positioning band is entered with an incorrect sign, the position will deviate by twice the positioning band, as shown below. Therefore, exercise sufficient caution.

[1] Push & hold mode
- Set a numeric value other than 0 in the “Push” field of the position table. (Current-limiting value)
- In the case of numeric specification, specify “1” to bit 0 in the control flag specification register CTLF.

[2] Push speed
Set the push speed with parameter No. 34 (push speed).
(It is individually set on an actuator model basis before shipment.)

[3] Maximum push amount
- Set the maximum push amount in the “Positioning band” field of the position table.
- In the case of numeric specification, set it in the positioning band register (INP).
(Consider the position error when work is installed, or the depressed amount for work of elastic material.)

[4] Push direction
- Sign of the “positioning band” in the position table
- In the case of numeric specification, set “0” or “1” to bit 1 in the control flag specification register (CTLF).

[5] Push complete judgment
- Push completion is judged with the motor generating torque (push force) and push time.
- For the push force, set a current-limiting value (%) in the “Push” field of the position table. In the case of numeric specification, set the value in the current-limiting value during push & hold operation register (PPOW).

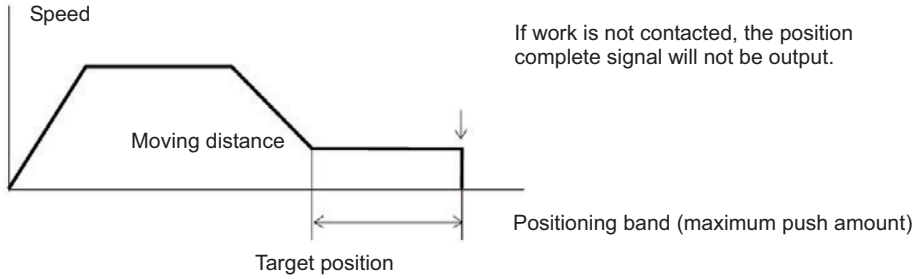
* Determine the push force according to the work characteristics (shape, material, etc.) and the current-limiting value according to the diagram for the relationship between the “push force and current-limiting value” of the actuator.

- Set the value of the push stop judgment time to parameter No. 6.
(The factory setting is 255 msec.)

[6] Continuous push
- When the push & hold operation is deemed to have completed, the position complete signal turns “1.” However, the actuator will continue to push the work until the next movement command is issued (= a command position number is specified and a positioning start signal is output).

(2) Work is not contacted (missed)

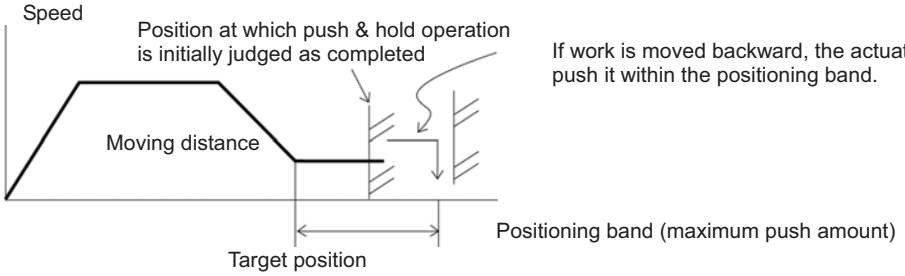
If work is not contacted even though the actuator has moved the distance by the set positioning band (when the motor current does not reach the current-limiting value during push & hold operation), the positioning complete signal will not be output. However, the completed position number will be output.
At this time, the PSFL bit of the device status register (DSS1) becomes “1.”
Accordingly, perform timeout check process for ample period on the host PLC side.



(3) Work moves during push & hold operation

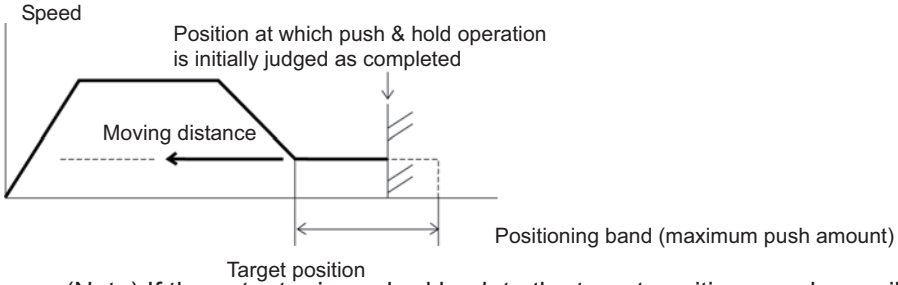
(1) Work moves in the pushed direction

If work moves in the pushed direction after push & hold operation has once been completed, the actuator will push the work within the positioning band.
If the current during movement drops below the current-limiting value during push & hold, the position complete signal will turn OFF. The signal will turn ON again when the current rises to or above the limiting value.



(2) Work moves in the opposite direction

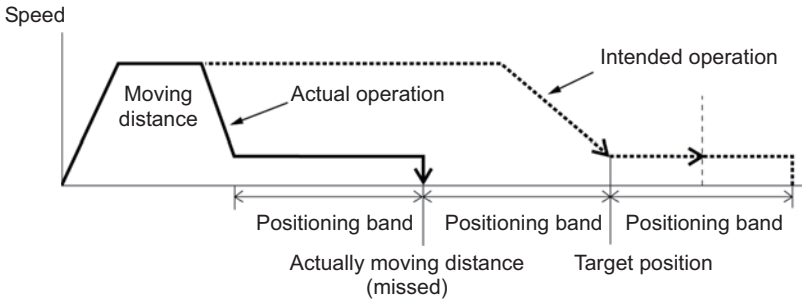
(Actuator is pushed back by the reactive force of the work)
If the actuator is pushed back after push & hold operation has once been completed because the actuator thrust is smaller than the reactive force of the work, the actuator will be pushed back all the way until its thrust balances out with the reactive force of the work. At this time, the position complete signal will remain ON.



(Note) If the actuator is pushed back to the target position, an alarm will be generated.

(4) Positioning band is entered with an incorrect sign

If the positioning band is entered with an incorrect sign, the position will deviate by twice the positioning band, as shown below. Therefore, exercise sufficient caution.

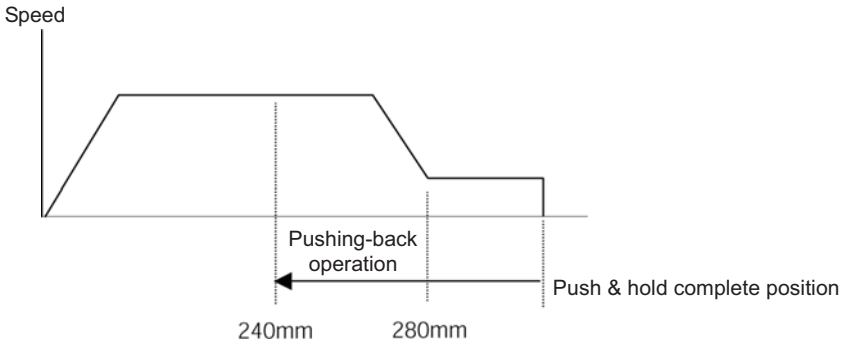


(5) Pushing back is performed after push & hold operation by specifying the relative coordinate

The reference position for the relative coordinate specification is not the current position at which the actuator stops after push & hold operation has completed but the target position of the position number for push execution. Exercise sufficient caution for this.

In the example above, if the position number is set as the relative coordinate minus 40 mm, the actuator will move to the position of 240 mm obtained by subtracting 40 from 280.

However, if push is specified, the actuator will perform relative movement from the stop position.

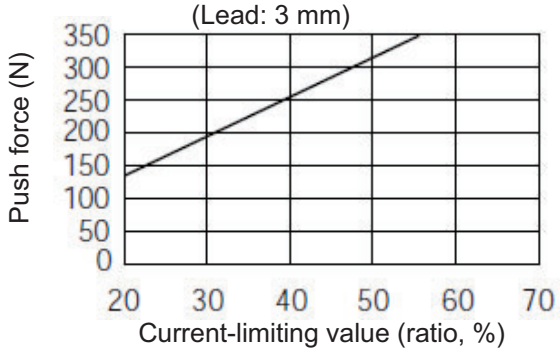


The graphs below show the relationships of current-limiting value [%] and push force [N] of respective actuators.
Note: For the relationships applicable to RCP3 controllers, refer to the operation manual for RCP3.

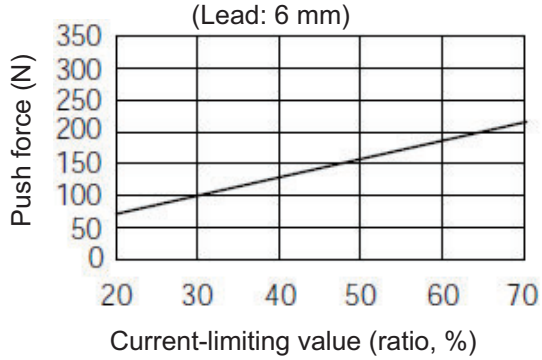
• Slider Type

(1) SA5C/SA6C/SS7C types

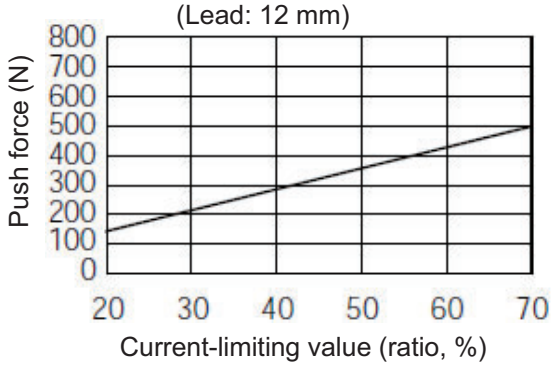
Low-speed type
(Lead: 3 mm)



Medium-speed type
(Lead: 6 mm)

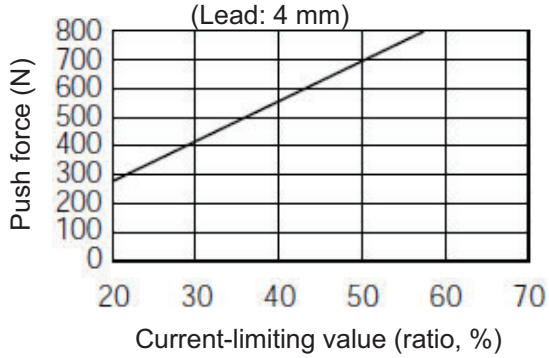


High-speed type
(Lead: 12 mm)

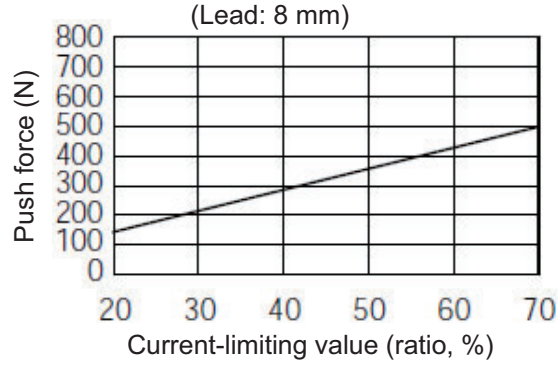


(2) SA7C Type

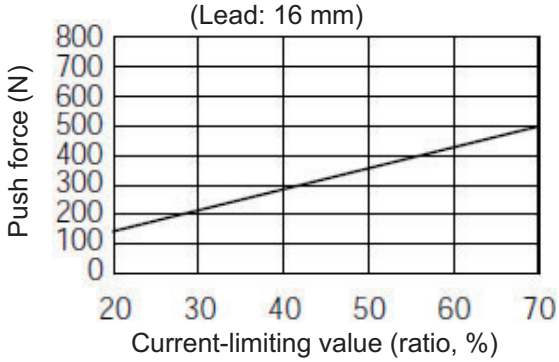
Low-speed type
(Lead: 4 mm)



Medium-speed type
(Lead: 8 mm)



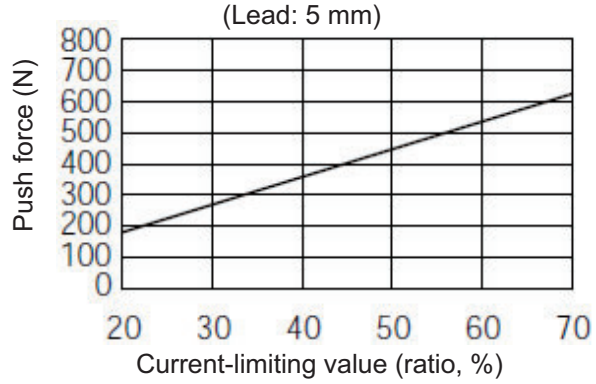
High-speed type
(Lead: 16 mm)



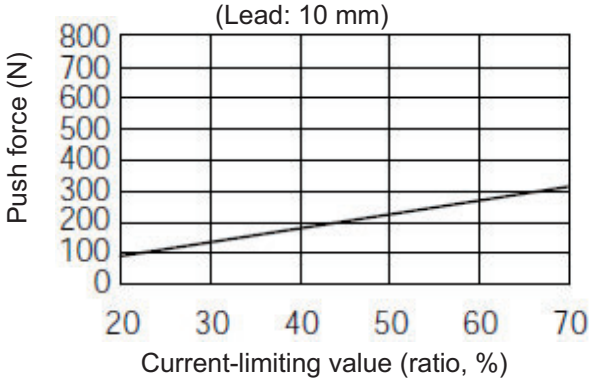
⚠ Caution: Precision of each push force at standstill is not guaranteed, and the above are reference values only.
Exercise caution that if the push force is too small, the actuator may malfunction during push-motion operation due to slide resistance, etc.
Find the maximum current-limiting value of your controller from the applicable graph above. The minimum value is 20%

(3) SS8C type

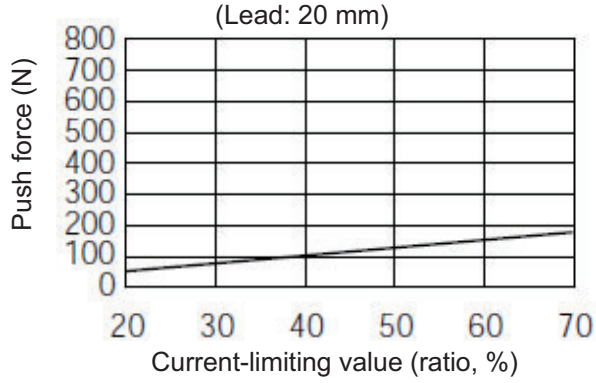
Low-speed type
(Lead: 5 mm)



Medium-speed type
(Lead: 10 mm)



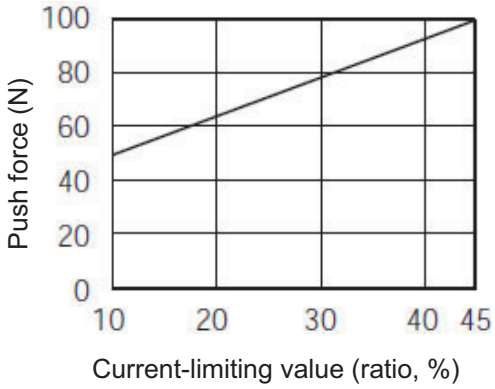
High-speed type
(Lead: 20 mm)



⚠ Caution:	Precision of each push force at standstill is not guaranteed, and the above are reference values only. Exercise caution that if the push force is too small, the actuator may malfunction during push-motion operation due to slide resistance, etc. Find the maximum current-limiting value of your controller from the applicable graph above. The minimum value is 20%

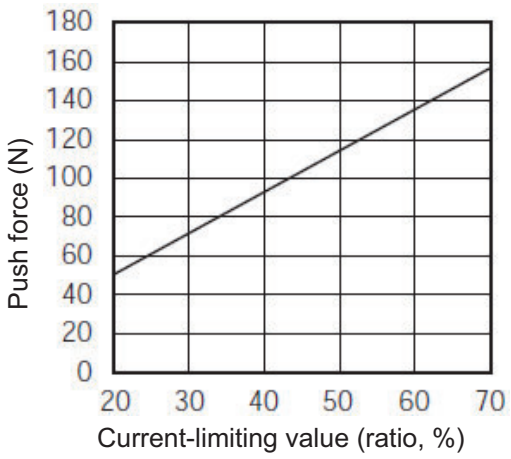
• Rod type

(1) RA2C type

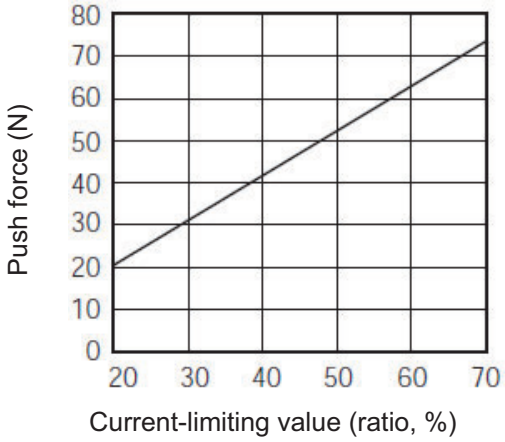


(2) RA3C type

Low-speed type
(Lead: 2.5 mm)



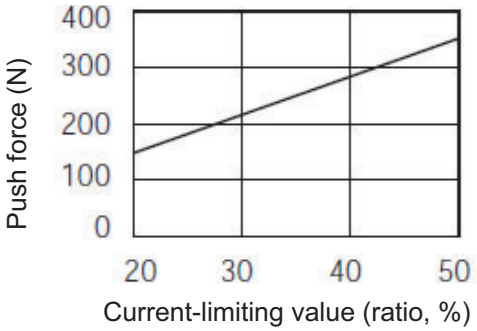
Medium-speed type
(Lead: 5 mm)



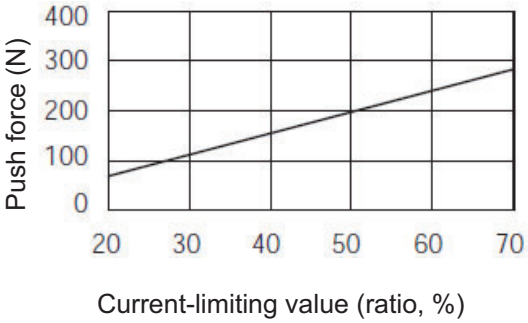
⚠ Caution:	Precision of each push force at standstill is not guaranteed, and the above are reference values only. Exercise caution that if the push force is too small, the actuator may malfunction during push-motion operation due to slide resistance, etc. Find the maximum current-limiting value of your controller from the applicable graph above. The minimum value is 20%

(3) RA4C type

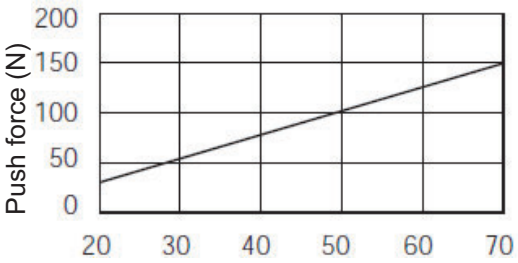
Low-speed type
(Lead: 2.5 mm)



Medium-speed type
(Lead: 5 mm)

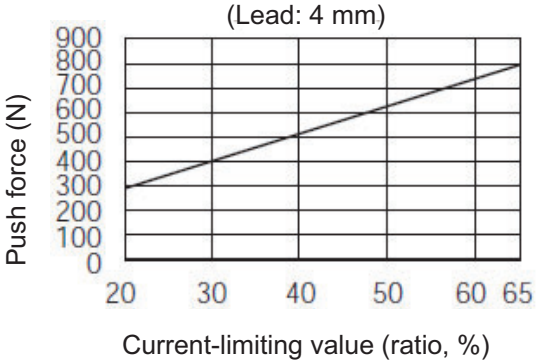


High-speed type
(Lead: 10 mm)

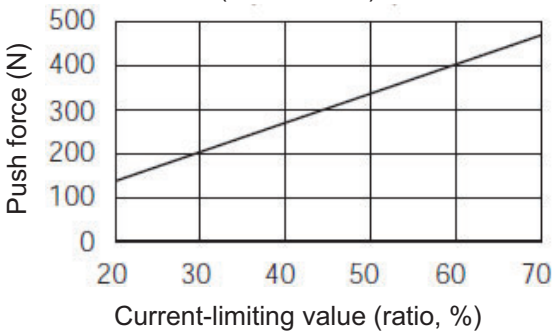


(4) RA6C type

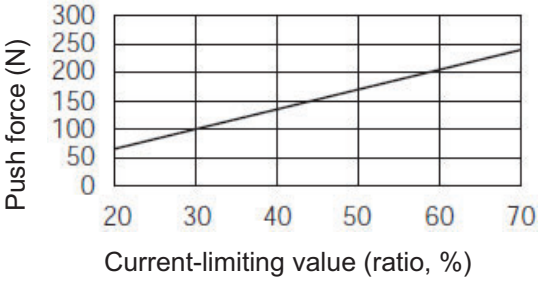
Low-speed type
(Lead: 4 mm)



Medium-speed type
(Lead: 8 mm)



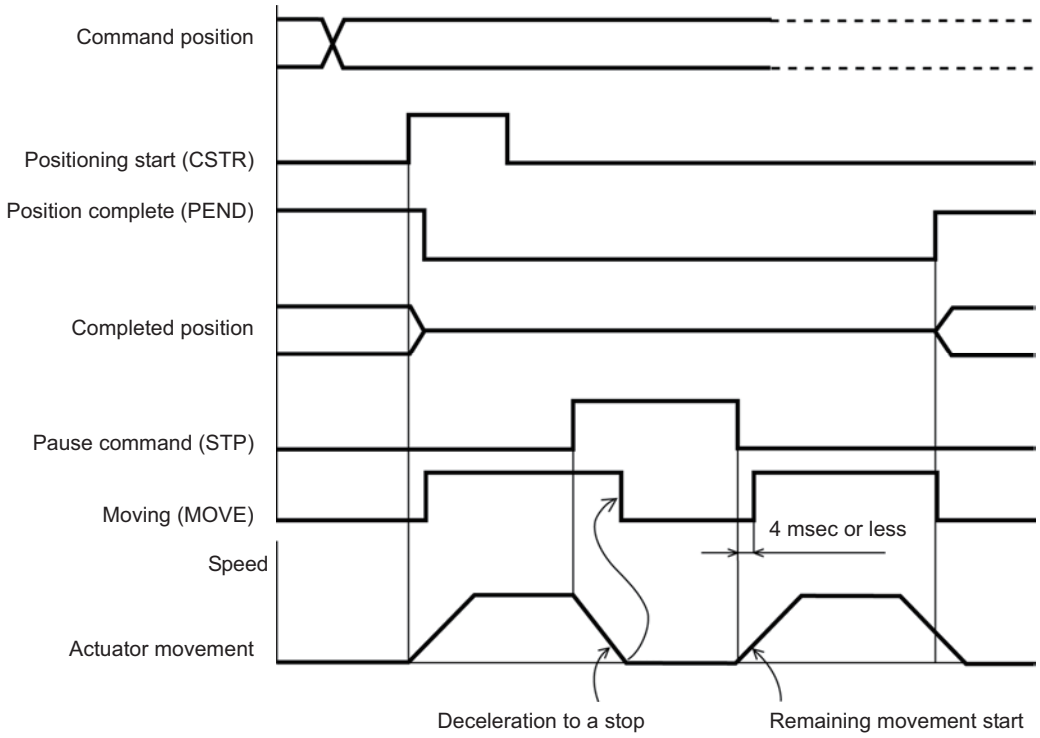
High-speed type
(Lead: 16 mm)



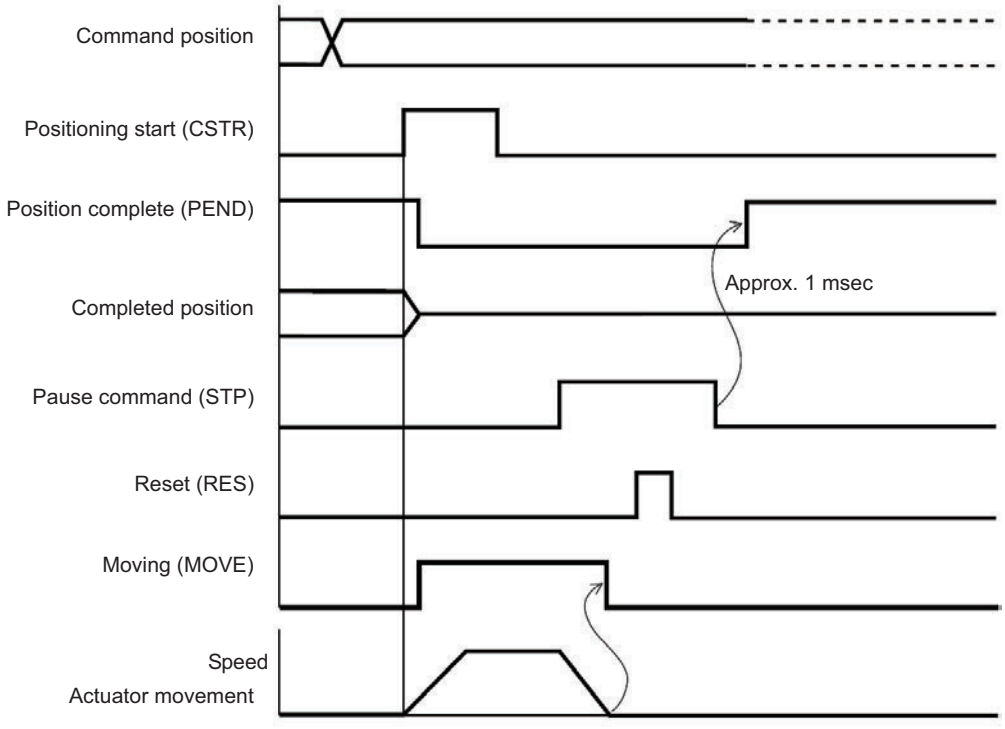
⚠ Caution: Precision of each push force at standstill is not guaranteed, and the above are reference values only.
Exercise caution that if the push force is too small, the actuator may malfunction during push-motion operation due to slide resistance, etc.
Find the maximum current-limiting value of your controller from the applicable graph above.
The minimum value is 20%

4.4.5 Pause

The actuator will decelerate to a stop by setting the pause command (STP) to “1” during its operation.
Since the remaining movement is retained, setting STP to “0” again will restart the remaining movement.



The remaining movement can be cancelled by setting the alarm reset (RES) to “1” during pause.
When a reset of the pause command (STP) is subsequently recognized, the position complete (PEND) signal will turn “1” within approx. 1 msec thereafter.
(The controller will detect a rise of the reset signal and cancel the remaining movement.)



4.4.6 Speed Change during Movement

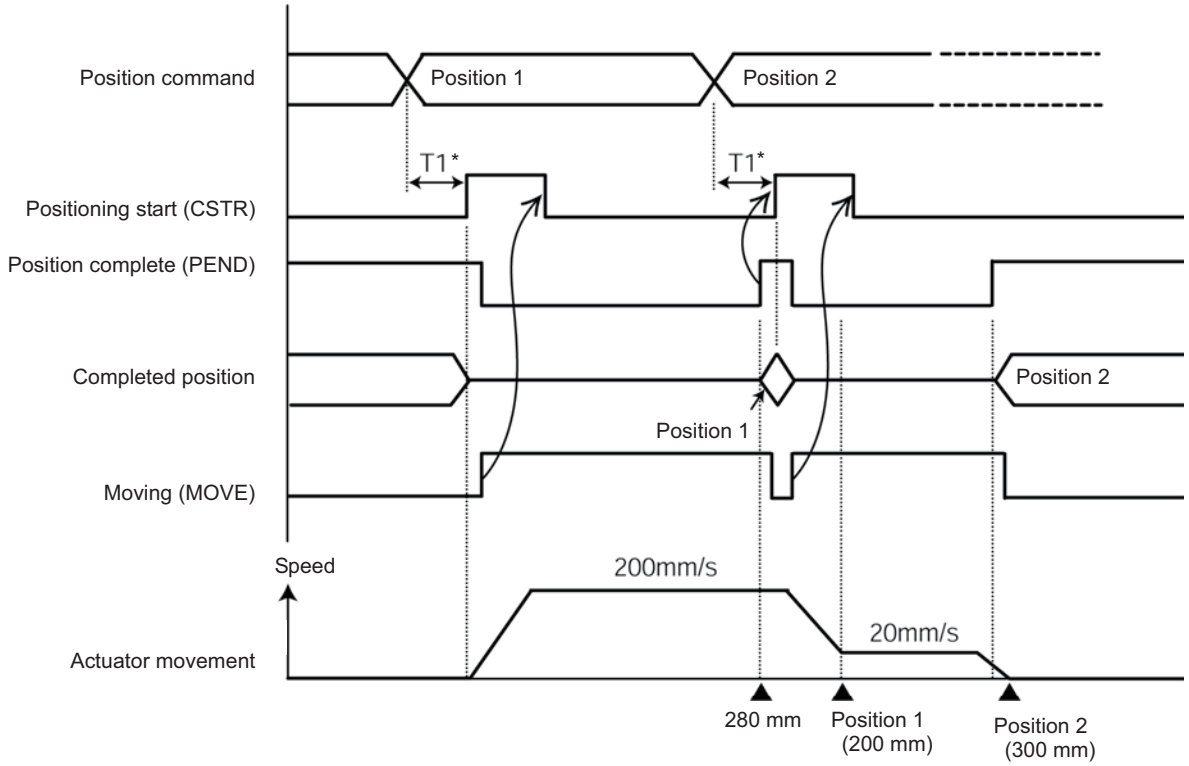
Speed control involving multiple speed levels is possible in a single operation. The actuator speed can be decreased or increased at a certain point during movement.
However, the position at which to implement each speed change must be set.

Applications refer to the case where the material of transferred work is soft or where it is not desired to give vibrations or an impact to the work having the easy-to-topple shape.

(Example) If positioning is performed at position 2 (300 mm from the home position), move the actuator at a speed of 200 mm/sec up to position 1 in mid-process (200 mm from the home position) and subsequently at a speed of 20 mm/sec.

Example of position table

No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]	Push [%]	Positioning band [mm]	Comment
1	*	*	*	*	*	*	
2	200.00	300.00	0.30	0.30	0	20.00	
3	380.00	20.00	0.30	0.30	0	0.10	



* T1: Set T1 to 0 msec or more in consideration of the scan time of the host controller.

(Note) If the pause command is output during home return operation, the movement command will be retained when the actuator has not pushed the mechanical end but operation must again begin with home return after the actuator has pushed the mechanical end and performed pushing-back operation.

■ Alarm reset (RES)

An alarm can be reset at a rise edge of 0 to 1.
If the cause for the alarm is not resolved, the alarm status will be entered again.
If an alarm is reset during pause, the remaining movement will be cancelled.

⚠ Caution: [1] If the start signal (CSTR) is set to “1,” the position complete signal (PEND) will be “0” and the moving signal (MOVE) will be “1.”
Set the start signal (CSTR) to “0” after confirming that the moving signal (MOVE) has become “1” while CSTR is “1.”

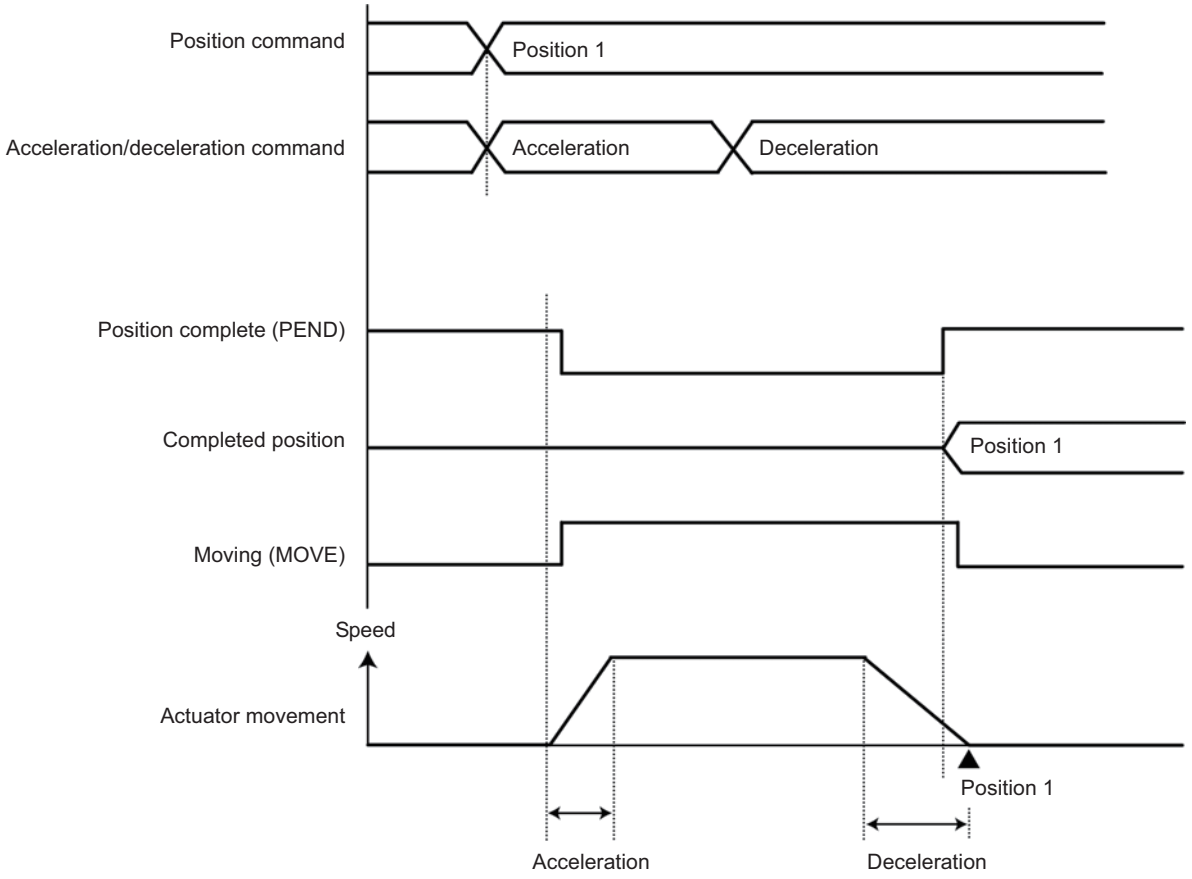
[2] If the positioning band at position 1 is made large, the actuator speed can be changed smoothly without stopping it temporarily.

4.4.7 Operation at Different Acceleration and Deceleration Settings

(1) If the operation by position number specification is used, the acceleration and deceleration can be set separately in the position table.

(2) If the operation by numeric specification is used, the acceleration/deceleration data (set on register 9906H) will become valid during data receiving. Therefore, to make the deceleration different from the acceleration, change the acceleration/deceleration data during movement.

(Example)

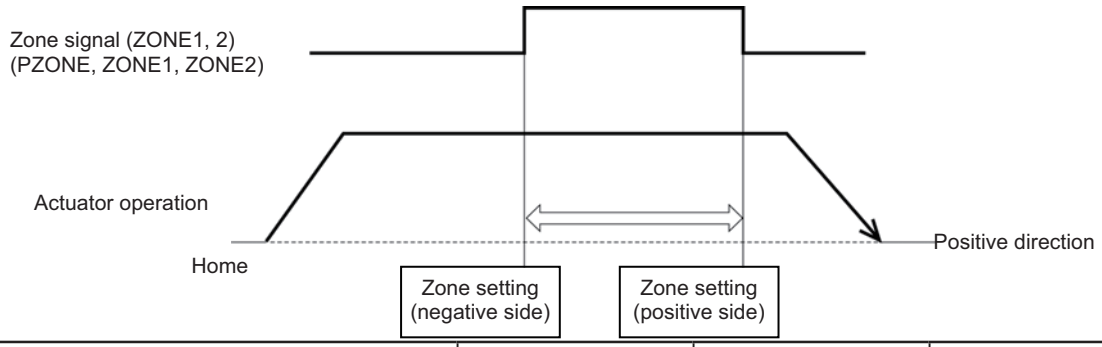


4.4.8 Zone Signal

This signal is output (becomes “1”) when the current position of the actuator is inside the set zone, and it can be used in the following application:

[1] Interlock signal to prevent interference with peripheral equipment
[2] Trigger signal to reduce the tact time for peripheral equipment
[3] Judgment of work not being contacted during push & hold operation
[4] End-point determination in constant pitch feeding of work placed in alignment

(Note) In the constant pitch feeding, the “Position” field of the position table indicates the relative amount but the zone setting establishes the absolute coordinate from the home position.



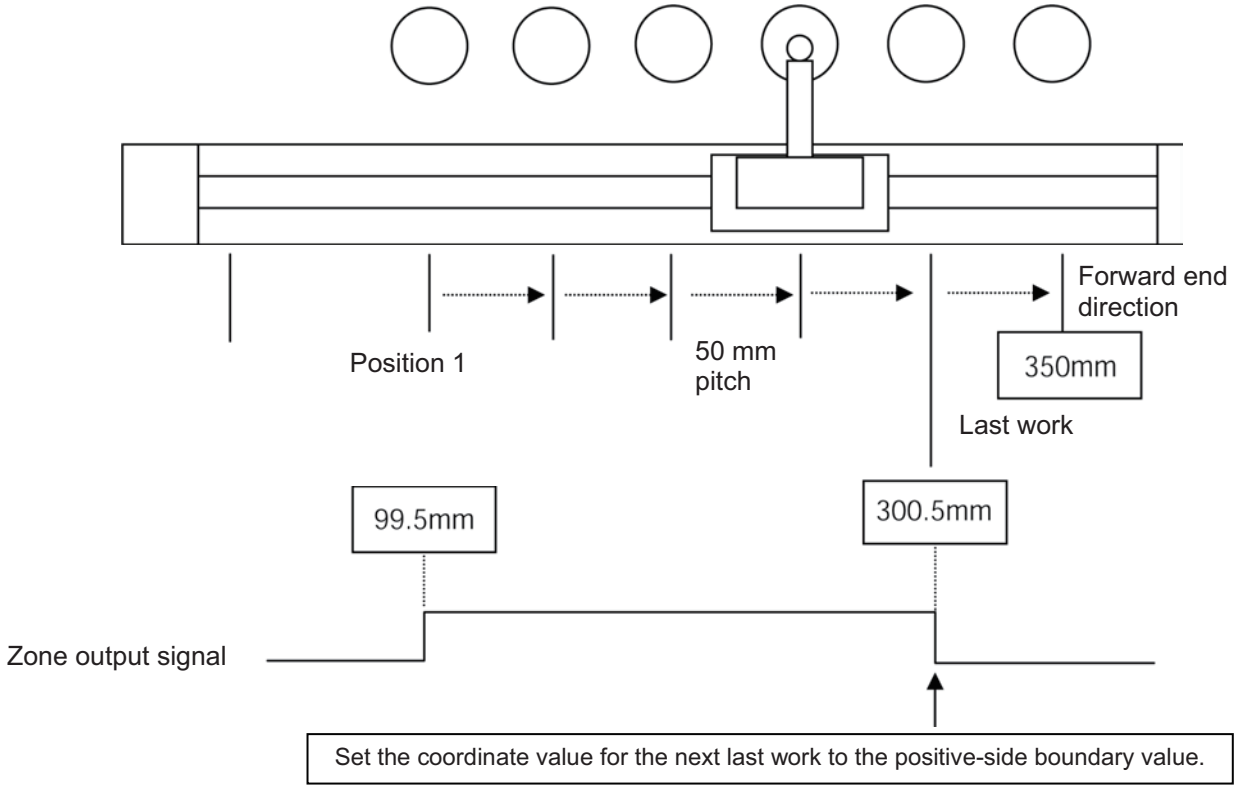
Setting	Zone signal*	Position no. specification mode	Numeric specification mode
Individual zone boundary in position table	Position zone output PZONE	○	×
Zone boundary 1 of user parameter (parameter No. 1, No. 2)	Zone output 1 ZONE1	○	○
Zone boundary 2 of user parameter (parameter No. 23, No. 24)	Zone output 2 ZONE2	○	○

* The zone signal is output to the zone status register (address 9013H).
It becomes “1” when the current position is inside the zone range or becomes “0” when the current position is outside the zone range.
The signal becomes valid after the completion of home return. It is valid even when the servo is OFF, provided that home return has been completed.

4.4.9 Pitch Feeding by Relative Coordinate Specification

For the target position in the position table, relative coordinate specification is also available. Therefore, it can be used in constant-pitch positioning (constant-pitch feeding).

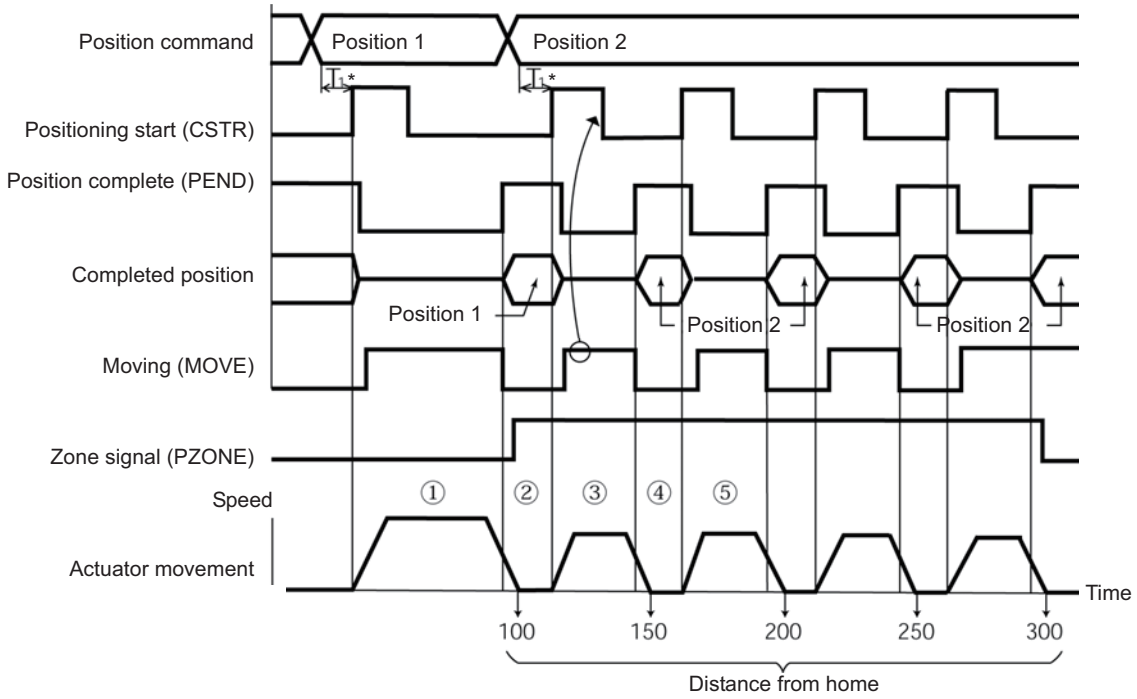
(1) Operation example in the position no. The following is the description of an example of positioning with a 50 mm pitch from position No. 1. Create a position table as shown below. Operational completion is judged by PLC's executing count control. The combined use of the zone signal allows a double check specification mode.



Example of position table

No.	Position [mm]	Zone + [mm]	Zone – [mm]	Incremental	Comment
0	*	*	*	0	
1	100.00	300.50	99.50	0	
2	= 50.00	300.50	99.50	1	

*Indicates the relative coordinate specification with the teaching pendant.



* T1: Set T1 to 0 msec or more in consideration of the scan time of the host controller.

[Operational description]

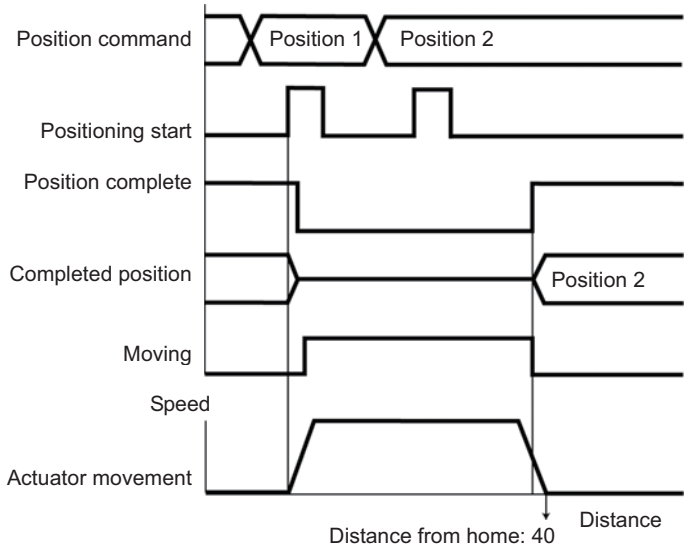
[1] Perform positioning operation to position 1 (100.00 mm).
[2] Upon completion of positioning to position 1, the position complete signal (PEND) will become “1.”
The zone signal (PZONE) will also become “1.”
After changing the position number from 1 to 2, set the start signal (CSTR) to “1.”
[3] When movement starts, (PEND) will change from “1” to “0” and the moving signal (MOVE) will change from “0” to “1.” After confirming that (MOVE) has become “1,” set the start signal (CSTR) to “0.”
[4] When the actuator has moved only 50 mm, (PEND) will become “1” and (MOVE) will become “0” again. At this time, the PLC counts the first time of movement.
Then, set the (CSTR) for the second 50 mm movement to “1.”
[5] Repeat the operations of [3] and [4].

The PLC checks the zone signal (PZONE) status when positioning has been completed and judges that the current position is the last work position if the signal has become “0.”
If the number of counts on the PLC side does not agree with the zone signal status, it is assumes that the signal timing is not synchronized.

(2) Notes on positioning operation

Selecting/entering a position number using relative coordinates during positioning will cause the actuator to move to the position corresponding to the initial position plus the relative movement. (If the relative movement is a negative value, the actuator will move to the position corresponding to the initial position minus the relative movement.)

Example) If the start signal for movement to position 2 is input while the actuator is moving to position 1, the actuator will move to the position 40 mm from the home.

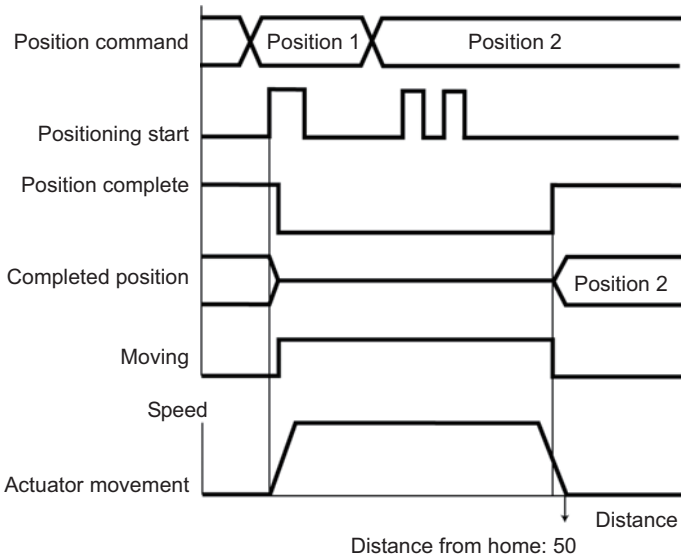


<Position table by teaching pendant>

No.	Position	Speed
0	*	*
1	30	100
2	10	100
⋮	⋮	⋮

If the start signal for movement to a position number using relative coordinates is input multiple times during positioning, the actuator will move to the position corresponding to the initial position plus the relative movement × number of times the signal was input.

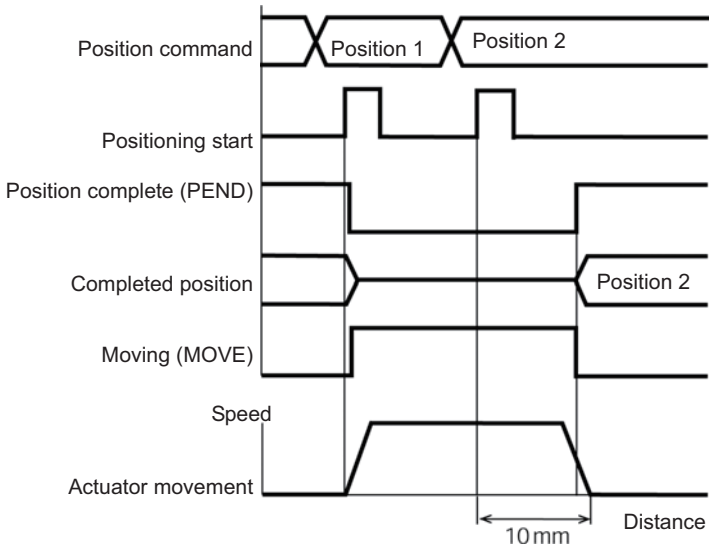
Example) If the start signal for movement to position 2 is input twice while the actuator is moving to position 1, the actuator will move to the position 50 mm from the home.



(3) Notes on push & hold operation

If the start signal is input with a position number using relative coordinates (push specification) selected/entered while the actuator is moving in the push & hold mode, the actuator will move to the position corresponding to the position at the time of start input plus the relative movement. Therefore, the end position will become indeterminate.

Example) If the start signal for movement to position 2 is input while the actuator is moving to position 1 in the push & hold mode, the actuator will move to the position 10 mm from where it was when the input signal was input.



<Position table by teaching pendant>

No.	Position	Speed
0	*	*
1	50	100
2	10	100
⋮	⋮	⋮

4.4.10 Power-saving Modes at Standby Positions

This controller possesses Automatic Servo-off and Full Servo functions to reduce the power consumption while the actuator is stopped. Read the description in this chapter carefully to save power so that the controller can be operated safely.
In the Full Servo Function, it is able to reduce the power consumption by controlling the pulse motor which consumes comparatively high current during a stop.
For the power saving function, which of Parameter No.53 or “Stop Mode” in the position table is to be used is determined by the actuator condition. The details are shown below.

Status	Description
Standby after home return is complete (Positioning to the target point is not done)	Power saving function executed with the values set in Parameter No.53 (Stop Mode of the position number is invalid)
Standby after the positioning is complete to the target position set in the position table	Power saving function executed with the values set in “Stop Mode” in each position number (Setting of Parameter No.53 is invalid)

⚠Caution: ・Full Servo Function is not effective while in jog operation and inching operation.
・Full Servo Function is not effective while in pressing operation. Do not use. It becomes effective at completion of positioning. In pressing, the function becomes effective only when miss-pressing occurs (the status at the completion of operation without pressing is the same as that at the completion of positioning).

●Set of power-saving mode

Select a proper power-saving mode from the conditions below. Set the corresponding value in the stop mode or parameter No.53 of the position table.

Set Value	Operation after completion of positioning
0	Servo ON not changed
4	Full Servo Control

4.5 Notes on ROBO Grippers

(1) Finger Operation

[1] Definition of Position

With the two-finger specification, the stroke represents the sum of travels of both fingers.
Accordingly, the travel of each finger is one-half the stroke.
The specified position indicates the travel of each finger from the home position toward the closing side.
For example, the maximum command value is 5 mm for the GRS type and 7 mm for the GRM type.

[2] Definition of Speed and Acceleration

Command values apply to each finger.
With the two-finger type, the actual speed (relative speed) and acceleration are twice the command values.

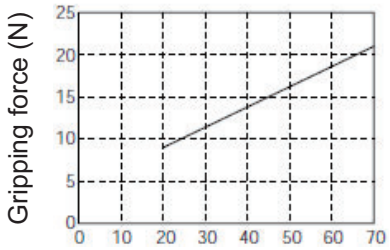
[3] Operation Mode in Gripper Applications

In applications where the ROBO Gripper is to grip the work, be sure to select the “push mode.”

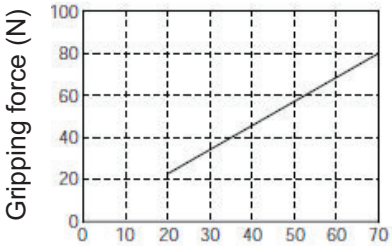
(Note) If the “positioning” mode is selected, a servo error may generate while the actuator is gripping the work.

[Graphs of Gripping Force and Current-limiting Value]

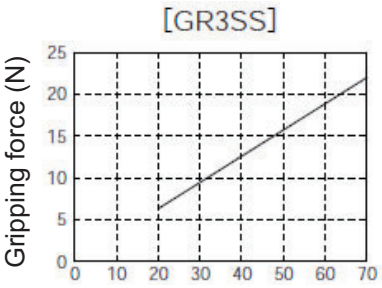
[GRS]



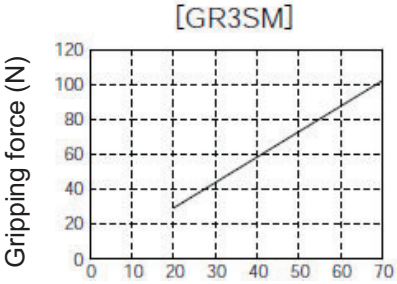
[GRM]



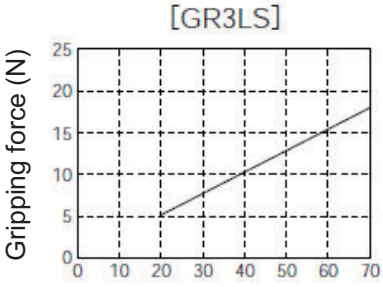
[GR3SS]



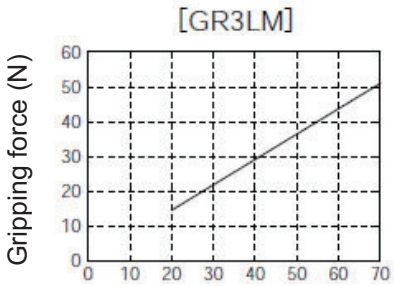
[GR3SM]



[GR3LS]



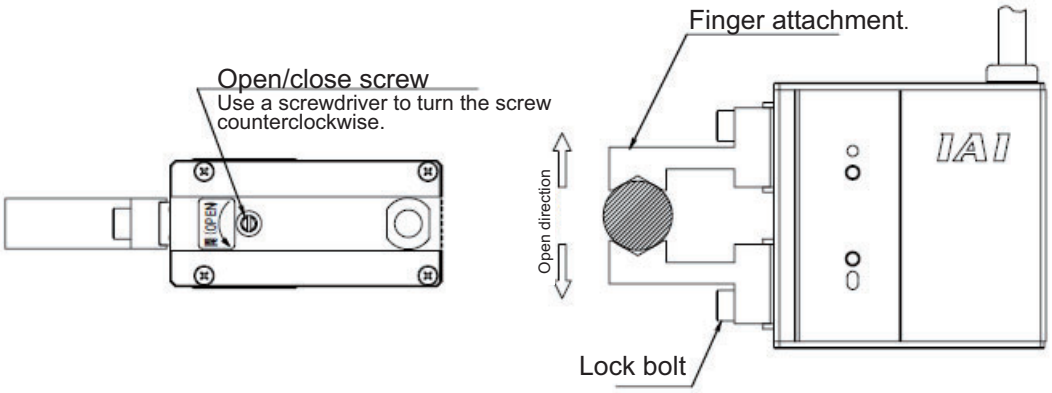
[GR3LM]



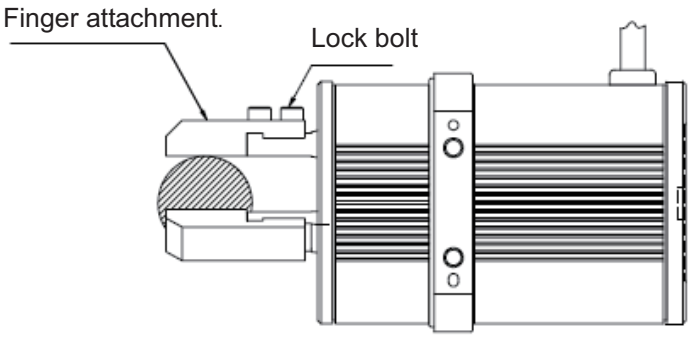
(2) Removing the Gripped Work

This gripper is structured in such a way that it will maintain its gripping force on the work through the self-lock function even when the servo is turned OFF or controller power is cut off.
If the gripped work must be removed while the power is cut off, do so by turning the open/close screw or taking out the finger attachment on one side.

[2-finger Type]
Turn the open/close screw or take out the finger attachment on one side.



[3-finger Type]
Take out one of the finger attachments.



4.6 Using a Rotary Actuator in the Multi-rotation Specification

Rotary actuators that support the multi-rotation specification let you specify multi-rotation operation or limited-rotation operation.

(1) Home Return

When a home return command is issued, the actuator moves in the home return direction to detect the limit switch and upon detecting the limit switch, the actuator reverses its direction. Thereafter, the actuator travels to a position where the limit switch turns off again, and then move the distance corresponding to the home return offset in parameter No. 22 to complete the home return.

(2) Operation Commands

Limited-rotation specification (Normal mode [selected by parameter No. 79])	Multi-rotation operation (Index mode [selected by parameter No. 79])
Push-motion operation is possible.	Push-motion operation is not possible.
Absolute coordinate specification -0.15° ~ 360.15°	Absolute coordinate specification 0.00° ~ 359.99°
Relative coordinate specification -360.15° ~ 360.15°	Relative coordinate specification -360.00° ~ 360.00°

Note

Pay attention to the setting of the PIO pattern parameter for the controllers listed below.
On the following types of controllers, relative coordinate specification cannot be used in the PIO patterns specified:

[1] PCON-C/CG: PIO pattern = 5 (User parameter No. 25)
[2] PCON-CY: PIO pattern = 0 (User parameter No. 25)

- Rotational axes of simple absolute unit specification do not support the index mode, so multi-rotation specification cannot be specified for these axes.

Applicable Models

Actuator	Controller
RCP2-RTBL-I-28P-20-360-*	PCON-C-28PI-*
RCP2-RTBL-I-28P-30-360-*	PCON-CG-28PI-*
RCP2-RTCL-I-28P-20-360-*	PCON-CY-28PI-*
RCP2-RTCL-I-28P-30-360-*	PCON-SE-28PI-*

5. Parameter Settings

5.1 Parameter Table

Parameters are classified into four types according to their content.

a: Parameter relating to the actuator stroke range
b: Parameter relating to the actuator operating characteristics
c: Parameter relating to the external interface
d: Servo gain adjustment

*

No.	Category	Symbol	Name	Unit	Default factory setting
1	a	ZONM	Zone boundary 1+	mm	Effective actuator length
2	a	ZONL	Zone boundary 1-	mm	Effective actuator length
3	a	LIMM	Soft limit+	mm	Effective actuator length
4	a	LIML	Soft limit-	mm	Effective actuator length
5	a	ORG	Home return direction (0: Reverse/1: Forward)	—	(In accordance with the specification at the time of order)
6	b	PSWT	Push & hold stop judgment period	msec	255
7	d	PLG0	Servo gain number	—	Set individually in accordance with the actuator characteristics
8	b	VCMD	Default speed	mm/sec	Set individually in accordance with the actuator characteristics
9	b	ACMD	Default acceleration/deceleration	G	Set individually in accordance with the actuator characteristics
10	b	INP	Default positioning band (in-position)	mm	0.10
12	b	SPOW	Current-limiting value at standstill after positioning	%	35
13	b	ODPW	Current-limiting value during home return	%	Set individually in accordance with the actuator characteristics
16	c	BRSL	SIO communication speed	bps	38400
17	c	RTIM	Minimum delay time for slave transmitter activation	msec	5
18	b	LS	Home position sensor input polarity	—	Set individually in accordance with the actuator characteristics
22	a	OFST	Home return offset	mm	Set individually in accordance with the actuator characteristics
23	a	ZNM2	Zone boundary 2+	mm	Effective actuator length
24	a	ZNL2	Zone boundary 2-	mm	Effective actuator length
28	b	PHSP1	Default movement direction for excitation-phase signal detection (0: Reverse/1: Forward)		Set individually in accordance with the actuator characteristics
29	b	PHSP2	Excitation-phase signal detection time	msec	10
31	d	VLPG	Speed loop proportional gain	—	Set individually in accordance with the actuator characteristics
32	d	VLPT	Speed loop integral gain	—	Set individually in accordance with the actuator characteristics
33	d	TRQF	Torque filter time constant	—	Set individually in accordance with the actuator characteristics
34	b	PSHV	Push speed	mm/sec	Set individually in accordance with the actuator characteristics
35	b	SAFV	Safety speed	mm/sec	100
39	c	FPIO1	Position complete signal output method (0: PEND: 1: INP)	—	0 (PEND)
42	b	FPIO4	Enable function (0: Valid/1: Invalid)	—	1 (Invalid)
43	b	AIOF	Home position check sensor input polarity	—	(In accordance with the specification at the time of order)
45	c	SIVM	Silent interval magnification	times	0 (Invalid magnification)
46	b	OVRD	Speed override	%	100
53	b	CTLF	Default stop mode	—	0 (Trapezoid)
77	b	LEAD	Ball screw lead length	mm	Set individually in accordance with the actuator characteristics.
78	b	ATYP	Axis operation type	—	Set individually in accordance with the actuator characteristics.
79	b	ATYP	Rotation axis mode selection	—	Set individually in accordance with the actuator characteristics.
80	b	ATYP	Rotation axis shortcut selection	—	Set individually in accordance with the actuator characteristics.
83	b	ETYP	ABS unit (0: Not used/1: Use)	—	Set individually in accordance with the actuator characteristics.

* The numbers are displayed on the PC software screen but not on the teaching pendant.
The missing numbers are not used and omitted.
The category codes are provided only for convenience and not displayed on either the PC software screen or teaching pendant.

5.2 Parameter Settings

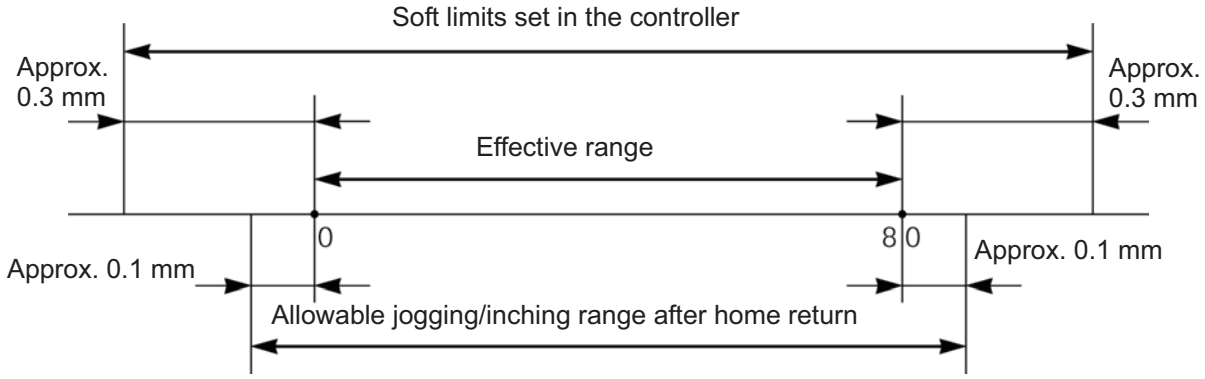
If a parameter has been changed, always restart the controller using a software reset command or by reconnecting the power.

5.2.1 Parameters Relating to the Actuator Stroke Range

- Soft limit (No. 3/4 LIMM/LIML)

Set the soft limit in the positive direction in parameter No. 3, and that in the negative direction in parameter No. 4. The factory setting for the soft limits conforms to the effective actuator length. Change the settings, as necessary, to prevent collision with an obstacle or when the actuator must be stroked slightly beyond its effective length. An incorrect soft limit setting will cause the actuator to collide into the mechanical end, so exercise sufficient caution. The minimum setting unit is “0.01 [mm].”
(Note) To change a soft limit, set a value corresponding to 0.3 mm outside of the effective range.

Example) Set the effective range to between 0 mm and 80 mm
Parameter No. 3 (positive side) 80.3
Parameter No. 4 (negative side) -0.3



- Home return direction (No. 5 ORG)

Unless specified by the user, the home return direction is set to the motor direction at the factory. Should a need arise to change the home direction after the actuator has been assembled into your system, reverse the setting in parameter No. 5 between “0” and “1.”
Also change the parameters for home return offset, soft limits and direction of excited phase signal detection if necessary.

⚠ Caution: If the home direction is reversed, all position data that have been input will be retained. The home direction cannot be reversed for rod-type actuators.

- Home return offset (No. 22 OFST)

The controller is shipped from the factory with an optimal value set in parameter No. 22, so the distance from each mechanical end to the home becomes uniform.
The minimum setting unit is 0.01 [mm].
The home return offset can be adjusted in the following condition:

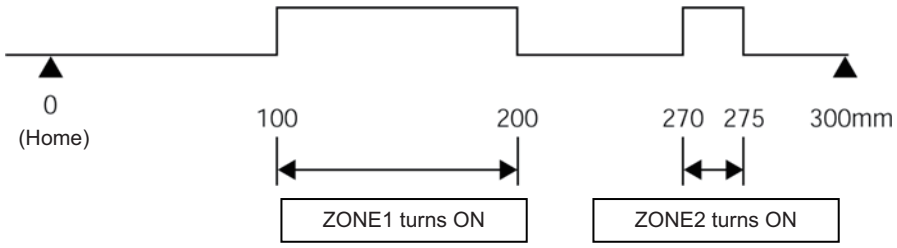
[1] Want to align the actuator home and the system's mechanical home after the actuator has been assembled into the system
[2] Want to set a new home after reversing the factory-set home direction
[3] Want to eliminate a slight deviation generated after replacing the actuator

> ⚠ Caution: If the home return offset has been changed, the soft limit parameters must also be adjusted accordingly.

- Zone boundary (1: No. 1/2 ZONM/ZONL, 2: No. 23/24 ZNM2/ZNL2)

Set the zone in which a zone output signal (ZONE1 or ZONE2) will turn ON.
The zone signal turns ON only when the current coordinate position is inside the negative (-) boundary and positive (+) boundary settings.
The positive and negative boundaries for the ZONE1 signal are set in parameter No. 1 and No. 2, respectively.
The positive and negative boundaries for the ZONE2 signal are set in parameter No. 23 and No. 24, respectively.
The minimum setting unit is 0.01 [mm].

Example) Use ZONE1 as an intermediate limit switch inside 100 and 200 mm, and use ZONE2 as a simple ruler inside 270 and 275 mm, with an actuator having a 300 mm stroke
Parameter No. 1 (positive side) 200, parameter No. 2 (negative side) 100
Parameter No. 23 (positive side) 275, parameter No. 24 (negative side) 270



5.2.2 Parameters Relating to the Actuator Operating Characteristics

- Default speed (No. 8 VCMD)

The factory setting is the rated speed of the actuator.
When a target position is written to an unregistered position table or the current position is read in the teaching mode, the setting in this parameter will be used as the speed data for the applicable position number.
To reduce the default speed from the rated speed, change the setting in parameter No. 8.

- Default acceleration/deceleration (No. 9 ACMD)

The factory setting is the rated acceleration/deceleration of the actuator.
When a target position is written to an unregistered position table or the current position is read in the teaching mode, the setting in this parameter will be used as the acceleration/deceleration data for the applicable position number.
To reduce the default acceleration/deceleration from the rated acceleration/deceleration, change the setting in parameter No. 9.

- Default positioning band (in-position) (No. 10 INP)

The factory setting is “0.10 [mm].”
When a target position is written to an unregistered position table or the current position is read in the teaching mode, the setting in this parameter will be used as the positioning band data for the applicable position number.
Increasing the default positioning band will allow the position complete signal to be output early. Change the setting in parameter No. 10 as necessary.

> ⚠ Caution: For the positioning band, set the value greater than that of the encoder resolution. Setting it smaller may cause a servo error.

- Current-limiting value during home return (No. 13 ODPW)

A current value appropriate for the standard specification of the actuator has been set at the time of shipment.
Increasing the value set in this parameter increases the home return torque.
This parameter need not be changed in normal conditions, but in certain situations such as when the slide resistance increases due to the affixing method, load condition, etc., of the actuator used vertically, the home return may complete before the correct position. In this case, the value set in parameter No. 13 must be increased.
(As a guide, the set value should not exceed 75%.)

- Current-limiting value at standstill after positioning (No. 12 SPOW)

A current value appropriate for the standard specification of the actuator has been set at the time of shipment.
Increasing the value set in this parameter increases the holding torque at standstill.
This parameter need not be changed in normal conditions, but if a large external force is applied to the actuator at standstill, hunting may occur. In this case, the value set in parameter No. 12 must be increased.
(As a guide, the set value should not exceed 70%.)

- Speed override (No. 46 OVRD)

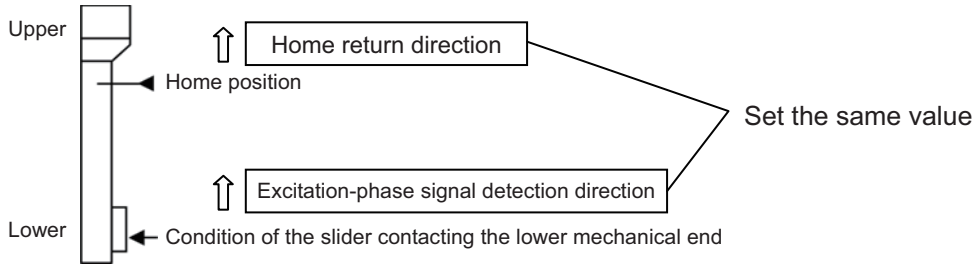
Use this parameter to move the actuator to prevent danger at the trial run startup time.
When a movement command is issued from the PLC, an override can be applied to the movement speed set in the “Speed” field of the position table by the setting in parameter No. 46.
Actual movement speed = [Speed set in the position table] × [setting in parameter No. 46] ÷ 100
Example) Value in the “Speed” field of the position table: 500 (mm/s)
Setting in parameter No. 46: 20 (%)
In this case, the actual movement speed becomes 100 mm/s.
The minimum setting unit is 1% and the input range is 1 to 100 (%). The factory setting is 100%.

(Note) This parameter is invalid for the movement command by the PC or teaching pendant and the movement command by direct numeric specification.
When the PC or teaching pendant is used, operation can be performed by setting a speed ratio on such a tool.

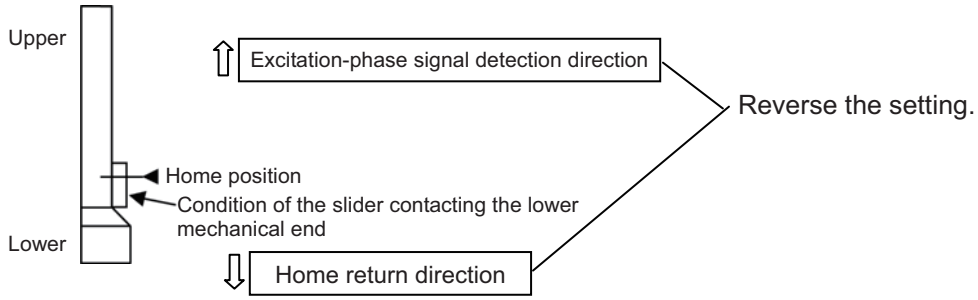
- Default movement direction for excitation-phase signal detection (No. 28 PHSP1)

Excitation-phase detection is performed at the first servo ON after the power is input. Define the detection direction at this time. This setting need not be changed in normal conditions of use. However, if the actuator contacts the mechanical end or an obstacle and cannot be moved by hand when the power is input, this setting must be changed to the direction in which the motor is easier to operate.
Set the value of parameter No. 28 to 0 or 1. If the detection direction is the same as the home return direction, set the same value as that in parameter No. 5 (home return direction).
To make this direction opposite the home return direction, set a value other than that in parameter No. 5 (home return direction).

(Example 1) Motor upper-side vertical installation + If the power is input when the slider is contacting the lower mechanical end:



(Example 2) Motor lower-side vertical installation + If the power is input when the slider is contacting the lower mechanical end



- Excitation-phase signal detection time (No. 29 PHSP2)

Excitation-phase detection is performed at the first servo ON after the power is input. Define the detection time at this time.
The factory setting is the detection time in accordance with the standard specifications of the actuator and this setting need not be changed in normal conditions of use.
Should an excitation detection error or a malfunction occur at the first servo ON after the power is input, the detection time set in parameter No. 29 can be changed as one of the remedies.
Before changing this parameter, contact us.

- Safety speed (No. 35 SAFV)

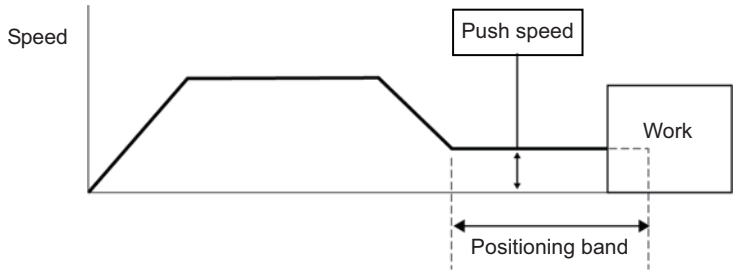
Define the feed speed for manual operation.
The factory setting is 100 [mm/sec].
When changing the speed, set an optimal value to parameter No. 35.
However, the maximum speed is controlled to 250 [mm/sec]. Use the setting in this parameter as a slower speed than the maximum speed.

- Default stop mode (No. 53 CTLF)

This parameter defines the power-saving modes.
For details,refer to 4.4.10,"Power-saving Modes at Standby Positions."

- Push speed (No. 34 PSHV)

This meter defines the speed after the target position has been reached during push & hold operation.
The factory setting is the default value in accordance with the actuator characteristics.
Set an appropriate value in consideration of the material, shape, etc., of the work.
However, the maximum speed is controlled to 20 [mm/sec] even in the high-speed type although it varies depending on the actuator. Use the push speed as a slower speed than this maximum one.

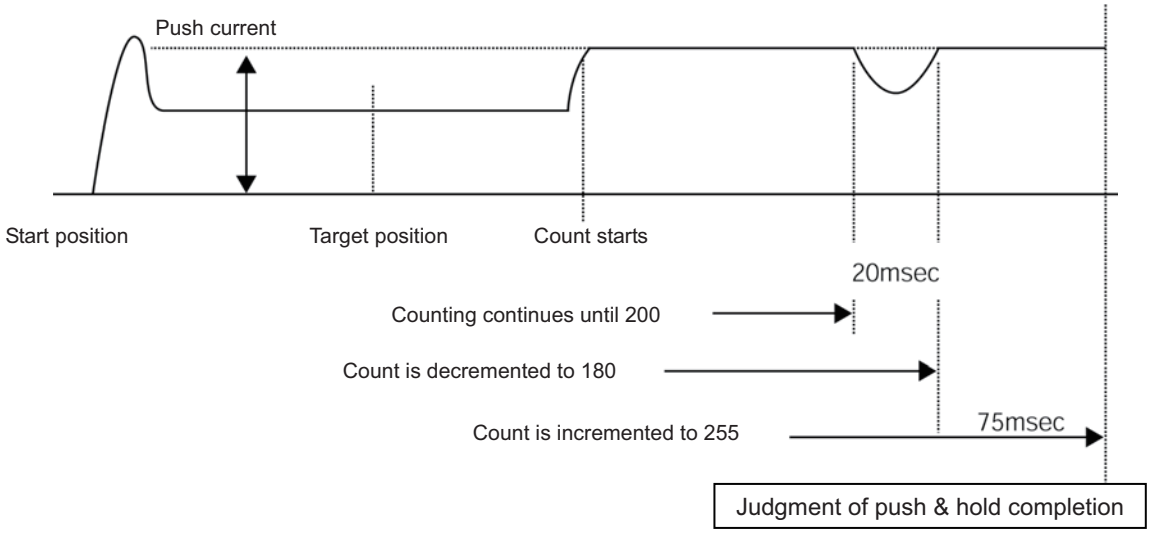


⚠ Caution: It is recommended to use the actuator at a speed of 5 mm/s or more to reduce the effect of variations in push speed.

- Push & hold stop judgment time (No. 6 PSWT)

This parameter is used as a judgment condition when determining if the work was contacted and the push & hold operation has been completed.
The push & hold operation is judged as completed if the current-limiting value set in the position table has been maintained for the period set in parameter No. 6.
Set an optimal value in consideration of the material, shape, etc., of the work, as well as the current-limiting value.
The minimum setting unit is 1 msec and the maximum judgment period is 9999 msec. The factory setting is 255 msec.

(Note) If the work has shifted and the current has changed during the push & hold judgment, the judgment follows the timing chart shown below. This example assumes a judgment period of 255 msec.



After reaching the push current, it is maintained for 200 msec. The current drops during the subsequent 20 msec period, and accordingly the count is decremented by 20. Therefore, when the operation is resumed the count will start from 180. Since the count will reach 255 after 75 msec at the push current, the controller will determine that the push & hold operation has been completed.
In this example, the total judgment period is 295 msec.

- Enable function (No. 42 FPIO4)

In ANSI-compliant teaching pendants, parameter No. 42 defines whether the deadman switch function is enabled or disabled.
ANSI-compliant teaching pendants are to be developed in the future.

	Set value
Enable (use)	0
Disable (not use)	1

The factory setting is 1 [Disable].

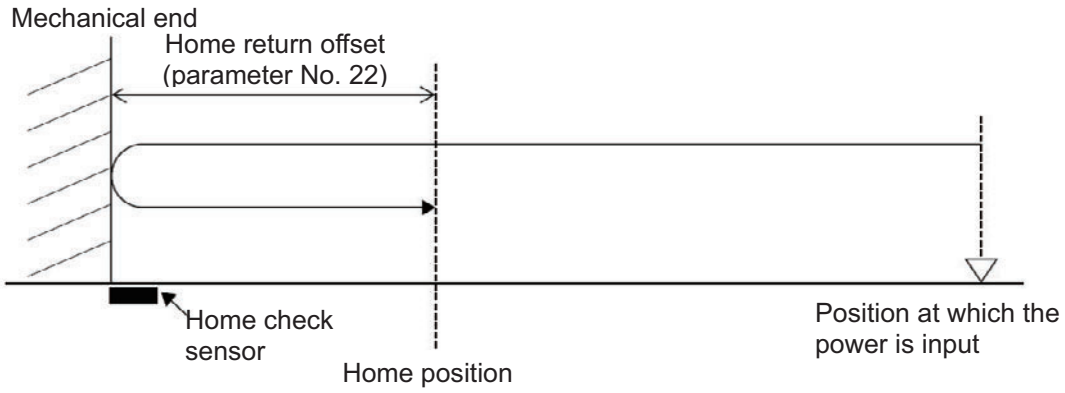
- Home check sensor input polarity (No. 43 AIOF)

The controller is not equipped with a home check sensor as a standard, but it can optionally be installed.
It need not be changed normally, but change the value of parameter No. 43 if the system is changed by the customer after shipment.
Definition of setting: 0 (Standard specification, sensor not used)
1 (Home check sensor used, sensor polarity: contact a)
2 (Home check senor used, sensor polarity: contact b)

[Operational description]

[1] When a home return command is issued, the actuator moves until it contacts a mechanical end, upon which the home check sensor signal is detected.
[2] Next, the actuator reverses its direction and moves until the home position and then stops.
[3] As long as the home check sensor signal has been changed, the controller recognizes that the home return has completed successfully.

If the signal is not yet changed, the controller recognizes a “position deviation” and generates a “home sensor non-detection error” while also outputting an alarm signal.



- Home sensor input polarity (No. 18 LS)

This parameter is available for RCP2-RTB/RTC-controlled rotational axes operating in the home sensor mode.
Definition of setting: 0 (Sensor not used)
1 (The sensor polarity is contact a)
2 (The sensor polarity is contact b)

- Ball screw lead length (No. 77 LEAD)

This parameter defines the ball screw lead length.
A default value appropriate for the characteristics of the actuator is set at the factory.

- Axis operation type (No. 78 ATYP)

This parameter defines the type of the actuator used.
Definition of settings : 0 (Linear axis)
: 1 (Rotational axis)

- Rotational axis mode selection (No. 79 ATYP)

If the axis operation type (No. 78) is set to “Rotational axis,” selecting the index mode fixes the expression range of current values to between 0 and 359.99. If the index mode is selected, shortcut control is possible.
Definition of settings : 0 (Normal mode)
: 1 (Index mode)

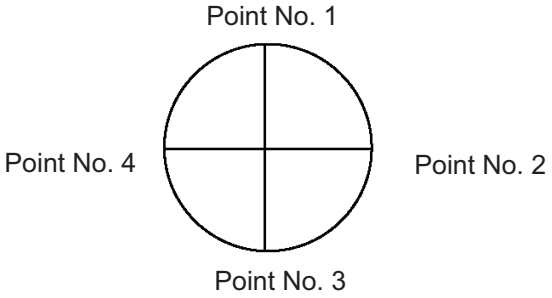
⚠Note: Push & hold operation cannot be performed in the index mode. If push action data is entered in the position data, the data will be disabled and the actuator will perform normal movement. The positioning band will correspond to the default positioning band set by the applicable parameter.

- Rotational axis shortcut selection (No. 80 ATYP)

Set this parameter if you wish to rotate a rotational axis in a fixed direction.
Shortcut refers to the actuator moving to the closest point from the current point.

	Set value
Do not select	0
Select	1

When the shortcut mode is selected, you can have the actuator rotate in a fixed direction.

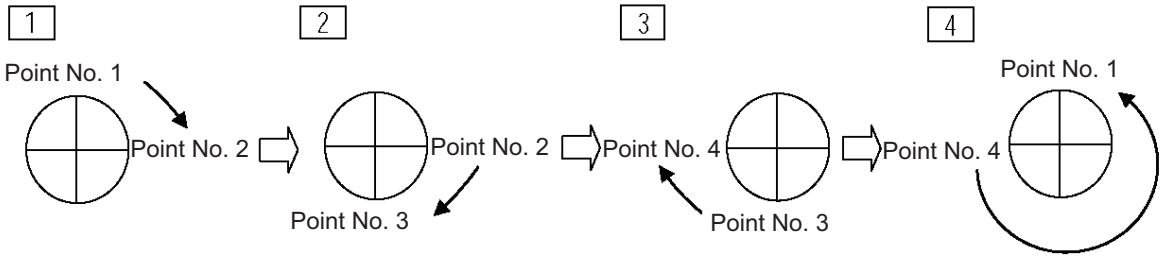


Positions

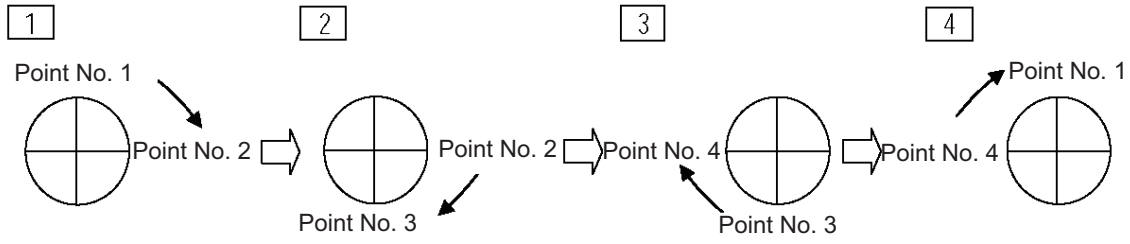
Point number	Set value
1	0
2	90
3	180
4	270

One degree of position data corresponds to 1 mm.

If the actuator is moved sequentially through positions 1 → 2 → 3 → 4, the actual movement will vary with and without selecting the shortcut mode.
When shortcut is not selected



When shortcut is selected



- Absolute unit (No. 83 ETYP)

Parameter No. 83 sets whether or not an optional simple absolute unit is used.

	Setting
Not used	0
Used	1

5.2.3 Parameters Relating to the External Interface

- Position complete signal output method (No. 39 FPIO)

Parameter No. 39 defines the condition of the position complete signal when the servo OFF condition or "deviation" occurs while the actuator has stopped under the positioning completed state.
From the viewpoint of the contents, this parameter is divided into the following two cases:

[1] Where the current position deviates from the set "positioning band" value due to an external force applied during servo ON
[2] Where the current position deviates from the set "positioning band" value due to an external force applied during servo OFF

The above is intended to offer flexibility to how the "position complete condition" is monitored in accordance with the equipment characteristics or the method of building a sequence circuit on the PLC side.
Especially when this parameter is used as is the case with the auto switch of the air cylinder, it is recommended to set 1 [INP].
The ON/OFF condition of the position complete signal becomes as follows in accordance with the setting in parameter No. 39:

Setting in Parameter No. 39	Description
0 [PEND]	[1] Servo ON condition The servo will remain ON even if the current position is outside the "positioning band" value range set with respect to the target position. [2] Servo On condition The servo will be OFF regardless of where the current position is.
1 [INP]	The parameter will be ON if the current position is inside the "positioning band" value range set with respect to the target position, and will be OFF if the current position is outside the range, regardless of whether the servo is ON or OFF. * It is like an auto switch of the air cylinder.

The factory setting is 0 [PEND].

- Serial communication speed (No. 16 BRSL)

Set the communication speed to be used when the control is performed via serial communication using the PLC's communication module.
Set an appropriate value in parameter No. 16 in accordance with the specification of the communication module.
One of 9600, 19200, 38400, 115200, and 230400 bps can be selected as the communication speed.
The factory setting is 38400 [bps].

- Minimum delay time for slave transmitter activation (No. 17 RTIM)

This parameter defines the minimum delay time until the controller's transmitter will be activated after completion of command reception, when serial communication is performed using the PLC's communication module.
The factory setting is 5 msec, but another necessary delay time must be set in parameter No. 17 if the specification of the communication module exceeds 5 msec.

- Silent interval magnification (No. 45 SIVM)

This parameter applies to commands via RS485 serial communication.
It defines the magnification of the silent interval time in the delimiter judgment of the RTU mode.
The factory setting is based on the communication time of 3.5 characters in accordance with the Modbus specification.
This parameter need not be changed under normal operation by the PC or teaching pendant.
When the character transmission interval of the PLC with a strict scan time exceeds the silent interval, parameter No. 45 allows the extension of the silent interval time.
The minimum setting unit is 1 [times], and the input range is 0 to 10. When the setting in this parameter is 0, it indicates that this parameter is invalid.

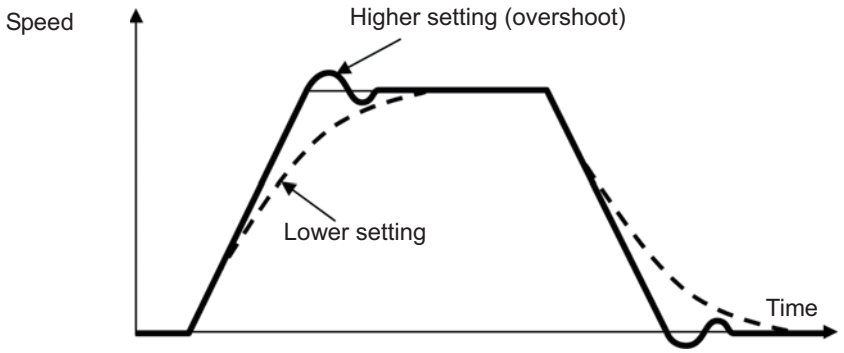
5.2.4 Servo Gain Adjustment

Since servo adjustment is made in accordance with the standard specification of the actuator before shipment, this setting need not be changed in normal conditions of use.
However, because vibrations or abnormal sounds may be produced due to the affixing method of the actuator or load conditions, parameters related to servo adjustment are released.
Especially custom-made items (the lead length of the ball screw is greater, stroke is longer, etc., than the standard items) may produce vibrations or abnormal sounds with the effect of external conditions.
In such cases, the parameters shown below need to be changed. Please contact IAI.

- Servo gain number (No. 7 PLG0)

Parameter No.	Unit	Input range	Default
7	5rad/sec	0 - 31	6

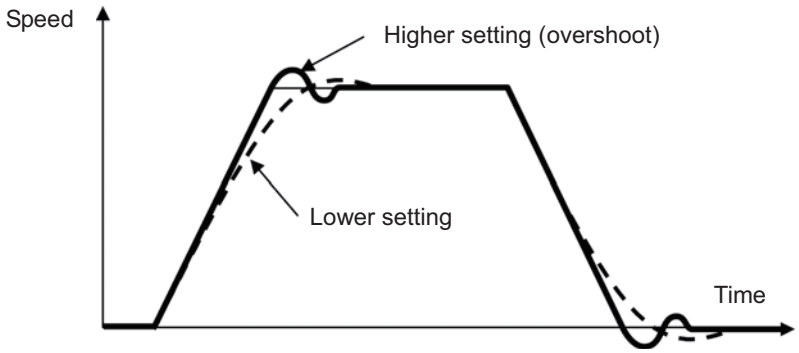
This parameter determines the response of the position control loop.
Increasing the setting in this parameter will enhance the response to the position command.
However, excessively increasing it facilitates producing overshoot.
Lower settings will deteriorate the response to the position command, which requires more time.



- Speed loop proportional gain (No. 31 VLPG)

Parameter No.	Unit	Input range	Default
31	—	1 – 27661	Individual setting in accordance with actuator characteristics

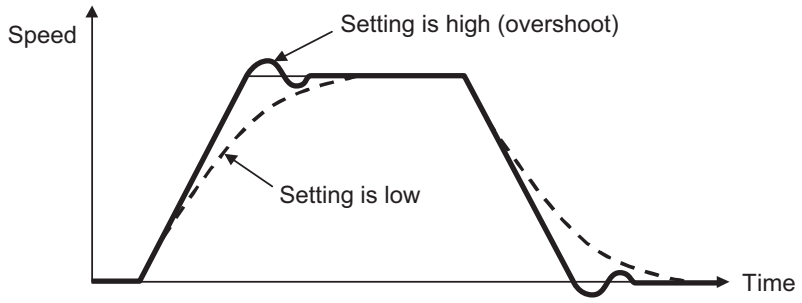
This parameter determines the response of the speed control loop.
Increasing the setting in this parameter will enhance the response to the position command. (The servo rigidity will be higher.)
The higher the load inertia becomes, the larger the value should be set.
However, excessively increasing the setting will cause overshooting or oscillation, which facilitates producing the vibrations of the mechanical system.



- Speed loop integral gain (No. 32 VLPT)

Parameter No.	Unit	Input range	Default
32	—	1 – 217270	Individual setting in accordance with actuator characteristics

This parameter determines the level of response with respect to a speed control loop.
Decreasing the setting results in lower response to the speed command and decreases the reactive force upon load change. If the setting is too low, compliance with the position command drops and the positioning time increases as a result.
Increasing the setting too much increases the tendency of the actuator to overshoot or oscillate, resulting in increased mechanical vibration.



- Torque filter time constant (No. 33 TRQF)

Parameter No.	Unit	Input range	Default
33	—	1 – 2500	Individual setting in accordance with actuator characteristics

This parameter defines the filter time constant to the torque command.
If the resonant frequency of the machine equals to or less than the response frequency of the servo loop, the motor will generate vibrations.
Increasing the setting in this parameter will be able to suppress the resonance of this machine system. However, excessively increasing the setting may impair the stability of the control system.

6. Troubleshooting

6.1 Action to Be Taken upon Occurrence of Problem

Upon occurrence of a problem, take an appropriate action in accordance with the procedure below in order to ensure speedy recovery and prevent recurrence of the problem.

a) Check the status indicator lamps.
   SV (green): The servo is ON.
   ALM (red): An alarm is present, or an emergency stop has been actuated or the motor drive power is cut off.
b) Check the host controller for errors.
c) Check the voltage of the main 24 VDC power supply.
d) Check for an alarm.
   Confirm the details of the error on the PC or teaching pendant.
e) Check the cables for connection error, disconnection or pinching.
   Before performing a continuity check, turn off the power (to prevent a runaway actuator) and disconnect the cables (to prevent accidental power connection due to a sneak current path).
f) Check the I/O signals.
g) Check the noise elimination measures (grounding, installation of a surge killer, etc.)
h) Review the events leading to the occurrence of a problem, as well as the operating condition at the time of occurrence.
i) Check the serial numbers of the controller and actuator.
j) Analyze the cause.
k) Take action.

Please check items a) through i) before contacting IAI.

(Reference) Lamp changes in each condition

	Servo OFF	Servo ON	Emergency-stop	Motor drive power is cut off
SV (green lamp)	Unlit	Lit	Unlit	Unlit
ALM (red lamp)	Unlit	Unlit	Lit	Lit

6.2 Alarm Level Classification

Alarms are classified into the following two levels in accordance with the symptoms they represent:

Alarm level	ALM lamp	Failure status register	What happens when alarm generates	How to reset
Operation cancellation	Lit (red)	ALMH is “1.”	The actuator decelerates to a stop and then the servo turns OFF.	• Reset the alarm by the PC/teaching pendant. • Input the reset signal from the PLC.
Cold start	Lit (red)	ALMH is “1.”	The actuator decelerates to a stop and then the servo turns OFF.	• Reset software by the PC/teaching pendant. • Reconnect the power.

⚠ 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.

6.3 Alarm Description and Cause/Action

(1) Operation-cancellation level alarms

Code	Error name	Cause/Action
080	Movement command during servo OFF	Cause: A movement command was issued by numeric specification while the servo was OFF. Action: Issue a movement command after confirming the servo is ON (SV or PEND is “1”).
083	Numeric command during home return non-completion	Cause: Numeric specification of the absolute position was performed while home return was not yet completed. (No problem in the position no. specification mode) Action: Issue a movement command by numeric specification after performing home return operation and confirming the complete signal (HEND).
084	Movement command during home return	Cause: A movement command was issued by numeric specification during home return. Action: Issue a movement command after performing home return operation and confirming the complete signal (HEND).
085	Position No. error during movement	Cause: Unregistered position number was specified in the position table in the position no. specification mode. Action: Recheck the position table.
090	Soft reset during servo ON	Cause: A soft reset command was received while the servo was ON. Action: Send a soft reset command to the controller after confirming that the servo is OFF (SV is “0”).

Code	Error name	Cause/Action
0A1	Parameter data error	Cause: The data input in the parameter area is not in an appropriate range. (Example) This error generates when there is a clear contradiction in magnitude correlation such as when 300 mm is entered by mistake for the value of soft limit- when the set value of soft limit+ is 200.3 mm. Action: Change the data to an appropriate value.
0A2	Position data error	Cause: [1] A movement command was issued when no target command was set in the “Position” field. [2] The value of the target value in the “Position” field exceeded the soft limit set value. Action: [1] Set the target position first. [2] Change the value of the target position to one within soft limit set values.
0A3	Position command data error	Cause: The speed or acceleration/deceleration value during numeric specification exceeded the maximum set value. Action: Change the value to an appropriate one.
0BA	Home sensor non-detection	This alarm indicates that the actuator with a home sensor used did not normally complete home return operation. Cause: [1] Work is interfering with peripheral equipment in the middle of home return. [2] The slide resistance of the actuator is locally high. [3] Installation failure, breakdown or disconnection of the home check sensor Action: If the work is not interfering with peripheral equipment, the cause of [2] or [3] is suspected. Please contact IAI.
0BE	Home return timeout	Cause: Home return is not completed within the period set in the applicable system parameter after the start of home return operation. (This alarm will not be generated in normal operation.) Action: The combination of the controller and actuator may be incorrect. Please contact IAI.
0C0	Excessive actual speed	Cause: This alarm indicates that the motor speed exceeded the maximum speed set in the applicable system parameter. This alarm will not be generated in normal operation, but may occur in the following condition: [1] The slide resistance of the actuator is locally high. [2] Instantaneous increase in load due to application of external force, which may cause the load to decrease and actuator to move rapidly before a servo error is detected. Action: Check the assembly condition of mechanical parts for abnormality. If the actuator itself is suspected to be the cause, please contact IAI.

Code	Error name	Cause/Action
0C1	Servo error	When this error generates, it means that the motor could not operate for at least 2 seconds after the move command was received and before the target position was reached. Cause: [1] The connector on the motor relay cable is loose or the cable is broken. [2] If the actuator has a brake, the brake cannot be released. [3] The actuator is receiving a large load due to an external force. [4] The slide resistance of the actuator itself is high. [5] The positioning band setting is smaller than the encoder resolution. Action [1] Check the wiring condition of the motor relay cable. [2] Check the wiring condition of the brake cable and turn on/off the brake release switch repeatedly to see if the brake makes “click” sounds. [3] Check the assembled conditions of mechanical parts for abnormality. [4] If the load weight is normal, turn off the power and try moving the actuator by hand to check the slide resistance. If the actuator itself is suspected to be the cause, please contact IAI. [5] Set the positioning band value greater than that of the encoder resolution.
0C9	Excessive motor supply voltage	This alarm indicates that the motor supply voltage is excessive (24 V+20%, 28.8 V or more). Cause: [1] High voltage of 24 V input power supply [2] Faulty part inside the controller Action: Check the voltage of the input power supply. If the voltage is normal, please contact IAI.
0CA	Overheating	This alarm indicates that the temperature around the power transistor in the controller is excessive (95°C or more). Cause: [1] High temperature around the controller [2] Faulty internal controller part Action: [1] Lower the surrounding air temperature of the controller. If action [1] does not improves the situation, contact IAI.
0CC	Abnormal control supply voltage	This alarm indicates that the voltage of the 24 V input power supply is excessive (24 V+20%: 28.8 V or more). Cause: [1] High voltage of 24 V input power supply [2] Faulty part inside the controller Action: Check the voltage of the input power supply. If the voltage is normal, please contact IAI.
0CE	Drop in control supply voltage	This alarm indicates that the voltage of the 24 V input power supply has dropped (24 V-20%: 19.2V or less). Cause: [1] Low voltage of the 24V input power supply [2] Faulty part inside the controller Action: Check the voltage of the input power supply. If the voltage is normal, please contact IAI.
0D8	Deviation overflow	The position deviation counter has overflowed. Cause: [1] The speed dropped during movement due to the effect of an external force, etc. [2] The acceleration setting is too high for the transferring mass. Action: [1] Check the load conditions, such as whether the load is contacting a surrounding object or the brake is released, and then remove the cause. [2] An overload condition is suspected, so review the load weight. Reconnect the power and then perform home return.
0D9	Soft limit over error	This alarm indicates that a soft limit has been reached.

(2) Cold-start level alarms

Code	Error name	Cause/Action
0B8	Excitation detection error	This control performs excited phase detection when the servo is turned ON for the first time after the power has been input. When this error generates, it means that the specified encoder signal level could not be detected after 100 ms of excitation. [1] The connector of the motor relay cable is loose or its circuit is open. [2] If the actuator is equipped with a brake, the brake cannot be released. [3] Large motor load due to application of external force [4] The power was input when the actuator was contacting the mechanical end. [5] Large slide resistance of the actuator itself Action: [1] Check the wiring condition of the motor relay cable. [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. [3] Check the assembly condition of mechanical parts for abnormality. [4] Move the actuator away from the mechanical end and then reconnect the power. [5] If the load weight is normal, cut off the power and move the actuator by hand to check the slide resistance. If the actuator is suspected to be the cause, please contact IAI.
0E5	Encoder receive error	Cause: [1] When the 24-V power supply is turned on, the controller power turns on before the power to the simple absolute unit. [2] When the detailed code is H’0001: The controller cannot communicate with the simple absolute unit properly due to noise, etc. [3] When the detailed code is H’0002: The controller cannot communicate with the simple absolute unit properly due to a broken communication wire in the encoder cable, etc. Action: [1] Make sure the power to the simple absolute unit turns on before (or at the same time as) the controller power. [2] Change the installation location of the controller. Install a FG, noise filter, clamp filter or implement other noise elimination measure. [3] Check the connectors on the encoder relay cable between the controller and simple absolute unit for looseness. Or, replace the cable.
0E8	Phase-A/B disconnection detection	Encoder signals cannot be detected correctly. Cause: [1] Loose or disconnected encoder-relay cable connector [2] Loose or disconnected actuator-end connector of the supplied cable [3] When a high-thrust rod-type actuator or actuator is used in combination with other types of actuators, the encoder relay cables are combined wrongly. Action: Check the connection condition of the encoder relay cable and conduct a continuity check. If the results are normal, please contact IAI. If [3] is the case, check the model of each encoder relay cable and connect the correct cable to each actuator without making wrong combinations. Cable model for high-thrust rod-type actuator: CB-RFA-PA*** Cable model for other types of actuators: CB-RCP2-PA***
0E9	Phase-A disconnection detection	
0EA	Phase-B disconnection detection	

Code	Error name	Cause/Action
0ED	Absolute encoder error (1)	Cause: [1] When the power was reconnected following the completion of an absolute reset, the current position changed due to an external factor, etc., while the ABS unit was communicating. [2] When an absolute reset was performed, the current position changed due to an external factor, etc., while the controller was communicating with the simple absolute unit. Action: [1] Detail code = H'0001 Turn off the power and then turn it back on in a condition where the actuator does not receive vibration, etc. [2] Detail code = H'0002 Perform an origin return operation again in a condition where the actuator does not receive vibration, etc.
0EE	Absolute encoder error (2)	Cause: [1] The power was turned on for the first time after connecting the battery of the simple absolute unit. [2] Detail code = H'0001 The battery voltage dropped to a level at which the encoder counter in the simple absolute unit could no longer retain the count. [3] Detail code = H'0002 The encoder connector was unplugged or encoder cable suffered a broken wire during power outage. [4] Detail code = H'0003 The parameter was changed. Action: If [1], [2] or [4] is the case, perform an absolute reset according to the specified procedure by referring to the operation manual for your simple absolute unit (5.2, "How to Perform Absolute Reset"). [2] Supply the power for at least 48 hours to fully charge the battery and then perform an absolute reset.
0EF	Absolute encoder error (3)	Cause: When the power was cut off, the current value changed at a speed equal to or above the set value of rotational speed due to an external factor, etc. Action: Change the value set in the simple absolute unit and take an appropriate action to prevent the actuator from moving at a speed equal to or above the set speed. If the battery backup time has enough allowance to do so, increase the setting of motor speed. Refer to: 5.1.1, "Piano Switch Settings" in the operation manual for your simple absolute unit. If this error has generated, perform an absolute reset according to the specified procedure (5.2, "How to Perform Absolute Reset").

Code	Error name	Cause/Action
0F4	Mismatched PCB	This controller has a different motor drive circuit in accordance with the motor capacity. Therefore, a mounted motor is determined based on the printed circuit board (PCB). To this end, it is checked in the initialization process after starting whether the motor type set in the applicable system parameter matches the board. The alarm indicates that the motor type does not match the board. Cause: A parameter input error or board assembling error is suspected. Action: Should this error occur, please contact IAI.
0F5	Nonvolatile memory write verify error	When data is written in the nonvolatile memory, the written data is read once for a check to verify the data matching. This alarm indicates that the written data is not matching. Cause: [1] Faulty nonvolatile memory [2] The memory has been rewritten more than 100,000 times. (The nominal rewrite limit of the nonvolatile memory is around 100,000 times.) Action: If the alarm is generated again after reconnecting the power, please contact IAI.
0F6	Nonvolatile memory write timeout	This alarm indicates that no response was made when data was written in the nonvolatile memory. Cause: [1] Faulty nonvolatile memory [2] The memory has been rewritten more than 100,000 times. (The nominal rewrite limit of the nonvolatile memory is around 100,000 times.) Action: If the alarm is generated again after reconnecting the power, please contact IAI.
0F8	Damaged nonvolatile memory	Abnormal data was detected during the nonvolatile memory check after starting. Cause: [1] Faulty nonvolatile memory [2] The memory has been rewritten more than 100,000 times. (The nominal rewrite limit of the nonvolatile memory is around 100,000 times.) Action: If the alarm is generated again after reconnecting the power, please contact IAI.
0FA	CPU error	The CPU was not operating properly. Cause: [1] Faulty CPU [2] Malfunction due to noise Action: If the alarm is generated again after reconnecting the power, please contact IAI.

6.4 Messages Displayed during Operation Using the Teaching Pendant or PC Software

This section explains the warning messages that may be displayed during operation using the teaching pendant or PC software.

Code	Message name	Cause/Action
112	Invalid data	An inappropriate value was entered in a parameter. (Example) 9601 was entered as the serial communication speed by mistake. Reenter an appropriate value.
113	Value too small	The entered value is smaller than the setting range.
114	Value too large	The entered value is larger than the setting range. Refer to the actuator specifications or parameter table and reenter an appropriate value.
115	Home return non-completion	The current position was written when home return was not yet completed. Execute home return again.
117	No movement data	Target position is not set under the selected position number. Enter the target position first.
11E	Paired data mismatch	The values indicating the magnitude relationship of a pair of data are inappropriate. (Example) The same value was entered in both the parameters for + and – soft limits. Reenter appropriate values.
11F	Absolute position too small	The minimum movement toward the target position is determined by the lead length of the drive system and resolution of the encoder. This message indicates that the entered target value is smaller than the minimum movement. (Example) If the lead length is 20 mm, the encoder's resolution is 800 pulses and accordingly the minimum movement becomes 20 ÷ 800 = 0.025 mm/pulse. In this case, this message will be displayed if 0.02 mm is entered as the target position.
121	Push & hold search end over	The final position in push & hold operation exceeds the soft limit. This has no negative effect if the actuator contacts the work. If the actuator misses the work, however, the soft limit will be reached and this message is displayed as a warning. Change either the target position or positioning band.
122	Multiple axes connected at assignment	Address was assigned when multiple axes were connected. Assign each address only when one axis is connected.
180 181 182 183	Address change OK Controller initialization OK Home change all clear I/O function changed	These messages are displayed to confirm operation. (They do not indicate an operation error or other abnormality.)
202	Emergency stop	An emergency stop condition was detected. (This is not an error.)
20A	Servo OFF during operation	This message indicates that the servo ON signal (SON) was turned OFF by the PLC while the actuator was moving, and that the servo turned OFF and the movement was disabled as a result.

Code	Message name	Cause/Action
20C	CSTR-ON during operation	This message indicates that the start signal (CSTR) became “1” by the PLC while the actuator was moving, and that duplicate movement commands occurred as a result.
20E	Soft limit over	This message indicates that a soft limit was reached.
210	HOME-ON during operation	This message indicates that the home return signal (HOME) became “1” by the PLC while the actuator was moving, and that duplicate movement commands occurred as a result.
221	Write in monitor mode prohibited	This message indicates that position table or parameter writing operation was performed in the monitor mode.
223	Operation in monitor mode prohibited	This message indicates that actuator movement operation was performed in the monitor mode.
301 302 304 305 306 308 30A 30B	Overrun error (M) Framing error (M) SCIR-QUE OV (M) SCIS-QUE OV (M) R-BF OV Response timeout (M) Packet R-QUE OV Packet S-QUE OV	These messages indicate an error in the serial communication with the controller. Cause: [1] Garbage data due to the effect of noise [2] Duplicate slave numbers when multiple controllers are controlled by serial communication. Action: [1] Adjust the wiring in a manner eliminating the effect of noise and review the installation of equipment, etc. [2] Change the slave numbers to avoid duplication. If the message is still displayed after taking the above actions, please contact IAI.
307	Memory command refused	This message indicates that the command was refused in the serial communication with the controller.
309	Write address error	This message indicates that an indeterminate WRITE address error occurred in the serial communication with the controller.
		These conditions do not occur in normal operation. Should they occur, record the entire error list before cutting off the power for use in the cause investigation. Also contact IAI.
30C	No connected axis	This message indicates that no controller axis number is recognized. Cause: [1] The controller is not operating properly. [2] Only the supplied communication cable (SGA/SGB) is disconnected. [3] If a SIO converter is used, 24V is supplied to the converter but the link cable is not connected. [4] When multiple controllers are linked together, the same number is set by mistake on two or more ADRS switches. Action: [1] Check if the RDY lamp on the controller is lit. If the lamp is not lit, the controller is faulty. [2] If a spare teaching pendant is available, replace the current pendant with the spare unit, or with a PC, and see if the message disappears. [3] Supply power after connecting the link cable between the converter and controller. [4] Make sure there are no duplicate ADRS switch settings. If the message is still displayed after taking the above actions, please contact IAI.

6.5 Specific Problems

- The ALM lamp illuminates in red when the power is input.

(An alarm is present, or an emergency stop has been actuated or the motor power is cut off.)
Check whether an alarm is present by connecting the PC or teaching pendant. If an alarm is present, check the description of the error and remove the cause.
If an error is not present, the emergency stop circuit may be activated.
Check the following items:

[1] Was the emergency-stop switch on the operational panel pressed? Also confirm that the necessary interlocks are released.
[2] Was the emergency-stop switch on the teaching pendant pressed?
[3] Was parameter No. 42 [enable function] set as Enable by mistake by connecting the teaching pendant incompatible with the enable switch?
[4] If multiple controllers are connected, are the crossover wires connected correctly?

- The SV lamp does not illuminate when the servo ON signal is input after the power was input.

(The servo does not turn ON.)
Cause: Check if parameter No. 42 [Enable function] is set to “Enable” by mistake by connecting a teaching pendant not supporting the enable switch.
If the SV lamp still remains unlit after the above check, contact IAI.

- Home return ends in mid-process in a vertical application.

Cause: [1] The loading mass exceeds the rating.
[2] The ball screw is receiving torsional stress due to the affixing method of the actuator, tightening of bolts only on one side, etc.
[3] The slide resistance of the actuator itself is large.

Action: If [1] is the case, increase the value set in user parameter No. 13 (current-limiting value during home return).
Increasing this value increases the home return torque. As a guide, the set value should not exceed 75%.
[2] Loosen the fixing bolts and check that the slider moves smoothly.
If the slider moves smoothly, review the affixing method and bolt tightening condition.
[3] If the slide resistance of the actuator itself is large, please contact IAI.

- Noise occurs during downward movements in a vertical application.

Cause: The loading mass exceeds the rating.
Action: [1] Decrease the speed.
[2] Decrease the value set in parameter No. 7 (servo gain number).
Do not decrease the parameter setting below “3.”

- Vibration occurs while the actuator is at standstill.

Cause: The slider is receiving an external force.
Action: If the external force cannot be removed, increase the value set in user parameter No. 12 (current-limiting value at standstill after positioning).
Increasing this value increases the holding torque at standstill. As a guide, the set value should not exceed 70%.

- The actuator overshoots when decelerated to a stop.

Cause: The load inertia is high due to an inappropriate balance between load and deceleration.
Action: Decrease the acceleration/deceleration setting.

- The home and target positions sometimes shift.

Cause: [1] The encoder waveform is disturbed by the effect of noise.
[2] In the case of a rod-type actuator, the non-rotation precision increased due to application of rotating moment to the rod.
Action: [1] Check if the grounding is implemented correctly. Also check for any equipment being a potential noise source.
[2] The actuator may have to be replaced in some cases. Please contact IAI.

- The actuator is slow during push-motion operation.

Cause: The setting of current-limiting value is low relative to the loading mass or slide resistance.
Action: Increase the setting of current-limiting value during push-motion operation.

- The actuator moves only half of the specified distance or twice.

Cause: [1] The combination of the controller and actuator is incorrect.
Since the lead length of the ball screw varies depending on the actuator type, incorrect combination changes the moving distance and speed.
[2] IAI’s error before shipment.
Action: [1] If there are multiple actuators of different types, check them for adequacy before connecting them with the controller by the attached seal labels, etc.
[2] Please contact IAI.

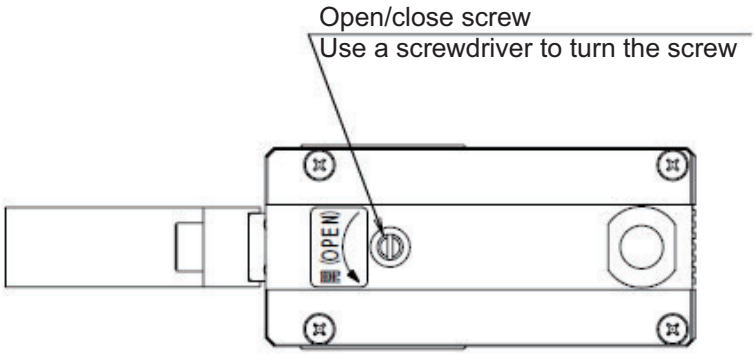
- A servo error generated while the ROBO Gripper was moving.

Cause: The work was not at an appropriate position and the finger attachment(s) contacted the work in the positioning mode.

Action: Consider the position deviation of the work and readjust the starting position of push and thickness of the finger attachment (including the buffer material) accordingly so that the work can be clamped in the push mode.
When resuming the operation, be sure to loosen the finger attachments by turning the open/close screw and then reset the alarm, because the feed mechanism may be locked.

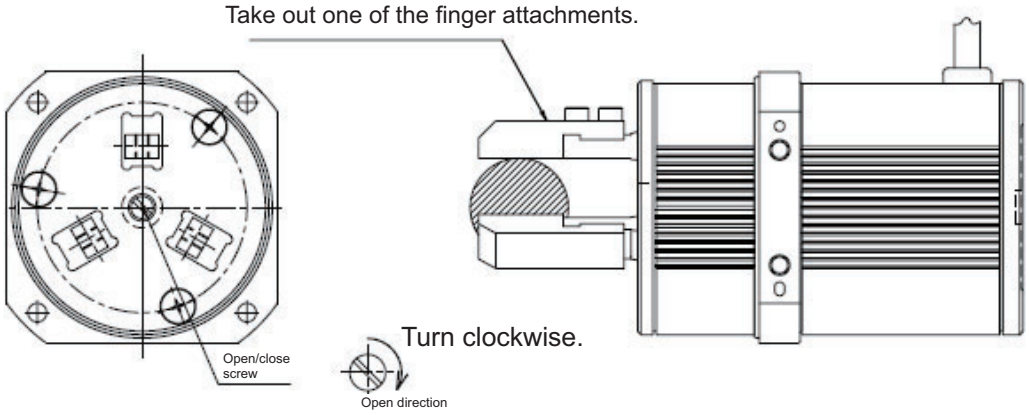
> ⚠ Caution: If the servo ON signal is disabled or the alarm is reset first while the servo ON signal is still ON, the servo will remain ON.
> In this condition, the open/close screw will return to the current position, even when turned, and the actuator will remain locked. As a result, issuing a move command again will only cause the alarm to generate again.

[2-finger Type]



[3-finger Type]

Take out one of the finger attachments and remove the work, and then turn the open/close screw clockwise.



- A malfunction occurs when the servo turns ON after the power is input.

Cause: Exciting-phase detection is not normally performed when the servo turns ON due to the following:
[1] The slider or rod is contacting the mechanical end.
[2] Transferred work is pushed by a strong external force.

Action: [1] Check that the slider or rod is not contacting the mechanical end.
If it is contacting the mechanical end, separate it.
If the actuator is equipped with a brake, move it after forcibly releasing the brake by turning on the brake release switch. At this time, exercise caution not to allow work to drop suddenly due to its own weight. Your hand may be caught by the dropped work or the robot hand or work itself may be damaged.
If the actuator cannot be moved by hand, there is also a method of changing the detection direction as necessary. Consult with IAI in advance.
For details, refer to “5.2.2 Parameters Relating to Actuator Operating Characteristics.”
[2] Check that the transferred work is not interfering with peripheral equipment.
If it is interfering, separate it 1 mm or more as a guide.
Taking action in [1] and [2] does not solve the problem, please contact IAI.

- The SV lamp blinks in green.
This indicates that the controller is in the auto servo OFF mode. (This is not an error or failure.)

7. Operation Examples

For operation examples of this product, refer to the following operation manuals:

- Device Net Gateway Unit Operation Manual
- CC-Link Gateway Unit Operation Manual
- Serial Communication Operation Manual for ROBO Cylinder Series

* Appendix

List of Specifications of Connectable Actuators

The specifications included in this specification 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.

⚠ 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.
- Do not change the setting of push speed (parameter No. 34). If you must change the push speed, consult IAI.
- 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	3.12	124	0.2	50	170	
					Vertical		125				
	SRGS4R	Ball screw	800	5	Horizontal/ vertical	6.25	250	0.3	26	90	20
				2.5	Horizontal	3.12	124	0.2	50	170	
					Vertical		125				
	SRGD4R	Ball screw	800	5	Horizontal/ vertical	6.25	250	0.3	26	90	20
				2.5	Horizontal	3.12	124	0.2	50	170	
					Vertical		125				

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			
	HS8C	Ball screw	800	30	Horizontal	37.5	1200 (at 50 to 800st) 1000 (at to 900st) 800 (at to 1000st)	0.3	–	–	–
					Vertical		750 (at 50 to 800st) 750 (at to 900st) 750 (at to 1000st)	0.2			
	HS8R	Ball screw	800	30	Horizontal	37.5	1200 (at 50 to 800st) 1000 (at to 900st) 800 (at to 1000st)	0.3	–	–	–
					Vertical		750 (at 50 to 800st) 750 (at to 900st) 750 (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	20
	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	200	–	5	18	5 (deg/s)
	GR3LM	–	800	12	–	15	200	–	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

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 (rotary type)	RTBS	–	800	Gear ratio: 1/30	–	15 (deg/s)	400 (deg/s)	–	–	–	–
		–		Gear ratio: 1/45	–	10 (deg/s)	266 (deg/s)	–	–	–	–
	RTBSL	–	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)	–	–	–	–
	RTCSL	–	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)	–	–	–	–
	RTBL	–	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)	–	–	–	–
	RTCL	–	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)	–	–	–	–
	RTBBL	–	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)	–	–	–	–
	RTCBL	–	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	
	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	
	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	
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			

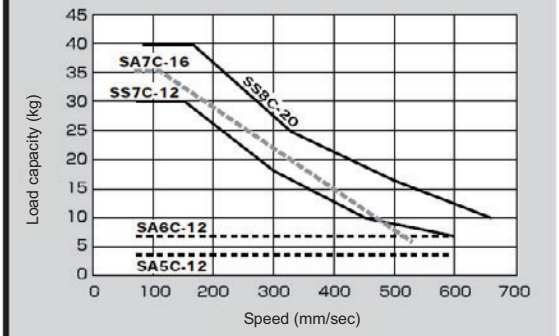
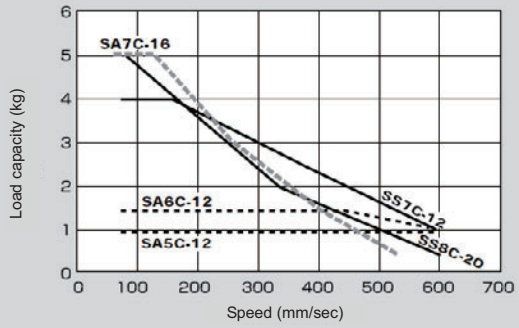
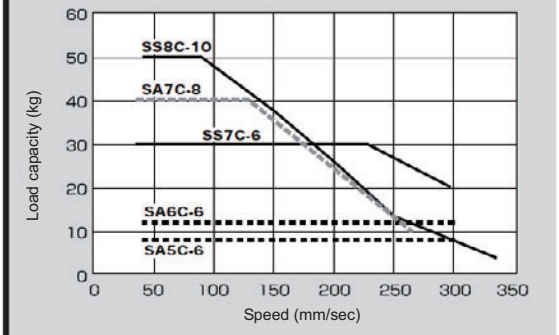
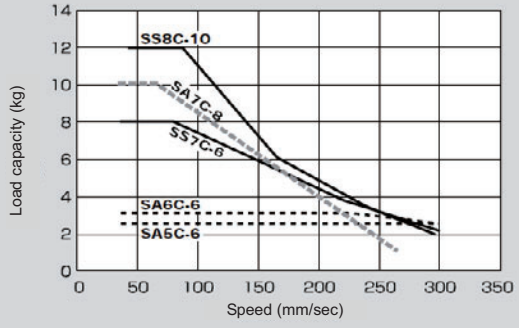
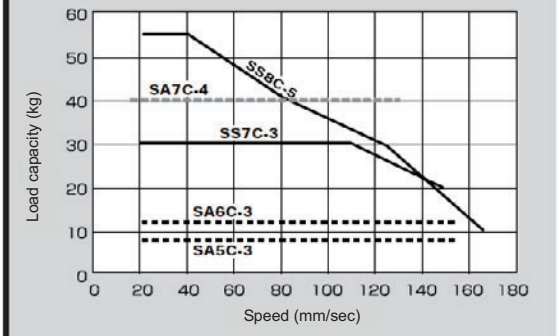
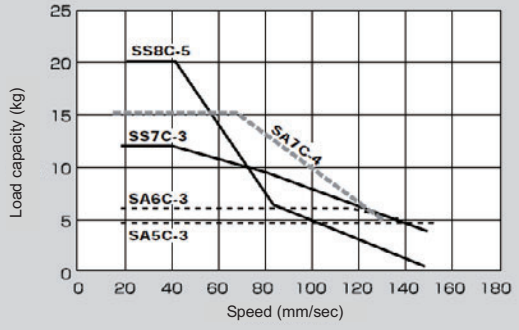
Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (slider type)	SA4C	Ball screw	800	10	Horizontal	12.5	380 (at 50st) 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			
	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			

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)	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			
	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			

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)	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			
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			

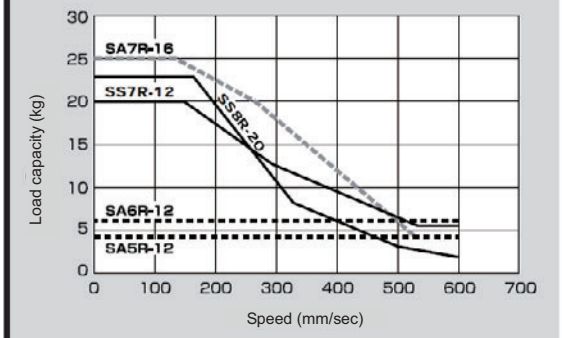
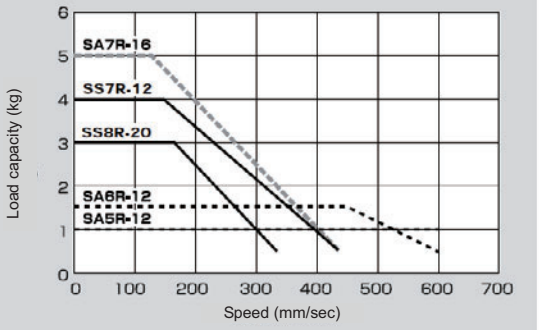
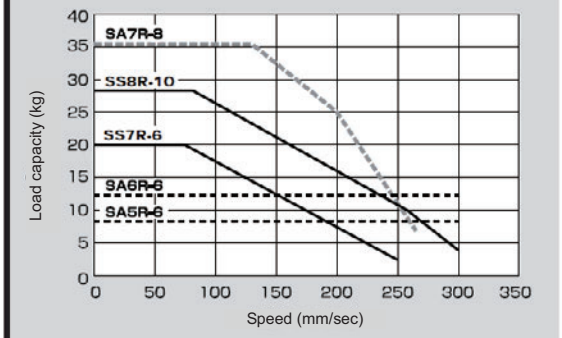
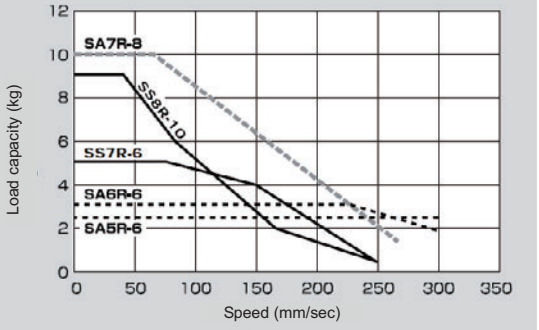
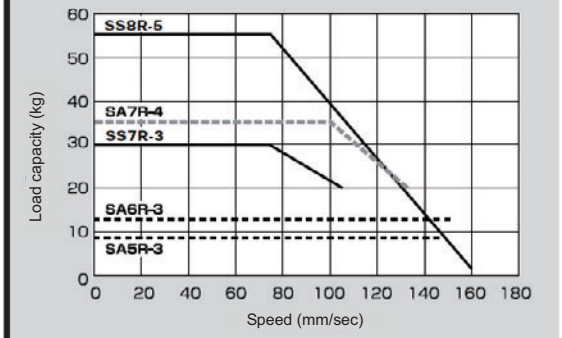
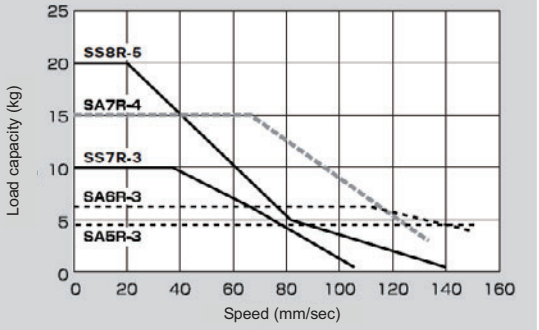
Actuator series	Type	Feed screw	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCP3 (table type)	TA6C	Ball screw	800	12	Horizontal	15	560	0.3	30	47	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			
	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			

Correlation diagram of speed and loading capacity for the slider type (motor-straight type)

	Horizontal installation	Vertical installation
High-speed type		
Medium-speed type		
Low-speed type		

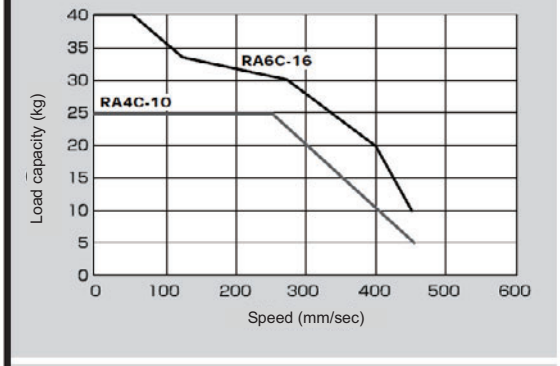
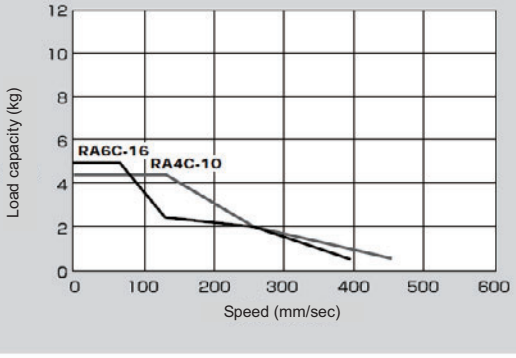
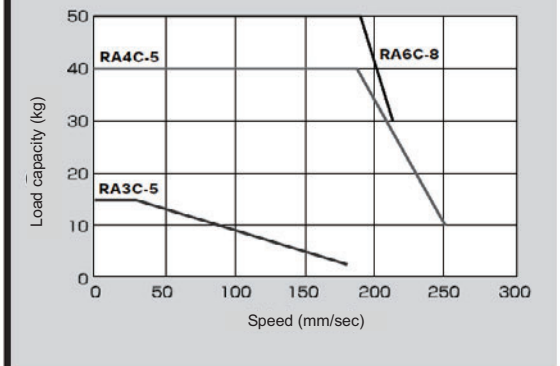
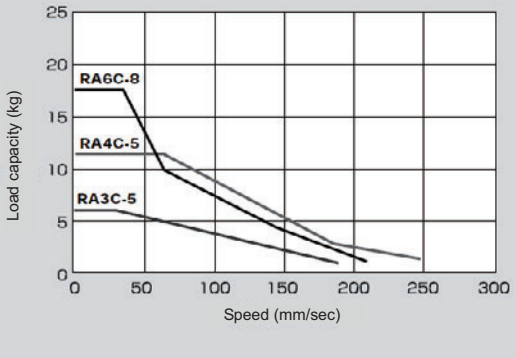
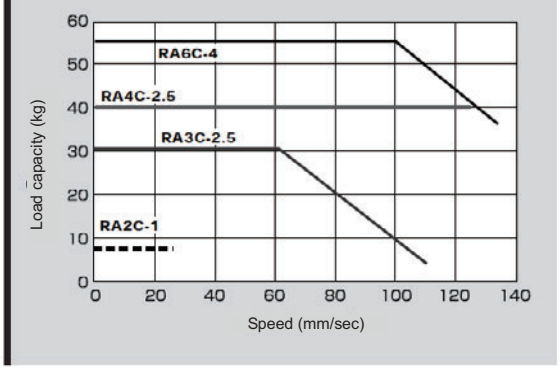
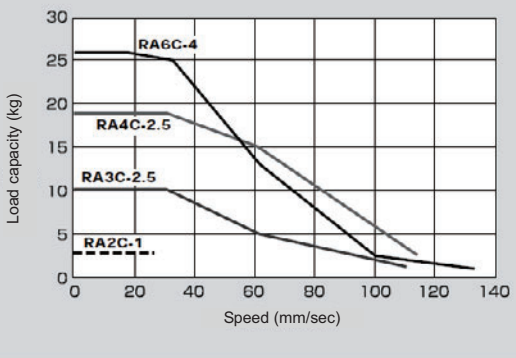
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the slider type (motor-reversing type)

	Horizontal installation	Vertical installation
High-speed type		
Medium-speed type		
Low-speed type		

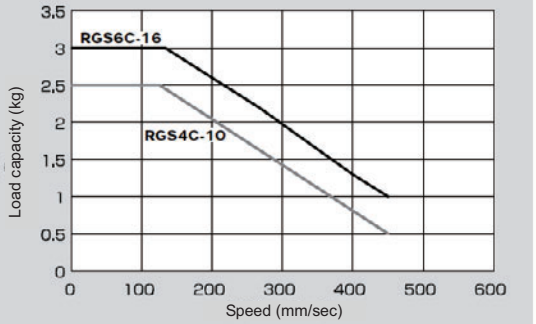
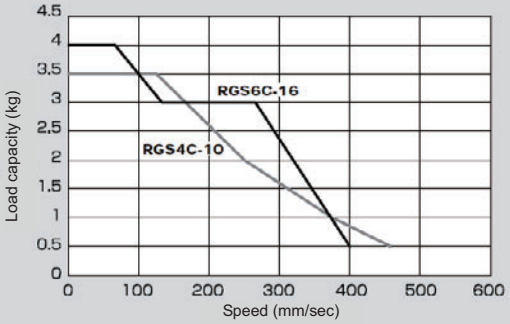
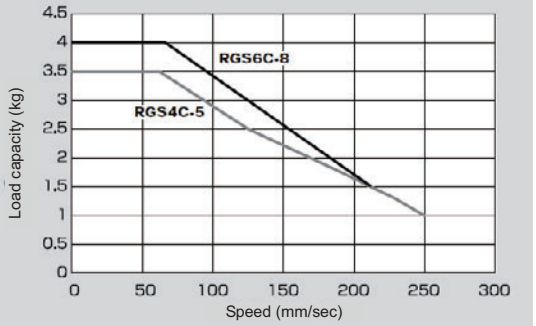
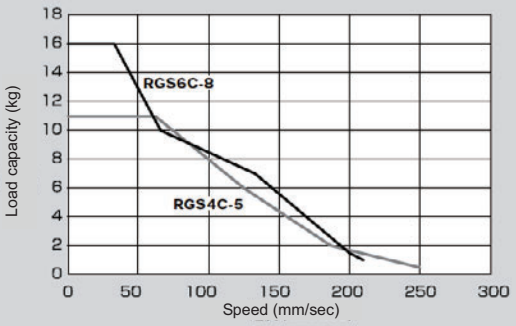
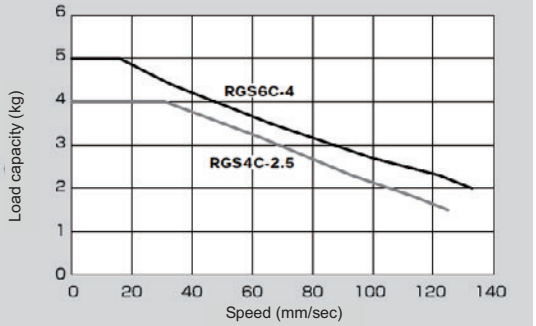
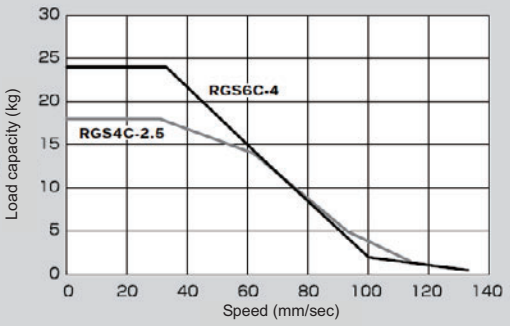
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the standard rod type

	Horizontal installation (Note 1)	Vertical installation
High-speed type		
Medium-speed type		
Low-speed type		

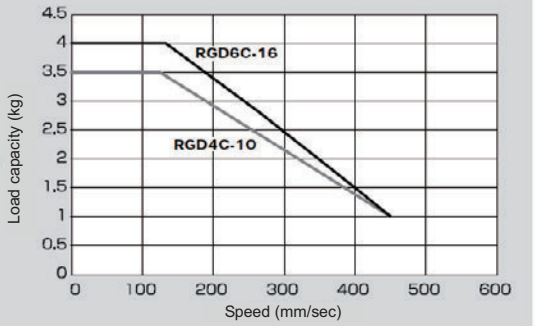
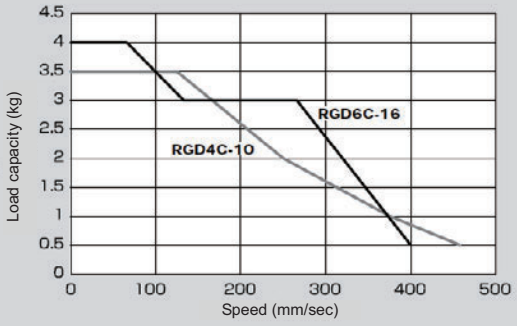
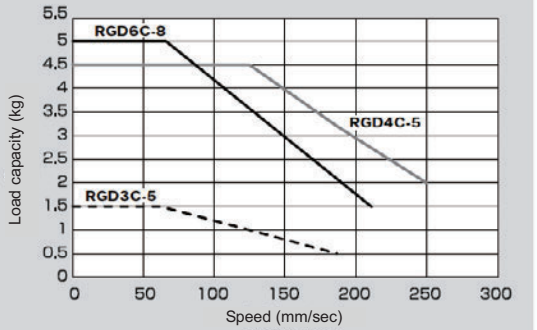
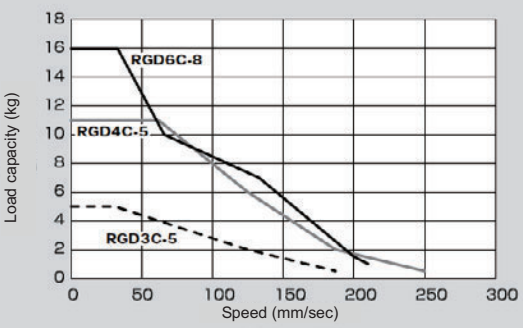
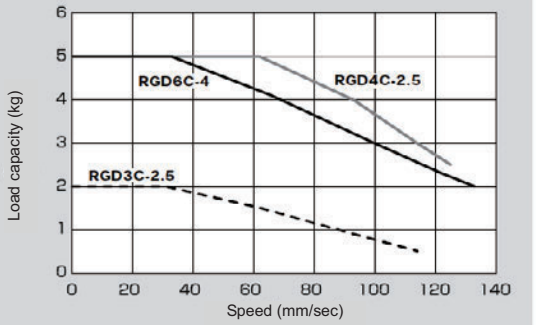
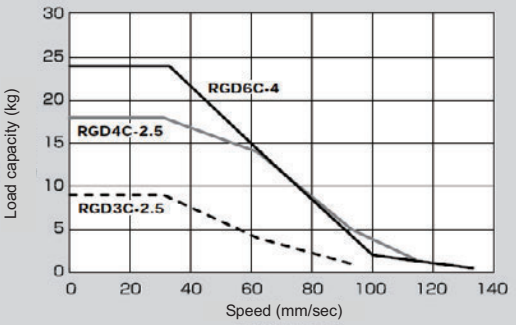
(Note) In the above graphs, the number after the type code indicates the lead.
(Note 1) The figures for horizontal installation assume use of an external guide.

Correlation diagram of speed and loading capacity for the single-guide type

	Horizontal installation	Vertical installation
High-speed type		
Medium-speed type		
Low-speed type		

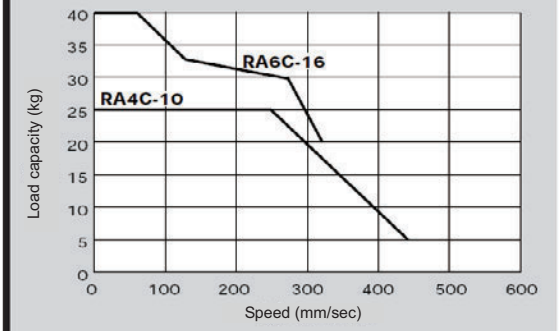
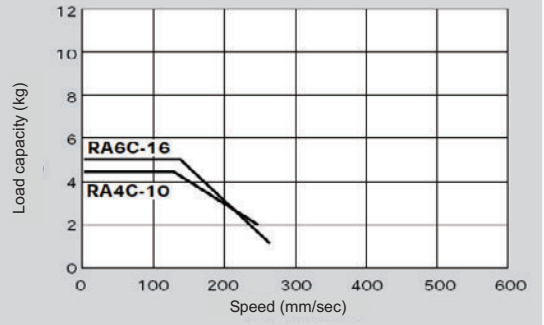
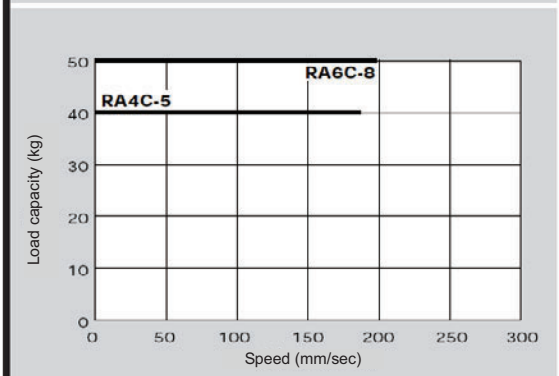
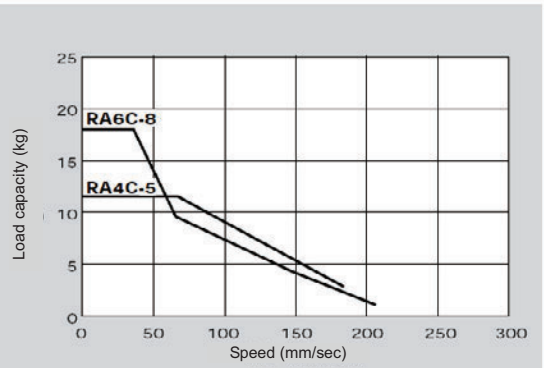
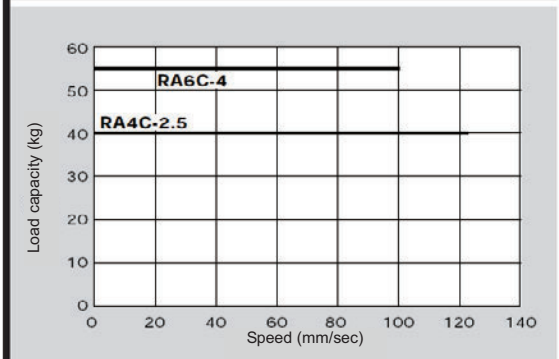
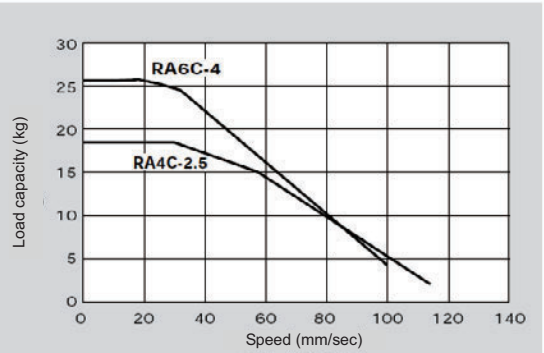
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the double-guide type

	Horizontal installation	Vertical installation
High-speed type		
Medium-speed type		
Low-speed type		

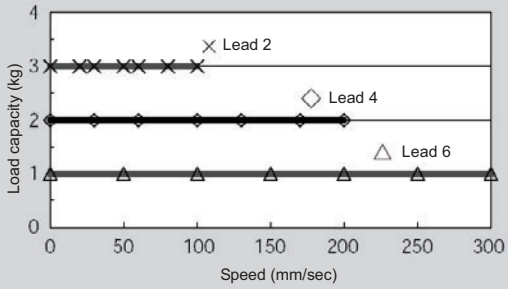
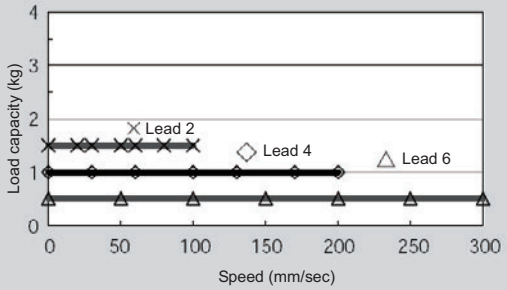
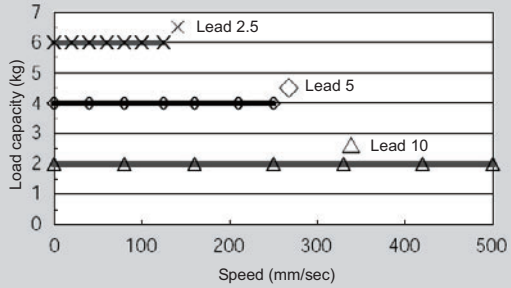
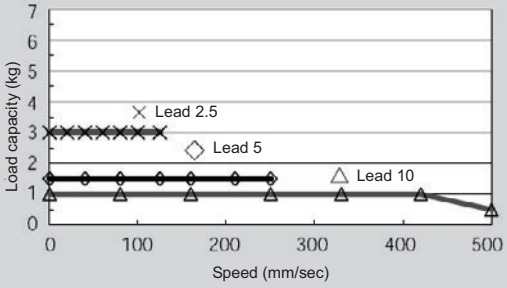
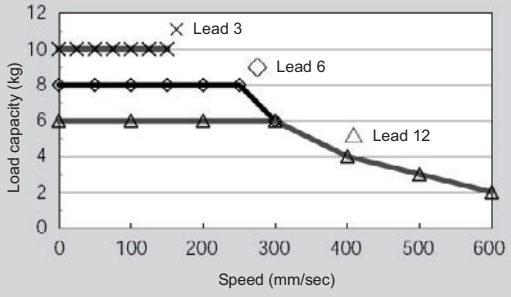
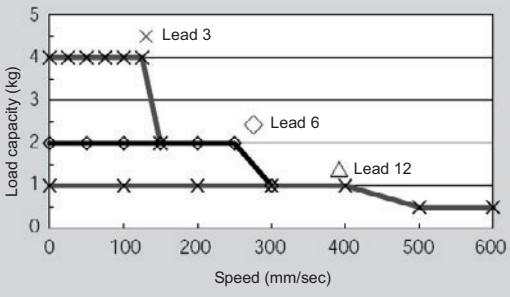
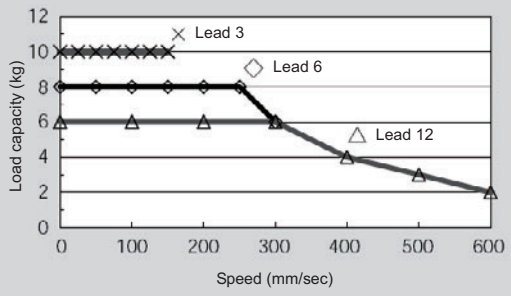
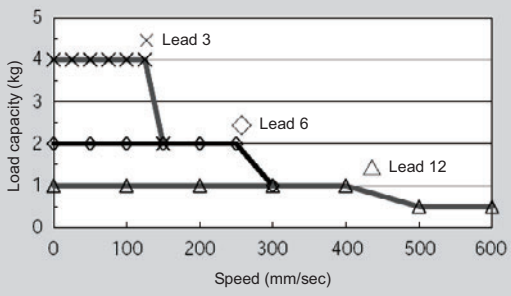
(Note) In the above graphs, the number after the type code indicates the lead.

Correlation diagram of speed and loading capacity for the dustproof/splash-proof type

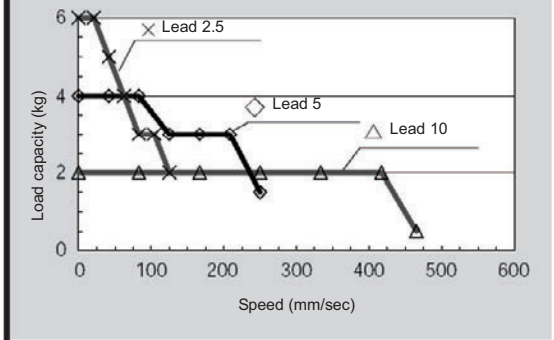
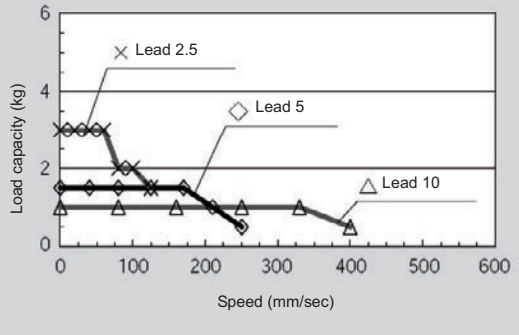
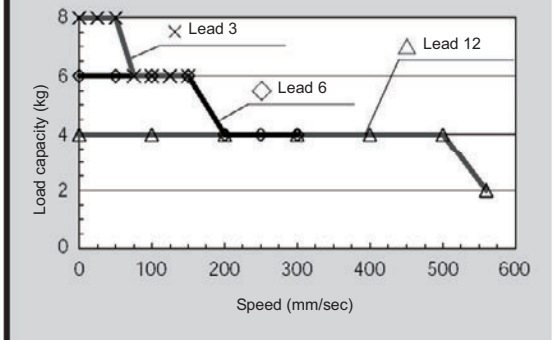
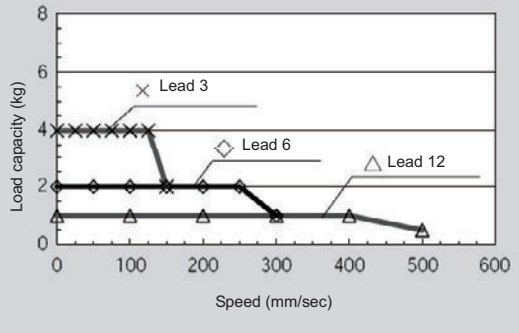
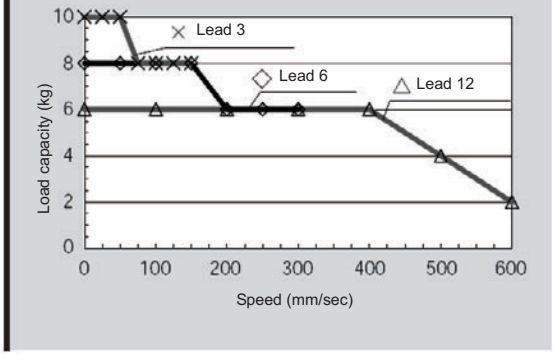
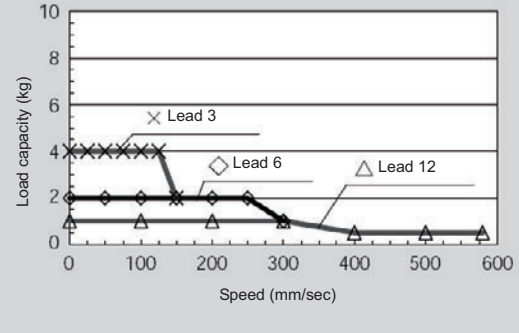
	Horizontal installation (Note 1)	Vertical installation (Note 2)
High-speed type		
Medium-speed type		
Low-speed type		

(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

	Horizontal installation	Vertical installation
SA3C		
SA4C		
SA5C		
SA6C		

Correlation diagram of speed and loading capacity for the RCP3 table type

	Horizontal installation	Vertical installation
TA5C		
TA6C		
TA7C		

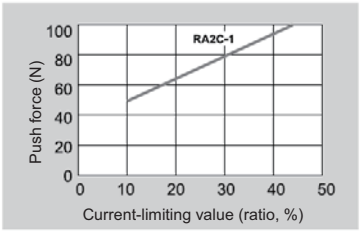
Push Force and Current-limiting Value

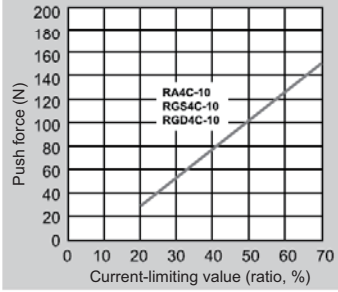
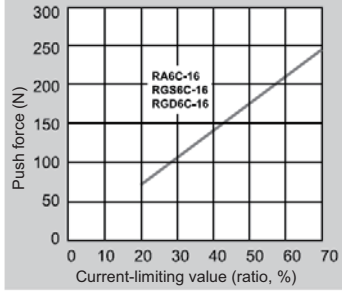
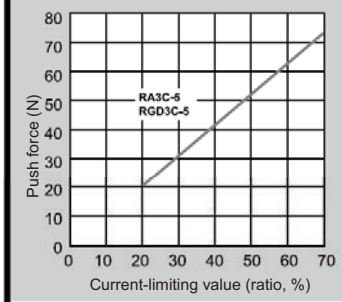
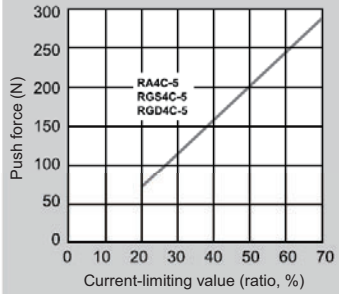
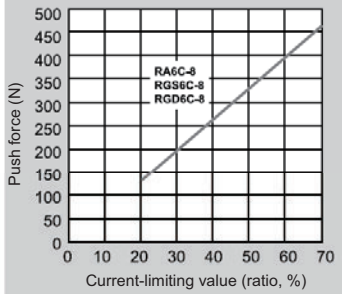
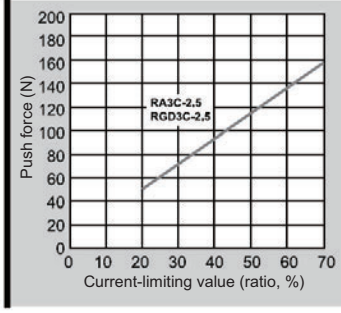
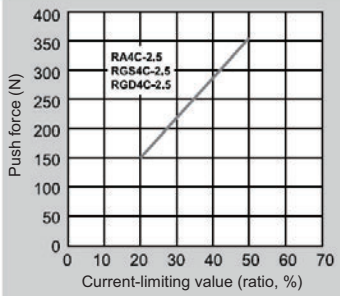
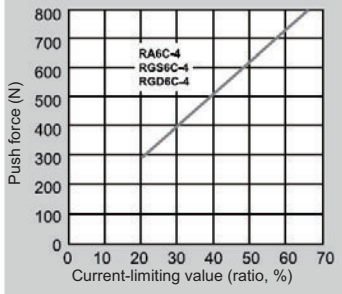
Caution

- The relationship of push force and current-limiting value is based on the rated push speed (factory setting) 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.
- Do not change the setting of push speed (parameter No. 7). If you must change the push speed, consult IAI.
- 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.

RCP2 Series — Rod Type

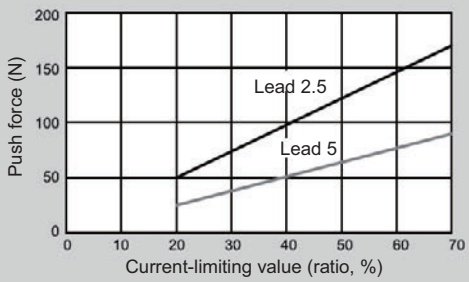
RA2C Type



	RA3C/RGD3C	RA4C/RGS4C/RGD4C	RA6C/RGS6C/RGD6C
High-speed type			
Medium-speed type			
Low-speed type			

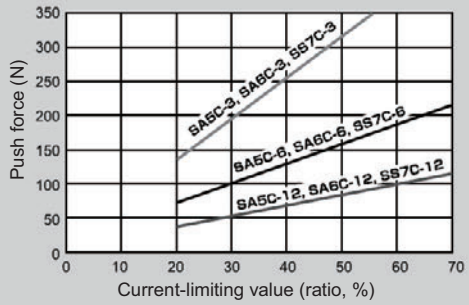
RCP2 Series **Short Type**

SRA4R/SRGS4R/SRGD4R

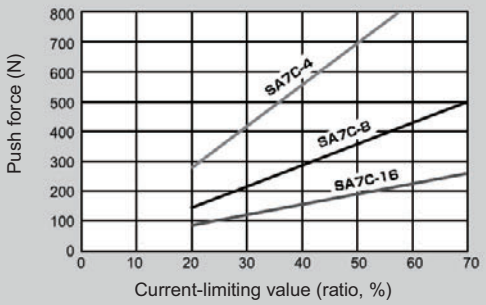


RCP2 Series **Slider Type**

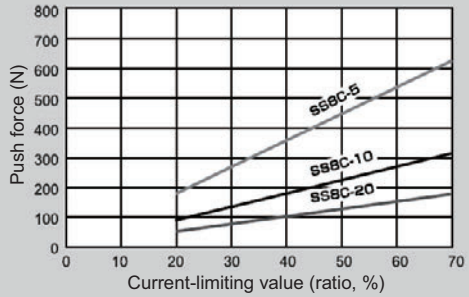
SA5C/SA6C/SS7C Type



SA7C Type

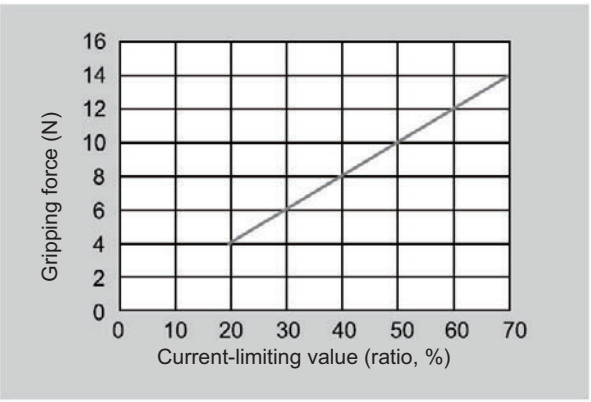


SS8C Type

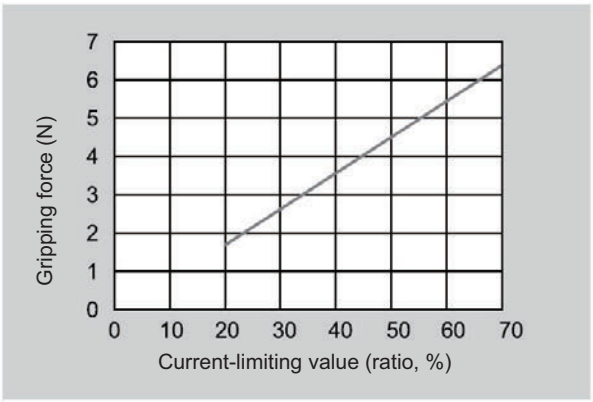


RCP2 Series **Gripper**

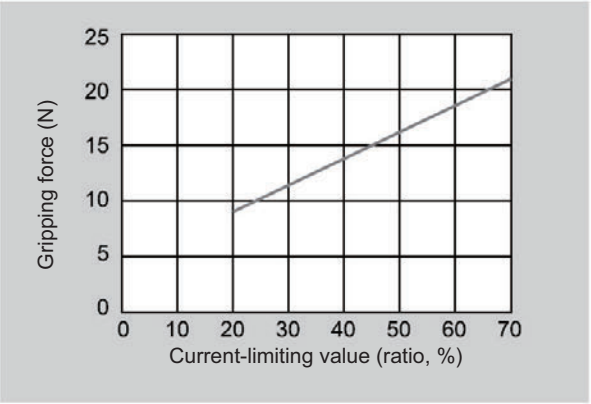
GRSS



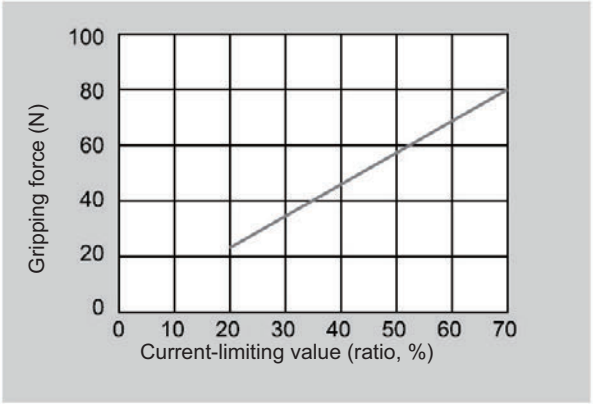
GRLS



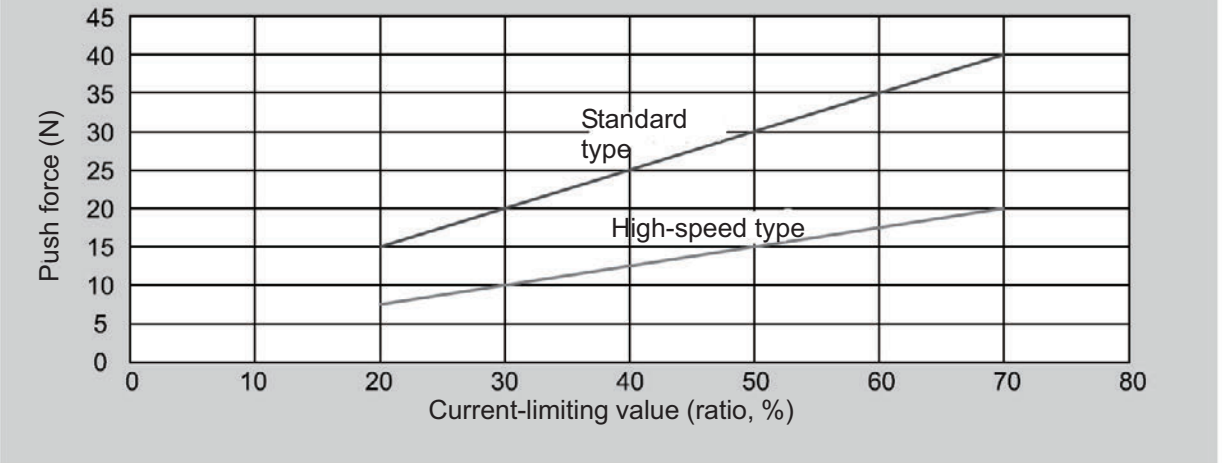
GRS



GRM

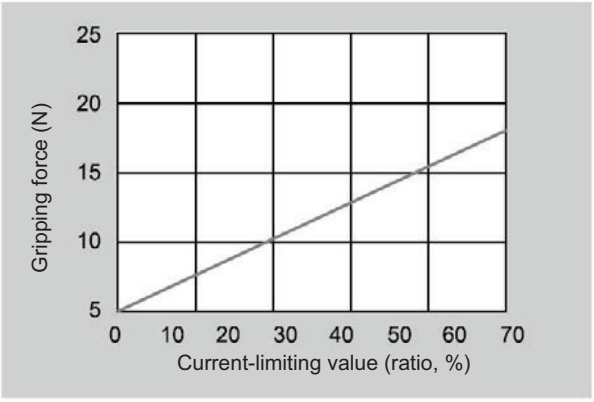


GRST

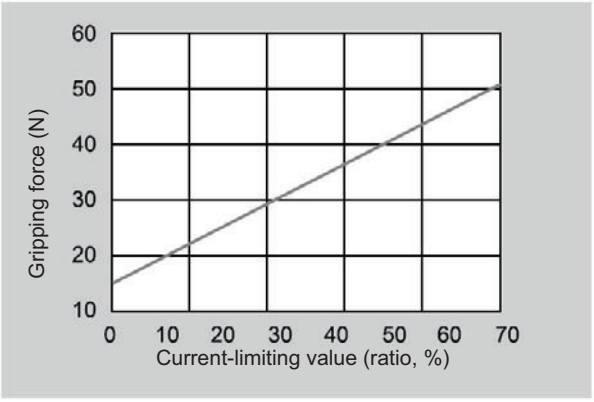


RCP2 Series | 3-finger Gripper

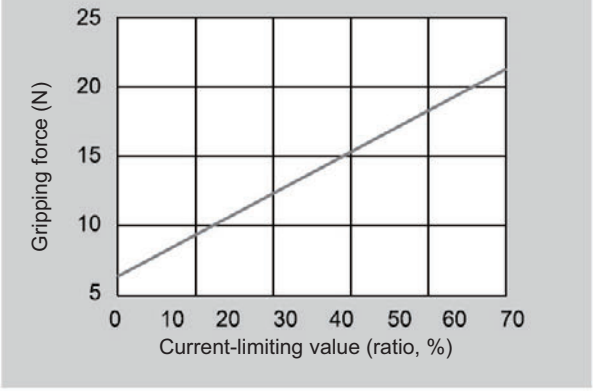
GR3LS



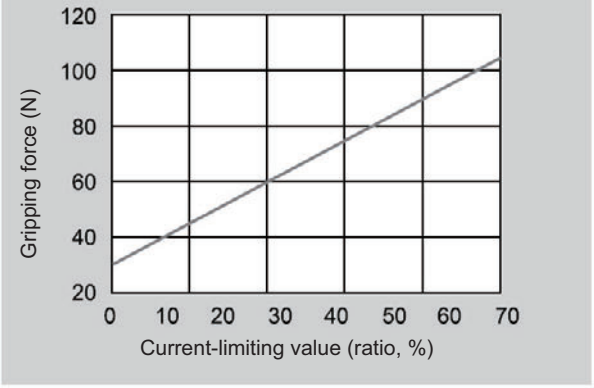
GR3LM



GR3SS

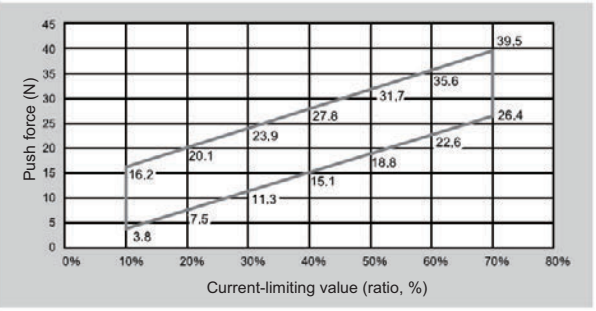


GR3SM

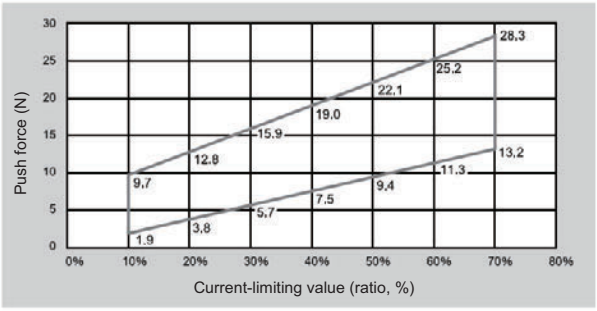


RCP3 Series **Slim, Compact Rod Type**

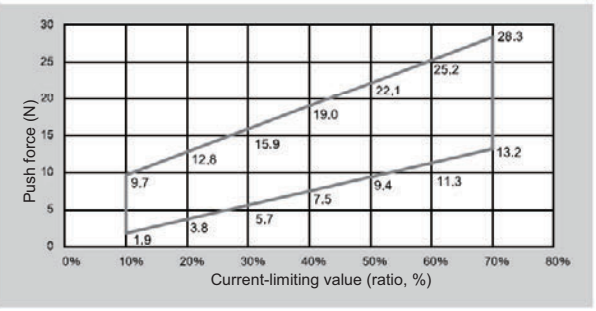
RA2AC/RA2AR Lead 1



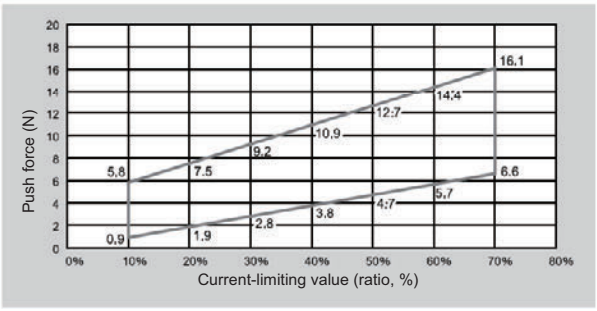
RA2BC/RA2BR Lead 2



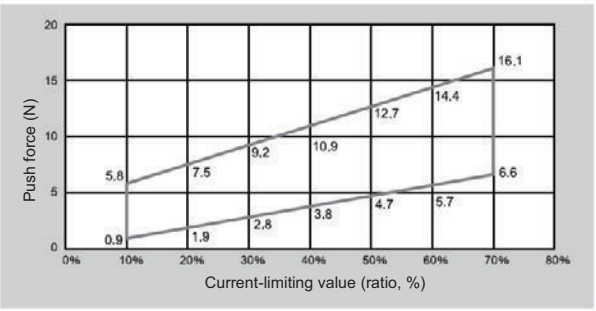
RA2AC/RA2AR Lead 2



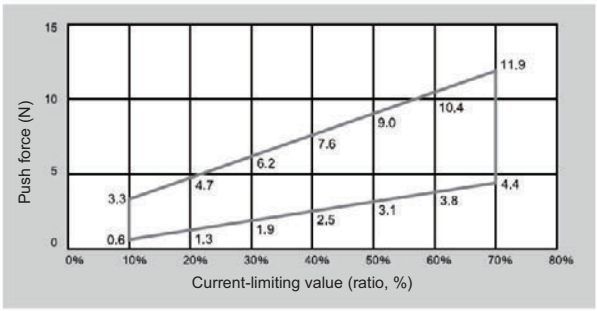
RA2BC/RA2BR Lead 4



RA2AC/RA2AR Lead 4

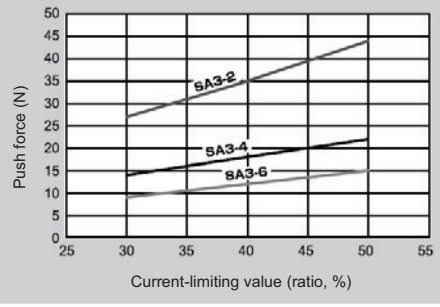


RA2BC/RA2BR Lead 6

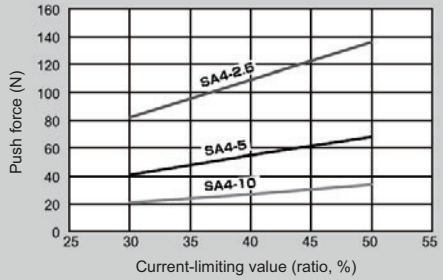


RCP3 Series Slider Type

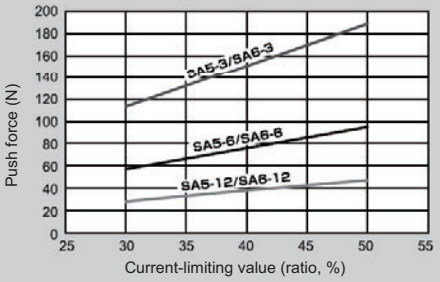
SA3C Type



SA4C Type

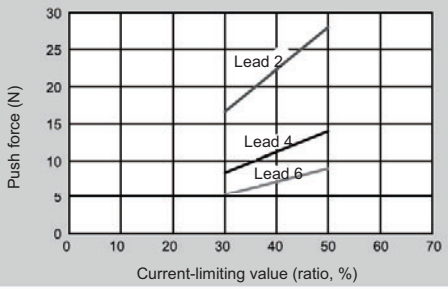


SA5C/SA6C Type

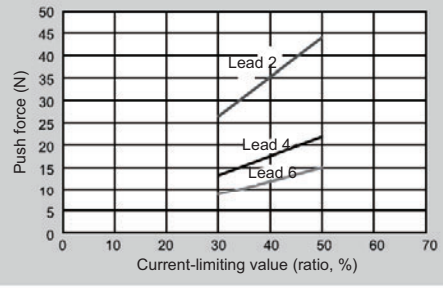


RCP3 Series Slim, Compact Table Type

TA3C/TA3R Type

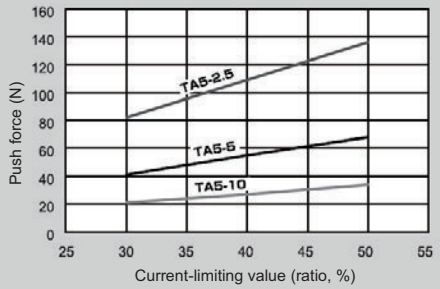


TA4C/TA4R Type

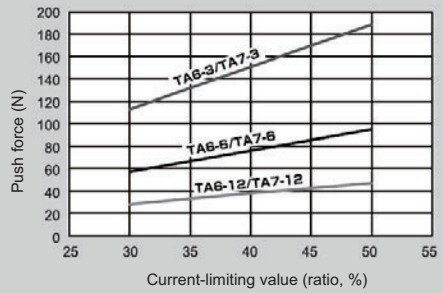


RCP3 Series Table Type

TA5C Type



TA6C/TA7C Type



Position Table Record

Date Recorded: _____

No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]	Push [%]	Threshold [%]	Positioning band [mm]	Zone + [mm]	Zone – [mm]	Acceleration/ deceleration mode	Incremental	Command mode	Standstill mode
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													

No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]	Push [%]	Threshold [%]	Positioning band [mm]	Zone + [mm]	Zone – [mm]	Acceleration/ deceleration mode	Incremental	Command mode	Standstill mode
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
34													
35													
36													
37													
38													
39													
40													
41													

No.	Position [mm]	Speed [mm/s]	Acceleration [G]	Deceleration [G]	Push [%]	Threshold [%]	Positioning band [mm]	Zone + [mm]	Zone – [mm]	Acceleration/ deceleration mode	Incremental	Command mode	Standstill mode
42													
43													
44													
45													
46													
47													
48													
49													
50													
51													
52													
53													
54													
55													
56													
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58													
59													
60													
61													
62													
63													
64													

Parameter Record

Recorded date: _____

Types: a: Parameter relating to actuator stroke range
b: Parameter relating to actuator operating characteristics
c: Parameter relating to external interface
d: Servo gain adjustment

No.	Type	Symbol	Name	Unit	Data
1	a	ZONM	Zone limit 1 + side	mm	
2	a	ZONL	Zone limit 1 – side	mm	
3	a	LIMM	Soft limit + side	mm	
4	a	LIML	Soft limit – side	mm	
5	a	ORG	Home direction [0: Reverse / 1: Forward]	-	
6	b	PSWT	Push-motion completion judgment time	msec	
7	d	PLG0	Servo gain number	-	
8	b	VCMD	Default speed	mm/sec	
9	b	ACMD	Default acceleration/deceleration	G	
10	b	INP	Default positioning band (in-position)	mm	
12	b	SPOW	Current-limiting value at standstill after positioning	%	
13	b	ODPW	Current-limiting value during homing	%	
16	c	BRSL	SIO communication speed	bps	
17	c	RTIM	Minimum delay time for slave transmitter activation	msec	
18	b	LS	Home sensor input polarity	-	
22	a	OFST	Home offset	mm	
23	a	ZNM2	Zone limit 2 + side	mm	
24	a	ZNL2	Zone limit 2 – side	mm	
28	b	PHSP1	Default direction of excited phase signal detection [0: Reverse / 1: Forward]		
29	b	PHSP2	Excited phase signal detection time	msec	
31	d	VLPG	Speed loop proportional gain	-	
32	d	VLPT	Speed loop integral gain	-	
33	d	TRQF	Torque filter time constant	-	
34	b	PSHV	Push speed	mm/sec	
35	b	SAFV	Safety speed	mm/sec	
39	c	FPIO1	Positioning complete signal output mode [0: PEND / 1: INP]	-	
42	b	FPIO4	Enable function [0: Enable / 1: Disable]	-	
43	b	AIOF	Home check sensor input polarity	-	
45	c	SIVM	Silent interval multiplication factor	times	
46	b	OVRD	Speed override	%	
53	b	CTLF	Default standstill mode	-	
77	b	LEAD	Ball screw lead	mm	
78	b	ATYP	Axis operation type	-	
79	b	ATYP	Rotational axis mode selection	-	
80	b	ATYP	Shortcut selection for rotational axis	-	
83	b	ETYP	Absolute unit [0: Do not use / 1: Use]	-	

Change History

Revision Date	Description of Revision
	First edition
	Second edition
2007.04	Third edition
2007.06	Fourth edition
2008.08	Fifth edition
2009.12	Fifth B edition • Added “About CE Marking”.
2010.02	Sixth edition • Operation Manual Catalog No. changed
2010.03	Seventh edition • “Please Read Before Use” added after top page • “H: High-acceleration loading specification” added to model name in P.6
2010.04	Eighth edition • “Precautions for Safety” in P.1 to 7, before Table of Contents, deleted and swapped to “Safety Guide” after Table of Contents • “List of Specifications of Applicable Actuators” in Appendix in P.113 swapped with “List of Specifications of Connectable Actuators” • “Push Force and Current-limiting Value” added to Appendix in P.129
	Ninth edition • Skipped
2010.09	Tenth edition • Note added regarding CE Marking at the beginning • Correction made to explanations of excited phase signal detection time in P.55 • Cautions for push-motion operation added to P.64 • 0C8 error added in P.103 • Correction made to referable parameter numbers in caution note in P.113 and 129
2011.01	Eleventh edition • Correction made in “Speed loop integral gain” in P.96
2011.04	Twelfth edition • Swapped over the page for CE Marking
2011.07	Thirteenth edition • Contents changed in 1.7 Warranty in P.18 to P.19 • Caution note added regarding positioning band setting in P.87 and P.102 • Contents changed and added in Appendix: List of Specifications of Connectable Actuators.

Revision Date	Description of Revision
2012.05	Fourteenth edition • “Explanation for UL Compliance” added before Contents • Contents added and changed in Safety Guide • 3.1 Installation Environment revised
2012.07	Fifteenth edition • Contents changed in UL
2013.01	Sixteenth edition • Contents deleted in UL
2013.11	Seventeenth edition ・4.4.10 Power-saving Modes at Standby Positions revised

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