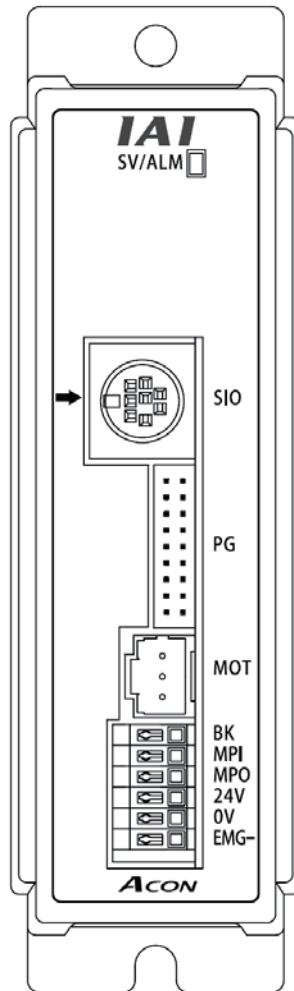




## ACON-SE Controller Serial Communication Type

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Operation Manual Thirteenth 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 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.

***ACON*** \_\_\_\_\_

## 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 ACON Controller Series.

Since the communication protocol is accordingly changed to the general Modbus method (compatible), the PC software and teaching pendants used in conventional RCS 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 RCS controllers
PC software (with USB-compatible communication cables)	RCM-101-USB	
Teaching pendant	RCM-T, CON-T	
Simple teaching pendant	RCM-E	
Data setter	RCM-P	
Touch panel display	RCM-PM-01	It is not compatible with RCS controller.

## 3. Recommendation for Backing Up Latest Data

This controller uses nonvolatile memory to store the 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 any other 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] Handwrite the position table and parameter table on paper.

- Changing the zone function

Application versions: V0015 or later

Now, zone signal settings that meet the relationship "Zone setting+ < Zone setting-" are also supported.

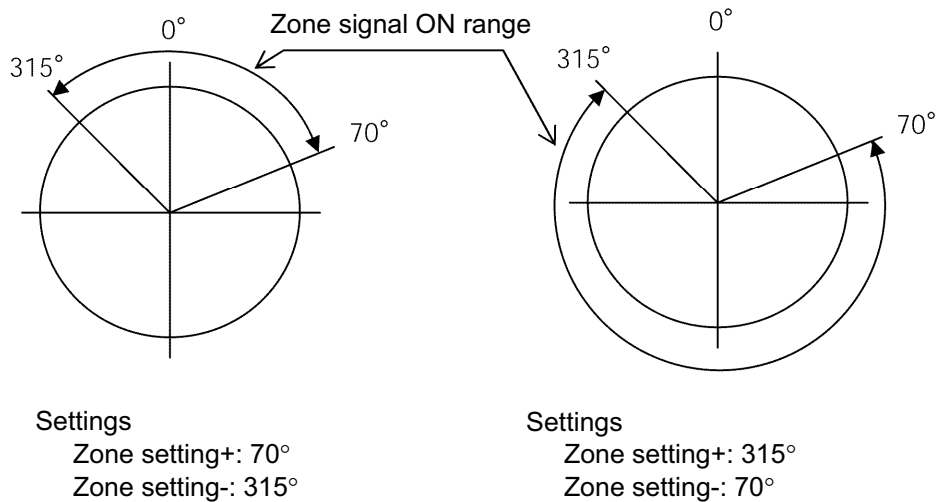
V0014 or earlier: "Zone setting+ ≤ Zone setting-" → No zone signal is output.

V0015 or later: "Zone setting+ = Zone setting-" → No zone signal is output only when this condition is satisfied.

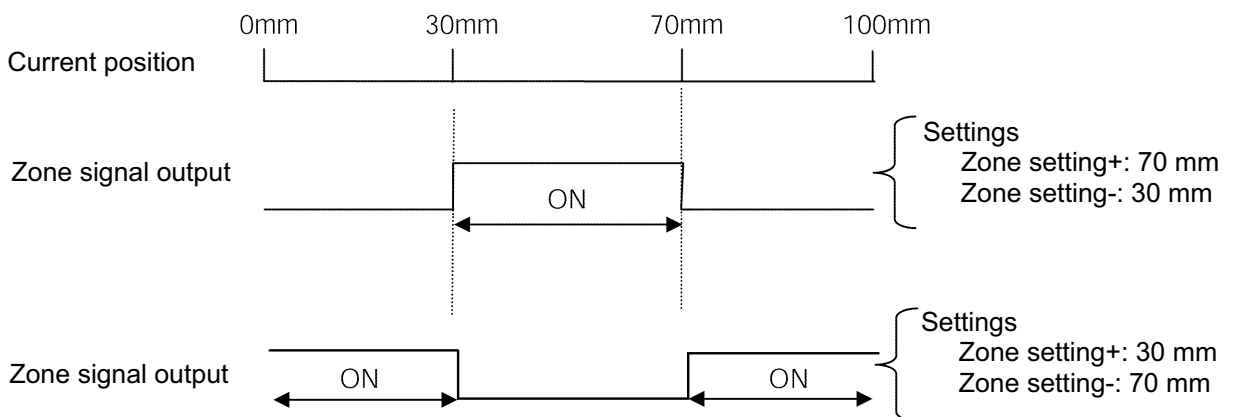
Accordingly, a zone signal can now be output even inside a zone that includes 0° when a rotary actuator is used in the index mode.

Examples are shown below.

[Rotary actuator in the index mode]



[Linear axis]





## **CE Marking**

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

***ACON*** \_\_\_\_\_

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## Safety Guide

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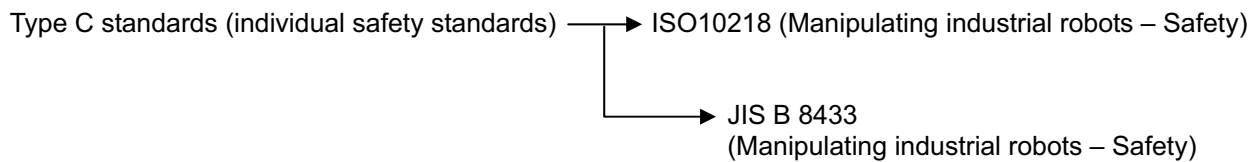
When designing and manufacturing a robot system, ensure safety by following the safety guides provided below and taking the necessary measures.

### Regulations and Standards Governing Industrial Robots

Safety measures on mechanical devices are generally classified into four categories under the International Industrial Standard ISO/DIS 12100, "Safety of machinery," as follows:

- Safety measures
  - Inherent safety design
  - Protective guards --- Safety fence, etc.
  - Additional safety measures --- Emergency stop device, etc.
  - Information on use --- Danger sign, warnings, operation manual

Based on this classification, various standards are established in a hierarchical manner under the International Standards ISO/IEC. The safety standards that apply to industrial robots are as follows:



Also, Japanese laws regulate the safety of industrial robots, as follows:

Industrial Safety and Health Law Article 59

Workers engaged in dangerous or harmful operations must receive special education.

Ordinance on Industrial Safety and Health

Article 36 --- Operations requiring special education

- No. 31 (Teaching, etc.) --- Teaching and other similar work involving industrial robots (exceptions apply)
- No. 32 (Inspection, etc.) --- Inspection, repair, adjustment and similar work involving industrial robots (exceptions apply)

Article 150 --- Measures to be taken by the user of an industrial robot

## Requirements for Industrial Robots under Ordinance on Industrial Safety and Health

Work area	Work condition	Cutoff of drive source	Measure	Article
Outside movement range	During automatic operation	Not cut off	Signs for starting operation	Article 104
			Installation of railings, enclosures, etc.	Article 150-4
Inside movement range	During teaching, etc.	Cut off (including stopping of operation)	Sign, etc., indicating that work is in progress	Article 150-3
			Preparation of work rules	Article 150-3
		Not cut off	Measures to enable immediate stopping of operation	Article 150-3
			Sign, etc., indicating that work is in progress	Article 150-3
			Provision of special education	Article 36-31
			Checkup, etc., before commencement of work	Article 151
	During inspection, etc.	Cut off	To be performed after stopping the operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
		Not cut off (when inspection, etc., must be performed during operation)	Preparation of work rules	Article 150-5
			Measures to enable immediate stopping of operation	Article 150-5
			Sign, etc., indicating that work is in progress	Article 150-5
			Provision of special education (excluding cleaning and lubrication)	Article 36-32

## Applicable Models of IAI's Industrial Robots

Machines meeting the following conditions are not classified as industrial robots according to Notice of Ministry of Labor No. 51 and Notice of Ministry of Labor/Labor Standards Office Director (Ki-Hatsu No. 340):

- (1) Single-axis robot with a motor wattage of 80 W or less
- (2) Combined multi-axis robot whose X, Y and Z-axes are 300 mm or shorter and whose rotating part, if any, has the maximum movement range of within 300 mm<sup>3</sup> including the tip of the rotating part
- (3) Multi-joint robot whose movable radius and Z-axis are within 300 mm

Among the products featured in our catalogs, the following models are classified as industrial robots:

1. Single-axis ROBO Cylinders  
RCS2/RCS2CR-SS8□ whose stroke exceeds 300 mm
2. Single-axis robots  
The following models whose stroke exceeds 300 mm and whose motor capacity also exceeds 80 W:  
ISA/ISPA, ISDA/ISPDA, ISWA/ISPWA, IF, FS, NS
3. Linear servo actuators  
All models whose stroke exceeds 300 mm
4. Cartesian robots  
Any robot that uses at least one axis corresponding to one of the models specified in Sections 1 to 3 and also CT4
5. IX SCARA robots  
All models whose arm length exceeds 300 mm  
(All models excluding IX-NNN1205/1505/1805/2515, NNW2515 and NNC1205/1505/1805/2515)

## Notes on Safety of Our Products

Common items you should note when performing each task on any IAI robot are explained below.





No.	Task	Note
1	Model selection	<ul style="list-style-type: none"> <li>● This product is not planned or designed for uses requiring high degrees of safety. Accordingly, it cannot be used to sustain or support life and must not be used in the following applications:               <ul style="list-style-type: none"> <li>[1] Medical devices relating to maintenance, management, etc., of life or health</li> <li>[2] Mechanisms or mechanical devices (vehicles, railway facilities, aircraft facilities, etc.) intended to move or transport people</li> <li>[3] Important safety parts in mechanical devices (safety devices, etc.)</li> </ul> </li> <li>● Do not use this product in the following environments:               <ul style="list-style-type: none"> <li>[1] Place subject to flammable gases, ignitable objects, flammables, explosives, etc.</li> <li>[2] Place that may be exposed to radiation</li> <li>[3] Place where the surrounding air temperature or relative humidity exceeds the specified range</li> <li>[4] Place subject to direct sunlight or radiated heat from large heat sources</li> <li>[5] Place subject to sudden temperature shift and bedewing</li> <li>[6] Place subject to corrosive gases (sulfuric acid, hydrochloric acid, etc.)</li> <li>[7] Place subject to excessive dust, salt or iron powder</li> <li>[8] Place where the product receives direct vibration or impact</li> </ul> </li> <li>● Do not use this product outside the specified ranges. Doing so may significantly shorten the life of the product or result in product failure or facility stoppage.</li> </ul>
2	Transportation	<ul style="list-style-type: none"> <li>● When transporting the product, exercise due caution not to bump or drop the product.</li> <li>● Use appropriate means for transportation.</li> <li>● Do not step on the package.</li> <li>● Do not place on the package any heavy article that may deform the package.</li> <li>● When using a crane with a capacity of 1 ton or more, the crane must be operated by personnel qualified to operate cranes and perform slinging operations.</li> <li>● When using a crane or other equipment, never use it to hoist any article exceeding the rated load of the applicable crane, etc.</li> <li>● Use hoisting accessories suitable for the article to be hoisted. Select appropriate hoisting accessories by making sure there is an ample allowance for safety in their cutting load, etc.</li> <li>● Do not climb onto the article being hoisted.</li> <li>● Do not keep the article hoisted.</li> <li>● Do not stand under the hoisted article.</li> </ul>
3	Storage/preservation	<ul style="list-style-type: none"> <li>● The storage/preservation environment should conform to the installation environment. Among others, be careful not to cause bedewing.</li> </ul>
4	Installation/startup	<p>(1) Installing the robot, controller, etc.</p> <ul style="list-style-type: none"> <li>● Be sure to firmly secure and affix the product (including its load). If the product tips over, drops, malfunctions, etc., damage or injury may result.</li> <li>● Do not step on the product or place any article on top. The product may tip over or the article may drop, resulting in injury, product damage, loss of/drop in product performance, shorter life, etc.</li> <li>● If the product is used in any of the following places, provide sufficient shielding measures:               <ul style="list-style-type: none"> <li>[1] Place subject to electrical noise</li> <li>[2] Place subject to a strong electric or magnetic field</li> <li>[3] Place where power lines or drive lines are wired nearby</li> <li>[4] Place subject to splashed water, oil or chemicals</li> </ul> </li> </ul>

No.	Task	Note
4	Installation/ startup	<p>(2) Wiring the cables</p> <ul style="list-style-type: none"> <li>● Use IAI's genuine cables to connect the actuator and controller or connect a teaching tool, etc.</li> <li>● Do not damage, forcibly bend, pull, loop round an object or pinch the cables or place heavy articles on top. Current leak or poor electrical continuity may occur, resulting in fire, electric shock or malfunction.</li> <li>● Wire the product correctly after turning off the power.</li> <li>● When wiring a DC power supply (+24 V), pay attention to the positive and negative polarities. Connecting the wires in wrong polarities may result in fire, product failure or malfunction.</li> <li>● Be sure to connect the cable connectors without fail and firmly. Failing to do so may result in fire, electric shock or product malfunction.</li> <li>● Do not cut and reconnect the cables of the product to extend or shorten the cables. Doing so may result in fire or product malfunction.</li> </ul> <p>(3) Grounding</p> <ul style="list-style-type: none"> <li>● Be sure to provide class D (former class 3) grounding for the controller. Grounding is required to prevent electric shock and electrostatic charges, improve noise resistance and suppress unnecessary electromagnetic radiation.</li> </ul> <p>(4) Safety measures</p> <ul style="list-style-type: none"> <li>● Implement safety measures (such as installing safety fences, etc.) to prevent entry into the movement range of the robot when the product is moving or can be moved. Contacting the moving robot may result in death or serious injury.</li> <li>● Be sure to provide an emergency stop circuit so that the product can be stopped immediately in case of emergency during operation.</li> <li>● Implement safety measures so that the product cannot be started only by turning on the power. If the product starts suddenly, injury or product damage may result.</li> <li>● Implement safety measures so that the product will not start upon cancellation of an emergency stop or recovery of power following a power outage. Failure to do so may result in injury, equipment damage, etc.</li> <li>● Put up a sign saying "WORK IN PROGRESS. DO NOT TURN ON POWER," etc., during installation, adjustment, etc. If the power is accidentally turned on, electric shock or injury may result.</li> <li>● Implement measures to prevent the load, etc., from dropping due to a power outage or emergency stop.</li> <li>● Ensure safety by wearing protective gloves, protective goggles and/or safety shoes, as necessary.</li> <li>● Do not insert fingers and objects into openings in the product. Doing so may result in injury, electric shock, product damage, fire, etc.</li> <li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the load, etc., due to the slider dropping by its dead weight.</li> </ul>
5	Teaching	<ul style="list-style-type: none"> <li>● Whenever possible, perform teaching from outside the safety fences. If teaching must be performed inside the safety fences, prepare "work rules" and make sure the operator understands the procedures thoroughly.</li> <li>● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs.</li> <li>● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party.</li> <li>● Put up a sign saying "WORK IN PROGRESS" in a conspicuous location.</li> <li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the load, etc., due to the slider dropping by its dead weight.</li> </ul> <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>

6	Confirmation operation	<ul style="list-style-type: none"> <li>● After teaching or programming, carry out step-by-step confirmation operation before switching to automatic operation.</li> <li>● When carrying out confirmation operation inside the safety fences, follow the specified work procedure just like during teaching.</li> <li>● When confirming the program operation, use the safety speed. Failure to do so may result in an unexpected movement due to programming errors, etc., causing injury.</li> <li>● Do not touch the terminal blocks and various setting switches while the power is supplied. Touching these parts may result in electric shock or malfunction.</li> </ul>
7	Automatic operation	<ul style="list-style-type: none"> <li>● Before commencing automatic operation, make sure no one is inside the safety fences.</li> <li>● Before commencing automatic operation, make sure all related peripherals are ready to operate in the auto mode and no abnormalities are displayed or indicated.</li> <li>● Be sure to start automatic operation from outside the safety fences.</li> <li>● If the product generated abnormal heat, smoke, odor or noise, stop the product immediately and turn off the power switch. Failure to do so may result in fire or product damage.</li> <li>● If a power outage occurred, turn off the power switch. Otherwise, the product may move suddenly when the power is restored, resulting in injury or product damage.</li> </ul>
8	Maintenance/ inspection	<ul style="list-style-type: none"> <li>● Whenever possible, work from outside the safety fences. If work must be performed inside the safety fences, prepare “work rules” and make sure the operator understands the procedures thoroughly.</li> <li>● When working inside the safety fences, turn off the power switch, as a rule.</li> <li>● When working inside the safety fences, the operator should carry a handy emergency stop switch so that the operation can be stopped any time when an abnormality occurs.</li> <li>● When working inside the safety fences, appoint a safety watcher in addition to the operator so that the operation can be stopped any time when an abnormality occurs. The safety watcher must also make sure the switches are not operated inadvertently by a third party.</li> <li>● Put up a sign saying “WORK IN PROGRESS” in a conspicuous location.</li> <li>● Use appropriate grease for the guides and ball screws by checking the operation manual for each model.</li> <li>● Do not perform a withstand voltage test. Conducting this test may result in product damage.</li> <li>● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the load, etc., due to the slider dropping by its dead weight.</li> </ul> <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>
9	Modification	<ul style="list-style-type: none"> <li>● The customer must not modify or disassemble/assemble the product or use maintenance parts not specified in the manual without first consulting IAI.</li> <li>● Any damage or loss resulting from the above actions will be excluded from the scope of warranty.</li> </ul>
10	Disposal	<ul style="list-style-type: none"> <li>● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.</li> <li>● When disposing of the product, do not throw it into fire. The product may explode or generate toxic gases.</li> </ul>

## Indication of Cautionary Information

The operation manual for each model denotes safety guides under “Danger,” “Warning,” “Caution” and “Note,” as specified below.

Level	Degree of danger/loss	Symbol
Danger	Failure to observe the instruction will result in an imminent danger leading to death or serious injury.	 <b>Danger</b>
Warning	Failure to observe the instruction may result in death or serious injury.	 <b>Warning</b>
Caution	Failure to observe the instruction may result in injury or property damage.	 <b>Caution</b>
Note	The user should take heed of this information to ensure the proper use of the product, although failure to do so will not result in injury.	 <b>Note</b>

**Acon** \_\_\_\_\_

## 1. Overview

### 1.1 Introduction

The ACON Series controllers are specifically designed for the RCA, RCA2 and RCL actuators, and adopt new functions to further enhance convenience and safety by reducing the size and cost while following the functions of the RCS controller.

In addition, the power-saving considered function has been adopted, with awareness of energy conservation raised.

Among the ACON 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.

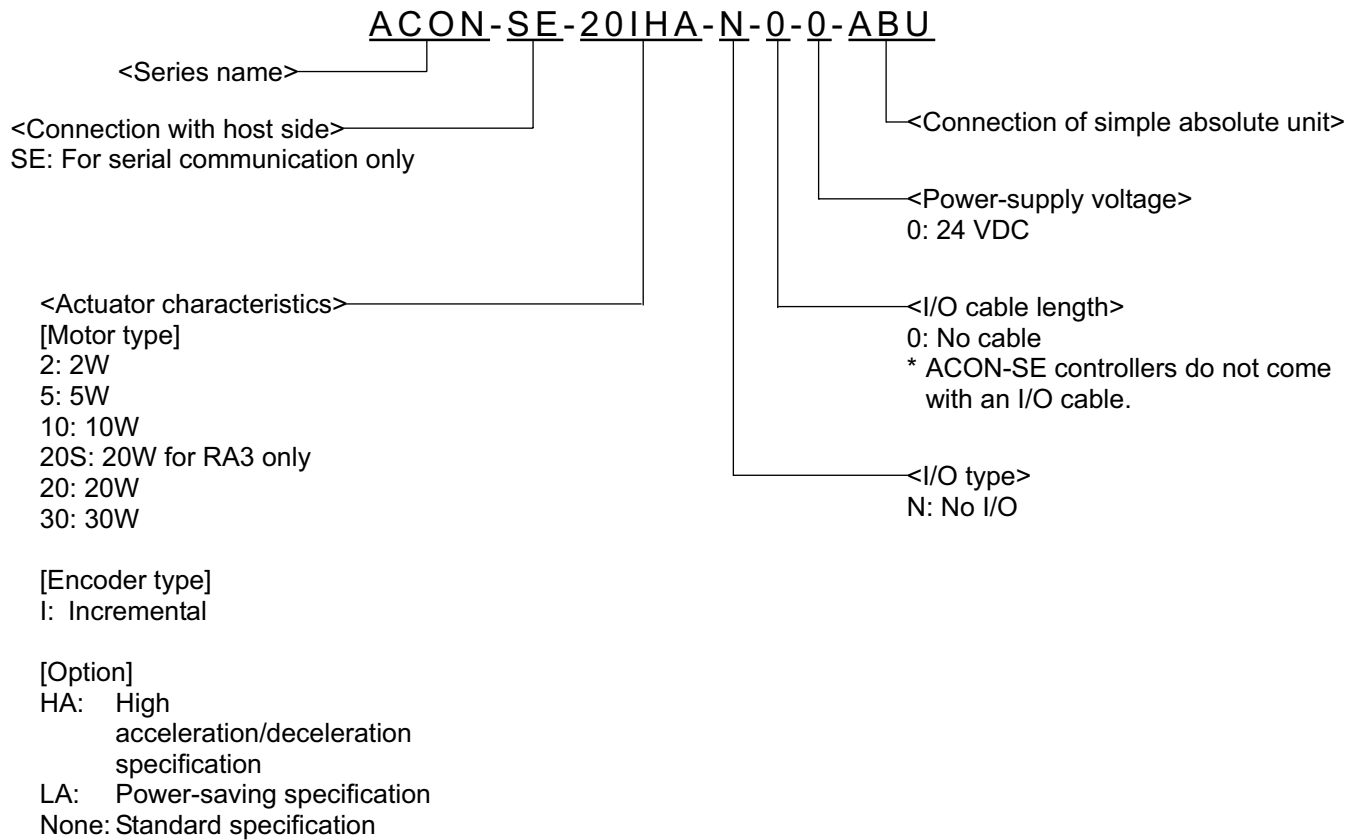
This Operation Manual does not completely cover all items other than normal operations or unexpected phenomena such as complicated signal changes by critical timing.  
Therefore, interpret any items not covered by this manual as "impossible to do" in principle.

- \* We have made every effort to ensure accuracy 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

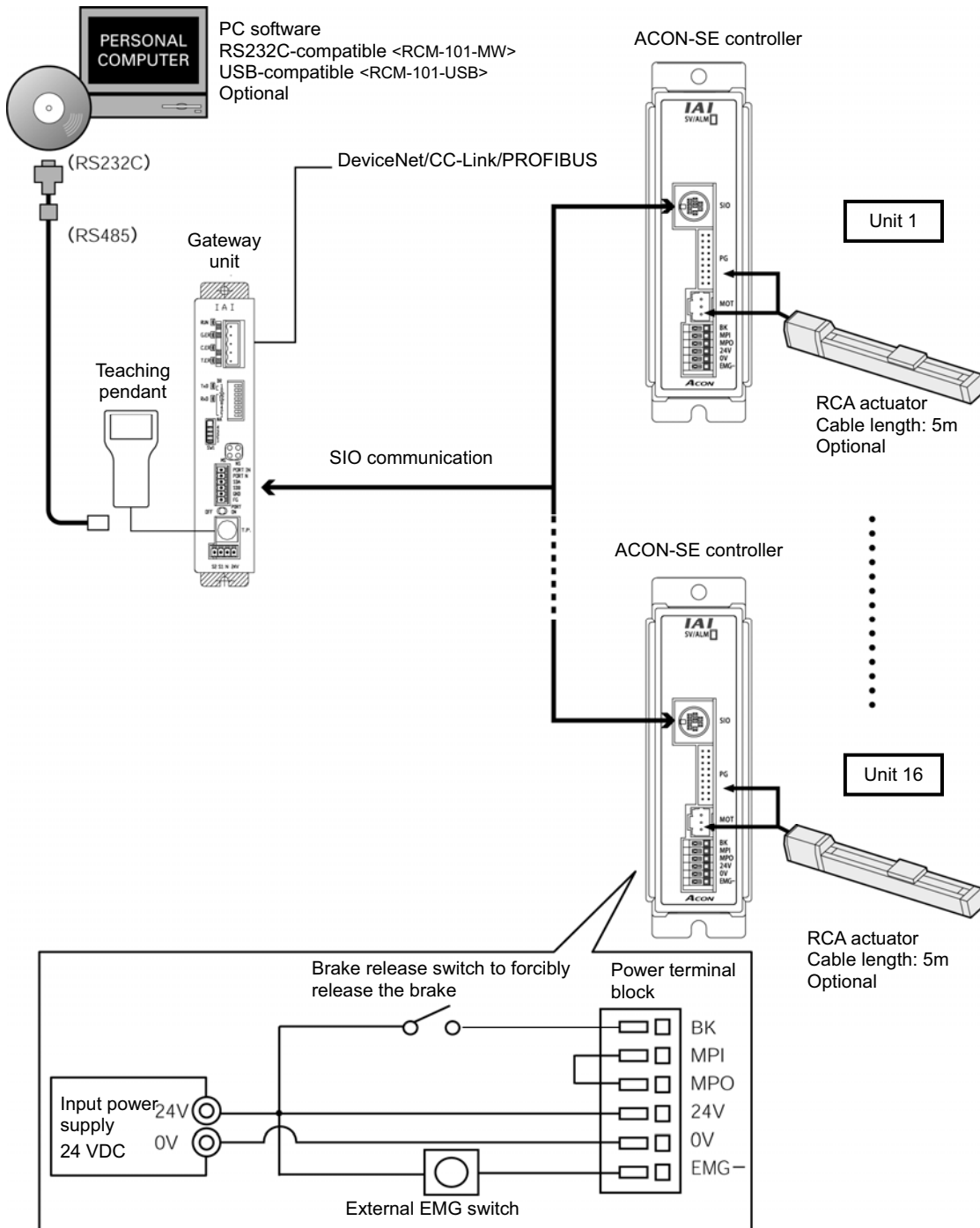
- (1) Control signals are input/output via serial communication RS485 (compatible with Modbus protocol).
- (2) Positioning points: 64
- (3) Setting of zone output boundary values  
The zone output boundary values were previously fixedly set with parameters. Convenience has been enhanced since they can 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.

## 1.3 Model Number



## 1.4 System Configuration

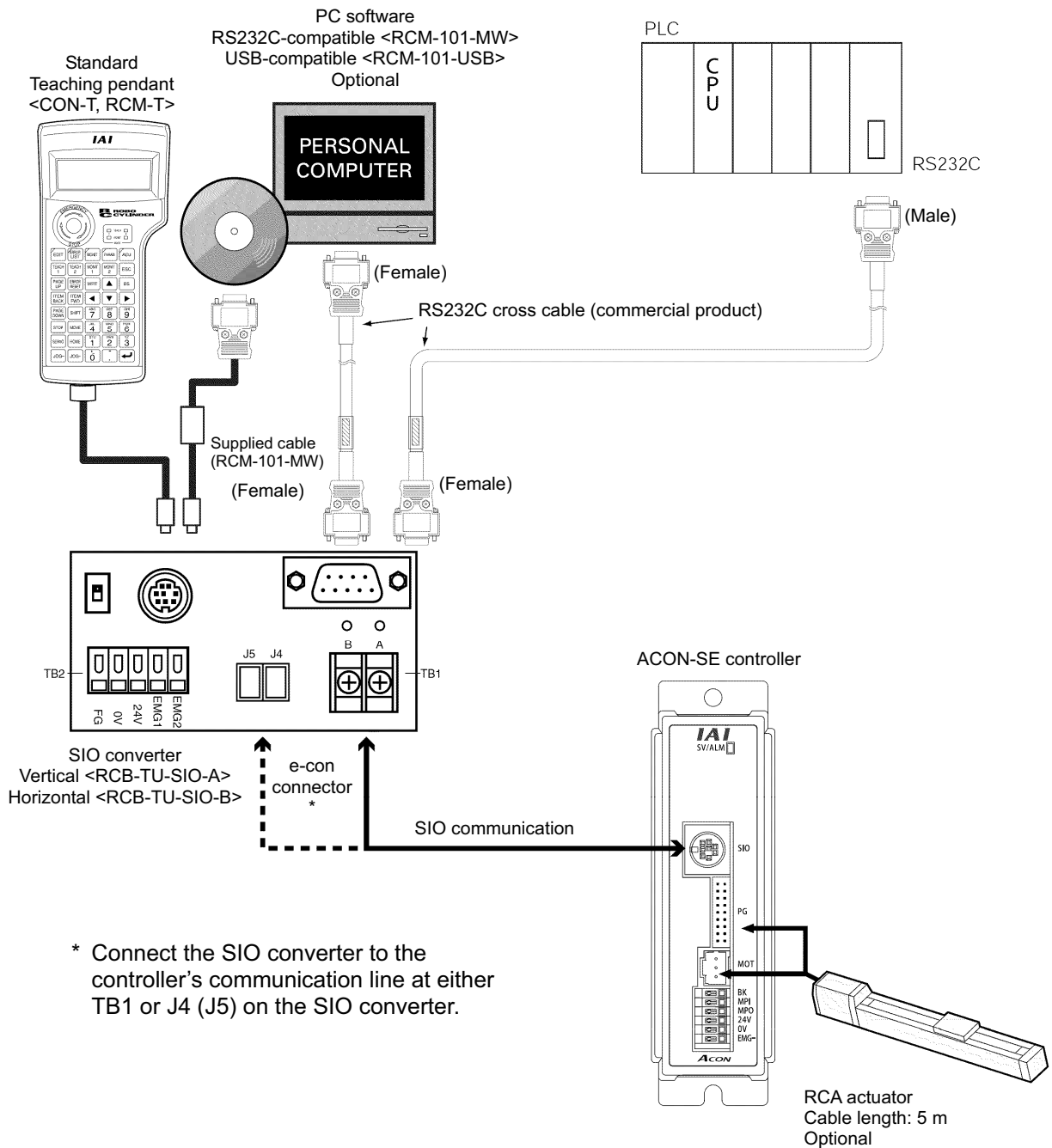
(1) When the gateway unit is used (supporting field network)



**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 ACON-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.



**⚠ 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.

## 1.5 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  
ACON-SE
- Actuator
- Communication cable
- Motor cable  
CB-ACS-MA\*\*\*
- Encoder cable  
CB-ACS-PA\*\*\*
- Operation Manual  
<Option>
- Teaching pendant  
RCM-T (standard)  
RCM-E (simple)  
RCM-P (data setting)  
CON-T (standard)
- PC software  
RS232C-compatible  
<RCM-101-MW>  
USB-compatible  
<RCM-101-USB>  
(including provided cables)
- Simple absolute unit
- Touch panel display  
<RCM-PM-01>

### 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 24V 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 24V power.

It is normal if at this time, the monitor LED [SV/ALM] on the front of the controller illuminates in orange for the first 2 seconds and then goes out.

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 “6. 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 default value of the safety speed is 100 mm/s or less.

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

## 1.6 Warranty

### 1.6.1 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

### 1.6.2 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.

### 1.6.3 Honoring Warranty

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

### 1.6.4 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.

## 1.6.5 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.

## 1.6.6 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

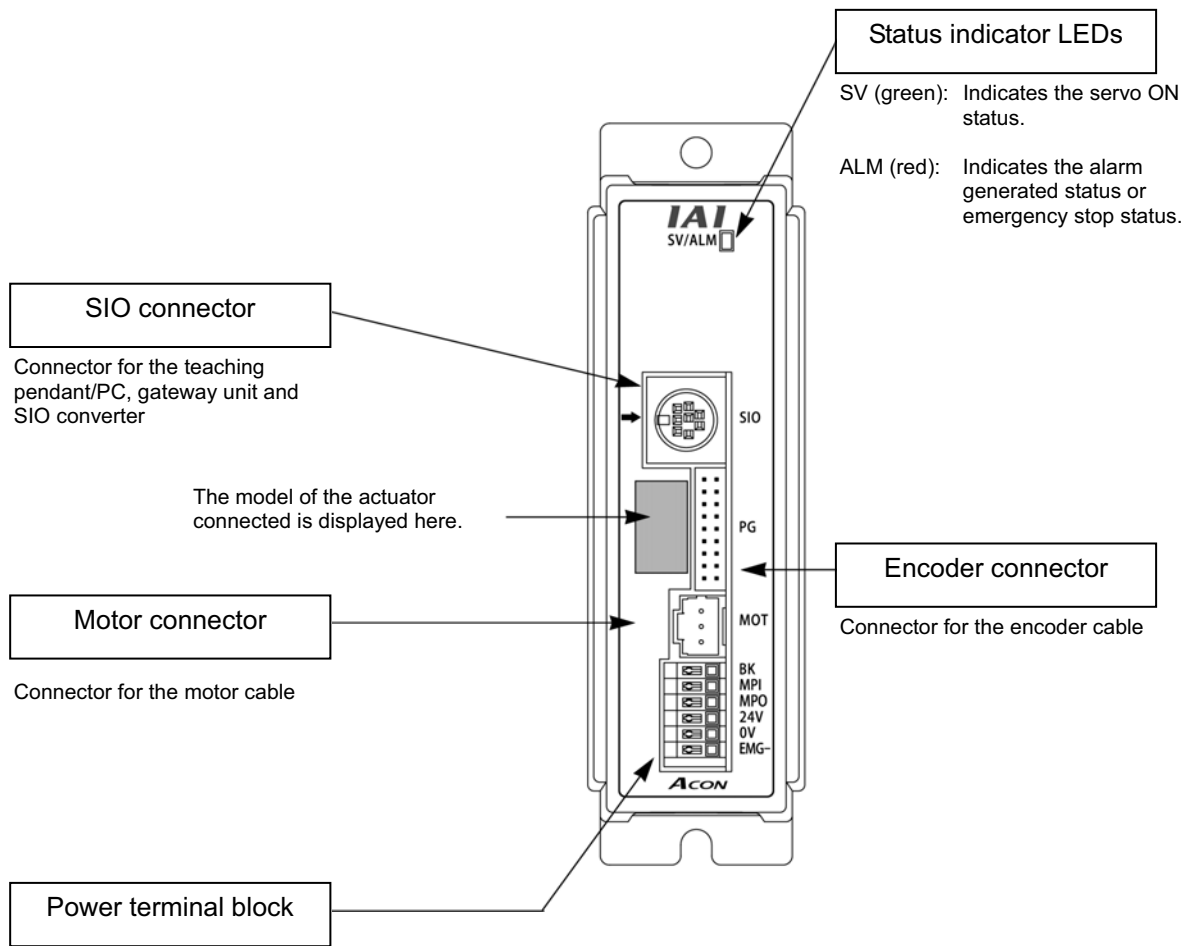
Specification item		Description				
Model		ACON-SE				
Number of controlled axes		1 axis per unit				
Power-supply voltage		24 VDC $\pm$ 10%				
Motor power supply capacity (Note 1)	Actuator	Motor type	Standard specification/Support high acceleration/deceleration		Support power-saving	
			Rated [A]	Maximum (Note 2)	Rated [A]	Maximum (Note 2)
	RCA/ RCA2	10 W	1.3	4.4	1.3	2.5
		20 W [Model code: 20]	1.3	4.4	1.3	2.5
		30 W	1.3	4.4	1.3	2.2
	RCL	20 W [Model code: 20S] For RA3, RA4 and TA5 types only	1.7	5.1	1.7	3.4
		2 W	0.8	4.6		
5 W		1.0	6.4			
10 W	1.3	6.4				
Heat output		8.4 W				
Encoder resolution	RCA		800 Pulse/rev			
	RCA2	RCA2-□□□ N	1048 Pulse/rev			
		Other than RCA2-□□□ N	800 Pulse/rev			
	RCL	RA1L/ SA1L/ SA4L/ SM4L	715 Pulse/rev			
		RA2L/ SA2L/ SA5L/ SM5L	855 Pulse/rev			
RA3L/ SA3L/ SA6L/ SM6L		1145 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.				
Position number		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 m $\Omega$				
Environment	Surrounding air temperature		0 to 40°C			
	Surrounding humidity		85%RH or less (non-condensing)			
	Surrounding environment		Not subject to corrosive gases			
	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: 0.035mm (continuous), 0.075mm (intermittent)			
Protection class		Air cooling without blower (IP20)				
Weight		128 g or less				
External dimensions		35 W x 120 H x 68 D mm				

(Note 1) Rush current of 5 to 12 times the rated current is conducted for approximately 1 to 2 msec after turning the power on. Note that the rush current value varies depending on the impedance of the power line.

(Note 2) The maximum current is conducted at the servo motor exciting phase detection performed in the first servo on processing after turning the power on (normally: approximately 1 to 2 seconds, maximum: 10 seconds)

\* For the DC power supply of +24 V, select the "peak load" specification or a power supply having sufficient allowance. In particular, pay attention when the robot has a remote sensing function.

## 2.2 Name and Function of Each Part of the Controller

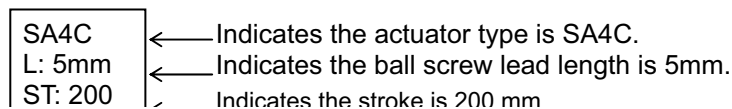


BK	Terminal for connecting the brake release switch to forcibly release the brake when the actuator is used with a brake option. Connect the opposite side of the switch to 24V.
MPI, MPO	A contact for cutting off motor drive power supply with safety category 1 or equivalent considered. MPI and MPO represent 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.)
24V	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

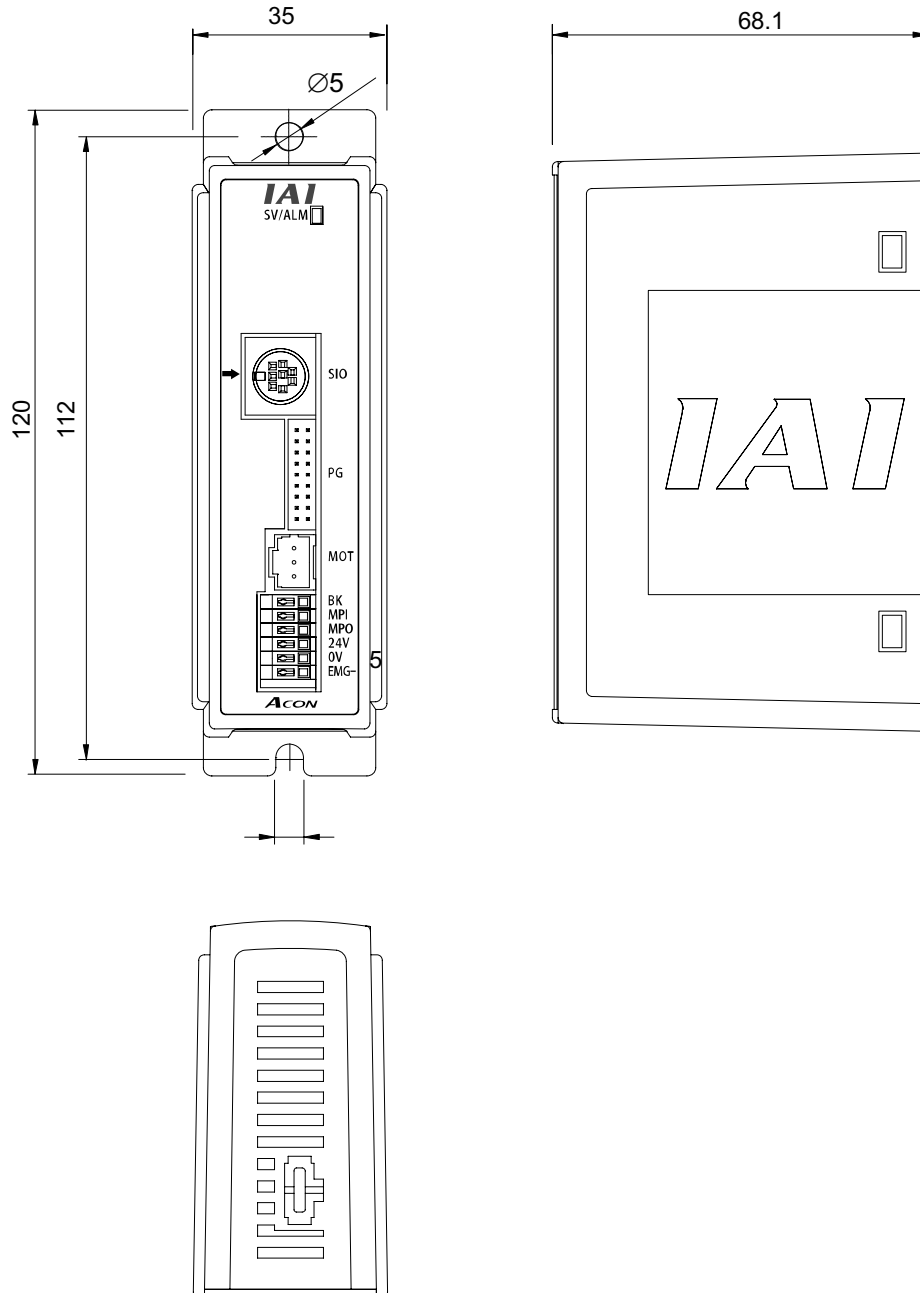
The type name, ball screw lead length, and stroke of the actuator are indicated. Before connecting cables, confirm that the actuator is an appropriate one.

Notation example:



## 2.3 External Dimensions

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



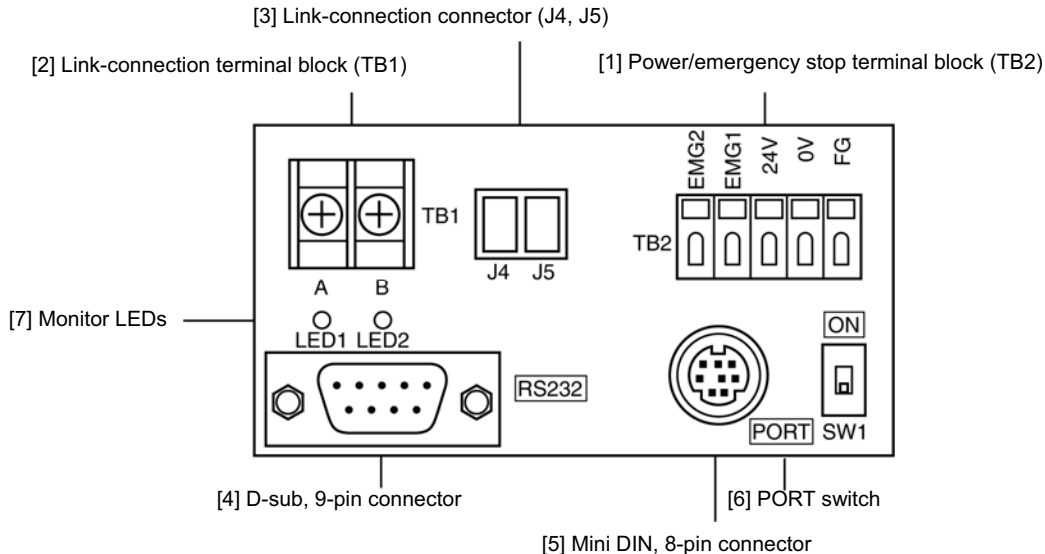
## 2.4 SIO Converter (Option)

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.
24V	Positive side of the 24V power supply (power supply for the teaching pendant and conversion circuit, power consumption: 0.1A or less)
0V	Negative side of the 24V power supply
FG	FG of the 24V 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.

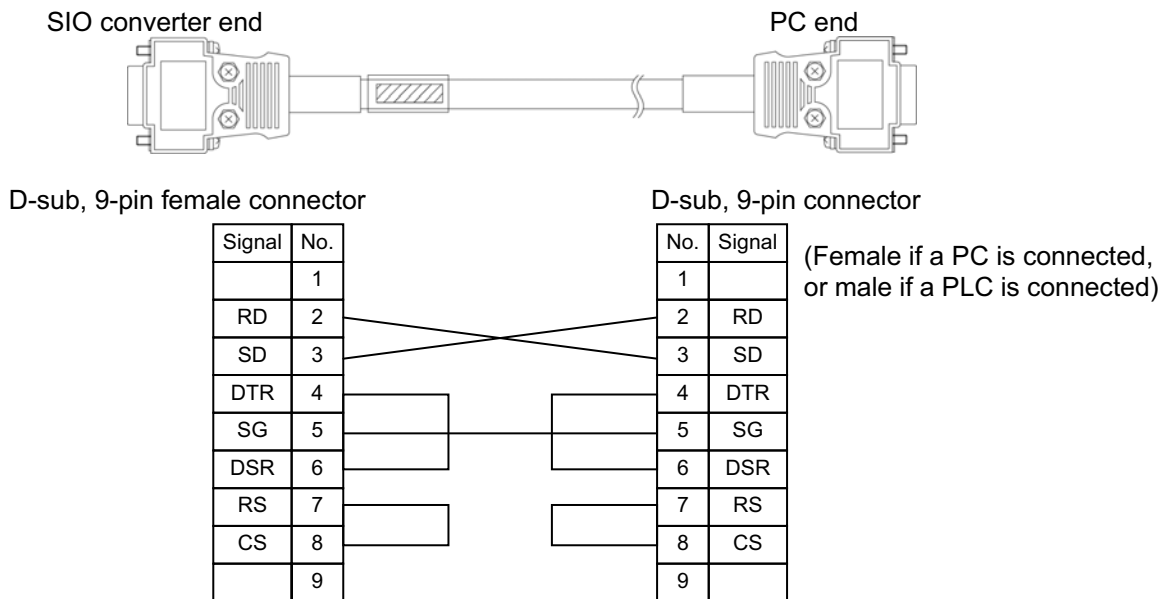
(Note) Be sure to use twisted pair wires for the above two connections (SGA/SGB).

### [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 or blinks while the controller is sending data.  
LED2 --- This LED illuminates or blinks while the RS232 is sending data.

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



(Reference) Comparison of New and Old Types

	New type	Old type
Model	RCC-TU-SIO-□	RCB-TU-SIO-□
Link port	<ul style="list-style-type: none"> <li>• Terminal block TB1</li> <li>• e-CON connectors J4, J5</li> </ul>	<ul style="list-style-type: none"> <li>• Terminal block TB1 (J4 and J5 are not available.)</li> </ul>
Connection to mini-DIN connector	<ul style="list-style-type: none"> <li>• Teaching pendant</li> <li>• PC (Supplied cables are used.)</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching pendant</li> </ul>
Connection to D-sub connector	<ul style="list-style-type: none"> <li>• PLC communication module (RS232C cross cable is used.)</li> <li>• PC (RS232C cross cable is used.)</li> </ul>	Same as on the left

## 3. Installation and Wiring

Pay due attention to the installation environment of the controller.

### 3.1 Installation Environment

- (1) When installing and wiring the controller, do not block the cooling ventilation holes. (Insufficient ventilation will not only prevent the controller from demonstrating its full performance, but it may also cause breakdown.)
- (2) Prevent foreign matter from entering the controller through the ventilation holes. Since the enclosure of the controller is not dustproof or waterproof (oilproof), avoid using the controller in a place subject to significant dust, oil mist or splashes of cutting fluid.
- (3) Do not expose the controller to direct sunlight or radiating heat from a large heat source such as a heat treatment furnace.
- (4) Use the controller in an environment free from corrosive or inflammable gases, under a temperature of 0 to 40°C and humidity of 85% or less (non-condensing).
- (5) Use the controller in an environment where it will not receive any external vibration or shock.
- (6) Prevent electrical noise from entering the controller or its cables.
- (7) The product can be used in an environment with Pollution Degree 2.

### 3.2 Supplied Voltage

The power supply specification is 24 VDC±10%.

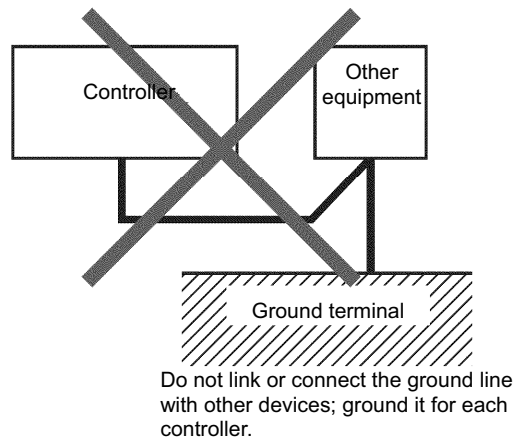
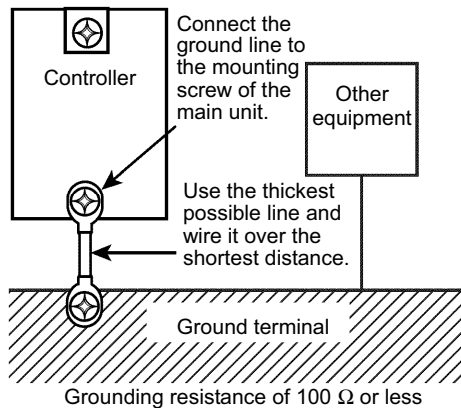
For the power-supply capacity, refer to the section, “Basic Specifications.”

### 3.3 Noise Elimination Measures and Grounding

The following explains the noise elimination measures that should be taken when using this controller.

#### (1) Wiring and power supply connection

- [1] Grounding must be made by ground resistance of 100 Ω or less using a dedicated grounding. Moreover, the thickness of cable shall be 1.6 mm or thicker.



[2] Precautions regarding wiring method

Use a twisted cable to connection the 24 VDC external power supply.

Separate wiring of signal lines and encoders from power supply lines and power lines.

(Do not tie them together or place in the same cable duct.)

If you want to extend the motor or encoder cable bey ond the length of the supplied cable, contact IAI.

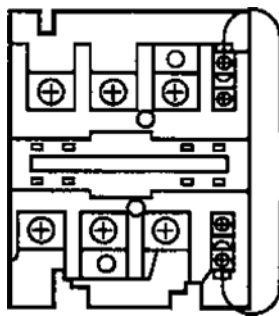
(2) Noise sources and elimination

Noise generates from many sources, but the most comm on sources of noise you should consider when designing a system are solenoid valves, magnet switches and relays.

Noise from these sources can be eliminated by implementing the measures specified below.

[1] AC solenoid valves, magnet switches and relays

Measure: Install a surge absorber in parallel with the coil.



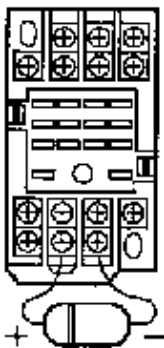
← Surge absorber

Connect to each coil over the shortest possible wiring distance.

When a surge absorber is installed on the terminal block, etc., its noise elimination effect will decrease if the distance from the coil is long.

[2] DC solenoid valves, magnet switches and relays

Measure: Install a diode in parallel wi th the coil or use a built-in diode type.



If DC power is used, exercise due caution because the diode, internal controller parts and/or DC power supply may be damaged if the diode is installed in the wrong polarities.

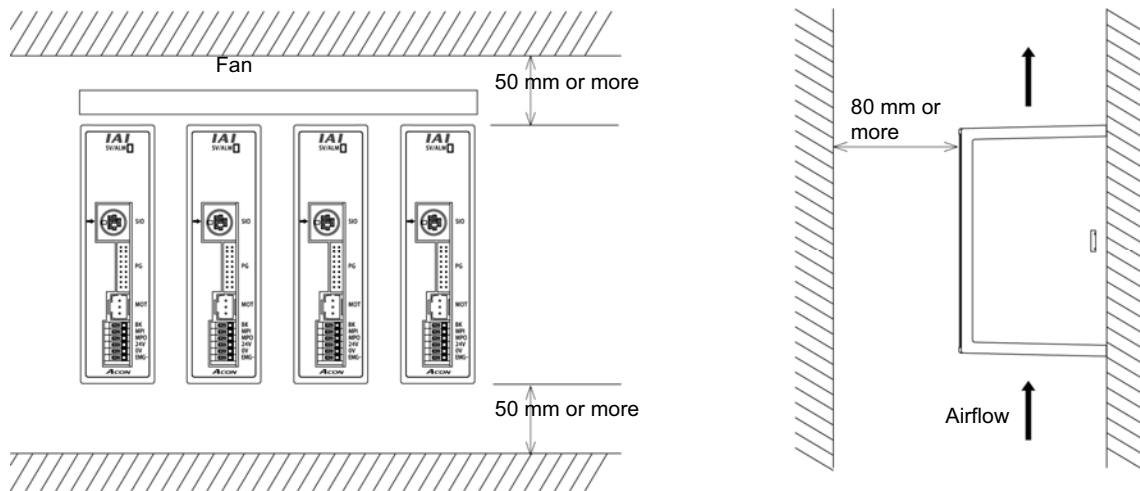
## 3.4 Heat Radiation and Installation

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.

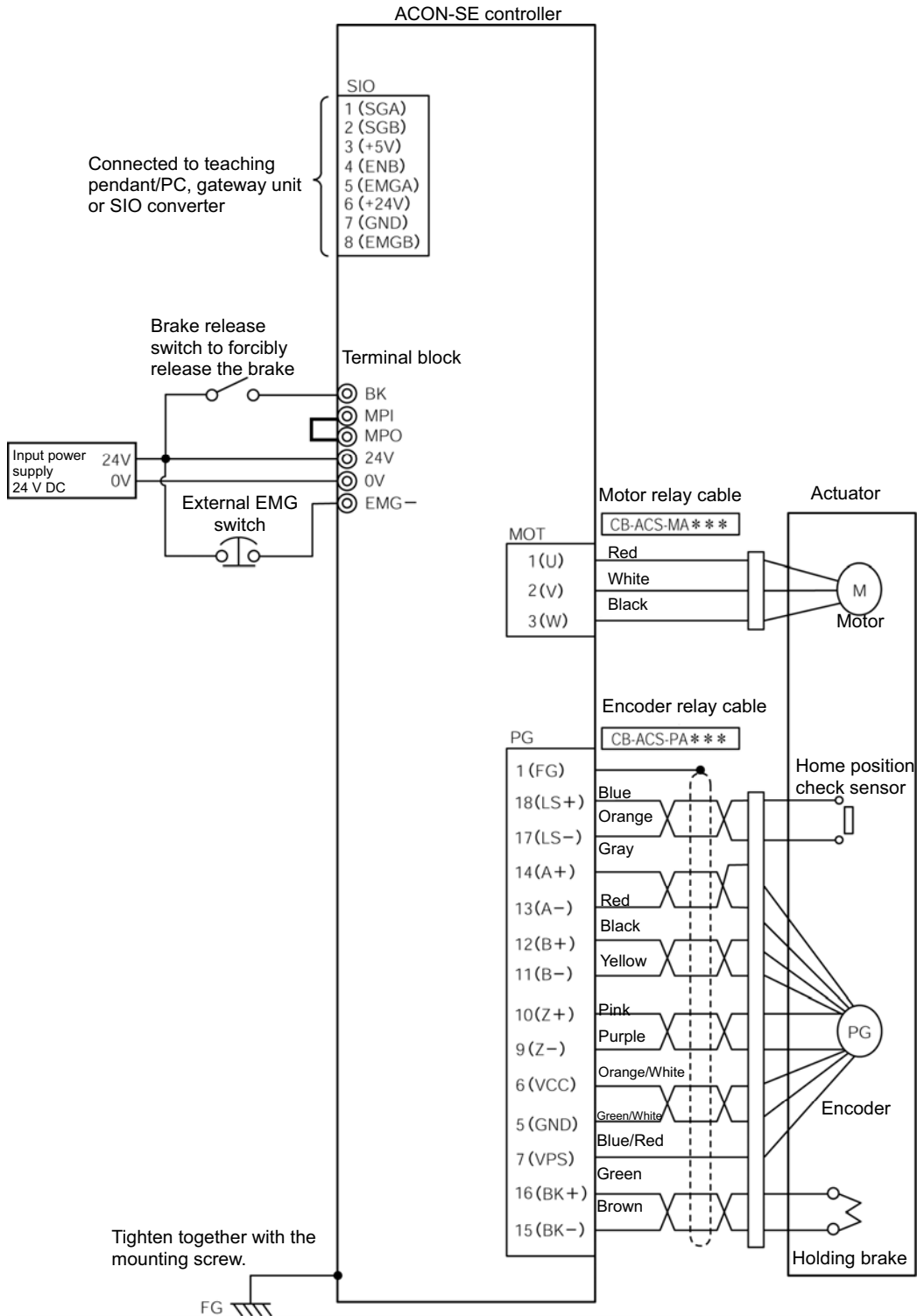


Regardless of whether your system consists of a single controller or multiple controllers, provide sufficient clearance around each controller so that it can be installed/removed easily.

## 3.5 External Connection Diagram

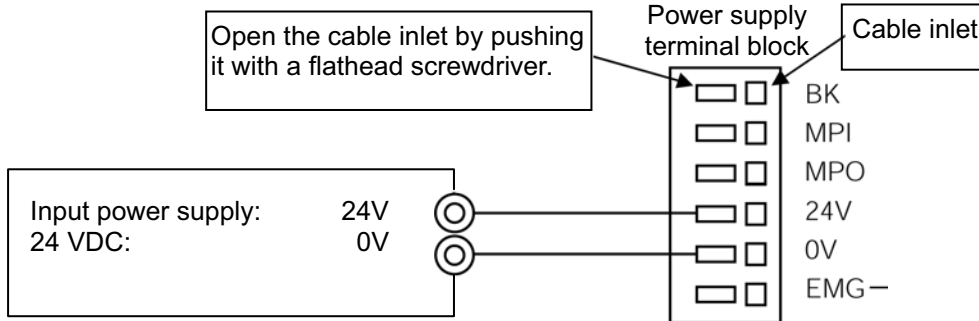
An example of standard wiring is shown below.

(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 +24V side of the 24 VDC power supply to the 24V 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	<p>Twisted wire: AWG size 22 (<math>0.3 \text{ mm}^2</math>) (copper wire)</p> <p>(Note) Pay attention to terminal treatment to avoid a short circuit resulting from chips.</p> <p>If the wire path is long, install a relay terminal block and change the wire size.</p>
Insulating sheath temperature rating	60°C or more
Stripped wire length	<p>9mm</p>

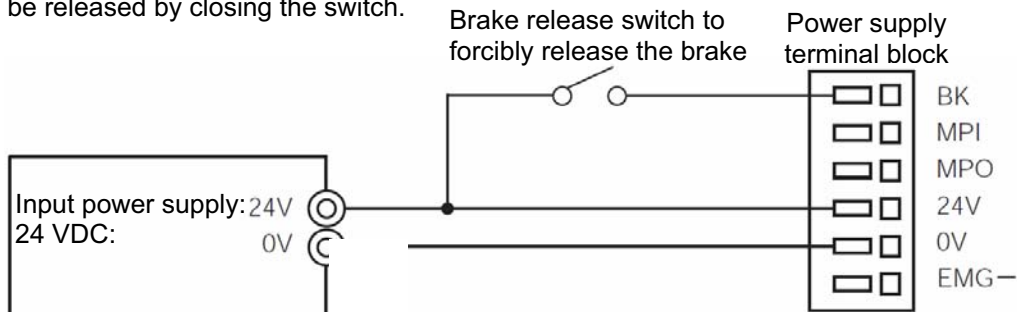
## 3.7 Wiring the Brake Release Switch to Forcibly Release the Brake

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.



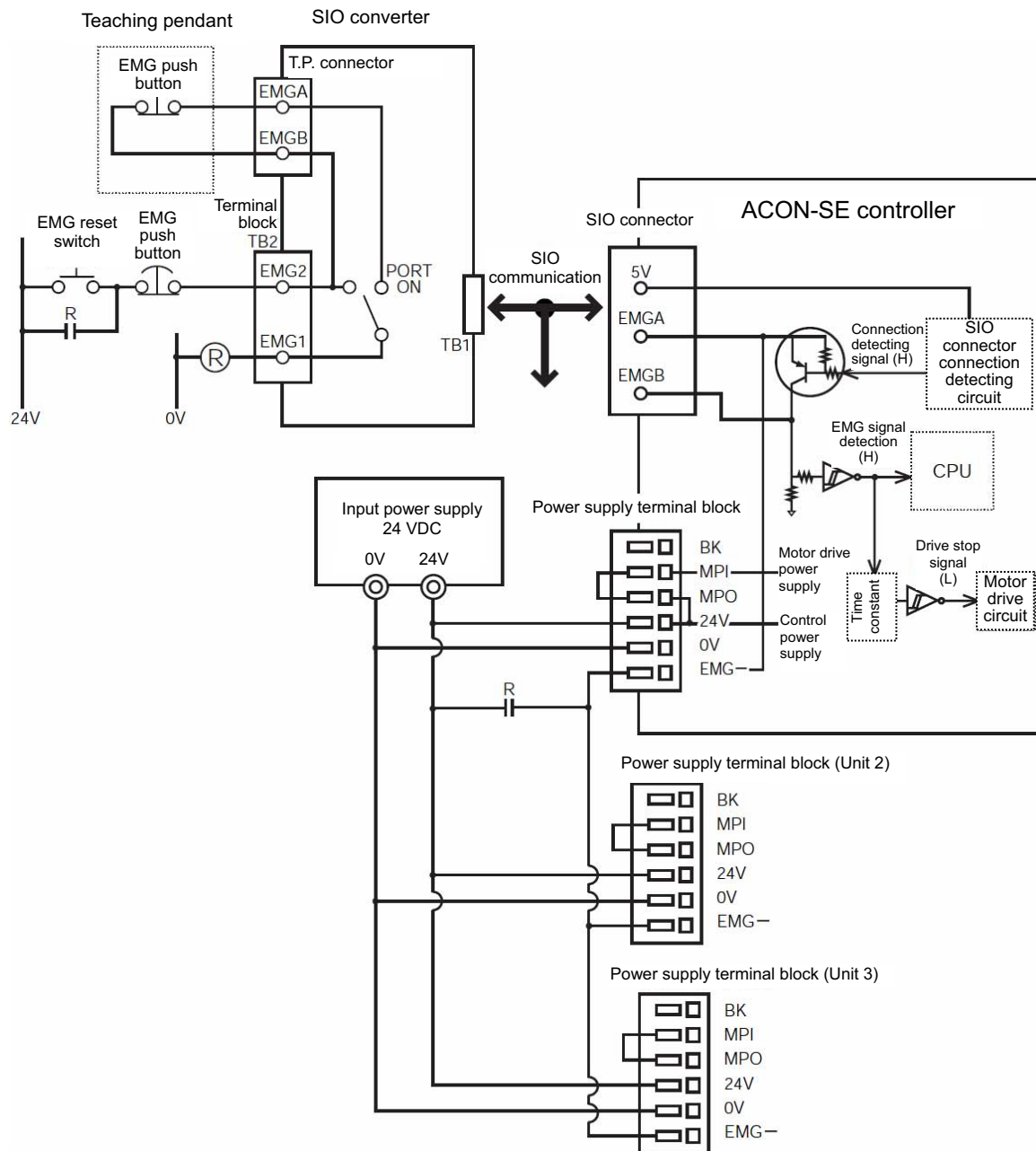
**⚠ Danger:** In the case of a vertical axis, release the brake while exercising caution to avoid hands from being caught and the robot hand or work from being damaged due to a sudden drop.

## 3.8 Wiring the Emergency Stop Circuit

### 3.8.1 Drive Signal Shutdown (Standard)

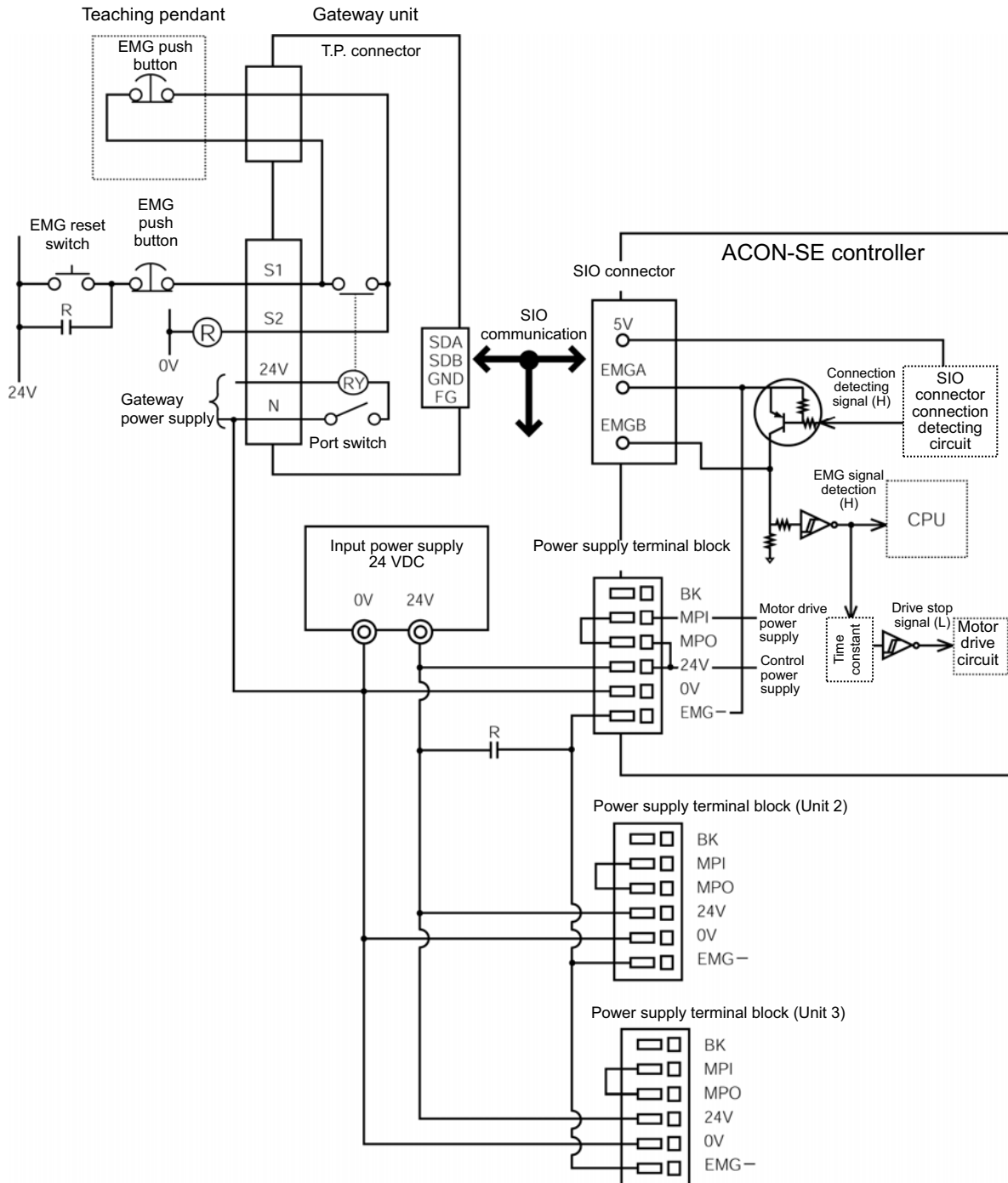
The motor drive is stopped by the controller internal circuit.  
The motor drive power supply is not shut off.

(1) When the SIO converter is used



**Caution:** The input current to the EMG terminal of ACON-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 ACON-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 ACON-SE power supply in common.

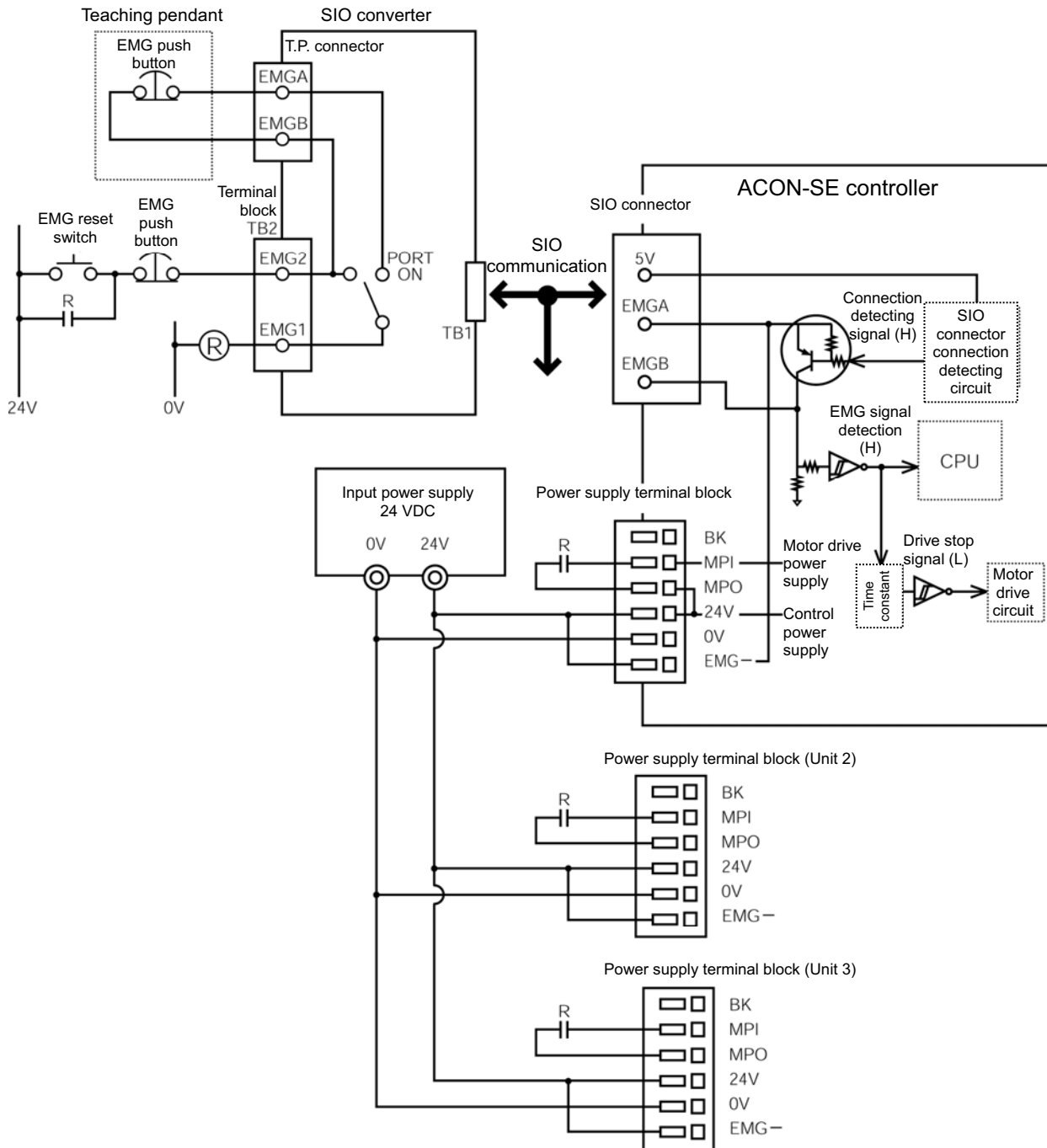
## 3.8.2 Cutting off the Motor Drive Power Supply

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.

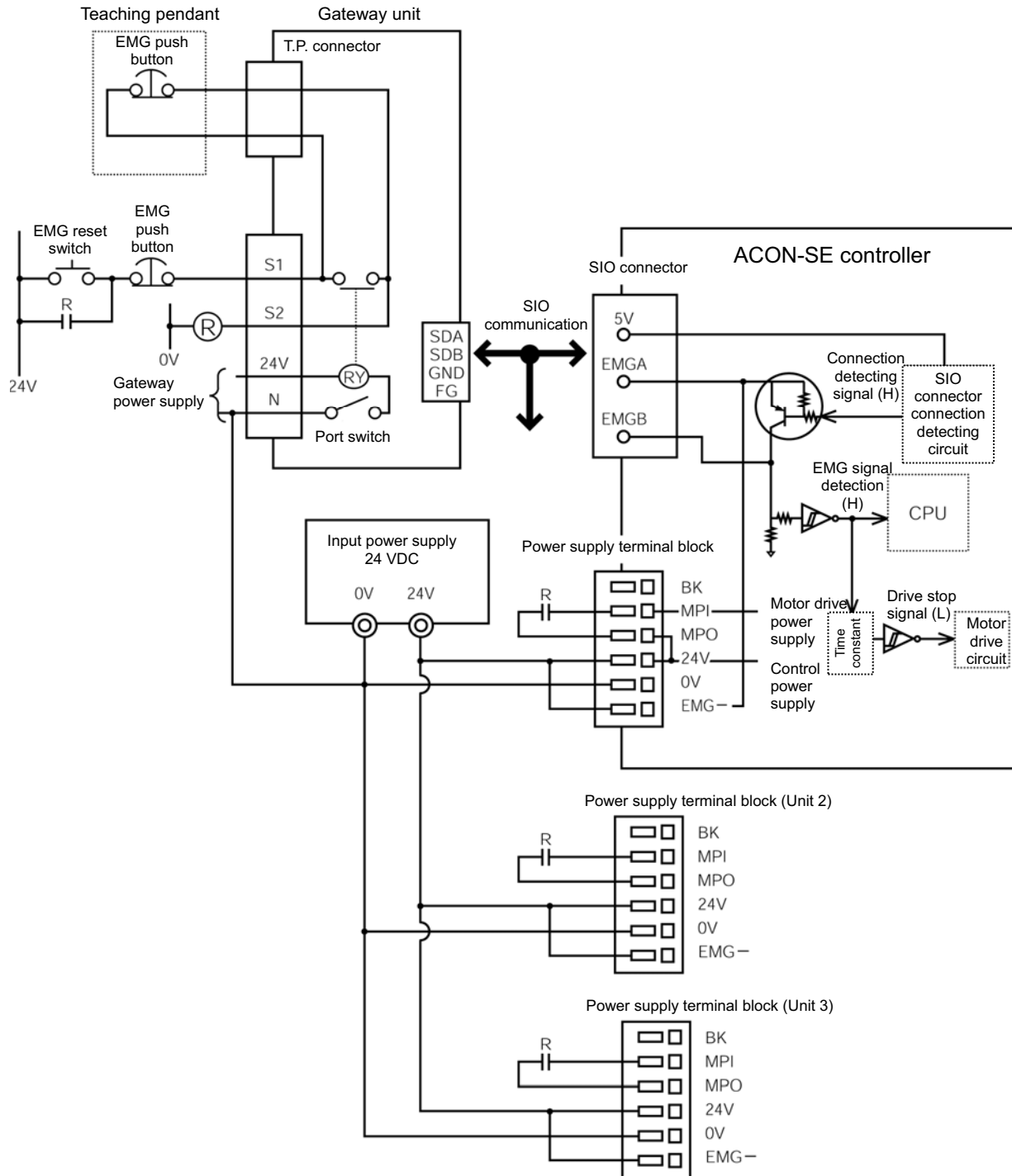
In addition, connect 24V of the controller power supply to the EMG terminal.

(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 ACON-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 ACON-SE power supply in common.

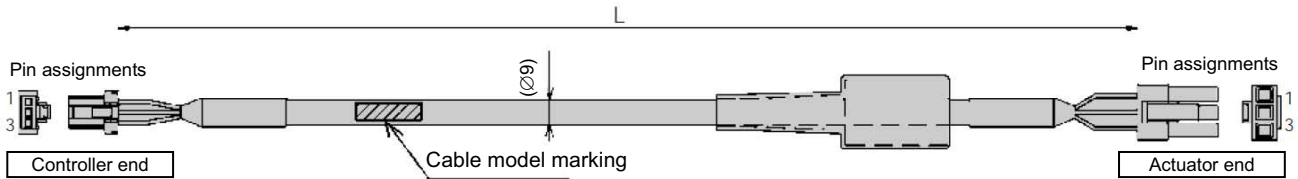
## 3.9 Connecting the Actuator

Dedicated relay cables are used to wire between the controller and actuator.

### (1) RCA motor cable

Model: CB-ACS-MA□□□CB

(□□□ indicates the cable length L. Example: 080 = 8 m)



Pin No.	Signal name	Cable color
1	U	Red
2	V	White
3	W	Black

Pin No.	Wire size
1	AWG22
2	
3	

Housing: DF1E-3S-2.5C (Hirose)  
Contact: DF1E-2022SC (Hirose)  
(or DF1B-2022SC)

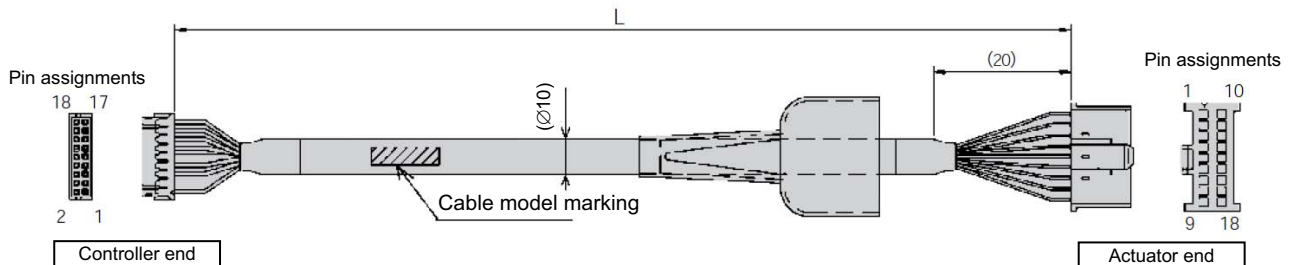
Housing: SLP-03V (J.S.T. Mfg.)  
Contact: BSF-21T-P1.4 (J.S.T. Mfg.)

### (2) RCA encoder cable/encoder robot cable

Standard cable model: CB-ACS-PA□□

Robot cable model: CB-ACS-PA-□□-RB (optional)

(□□□ indicates the cable length L. Example: 080 = 8 m)



Pin No.	Signal name	Description	Cable color	
			Standard cable	Robot cable
18	LS+	Home check sensor	Blue	White/Purple
17	LS-		Orange	White/Grey
16	BK+	Brake power	Green	Yellow
15	BK-		Brown	Blue
14	ENA	Encoder phase A signal	Grey	White/Blue
13	EN $\bar{A}$		Red	White/Yellow
12	ENB	Encoder phase B signal	Black	White/red
11	EN $\bar{B}$		Yellow	White/Black
10	ENZ	Encoder phase Z signal	Pink	Orange
9	EN $\bar{Z}$		Purple	Green
8	—	—	White	Purple
7	VPS	Encoder control	Blue/Red	Grey
6	5V	Encoder power signal	Orange/White	Red
5	GND		Green/White	Black
4	—	—	—	—
3	—	—	—	—
2	—	—	—	—
1	FG	Shield	Drain	Drain

Pin No.	Signal name
1	ENA
2	EN $\bar{A}$
3	ENB
4	EN $\bar{B}$
5	—
6	—
7	LS+
8	—
9	FG
10	ENZ
11	EN $\bar{Z}$
12	—
13	VPS
14	5V
15	GND
16	LS-
17	BK-
18	BK+

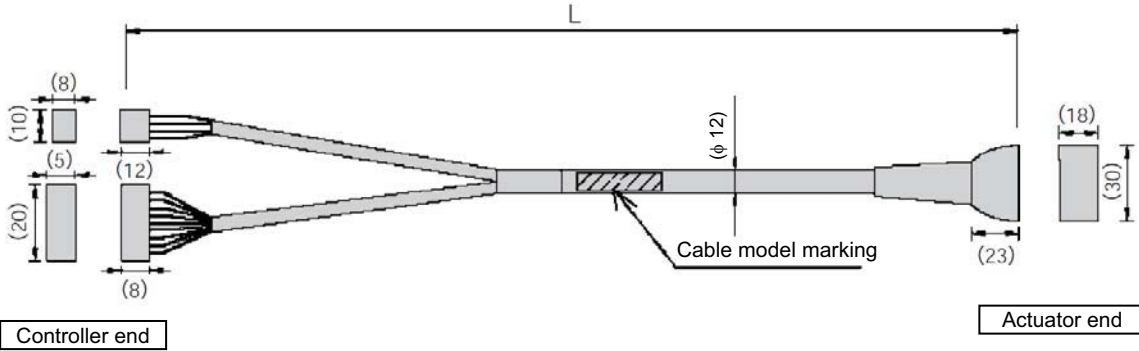
Housing: PHDR-18VR (J.S.T. Mfg.)  
Contact: SPHD-001T-P0.5 (J.S.T. Mfg.)

Housing: XMP-18V (J.S.T. Mfg.)  
Contact: BXA-001T-P0.6 (J.S.T. Mfg.)  
Retainer: XMS-09V (J.S.T. Mfg.)

(3) RCA2 monitor/encoder integrated cable

Model: CB-ACS-MPA□□□

(□□□ indicates the cable length L. Example: 080 = 8 m)



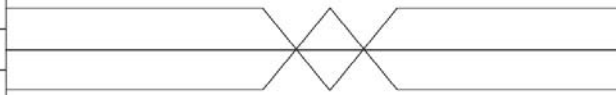
Controller end

Actuator end

Housing: DF1E-3S-2.5C

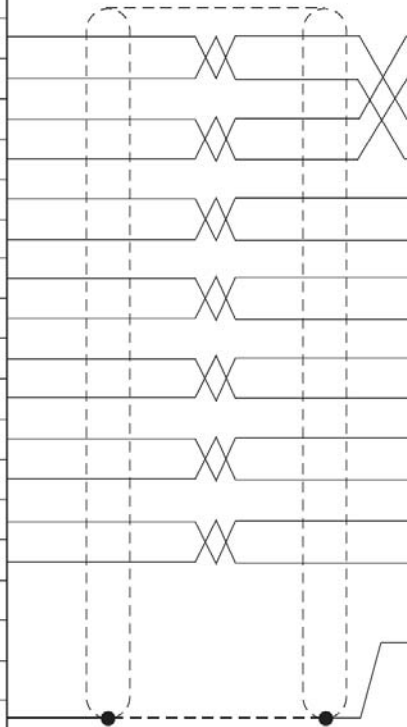
Contact: DF1E-2022SCF

Pin No.	Signal name	Cable name
1	U	Red
2	V	Yellow
3	W	Black



Pin No.
A1
B1
A2
B2
A3
B3
A4
B4
A5
B5
A6
B6
A7
B7
A8
B8
A9
B9
A10
B10
A11
B11

Pin No.	Signal name	Description	Cable name
18	LS+	Home check sensor	Pink (Red ●)
17	LS-		Pink (Blue ●)
16	BK+	Brake power	Yellow (Red ●)
15	BK-		Yellow (Blue ●)
14	A+	Encoder phase A signal	White (Red ●)
13	A-		White (Blue ●)
12	B+	Encoder phase B signal	Orange (Red ●)
11	B-		Orange (Blue ●)
10	Z+	Encoder phase Z signal	Grey (Red ●)
9	Z-		Grey (Blue ●)
8	-	-	Orange (Red ● continuous)
7	/PS	Encoder control	Orange (Blue ● continuous)
6	VCC	Encoder power signal	Grey (Red ● continuous)
5	GND		Grey (Blue ● continuous)
4	-	-	-
3	-	-	-
2	-	-	-
1	FG	Shield	Shield



Housing: PHDR-18VR (J.S.T. Mfg.)  
Contact: SPHD-001T-P0.5 (J.S.T. Mfg.)

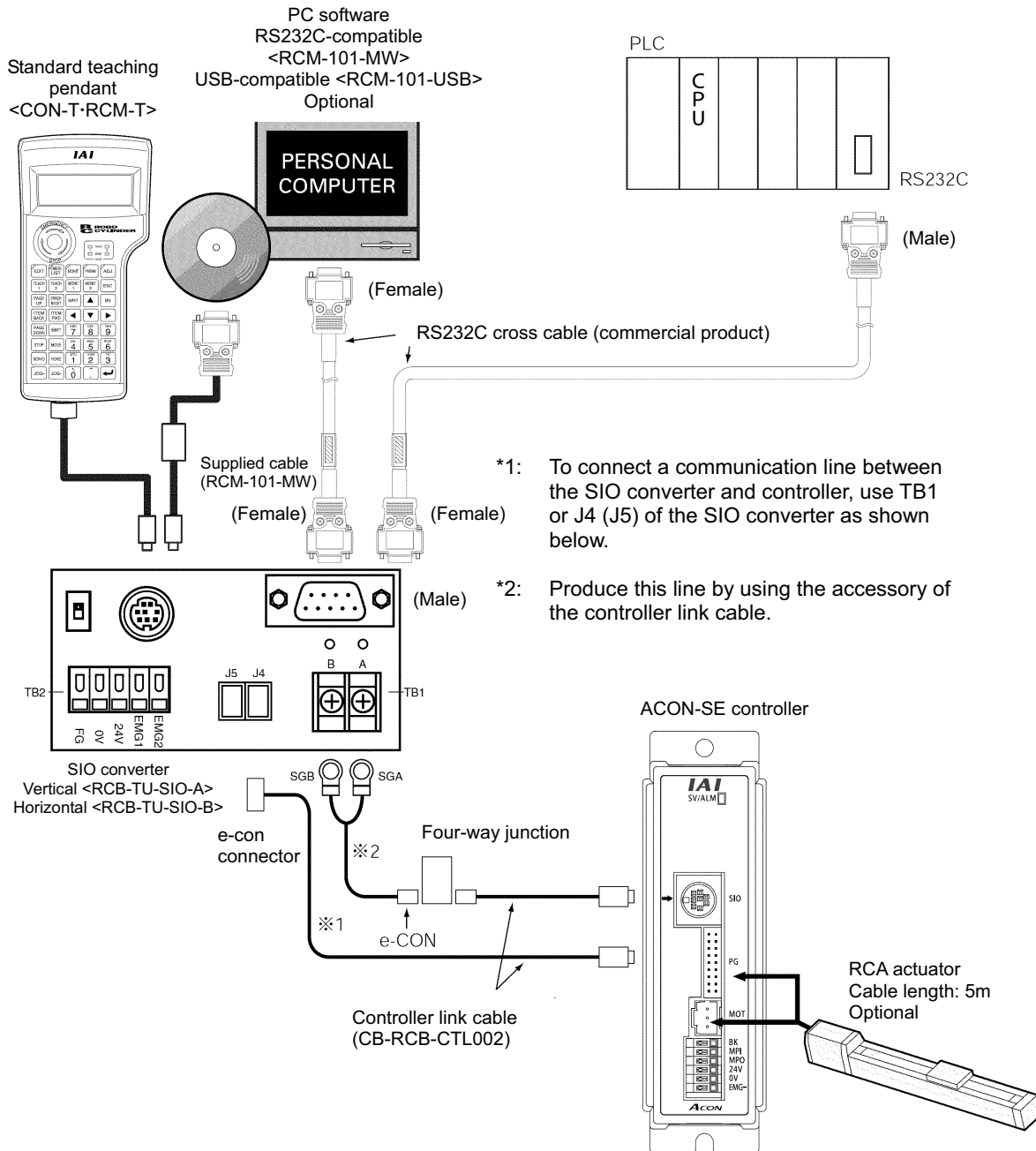
Housing: D-1100D1-1827863-1 (AMP)  
Contact: D-1 1827570-2

## 3.10 Connecting the SIO Communication

### 3.10.1 Connecting the RS232C Serial Communication

#### (1) Basic information

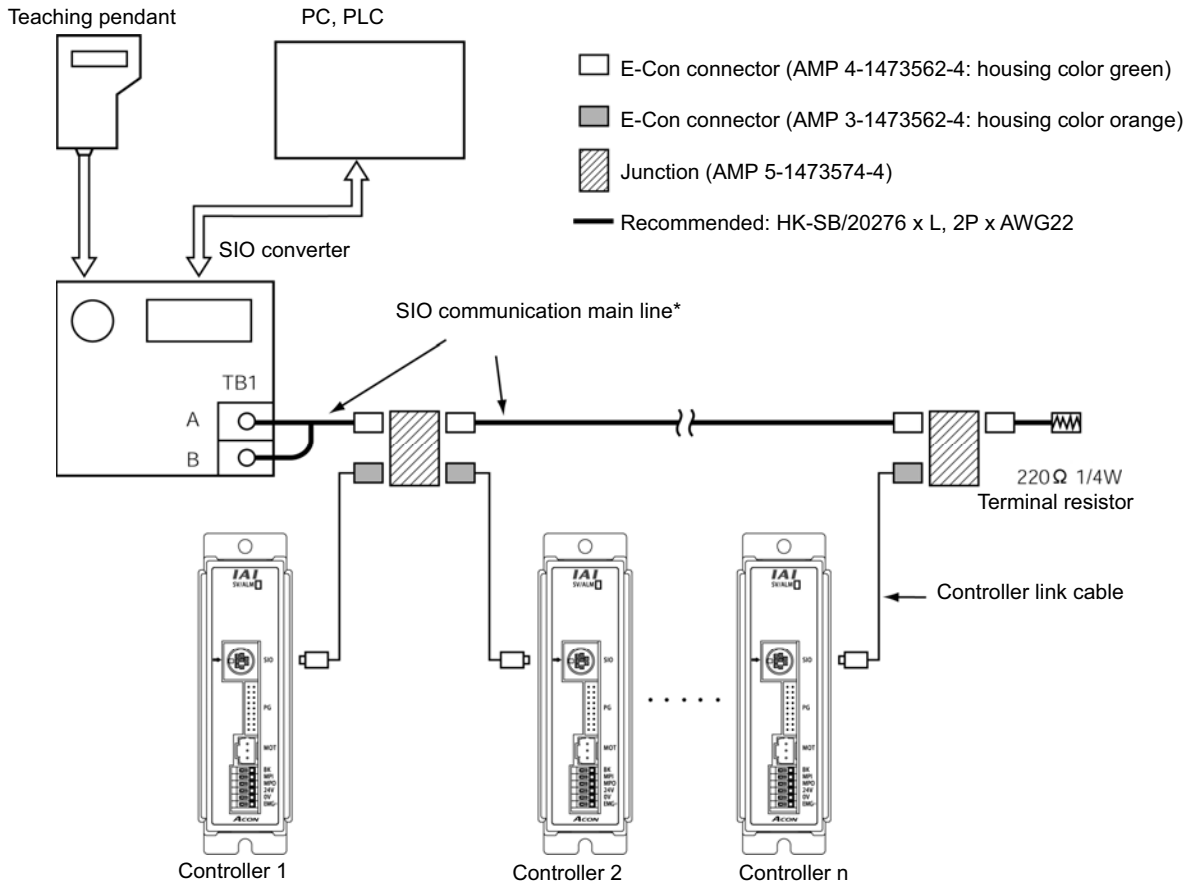
Connect the teaching pendant, PC or PLC, and controller using the SIO converter (RS232C/RS485 conversion) as shown below.



**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 $\Omega$ , 1/4 W



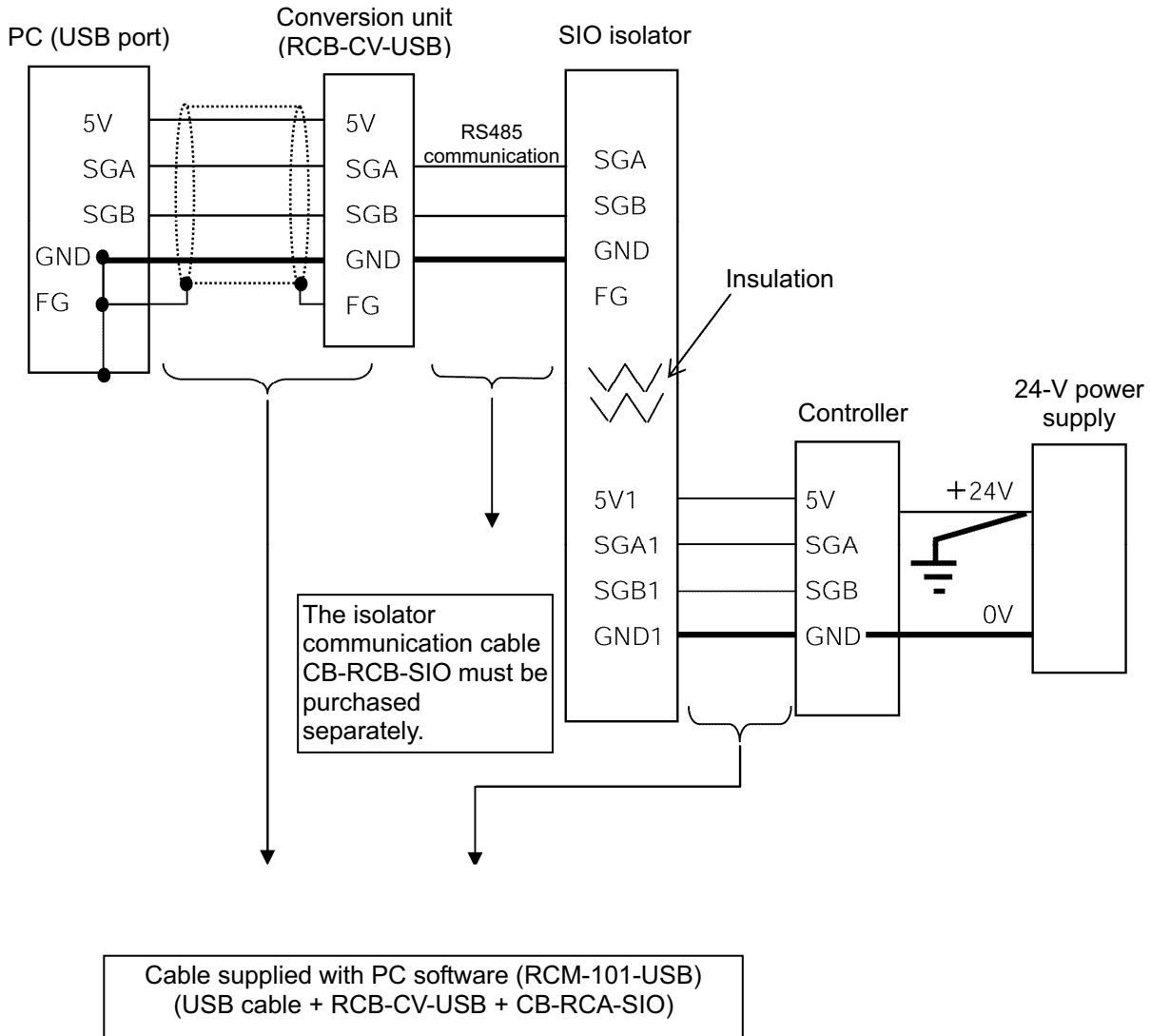
- \* The SIO communication main line must be prepared by the customer.  
Each one unit of the junction, E-Con connector and terminal resistor are supplied with the controller link cable.

<p><b>⚠ Caution:</b></p>	[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.
	[2]	For the power supplies of the SIO converter and all controllers, make 0V in common.
	[3]	Connect a shielded cable to FG on an axis basis.
	[4]	If the total link cable length is more than 30 m, use the wire size of 22AWG or larger.
	[5]	If the positive side of the 24-V power supply is grounded, do not connect the SIO converter and the FG terminal of the PC to ground. If the positive side of the 24-V power supply is grounded and no SIO converter is used, be sure to use a SIO isolator (RCB-ISL-SIO). (Refer to the next page.)

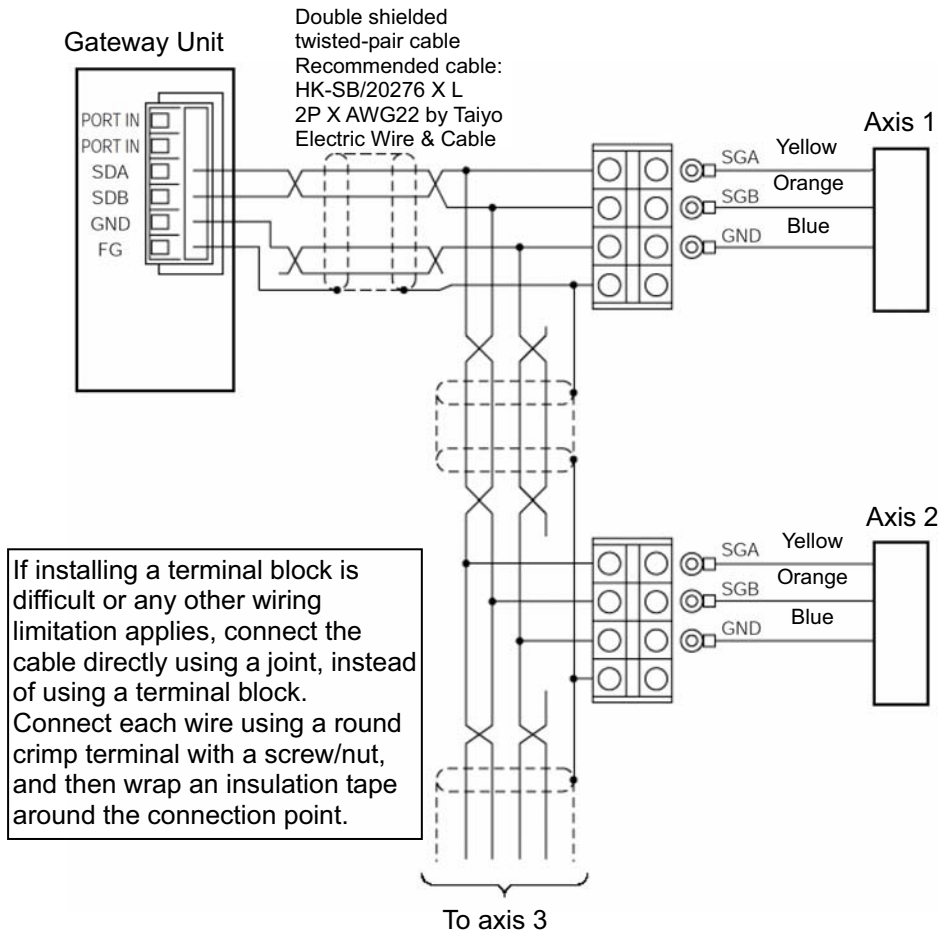
Connecting the PC to the ACON without using SIO converter (Grounding the positive side)

Be sure to connect the PC using a SIO isolator (RCB-ISL-SIO).

Take note, however, that only the RCM-101-USB PC software supports this configuration and RCM-101-MW cannot be used.



■ Detail Connection Diagram  
[Connection by Terminal Block or Joint]

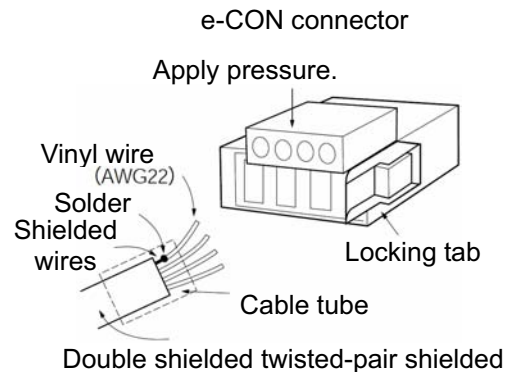


\* The user must provide relay terminals. Also, connect a terminal resistor ( $220 \Omega$ ,  $1/4 W$ ) between the SGA and SGB terminals.  
Do not ground the end of the main communication line, but terminate it using a terminal block or leave the end open without any termination.

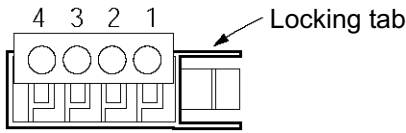
■ Preparation of Communication Main Line

[Wiring by Connector]

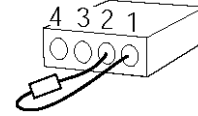
- [1] Strip the sheath of a double shielded twisted-pair cable by approx. 15 to 20 mm.
- [2] Twist the shield wires and solder them onto vinyl wires of AWG22 (outer diameter 1.35 to 1.6 mm) or equivalent.
- [3] Place a cable protection tube over the cable.
- [4] Insert the four wires into the cable insertion holes in the connector (SDA, SDB, GND, FG) without stripping the core sheath.
- [5] With the cable inserted in the press-fit cable housing, apply pressure from above to pressure-weld the core wires.
- [6] Heat-treat the cable protection tube.



e-CON connector pin numbers



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



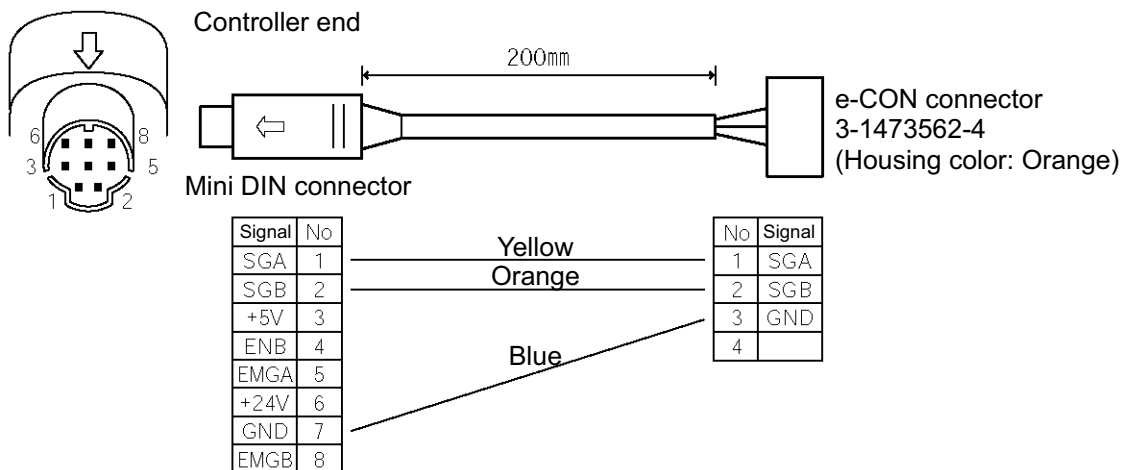
## Caution

- [1] When wiring to the e-CON connector, stripping the wires may cause the stripped wires to short inside the connector.
- [2] Wires that can be connected to the e-CON connector are those with the AWG22 outer sheath diameter of 1.35 to 1.60. When pressure-welding a wire, use pliers, etc., to keep the pressure-welding part horizontally during the pressure-welding process in order to make sure a force is applied evenly. If the wire size is wrong or the pressure-welding part is slanted during pressure-welding, communication errors may occur due to poor contact.

### [Connection by Terminal Block or Joint]

- [1] Cut the e-CON connector on the controller link cable provided as an option and then connect the cut end to a terminal block using crimp terminals appropriate for the terminal block. To join the controller link cable directly without using a terminal block, join each wire using a round crimp terminal with a screw/nut, and then wrap an insulation tape around the connection point.
- [2] Also connect the terminal resistor to the terminal block. Protect the conductor part of the resistor using an insulation tube, etc. Even when a joint is used for connection, also protect the conductor part using an insulation tube, etc., in the same manner. When taping, be careful not to wrap the resistor itself with the tape.

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

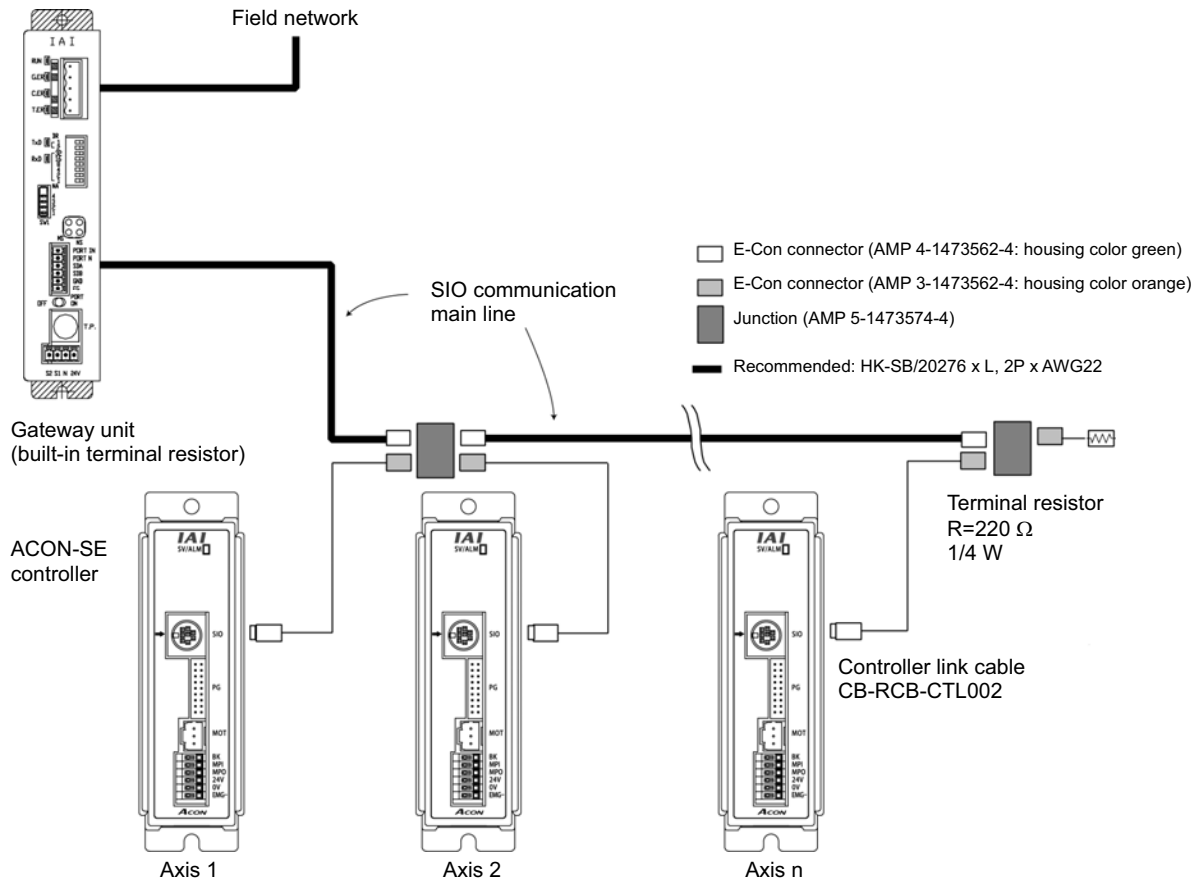


The following parts are supplied with the controller link cable.

- |                       |                                   |                      |          |
|-----------------------|-----------------------------------|----------------------|----------|
| [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 |

### 3.10.2 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).



### 3.10.3 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 CON-T, 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.

## 4. Description of Operating Functions

The ACON-SE is a dedicated serial communication controller supporting 64 positions (positioning points). This controller does not support PIO patterns.

With ACON-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 ACON-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 ACON-SE Functions

	Operation by position number specification				Operation by numeric specification								
	Serial communication	Gateway position number specification mode	DeviceNet gateway		CC-Link gateway		Command specification mode	Command specification mode					
			Serial communication	Direct numeric specification mode	Command specification mode	Position data limiting mode			Normal positioning mode	Push & hold enabled mode			
Home return operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Positioning operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speed setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acceleration/deceleration setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operation at different acceleration/deceleration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pitch (incremental) feeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Push & hold operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Speed change during movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pause	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zone signal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Power saving mode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Position table	Required	Required	Not required	Not required	Not required	Not required	Not required	Not required	Required	Required	Required	Required	Required

## 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	0	
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: 5mm 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).

M D I	
イ	Absolute coordinate specification (ABS)
ソ	Relative coordinate specification (INC)

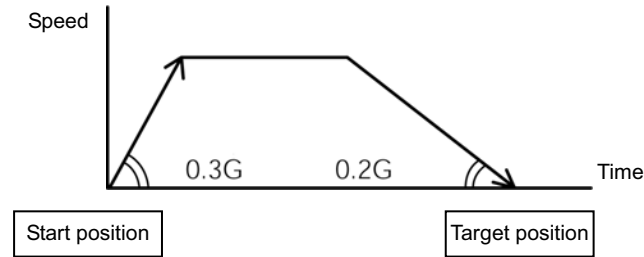
This letter indicates the following:  
A: Absolute coordinate specification (ABS)  
I: Relative coordinate specification (INC)

\* Indicates the relative coordinate specification with the teaching pendant (CON-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:

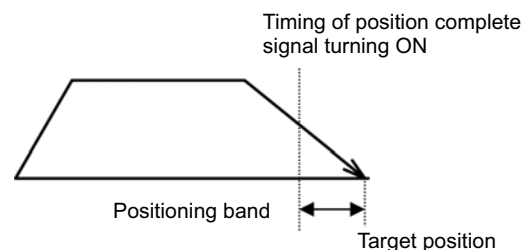
- This field is invalid in the case of this controller. The default value is “0.”

(7) Positioning band:

- The “positioning operation” and “push & hold operation” have different implications.

[Positioning operation]

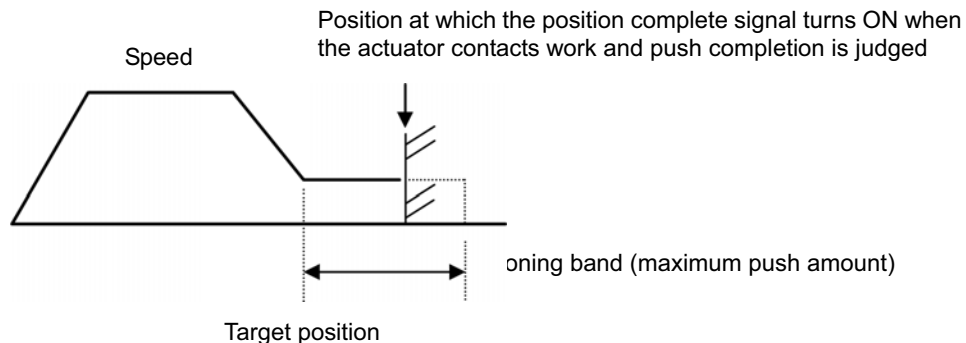
It defines the distance to the target position from a position at which the position complete signal turns ON. Since increasing the positioning band value hastens the next sequence operation, it becomes a factor for tact time reduction. Set the optimum value by considering a balance of the entire equipment.



[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.



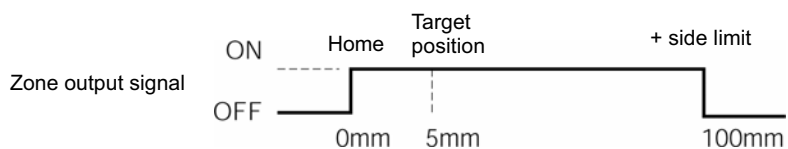
(8) Zone +/-:

- It defines the zone where the zone output signal turns ON. It can be set separately for each target position.

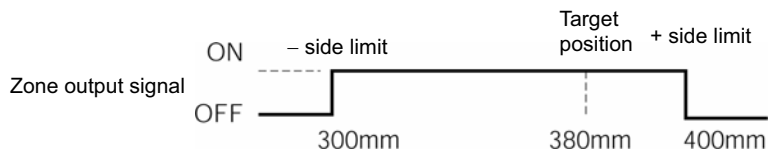
[Setting example]

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



\* The functions have been changed in the new version. Refer to the notes provided at the beginning of the manual.

(9) Acceleration/deceleration mode:

- It defines the acceleration/deceleration characteristics.  
The default value is 0.
- 0: Trapezoid pattern
- 1: S-shaped motion
- 2: First-order lag filter

Trapezoid pattern



- \* Set the acceleration and deceleration in the "Acceleration" and "Deceleration" fields of the position table.

S-shaped motion

A curve, which is gradual at the beginning of acceleration but rises sharply halfway, is drawn.

Use it in the applications for which you want to set the acceleration/deceleration high due to tact time requirement but desire a gradual curve at the beginning of movement or immediately before stop.

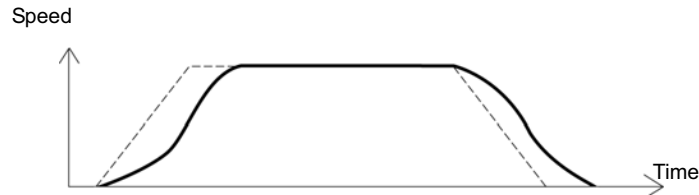


- \* Set the degree of the S-shaped motion with the parameter No. 56 [S-shaped motion ratio setting].  
The setting unit is % and the setting range is between 0 and 100.  
(The above is the image graph when 100% setting is made.)  
If "0" is set, the S-shaped motion becomes invalid.  
However, it will not be reflected in jogging/inching by PC or teaching pendant operation.
- \* The acceleration/deceleration time does not change, but the acceleration/deceleration speeds in the middle of acceleration/deceleration become larger than those set in the position table. (double at maximum).

- ⚠ Caution:
- [1] Even if you issue a position command or high-value command with specified S-motion acceleration/deceleration in order to change moving speed while the actuator is operating, trapezoid control, rather than S-motion acceleration/deceleration control, is performed. Make sure to issue a command when the actuator is stopped.
  - [2] S-motion acceleration/deceleration is disabled in the index mode of the rotary actuator. Trapezoid control is performed even if S-motion acceleration/deceleration control is specified.
  - [3] If acceleration or deceleration time exceeding 2 seconds is set, do not command S-motion acceleration/deceleration control. Normal operation cannot be performed.
  - [4] Do not suspend the operation during acceleration or deceleration. The speed changes (accelerates), which may be dangerous.

## First-order lag filter

More gradual acceleration/deceleration curves are drawn than the linear acceleration/deceleration (trapezoid pattern). Use this in the applications by giving micro vibrations to work during acceleration/deceleration not desired.



- \* Set the degree of primary delay using parameter No. 55 [Primary filter time constant for position command]. The setting unit is msec, and a desired value can be set in 0.1-msec increments in a range of 0.0 to 100.0. If "0" is set, the primary delay filter becomes invalid. Take note, however, that this setting will not be reflected in jogging/inching by PC or teaching pendant operation.

- (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.

## 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 ACON-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		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
[Common] *1	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


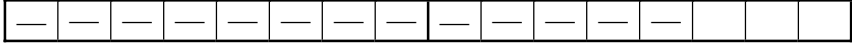
(PLC → Controller)

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  *1 [Numeric specification]	9900H	<div style="display: flex; justify-content: space-between; align-items: center;"> <span>b15</span> <span>b8 b7</span> <span>b0</span> </div> <div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>High order</span> </div>
	9901H	<div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>Low order</span> </div>
	<p>32-bit signed integer (unit: 0.01 mm) The setting range is FFF0BBC1H to 000F423FH (-999999 to 999999).</p> <ul style="list-style-type: none"> <li>If a negative value is set, it is displayed as a 2's complement. Accordingly, the most significant bit becomes "1."</li> </ul> <p>When the low-order word (9901H) in this register is rewritten, positioning operation starts.</p>	
INP Position data specification  *1 [Numeric specification]	9902H	<div style="display: flex; justify-content: space-between; align-items: center;"> <span>b15</span> <span>b8 b7</span> <span>b0</span> </div> <div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>High order</span> </div>
	9903H	<div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>Low order</span> </div>
	<p>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 &amp; hold operation (required to specify with the CTLF flag).</p>	
VCMD Speed specification  *1 [Numeric specification]	9904H	<div style="display: flex; justify-content: space-between; align-items: center;"> <span>b15</span> <span>b8 b7</span> <span>b0</span> </div> <div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>High order</span> </div>
	9905H	<div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>Low order</span> </div>
	<p>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.</p>	
ACMD Acceleration/ deceleration  *1 [Numeric specification]	9906H	<div style="display: flex; justify-content: space-between; align-items: center;"> <span>b15</span> <span>b8 b7</span> <span>b0</span> </div> <div style="border: 1px solid black; width: 100%; height: 15px; margin-bottom: 5px;"></div>
	<p>16-bit integer (unit: 0.01G, setting range: 0 – 300) When this register is rewritten, movement starts.</p>	

(PLC→ Controller)

Register	Address	Description
PPOW Current-limiting value during push & hold operation *1 [Numeric specification]	9907H	<div style="text-align: center;"> <span style="margin-right: 100px;">b15</span> <span style="margin-right: 20px;">b8</span> <span style="margin-right: 20px;">b7</span> <span style="float: right;">b0</span> </div> 
		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	<div style="text-align: center;"> <span style="margin-right: 100px;">b15</span> <span style="margin-right: 20px;">b8</span> <span style="margin-right: 20px;">b7</span> <span style="margin-right: 20px;">b2</span> <span style="margin-right: 20px;">b1</span> <span style="float: right;">b0</span> </div> 
		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		15 – 9	—	—	—
Address 9013H  [Common]*	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		15 – 6	—	—	—
Address 9014H  [POS specification]*	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	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">High order</div> <div style="display: flex; align-items: center;"> <div style="margin-right: 5px;">b15</div> <div style="border: 1px solid black; width: 100%; height: 15px; position: relative;"> <div style="position: absolute; left: 0; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 15px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 30px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 45px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 60px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 75px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 90px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 105px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 120px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 135px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 150px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 165px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 180px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 195px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 210px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 225px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 240px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 255px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 270px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 285px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 300px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 315px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 330px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 345px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 360px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 375px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 390px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 405px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 420px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 435px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 450px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 465px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 480px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; 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left: 630px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 645px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 660px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 675px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 690px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 705px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 720px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 735px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 750px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 765px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 780px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 795px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 810px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 825px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 840px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 855px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 870px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 885px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 900px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 915px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 930px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 945px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 960px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 975px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> <div style="position: absolute; left: 990px; top: 0; width: 15px; height: 15px; border: 1px solid black;"></div> </div> </div> </div>

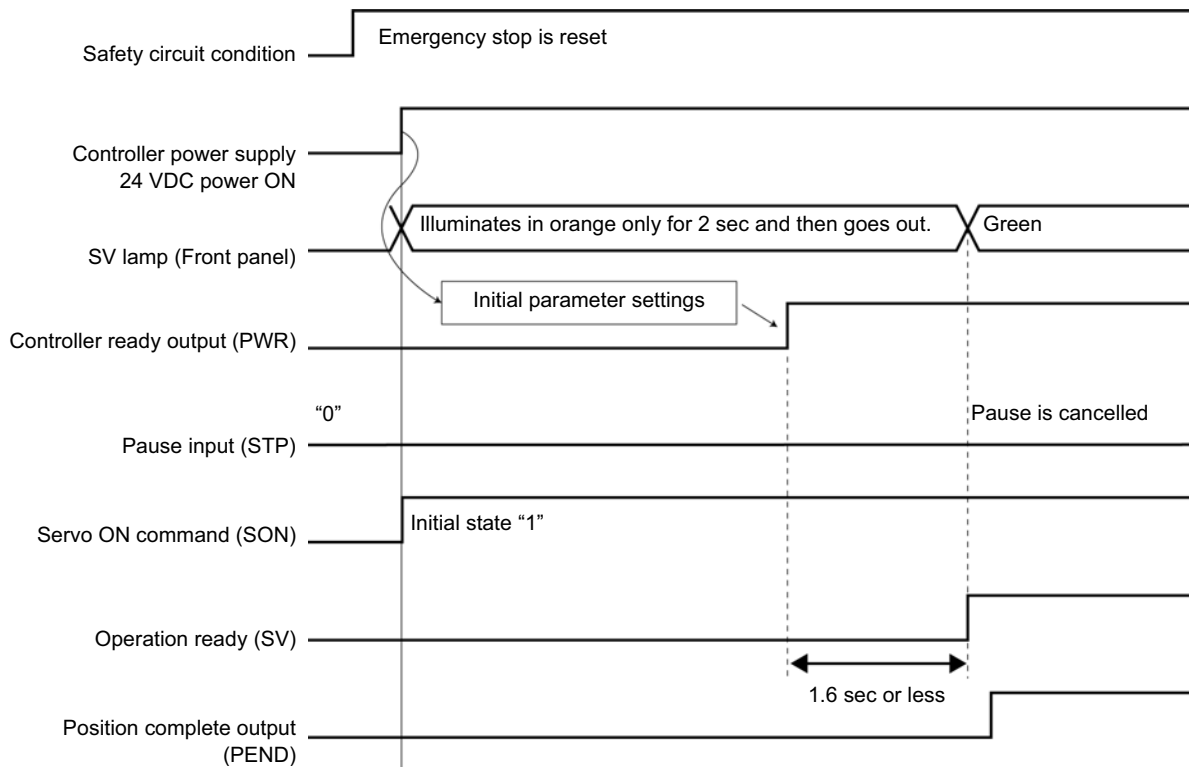
The current position is indicated as a 32-bit signed integer (unit: 0.01 mm). If a negative value is set, it is displayed as a 2's complement. Accordingly, the most significant bit becomes “1.”

## 4.4 Operation Timings

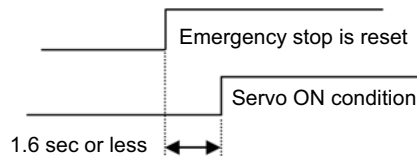
### 4.4.1 Timing after Power ON

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: 24V 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.



**Caution:** For the timing of emergency stop reset after power-on from the emergency stop condition, the servo will be turned ON in 1.6 sec at maximum after emergency stop reset.



**⚠ Warning:** A pulse motor is used as the drive motor, so the excited phase is detected when the servo is turned on for the first time following the power on.  
This means that when the servo is turned on, the actuator must be able to move.  
If the slider or rod is stopped at the mechanical end or the load carried on it is contacting any surrounding equipment, this excited phase detection is not performed and the actuator may operate abnormally or generate an excited phase detection error.  
In this case, move the actuator by hand, before the servo is turned on, to a position where it can move.  
If the actuator has a brake, the brake release switch must be turned on to forcibly release the brake. When doing this, however, be careful not to let your hand pinched or the robot hand or work part damaged due to the actuator dropping suddenly because of its own weight.  
If the actuator cannot be moved by hand, changing the setting of parameter No. 28 (excited phase signal detection direction) may provide a 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

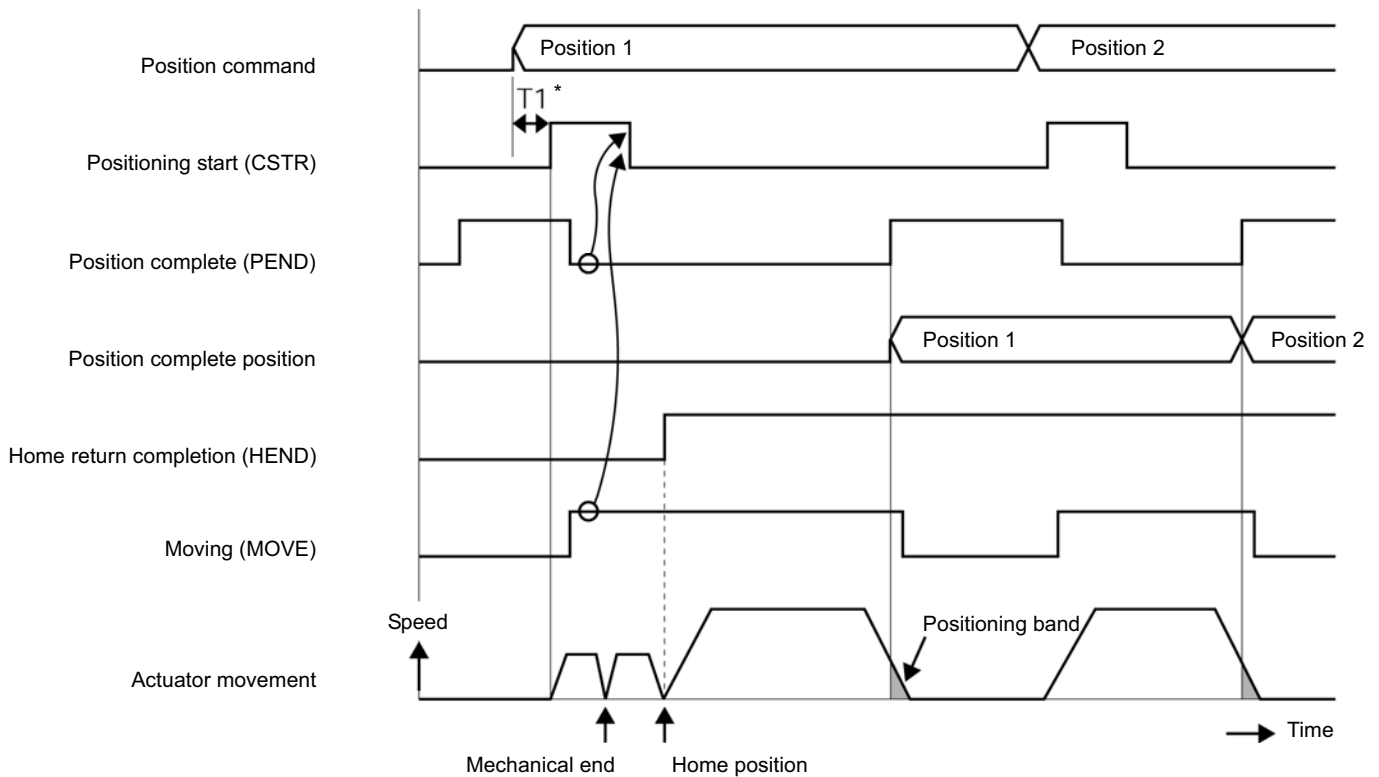
First, turn on the 24 VDC power supply and confirm that the position complete signal (PEND) is "1" by referring to 4.4.1. Home return has not been completed immediately after the power is input. It is required to perform home return by issuing the home return command (HOME) as described in 4.4.2.

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		



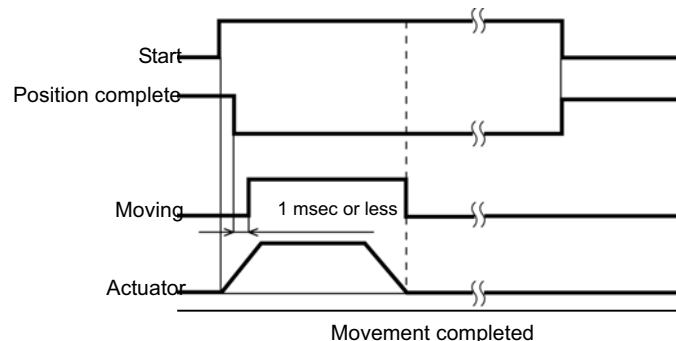
\* T1: Set T1 to 6 msec or more in consideration of the scan time of the host controller.

## 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.

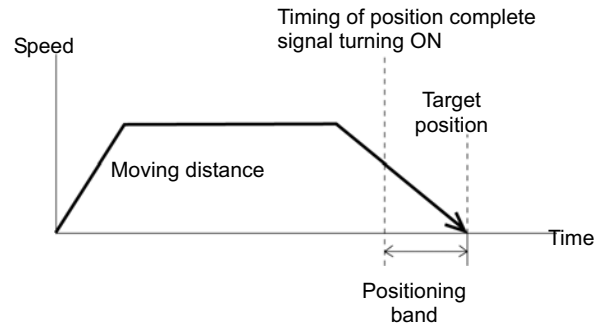
## ■ Position Complete (PEND)

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."

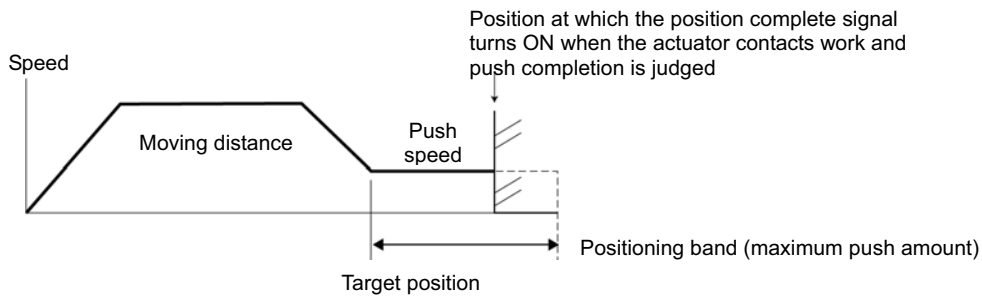
## 4.4.4 Push & Hold Operation

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.

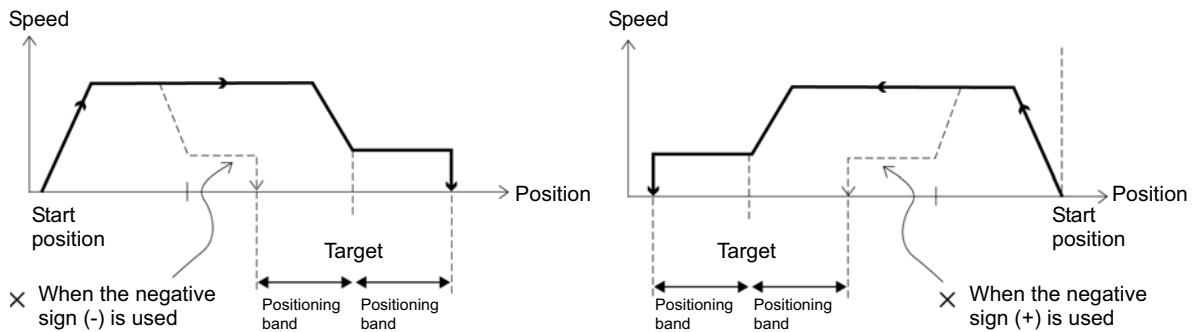
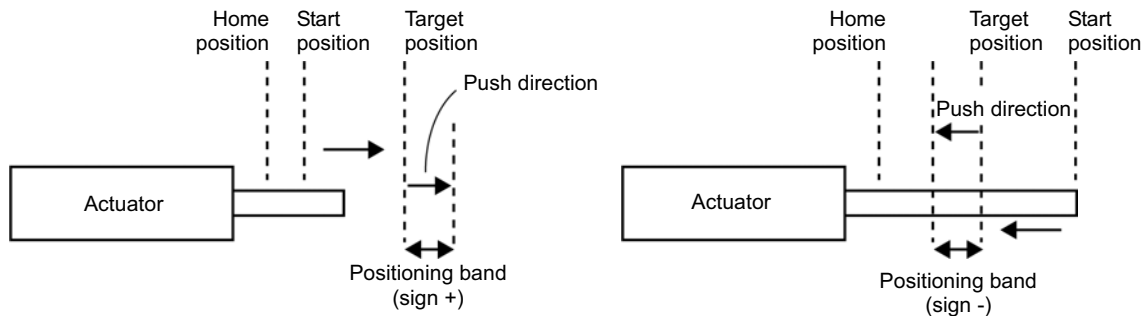
### (1) Basic operation

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



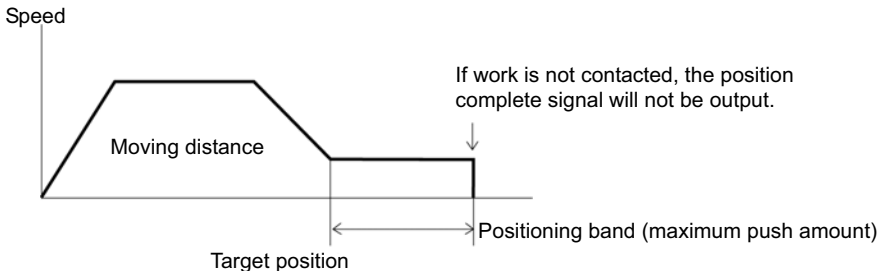
When work is pushed in the direction which increases the coordinate value from the start position toward the target position as shown above, the push direction will be positive (+). On the other hand, when work is pushed in the direction which decreases the coordinate value, the push direction will be 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."

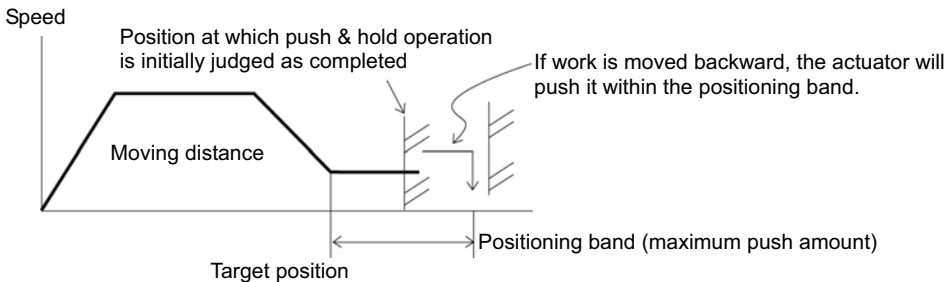


(3) Work moves during push & hold operation

(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.

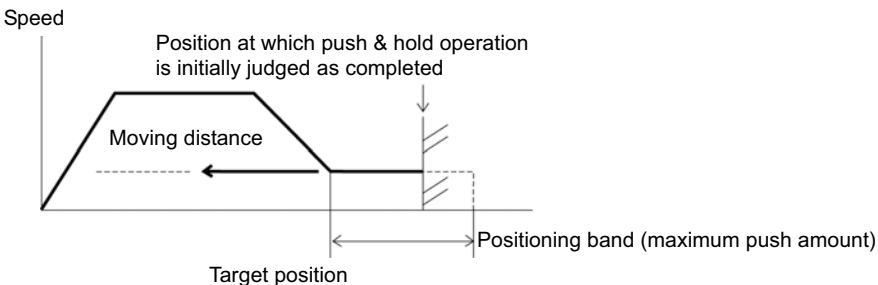
If the current during movement drops below the current-limiting value during push & hold, the position complete signal will turn OFF. The signal will turn ON again when the current rises to or above the limiting value.



(2) Work moves in the opposite direction

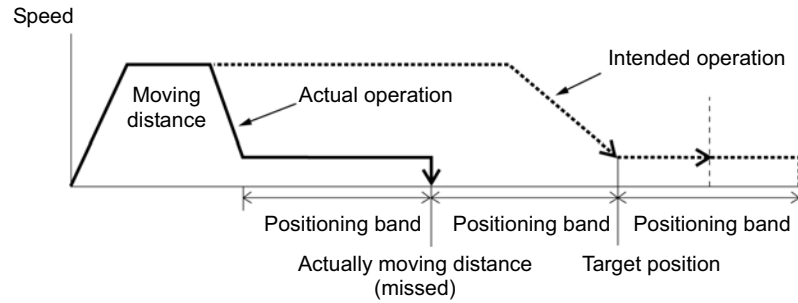
(Actuator is pushed back by the reactive force of the work)

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.

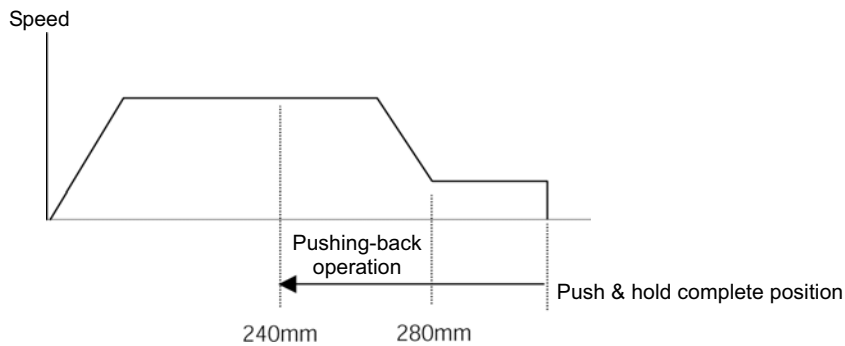


(Note) If the actuator is pushed back to the target position, an alarm will be generated.

- (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.

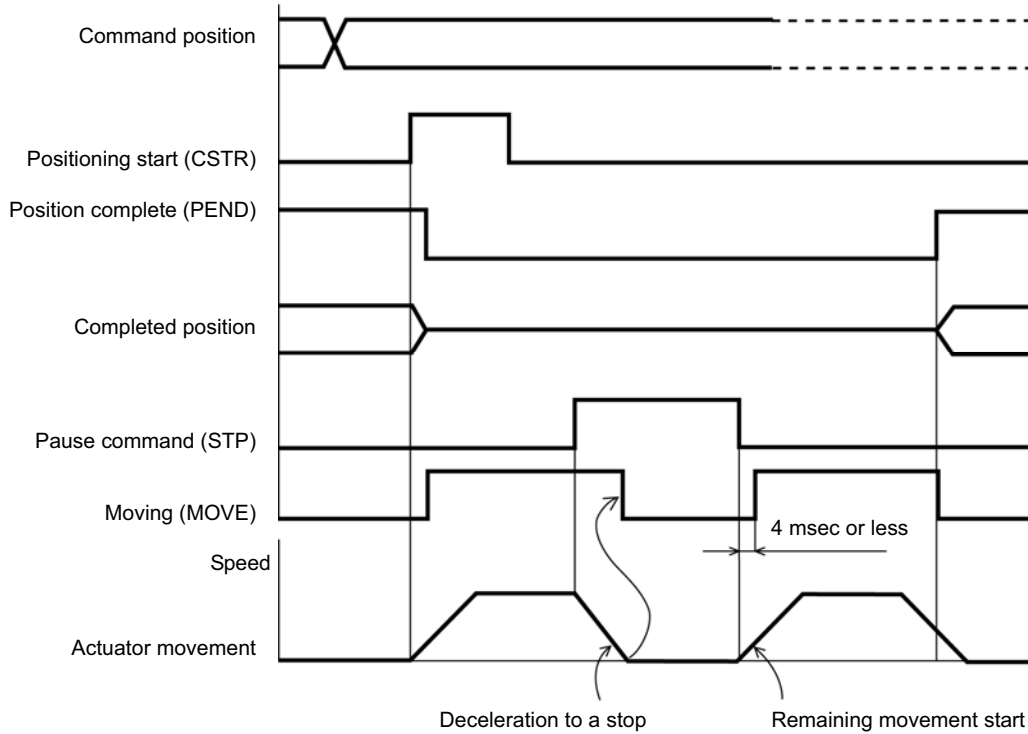


- (5) Pushing back is performed after push & hold operation by specifying the relative coordinate  
 The reference position for the relative coordinate specification is not the current position at which the actuator stops after push & hold operation has completed but the target position of the position 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.



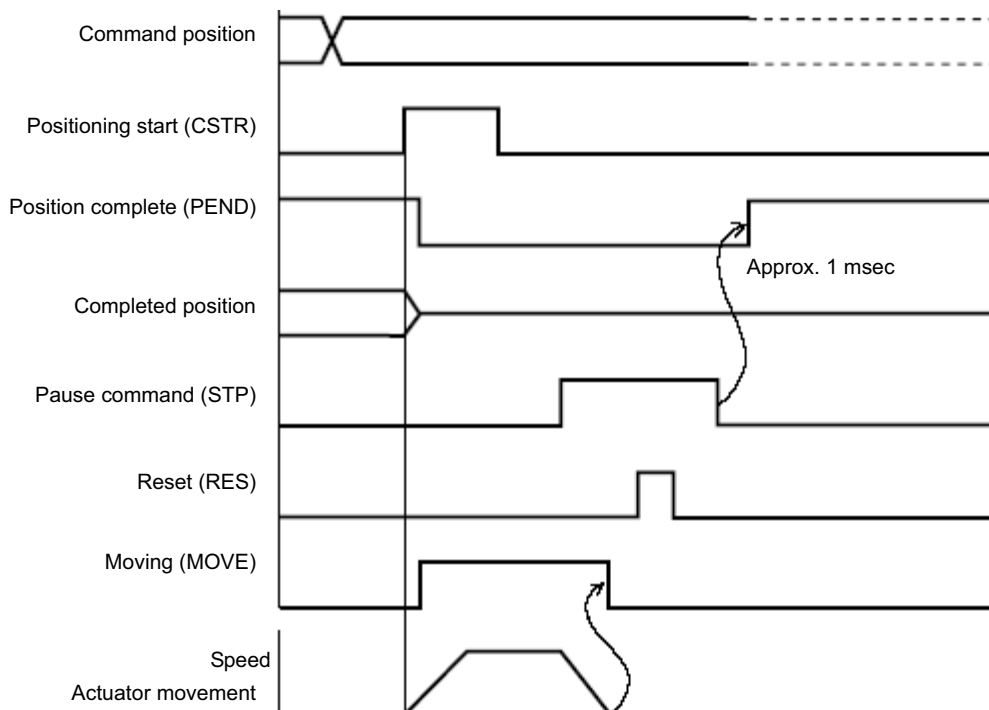
## 4.4.5 Pause

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.

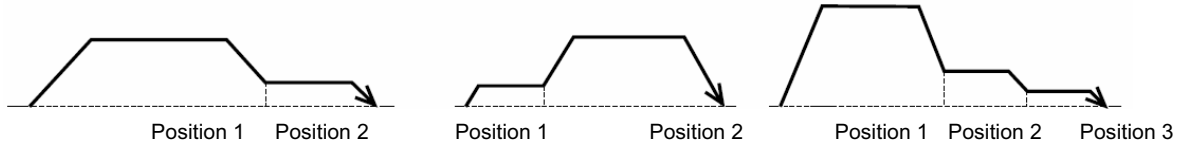
(The controller will detect a rise of the reset signal and cancel the remaining movement.)



## 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.

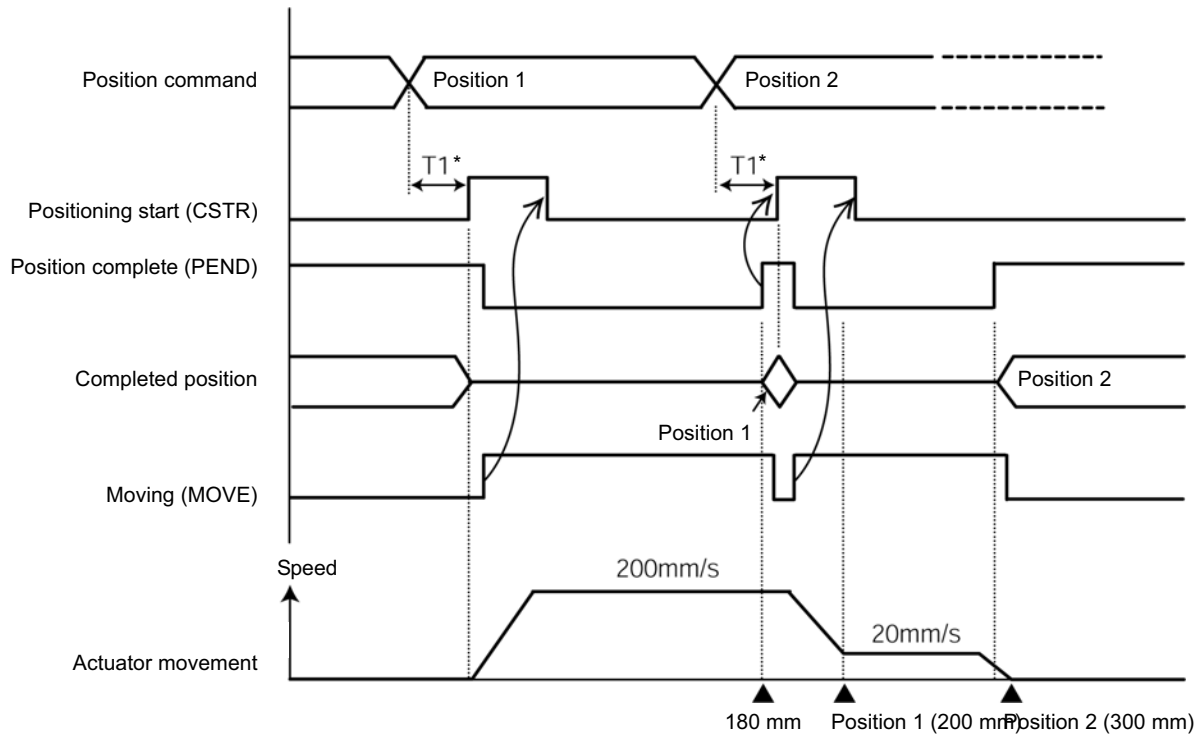


Applications refer to the case where the material of transferred work is soft or where it is not desired to give vibrations or an impact to the work having the easy-to-topple shape.

(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 6 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.

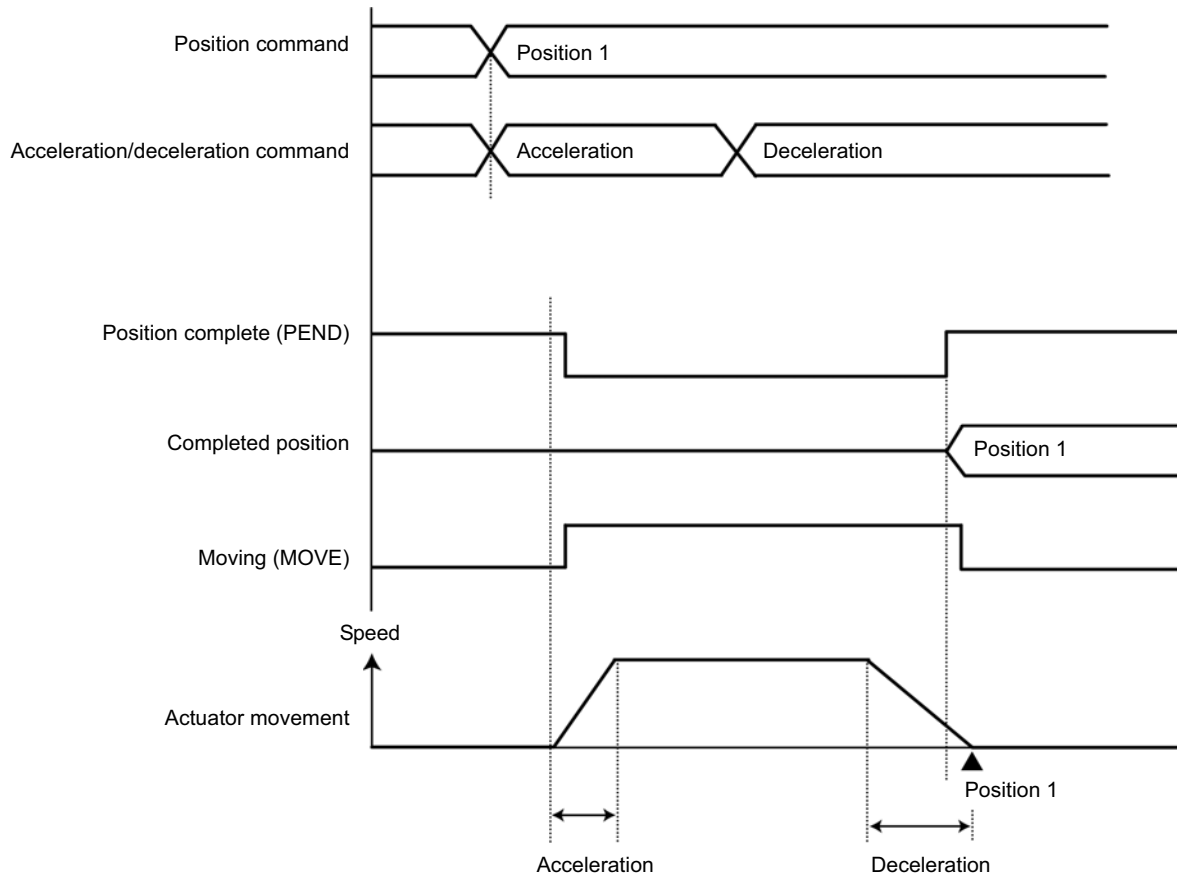
If an alarm is reset during pause, the remaining movement will be cancelled.

<p> 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.</p>
--

## 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.

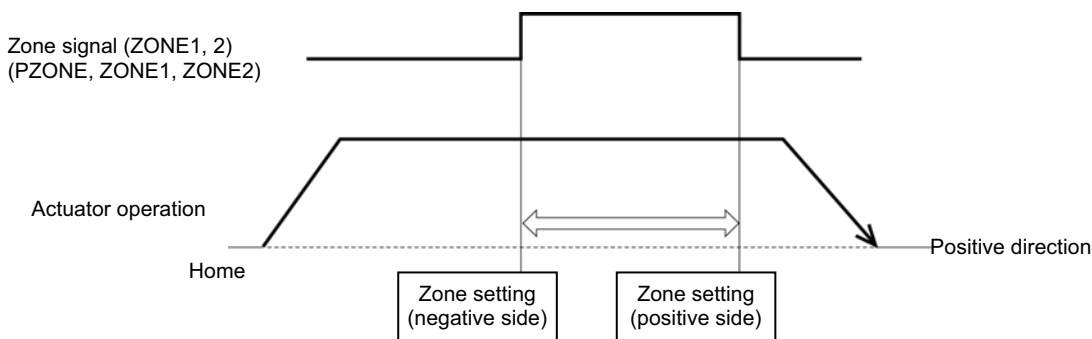
(Example)



## 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.



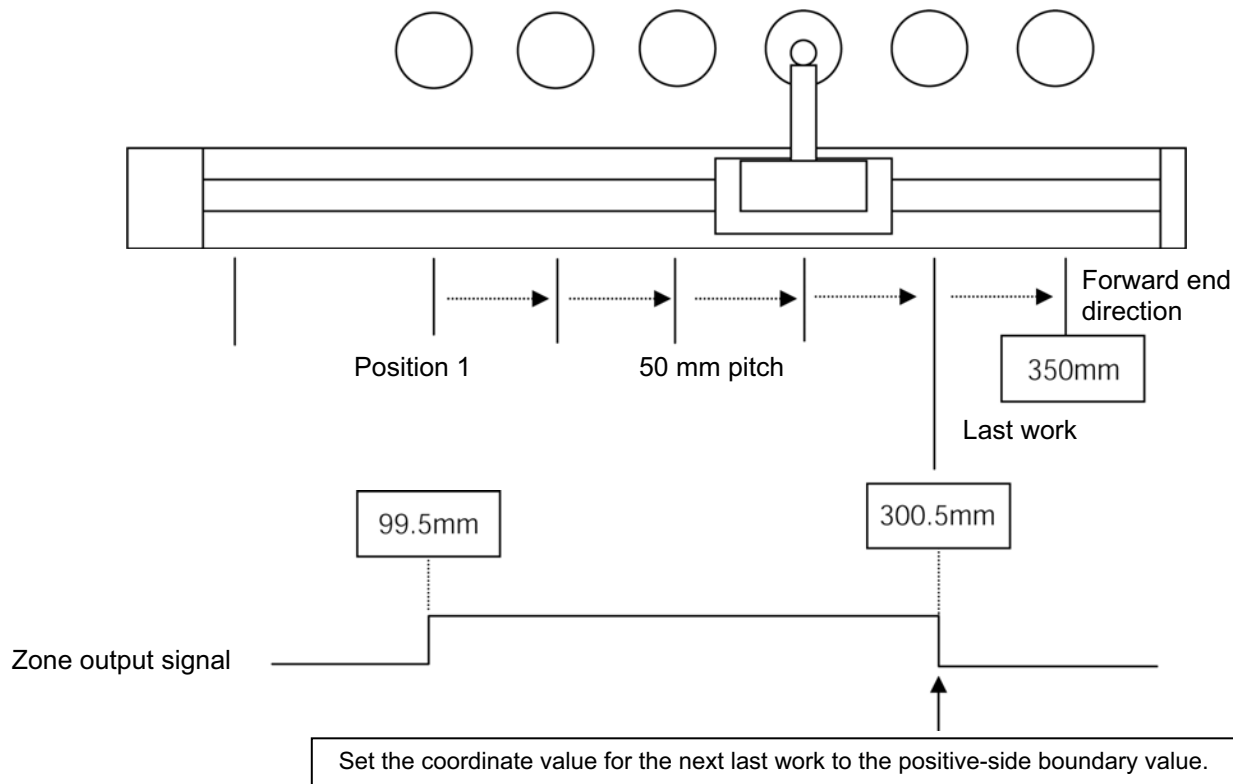
Setting	Zone signal*	Position no. specification mode	Numeric specification mode
Individual zone boundary in position table	Position zone output PZONE	○	×
Zone boundary 1 of user parameter (parameter No. 1, No. 2)	Zone output 1 ZONE1	○	○
Zone boundary 2 of user parameter (parameter No. 23, No. 24)	Zone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

- 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.



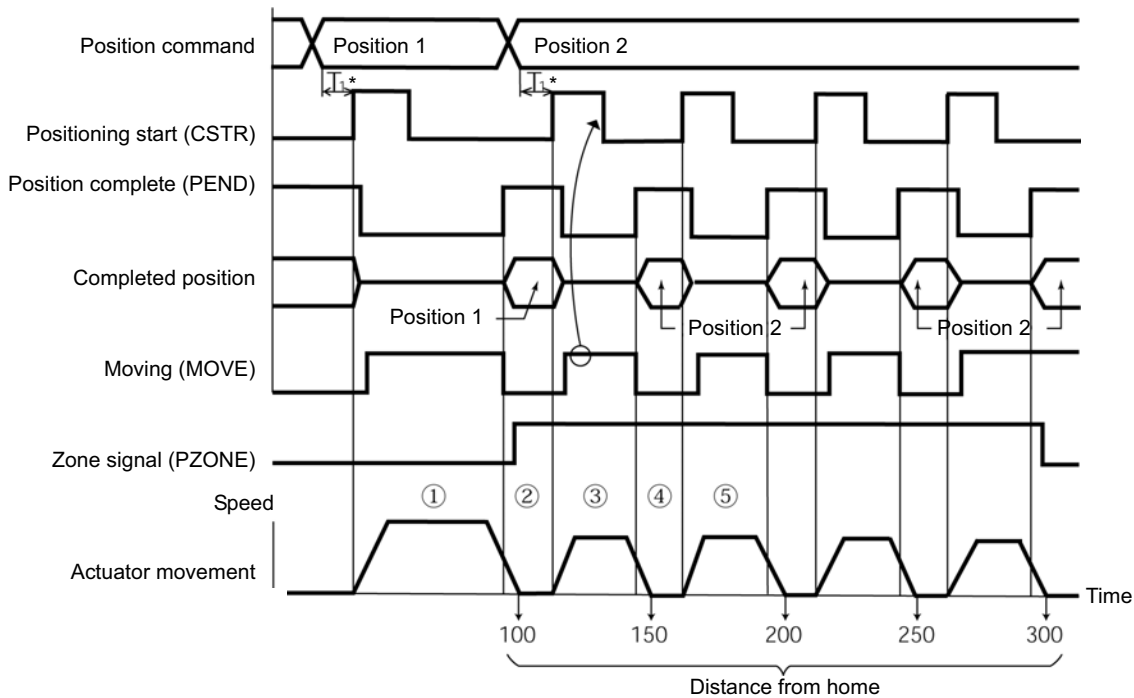
Example of position table

M D I	No .	0	A . 0 0
イチ	I	0 . 0 0	m m
ソクト*	↑	1 0 . 0 0	m m / s

\*Indicates the relative coordinate specification with the teaching pendant (CON-T).  
(I: Relative coordinate specification, A: Absolute coordinate specification)

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 (RCM-T).



\* T1: Set T1 to 6 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].

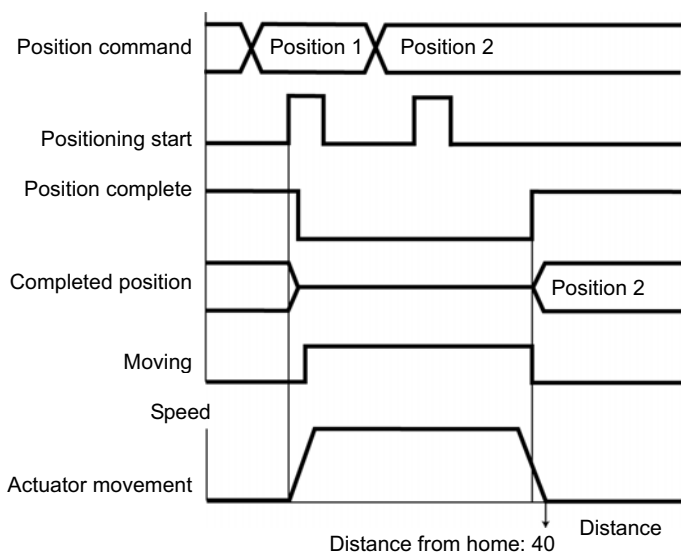
The PLC checks the zone signal (PZONE) status when positioning has been completed and judges that the current position is the last work position if the signal has become "0."

If the number of counts on the PLC side does not agree with the zone signal status, it is assumed 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 [CONT-T]>

M D I	No.	1	A . 0 0
イテ	A	3 0 . 0 0	mm
ソクト		1 0 0 . 0 0	mm / s

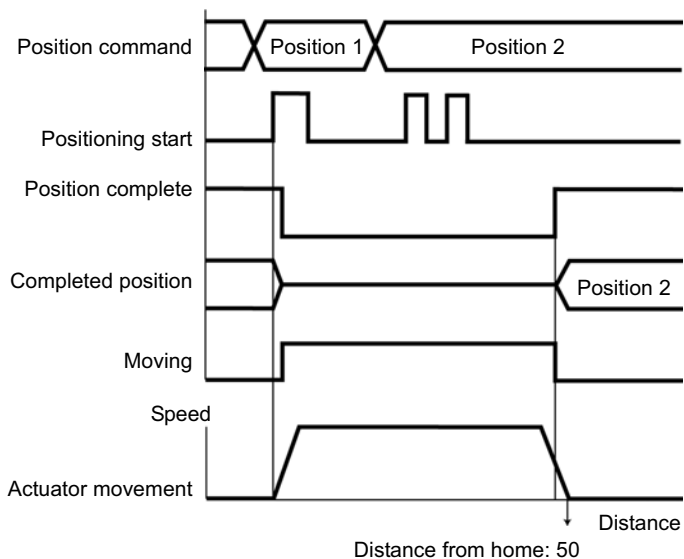
Position 1

M D I	No.	2	A . 0 0
イテ	I	1 0 . 0 0	mm
ソクト		1 0 0 . 0 0	mm / s

Position 2

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.

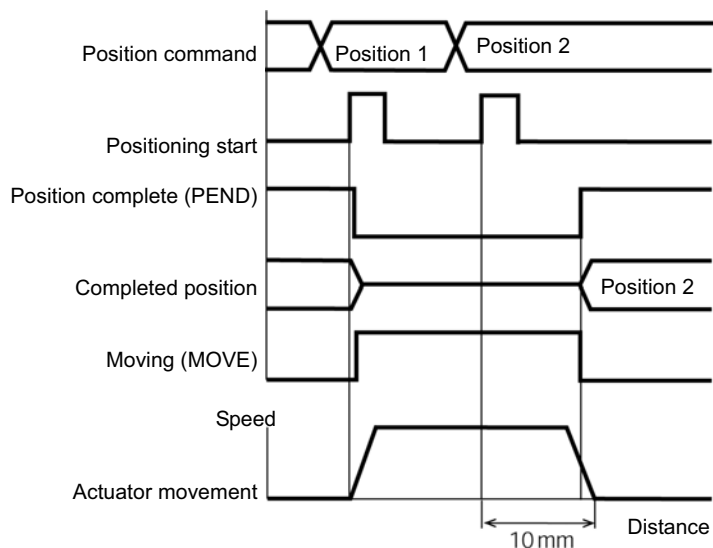
Example) If the start signal for movement to position 2 is input twice while the actuator is moving to position 1, the actuator will move to the position 50 mm from the home.



### (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 [CONT-T]>

M D I	N o .	1	A . 0 0
イテ	A	5 0 . 0 0	m m
ソクト *		1 0 0 . 0 0	m m / s

Position 1

M D I	N o .	2	A . 0 0
イテ	I	1 0 . 0 0	m m
ソクト *		1 0 0 . 0 0	m m / s

Position 2

## 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
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	AIOF	Home position sensor input polarity	—	0 (Invalid)
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)	—	0 (Reverse)
29	b	PHSP2	Excitation-phase signal detection time	msec	128
30	b	PHSP	Pole sense type (0: Current restraint/1: Distance restraint)	—	1 (Distance restraint)
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	Set individually in accordance with the actuator characteristics
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
52	b	CTLF	Default acceleration/deceleration mode	—	0 (Trapezoid)
54	d	CLPF	Current control band number	—	Set individually in accordance with the actuator characteristics
55	b	PLPF	Position command primary filter time constant	msec	0

No.	Category	Symbol	Name	Unit	Default factory setting
56	b	SCRV	S-shaped motion ratio setting	%	0
71	b	PLFG	Position feed forward gain	—	0
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.
88	a	SWLM	Software limit margin	mm	Set individually in accordance with the actuator characteristics.
91	b	PSFC	Current-limiting value at stopping due to missed push-motion	—	0 (Current-limiting value during movement)

\* 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)**

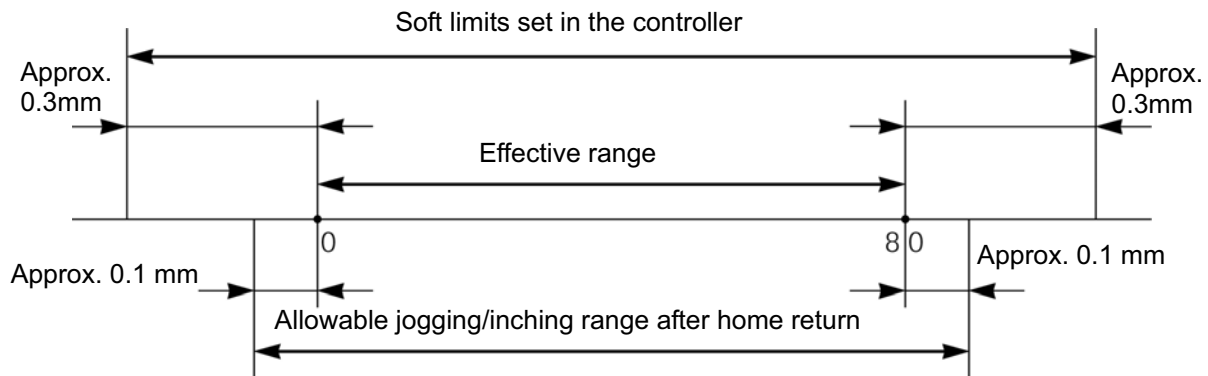
Set the soft limit in the positive direction in parameter No. 3, and that in the negative direction in parameter No. 4. The factory setting for the soft limits conforms to the effective actuator length. Change the settings, as necessary, to prevent collision with an obstacle or when the actuator must 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 0.3mm outside of the effective range.

Example) Set the effective range to between 0 mm and 80 mm

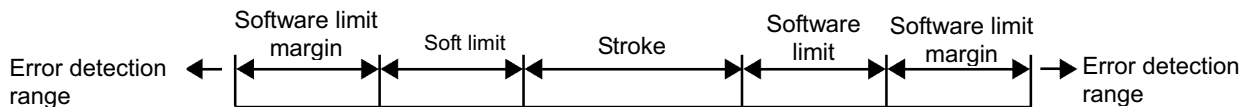
Parameter No. 3 (positive side) 80.3

Parameter No. 4 (negative side) -0.3



- **Software limit margin (No. 88 SWLM)**

If the actuator goes outside the range defined by the soft limits, a "Software limit over error" occurs. By setting parameter No. 88, you can disable the detection of this error for the dimension corresponding to the value set in parameter No. 88 from each soft limit. The minimum setting range is 0.01 mm.



- **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 home return offset and soft limit parameter, if necessary.

**Caution:** If the home direction is reversed, all position data that have been input will be retained. Use the rod-type actuator in the home position on the motor side.

- 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.

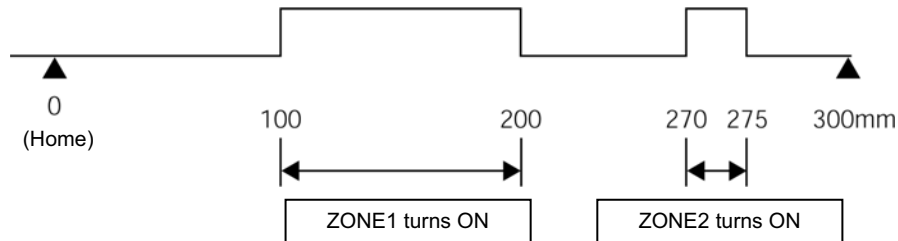
The positive and negative boundaries for the ZONE2 signal are set in parameter No. 23 and No. 24, respectively.

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 275mm, 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



\* The functions have been changed in the new version. Refer to the notes provided at the beginning of the manual.

## 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.

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

The factory setting conforms to the standard specification of the actuator.

This parameter does not require changing under normal circumstances. Do not change the parameter value.

- 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)**

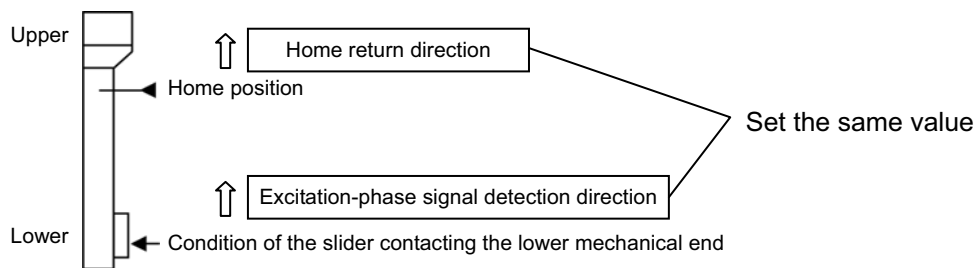
Excitation-phase detection is performed at the first servo ON after the power is input. Define the detection direction at this time. This setting need not be changed in normal conditions of use. However, if the actuator contacts the mechanical end or an obstacle and cannot be moved by hand when the power 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).

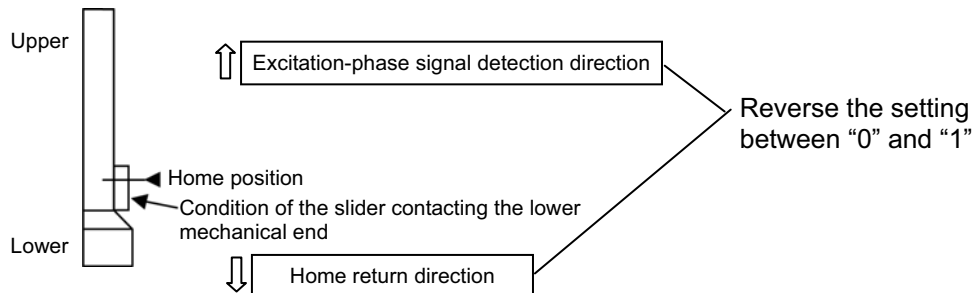
To make this direction opposite the home return direction, set a value other than that in parameter No. 5 (home return direction).

This parameter is valid only when the pole sense type is the current suppression scheme.

(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 (excitation switching cycle) 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.

- **Pole sense type (No. 30 PHSP)**

Magnetic pole detection operation is performed at the first servo ON after the power is input, and the operating mode at this time is defined in parameter No. 30.

This setting need not be changed in normal conditions of use, so it must not be changed by the customer.

Definition of set value: 0 (Current restraint)  
1 (Distance restraint)

The factory setting is 1 (distance restraint).

- Safety speed (No. 35 SAFV)

Define the feed speed for manual operation.

The speed is individually set in accordance with the actuator characteristics.

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 acceleration/deceleration mode (No. 52 CTLF)

When a target position is written to an unregistered position table, the setting in this parameter will be used as the data in the "Acceleration/deceleration mode" field corresponding to the applicable position number.

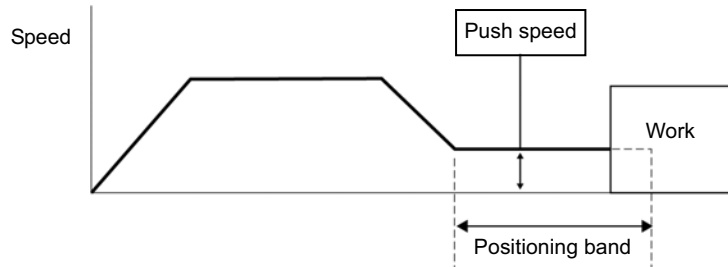
The factory setting is 0 (trapezoid pattern).

To change the default condition of the acceleration/deceleration pattern, set the values of parameter No. 52 as follows:

	Set value
Trapezoid pattern	0
S-shaped motion	1
Primary delay filter	2

- 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.

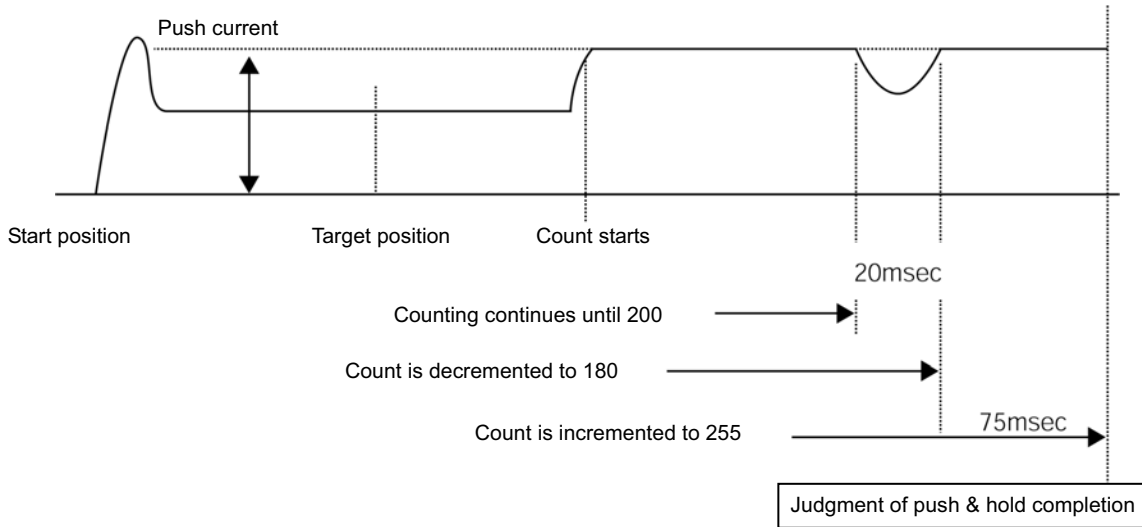
- Push & hold stop judgment time (No. 6 PSWT)

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.

	Setting
Enable (use)	0
Disable (not use)	1

The factory setting is 1 [Disable].

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

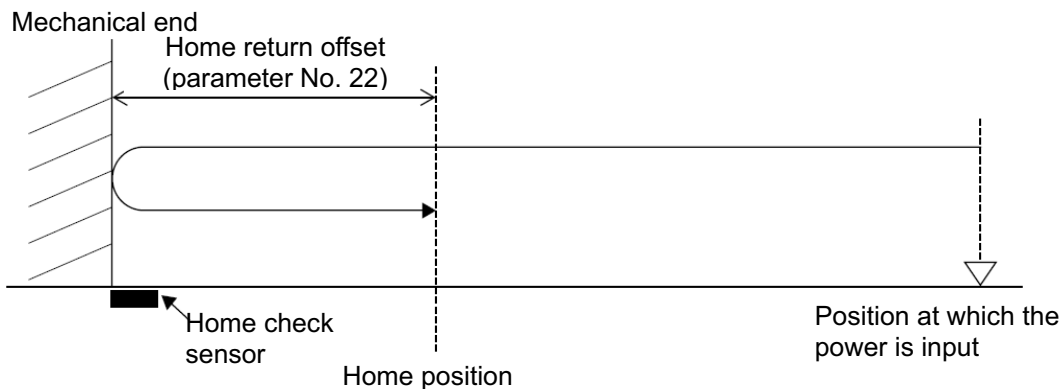
The controller is not equipped with a home check sensor as a standard, but it can optionally be installed. It need not be changed normally, but change the value of parameter No. 43 if the system is changed by the customer after shipment.

Definition of setting: 0 (Standard specification, sensor not used)  
 1 (Home check sensor used, sensor polarity: contact a)  
 2 (Home check sensor 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 detected, the controller recognizes that the home return has completed successfully.

If the signal is not yet detected, 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 AIOF)

Parameter No. 18 defines the input polarity of the home sensor.

The factory setting is 0 (sensor not used) since the current RCA actuator does not adopt the home sensor system. This parameter is prepared for future actuator development, and must not be changed by the customer.

Definition of setting: 0 (Sensor not used)  
 1 (Home sensor used, sensor polarity: contact a)  
 2 (Home sensor used, sensor polarity: contact b)

- Position command primary filter time constant (No. 55 PLPF)

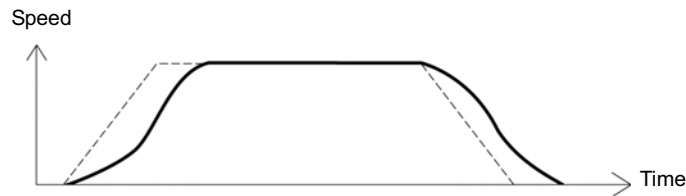
Parameter No. 55 defines the degree of delay if 1 [primary delay filter] is set in the “Acceleration/deceleration mode” field of the position table.

The setting unit is [msec], minimum input unit is 0.1 msec, and setting range is 0.0 to 100.0.

The factory setting is 0 [msec].

When the setting in this parameter is 0, the primary delay filter will become invalid.

The larger the setting becomes, the larger the delay degree will become.

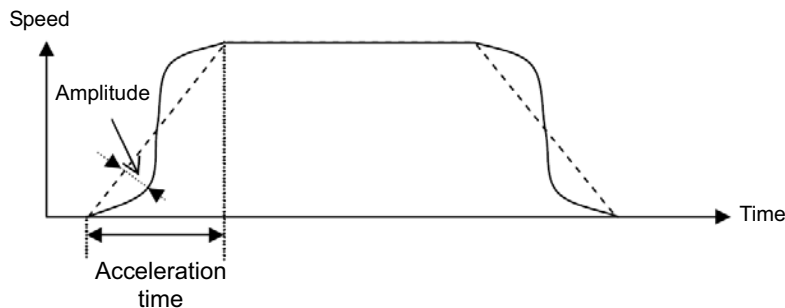


- S-shaped motion ratio setting (No. 56 SCRv)

Parameter No. 56 defines the degree of S-shaped motion if 2 [S-shaped motion] is set in the “Acceleration/deceleration mode” field of the position table.

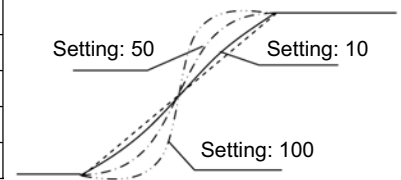
The setting unit is % and the setting range is 0 to 100.

The factory setting is 0% (= S-motion mode is disabled).



In the S-motion mode, a sine wave pattern is applied where the acceleration time corresponds to one period. Use parameter No. 56 to specify a desired amplitude level.

Setting of parameter No. 56 [%]	Amplitude level
0 [factory setting]	S-motion mode is disabled (dotted line in the figure below)
100	Sine wave amplitude x 1 (two-dot chain line in the figure below)
50	Sine wave amplitude x 0.5 (one-dot chain line in the figure below)
10	Sine wave amplitude x 0.1 (solid line in the figure below)



- ⚠ Caution:
- Even if you issue a position command or high-value command with specified S-motion acceleration/deceleration in order to change moving speed while the actuator is operating, trapezoid control, rather than S-motion acceleration/deceleration control, is performed. Make sure to issue a command when the actuator is stopped.
  - S-motion acceleration/deceleration is disabled in the index mode of the rotary actuator. Trapezoid control is performed even if S-motion acceleration/deceleration control is specified.
  - If acceleration or deceleration time exceeding 2 seconds is set, do not command S-motion acceleration/deceleration control. Normal operation cannot be performed.
  - Do not suspend the operation during acceleration or deceleration. The speed changes (accelerates), which may be dangerous.

- Position feed forward gain (No. 71 PLFG)

Parameter No.	Unit	Setting range	Default
71	—	0 – 100	Set individually in accordance with the actuator characteristics.

Set the feed forward gain of the position control system.

When the setting in this parameter is made, the servo gain will increase with the enhancement of the position control loop.

This parameter is used to enhance the response in the system with low machine rigidity or the mechanical system with a high load inertia ratio.

The standard setting is 10 to 80, and increasing the setting in this parameter decreases the deviation and enhances the response.

Setting a large value may generate vibrations or noise.

- 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.

\* Do not change the setting.

- 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)

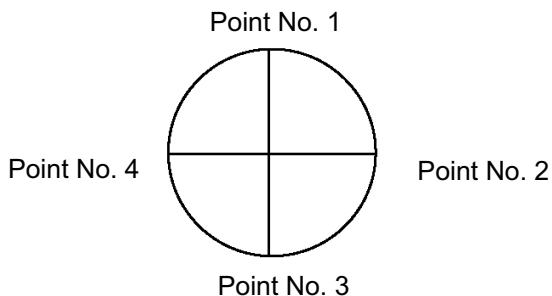
: 1 (Index mode)

**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)

Shortcut refers to an operation whereby the actuator moves to the next point by rotating in the direction requiring the shorter travel.

	Setting
Do not select	0
Select	1



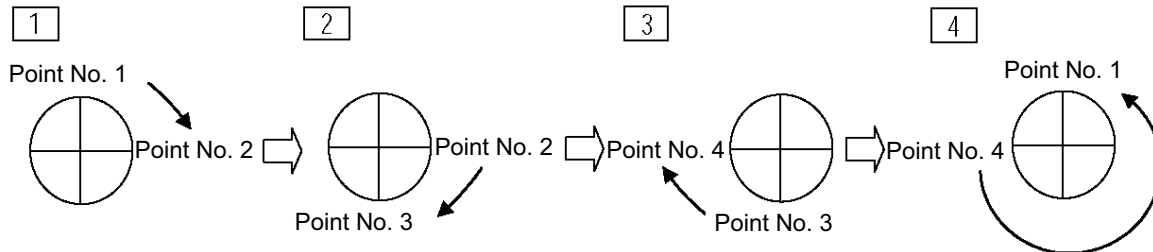
Positions

Point number	Position data
1	0
2	90
3	180
4	270

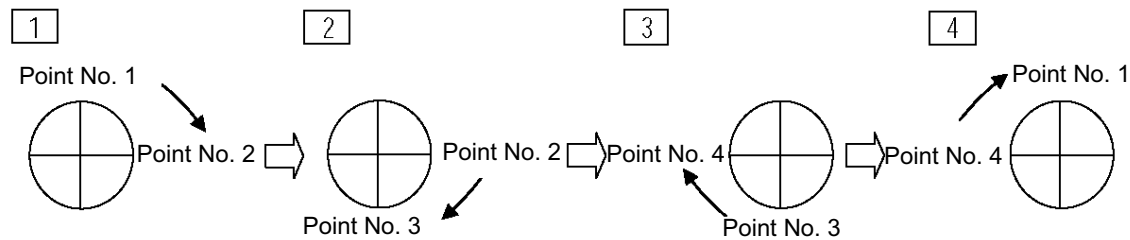
One degree of position data corresponds to 1 mm.

If the actuator is moved in the order to positions 1 → 2 → 3 → 4, the actuator will operate differently depending on whether or not shortcut is selected.

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

- Current-limiting value at stopping due to missed push-motion (No. 91 PSFC)

The current-limiting value at stopping when the actuator misses the push-motion is defined.

Parameter No. 91	Description
0	Current-limiting value during movement (2.8 to 4 times depending on the characteristics of the actuator)
1	Current-limiting value during push & hold operation

## 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]	<ul style="list-style-type: none"> <li>[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.</li> <li>[2] Servo On condition The servo will be OFF regardless of where the current position is.</li> </ul>
1 [INP]	<p>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.</p> <p>* It is like an auto switch of the air cylinder.</p>

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].

Set 230400 bps when using the controller with the gateway unit.

- 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.

Set 2 msec when using the controller with the gateway unit.

- 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 loading 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)

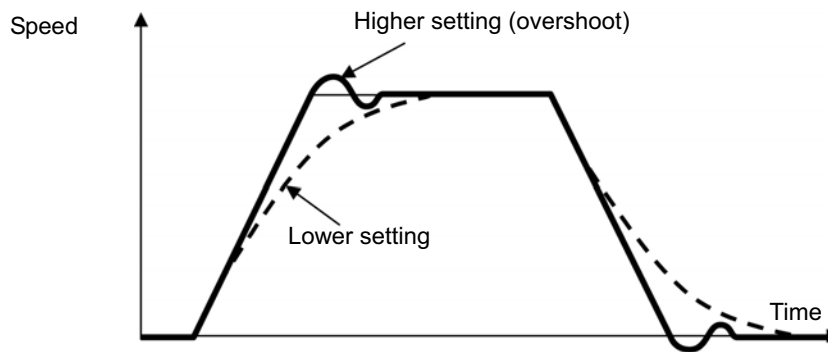
Parameter No.	Unit	Input range	Default
7	5rad/sec	0 – 15	Individual setting in accordance with actuator characteristics

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)

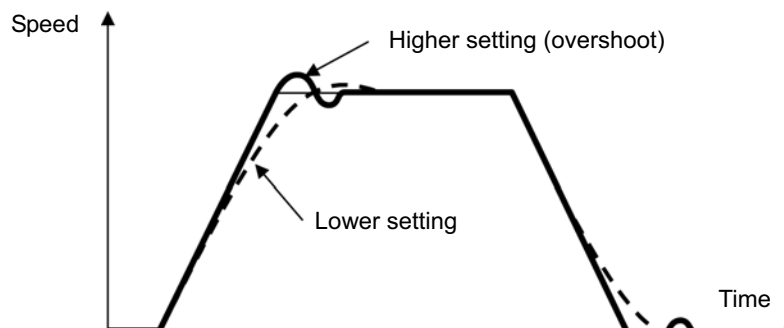
Parameter No.	Unit	Input range	Default
31	—	1 – 27661	Individual setting in accordance with actuator characteristics

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.

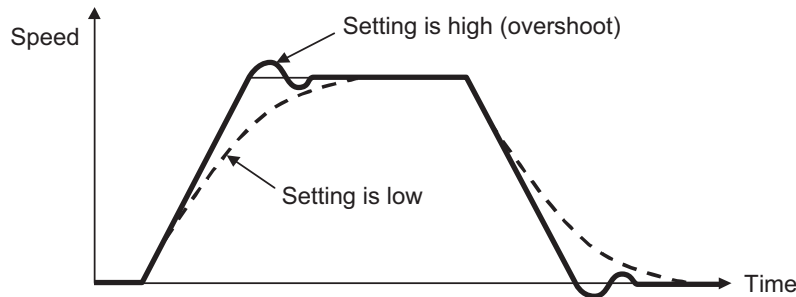
However, excessively increasing the setting will cause overshooting or oscillation, which facilitates producing the vibrations of the mechanical system.



- 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.

- Current control band number (No. 54 CLPF)

Parameter No.	Unit	Input range	Default
54	—	0 – 7	Individual setting in accordance with actuator characteristics

This parameter sets the control band of the PI current control system. It need not be changed under normal conditions of use and must not be changed by the customer. Changing the setting carelessly may impair the stability of the control system. It is very dangerous. Changing this parameter when a resonant sound is produced allows the resonant sound to be suppressed. Even in this case, be sure to change it in accordance with IAI's instructions.

## 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

Both the SV and ALM lamps are unlit in the pole sense mode.

## 6.2 Alarm Level Classification

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

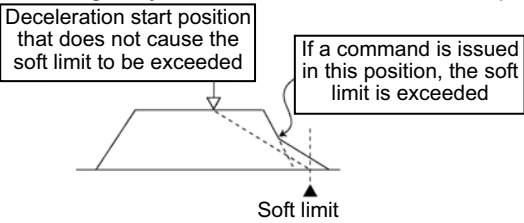
Alarm level	ALM lamp	Failure status register	What happens when alarm generates	How to reset
Operation cancellation	Lit (red)	ALML is "1."	The actuator decelerates to a stop and then the servo turns OFF.	<ul style="list-style-type: none"><li>- Reset the alarm by the PC/teaching pendant.</li><li>- Input the reset signal from the PLC.</li></ul>
Cold start	Lit (red)	ALMH is "1."	The actuator decelerates to a stop and then the servo turns OFF.	<ul style="list-style-type: none"><li>- Reset software by the PC/teaching pendant.</li><li>- Reconnect the power.</li></ul>



**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").
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.
0A7	Deceleration command error	<p>If the target position is near a soft limit and the deceleration is set low, issuing a command specifying the applicable position number while the actuator is moving may cause the actuator to move past the soft limit.</p>  <p>Cause: When the speed is changed while the actuator is moving, the next move command is not issued quickly enough. Action: Quicken the timing of speed change so as to prevent the actuator from overshooting beyond the soft limit.</p>

Code	Error name	Cause/Action
0B5	Phase-Z position error	The position at which phase Z was detected during home return was outside the specified range, or phase Z was not detected. Cause: Faulty encoder Action: Contact IAI.
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.
0C9	Excessive motor supply voltage	This alarm indicates that the motor supply voltage is excessive (24V+20%, 28.8V or more). Cause: [1] High voltage of 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.
0CC	Abnormal control supply voltage	This alarm indicates that the voltage of the 24V input power supply is excessive (24V+20%: 28.8V or more). Cause: [1] High voltage of 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.
0CE	Drop in control supply voltage	This alarm indicates that the voltage of the 24V input power supply has dropped (24V-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.

Code	Error name	Cause/Action
0D2	Excessive motor power-supply voltage	<p>Cause: This error occurs when overvoltage of motor power has been detected (38V or more)</p> <p>Action: Check the motor power input voltage (MPI terminal). In case there is no fault found in voltage, malfunction of controller can be considered. Please contact us.</p>
0D8	Deviation overflow	<p>The position deviation counter has overflowed.</p> <p>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 payload.</p> <p>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.</p>
0D9	Soft limit over error	This alarm indicates that a soft limit has been reached.
0DC	Push & hold operation range over error	<p>This error will occur if, after the push &amp; hold operation has completed, the push-back force is too strong and the work is pushed back to the target position.</p> <p>Review the entire system.</p>
0ED	Absolute encoder error (1)	<p>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.</p> <p>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.</p>
0EE	Absolute encoder error (2)	<p>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.</p> <p>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.</p>

0EF	Absolute encoder error (3)	<p><b>Cause:</b> 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.</p> <p><b>Action:</b> 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.</p> <p><b>Refer to:</b> 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").</p>
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## (2) Cold-start level alarms

Code	Error name	Cause/Action
0A1	Parameter data error	<p>Cause: The data input range in the parameter area is not appropriate. (Example) This error occurs when the magnitude relationship is apparently inappropriate such as when 300 mm was incorrectly input as the value of the soft limit negative side while the value of the soft limit positive side was 200.3mm.</p> <p>Action: Change the value to an appropriate one.</p>
0A8	Motor/encoder type not supported	<p>Cause: The monitor type or encoder type set in the applicable parameter is not supported.</p> <p>Action: If this error persists after reconnecting the power, contact IAI.</p>
0B4	Electrical angle mismatch	<p>Cause: The position deviation counter has overflowed.</p> <p>Action: Check the load condition, such as whether the work is not contacting any nearby object or if the brake is released. If the electrical angle is not yet confirmed (phase Z is not yet detected), deviation overflow may be a cause. In this case, check the cable connection because deviation overflow can be caused by a broken motor wire or encoder line output error.</p>
0B7	Indeterminate magnetic pole	<p>This controller will conduct magnetic pole phase detection when the servo is first turned ON after the power is input. This alarm indicates that the magnetic pole phase cannot be detected even with a lapse of a specified period of time.</p> <p>Cause: [1] Loose or disconnected motor-relay cable connector [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] Large slide resistance of the actuator itself</p> <p>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] If the load 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.</p>
0C8	Overcurrent	<p>Cause: The output current of the supply circuit has become excessively high. This condition does not occur under normal operation, but insulation degradation of the motor coil is suspected.</p> <p>Action: Measure the phase resistance of the motor cable lines U, V and W and insulating resistance with a ground to check the presence of insulation degradation. Before executing measurement, please contact IAI.</p>
0CA	Overheating	<p>This alarm indicates that the temperature around the power transistor and regenerative resistor in the controller is excessive.</p> <p>Cause: [1] High temperature around the controller [2] Excessive regenerative energy (The deceleration setting is too high during a downward movement of the vertically installed actuator.) [3] Faulty internal controller part</p> <p>Action: [1] Lower the surrounding air temperature of the controller. [2] Revise the settings so that the deceleration decrease. If neither action [1] nor [2] improves the situation, contact IAI.</p>

Code	Error name	Cause/Action
0CB	Current sensor offset adjustment error	<p>The condition of the current detection sensor inside the controller is checked in the initialization processing after the power is input. A sensor error was detected at this time.</p> <p>Cause: [1] Faulty current detection sensor and peripheral components [2] Inappropriately adjusted offset</p> <p>Action: The board must be replaced or the offset must be adjusted. Please contact IAI.</p>
0E0	Overload	<p>Cause: [1] Load increased due to application of external force. [2] If the actuator is equipped with a brake, the brake cannot be released. [3] The slide resistance of the actuator is locally high.</p> <p>Action: [1] Recheck the surroundings of the work. If abnormal external force was applied to the work, correct it. [2] Turn on the brake release switch and confirm that the brake is released. If the brake is not released, a failure of the brake itself, cable disconnection or a faulty part of the brake circuit inside the controller is suspected. [3] If the work can be moved by hand, move it and check that there is no part which is of high slide resistance. If [2] or [3] is applicable, please contact IAI.</p> <p>Note: Before restarting operation, be sure to remove the cause. If the power is cut off once, input the power again after 30 min or more have elapsed to prevent the motor coil from burnout.</p>
0E8	Phase-A/B disconnection detection	<p>Encoder signals cannot be detected correctly.</p> <p>Cause: [1] Loose or disconnected encoder-relay cable connector [2] Loose or disconnected actuator-end connector of the supplied cable</p> <p>Action: Check the connection condition of the encoder relay cable and conduct a continuity check. If the results are normal, please contact IAI.</p>
0F4	Mismatched PCB	<p>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).</p> <p>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.</p> <p>Cause: A parameter input error or board assembling error is suspected.</p> <p>Action: Should this error occur, please contact IAI.</p>
0F5	Nonvolatile memory write verify error	<p>When data is written in the nonvolatile memory, the written data is read once for a check to verify the data matching.</p> <p>This alarm indicates that the written data is not matching.</p> <p>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.)</p> <p>Action: If the alarm is generated again after reconnecting the power, please contact IAI.</p>

Code	Error name	Cause/Action
0F6	Nonvolatile memory write timeout	<p>This alarm indicates that no response was made when data was written in the nonvolatile memory.</p> <p>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.)</p> <p>Action: If the alarm is generated again after reconnecting the power, please contact IAI.</p>
0F8	Damaged nonvolatile memory	<p>Abnormal data was detected during the nonvolatile memory check after starting.</p> <p>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.)</p> <p>Action: If the alarm is generated again after reconnecting the power, please contact IAI.</p>
0FA	CPU error	<p>The CPU was not operating properly.</p> <p>Cause: [1] Faulty CPU [2] Malfunction due to noise</p> <p>Action: If the alarm is generated again after reconnecting the power, please contact IAI.</p>

## 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 $20 \div 800 = 0.025$ 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	<p>These messages indicate an error in the serial communication with the controller.</p> <p>Cause: [1] Garbage data due to the effect of noise [2] Duplicate slave numbers when multiple controllers are controlled by serial communication.</p> <p>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.</p> <p>If the message is still displayed after taking the above actions, please contact IAI.</p>
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.
		<p>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.</p> <p>Also contact IAI.</p>
30C	No connected axis	<p>This message indicates that no controller axis number is recognized.</p> <p>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] There are duplicate axis numbers when multiple controllers are linked.</p> <p>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 the axis number settings are not duplicated.</p> <p>If the message is still displayed after taking the above actions, please contact IAI.</p>

## 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: Check / Change the parameters set in User Parameter No. 13 (Current Limit at Home Return).

Reference for setting is from 120% (when direction of home return is upwards) to the initial setting or 80% (when direction of home return is downwards).

[1] Review the loading mass if this is the cause.

[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."

- 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 accuracy 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 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 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.

## 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	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RA3C	Ball screw	20	800	10	Horizontal/vertical	12.5	500	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	250	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	125	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
					10	Horizontal/vertical	12.5	500	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	250	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	125	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
	RGS3C	Ball screw	20	800	10	Horizontal/vertical	12.5	500	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	250	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	125	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
					10	Horizontal/vertical	12.5	500	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	250	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	125	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
	RGD3C	Ball screw	20	800	10	Horizontal/vertical	12.5	500	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	250	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	125	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
					10	Horizontal/vertical	12.5	500	0.3	-	-	-
					5	Horizontal/vertical	6.25	250	0.3	-	-	-
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-
	RA3D	Ball screw	20	800	10	Horizontal/vertical	12.5	500	0.3	-	-	-
					5	Horizontal/vertical	6.25	250	0.3	-	-	-
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-
					10	Horizontal/vertical	12.5	500	0.3	-	-	-
					5	Horizontal/vertical	6.25	250	0.3	-	-	-
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-
RGS3D	Ball screw	20	800	10	Horizontal/vertical	12.5	500	0.3	-	-	-	
				5	Horizontal/vertical	6.25	250	0.3	-	-	-	
				2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	
				10	Horizontal/vertical	12.5	500	0.3	-	-	-	
				5	Horizontal/vertical	6.25	250	0.3	-	-	-	
				2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	
RGD3D	Ball screw	20	800	10	Horizontal/vertical	12.5	500	0.3	-	-	-	
				5	Horizontal/vertical	6.25	250	0.3	-	-	-	
				2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]	
RCA (rod type)	RA3R	Ball screw	20	800	10	Horizontal/vertical	12.5	500	0.3	-	-	-	
					5	Horizontal/vertical	6.25	250	0.3	-	-	-	
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	
					10	Horizontal/vertical	12.5	500	0.3	-	-	-	
					5	Horizontal/vertical	6.25	250	0.3	-	-	-	
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	
	RGD3R	Ball screw	20	800	10	Horizontal/vertical	12.5	500	0.3	-	-	-	
					5	Horizontal/vertical	6.25	250	0.3	-	-	-	
					2.5	Horizontal/vertical	3.12	125	0.2	-	-	-	
					12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-	
	RA4C	Ball screw	20	800	12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-	
			30		12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-	
	RGS4C	Ball screw	20	800	12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-	
			30		12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-	
					3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-	
		RGD4C	Ball screw	20	800	12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
						6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
						3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
				30		12	Horizontal/vertical	15	600	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
						6	Horizontal/vertical	7.5	300	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
						3	Horizontal/vertical	3.75	150	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-

\* Appendix

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (rod type)	RA4D	Ball screw	20	800	12	Horizontal/vertical	15	600	0.3	-	-	-
					6	Horizontal/vertical	7.5	300	0.3	-	-	-
					3	Horizontal/vertical	3.75	150	0.2	-	-	-
			12		Horizontal/vertical	15	600	0.3	-	-	-	
			6		Horizontal/vertical	7.5	300	0.3	-	-	-	
			3		Horizontal/vertical	3.75	150	0.2	-	-	-	
	RGS4D	Ball screw	20	800	12	Horizontal/vertical	15	600	0.3	-	-	-
					6	Horizontal/vertical	7.5	300	0.3	-	-	-
					3	Horizontal/vertical	3.75	150	0.2	-	-	-
			12		Horizontal/vertical	15	600	0.3	-	-	-	
			6		Horizontal/vertical	7.5	300	0.3	-	-	-	
			3		Horizontal/vertical	3.75	150	0.2	-	-	-	
	RGD4D	Ball screw	20	800	12	Horizontal/vertical	15	600	0.3	-	-	-
					6	Horizontal/vertical	7.5	300	0.3	-	-	-
					3	Horizontal/vertical	3.75	150	0.2	-	-	-
			12		Horizontal/vertical	15	600	0.3	-	-	-	
			6		Horizontal/vertical	7.5	300	0.3	-	-	-	
			3		Horizontal/vertical	3.75	150	0.2	-	-	-	
	RA4R	Ball screw	20	800	12	Horizontal/vertical	15	600	0.3	-	-	-
					6	Horizontal/vertical	7.5	300	0.3	-	-	-
					3	Horizontal/vertical	3.75	150	0.2	-	-	-
			12		Horizontal/vertical	15	600	0.3	-	-	-	
			6		Horizontal/vertical	7.5	300	0.3	-	-	-	
			3		Horizontal/vertical	3.75	150	0.2	-	-	-	

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]				
RCA (rod type)	RGD4R	Ball screw	20	800	12	Horizontal/vertical	15	600	0.3	-	-	-				
					6	Horizontal/vertical	7.5	300	0.3	-	-	-				
					3	Horizontal/vertical	3.75	150	0.2	-	-	-				
					12	Horizontal/vertical	15	600	0.3	-	-	-				
					6	Horizontal/vertical	7.5	300	0.3	-	-	-				
					3	Horizontal/vertical	3.75	150	0.2	-	-	-				
			30		12	Horizontal/vertical	15	600	0.3	-	-	-				
					6	Horizontal/vertical	7.5	300	0.3	-	-	-				
					3	Horizontal/vertical	3.75	150	0.2	-	-	-				
	SRA4R	Ball screw	20	800	5	Horizontal	6.25	250	0.3	-	-	-				
					5	Vertical			0.2	-	-	-				
					2.5	Horizontal	3.12	125	0.2	-	-	-				
					2.5	Vertical			0.2	-	-	-				
					SRGS4R	Ball screw	20	800	5	Horizontal	6.25	250	0.3	-	-	-
									5	Vertical			0.2	-	-	-
	2.5	Horizontal	3.12	125					0.2	-	-	-				
	2.5	Vertical							0.2	-	-	-				
	SRGD4R	Ball screw	20	800					5	Horizontal	6.25	250	0.3	-	-	-
									5	Vertical			0.2	-	-	-
					2.5	Horizontal	3.12	125	0.2	-	-	-				
					2.5	Vertical			0.2	-	-	-				



Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (slider type)	SA4C	Ball screw	20	800	10	Horizontal/vertical	12.5	665	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					5	Horizontal/vertical	6.25	330	Energy-saving spec.: 0.3 High acc/dec spec.: 1.0	-	-	-
					2.5	Horizontal/vertical	3.12	165	Energy-saving spec.: 0.2 High acc/dec spec.: 0.2	-	-	-
	SA4D	Ball screw	20	800	10	Horizontal/vertical	12.5	665	0.3	-	-	-
					5	Horizontal/vertical	6.25	330	0.3	-	-	-
					2.5	Horizontal/vertical	3.12	165	0.2	-	-	-
	SA4R	Ball screw	20	800	10	Horizontal/vertical	12.5	665	0.3	-	-	-
					5	Horizontal/vertical	6.25	330	0.3	-	-	-
					2.5	Horizontal/vertical	3.12	165	0.2	-	-	-
	SA5C	Ball screw	20	800	20	Horizontal	25	1300	Energy-saving spec.: 0.3	-	-	-
						Vertical		800	High acc/dec spec.: 0.8	-	-	-
					12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st)	Energy-saving spec.: 0.3 High acc/dec spec.: 0.8	-	-	-
					6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	Energy-saving spec.: 0.3 High acc/dec spec.: 0.8	-	-	-
	SA5D	Ball screw	20	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	-	-	-
					6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	-	-	-
					3	Horizontal/vertical	3.75	200 (at 50 to 450st) 190 (at 500st)	0.2	-	-	-
	SA5R	Ball screw	20	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	-	-	-
					6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	-	-	-
					3	Horizontal/vertical	3.75	200 (at 50 to 450st) 190 (at 500st)	0.2	-	-	-

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]				
RCA (slider type)	SA6C	Ball screw	30	800	20	Horizontal	25	1300 (at 50 to 500st) 1160 (at 550st) 990 (at 600st)	Energy-saving spec.: 0.3	-	-	-				
						Vertical		800	High acc/dec spec.: 0.8	-	-	-				
					12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	Energy-saving spec.: 0.3	-	-	-				
								High acc/dec spec.: 1.0								
						6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	Energy-saving spec.: 0.3	-	-	-			
					3	Horizontal/vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	Energy-saving spec.: 0.2	-	-	-				
								High acc/dec spec.: 0.2								
					SA6D	Ball screw	30	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	-	-	-
									6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	-	-	-
									3	Horizontal/vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	-	-	-
					SA6R	Ball screw	30	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	-	-	-
									6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	-	-	-
	3	Horizontal/vertical	3.75	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)					0.2	-	-	-				
	SS4D	Ball screw	20	800	10	Horizontal/vertical	12.5	665	0.3	-	-	-				
					5	Horizontal/vertical	6.25	330	0.3	-	-	-				
					2.5	Horizontal/vertical	3.12	165	0.2	-	-	-				
	SS5D	Ball screw	20	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st)	0.3	-	-	-				
					6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st)	0.3	-	-	-				
					3	Horizontal/vertical	3.25	200 (at 50 to 450st) 190 (at 500st)	0.2	-	-	-				

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA (slider type)	SS6D	Ball screw	30	800	12	Horizontal/vertical	15	800 (at 50 to 450st) 760 (at 500st) 640 (at 550st) 540 (at 600st)	0.3	-	-	-
					6	Horizontal/vertical	7.5	400 (at 50 to 450st) 380 (at 500st) 320 (at 550st) 270 (at 600st)	0.3	-	-	-
					3	Horizontal/vertical	3.25	200 (at 50 to 450st) 190 (at 500st) 160 (at 550st) 135 (at 600st)	0.2	-	-	-
RCA (arm type)	A4R	Ball screw	20	800	10	Horizontal/vertical	12.5	330	0.2	-	-	-
					5	Horizontal/vertical	6.25	165	0.2	-	-	-
	A5R	Ball screw	20	800	12	Horizontal/vertical	15	400	0.2	-	-	-
					6	Horizontal/vertical	7.5	200	0.2	-	-	-
	A6R	Ball screw	30	800	12	Horizontal/vertical	15	400	0.2	-	-	-
					6	Horizontal/vertical	7.5	200	0.2	-	-	-
RCA2 (rod type)	RN3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	RP3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	GS3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	GD3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	SD3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	RN4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
						Horizontal	3.81	200	0.3	-	-	-
Vertical												
Horizontal						1.90	100	0.2	-	-	-	
												Vertical
Lead screw		6	Horizontal	5.72	220	0.2	-	-	-			
										Vertical	0.2	-
		Horizontal	3.81	200	0.2	-	-	-				
									Vertical	0.2	-	-
		Horizontal	1.90	100	0.2	-	-	-				
									Vertical	0.2	-	-

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (rod type)	RP4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
		Lead screw			6	Horizontal	5.72	220	0.2	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	3.81	200	0.2	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	GS4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
		Lead screw			6	Horizontal	5.72	220	0.2	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	3.81	200	0.2	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	GD4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
		Lead screw			6	Horizontal	5.72	220	0.2	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	3.81	200	0.2	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	SD4N	Ball screw	20	1048	6	Horizontal	5.72	240 (at 25st) 300 (at 50 to 75st)	0.3	-	-	-
						Vertical		200 (at 25st) 300 (at 50 to 75st)	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-
		Lead screw			6	Horizontal	5.72	200 (at 25st) 300 (at 50 to 75st)	0.2	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	3.81	200	0.2	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical			0.2	-	-	-

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (slider type)	SA3C	Ball screw	10	800	6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	5	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	2.5	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	SA3R	Ball screw	10	800	6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	5	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	2.5	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	SA4C	Ball screw	20	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100 to 500st)	0.3	-	-	-
						Vertical			0.2	-	-	-
					5	Horizontal	6.25	250	0.3	-	-	-
						Vertical			0.2	-	-	-
					2.5	Horizontal	3.12	125	0.2	-	-	-
						Vertical			0.2	-	-	-
	SA4R	Ball screw	20	800	10	Horizontal	12.5	380 (at 50st) 500 (at 100 to 500st)	0.3	-	-	-
						Vertical			0.2	-	-	-
					5	Horizontal	6.25	250	0.3	-	-	-
						Vertical			0.2	-	-	-
					2.5	Horizontal	3.12	125	0.2	-	-	-
						Vertical			0.2	-	-	-

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]	
RCA2 (slider type)	SA5C	Ball screw	20	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.3	-	-	-	
						Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)					
					12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st)	0.3	-	-	-	
						Vertical		570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)					
					6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st)	0.3	-	-	-	
						Vertical		185 (at 750st) 165 (at 800st)					
					3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st)	0.2	-	-	-	
						Vertical		105 (at 700st) 90 (at 750st) 80 (at 800st)					
	SA5R	Ball screw	20	800	12	Horizontal	15	380 (at 50st) 540 (at 100st) 600 (at 150st to 550st)	0.3	-	-	-	-
						Vertical		570 (at 600st) 490 (at 650st) 425 (at 700st) 370 (at 750st) 330 (at 800st)					
					6	Horizontal	7.5	300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st)	0.3	-	-	-	
						Vertical		185 (at 750st) 165 (at 800st)					
					3	Horizontal	3.75	150 (at 50st to 550st) 140 (at 600st) 120 (at 650st)	0.2	-	-	-	
						Vertical		105 (at 700st) 90 (at 750st) 80 (at 800st)					



Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (slider type)	SA6C	Ball screw	30	800	20	Horizontal	25	380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 860 (at 250st) 940 (at 300st) 1000 (at 350 to 600st) 910 (at 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)	0.3	-	-	-
						Vertical		380 (at 50st) 540 (at 100st) 660 (at 150st) 770 (at 200st) 800 (at 250 to 650st) 790 (at 700st) 690 (at 750st) 610 (at 800st)				
					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	-	-	-
						Vertical		300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	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	-	-	-
						Vertical		150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	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	-	-	-
						Vertical		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)	0.2			
	SA6R	Ball screw	30	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	-	-	-
						Vertical		300 (at 50st to 550st) 285 (at 600st) 245 (at 650st) 210 (at 700st) 185 (at 750st) 165 (at 800st)	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	-	-	-
						Vertical		150 (at 50st to 550st) 140 (at 600st) 120 (at 650st) 105 (at 700st) 90 (at 750st) 80 (at 800st)	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	-	-	-
						Vertical		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)	0.2			

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (table type)	TC3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	TW3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	TF3N	Lead screw	10	1048	4	Horizontal/vertical	3.81	200	0.2	-	-	-
					2		1.90	100				
					1		0.95	50				
	TC4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical		200	0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical		100	0.2	-	-	-
		Lead screw	6	Horizontal	5.72	220	0.2	-	-	-		
				Vertical		220	0.2	-	-	-		
			4	Horizontal	3.81	200	0.2	-	-	-		
				Vertical		200	0.2	-	-	-		
			2	Horizontal	1.90	100	0.2	-	-	-		
				Vertical		100	0.2	-	-	-		
	TW4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical		200	0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical		100	0.2	-	-	-
		Lead screw	6	Horizontal	5.72	220	0.2	-	-	-		
				Vertical		220	0.2	-	-	-		
			4	Horizontal	3.81	200	0.2	-	-	-		
				Vertical		200	0.2	-	-	-		
			2	Horizontal	1.90	100	0.2	-	-	-		
				Vertical		100	0.2	-	-	-		
	TF4N	Ball screw	20	1048	6	Horizontal	5.72	270	0.3	-	-	-
						Vertical		220	0.2	-	-	-
					4	Horizontal	3.81	200	0.3	-	-	-
						Vertical		200	0.2	-	-	-
					2	Horizontal	1.90	100	0.2	-	-	-
						Vertical		100	0.2	-	-	-
		Lead screw	6	Horizontal	5.72	220	0.2	-	-	-		
				Vertical		220	0.2	-	-	-		
			4	Horizontal	3.81	200	0.2	-	-	-		
				Vertical		200	0.2	-	-	-		
			2	Horizontal	1.90	100	0.2	-	-	-		
				Vertical		100	0.2	-	-	-		
	TA4C	Ball screw	10	800	6	Horizontal	7.5	300	0.3	-	-	-
						Vertical		300	0.2	-	-	-
					4	Horizontal	5	200	0.3	-	-	-
Vertical						200		0.2	-	-	-	
2					Horizontal	2.5	100	0.2	-	-	-	
					Vertical		100	0.2	-	-	-	

\* Appendix

Actuator series	Type	Feed screw	Motor output [W]	No. of encoder pulses	Lead [mm]	Mounting direction	Minimum speed [mm/s]	Maximum speed [mm/s]	Maximum acceleration/ deceleration [G]	Minimum push force [N]	Maximum push force [N]	Rated push speed [mm/s]
RCA2 (table type)	TA4R	Ball screw	10	800	6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					4	Horizontal	5	200	0.3	-	-	-
						Vertical			0.2	-	-	-
					2	Horizontal	2.5	100	0.2	-	-	-
						Vertical			0.2	-	-	-
	TA5C	Ball screw	20	800	10	Horizontal	12.5	465	0.3	-	-	-
						Vertical		400	0.2	-	-	-
					5	Horizontal	6.25	250	0.3	-	-	-
						Vertical			0.2	-	-	-
					2.5	Horizontal	3.12	125	0.2	-	-	-
						Vertical			0.2	-	-	-
	TA5R	Ball screw	20	800	10	Horizontal	12.5	465	0.3	-	-	-
						Vertical		400	0.2	-	-	-
					5	Horizontal	6.25	250	0.3	-	-	-
						Vertical			0.2	-	-	-
					2.5	Horizontal	3.12	125	0.2	-	-	-
						Vertical			0.2	-	-	-
	TA6C	Ball screw	20	800	12	Horizontal	15	560	0.3	-	-	-
						Vertical		500	0.2	-	-	-
					6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					3	Horizontal	3.75	150	0.2	-	-	-
						Vertical			0.2	-	-	-
	TA6R	Ball screw	20	800	12	Horizontal	15	560	0.3	-	-	-
						Vertical		500	0.2	-	-	-
					6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					3	Horizontal	3.75	150	0.2	-	-	-
						Vertical			0.2	-	-	-
	TA7C	Ball screw	30	800	12	Horizontal	15	600	0.3	-	-	-
						Vertical		580	0.2	-	-	-
					6	Horizontal	7.5	300	0.3	-	-	-
						Vertical			0.2	-	-	-
					3	Horizontal	3.75	150	0.2	-	-	-
						Vertical			0.2	-	-	-
TA7R	Ball screw	30	800	12	Horizontal	15	600	0.3	-	-	-	
					Vertical		580	0.2	-	-	-	
				6	Horizontal	7.5	300	0.3	-	-	-	
					Vertical			0.2	-	-	-	
				3	Horizontal	3.75	150	0.2	-	-	-	
					Vertical			0.2	-	-	-	
RCL	RA1L	Linear	-	715	-	Horizontal/vertical	42	300	2	0.75	2	2
	RA2L			855		Horizontal/vertical	42	340	2	1.5	4	4
	RA3L			1145		Horizontal/vertical	42	450	2	3	8	8
	SA1L			715		Horizontal	42	420	2	-	-	-
	SA2L			855		Horizontal	42	460	2	-	-	-
	SA3L			1145		Horizontal	42	600	2	-	-	-
	SA4L			715		Horizontal	42	1200	2	-	-	-
	SM4L			715		Horizontal	42	1200	2	-	-	-
	SA5L			855		Horizontal	42	1400	2	-	-	-
	SM5L			855		Horizontal	42	1400	2	-	-	-
	SA6L			1145		Horizontal	42	1600	2	-	-	-
	SM6L			1145		Horizontal	42	1600	2	-	-	-

## Recording of Position-Data Table

Recorded date:

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	Stop 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	Stop 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	Stop mode
42													
43													
43													
44													
45													
46													
47													
48													
49													
50													
51													
52													
53													
54													
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57													
58													
59													
60													
61													
62													
63													

## Recording of Parameters

Recorded date: \_\_\_\_\_

- 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	
2	a	ZONL	Zone boundary 1-	mm	
3	a	LIMM	Soft limit+	mm	
4	a	LIML	Soft limit-	mm	
5	a	ORG	Home return direction (0: Reverse/1: Forward)	—	
6	b	PSWT	Push & hold stop judgment period	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	
13	b	ODPW	Current-limiting value during home return	%	
16	c	BRSL	SIO communication speed	bps	
17	c	RTIM	Minimum delay time for slave transmitter activation	msec	
18	b	AIOF	Home position sensor input polarity	—	
22	a	OFST	Home return offset	mm	
23	a	ZNM2	Zone boundary 2+	mm	
24	a	ZNL2	Zone boundary 2-	mm	
28	b	PHSP1	Default movement direction for excitation-phase signal detection (0: Reverse/1: Forward)		
29	b	PHSP2	Excitation-phase signal detection time	msec	
30	b	PHSP	Pole sense type (0: Current restraint/1: Distance restraint)	—	
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	Position complete signal output method (0: PEND: 1: INP)	—	
42	b	FPIO4	Enable function (0: Valid/1: Invalid)	—	
43	b	AIOF	Home position check sensor input polarity	—	
45	c	SIVM	Silent interval magnification	times	
46	b	OVRD	Speed override	%	
52	b	CTLF	Default acceleration/deceleration mode	—	
54	d	CLPF	Current control band number	—	
55	b	PLPF	Position command primary filter time constant	msec	
56	b	SCRV	S-shaped motion ratio setting	%	
71	d	PLFG	Position feed forward gain	—	
77	b	LEAD	Ball screw lead length	mm	

No.	Category	Symbol	Name	Unit	Default factory setting
78	b	ATYP	Axis operation type	-	
79	b	ATYP	Rotation axis mode selection	-	
80	b	ATYP	Rotation axis shortcut selection	-	
83	b	ETYP	ABS unit [0: Not used/1: Use]	-	
88	a	SWLM	Software limit margin	mm	
91	b	PSFC	Current-limiting value at stopping due to missed push-motion	-	

\* 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.

## Change History

Revision Date	Description of Revision
August 2007	First edition  2nd edition <ul style="list-style-type: none"> <li>• Added the description in 1, "24V Power Supplies When UL Certification Is Required" in CAUTION.</li> <li>• Added the description in 2, "Use Environment" in CAUTION.</li> </ul>
August 2008	3rd edition <ul style="list-style-type: none"> <li>• Changed the description from "serial communication protocol operation manual" to "ROBO Cylinder series serial communication operation manual" on page 1.</li> <li>• Change the contents of power capacity in Basic Specifications on page 12.</li> <li>• Changed the description in 3.2 and added "(former class 3 grounding)" in the sentence about class D grounding on page 17.</li> <li>• Deleted the sentence "The operation mode of PCON-SE is the same as the standard type of PCON-CY." and added the description regarding PIO patterns on page 33.</li> <li>• Changed the listed page of ACON-SE function list on page 34.</li> <li>• Deleted 4.3 on page 39.</li> <li>• Changed the item number from 4.4.1 to 4.3, description from "serial communication protocol operation manual" to "ROBO Cylinder series operation manual" and from "(Note)" to "*1" on pages 41 to 43.</li> <li>• Changed "(Note)" to "*2" on page 44.</li> <li>• Added the annotation * on pages 45 and 46.</li> </ul>
March 2009	4th edition <ul style="list-style-type: none"> <li>• Added a page about changing the zone function in the beginning.</li> <li>• Deleted the differences on control between the air cylinder on pages 4 and 5.</li> <li>• Added the additional models on page 4.</li> <li>• Changed the teaching drawing to CON-T on pages 6 and 26.</li> <li>• Corrected the specification (added current value of additional models and encoder resolution) on page 10.</li> <li>• Unified the signage about noise elimination measure with other models on pages 15 and 16.</li> <li>• Added the description about grounding on the positive side on page 28.</li> <li>• Added the detailed explanation about handling of eCON connector on pages 29 and 30.</li> <li>• Corrected the input signal time on pages 50 and 64.</li> <li>• Added the additional parameters o No.77 or later on pages 68, 69, 77 and 78.</li> <li>• Added the error code: 0A7, 0B5, 0D2, 0DC, 0A9 and 0B4 on pages 85 to 90.</li> <li>• Added the additional models on pages 97 to 99.</li> </ul>

Revision Date	Description of Revision
October 2009	5th edition <ul style="list-style-type: none"> <li>• Added the slim compact type on the number of encoder pulses in the specification on page 10.</li> <li>• Updated the cable drawing on pages 24 and 25.</li> <li>• Added the explanation of S-shaped motion on page 76.</li> <li>• Added the cause of error 0B5 and absolute error on page 85.</li> </ul>
February 2010	6th edition <ul style="list-style-type: none"> <li>• Added the description about CE Marking.</li> </ul>
April 2010	7th edition <ul style="list-style-type: none"> <li>• Added "Please Read Before Use" on the first page after the cover.</li> <li>• Added "Safety Guide" on the first page after the Table of Contents.</li> <li>• Added "Change History" on the last page.</li> <li>• Updated the back cover to the latest one. (Changed the addresses of headquarters and sales offices, 24-hour customer service Eight, etc.)</li> </ul>
July 2010	8th edition <ul style="list-style-type: none"> <li>• Replaced the warning on page 55.</li> </ul>
August 2010	9th edition <ul style="list-style-type: none"> <li>• Added the caution about S-shaped acceleration/deceleration function.</li> </ul>
January 2011	10th edition <ul style="list-style-type: none"> <li>• Correction made in "Speed loop integral gain" in P.90</li> </ul>
April 2011	11th edition <ul style="list-style-type: none"> <li>• Swapped over the page for CE Marking</li> </ul>
July 2011	12th edition <ul style="list-style-type: none"> <li>• Contents changed in 1.6 Warranty in P.16 to P.17</li> <li>• Contents changed and added in Appendix: List of Specifications of Connectable Actuators.</li> </ul>
December 2012	13th edition <ul style="list-style-type: none"> <li>• Explanation changed for home return current (Parameter No. 13) in P. 79 and 103</li> <li>• Added "D2 Error" in P. 95</li> </ul>
March 2015	13th C edition <ul style="list-style-type: none"> <li>• Correction made to moto maximum current at 30 watts (4.0 to 4.4A) in 18</li> </ul>







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