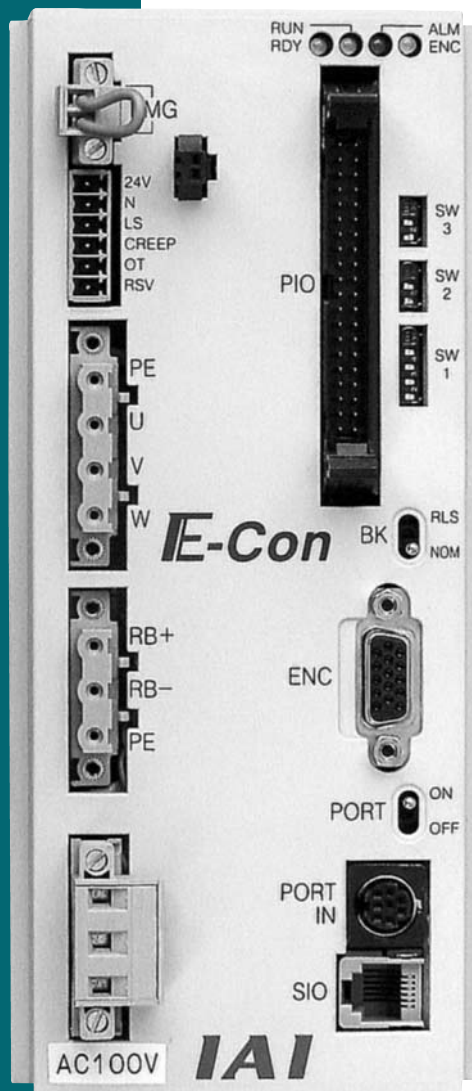


E-Con

E-Con Controller

Operation Manual Fifteenth 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.

(1) Hold · Servo ON Signal

When operating the E-Con Controller, you will need to turn ON the Hold & Servo ON signal Input Signal of PIO.



In case the Hold Stop Input Signal of PIO remains OFF, E-CON will not move due to hold status. Therefore, please be careful.

(2) Although the exterior of the power supply 100V type controller and 200V type controller is the same, applying 200V to the 100 type controller will cause damage. Please be extra careful when connecting power.

(3) Position 0 may be output regardless of the actual position. At the timings specified below, the positioning completion signal turns ON no matter where the actual position is. As a result, the output status becomes "Position 0."

1. When the power is turned on
 2. When the emergency stop is reset
 3. When the alarm is reset
 4. When a reset is performed after hold
- Be extra careful when using Position 0.

(4) With the absolute type, 0E5 (Encoder Reception Error) will be displayed under certain conditions, such as when the power is first turned on after disconnecting the battery or PG cable. This display does not indicate fault. Perform an absolute reset in accordance with the specified procedure.

(5) Recommendation for backing up latest data

This controller uses nonvolatile memory to store position table data and parameters. Although data in the memory is retained even after the power is cut off, the stored data will be lost if the nonvolatile memory is damaged.

It is therefore recommended that you regularly back up the latest position table data and parameters in case of accidental data loss. Regular backup will also let you restore data quickly if the controller must be replaced for other reasons.

Use the following methods to back up data:

- [1] Use the PC software to save the data to a CD or FD.
- [2] Create a position table sheet or parameter sheet and keep a written record of backup.

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Safety Guide

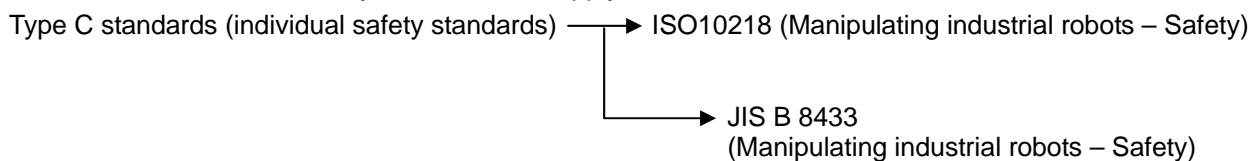
When designing and manufacturing a robot system, ensure safety by following the safety guides provided below and taking the necessary measures.

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
		Not cut off	Preparation of work rules	Article 150-3
			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 mm³ including the end 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 1 to 3
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">● 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">[1] Medical devices relating to maintenance, management, etc., of life or health[2] Mechanisms or mechanical devices (vehicles, railway facilities, aircraft facilities, etc.) intended to move or transport people[3] Important safety parts in mechanical devices (safety devices, etc.)● Do not use this product in the following environments:<ul style="list-style-type: none">[1] Place subject to flammable gases, ignitable objects, flammables, explosives, etc.[2] Place that may be exposed to radiation[3] Place where the surrounding air temperature or relative humidity exceeds the specified range[4] Place subject to direct sunlight or radiated heat from large heat sources[5] Place subject to sudden temperature shift and condensation[6] Place subject to corrosive gases (sulfuric acid, hydrochloric acid, etc.)[7] Place subject to excessive dust, salt or iron powder[8] Place where the product receives direct vibration or impact● 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.
2	Transportation	<ul style="list-style-type: none">● When transporting the product, exercise due caution not to bump or drop the product.● Use appropriate means for transportation.● Do not step on the package.● Do not place on the package any heavy article that may deform the package.● 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.● When using a crane or other equipment, never use it to hoist any article exceeding the rated load of the applicable crane, etc.● 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.● Do not climb onto the article being hoisted.● Do not keep the article hoisted.● Do not stand under the hoisted article.
3	Storage/preservation	<ul style="list-style-type: none">● The storage/preservation environment should conform to the installation environment. Among others, be careful not to cause condensation.
4	Installation/startup	<p>(1) Installing the robot, controller, etc.</p> <ul style="list-style-type: none">● Be sure to firmly secure and affix the product (including its work part). If the product tips over, drops, malfunctions, etc., damage or injury may result.● 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.● If the product is used in any of the following places, provide sufficient shielding measures:<ul style="list-style-type: none">[1] Place subject to electrical noise[2] Place subject to a strong electric or magnetic field[3] Place where power lines or drive lines are wired nearby[4] Place subject to splashed water, oil or chemicals

4	Installation/ startup	<p>(2) Wiring the cables</p> <ul style="list-style-type: none"> ● Use IAI's genuine cables to connect the actuator and controller or connect a teaching tool, etc. ● 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. ● Wire the product correctly after turning off the power. ● 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. ● Securely connect the cables and connectors so that they will not be disconnected or come loose. Failing to do so may result in fire, electric shock or product malfunction. ● 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. <p>(3) Grounding</p> <ul style="list-style-type: none"> ● 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. <p>(4) Safety measures</p> <ul style="list-style-type: none"> ● 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. ● Be sure to provide an emergency stop circuit so that the product can be stopped immediately in case of emergency during operation. ● 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. ● 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. ● 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. ● Implement measures to prevent the work part, etc., from dropping due to a power outage or emergency stop. ● Ensure safety by wearing protective gloves, protective goggles and/or safety shoes, as necessary. ● Do not insert fingers and objects into openings in the product. Doing so may result in injury, electric shock, product damage, fire, etc. ● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight.
5	Teaching	<ul style="list-style-type: none"> ● 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. ● 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. ● 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. ● Put up a sign saying "WORK IN PROGRESS" in a conspicuous location. ● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight. <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>

6	Confirmation operation	<ul style="list-style-type: none">● After teaching or programming, carry out step-by-step confirmation operation before switching to automatic operation.● When carrying out confirmation operation inside the safety fences, follow the specified work procedure just like during teaching.● 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.● 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.
7	Automatic operation	<ul style="list-style-type: none">● Before commencing automatic operation, make sure no one is inside the safety fences.● Before commencing automatic operation, make sure all related peripherals are ready to operate in the auto mode and no abnormalities are displayed or indicated.● Be sure to start automatic operation from outside the safety fences.● 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.● 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.
8	Maintenance/ inspection	<ul style="list-style-type: none">● 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.● When working inside the safety fences, turn off the power switch, as a rule.● 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.● 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.● Put up a sign saying "WORK IN PROGRESS" in a conspicuous location.● Use appropriate grease for the guides and ball screws by checking the operation manual for each model.● Do not perform a withstand voltage test. Conducting this test may result in product damage.● When releasing the brake of a vertically installed actuator, be careful not to pinch your hand or damage the work part, etc., due to the slider dropping by its dead weight. <p>* Safety fences --- Indicate the movement range if safety fences are not provided.</p>
9	Modification	<ul style="list-style-type: none">● The customer must not modify or disassemble/assemble the product or use maintenance parts not specified in the manual without first consulting IAI.● Any damage or loss resulting from the above actions will be excluded from the scope of warranty.
10	Disposal	<ul style="list-style-type: none">● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste.● When disposing of the product, do not throw it into fire. The product may explode or generate toxic gases.

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.	 Danger
Warning	Failure to observe the instruction may result in death or serious injury.	 Warning
Caution	Failure to observe the instruction may result in injury or property damage.	 Caution
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.	 Note

IE-Con _____

1. Overview

1-1 Forward

Thank you very much for purchasing the E-Con Controller. This manual explains the features of this machine and its operating procedures.

Without knowing beforehand how to correctly use or operate the controller, not only will the user be unable to take full advantage of all the functions built into this product but the user might also, inadvertently cause damage to the robot or shorten its life. Please read this manual as well as other manuals carefully pertaining to the product to acquire an understanding of the proper method of handling and operating the controller. Keep this manual handy so that you can refer to the appropriate sections as the need arises.

Also refer to the operation manuals for the various actuators you are using, as well as the operation manual(s) for the optional PC software and/or teaching pendant if applicable.

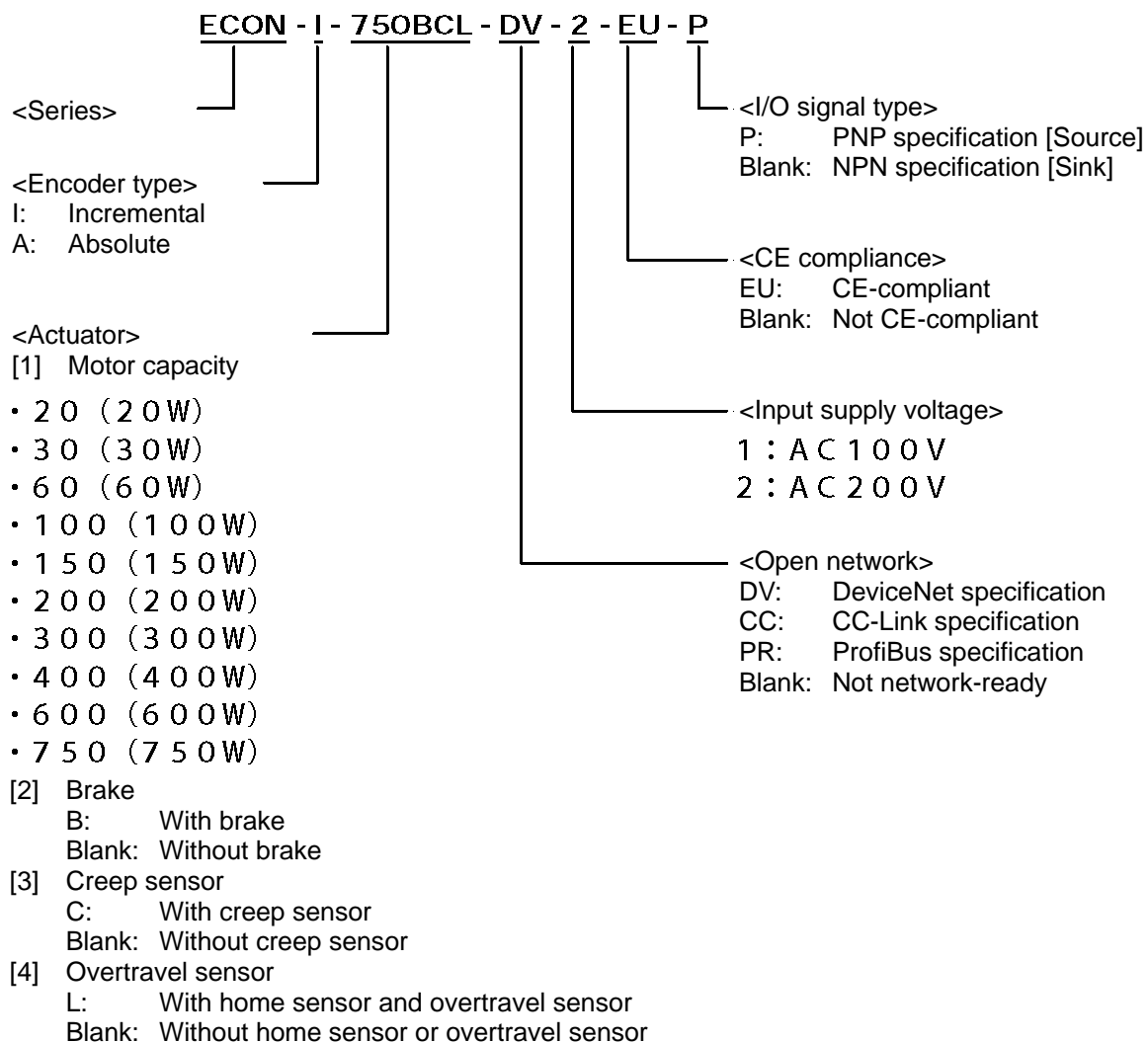
Absolute Specifications:

- With the absolute home controller, once power is applied, and absolute reset is executed, you can execute positioning without the need to home after reapplying the power. Other basic functions are the same as the standard E-Con Controller.
- Absolute reset is not set at time of shipment. Please execute absolute reset by yourself.
- Only the absolute actuator can be operated using the E-Con Controller absolute specification. The incremental actuator cannot be used.
- Notes on installing the absolute data backup battery
Follow the steps below to install the battery in order to initialize the battery circuit and thereby prevent the battery from being consumed early:
 - (1) Connect the encoder cable.
 - (2) Turn on the power.
 - (3) Install the absolute data backup battery.Be sure to perform the above operation after the encoder cable is disconnected for relocation, etc.

- Actuator Duty
Operate IAI's actuator at a duty of 50% or less to maintain an optimum balance between its service life and precision. The duty is calculated using the formula below:

$$\text{Duty (\%)} = \text{Operating time} / (\text{Operating time} + \text{Stationary time}) \times 100$$

1-2 How to Read Model Number



- **Controller Version**

A "SERIAL No." label is attached on the right side face of the controller.

The last two characters (alphabet and number) in the portion following SERIAL No. indicate the controller version.

Example) If the label reads "SERIAL No. ET352720 I3," the controller version is "I3."

When the controller version is increased, the alphabet changes in an alphabetical order while the number is incremented by one.

The specifications of the controller vary slightly, depending on the version

* All precautions have been taken to ensure the precision of the contents of this manual. However, if you become aware of any inaccuracies or discrepancies, please contact IAI.

Keep this manual in a handy place so that you can reference it quickly as necessary.

1-3 Safety Precautions

Please read the following information carefully in order to gain an understanding of safety precautions.
--

This product was developed as components for driving automated equipment and is designed not to produce greater torque or speed than is necessary. However, strictly observe the following items to prevent any accidents from occurring.

1. As a rule, any handling or operating methods not described in this manual should be viewed as things that should not be attempted. Please contact IAI if any portion of the contents of this manual are unclear.
2. Use only the products specified for wiring between the actuator and controller.
3. Stand clear of the operating range of the machine when it is in motion or is ready to operate (when the control power is on). Surround the system with safety partitions if there is a possibility that people can enter the area where the machine is being used.
4. When assembling, adjusting, or performing maintenance on the machine, always disengage the power supply to the controller. During work, display a sign stating work in progress where it is readily visible. Also, keep the power cable close to the operator so that another person cannot inadvertently switch on the power.
5. When more than one person is working on the system, agree on signals beforehand to ensure everyone's safety before beginning work. In particular, when doing work involving axis movement, always call out for everyone's safety regardless of whether power is ON or OFF, or the axis is to be mechanically driven or manually moved.
6. When the user needs to lengthen the cables, check the wiring carefully to make sure it is correct before turning the power ON since miswiring can lead to malfunction.

1-4 Warranty Period and Scope of Warranty

The E-Con Controller undergoes stringent testing before it is shipped from our factory. IAI provides the following warranty:

1. Warranty Period

The warranty period expires upon elapse of one of the following periods, whichever occurs first.

- 18 months after the shipment from IAI
- 12 months after delivery to the location specified by the user.

2. Scope of Warranty

If within the period specified above, a breakdown occurs while operating the controller under normal conditions and is clearly the responsibility of the manufacturer, IAI will repair the unit at no cost. However, the following items are not covered by this warranty:

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use (battery, etc.).
- Unit seems to be noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling or use.
- Damage resulting from user error or failure to perform proper maintenance.
- Use of any part which is not a genuine part of IAI
- Any alterations not authorized by IAI or its representatives, including parameters.
- Damage caused by fire and other natural disasters or accidents.

The warranty pertains to the purchased product itself and does not cover any loss that might arise from a breakdown of the product. Any repairs will be done at our factory.

Make sure you understand the foregoing terms of warranty.

1-5 Setting Environment and Noise Measures

Please be careful for controller setting environment

1-5-1 Installation Environment

This controller can be used in an environment of pollution degree 2*¹ or equivalent.

*1 Pollution degree 2: Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.
(EN60947-5-1)

- (1) Do NOT block the air vents of your controller when installing your IA system.
(Unavailability of sufficient ventilation not only prevents the controller from demonstrating its designed performance, but it may also lead to a controller failure.)
- (2) Prevent foreign matters from entering the controller through the vent holes. Your controller is NOT dust, water, or oil proof. Avoid using your IA system in environments subject to contamination by dust, oil, mist, or cutting oil.
- (3) Do not expose your IA system to direct sunlight or radiation heat from a large heat source such as heat treat furnace, etc.
- (4) Avoid placing your IA system under conditions of extreme temperatures above 40°C or below 0°C. The level of humidity should not be exceed 85%. Do NOT expose to corrosive or inflammable gas.
- (5) Avoid external vibration, unnecessary impact, or excessive shocks to your controller.
- (6) Take steps to shield controllers and wiring cables from electromagnetic noise.

1-5-2 Power Source

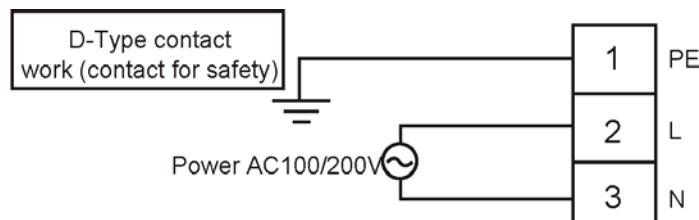
There are AC 100 V and AC 200 V depending on the controller specification.

1-5-3 Noise Elimination Measures and Grounding

(1) Wiring and Power Supply

The PE terminal on the power-supply terminal block is used for safety grounding. Provide a class D grounding connection to this terminal.

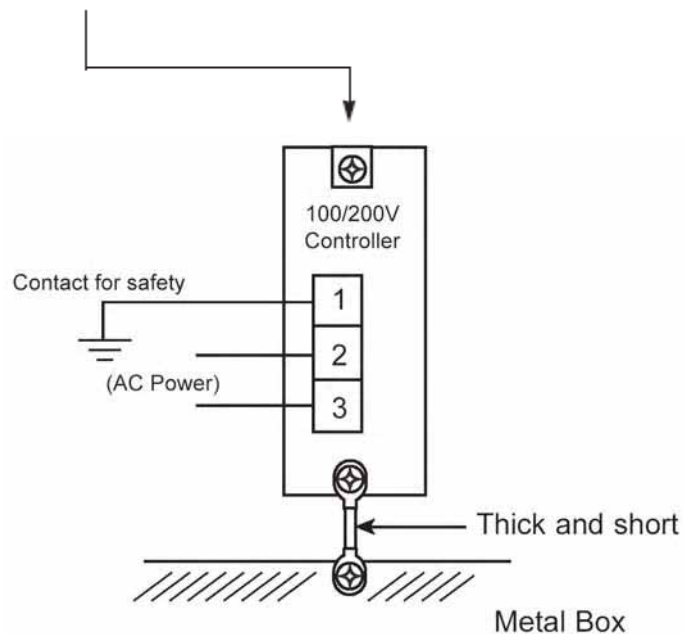
The thickness of the cable should be 0.75 mm² (#18AWG) or larger and above AC cables.



(2) Noise Elimination Grounding

You will need to set noise compliance and grounding whether AC 100 or 200 V.

1. Directly screw the main body to the metal box.



2. Wiring Notes

Isolate the controller cable from high power lines such as motor circuits (Do not bundle, and do not place in the same piping circuit).

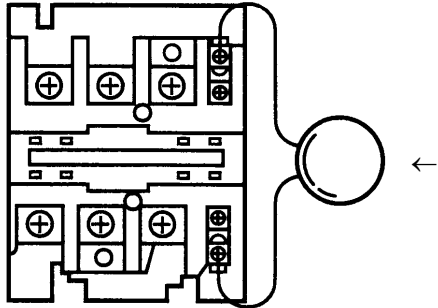
Consult with IAI's technical service department or sales engineering department if you need longer motor and encoder cables than what comes with the controller.

(3) Noise Source and Noise Suppression

When using electrical components such as electromagnets, solenoid valve, magnet switch or relays which create electromagnetic noise, some type of noise suppression device should be used.

1. AC solenoid valve · magnetic switch · relay

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



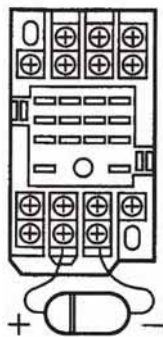
Point

Install a surge absorber to each coil over a minimum wiring length.

Installing a surge absorber to the terminal block or other part will be less effective because of a longer distance from the coil.

2. DC solenoid valve · magnetic switch · relay

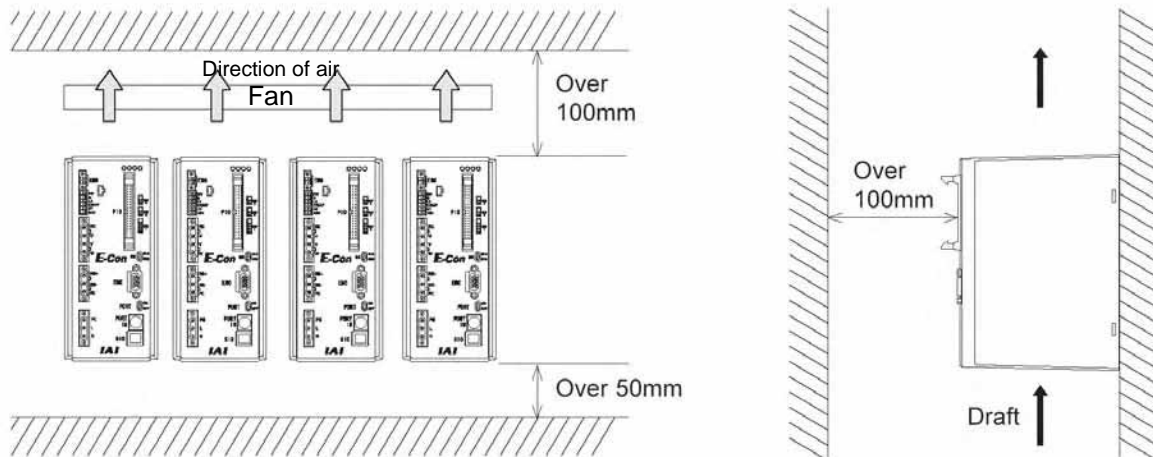
Measure: Install a diode in parallel with the coil. Determine the diode capacity in accordance with the load capacity.



In a DC circuit, connecting a diode in reverse polarity will damage the diode, internal parts of the controller and/or DC power supply, so exercise due caution.

1-6 Heat Dissipation and Mounting

The size of the controller panel, controller position and cooling method should all be designed so that the controller boundary temperature remains under 40°C. As the diagram below shows, mount vertically (wall mounting). Controllers are cooled by active ventilation (blowing upward). For installation, make sure to leave more than 100mm of space above and 50mm of space below the controller, following this direction. When mounting with several controllers lined up, also mount an agitator fan above the controllers in order to maintain surrounding air temperature. In addition, the spacing between the controller front side and wall (cover) should be more than 100mm.



As for the spacing in between the controllers, whether or not it's a single controller or multiple controllers, please leave enough space so that controller mounting and removal may be done easily.

2. Specifications

2-1 Basic Specifications

Item			Specification	
Power Voltage			Motor Capacity: 20 to 200 W	Single phase AC 90 to 125 V
			20 to 750 W	Single phase AC 180 to 250 V
Power Current / Capacity (Note 1)			Motor capacity: 30 W or less	Rating: 60 W/100 VA
			60 W	100 W / 160 VA
			100 W	150 W / 240 VA
			150 W	210 W / 350 VA
			200 W	270 W / 450 VA
			400 W	520 W / 870 VA
			600 W	770 W / 1300 VA
			750 W	1000 W / 1600 VA
Rush current (Maximum, instantaneous) (Note 2)			Single phase AC 90 to 125 V	44 A
			Single phase AC 180 to 250 V	200 W or less/88 A, 400 W or more/112 A
Unit Weight			1,200 g (Standard), 1,500 g (Absolute specification)	
Surrounding Air Temperature / Humidity			Temperature: 0 to 40°C, Humidity: Less than 85%RH	
Surrounding Environment			IP 10 (No Corrosive Gas)	
Protective Function			Motor overvoltage, motor overcurrent, driver temperature error, encoder error, motor overload, etc.	
Withstand voltage (Note 3)			1500 VAC, 1 minute	
LED Display			RDY (green), RUN (green), ALM (red), ENC (orange)	
DI/DO Interface			24 VDC Isolation	
I/O Signal	PIO	Exclusive Input 10 port	Start	
			Command Position Number (6 bit Binary)	
			Hold	
			Reset	
			Servo ON	
		Exclusive Output 13 port	Complete Position Number (6 bit Binary)	
			Complete Positioning	
			Complete Homing	
			Zone	
			Emergency Stop	
			Alarm	
			Moving	
			Battery Alarm	
	SIO		Termi-Bus communication protocol	
Position Number			64 points	
Data Input Method			Teaching Pendant or PC Interface Software	
Regenerative Resistance Unit (Note 4)			Motor Capacity	
			60 to 150 W	Integrated into the controller
			200 to 750 W	External unit
Accessories			PIO Flat Cable, Power Connector, EMG Connector	

*Note 1: Instantaneous value is 3 times more.

*Note 2: Select a medium-speed NFB.

*Note 3: The withstand voltage of the motor used in the actuator is 1000 V for 1 minute. Before performing a withstand voltage test with the controller and actuator connected, make sure that the supplied voltage will not exceed 1000 V for a period over 1 minute.

*Note 4: Whether you need an external unit or not, it depends on condition of usage. Refer to 7, "Regenerative Resistance Unit (Optional)."

2.1.1 Backup Battery (Absolute Specification)

(1) Battery Specifications

Item	Description
Model Number	AB-1
Type	Lithium battery
Manufacturer	Toshiba Battery (ER6VP)
Nominal voltage	3.6 V
Rated capacity	2000 mAh
Weight	Approx. 8.5 g
Battery retention time *1	Approx. 20,000 hours (at surrounding air temperature of 20°C)

Note 1) The current consumption during absolute data backup is approx. 100 μ A (approx. 4 μ A if the main controller power is on).

* To avoid breakdown, do not attempt to modify or extend the battery cable.

* The battery is always replaced together with the battery board. The battery cannot be replaced separately. Only use the battery specified by IAI.

(2) Battery Alarm and Battery Error

Once the battery voltage has dropped to approx. 3.1 V, a battery alarm occurs (alarm code: 07A). This alarm is output to PIO connector pin 7. The controller does not stop operating immediately upon occurrence of a battery alarm. The alarm merely alerts the user that the battery must be replaced as soon as possible. After a battery alarm occurs, the controller can still operate for approx. 220 hours (approx. 9 days) before a battery error occurs.

To temporarily reset the battery alarm, input a reset signal or press the **BEGIN/END** key on the teaching pendant for at least 2.5 seconds.

Note) The battery alarm function is supported on controllers of version H2 or later.

Once the battery voltage has dropped to approx. 2.5 V, a battery error occurs. This error (alarm code: 0E5) will be detected the next time the controller power is turned on. A battery error is detected only after the controller power has been turned on.

The controller can no longer operate once a battery error occurs. You must replace the battery and perform an absolute reset.

If the battery was replaced when the controller power was off, the retention condition of position information (absolute data) will vary as follows, depending on how long the controller has been out of battery.

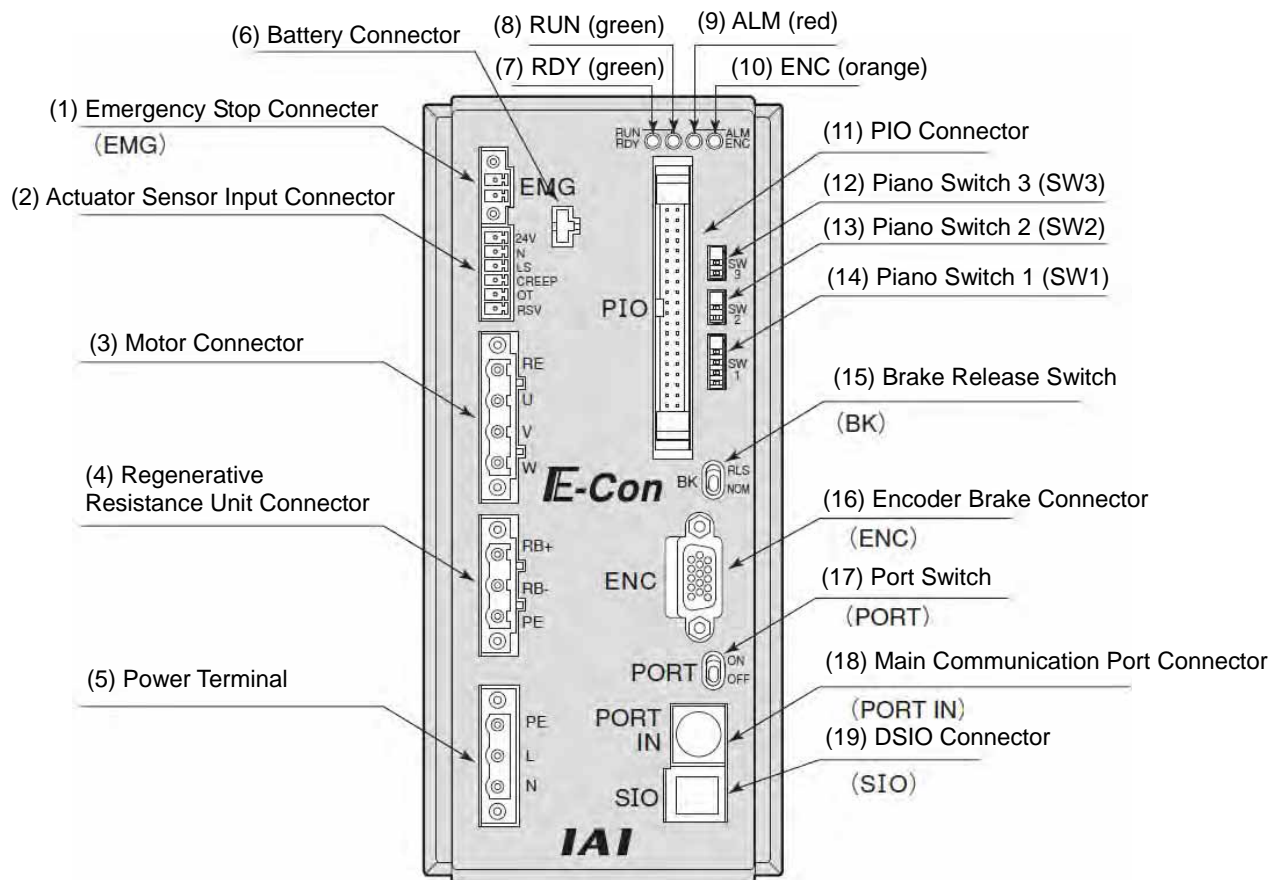
Battery-out duration	Retention condition of position information (absolute data)
Less than 5 minutes	Position information (absolute data) has been retained. Absolute reset is not required.
5 to 15 minutes	A battery alarm occurs. Position information has been retained. Absolute reset is not required.
More than 15 minutes	A battery error occurs. Position information has not been retained. Absolute reset is required.

Note) The function to retain position information (absolute data) during battery replacement is supported on controllers of version H2 or later.

If a battery error was present prior to the replacement, an absolute reset is required even when the battery has been out for less than 15 minutes.

2-2 Name of Parts and Functions

2-2-1 Names



2-2-2 Functions

(1) Emergency Stop Connector

EMG: This is a terminal block for emergency stop. B contact when open. It is connected at the time of shipment.

(2) Actuator Sensor Input Connector

This is a connector for Limit Switch (LS) · CREEP · Over Travel (OT) sensor.

(3) Motor Connector

This is the connector for the motor power cable of the actuator.

(4) Regenerative Resistance Unit Connector

This is the connector for the Regenerative Resistance Unit. Necessity depends on user application conditions.

(5) Power Terminal

L · N: This is the connection from the AC Power source.
PE: This is contact for safety (D Type contact work)

(6) Battery Connector

This is the connector for the absolute encoder backup battery (absolute specifications).

(7~10) LED Display

- (7) RDY(green): Turns on when no alarm is present or no emergency stop is actuated.
- (8) RUN (green): Turns on when the servo is ON and the actuator is moving.
- (9) ALM (red): Turns on during alarm.
- (10) ENC (orange): This will turn on when encoder breaks or not detected.

(11) PIO connector (PIO)

Connector for the PIO cable.

(12) Piano switch 3 (SW3)

This is the interchange switch for encoder voltage. This is used when voltage drop must be considered for special cable application. Interchange assembly of 1 and 2 will change the encoder voltage as follows:

1	2	Applicable Cable Length
ON	OFF	~ 15 m
OFF	ON	15 to 25 m
ON	ON	25 to 30 m

Caution: Piano Switch number starts from the bottom side.

(13) Piano switch 2 (SW2)

1: Clears ABS-CLR and absolute encoder data. This is used when resetting the absolute: Normally (Bottom) OFF

2: FWP, Light Protect Switch. This is used during remote-UP: Normally OFF (Top)

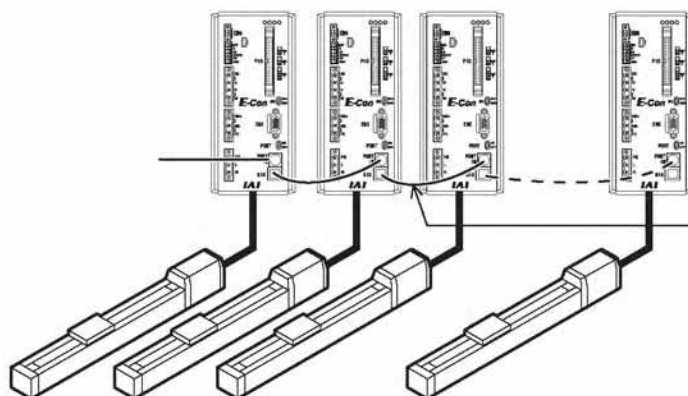
* The piano switch turns ON when tilted to right, and turns OFF when tilted to left, as viewed from the front side.

(14) Piano switch 1 (SW1)

Piano Switch 1~4: Axis number setting switch

When connecting more than 2 axes onto the SIO Connector, serial reorganization occurs when setting the actuator axis number. You may set up to 0~15 axes (at the time of shipment, numbers 1~4 are all set as OFF. This application is for single axis unit). For every controller, please set the piano switch and set the desired axis number. As for the number, make sure that the same number is not used for more than controller. As long as all numbers are unique, they may not be consecutive or some numbers may be skipped in between.

Axis Number	Piano Switch Number			
	1	2	3	4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON



Please note:
The controller link cable length is 200mm.
The controllers can be connected up to a maximum of 16 units.

Caution: In case of number of axes greater than 1, the emergency stop of the teaching pendant will only effect the controller axis connected to the teaching pendant.

(15) Brake Release Switch (BK)

Effective when only break option is selected.

RLS: Release position turns the brake OFF.

NOM: Normal position makes the brake active. (normal setting)

(16) Encoder • Brake Connector (ENC)

This is the connector for Encoder & Brake power cable.

(17) Port Switch (PORT)

ON: PORT IN Port (Teaching Pendant · PC Software) will be activated. However, in case of exclusive teaching pendant and exclusive cables are not connected, emergency stop status will occur.

OFF: PORT IN Port (Teaching Pendant · PC Software) will be deactivated (Since SIO line is hot, communication between the controllers will be possible).

(18) Main Communication Port Connector (PORT IN)

This is the connector for the teaching pendant or external device communication cable.

This is also the connector for the controller link cable for connection with two or more axes.

(19) SIO Connector (SIO)

This is the connector for connection between controllers when connecting two or more controllers.

2-2-3 Signal Tables for Connectors and Terminal Blocks

- SIO Connector

Pin. No	Signal Name	Function
1	(+5 V)	(5 VDC Power Output) or (Reserve Signal Terminal)
2	S GA	Line transceiver I/O positive logic side
3	G ND	Ground for communication
4	S GB	Line Transceiver I/O negative logic side
5	G ND	Ground for communication
6	+5 V	5 VDC Power Output

- Main Communication Port Connector

Pin. No	Signal Name	Function
1	SGA	Serial Communication
2	SGB	Serial Communication
3	5 V	5 V Power Output
4	EMGS	Emergency Stop Status
5	EMGA	*1
6	24 V	24 V Power Point
7	GND	Ground
8	EMGB	*1

*Note 1: This is used as an emergency stop (B contact).
When disconnecting the emergency stop, please short-circuit.

- Motor Connector (GIC2.5/4-STF-7.62 Phoenix Contact)

Signal Name	Connection Line
PE	Motor FG
U	Motor U Phase
V	Motor V Phase
W	Motor W Phase


- Encoder · Brake Connector (D-Sub DE-15 Type)

Pin. No	Signal Name	Connection Line
1	EN A+	Encoder A+
2	EN A-	Encoder A-
3	EN B+	Encoder B+
4	EN B-	Encoder B-
5	EN Z+	Encoder Z+
6	EN Z-	Encoder Z-
7	SD+	Encoder SD+
8	SD-	Encoder SD-
9	BAT+	(Battery +)
10	GND	(Battery -)
11	EN5	Encoder 5 V+
12	EN GND	Encoder COM-
13	BK N	Brake -
14	BK P	Brake +
15	FG	Shield

- Power Terminal Board (GMSTB2.5/3-STF-7.62 Phoenix Contact)

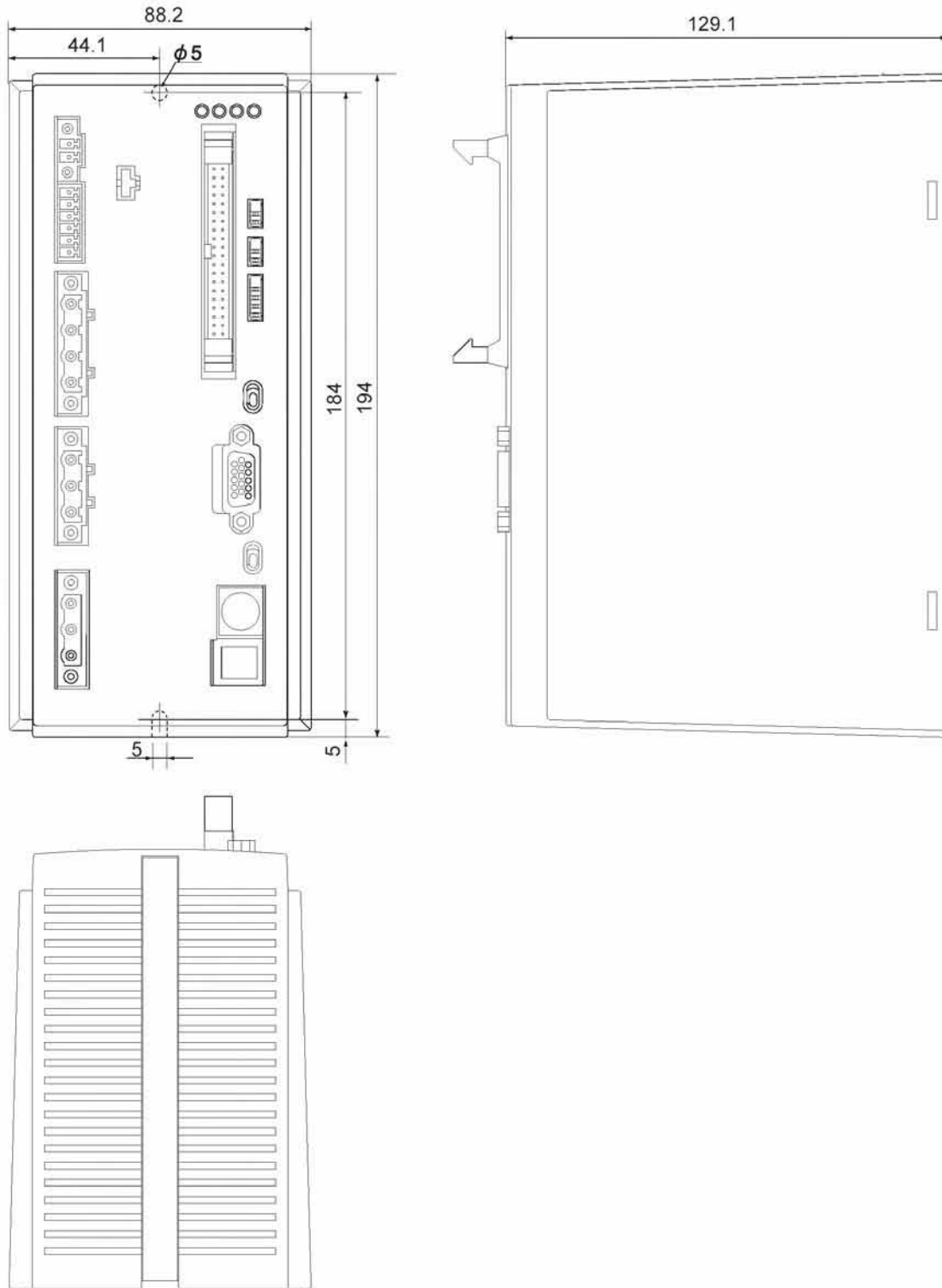
Signal Name	Connection Line
PE	Ground
L	Live side of the AC single-phase power supply
N	Grounded side of the AC single-phase power supply

- Power and Emergency Stop Terminal Board (MC1.5/2-STF-3.81 Phoenix Contact)

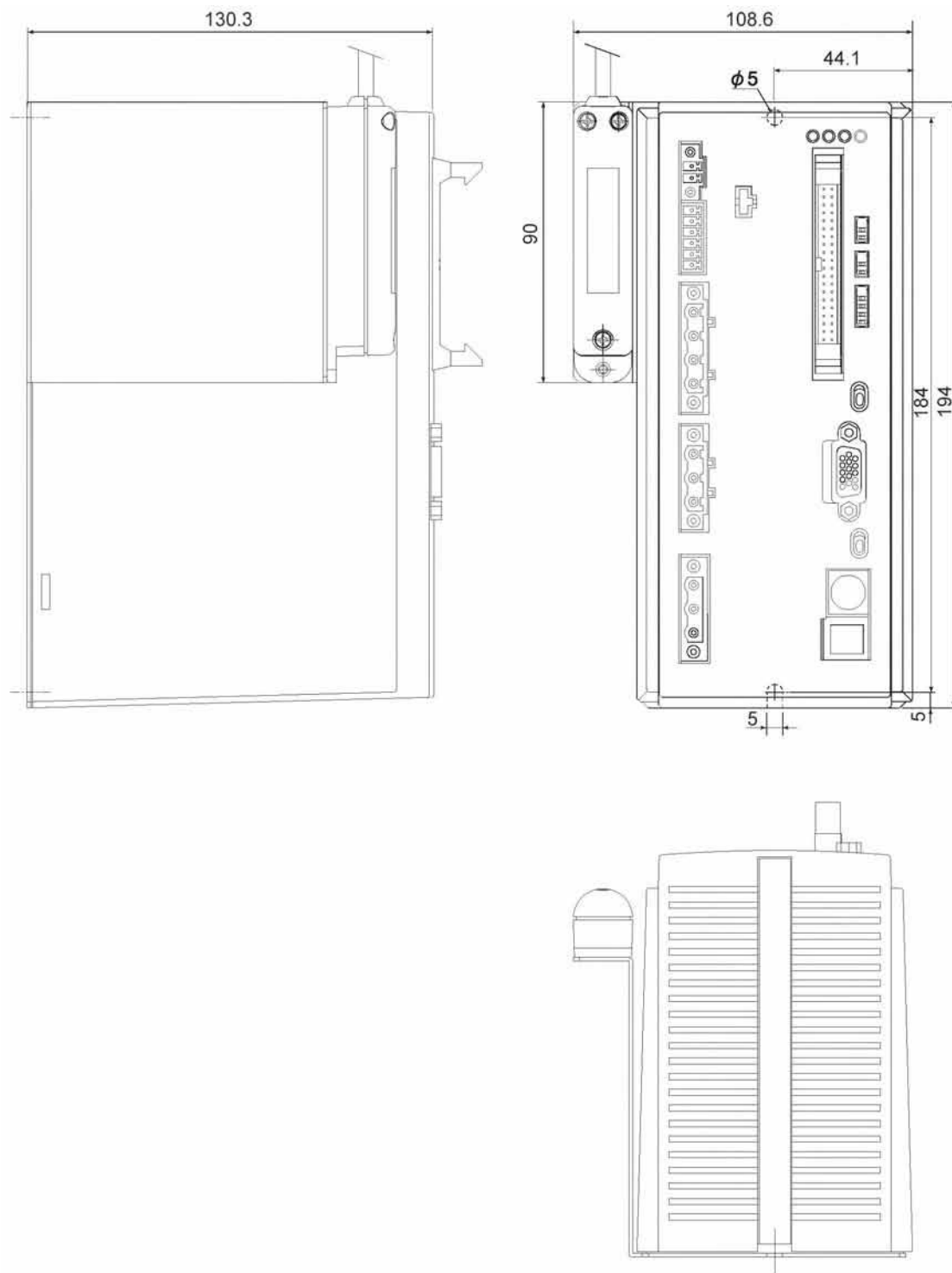
Signal Name	Connection Line
	Connection to the emergency stop circuit (The controller is shipped with this signal shorted.)

2-3 External Dimensional Diagram

2-3-1 Standard Specifications



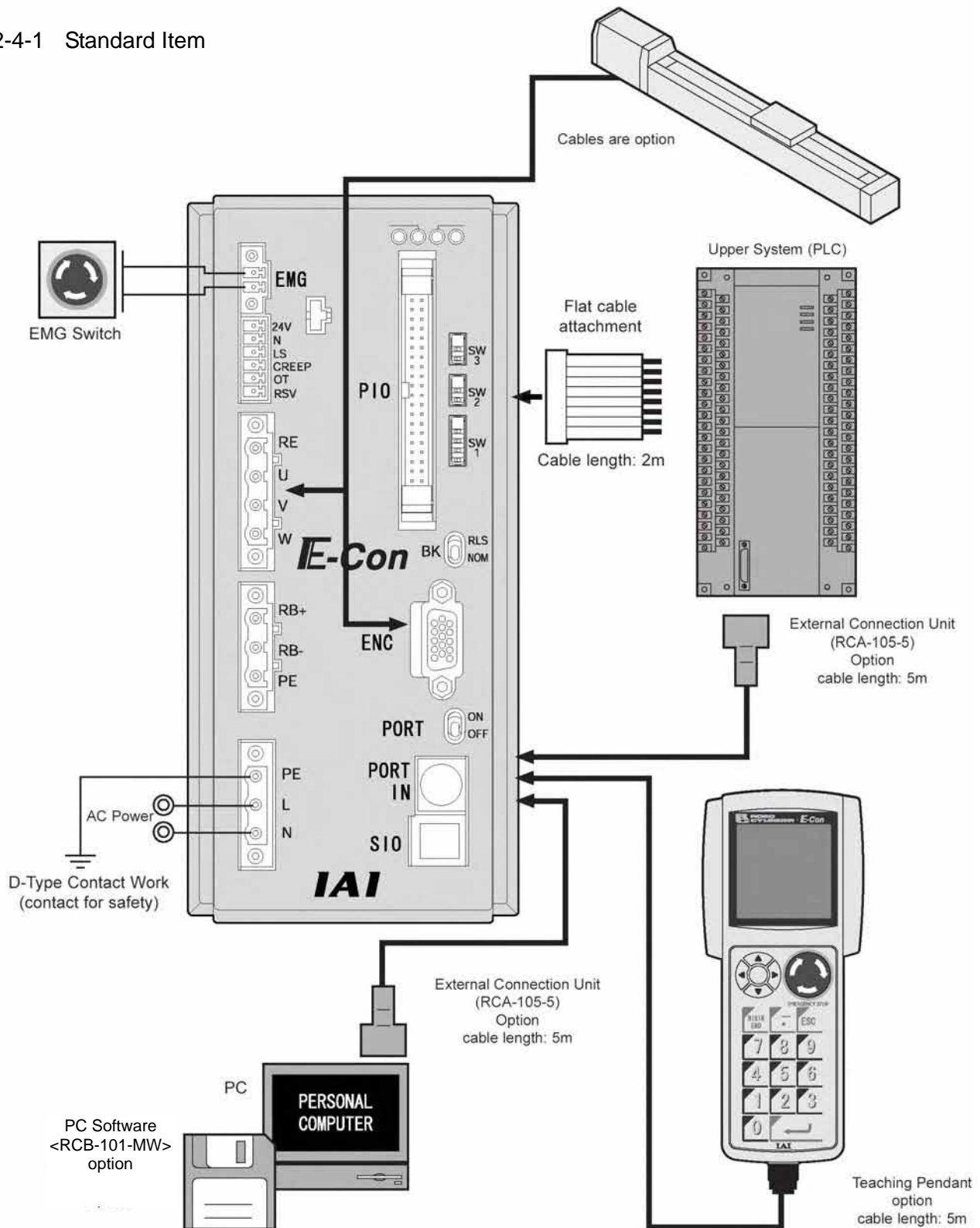
2-3-2 Absolute Specification



I-E-Con

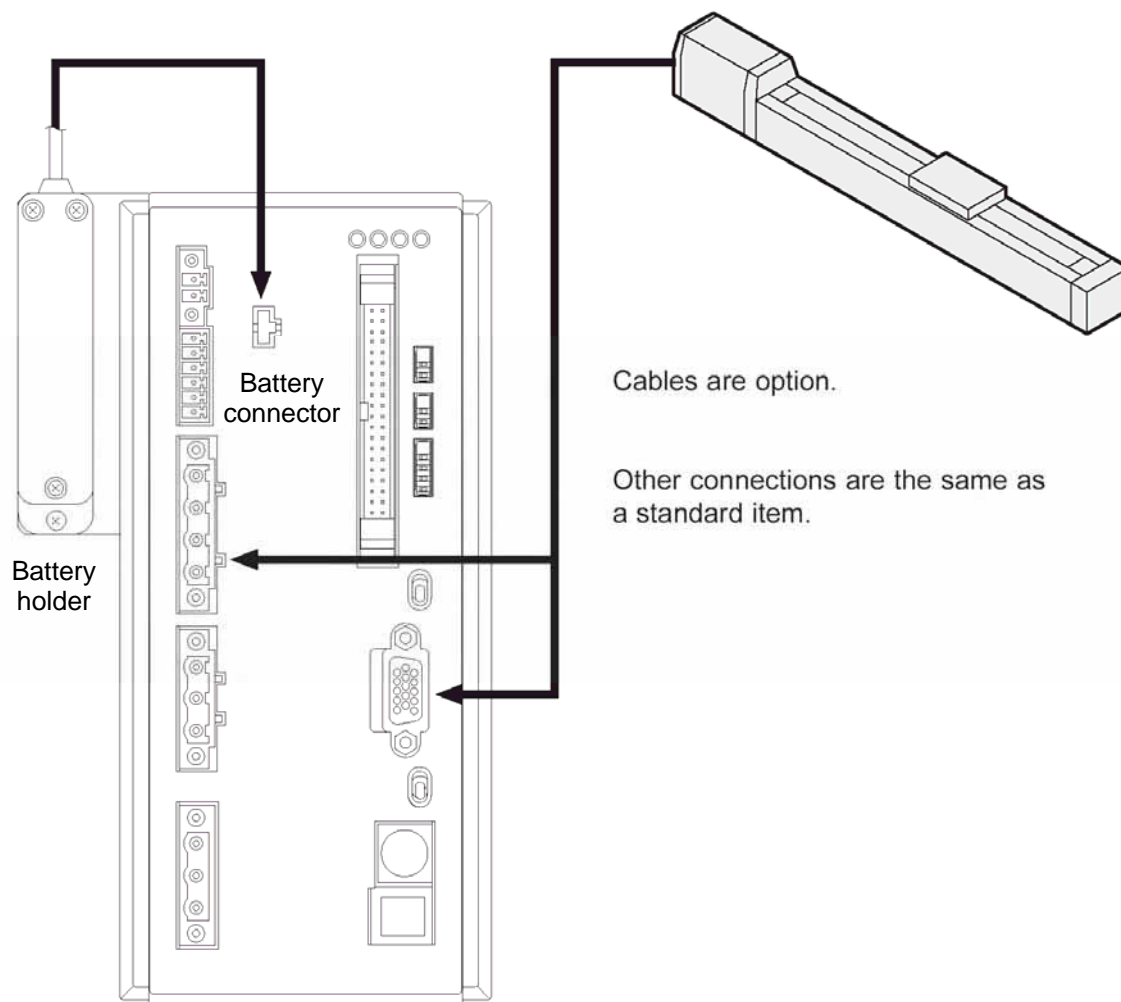
2-4 Connection Method

2-4-1 Standard Item



Note: Always set Nos. 1 and 2 of piano switch 2 (SW2) to OFF.

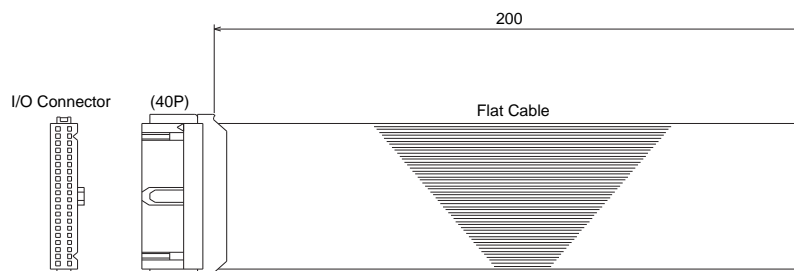
2-4-2 Absolute Specifications



2-5 Supplied Cables

2-5-1 I/O Flat Cable

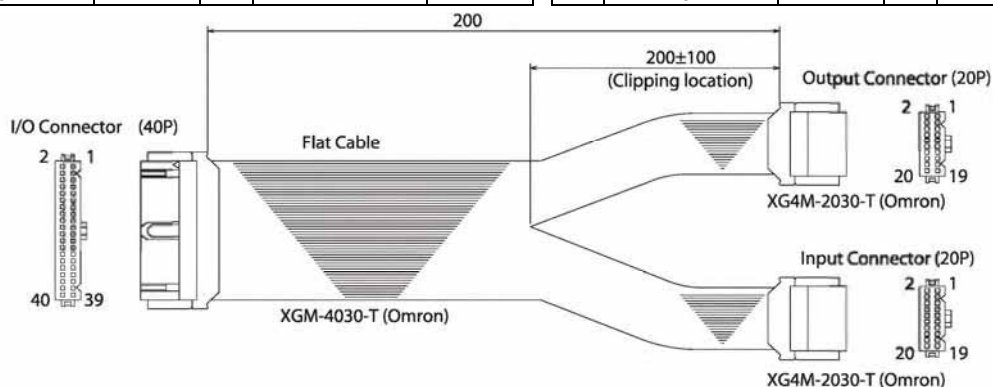
* Accessory



I/O Connector (40P)

No.	Signal Name	Color	No.	Signal Name	Color	No.	Signal Name	Color	No.	Signal Name	Color
1	C OMOA	Brown - 1	11	* Emergency stop	Brown - 2	21	C OMIA	Brown - 3	31	N C	Brown - 4
2	C OMOA	Red - 1	12	Complete position 16	Red - 2	22	C OMIA	Red - 3	32	Command position 16	Red - 4
3	C OMOB	Orange - 1	13	* Alarm	Orange - 2	23	C OMIB	Orange - 3	33	* Hold	Orange - 4
4	C OMOB	Yellow - 1	14	Complete position 8	Yellow - 2	24	C OMIB	Yellow - 3	34	Command position 8	Yellow - 4
5	N C	Green - 1	15	Z one	Green - 2	25	N C	Green - 3	35	Servo ON	Green - 4
6	N C	Blue - 1	16	Complete position 4	Blue - 2	26	N C	Blue - 3	36	Command position 4	Blue - 4
7	*Battery alarm	Purple - 1	17	Homing complete	Purple - 2	27	N C	Purple - 3	37	Reset	Purple - 4
8	N C	Gray - 1	18	Complete position 2	Gray - 2	28	N C	Gray - 3	38	Command position 2	Gray - 4
9	Moving	White - 1	19	Positioning complete	White - 2	29	N C	White - 3	39	Start	White - 4
10	Complete position 32	Black - 1	20	Complete position 1	Black - 2	30	Command position 32	Black - 3	40	Command position 1	Black - 4

* Option



(A) Output Connector (20P)

(B) Input Connector (20P)

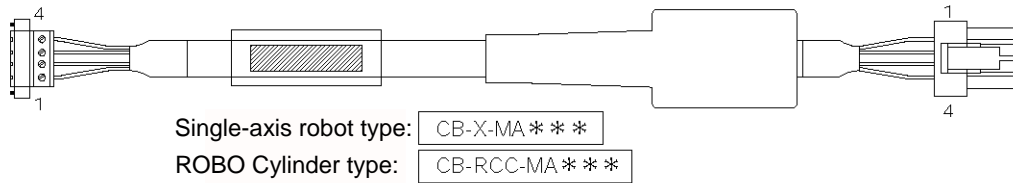
No.	Signal Name	Color	No.	Signal Name	Color	No.	Signal Name	Color	No.	Signal Name	Color
1	C OMOA	Brown - 1	11	* Emergency stop	Brown - 2	1	C OMIA	Brown - 1	11	N C	Brown - 2
2	C OMOA	Red - 1	12	Complete position 16	Red - 2	2	C OMIA	Red - 1	12	Command position 16	Red - 2
3	C OMOB	Orange - 1	13	* Alarm	Orange - 2	3	C OMIB	Orange - 1	13	* Hold	Orange - 2
4	C OMOB	Yellow - 1	14	Complete position 8	Yellow - 2	4	C OMIB	Yellow - 1	14	Command position 8	Yellow - 2
5	N C	Green - 1	15	Zone	Green - 2	5	N C	Green - 1	15	Servo ON	Green - 2
6	N C	Blue - 1	16	Complete position 4	Blue - 2	6	N C	Blue - 1	16	Command position 4	Blue - 2
7	*Battery alarm	Purple - 1	17	Homing complete	Purple - 2	7	N C	Purple - 1	17	Reset	Purple - 2
8	N C	Gray - 1	18	Complete position 2	Gray - 2	8	N C	Gray - 1	18	Command position 2	Gray - 2
9	Moving	White - 1	19	Positioning complete	White - 2	9	N C	White - 1	19	Start	White - 2
10	Complete position 32	Black - 1	20	Complete position 1	Black - 2	10	Command position 32	Black - 1	20	Command position 1	Black - 2

*I/O connector (40P) is same as the figure above.

2-5-2 Motor Extension Cable

Controller end

Actuator end



Cable color	Signal abbreviation	Pin no.
Green	PE	1
Red	U	2
White	V	3
Black	W	4

Pin no.	Signal abbreviation	Cable color
1	U	Red
2	V	White
3	W	Black
4	PE	Green

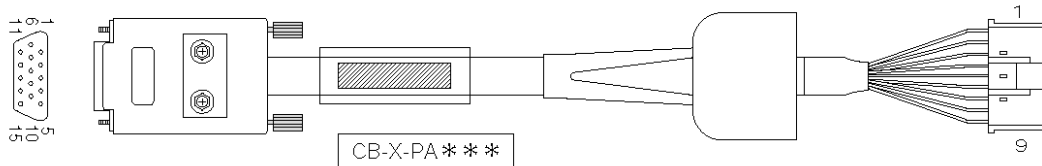
Reverse plug : GIC2. 5/4-STF-7.62 (Phoenix)

Plug housing : SLP-04V (J.S.T. Mfg.)
Socket contact : BSF-21T-P1.4 (J.S.T. Mfg.)

2-5-3 Encoder Extension Cable (Single-axis Robot Type)

Controller end

Actuator end



Cable color	Signal abbreviation	Pin no.
—	—	1
—	—	2
—	—	3
—	—	4
—	—	5
—	—	6
Blue	SD	7
Orange	$\overline{\text{SD}}$	8
Black	BAT+	9
Yellow	BAT—	10
Green	VCC	11
Brown	GND	12
Gray	BK—	13
Red	BK+	14
—	—	15

Pin no.	Signal abbreviation	Cable color
1	BAT+	Black
2	BAT—	Yellow
3	SD	Blue
4	$\overline{\text{SD}}$	Orange
5	VCC	Green
6	GND	Brown
7	FG	Ground
8	BK—	Gray
9	BK+	Red

Clamp the shield to the hood.

Ground wire and braided shield wire

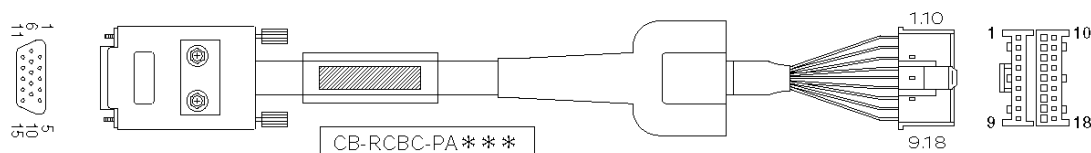
Plug connector with hood : 17HE-23150-C (D13A) (DDK)
Contact : 17H-7PCR-102 (P500) (DDK)

Plug connector with hood : XMP-09V (J.S.T. Mfg.)
Socket contact : BXA-001T-P0.6 (J.S.T. Mfg.)
Retainer : XMS-09V (J.S.T. Mfg.)

2-5-4 Encoder Extension Cable (ROBO Cylinder Type)

Controller end

Actuator end



Cable color	Signal abbreviation	Pin no.	Pin no.	Signal abbreviation	Cable color
Pink	A/U	1	1	A/U	Pink
Purple	\bar{A}/\bar{U}	2	2	\bar{A}/\bar{U}	Purple
White	B/V	3	3	B/V	White
Blue/Red	\bar{B}/\bar{V}	4	4	\bar{B}/\bar{V}	Blue/Red
Orange/White	Z/W	5	5	Z/W	Orange/White
Green/White	\bar{Z}/\bar{W}	6	6	\bar{Z}/\bar{W}	Green/White
Blue	SD	7	7	—	—
Orange	$\bar{S}\bar{D}$	8	8	—	—
Black	BAT+	9	9	FG	Ground
Yellow	BAT—	10	10	SD	Blue
Green	VCC	11	11	$\bar{S}\bar{D}$	Orange
Brown	GND	12	12	BAT+	Black
Gray	BK—	13	13	BAT—	Yellow
Red	BK+	14	14	VCC	Green
—	—	15	15	GND	Brown
Clamp the shield to the hood.			16	—	—
			17	BK—	Gray
			18	BK+	Red

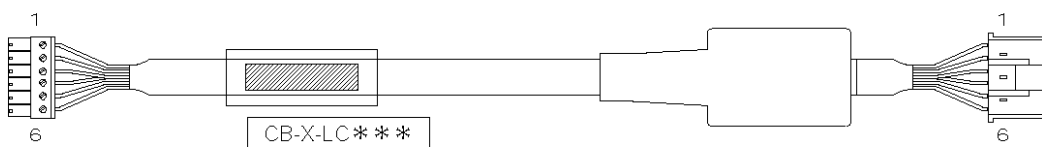
Plug connector with hood : 17HE-23150-C (D13A) (DDK)
Contact : 17H-7PCR-102 (P500) (DDK)

Plug housing : XMP-18V (J.S.T. Mfg.)
Socket contact : BXA-001T-P0.6 (J.S.T. Mfg.)
Retainer : XMS-09V (J.S.T. Mfg.)

2-5-5 Limit Switch Extension Cable

Controller end

Actuator end



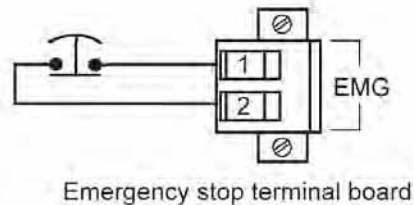
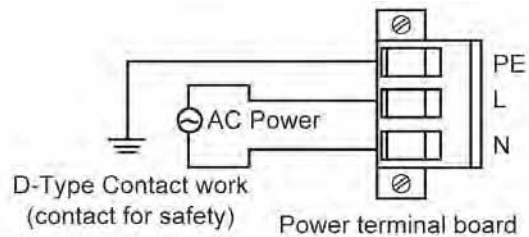
Cable color	Signal abbreviation	Pin no.	Pin no.	Signal abbreviation	Cable color
Light blue	24VOUT	6	1	24VOUT	Light blue
Pink	N	5	2	N	Pink
Light green	LS	4	3	LS	Light green
Orange	CREEP	3	4	CREEP	Orange
Gray	OT	2	5	OT	Gray
1B/light blue	RSV	1	6	RSV	1B/light blue

Note) 1B indicates one black dot.
Plug : MC1.5/6-ST-3.5 (Phoenix)

Plug housing : XMP-06V (J.S.T. Mfg.)
Socket contact : BXA-001T-P0.6 (J.S.T. Mfg.)
Retainer : XMS-06V (J.S.T. Mfg.)

2-6 Wiring

2-6-1 Wiring for Power • Emergency Stop



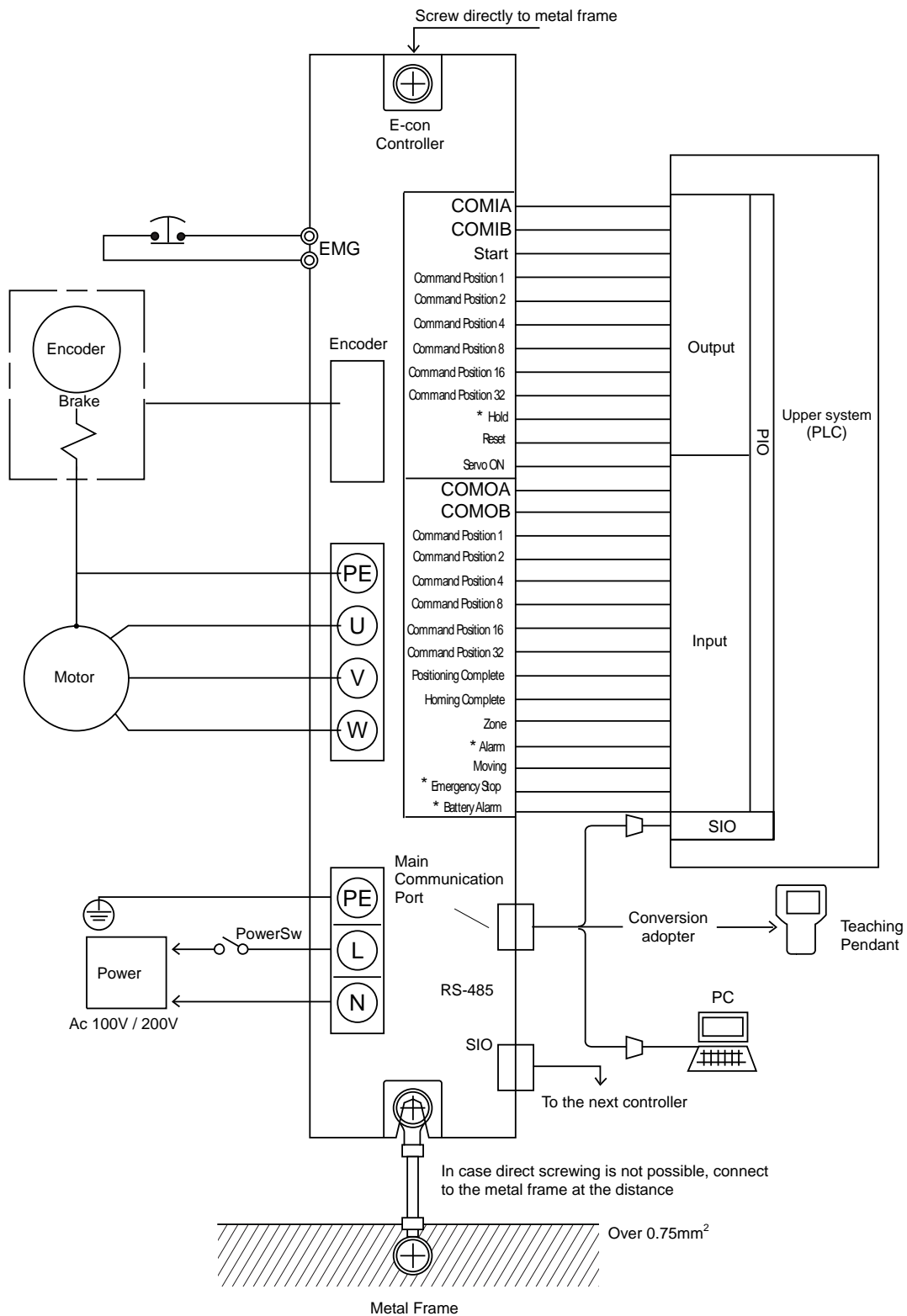
* The two EMG terminals are emergency-stop switch contact terminals of the contact-b input logic. They have been shorted at the factory so that an emergency stop will not be actuated. 24 VDC is output to pin 1.

Caution: When wiring power at the customer site, please make sure that the following specifications are met.

Applicable conduit	Single Line - $\varnothing 1.0$ (AWG18) Stranded Line - 0.75 mm^3 (AWG18)
Specification possible conduit range	Single Line - $\varnothing 0.4$ (AWG26) to $\varnothing 1.2$ (AWG16) Stranded Line - 0.3 mm^2 (AWG22) to 1.25 mm^2 (AWG16) Stranded Diameter - Over $\varnothing 0.18$
Length of un-sealed connect wire	11 mm
Applicable tool for button operation	Minus Driver (axis diameter $\varnothing 3$, blade point width 2.6)

Caution: This controller does not have a power switch.

2-6-2 External Connection Diagram



(Note) *Hold, *alarm, *emergency stop and *battery alarms are contact-b signals.

2-6-3 PIO Interface

PIO Interface list for controllers with NPN I/O is indicated as below:

In addition, the PIO cable end is cut off on the external device side for flat cable specifications.

PIO Connector (40 Pin)

Pin No.	Section	Reference Number	Signal Name	Cable Color	Pin No.	Section	Reference Number	Signal Name	Cable Color
1		(1)	COMOA	Brown - 1	2		(1)	COMOA	Red - 1
3		(2)	COMOB	Orange - 1	4		(2)	COMOB	Yellow - 1
5	Output		NC	Green - 1	6	Output		NC	Blue - 1
7		(9)	* Battery Alarm	Purple - 1	8				Gray - 1
9		(3)	Moving	White - 1	10		(10)	Complete Position 32	Black - 1
11		(4)	* Emergency Stop	Brown - 2	12			Complete Position 16	Red - 2
13		(5)	* Alarm	Orange - 2	14			Complete Position 8	Yellow - 2
15		(6)	Zone	Green - 2	16			Complete Position 4	Blue - 2
17		(7)	Complete Homing	Purple - 2	18			Complete Position 2	Gray - 2
19		(8)	Complete Positioning	White - 2	20			Complete Position 1	Black - 2

Pin No.	Section	Reference Number	Signal Name	Cable Color	Pin No.	Section	Reference Number	Signal Name	Cable Color
21		(11)	COMIA	Brown - 3	22		(11)	COMIA	Red - 3
23		(12)	COMIB	Orange - 3	24		(12)	COMIB	Yellow - 3
25	Input		NC	Green - 3	26	Input		NC	Blue - 3
27				Purple - 3	28				Gray - 3
29				White - 3	30		(17)	Complete Position 32	Black - 3
31				Brown - 4	32			Complete Position 16	Red - 4
33		(13)	* Hold	Orange - 4	34			Complete Position 8	Yellow - 4
35		(14)	SERVO ON	Green - 4	36			Complete Position 4	Blue - 4
37		(15)	Reset	Purple - 4	38			Complete Position 2	Gray - 4
39		(16)	Start	White - 4	40			Complete Position 1	Black - 4

Caution
Ports with * mark indicate b contact. (always ON)
Never connect to unused port.

- | | | |
|-----------|---|----------------------|
| (1) COMOA | } | Power for input port |
| (2) COMOB | | Power for input port |

Connect a DC24 V potential across COMOA & COMOB, for output functionality.
Polarity does not exist between COMOA & COMOB.
Pin Numbers. 1 and 2 are connected internally and Pin Numbers. 3 and 4 are also connected internally.

- | | |
|---------------------|---|
| (3) During Transfer | Turns on during transfer. When you want to detect holding motor during hold, use this signal. |
| (4) Emergency Stop | Turns off at emergency stop. During normal operation, stays ON.
A normal condition is restored once the emergency stop is cancelled. |
| (5) Alarm | Turns OFF during an alarm. During normal operation, stays ON. For homing, execute reset input or cycle power, after alarm factor is solved. |
| (6) Zone | Outputs within range set in the parameter. |
| (7) Homing Complete | Upon applying power, turns ON once initial homing completes. Afterwards, as long as alarm does not occur and power does not turn OFF, continues to stay ON. This will not turn OFF simply by emergency stop input. Turning the home complete signal OFF means homing is executed prior to this next movement: |

Caution: With the absolute specifications, once absolute reset is executed, upon applying power, homing complete signal will turn ON. In case homing complete signal turns OFF due to an alarm occurrence, you will need to execute absolute reset again.

- | | |
|--------------------------|--|
| (8) Positioning Complete | Upon applying power, once the operation preparation completes, turns ON. Turns OFF upon start signal input. Turns ON once movement completes. The timing for the positioning complete ON and Complete position output are the same. |
| (9) Battery Alarm | With the absolute specifications, this signal turns OFF when the backup battery voltage drops to 3.1 V or below (battery alarm is a contact-B signal and remains ON in normal condition). It indicates that the battery must be replaced soon. When a battery alarm generates, operation is not disabled immediately. Following a battery alarm, the battery will last for approx. 220 hours (approx. 9 days) before a battery error occurs.
Note) The battery alarm function is available with H2 and later versions of controllers.
The battery alarm signal remains OFF with the incremental specification. |

- (10) Complete Position Turns OFF simultaneously as timing once positioning complete turns OFF. All will turn OFF during emergency stop or direct teaching. In case operation is possible afterwards, in case the current actuator position is within the positioning range from the last positioning complete position, outputs its complete position. All will remain OFF in case of being outside of the positioning band. In case operation is possible during push mode, in either from emergency stop or direct teach, all will remain OFF regardless of the current position.
If an alarm occurs, the four bits of complete positions 1, 2, 4 and 8 will be output as an alarm code (short pattern). This signal means different conditions in normal state and alarm state, so pay attention not to misinterpret the signal in the sequence. (Refer to 6-3, "Alarm Output by PIO.")
- (11) COMIA }
(12) COMIB } Power for input port
- Connect DC24V power for input port between COMIA and COMIB. Pin Numbers. 21 and 22 are connected internally and Pin Numbers. 23 and 24 are also connected internally.
- (13) Hold This is a B-contact input. During movement, remains ON. Turns OFF to HOLD or freeze motion.
- (14) Servo ON When this signal is turned ON, servo is turned ON.
- (15) Reset Once the signal is detected, the controller completes an alarm reset. In case the source of the alarm is not resolved, alarm will reoccur even after resetting the alarm. Cancels remaining movement load during hold.
- (16) Start Input for movement start signal.
- (17) Command Position Position select inputs. This is the relationship between the input pin No. and selected positron No. (6 bit binary)

You may input select 64 positions of position 0 to position 63.

1: ON, 0: OFF

Pin No.	40	Command Position 1	0	1	0	1	0	1	0	1
	38	Command Position 2	0	0	1	1	1	0	1	1
	36	Command Position 4	0	0	0	0	0	1	1	1
	34	Command Position 8	0	0	0	0	0	0	0	0
	32	Command Position 16	0	0	0	0	0	0	0	0
	30	Command Position 32	0	0	0	0	0	0	1	0
Selected Position No.			0	1	2	3	4	5	6	7

1	0	1	0	1	0	1
0	1	1	0	0	1	1
0	0	0	1	1	1	1
1	1	1	1	1	1	1
1	1	1	1	1	1	1
1	1	1	1	1	1	1
57	58	59	60	61	62	63

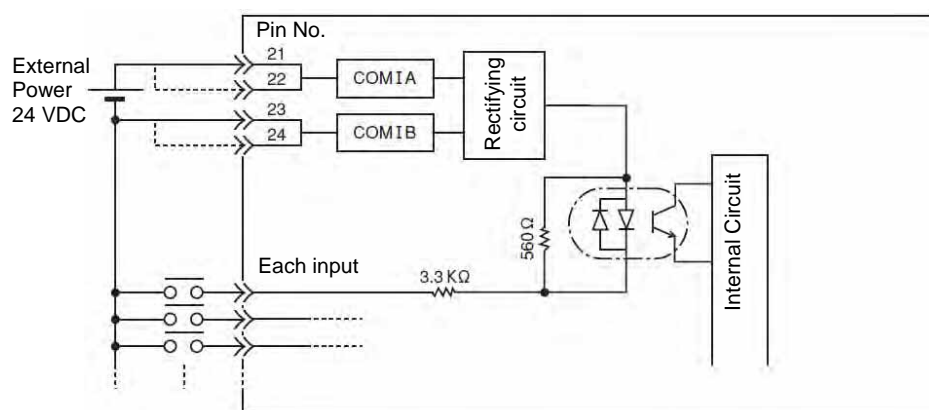
Caution: A controller operation error may occur when selecting an undefined position number and triggering the Start Input ON. (alarm code 0B1, bank 31 error).

2-6-4 External I/O Specifications

Input Area

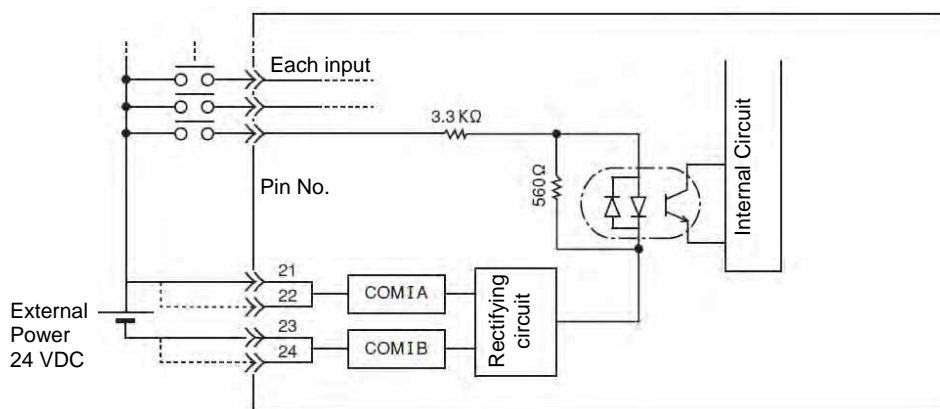
Column	Specifications
Number of inputs	10 points
Input Voltage	24 VDC $\pm 20\%$
Input Current	7 mA/1 Circuit
Movement Voltage	ON Voltage . . . Minimum 16 V (4.5 mA) OFF Voltage . . . Minimum 6 V (1.4 mA)
Isolation Method	Photo Coupler

Internal Circuit Structure (Standard NPN Specifications)



- Connect 24 VDC between COMIA and COMIB.
- As for the common side of input, connect to the minus side of the external power.
- Pins No. 21 and 22 of COMIA, and Pins No.23 and 24 of COMIB are connected, respectively internally.

Internal Circuit Structure (Optional PNP Specifications)



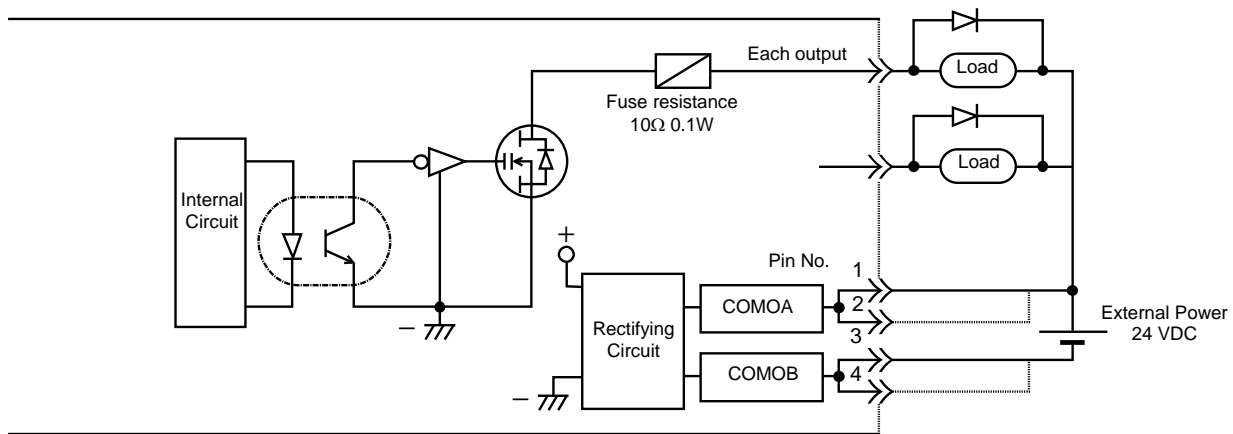
- Connect 24 VDC between COMIA and COMIB.
- As for the common side of input, connect to the plus side of the external power.
- Pins No. 21 and 22 of COMIA and pins No. 23 and 24 of COMIB are respectively connected internally.

Output Area

100 mA output circuit according to Power M O S F E T

Column	Specifications
Number of outputs	12 points
Rated Load Voltage	24 VDC/60 V (peak) (No fly wheel diodes)
Maximum Load Current	100 mA/1 Circuit
Isolation Method	Photo Coupler
Overcurrent Protection	Fuse resistance 10 Ω & 0.1 W

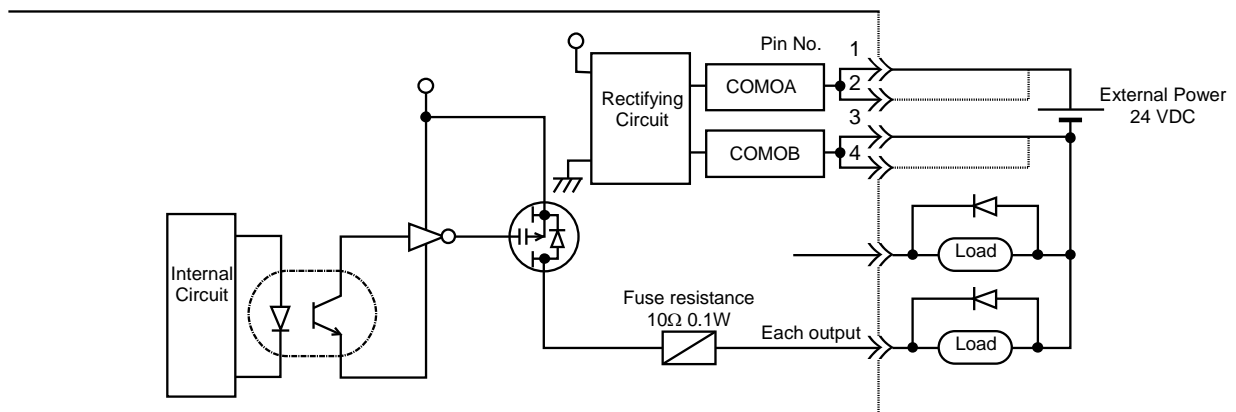
Internal Circuit Structure (Standard NPN Specifications)



- Add 24 VDC between COMOA and COMOB. Polarity does not exist between COMOA and COMOB.
- Pin No. 1 and 2, 3 and 4 are connected respectively internally.

Note 1) As for output circuit, fly wheel diode does not exist in open drain of Power MOSFET. Always execute fly back voltage control compliance using diode on the L load of relay (this is most effective for spike noise prevention when mounting diode to coil in short distance).

Internal Circuit Structure (Optional PNP Specifications)



3. Data Input (Basic)

Since this controller does not have any commands, there is no need to write any programs. In order to make the actuator move to the assigned position, all you need to do is to input the position data into the position data table. Position data includes No., Position (Position), Speed (Speed), Acceleration/Deceleration (Acc/Dcc), Push (Push), Positioning Band (Positioning Band), and Acceleration Only MAX (Acc. only Max). With Japanese specifications, the names of these data items are indicated in katakana on teaching pendants.

Position data is specified in the absolute coordinate specification (absolute) mode where the distance from the home is input, or in the incremental coordinate specification (incremental) mode where the relative transfer load from the current position is input.

Position Table

No.	Position Caution	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	0	100	0.3	0	0.1	0
1	30	100	0.3	0	0.1	0
2	10	100	0.3	0	0.1	0
:	:	:	:	:	:	:
63	100	100	0.3	0	0.1	0

When data is input in the "Position" field of the position data table, the default values are input for the above data. Change the default values as necessary.
To change a default value, change the corresponding parameter named "Default XXX."
The default values vary according to the actuator type.

"=" indicates that this is an Absolute (This is displayed by the Teaching Pendant. With a PC, incremental column will be displayed).

Caution: For data input, please first execute from position. Input from other data will be rejected.
As for position, input may be done up to two decimals places.

3-1 Position Data Table

- (1) No.
- Indicates the position number. To input the relative transfer load, type the Minus Key. When using the teaching pendant for input operation, "=" will be displayed between the number and position. For Absolute coordinate assign, setting is not necessary here.

- (2) Position

- Input the target value you want to move the actuator to. [mm]

Absolute Coordinate Assign: Input the distance from the home to the target position you want to move the actuator to. A negative value cannot be input.

Relative Coordinate Assign: Input the distance from the current position to the target position you want to move the actuator to. A negative value can also be input (if the target position is in the negative direction of the displayed coordinates).

No.	Position	
0	30	
1	10	
2	= -10	
3	= -100	

Absolute Coordinate Assign: 30 mm from home

Relative Coordinate Assign: Plus 10 mm from current location

Relative Coordinate Assign: -10 mm from current location

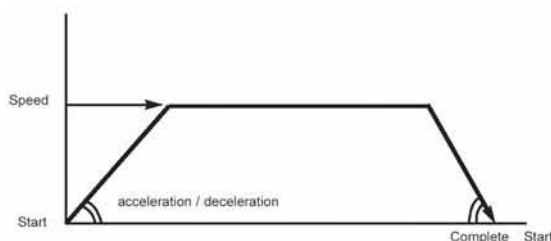
Absolute Coordinate Assign: 100 mm from home

- (3) Speed

- The speed at which the actuator moves (mm/sec).
The default value will differ according to actuator type.

- (4) Acceleration/Deceleration

- Inputs the acceleration/deceleration of the actuator (G).
The acceleration should basically conform to the rating specified in the catalog. With E-Con controllers, an acceleration level above the rating can be used to shorten the tact time only if the actuator is used in a condition where "the payload is significantly smaller than the rated loading capacity."
To deal with this situation, the "Acc/Dec" field in the position table allows for input of values greater than the rated acceleration.



Acceleration / Deceleration G Speed MIN 0.01G slow rise
MAX1.00G fast rise

Caution: When setting speed and acceleration/deceleration, refer to the supplied specification list of supported actuators and also consider the installation condition and load shape to determine appropriate values that will not cause the actuator to receive excessive impact or vibration.

To set values higher than the recommended values, the payload should be considered and the actuator characteristics vary depending on the model. Therefore, for the maximum settings allowed for each actuator model, please contact IAI's Sales Engineering Section.

(5) Push

- Selects either the Positioning Mode or Push Mode.

The initial value is set as 0.

0: Positioning Mode (=normal operation)

Other than 0: Push mode (%)

- Input the current limit value to be applied to the servo motor when the work part is pushed in the Push Mode. The rated thrust of the actuator is multiplied by this value to determine the push force at standstill. Note that this value of push force at standstill is only a guide.

Standard Push Force X Current Limit Value (%)

→ Rough Standard of Push Force During Hold

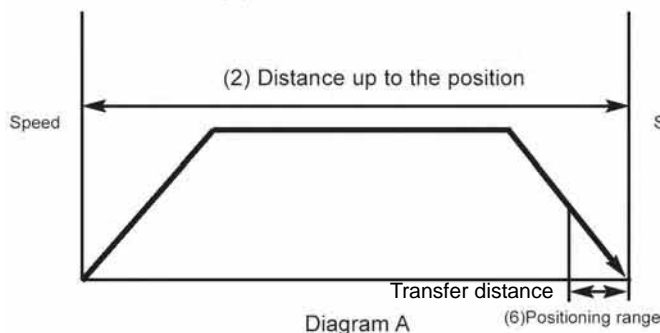
Use standard setting of about 70% current limit value for push force. For normal operation, keep the push force setting above a value of 30%.

Caution: If push force is too weak, there is possibility that the push load to be undetected.

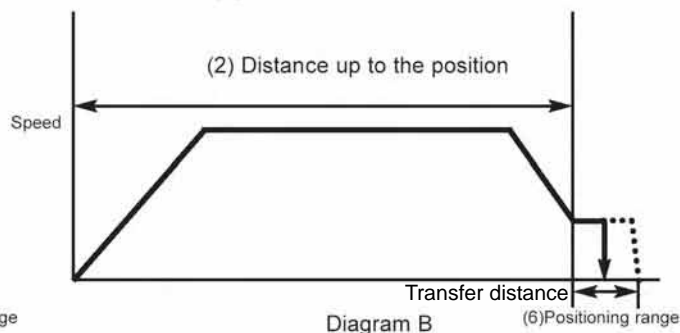
(6) Positioning Band

- As for the positioning band, depending on the value set in the position band (5th) column, either 0 or other than 0, its function will vary.
(A) Push = 0 (Positioning Mode)
- Input the positioning completion detection band (distance to the target position) in the Positioning Mode. [mm]
- The distance to the target position indicates the distance corresponding to the value input here before the target position, and once the actuator enters this range, positioning complete signal is output. Positioning complete signal will output when the actuator arrives at the designed position in the point table.
The initial value is set as 0.1 mm (see diagram A).
- (B) Push = with a value greater than 0 (Push Mode)
- Inputs the maximum push load distance from the given point in push mode (mm) (see diagram B).
- When the push direction is a negative direction pull from the displayed coordinate, a "minus" sign should be placed next to the input value.

(A) Push = 0



(B) Push = other than 0



(7) Acceleration only MAX

- Selects either the assigned acceleration or the maximum acceleration. Inputs are either 1 or 0. The initial value is set as 0.

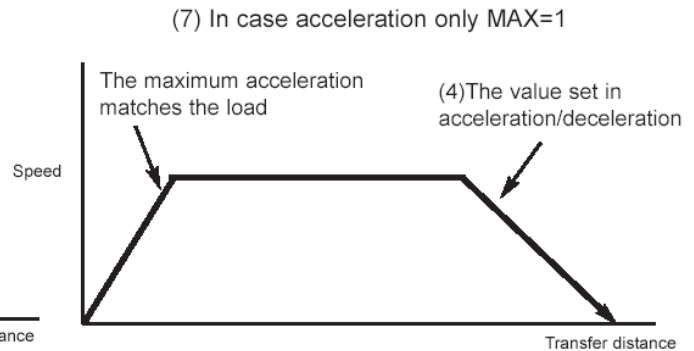
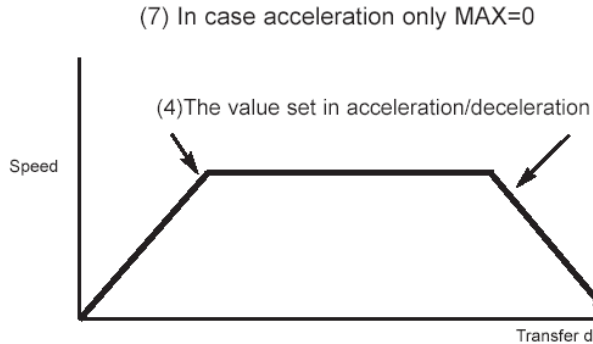
0: Assigned acceleration

The value input in (4) becomes the actual acceleration/deceleration.

1: Maximum acceleration

The maximum acceleration is applied only during acceleration.

The deceleration corresponds to the value input in (4).



Caution: As a rough guide, enable the acceleration only MAX setting when the actual payload is no more than one-third of the rated loading capacity. Check the rated loading capacity of your actuator by referring to the supplied specification list of supported actuators.

3-1-1 Push Force at Standstill

To operate the actuator in the push mode, enter a current limit value (%) in the “Push” field of the position data table.

With E-Con controllers, the push force at standstill must correspond to approx. 70% of the current limit value. You can increase/decrease the push force at standstill by increasing/decreasing the current limit value, but the controller will not operate normally if the current limit value is set to 30% or below.

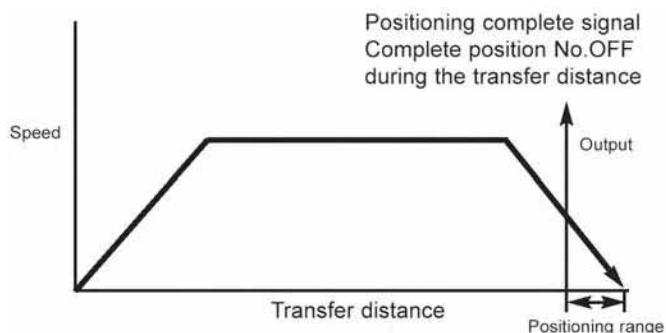
The table below lists the push forces at standstill of rod-type RCS actuators based on a current limit value of 70%.

	Type	Motor W	Speed type	Push force N (kgf)
Rod type	RA55	60	L	178 (18.2)
			M	89 (9.1)
			H	44 (4.5)
		100	L	296 (30.3)
			M	149 (15.2)
			H	74 (7.6)
	RB7530	60	L	238 (24.3)
			M	118 (12.1)
			H	59 (6.1)
		100	M	198 (20.2)
			H	99 (10.1)
Flat type	F55	60	L	296 (30.3)
			M	149 (15.2)
			H	74 (7.6)
		100	M	222 (22.7)
			H	111 (11.4)
		100	L	178 (18.2)
			M	89 (9.1)
			H	44 (4.5)
		100	L	296 (30.3)
			M	149 (15.2)
			H	74 (7.6)

Caution: Precision of push force at standstill is not guaranteed. The above figures are provided only for reference.

3-2 Mode Explanation

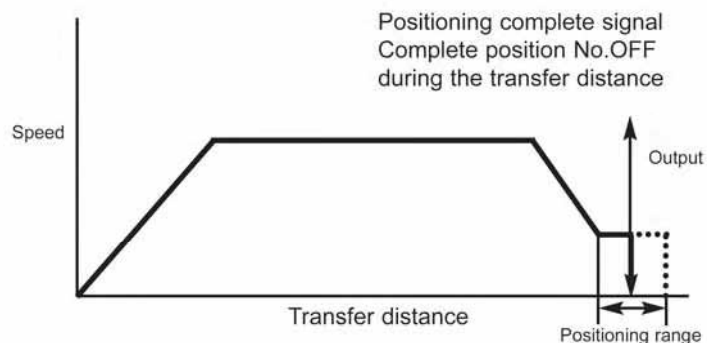
3-2-1 Positioning Mode Push=0



- (1) From the position, the positioning complete output turns ON prior to the positioning band portion and turn OFF during transfer output. Also output the complete position No. signal.

3-2-2 Push Mode (Push) = Other than 0

(1) When push-motion operation has been successful



- (1) After reaching the position shown, the actuator moves forward at a low rate speed. Once the actuator pushes the work part and the parameter passes a set time (Note) with the servo motor current achieving the push value, the positioning completion output turns ON. The Complete Position No. signal also turns ON. Output during transfer turns OFF.

Note: If needed, set the "push recognition time" in the parameters. 255 msec is the default value. The actuator is pushing the work part.

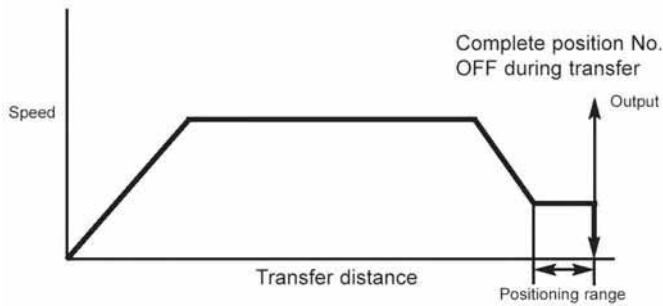
Warning

The actuator continues to push the work part with the push force at standstill determined by the current limit value. Exercise due caution when handling the actuator, work part, etc., in this condition because the actuator is not stopped.

The push speed changes as follows, depending on the speed set in the position data table.

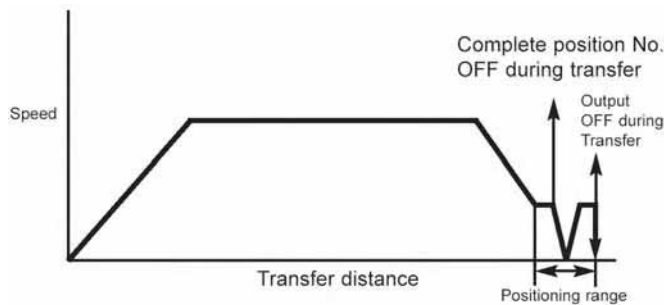
	Set speed	
	20 mm/sec or above	Below 20 mm/sec
Push speed	20 mm/sec	Set speed

(2) When push fails (blank shot)



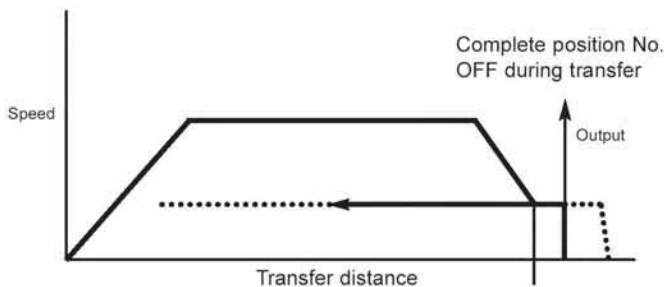
- (1) Upon reaching the position, the actuator moves forward at a low rate speed. When the servo motor current does not reach the peak current restriction value in the positioning band, the positioning completion output will not turn ON even when the actuator moves to the positioning band range. In this case, only the complete position number outputs turn ON. Output during transfer turns OFF. To confirm stop status, check if output during transfer is OFF.

(3) Upon push, the moving work part increases. 1. When the work part moves in the push direction



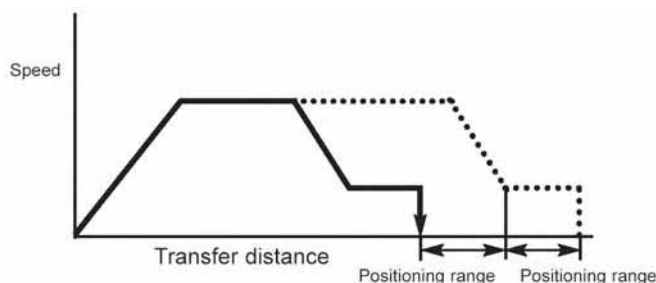
If the work part moves to the push direction after the positioning complete output turns ON, (output during transfer is OFF) the actuator will push the work part within the positioning band range. Output during transfer turns ON. The positioning complete ON and complete position number outputs will not change. In-motion output will remain ON. In-motion output will turn OFF when motion stops.

2. When the work part moves in the opposite of push direction (when the actuator is pushed back due to a reaction force from work part)



When the reaction force of the work part is greater than the push force of the actuator, and the actuator is pushed back after the positioning complete output turns ON, the actuator will be pushed back until the forces balances out. The positioning complete ON and complete position number outputs will not change. In-motion output will remain ON until motion stops.

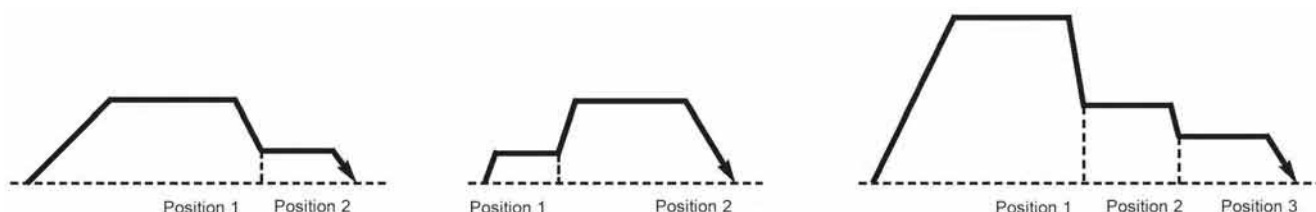
(4) When the input value of positioning band is wrong



When a mistake is made in the code for the positioning band data, as the left diagram shows, only the width (positioning complete width x 2) will be off, so please be careful

3-2-3 Speed Change Movement During Transfer

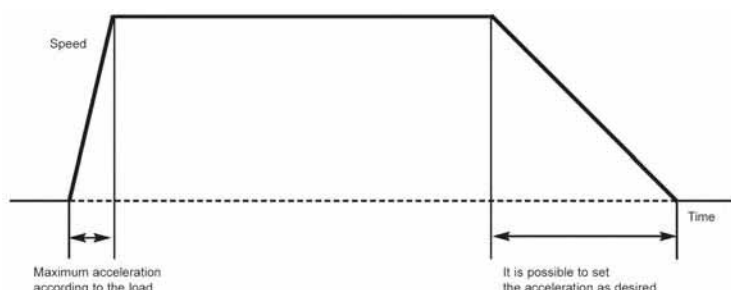
Multiple speed control is possible in one movement. Speed will go slower or faster at any given point. However, different position data is needed every time speed is changed.



3-2-4 Movement with Variable Acceleration • Deceleration Values

By inputting 1 into "MAX ACC Flag" the position data table, the transfer movement may operate with a variable range of acceleration and deceleration values.

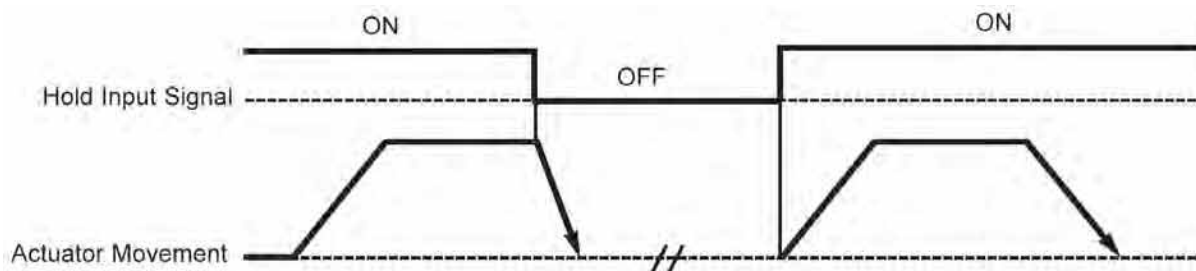
The acceleration corresponds to the maximum acceleration. The deceleration is the value input in the "Acc/Dec" field of the position data table.



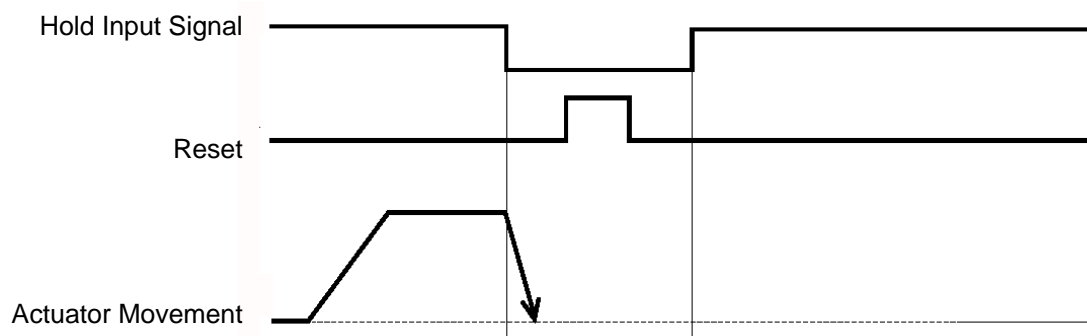
Caution: Although the specific value differs depending on the actuator, the maximum acceleration cannot be more than three times the rated acceleration. Accordingly, this function should be enabled only when the payload is no more than one-third of the rated loading capacity and the actuator needs to be stopped gradually at slow deceleration. If this function is enabled when the payload is equivalent to the rated loading capacity, an overload error may occur. Even if an overload error does not occur, the actuator will still receive excessive impact loads that may negatively affect the life of the actuator. Therefore, exercise due caution when enabling this function. Check the rated loading capacity of your actuator by referring to the supplied specification list of supported actuators.

3-2-5 Hold Input

This is used for temporary stop. The actuator will hold according to the external input signal (Hold) during moving. Based on safety compliance, the signal will become a B-contact input (reversed logic). When the hold input is turned OFF, the actuator will stop at that point and will move again only when the hold input is turned back ON.



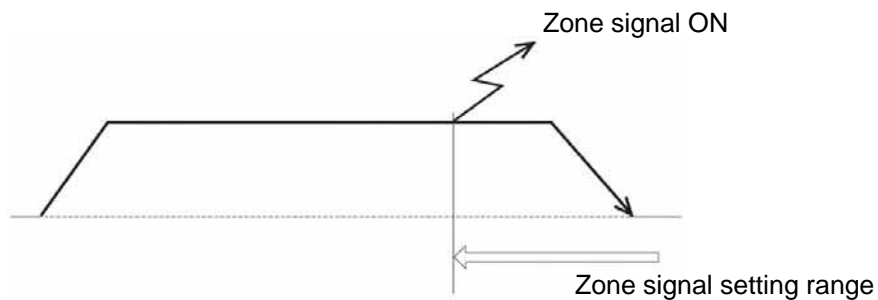
The remaining movement of the actuator can be cancelled by turning the reset input ON while the hold signal is being input (at the leading edge of the reset input signal).



3-2-6 Zone Signal Output

During transfer, the zone signal is output once the actuator is inside the specified territory (this territory can be set between desired positions).

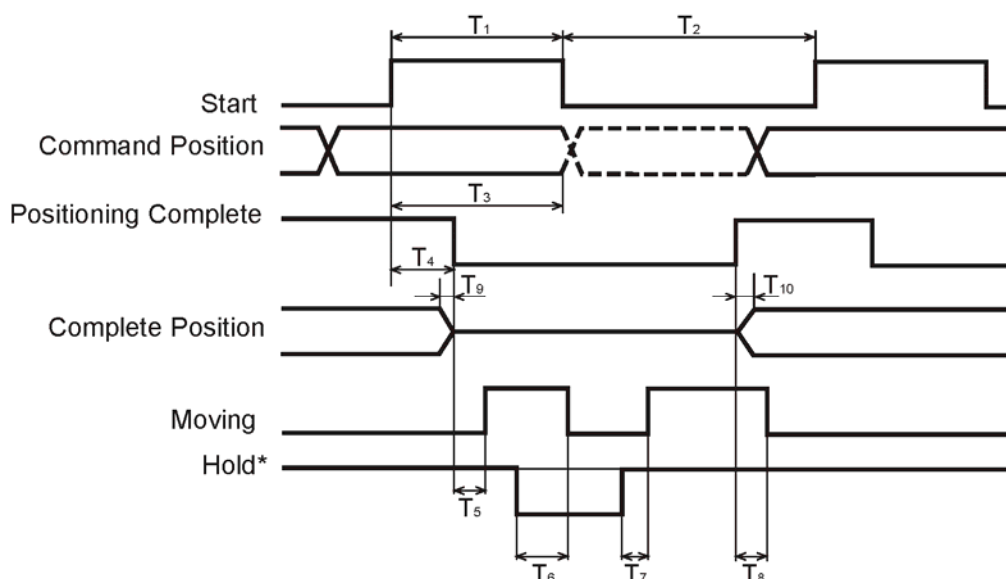
By setting the zone parameter beforehand, once a moving slider enters that territory, the zone signal output turn ON. (The territory can be set even in the middle of the stroke.)



3-2-7 Homing

During power-up or upon alarm release, you will need to home. After selecting the position number and starting, homing is executed first. Upon homing, homing complete output will turn ON (standard specifications). You may not execute just homing from P I/O. In addition, in case you wish to move to the home position in normal mode, we recommend you set the position number to where 0 was input into the position of position data, and then, move to that position. With the absolute specifications, once home location is taught, there is no need to home after cycling power.

3-3 Timing Chart



ACC/DEC	Content	Minimum value	Maximum value
T1	Start ON minimum time width	6 msec	-
T2	Start OFF minimum time width	6 msec	-
T3	Start ON → Command Position hold time	6 msec	-
T4	Start ON → Positioning complete OFF delay time	-	7 msec
T5	Positioning complete OFF → ON during moving delay time	-	1 msec
T6	Hold OFF → OFF during moving delay time	-	*1
T7	Hold ON → ON during moving delay time	-	6 msec
T8	During moving OFF → ON positioning complete delay time	-	2 msec
T9	Positioning complete OFF → OFF positioning complete delay time	0.1 msec	1 msec
T10	Complete position ON → Positioning complete output delay time	0.1 msec	1 msec

*2

*1: Maximum value will depend on acceleration/deceleration.

*2: To view complete position, upon positioning complete ON, please allow more time for the scan of the sequencer.

3-4 Items to Note on Gripper (RCS-G20)

(1) Finger Operation

[1] Definition of position

The stroke in the specification table indicates a sum of travels of both fingers.

In other words, the travel of each finger is a half of the stroke.

The specified position therefore represents the distance traveled by each finger from its home position toward the closing side.

[2] Definition of speed and acceleration

Speed and acceleration command values indicate a sum of both fingers.

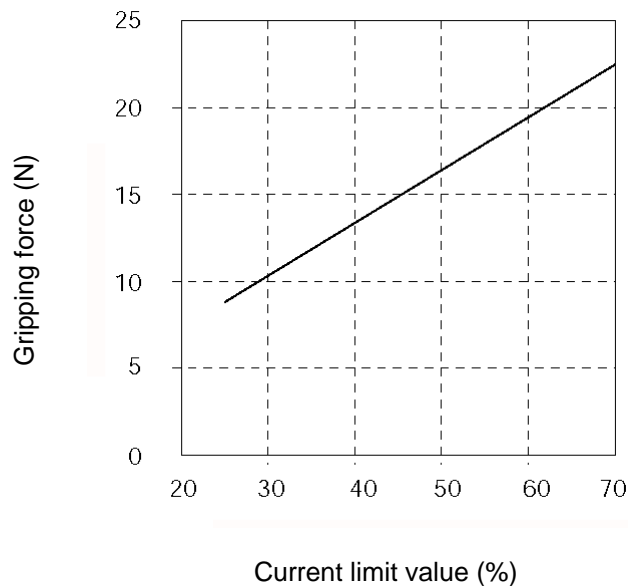
In other words, the speed or acceleration applicable to each finger is a half of the command value.

[3] Gripper operation mode

If the actuator is used as a gripper to grip the work part, it is recommended to operate the actuator in the “push mode.”

If the actuator is operated in the “positioning mode,” an overload or deviation overflow error may occur when the work part is gripped.

[Diagram of Gripping Force Per Finger vs. Current Limit Value]



4. Using the Controller <Practice>

4-1 Power-Up (Standard Specification)

(For Absolute specification, please refer to 4-2. Absolute Reset Procedure)

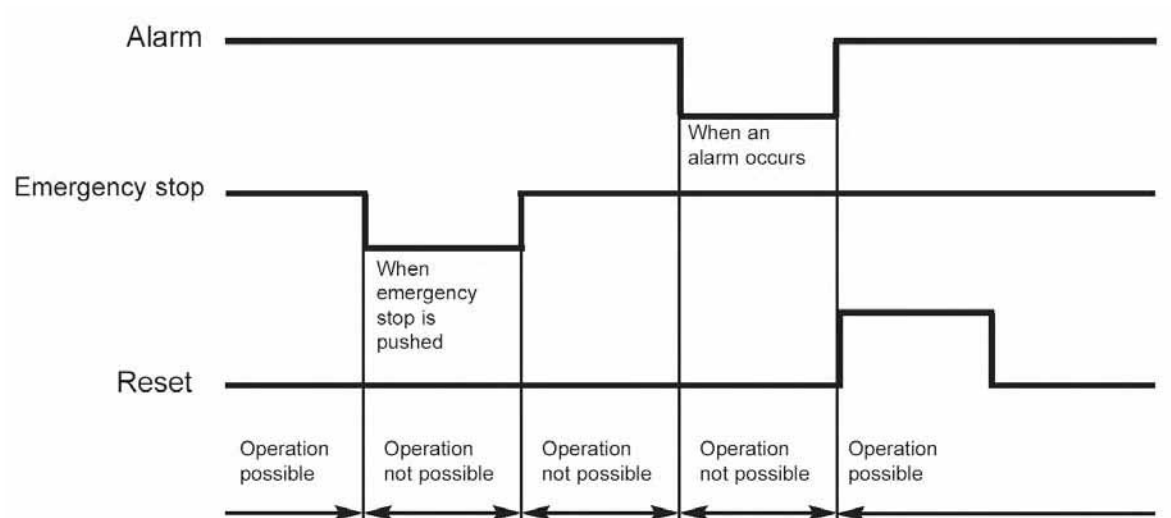
- (1) Confirm that both Nos. 1 and 2 of piano switch 2 (SW2) are set to OFF. If these switches are set to ON, tilt them back to the OFF positions.
- (2) Connect the motor · brake cable and encoder cable to the controller.
- (3) Connect the upper PLC to the P I/O Connector using the attached flat cable.
- (4) When connecting more than 2-axes, address each controller by using the piano switches. For details, please refer to the “specifications” section under the piano switch settings.
- (5) Supply main power to the controller terminal board.
- (6) Supply P I/O Power (24 V). (Input COMIA or COMIB. Output across COMOA and COMOB)
- (7) Turn the P I/O Hold Input ON
- (8) Normal status is when the RDY turns ON, and abnormal status is when the ALM turns ON. Please refer to the Alarm List. LED Display is not lit during emergency stop.

<p>Caution: When the P I/O is powered before main power or when the power source is common, upon supplying power, the P I/O output may be in an unstable status for approximately 1 msec. As for signal to the Input I/O, please execute after the Positioning Completion Signal turns ON after power-up.</p>
--

The controller is now ready to operate.

4-1-1 Movement Capable Status

- (1) Servo will turn ON at the same time the power is turned ON. Once Power-Up is complete, the positioning completion output turns ON.
- (2) The relationship of the P I/O alarm, emergency stop output reset input and the operation status is indicated in the diagram below:



4-2 Absolute Reset Procedure (Absolute Specifications)

Caution) With the absolute type, 0E5 (Encoder Reception Error) will be displayed under certain conditions, such as when the power is first turned on after disconnecting the battery or PG cable. This display does not indicate fault. Perform an absolute reset in accordance with the specified procedure.

The absolute reset procedure varies depending on the controller version.

A "SERIAL No." label is attached on the right side face of the controller.

Check the second last character (alphabet) in the portion following SERIAL No.

Example) If the label reads "SERIAL No. UK251050 E1," the controller version is "E."

The absolute reset procedure is different between units whose serial number contains E or preceding alphabet (A*, ..., E* (* indicates a number)) and those whose serial number contains F or subsequent alphabet (F*, G*, ... (* indicates a number)).

(A unit whose serial number contains F or subsequent alphabet requires that a homing operation be performed using the teaching pendant or PC software.)

Absolute Reset Procedure for Controller Version F* or Later

- (1) Connect the motor cable and encoder/brake cable to the controller.
- (2) Connect the PIO connector and the upper PLC using the supplied flat cable.
- (3) If two or more axes are connected via controller link cables, set axis numbers using piano switch 1 (SW1) on the controller.
For details, refer to 2-2, "Name of Parts and Functions."
- (4) Connect the battery to the controller.
- (5) Turn ON switch No. 1 (lower side) of piano switch 2 (SW2) on the controller (tilt toward the right).
- (6) Turn on the main power to the controller.
- (7) The ALM LED indicator is lit.
- (8) Turn ON the hold/servo ON input signals via the PIO.
- (9) Input a reset signal via the PIO to execute an alarm reset.
- (10) Perform homing using the teaching pendant or PC software.
- (11) Turn OFF switch No. 1 of piano switch 2 (SW2) on the controller (tilt toward the left).

This completes the absolute reset.

Absolute Reset Procedure for Controller Version E* or Earlier

- (1) Connect the motor · brake cable and encoder cable to the controller (Note 1).
- (2) Connect the upper PLC to the P I/O Connector using the attached flat cable.
- (3) When connecting more than 2-axes, address each controller by using the piano switches.
For details, refer to 2-2, "Name of Parts and Functions."
- (4) Connect the battery to the controller.
- (5) Put actuator's slider or rod to the home direction of mechanic end.
- (6) Turn on No.1 switch (the bottom one) of SW2. (Turn it over to right side.)
- (7) Supply main power to the controller.
- (8) RDY turns on at LED display.
- (9) Turn off No.1 switch of SW2. (Turn it over to left side)*1
That's all for absolute reset. Home is set to few mm ahead from the present position (mechanic end). (The distance from the mechanical end is different by type of actuator.)
- (10) To continue moving the actuator, turn on SERVO ON input (Pin 35) and Hold (Pin 33) of the PIO.

Note 1) If you leave No.1 switch of SW2 ON, when you supply power next time, absolute reset is executed at actuator's position at that moment.

Note 1) The absolute actuators are the only actuators that can operate using E-Con Absolute specification. The standard actuators can not be used with the absolute controllers.

4-3 Move After Power-Up (Standard)

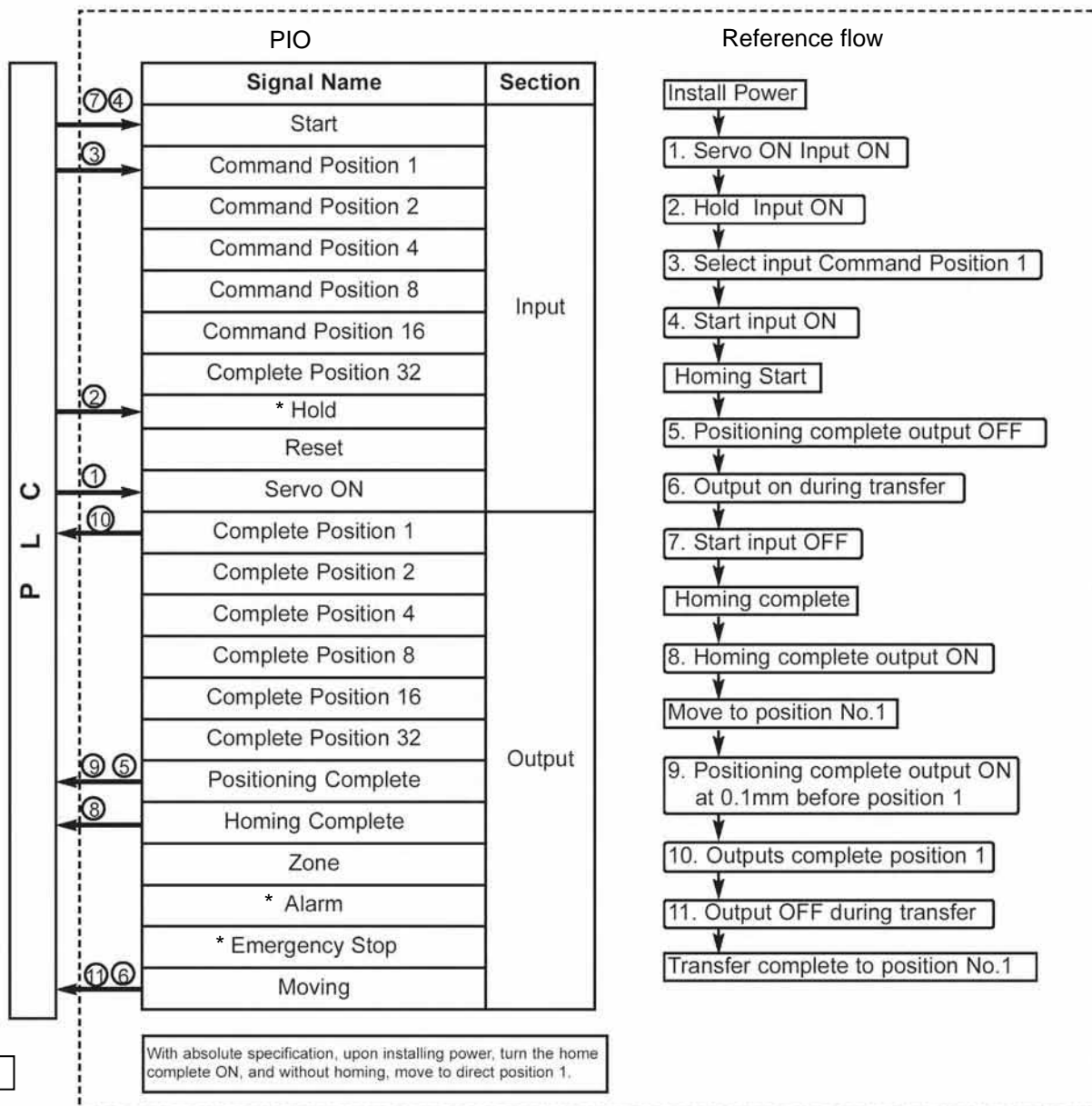
Operation application example:

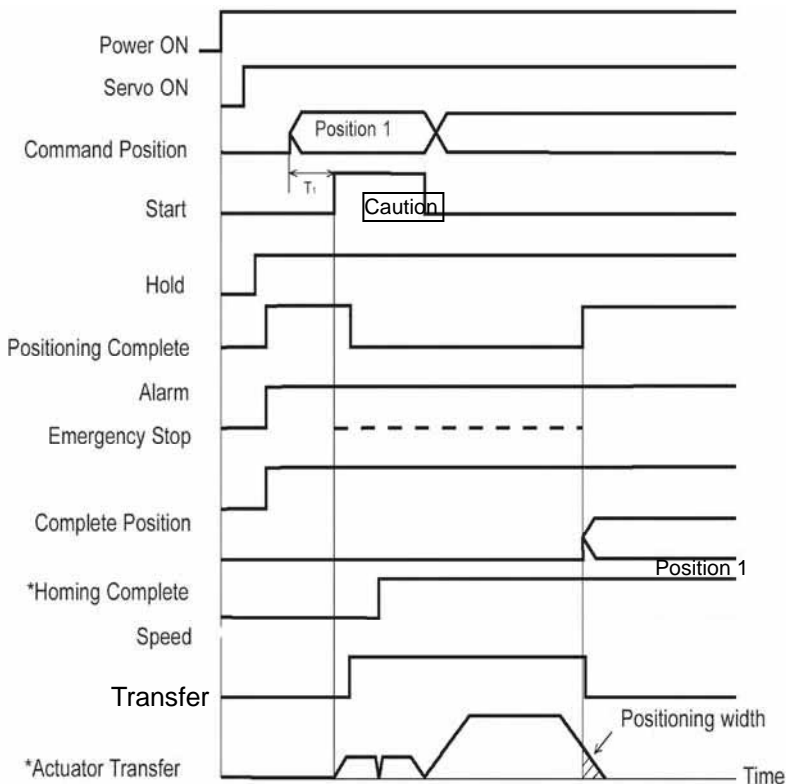
After Power-Up, move to point 150 mm from home at a speed of 200 mm/sec.

Position data table (column with dark line indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	0	100	0.3	0	0.1	0
1	150	200	0.3	0	0.1	0
:						

E-Con Controller



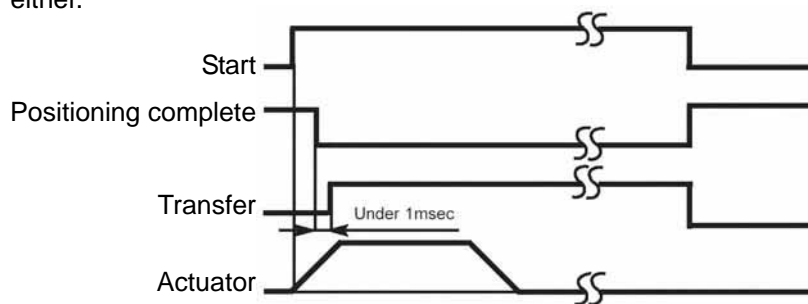


After Power-Up and operation preparation is ready, positioning complete output will turn ON. (If servo ON input is OFF, positioning complete output will not turn ON.) To confirm system is RDY, check if positioning complete output is on. When system is RDY and positioning is complete, positioning complete output turns ON. After power-up, the complete position outputs are all OFF, once motion is completed, position complete turns on. When completing to position No.0, the position complete outputs are do not change state. Also actuators do not move unless the HOLD input is ON.

T1: Over 6 msec Time from Command Position Select Input to Start Input ON. (Please consider scanning time of the upper controller)

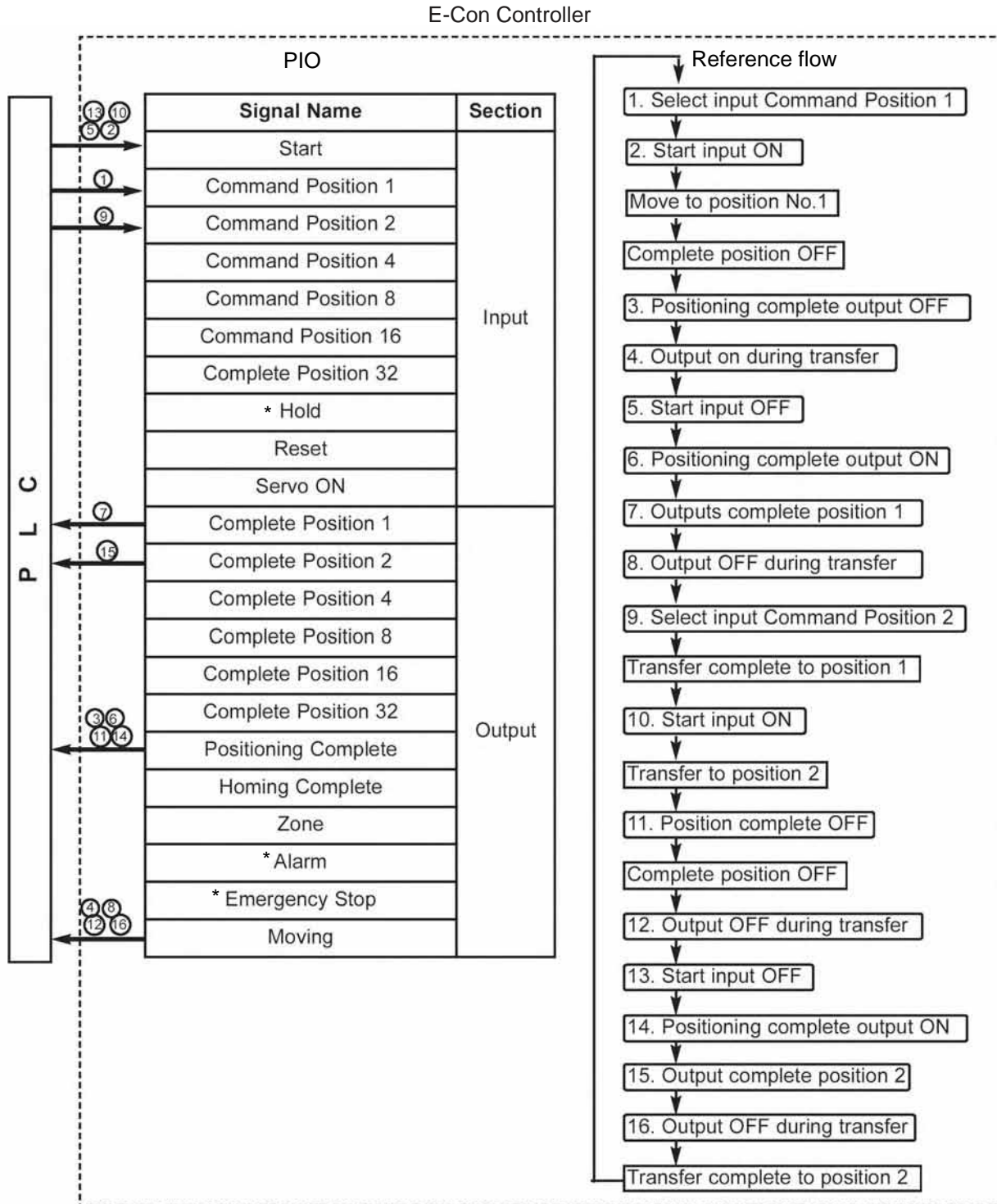
* For absolute specification, homing complete signal turns ON after supply power and homing is not executed.

Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status. A the diagram below shows, if you leave the Start Input ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes. The moving output signal does not turn OFF, either.



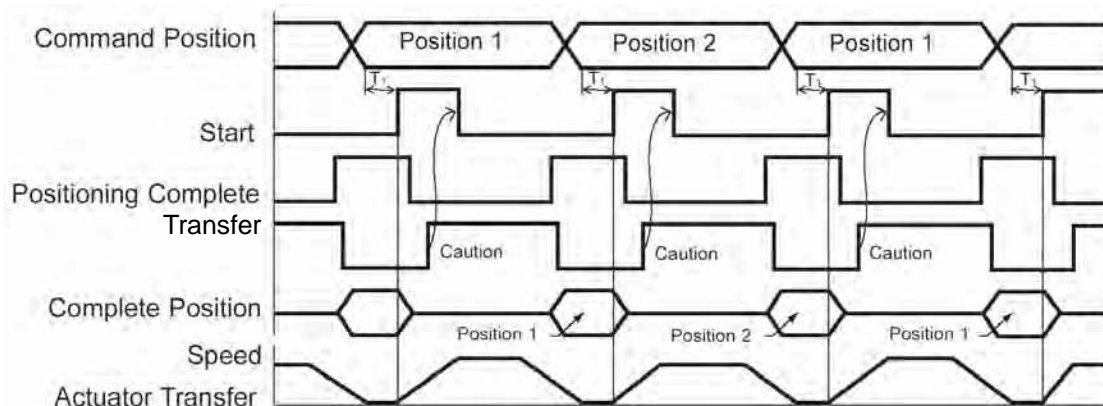
4-4 Positioning Mode (2 point space reciprocation)

Movement example) Reciprocate 2 positions. Assign the position 1 at 250 mm from home, and Position 2 at 100 mm from home. Set speed to 200 mm/sec for Position 1 and 100 mm/sec for Position 2.



Position Data Table (Columns with the thick lines indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	*	*	*	*	*	*
1	250	200	0.3	0	0.1	0
2	100	100	0.3	0	0.1	0
:						

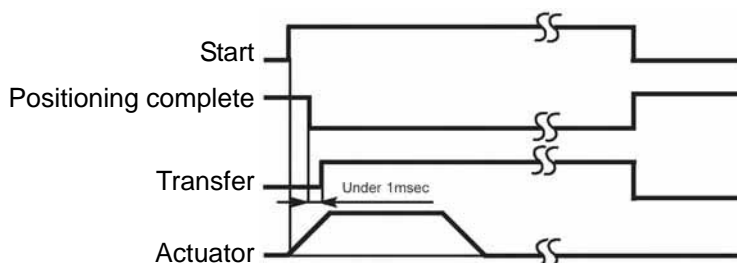


T1: Over 6 msec Time from Command Position Select Input to Start Signal ON

(However, please consider the scan time of the upper controller.)

Please input Command Positron after previous positioning complete turns ON.

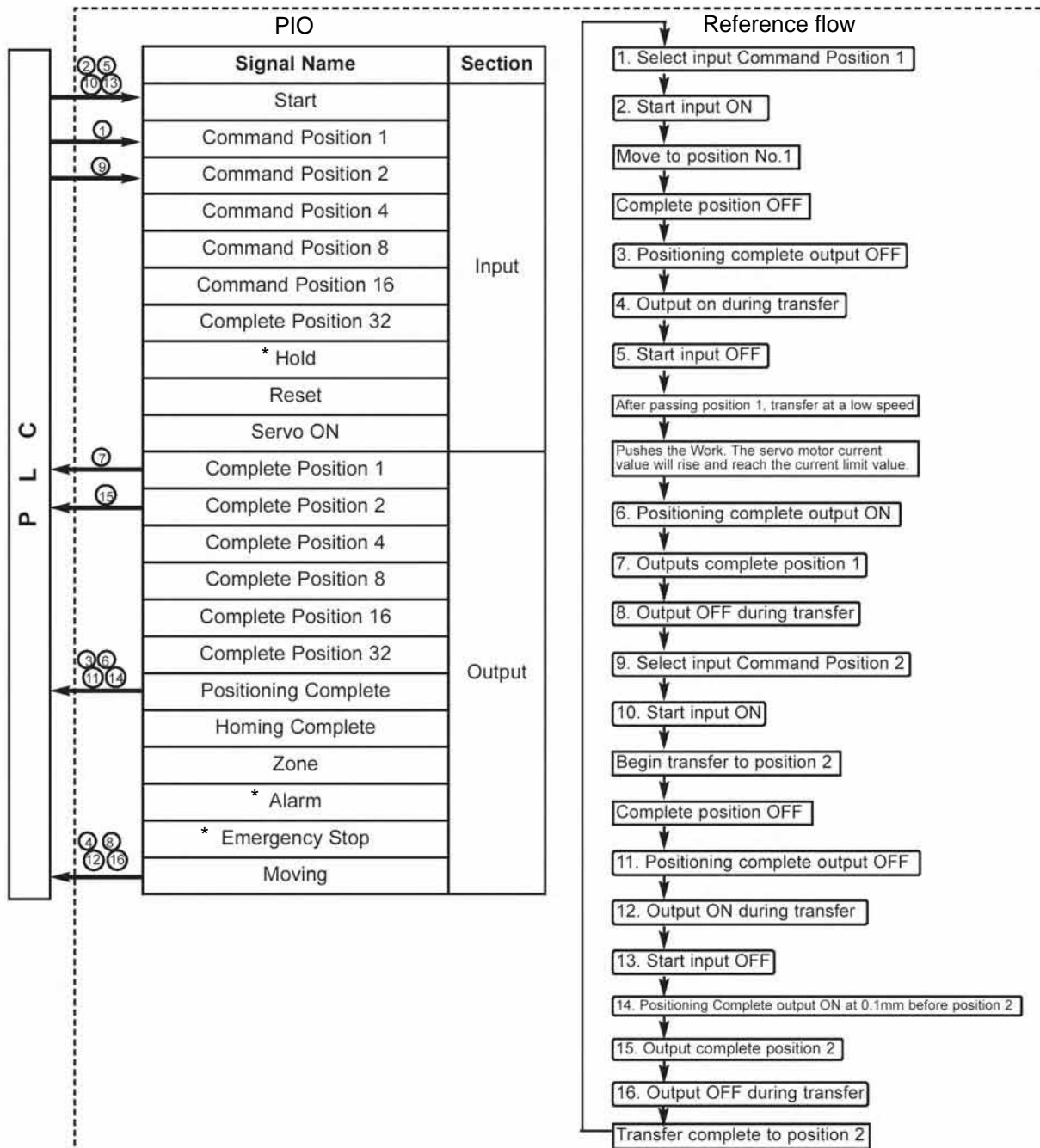
Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.
 A the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes. The moving output signal does not turn OFF, either.



4-5 Push Mode

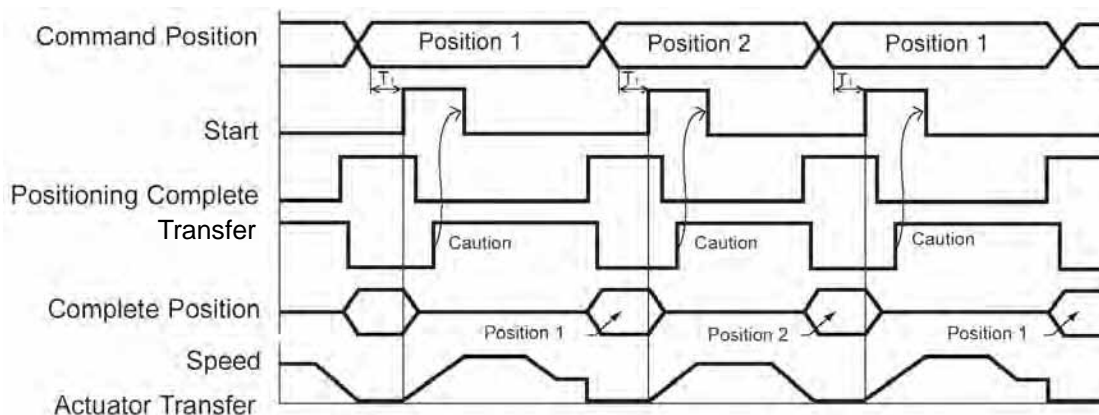
Movement Example) Use via Push Mode and Positioning Mode. Assign Position 1 to 280 mm from home and Position 2 to 40 mm from home. Move to Position 1 in Push Mode (until the actuator contacts the front side). Use the Push Mode to move to Position 2 (match to opposite motor side direction). Assign the maximum push to 15 mm, and the current limit value during push to 50%. Transfer to Position 2 by positioning mode. Set transfer speed 200 mm/sec for Position 1 and 100 mm/sec for Position 2.

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Position Data Table (Columns with the thick lines indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	*	*	*	*	*	*
1	280	200	0.3	50	15	0
2	40	100	0.3	0	0.1	0
:						

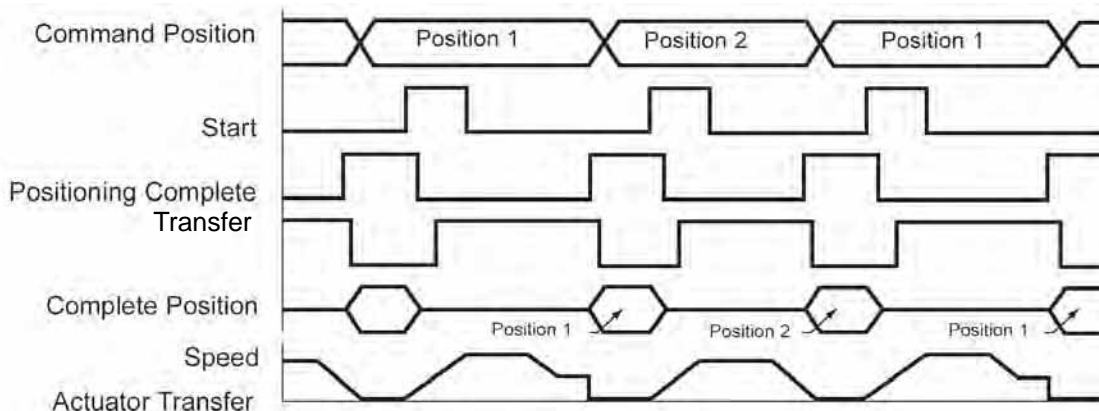


T1: Over 6 msec Time from Command Position Select Input to Start Signal ON

(However, please consider the scan time of the upper controller.)

Please input Command Positron after previous positioning complete turns ON.

Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status. In push-motion operation, if the actuator misses the work part, positioning complete output will not turn on as shown the diagram below. Complete position output and the output during transfer will turn OFF.

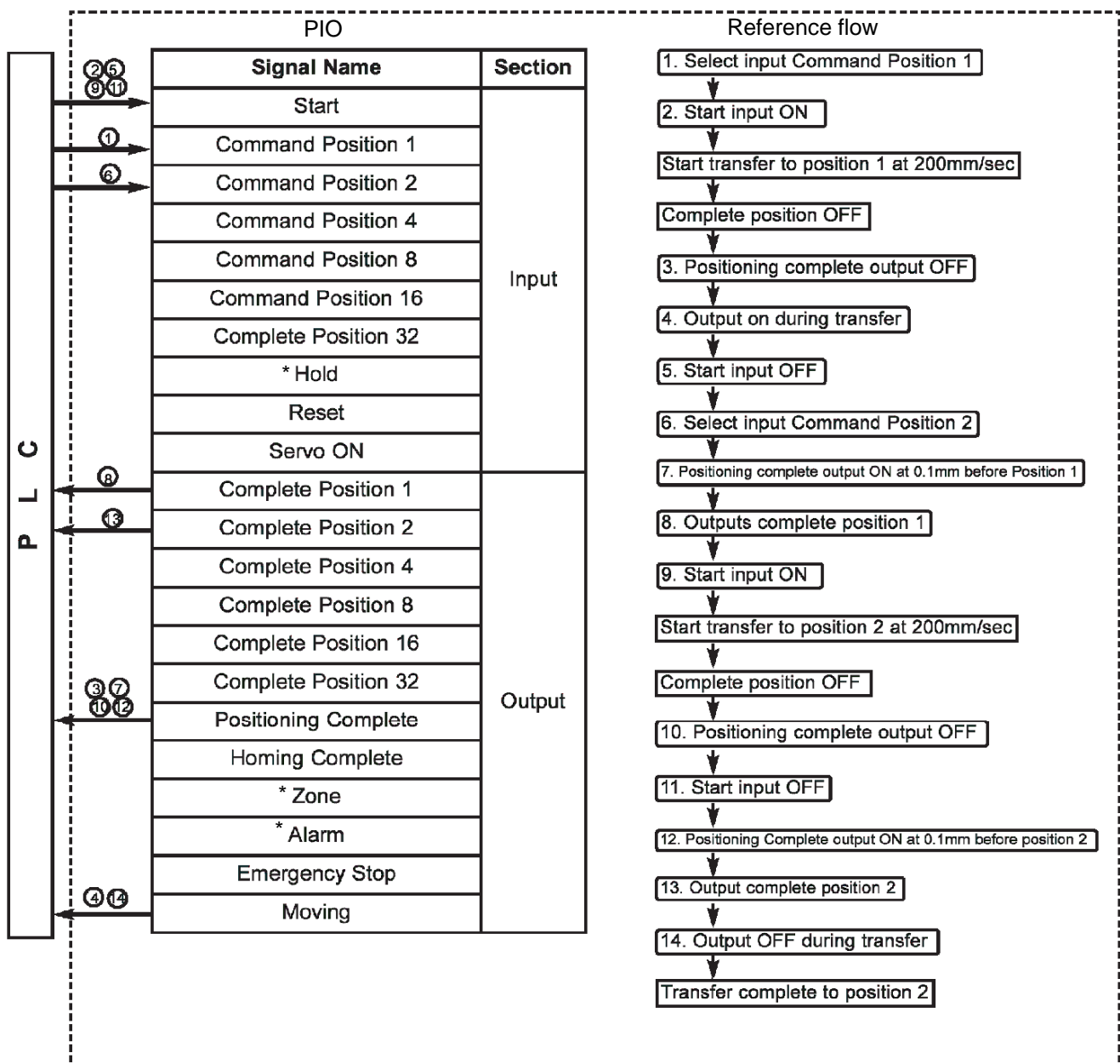


4-6 Speed Change Movement During Transfer

Movement Example) During movement, speed decreases when approaching a given location. Assign Position 1 at 150 mm away from home, and Position 2 at 200 mm away from home. Assign Position 2 as the carry-over position, and move to Position 1 at a speed of 200 mm/sec and from Position 1 to 2 move 100 mm/sec.

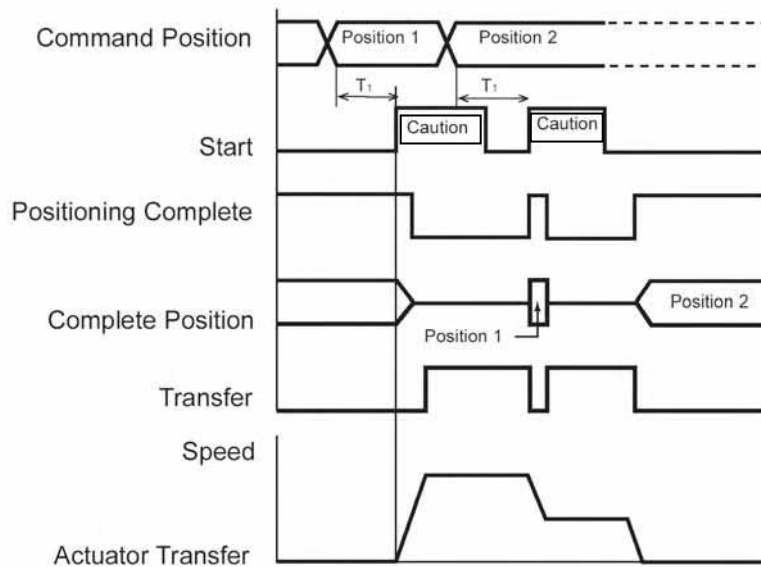
Method) In this case, motion is executed in consecutive order, first with Position 1, then followed by Position 2. However, before stopping at Position 1, it is necessary to first execute the Start Signal Input after setting the Command Position. To achieve this, set the Pos band for Position 1 and right after Position 1 is complete, input the Start Signal for Position 2 (Command Position inputs should be set during movement to Position 1).

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Position Data Table (Columns with the thick lines indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	*	*	*	*	*	*
1	150	200	0.3	0	1	0
2	200	100	0.3	0	0.1	0
:						



T1: Over 6 msec Time from Command Position Select Input to Start Signal ON

(However, please consider the scan time of the upper controller.)

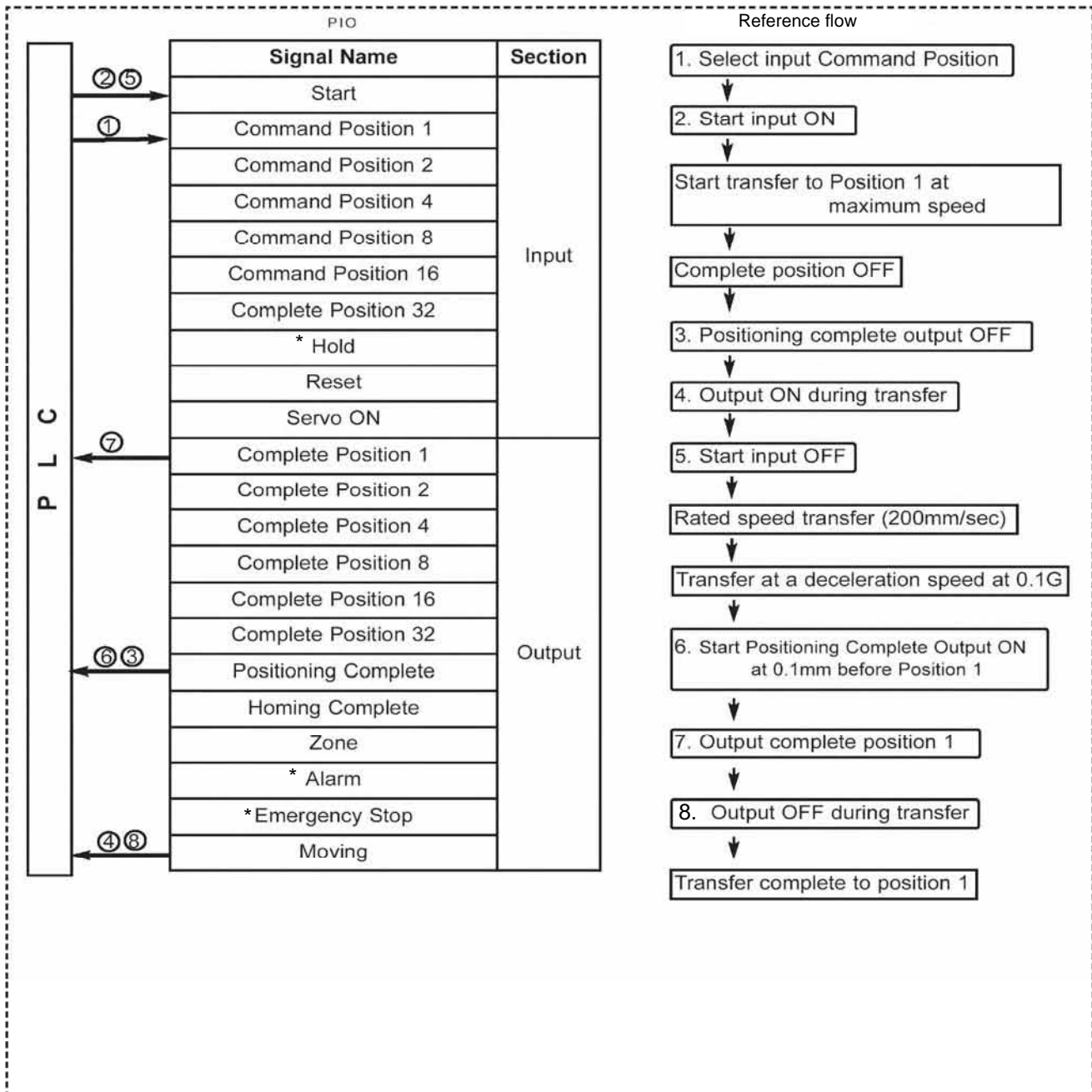
Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.

4-7 Movement Using Different Acceleration Value • Deceleration Value

Movement Example) Perform positioning at a speed of 200 mm/sec to a location (Position 1) 150 mm away from home. The actuator accelerates at the maximum acceleration and decelerates at 0.1 G.

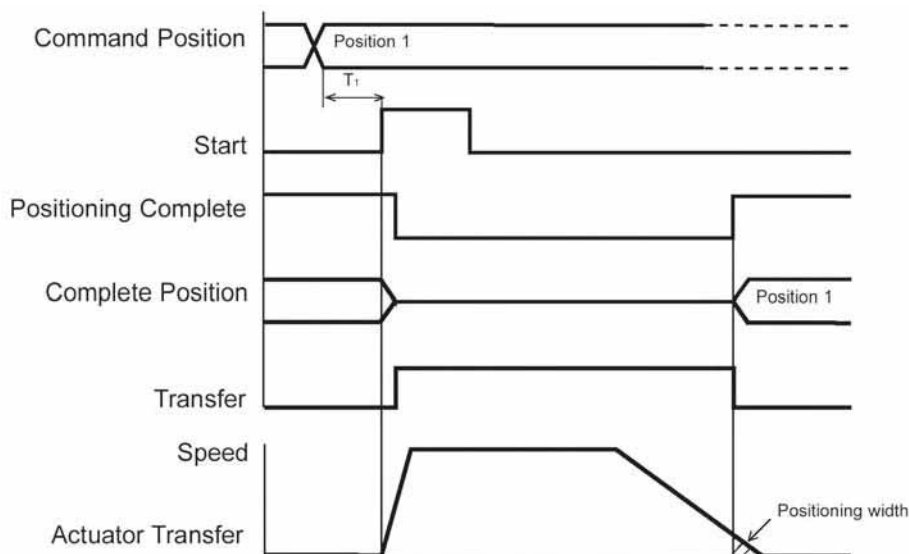
Method) Set "1" in the "Acc. only Max" field of the position data table to apply the maximum acceleration. Enter "0.1" in the "Acc/Dec" field of the position data table to set the deceleration to 0.1 G.

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Position Data Table (Columns with the thick lines indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	*	*	*	*	*	*
1	150	200	0.1	0	0.1	1
:						

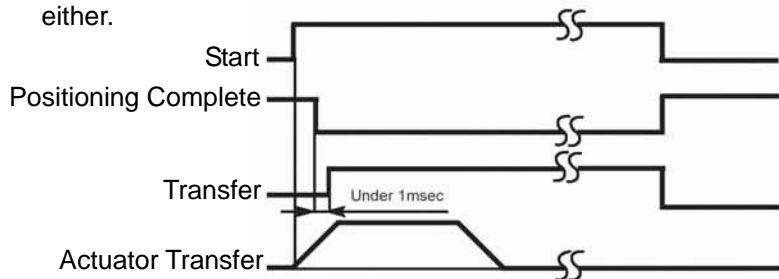


T1: Over 6 msec Time from Command position select input to start input ON.

(However, please consider the scan time of the upper controller)

Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.

As the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes. The moving output signal does not turn OFF, either.

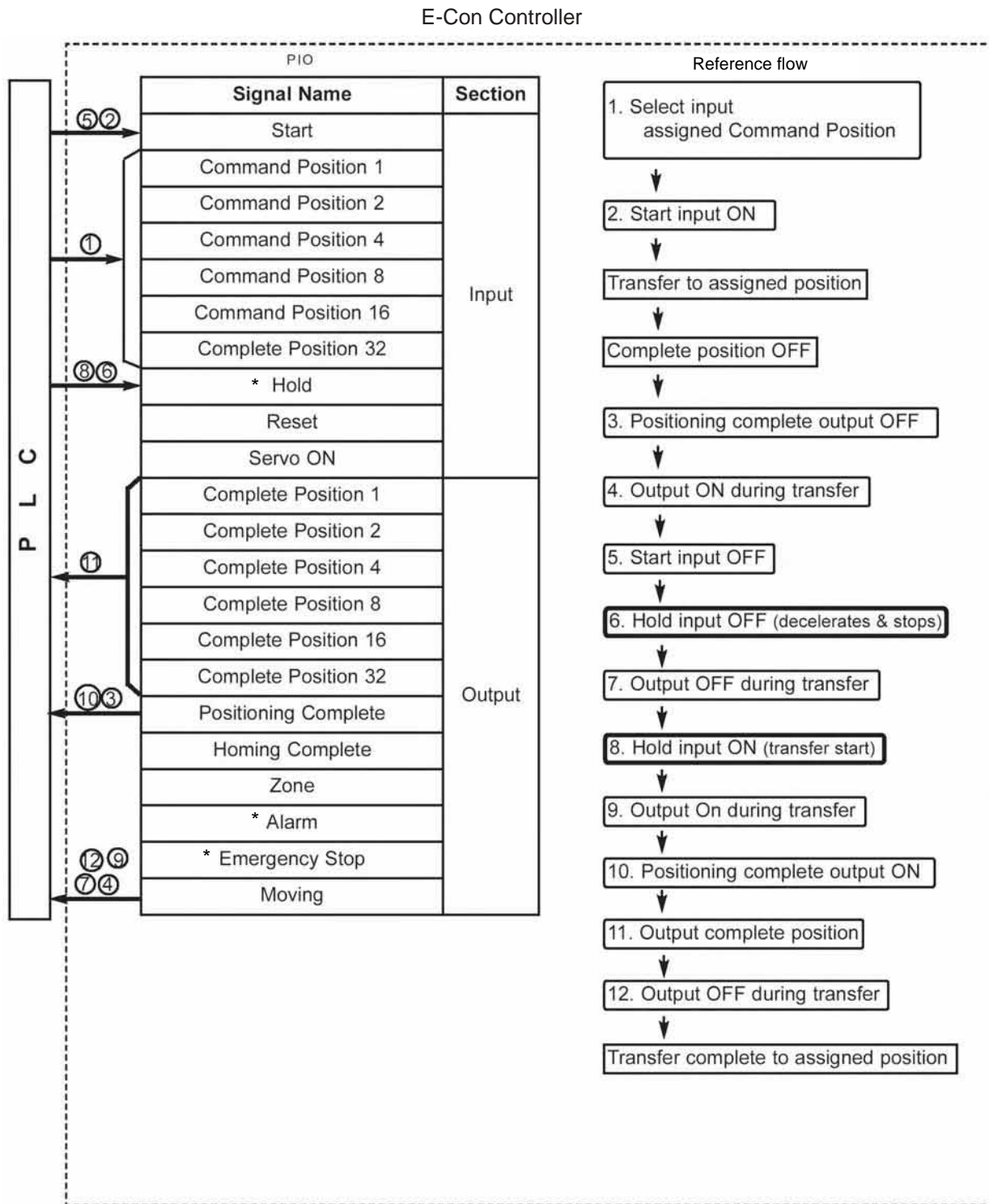


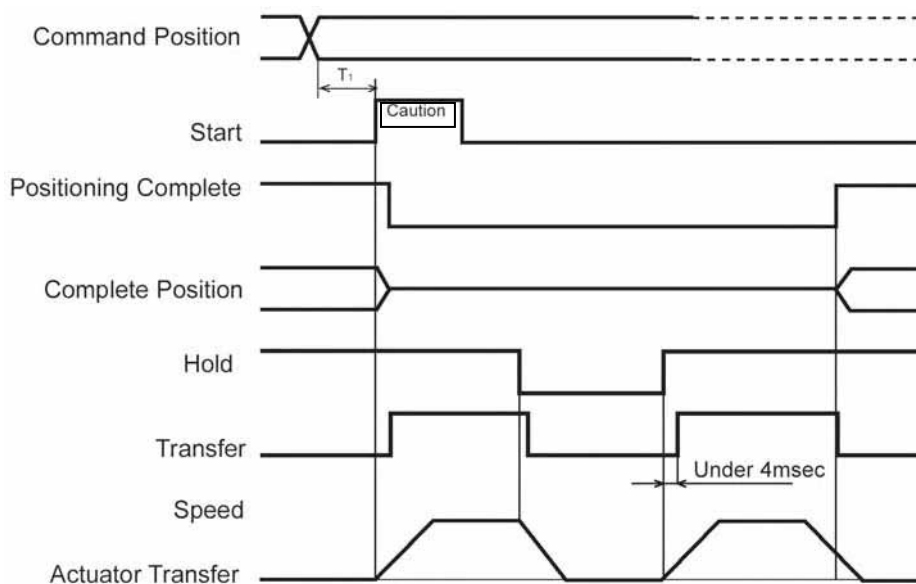
If an overload alarm occurs frequently when this function is used, disable the "acceleration only MAX" function.

4-8 Hold

Movement Example) Temporary stops the movement of the actuator.

Method) Uses the Hold Input.

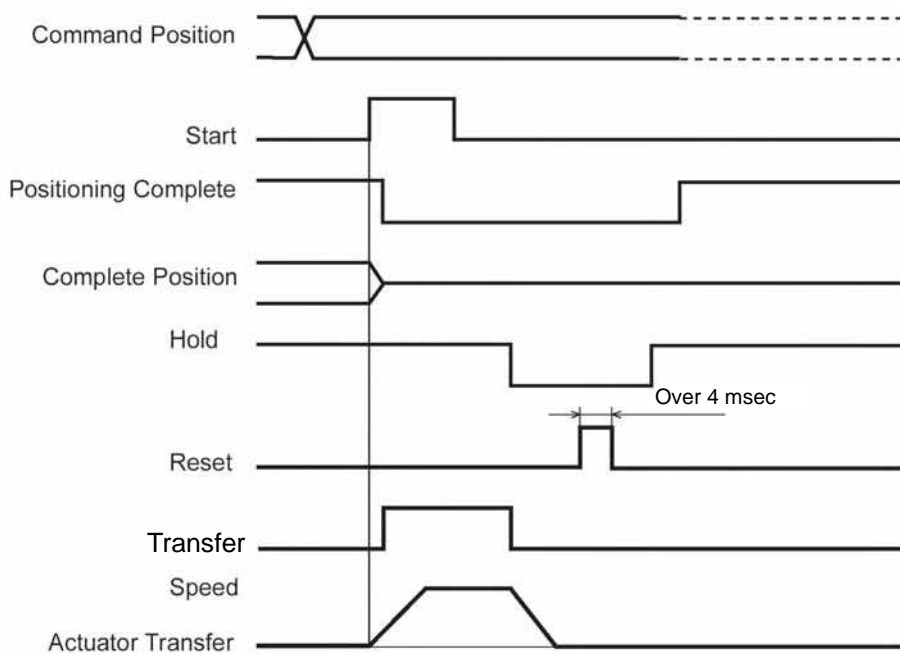




T1: Over 6 msec Time from Command Position Select Input to Start Signal ON
(However, please consider the scan time of the upper controller)

Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that the output during motion turns ON with Start Signal ON status.

You can cancel the remaining transfer by turning ON the reset input signal while the actuator is held.
(The remaining transfer will be cancelled upon detection of the leading edge of the reset signal.)



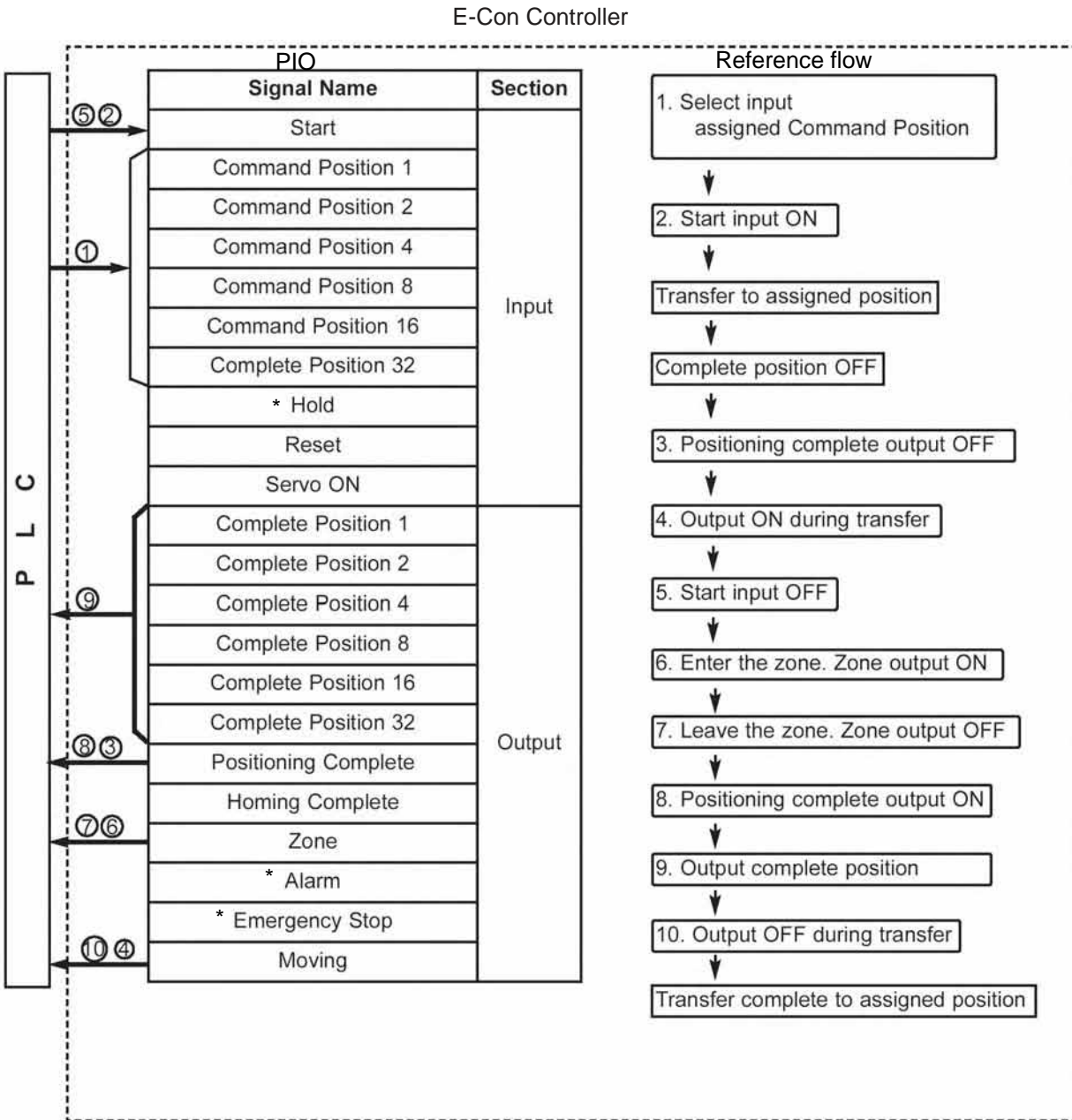
4-9 Zone Signal Output

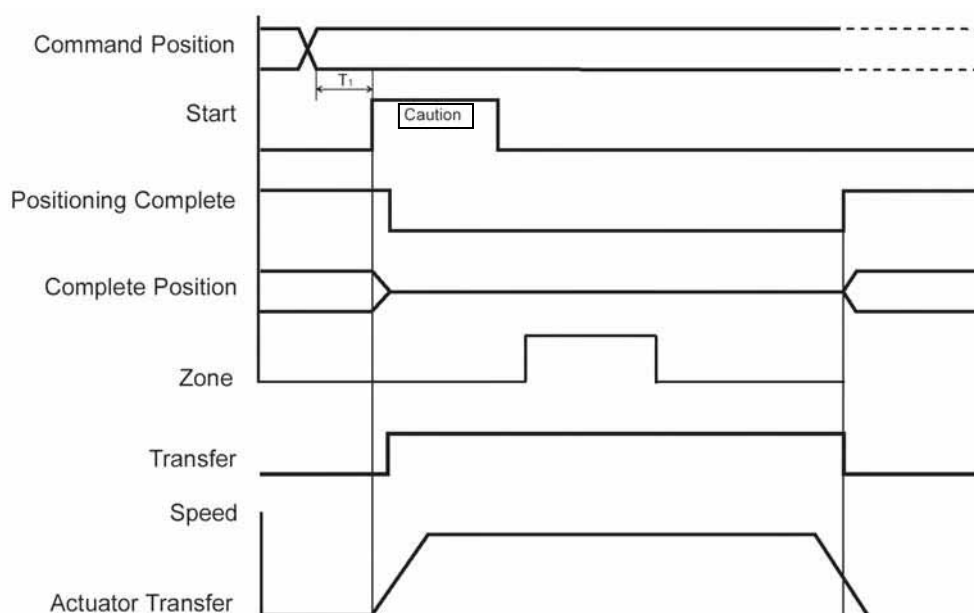
Movement example) During motion, the Zone Signal output will turn ON from 40 mm from home to position 120 mm from home. (40 mm < Zone Signal Output < 120 mm).

Method) Zone Signal Output boundary is set in the Parameter Zone Limit + and Zone Limit -.

Input as the following:

Zone Boundary value +	120
Zone Boundary value -	40





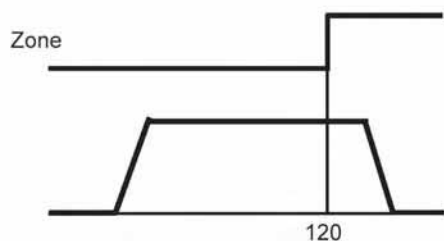
T_1 : Over 6 msec Time from command position select input to start input ON

(However, please consider the scan time of the upper controller)

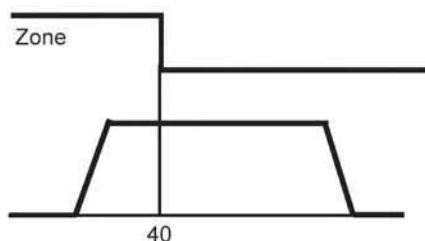
Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.

Other zone output (example):

Zone output at over 120



Zone output at under 40



Zone Boundary value +	Maximum Stroke Length
Zone Boundary value -	120

Zone Boundary value +	40
Zone Boundary value -	0

4-10 Transfer to Home

Movement Example) Homing alone cannot be performed using PIO.

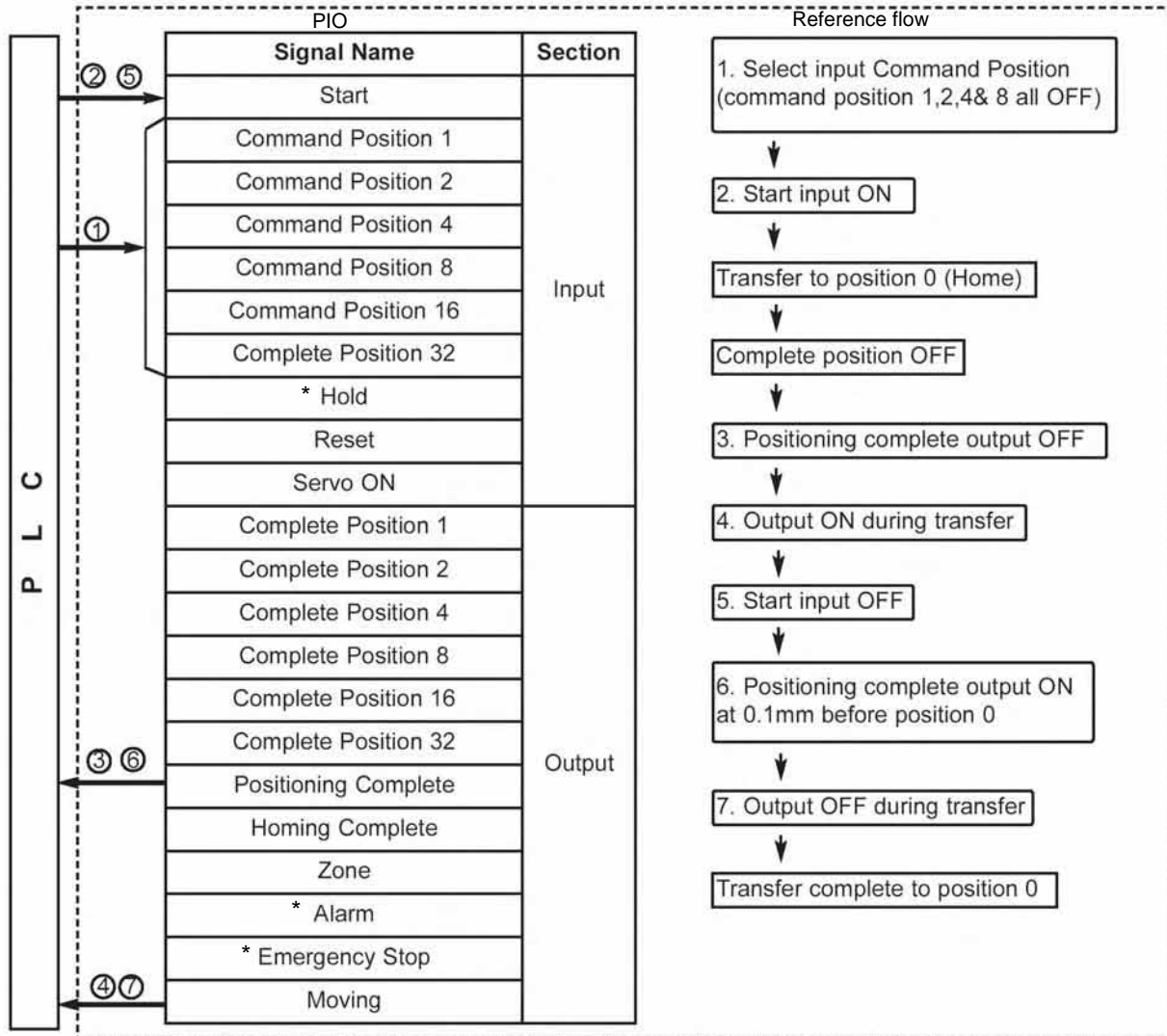
You cannot home using the position data table (position 0 at 0 mm). Homing occurs when controller is told to move to a point when the actuator has not been homed yet.

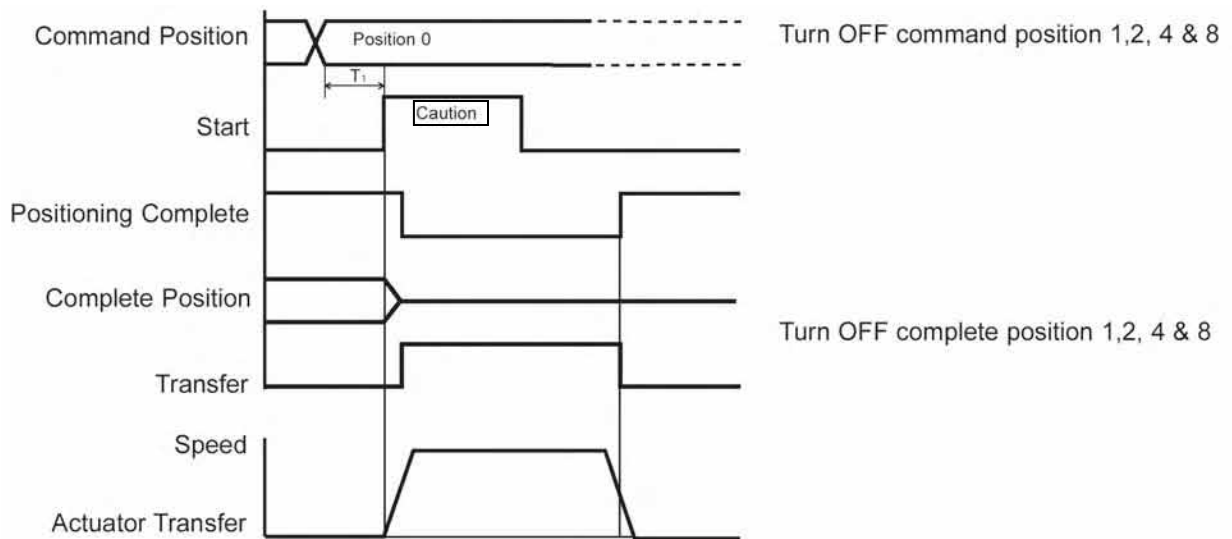
Method) You must create point data at distance 0 from the home and move the actuator to this position. Input the home data to position 0. To return the actuator to its home, move it to position 0.

Position Data Table (Columns with the thick lines indicate the input insert)

No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	0	100	0.3	0	0.1	0
1	*	*	*	*	*	*
:						

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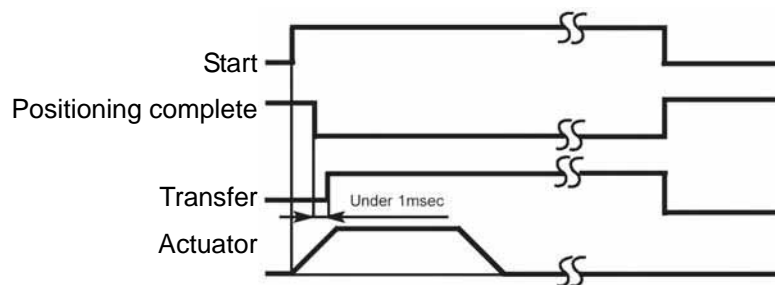
T1: Over 6 msec Time from command position select input to start input ON

(However, please consider the scan time of the controller)

It is not necessary to input data with a distance of 0 mm from home to position 0.

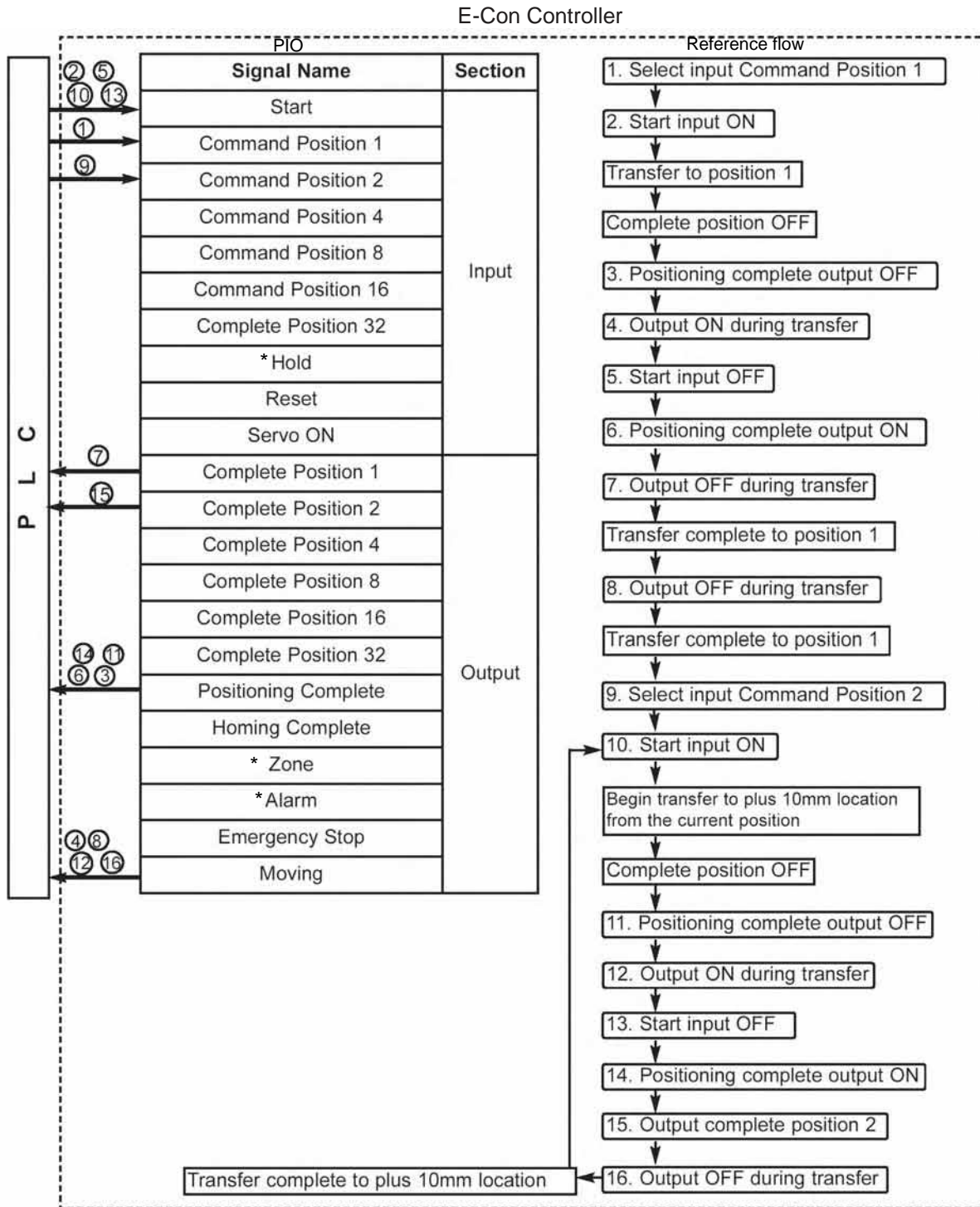
The data of distance 0 mm from home is input to position 0 mm as example here, you can also input that data to positions 1-63.

Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.
As the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes. The moving output signal does not turn OFF, either.



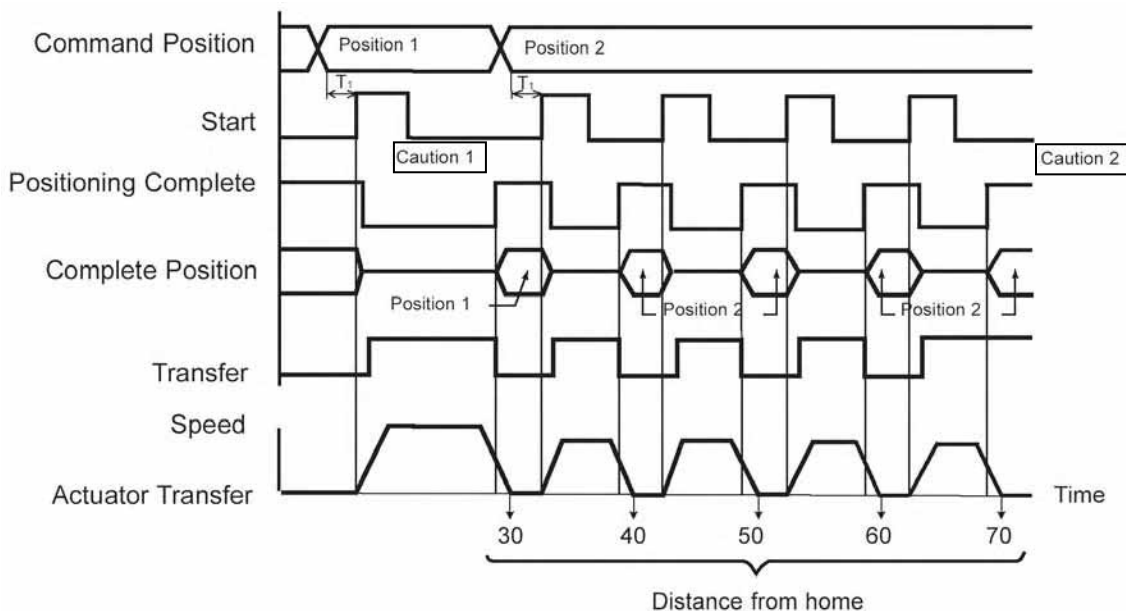
4-11 Incremental Movement in Relative Coordinate

Movement example) Move to position 30 mm from home, and from there, move the actuator in increments of 10 mm. The transfer speed from home to the 30 mm location is set at 100 mm/sec, and the 10 mm incremental movements are set at 20 mm/s.



Position Data Table (Columns with the thick lines indicate the input insert)

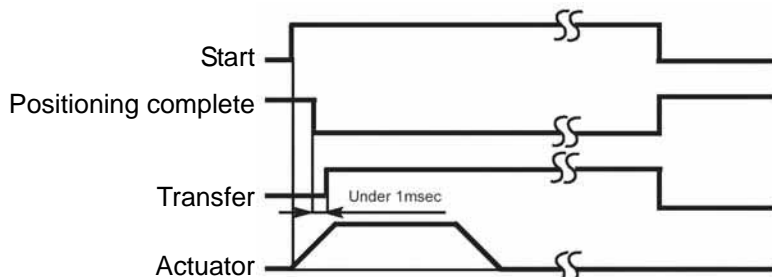
No.	Position	Speed	Acc/Dec	Push	Positioning Band	Acc. only Max
0	*	*	*	*	*	*
1	30	100	0.3	0	0.1	0
2	10	20	0.3	0	0.1	0
:						



T1: Over 6 msec Time from command position select input to start input ON
(However, please consider the scan time of the upper controller)

Note 1: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving output turns ON with Start Signal ON status.

As the diagram below shows, if you leave the Start Input ON, even if the actuator completes transfer, positioning output will not turn ON. The moving output signal does not turn OFF, either.



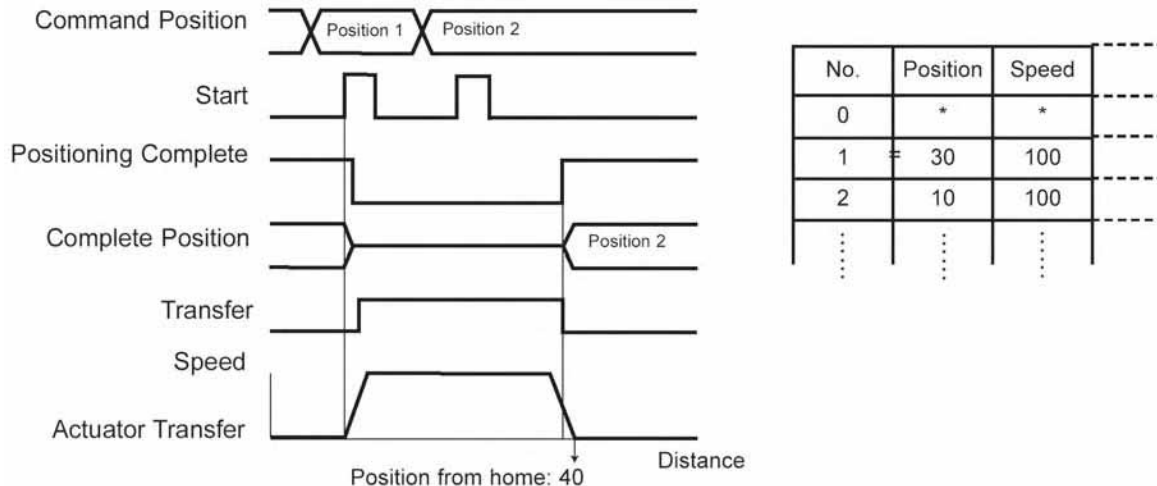
Note 2: In case a soft limit is reached when relative transfer is executed consecutively, the actuator will stop at the position and the positioning complete signal will be output.

4-12 Caution Regarding Relative Coordinate Assign

(1) Caution During Positioning Movement

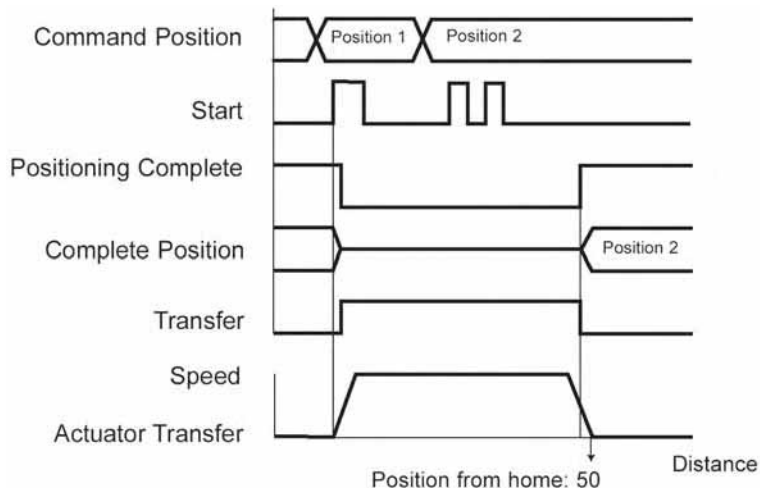
When an incremental coordinate position number is selected/input and then the Start Input is turned ON while the actuator is performing positioning operation, the actuator will move to the position corresponding to the initial position plus the relative transfer load. (If the relative transfer load is negative, the actuator will move to the position corresponding to the initial position less the relative transfer load.)

Example: When the Start Input of Position 2 is executed during movement to Position 1, the actuator moves to a position 40 mm away from home.



If the Start Input is turned ON for an incremental coordinate position number several times while the actuator is performing positioning operation, the actuator will move to the position corresponding to the initial position plus "Relative transfer load x Number of times the Start Input was turned ON."

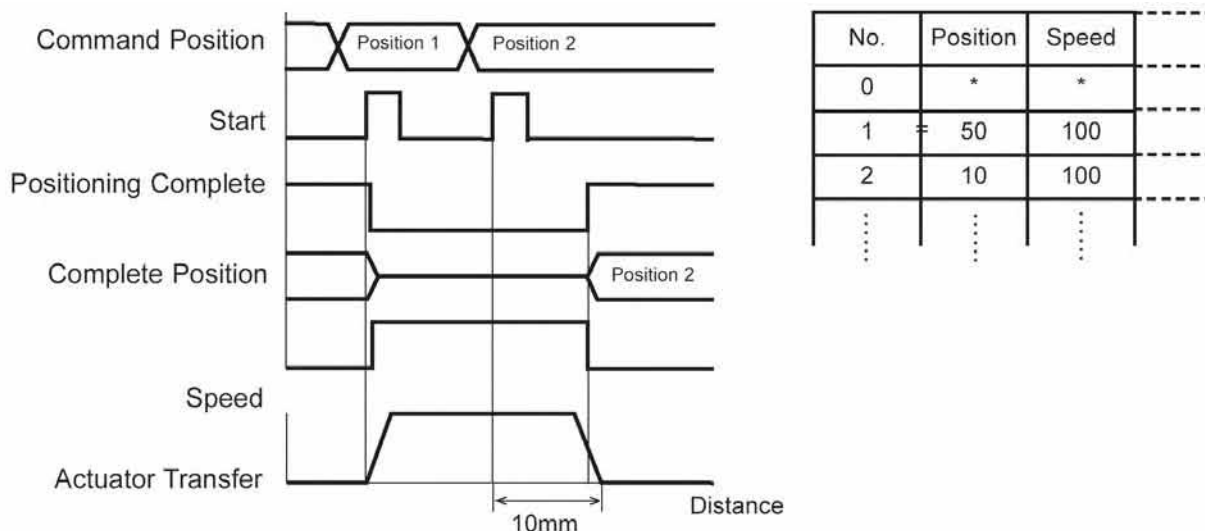
Example: In case Start Input of Position 2 is executed twice during movement towards Position 1, the actuator moves to a position approximately 50 mm away from home.



(2) Caution During Push Movement

If an incremental coordinate position number is selected/input and then the Start Input is turned ON while the actuator is moving in the Push Mode, the actuator will move to the position corresponding to the position at which the Start Input was turned ON plus the relative transfer load. Accordingly, the end position is indeterminable.

Example: The Start Input Position 2 is executed during movement towards Position 1 during Push Mode and the actuator moves to a position that is 10 mm away from the Input Position 1.



(3) Accumulation Error Due to Consecutive Relative Transfer

The position data only recognizes a minimum resolution. The minimum resolution is specified according to lead and number of encoder pulses. Therefore, an error may occur between the value input for the position and the corresponding movement of the actuator. When a relative transfer is executed consecutively, this error will accumulate.

The maximum error width is the value which divided the lead value of an actuator by 16384.

(On the RCS-RB7530/RB7535, the maximum error width is the value calculated by dividing the lead by 3072. On the RCS-R10/R20/R30 and RCS-G20, it is calculated by dividing the lead by 4096.)

To clear the accumulated errors, an absolute coordinate command must be issued before the allowable error limit is exceeded.

5. Parameters

5-1 Parameter Classification

The parameters are classified into the following four types depending on their function:

Types:

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

5-2 Parameter List

No.	Type	Name	Unit	Factory default
1	a	Zone limit + side	mm	Effective actuator length
2	a	Zone limit – side	mm	Effective actuator length
3	a	Soft limit + side	mm	Effective actuator length
4	a	Soft limit – side	mm	Effective actuator length
5	a	Home direction [0: Reverse/1: Forward]	-	(In accordance with the ordered specification.)
6	b	Push & hold recognition time	msec	255
7	d	Servo gain No.	-	Set individually depending on the actuator characteristics.
8	b	Initial speed setting	mm/sec	Set individually depending on the actuator characteristics.
9	b	Initial acceleration/deceleration setting	G	Set individually depending on the actuator characteristics.
10	b	Initial positioning band (in-position)	mm	0.10
11	b	Initial acceleration only MAX flag	-	0
12	b	Current limit value during positioning stop	%	Set individually depending on the actuator characteristics.
13	b	Current limit value during homing	%	Set individually depending on the actuator characteristics.
14	b	Movement flag during stop	-	1
15	c	Hold input disable selection [0: Enable/1: Disable]	-	0
16	c	Serial communication speed	bps	38400
17	c	Minimum delay before slave transmitter activation	msec	5
18	b	Home sensor input polarity	-	(In accordance with the ordered specification.)
19	b	Overrun sensor input polarity	-	(In accordance with the ordered specification.)
20	b	Creep sensor input polarity	-	(In accordance with the ordered specification.)
21	c	Servo ON input disable selection [0: Enable/1: Disable]	-	0
22	a	Home offset	mm	Set individually depending on the actuator characteristics.

(Note) The numbers are shown on the PC software screen, but not on the teaching pendant.
The type symbols are given for convenience and not shown on the PC software screen or teaching pendant.

5-3 Parameter Settings

If you have changed any parameter, be sure to restart the controller via a software reset or reconnect the controller power.

5-3-1 Parameters Relating to Actuator Stroke Range

● Soft limits

Set the + soft limit in parameter No. 3 and – soft limit in parameter No. 4.

Both parameters have been set to the effective actuator length at the factory. Change the parameter settings if necessary, such as when an obstacle is present and collision between the actuator and obstacle must be prevented or when the actuator must be operated beyond the effective length.

Exercise due caution when setting these parameters, as wrong settings will cause collision with the mechanical end.

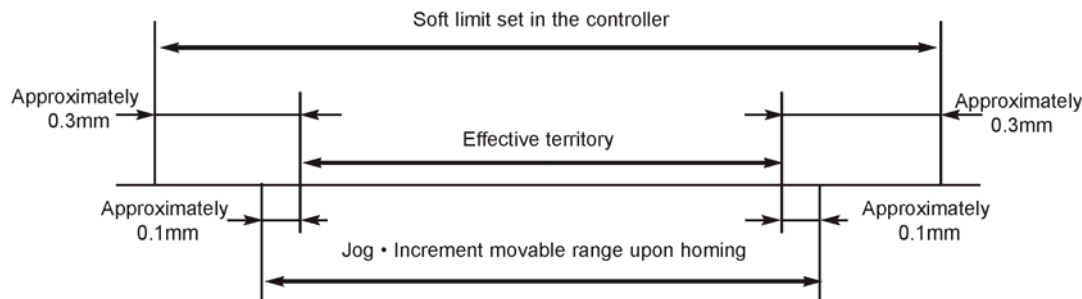
The minimum setting unit is 0.01 mm.

(Note) To change these parameters, set values corresponding to positions that are 0.3 mm wider than the desired effective range.

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

Parameter No. 3 (+ side): 80.3

Parameter No. 4 (– side): -0.3



● Zone limits

Set the zone in which the zone output signal turns ON.

The zone signal will turn ON when the current coordinate is between the – setting and + setting.

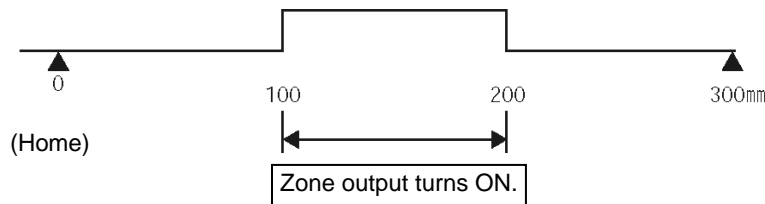
Set the + zone limit in parameter No. 1 and – zone limit in parameter No. 2.

The minimum setting unit is 0.01 mm.

Example) With the actuator of 300-mm stroke, use the zone limits as an intermediate LS actuating in a range of 100 to 200 mm

Parameter No. 1 (+ side): 200

Parameter No. 2 (– side): 100



● Home direction

If not specified by the user, the home direction is set to the motor side before shipment.

If you must change the home direction after the actuator has been assembled to your equipment, switch 0 and 1 in the setting of parameter No. 5.

If necessary, also change the home offset and soft limits.

Caution: Rod-type actuators do not permit reversing of the home direction.
If the home direction is reversed, all position data currently input will be cleared.

- Home offset

Parameter No. 22 has been set to an optimal value at the factory so that the distance from the mechanical end to home will remain constant.

The minimum setting unit is 0.01 mm.

This parameter can be adjusted in the following conditions:

- [1] Align the actuator's home with the mechanical home on the equipment after the actuator has been assembled to the equipment.
- [2] Set the home position again after reversing the factory-set home direction.
- [3] Correct the minor position deviation that has generated after the actuator was replaced.

Caution: If you have changed the home offset, the soft limit parameters must also be reviewed.

5-3-2 Parameters Relating to Actuator Operating Characteristics

- Initial speed setting

This parameter has been set to the rated speed of the actuator at the factory.

If a target position was written to an unregistered position table or the current position was acquired in the teaching mode, the controller regards the value of this parameter as the speed data corresponding to the applicable position number.

To set a speed lower than the rated speed, change the setting of parameter No. 8.

- Initial acceleration/deceleration setting

This parameter has been set to the rated acceleration/deceleration of the actuator at the factory.

If a target position was written to an unregistered position table or the current position was acquired in the teaching mode, the controller regards the value of this parameter as the acceleration/deceleration data corresponding to the applicable position number.

To set an acceleration/deceleration lower than the rated acceleration/deceleration, change the setting of parameter No. 9.

- Initial positioning band (in-position)

This parameter has been set to "0.10" mm at the factory.

If a target position was written to an unregistered position table or the current position was acquired in the teaching mode, the controller regards the value of this parameter as the positioning band data corresponding to the applicable position number.

Since increasing this value will cause a position complete signal to output early, change the setting of parameter No. 10 as necessary.

- Initial acceleration only MAX flag

To cause the actuator to stop gradually at slow deceleration, you must set a lower acceleration/deceleration. However, this will also slow the acceleration.

This parameter lets you set a quicker acceleration without affecting the deceleration.

Note, however, that this parameter can be used only when the actual payload is no more than one-third of the rated loading capacity.

Check the rated loading capacity of your actuator by referring to the supplied specification list of supported actuators.

This parameter has been set to "0" (Disable) at the factory.

If a target position was written to an unregistered position table or the current position was acquired in the teaching mode, the controller regards the value of this parameter as the "acceleration only MAX" data corresponding to the applicable position number.

To enable this function, change parameter No. 11 to "1" (Enable).

● Push & hold recognition time

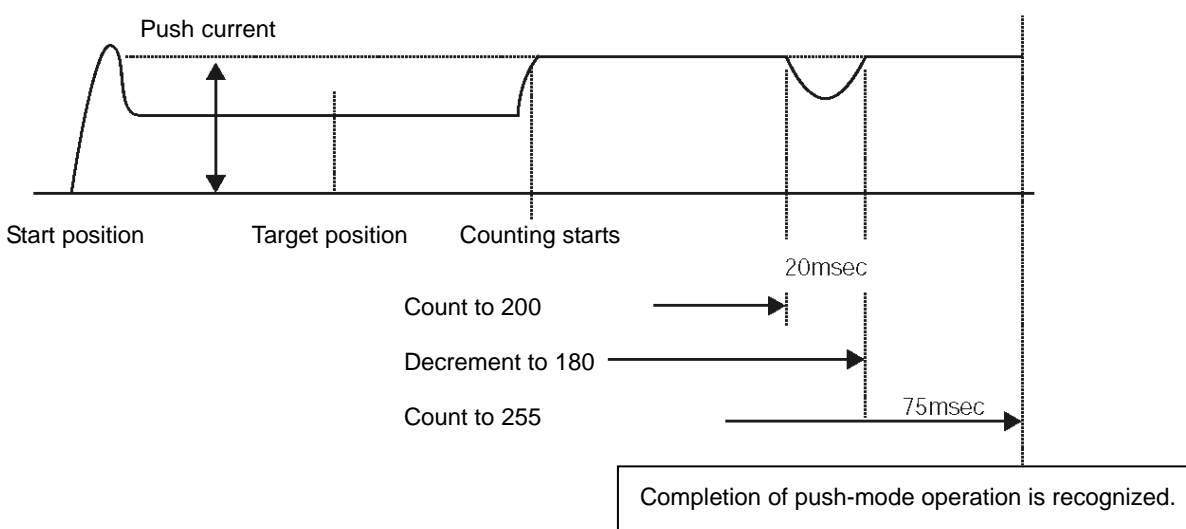
This parameter is used as a condition for determining if the actuator has contacted the work part and completed its push-mode operation.

Specifically, push-mode operation is deemed complete if the current limit value set in the position table has been maintained for the time set in parameter No. 6.

Set this parameter to an optimal value in accordance with the current limit value, by considering the shape and strength of the work part, etc.

The minimum setting unit is 1 msec, and the maximum value is 255 msec. This parameter has been set to "255" msec at the factory.

(Note) If the work part has shifted and current has changed during the push & hold recognition time, the judgment will be made as follows. In this example, the push & hold recognition time is set to 255 msec.



If the push current is maintained for 200 msec and then drops for 20 msec thereafter, the counter is decremented by 20. Upon recovery of the push current, counting resumes from 180. If the push current is maintained for 75 msec, the counter will have counted up to 255 and thus the controller will recognize completion of push-mode operation.

In this case, the judgment requires a total of 295 msec.

● Current limit value during positioning stop

At the factory, this parameter has been set to a current value corresponding to the standard specification of the actuator.

Increasing this value will increase the holding torque while the actuator is stopped.

This parameter need not be changed in normal conditions of use. However, hunting will occur if excessive external force applies to the actuator while the actuator is stopped. In this case, the value set in parameter No. 12 must be increased.

If you need to change this parameter, please contact IAI first.

● Current limit value during homing

At the factory, this parameter has been set to a current value corresponding to the standard specification of the actuator.

Increasing this value will increase the torque during homing.

This parameter need not be changed in normal conditions of use. However, the value set in parameter No. 13 must be increased if the slide resistance has increased in a vertical application due to the affixing method, load condition, etc., and homing completes before the correct position.

If you wish to change this parameter, please contact IAI first.

- Movement flag during stop

This parameter defines whether to enable or disable the dynamic brake while the actuator is stopped. It has been set to “1” (Enable) at the factory.

This parameter need not be changed in normal conditions of use, but there are situations where the actuator must be moved by hand with the servo turned OFF but the actuator does not move smoothly due to large slide resistance (this often occurs with actuators having a short ball screw lead).

In this case, you can change the value of parameter No. 14 to “0” (Disable) to release the dynamic brake and make the actuator move smoothly.

Caution: Before resuming normal operation, be sure to reset this parameter to “1” (Enable).

- Home sensor input polarity

On actuators of the standard specification, homing is performed based on the mechanical-end push mode. However, you can also select the sensor mode as an option.

At the factory, this parameter has been set to an appropriate value in accordance with the user's specification. Therefore, it need not be changed in normal conditions of use. If you have changed the mode after shipment, change the value of parameter No. 18.

Definition of settings:

- 0 (Standard specification; no sensor)
- 1 (Use home sensor; sensor polarity conforming to “contact a” logic)
- 2 (Use home sensor; sensor polarity conforming to “contact b” logic)

- Overrun sensor input polarity

Actuators of the standard specification do not come with an over-travel detection sensor, but it can be installed as an option.

At the factory, this parameter has been set to an appropriate value in accordance with the user's specification. Therefore, it need not be changed in normal conditions of use. If you have changed the mode after shipment, change the value of parameter No. 19.

Definition of settings:

- 0 (Standard specification; no sensor)
- 1 (Use over-travel detection sensor; sensor polarity conforming to “contact a” logic)
- 2 (Use over-travel detection sensor; sensor polarity conforming to “contact b” logic)

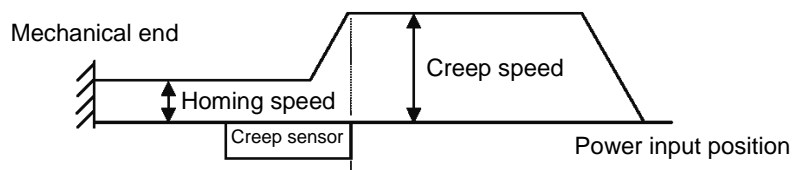
- Creep sensor input polarity

Normally, the traveling speed during homing is set to the low speed of 20 mm/s.

Therefore, an actuator with a long stroke takes a longer time to complete homing if the power was cut off when the actuator was away from home.

An optional creep sensor is provided to save time in this situation.

The actuator moves at the creep speed (100 mm/s or below) until a creep sensor is detected. Once a creep sensor is detected, the traveling speed will change to the homing speed (20 mm/s).



The actuator starts decelerating upon detection of a creep sensor.

At the factory, this parameter has been set to an appropriate value in accordance with the user's specification. Therefore, it need not be changed in normal conditions of use. If you have changed the mode after shipment, change the value of parameter No. 20.

Definition of settings:

- 0 (Standard specification; no sensor)
- 1 (Use creep sensor; sensor polarity conforming to “contact a” logic)
- 2 (Use creep sensor; sensor polarity conforming to “contact b” logic)

5-3-3 Parameters Relating to External Interface

- Hold input disable selection

Parameter No. 15 sets whether to enable or disable the hold input signal.

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

This parameter has been set to "0" (Enable) at the factory.

- Servo ON input disable selection

Parameter No. 21 sets whether to enable or disable the servo ON input signal.

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

This parameter has been set to "0" (Enable) at the factory.

- Serial communication speed

This parameter sets the communication speed to be used when the controller implements serial communication control via the PLC's communication module.

Set parameter No. 16 to a value appropriate for the specification of the communication module.

9600, 19200, 38400 or 115200 bps can be selected as the communication speed.

This parameter has been set to "38400" bps at the factory.

- Minimum delay before slave transmitter activation

This parameter defines the minimum delay before the controller's transmitter is activated following the completion of command reception, when the controller implements serial communication control via the PLC's communication module.

This parameter has been set to "5" msec at the factory. If the communication module specification exceeds 5 msec, set the required time in parameter No. 17.

5-3-4 Servo Gain Adjustment

- Servo gain No.

At the factory, this parameter has been set to an appropriate value in accordance with the standard specification of the actuator.

Although it need not be changed in normal conditions of use, vibration or noise may occur if the load condition has changed significantly after shipment due to change in the actuator affixing method, load condition, etc., when the actuator is used in a vertical application.

In this case, changing the value of parameter No. 7 will improve the situation, but the new setting must be determined carefully by taking into consideration all factors affecting the relationship of actuator operation. Please contact IAI.

6. Troubleshooting

6-1 What to Do When A Problem Occurs

If you encountered a problem, follow the steps below to conduct the specified checks to gather information needed to implement quick recovery and prevent recurrence of the problem.

- a. Check the status indicator lamps
 - RDY (green) --- The controller is receiving power and the CPU is operating normally.
 - RUN (green) --- The servo is ON and the actuator is moving.
 - ALM (red) --- An alarm is present.
 - ENC (orange) --- The encoder circuit is open or the encoder is not recognized.
- b. Check the host controller for abnormality.
- c. Check the voltage of the main power supply.
- d. Check the voltage of the 24-VDC power supply for I/O signals.
- e. Check for alarms.
 - Check the details of each alarm on the PC or teaching pendant.
- f. Check the cables for miswiring, disconnection and pinching.
 - Before checking the continuity of cables, turn off the power (to prevent a runaway actuator) and disconnect all wirings (to prevent the power from being supplied unexpectedly due to a sneak path).
- g. Check the I/O signals.
- h. Check the noise elimination measure (ground connection, surge killer installation, etc.).
- i. Identify how the problem occurred and the operating condition when the problem occurred.
- j. Check the serial numbers of the controller and actuator.
- k. Analyze the cause.
- l. Take an action.

Before contacting IAI, please check the items in a through j above. Provide the information to our technical staff.

	Servo OFF	Servo ON, stopped	Servo ON, moving	Alarm present (excluding message level alarms)	Emergency stop actuated
RDY lamp	Lit	Lit	Lit	Unlit	Unlit
RUN lamp	Unlit	Unlit	Lit	Unlit	Unlit
ALM lamp	Unlit	Unlit	Unlit	Lit	Unlit
ENC lamp	Unlit	Unlit	Unlit	This lamp turns on only when an encoder error has been detected.	Unlit
Position complete	OFF	ON	OFF	OFF	OFF
Moving	OFF	OFF	ON	OFF	OFF
*Emergency stop	ON	ON	ON	ON	OFF
*Alarm	ON	ON	ON	OFF	ON

(Note) The *emergency stop and *alarm signals operate on the negative logic.
 After the power is input, these signals remain ON while the controller is normal. They turn OFF when the power is cut off.
 These signals cannot be used for providing a contact-b interlock when the power is not supplied to the controller.

6-2 Alarm Level Classification

The alarms are classified into three levels based on the corresponding symptoms.

Alarm level	ALM lamp	*Alarm	Condition at occurrence of alarm	How to reset
Message	Unlit	Not output	An error is displayed on the PC software screen or teaching pendant.	
Operation cancellation	Lit	Output	The actuator decelerates to a stop, and then the servo turns off.	Input a reset signal from the PLC. Execute reset using the PC/teaching pendant.
Cold start	Lit	Output	The actuator decelerates to a stop, and then the servo turns off.	Reconnect the power.

(Note) Whatever the alarm, always investigate the cause of the alarm and remove the cause before resetting the alarm. If the cause of the alarm cannot be removed, or when the alarm cannot be reset even after the cause has been removed, please contact IAI.

If the same error occurs again after a reset, the cause of the alarm still exists.

6-3 Alarm Output by PIO

So that the PLC can identify each alarm occurring in the controller, the content of each controller alarm is output using the ports corresponding to the last four bits of the complete position output signal.

(This function is not available for message level errors.)

The PLC should be able to identify if a given output indicates a complete position number or alarm based on the status of the alarm output signal.

Alarm Bit Assignment Table (● = OFF, ○ = ON)

Alarm	Complete Position No.				Alarm Content	Alarm Code*
	8	4	2	1		
○	/	/	/	/	Normal	/
●	●	○	●	○	CPU abnormal	0FA
●	●	○	○	●	Wrong EEPROM Data Setting	0B0, 0B1
●	●	○	○	○	Homing abnormal	0BE
●	○	●	●	●	Servo malfunction	0C0
●	○	●	●	○	Electric conversion area abnormal	0B8 to 0CA
●	○	●	○	○	Excessive deviation abnormal	0D8, 0DC
●	○	○	●	●	Excessive load abnormal	0ED
●	○	○	●	○	Encoder breakage, battery voltage low	0E4 to 0E7
●	○	○	○	○	Corruption of EEPROM data	0F8

* The alarm codes are displayed at teaching pendant and PC interface software.

6-4 Alarms, Causes and Actions

(1) Message Alarms

Code	Error	Cause/action
040	Emergency stop	Cause: An emergency stop status was detected. (This is not an error.)
05A	Receive overrun	An error occurred during operation using the PC software/teaching pendant or serial communication via PLC's communication module. Cause: [1] Garbage data due to noise [2] Duplicate slave numbers when multiple actuators are controlled via serial communication Action: [1] Revise the wiring, equipment layout, etc., to eliminate noise. [2] Change the slave numbers to eliminate duplication.
05B	Receive framing error	
05C	Receive timeout error	
05D	Header error	
05E	Delimiter error	
07F	BCC error	
061	FNCCHR W address error	An error occurred during serial communication via the PLC's communication module. Cause: An undefined command or out-of-range data was received. Action: Review the data sent and correct the format.
062	Operand 1 error	
063	Operand 2 error	
064	Operand 3 error	
065	EEPROM write timeout	Cause: Writing of parameter or position data to the nonvolatile memory does not complete within 200 ms. (This alarm does not occur during normal operation.) Action: Do not issue a PLC command and write data using the PC/teaching pendant at the same time.
070	Movement command at RUN-OFF	Cause: A movement command was issued when the servo was OFF. Action: Before issuing a movement command, confirm that the servo is ON (the position complete signal is ON).
071	PTP before homing completion	Cause: A movement command was issued to the absolute actuator via serial communication when the home position was not yet established. Action: Perform an absolute reset to establish the home position first. (Refer to 4-2, "Absolute Reset Procedure.")
073	Error reset at servo ON	Cause: An alarm reset command was issued while the actuator was operating via serial communication with the servo ON. (This alarm does not cover PIO commands.) Action: Before issuing an alarm reset command, confirm that the servo is OFF.
075	Movement command during homing	Cause: The next movement command was issued in the middle of homing. Action: Issue the next movement command after homing has completed.
07A	ABS battery voltage low	Cause: The battery voltage was 3.2 V or below when the power was input. Action: Replace the battery as soon as possible.

(2) Operation Cancellation Alarms

Code	Error	Cause/action
0B0	Bank 30 data error	<p>Cause: Out-of-range or invalid data is included in the parameter area of the memory. (This alarm does not occur as a result of normal parameter input operation, but it may occur during serial communication using the PLC's communication module.)</p> <p>Action: Before transferring parameter data, confirm that the parameter values are correct.</p>
0B1	Bank 31 data error	<p>Cause: [1] A movement command was issued with an unregistered position data number selected. [2] The position data value exceeds a soft limit. [3] A position number was recognized wrongly due to start signal fluctuation or because a start signal was input too early.</p> <p>Action: [1] Revise the sequence so that an unregistered position will not be selected. [2] Change the position data to a value not exceeding the soft limit. [3] The minimum timer setting may not be recognized depending on the PLC. Pay attention to the timer setting.</p>
0BE	Homing timeout	<p>Cause: Homing was started but it does not complete after elapse of the time specified by the applicable manufacturer parameter. (This alarm does not occur during normal operation.)</p> <p>Action: As one possible cause, the controller and actuator may not be combined correctly. Please contact IAI.</p>
0C0	Excessive actual speed	<p>Cause: The motor speed exceeded the maximum level set by the applicable manufacturer parameter. This alarm does not occur during normal operation, but it may occur if the actuator moved rapidly as a result excessive load, but the load decreases before an overload is detected. This may be caused by the following conditions: [1] The slide resistance of the actuator increased locally. [2] The load increased due to momentary application of external force.</p> <p>Action: Check the assembled mechanical parts for abnormality. If the actuator itself is suspected to be the problem, please contact IAI.</p>
0C9	Overvoltage	<p>Cause: Regenerative energy was not fully absorbed during deceleration, and the voltage in the power circuit has become abnormally high as a result. In particular, this alarm tends to occur when the actuator installed vertically is decelerating to a stop following a downward movement command.</p> <p>Action: The regenerative resistance unit capacity may be insufficient. Check if the regenerative resistance unit capacity matches the motor wattage. If necessary, you can also reduce the acceleration/deceleration setting. If the error persists, please contact IAI.</p>

Code	Error	Cause/action
0CA	Overheat	<p>The surrounding air temperature of the power transistor in the controller rose excessively (to 95°C or above).</p> <p>Cause: [1] High surrounding air temperature of the controller [2] Defective internal part of the controller</p> <p>Action: [1] Lower the surrounding air temperature of the controller. If the surrounding air temperature is normal, please contact IAI.</p>
0CC	Abnormal control power voltage	<p>The voltage of the 24-V input power supply dropped (by 20% or more, or to 19.2 V or below).</p> <p>Cause: [1] Low voltage of the 24-V input power supply [2] Faulty internal part of the controller</p> <p>Action: Check the voltage of the input power-supply. If the voltage is normal, please contact IAI.</p>
0DC	Out of push operation range	<p>The actuator was “pushed back” during push-motion operation in the push mode.</p> <p>Cause: Strong external force is applied to the work part.</p> <p>Action: Revise the mechanism around the work part so that strong external force will not apply to the work part. Or, increase the current limit value.</p>
0E0	Overload	<p>Cause: [1] The load increased due to external force. [2] The brake cannot be released on the actuator with brake. [3] The slide resistance of the actuator increased locally.</p> <p>Action: [1] Review the area around the work part. If abnormal external force is being applied, correct the situation. [2] Turn on the break release switch to check if the break will be released. If the brake is not released, a faulty brake, open cable, or defective brake circuit part in the controller is suspected. [3] Move the controller by hand, if possible, to check for points where large slide resistance is felt. In the case of [2] or [3], please contact IAI.</p> <p>Note: Before resuming the operation, always remove the cause of the alarm. If the controller power was turned off, wait for at least 30 minutes before turning on the power to protect the motor coil from burn damage.</p>

(3) Cold Start Alarms

Code	Error	Cause/action
0BA	Home sensor not yet detected	<p>The mechanical end was reached before a home sensor was detected during homing using a home sensor. (Or, the load is so heavy that the actuator cannot move.)</p> <p>Cause: [1] Home sensor cannot be detected because the sensor is not installed in a proper position. [2] The cable is open or the connector is not installed properly. [3] The work part is receiving external force.</p> <p>Action: [1] Adjust the installation position of the sensor again. [2] Perform a continuity check to see if the cable is open. Also check if the connector is installed properly. [3] Revise the mechanism around the work part so that strong external force will not apply to the work part. If the cause cannot be specified, please contact IAI.</p>
0BF	Creep sensor not yet detected	<p>A home sensor was detected or the mechanical end was reached before a creep sensor was detected during homing using a creep sensor. (Or, the load is so heavy that the actuator cannot move.)</p> <p>Cause: [1] Creep sensor cannot be detected because the sensor is not installed in a proper position. [2] The cable is open or the connector is not installed properly. [3] The work part is receiving external force.</p> <p>Action: [1] Adjust the installation position of the sensor again. [2] Perform a continuity check to see if the cable is open. Also check if the connector is installed properly. [3] Revise the mechanism around the work part so that strong external force will not apply to the work part. If the cause cannot be specified, please contact IAI.</p>
0C2	Overrun sensor detection	<p>A sensor was detected from the OT sensor installed on the mechanical end.</p> <p>Cause: [1] The actuator was moved by hand or received external force when the servo was OFF (normal detection). [2] The actuator was jogged when the soft stroke check was not yet functioning properly prior to the establishment of home coordinate (normal detection). [3] The home position used in homing was not correct, or the absolute coordinates have shifted due to an inappropriate absolute reset position. [4] The sensor characteristics do not match the setting of sensor parameter No. 19, or the sensor is not wired correctly. [5] The controller and actuator are not combined correctly, or any of the soft limits or screw lead set in the controller is inappropriate.</p> <p>Action: In the case of [1] or [2], move the actuator to the opposite direction by hand. If this alarm occurred within the effective stroke range, [3], [4] or [5] is suspected. Check the home position, parameter setting, wiring, etc. If the cause cannot be specified, please contact IAI.</p>

Code	Error	Cause/action
0C8	Overcurrent	<p>Cause: The output current from the power circuit became abnormally high. This alarm does not occur in normal conditions of use, but it may occur when the motor coil isolation has deteriorated.</p> <p>Action: Measure inter-phase resistance between motor connection leads U, V and W as well as isolation resistance relative to the ground, to check for deterioration of isolation. Please contact IAI before performing these measurements.</p>
0CB	Current sensor offset adjustment error	<p>The condition of the current detection sensor in the controller is checked in the initialization process after the controller is started. This alarm occurs when a sensor error was found in this check.</p> <p>Cause: [1] Faulty current detection sensor or peripheral part [2] Inappropriate offset adjustment</p> <p>Action: You must change the board or adjust the offset. Please contact IAI.</p>
0CD	Blown emergency stop relay	<p>Cause: The emergency stop relay in the controller has blown.</p> <p>Action: You must replace the relay or controller. Please contact IAI.</p>
0D8	Deviation overflow	<p>The position deviation counter has overflowed.</p> <p>Cause: [1] The work part hit a nearby object during movement, and the speed has decreased as a result. [2] The acceleration setting is too high with respect to the payload. [3] The brake is not fitted correctly and thus it cannot be released properly.</p> <p>Action: [1] Revise the mechanism around the work part so that strong external force will not apply to the work part. If [2] or [3] is suspected, please contact IAI.</p>
0E4	Encoder send error	<p>The controller and encoder exchange position data via serial communication. This error occurs when the data sent from the controller could not be received by the encoder successfully.</p> <p>Cause: [1] Garbage data due to noise [2] Faulty communication IC mounted on the encoder board [3] Faulty communication IC mounted on the controller board</p> <p>Action: [1] Turn off the power to all peripherals and move only the controller and actuator. If the error does not occur, noise is the likely cause. In the case of [2] or [3], the encoder or controller must be replaced. If the cause cannot be specified, please contact IAI.</p>

Code	Error	Cause/action
0E5	Encoder receive error	<p>The controller and encoder exchange position data via serial communication. This error occurs when the encoder did not return correct data in response to a request from the controller, or the battery voltage became low.</p> <p>Cause:</p> <ul style="list-style-type: none"> [1] Low battery voltage (Absolute controllers are shipped with the encoder cable removed. On these controllers, this error always occurs when the power is turned on for the first time at the user's site.) [2] Open encoder extension cable or supplied actuator cable, or poor connector contact [3] Garbage data due to noise [4] Faulty communication IC mounted on the encoder board [5] Faulty communication IC mounted on the controller board <p>Action:</p> <ul style="list-style-type: none"> [1] If the error occurred after the power was turned on for the first time, be sure to perform an absolute reset. (Refer to 4-2, "Absolute Reset Procedure.") If the I/O output signal "Battery alarm" is OFF, the battery voltage is low. Replace the battery as soon as possible. [2] Check the connector for possibility of open circuit, and examine the connection condition. (Perform a continuity check by referring to 2-5, "Supplied Cables.") [3] Turn off the power to all peripherals and move only the controller and actuator. If the error does not occur, noise is the likely cause. <p>In the case of [4] or [5], the encoder or controller must be replaced. If the cause cannot be specified, please contact IAI.</p>
0E6	Encoder count error	<p>The ASIC mounted on the encoder board is unable to detect position information correctly.</p> <p>Cause:</p> <ul style="list-style-type: none"> [1] When the absolute actuator is installed vertically, the acceleration limit was exceeded due to a rapid drop of the load caused by the brake being released when the power was cut off. (This error does not occur in normal conditions of use, but it may occur if the work part received external force from above.) [2] Foreign deposit on the cable wheel [3] The position relationship of cable wheel and photo-sensor changed due to axis center run-out caused by excessive external force, etc. [4] Faulty component mounted on the encoder board <p>Action:</p> <p>If [1] is suspected, perform an absolute reset. In the case of [2] to [4], you must clean the cable wheel (by air blow), adjust the installation position again, or replace the motor unit or actuator. In any case, please contact IAI.</p>

Code	Error	Cause/action
0E7	Phase A/B/Z open	Encoder signal cannot be detected properly. Cause: [1] Open encoder extension cable or supplied actuator cable, or poor connector contact [2] Faulty encoder Action: [1] Check the connector for possibility of open circuit, and examine the connection condition. (Perform a continuity check by referring to 2-5, "Supplied Cables.") If the cable is normal, the encoder may be faulty. Please contact IAI.
0F8	Corrupt nonvolatile memory	Abnormal data was detected during the nonvolatile memory check at the startup. Cause: [1] Faulty nonvolatile memory [2] The memory was written more than 100,000 times. (As a rough guide, the nominal life of nonvolatile memory is around 100,000 rewrites.) Action: If the alarm occurs again after the power has been reconnected, please contact IAI.
0F9	Abnormal expansion RAM	Abnormal data was detected during the expansion RAM check at the startup. Cause: [1] Malfunction due to noise, etc. [2] Faulty RAM [3] Faulty circuit component around RAM Action: Reconnect the power. If the alarm occurs again, check for effect of noise. If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected. If the cause cannot be specified, please contact IAI.
0FA	Abnormal CPU	The CPU is not operating properly. Cause: [1] Malfunction due to noise, etc. [2] Faulty CPU [3] Faulty circuit component around CPU Action: Reconnect the power. If the alarm occurs again, check for effect of noise. If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected. If the cause cannot be specified, please contact IAI.
0FB	Abnormal FPGA	The FPGA (gate array) is not operating properly in the absolute controller. Cause: [1] Malfunction due to noise, etc. [2] Faulty FPGA [3] Faulty circuit component around FPGA [4] The board in the controller is not installed properly. Action: Reconnect the power. If the alarm occurs again, check for effect of noise. If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected. If the cause cannot be specified, please contact IAI.

6-5 Messages Displayed during Operations Using Teaching Pendant or PC Software

The warning messages that may be displayed during operations using the teaching pendant or PC software are explained below.

Code	Message	Description
112	Input data error	An inappropriate value was input as a user parameter setting. (Example) "9601" was input as the serial communication speed by mistake. Input an appropriate value again.
113 114	Input value too small Input value too large	The input value is under the setting range. The input value is over the setting range. Input an appropriate value again by referring to the actuator specifications and parameter list.
115	Homing not yet complete	The current position was written before homing was complete. Perform homing first.
116	Last position data available	When new data is added, data already exists in the last position of the position table. Clear or delete the data in the last position first.
117	No movement data	No target position is set under the selected position number. Input a target position first.
11E	Inconsistent data pair	The magnitude relationship of a pair of data is inappropriate. (Example) The same value is set in both the + and – soft limit parameters. Input appropriate values again.
11F	Absolute value too small	The minimum travel toward a target position is determined by the lead of the drive system and encoder resolution. This message indicates that the input target position is less than this minimum travel. (Example) With the RCS-R30, the lead is 90° and encoder resolution is 3,072 pulses. Therefore, the minimum travel is calculated as 0.029°/pulses (90 ÷ 3,072). If "0.02°" is input as the target position, this message will be displayed.
121	Push search end over	The final position in push-motion operation exceeds a soft limit. No harm is done as long as the actuator contacts the work part. If it misses the work part, however, the actuator will reach the soft limit and this message will be displayed. Change either the target position or positioning band.
122	Multiple axes connected at assignment	An axis number was assigned when multiple axes were connected. Always assign an axis number when only one axis is connected.
180 181 182	Axis number change OK Controller initialization OK Home change all clear	This is an operation check message. (It does not indicate misoperation or error.)
201	Emergency stop	An emergency stop was actuated. (This is not an error.)
20A	Servo OFF during movement	The servo ON signal (SON) was turned OFF by the PLC while the actuator was moving. As a result, the servo turned OFF and the actuator stopped.

Code	Message	Description
20C	CSTR-ON during operation	The start signal (CSTR) was turned ON by the PLC while the actuator was moving. As a result, duplication of movement commands occurred.
20D	STP-OFF during operation	The hold signal (*STP) was turned OFF by the PLC while the actuator was moving. As a result, the actuator stopped.
20E	Soft limit over	A soft limit was reached.
20F	Missed work part in push-motion operation	The actuator missed the work part in push-motion operation. Check the work part condition and review the target position/positioning band settings.
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	An error occurred in serial communication with the controller. Cause: [1] Garbage data due to noise [2] Duplicate slave numbers when multiple actuators are controlled via serial communication Action: [1] Revise the wiring, equipment layout, etc., to eliminate noise. [2] Change the slave numbers to eliminate duplication. If the message persists, please contact IAI.
307 309	Memory command denied Write address error	A command was denied in serial communication with the controller. An indeterminable write address error occurred in serial communication with the controller. These messages do not generate during normal operation. Should either of them occur, record the entire error list before turning off the power. The recorded error list will help us identify the cause of the problem. Also contact IAI.
30C	No connected axis	The controller axis number cannot be recognized. Cause: [1] The controller is not operating properly. [2] Only the communication line of the supplied cable (SGA/SGB) is open. [3] When RCP2 and ERC controllers are linked together via SIO converters, not all link cables are connected although 24 V is supplied to all converters. [4] The piano switches are set to the same number on multiple controllers being linked. Action: [1] Check if the RDY LED on the controller is lit. If this LED is not lit, the controller is faulty. [2] If you have a spare teaching pendant, change to the spare teaching pendant. Or, switch to the PC software mode and see if the message will disappear. [3] Connect all pairs of converter and controller using link cables, and then supply the power. [4] Do not set the piano switches to the same number on multiple linked controllers. If the message persists, please contact IAI.

7. Regenerative Resistance Unit (Optional)

A regenerative resistance unit is required only when the actuator is used as a vertical axis. It is not required in an application where the actuator is used as a horizontal axis because the built-in regenerative resistance capacity is sufficient.

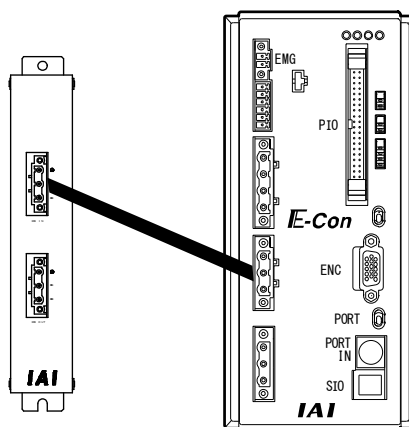
7-1 Number of Units Connected

If the number of regenerative resistance units is insufficient, an “Excess Power Voltage (0C9)” error generates.

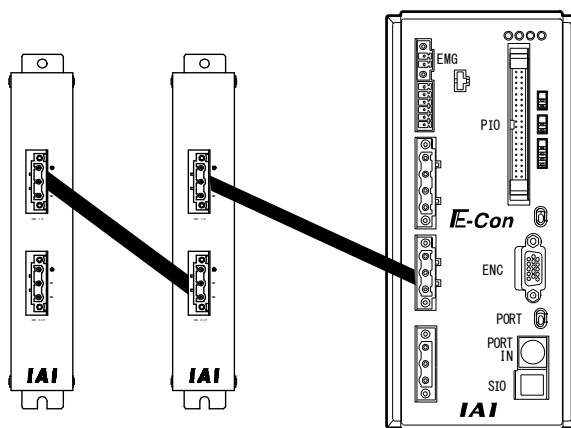
Motor wattage	Horizontal application	Vertical application
0 to 150 W	Not required	Not required
200 to 600 W		1 unit
750 W		2 units

7-2 Connection Method

Connect the supplied connection cable to the regenerative resistance unit connector on the controller.



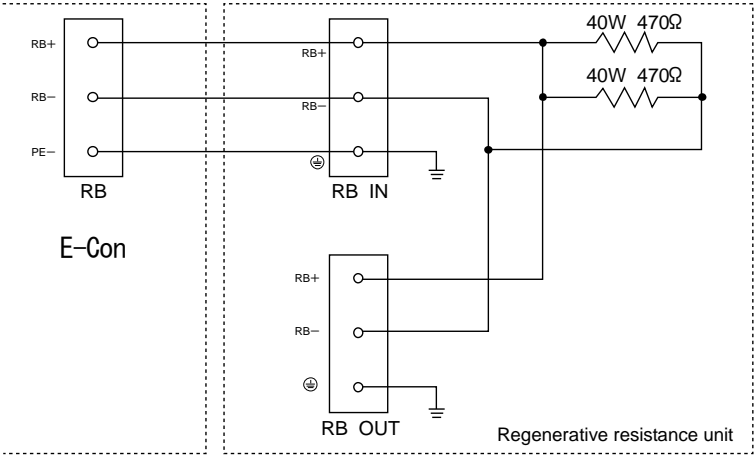
Connecting one unit



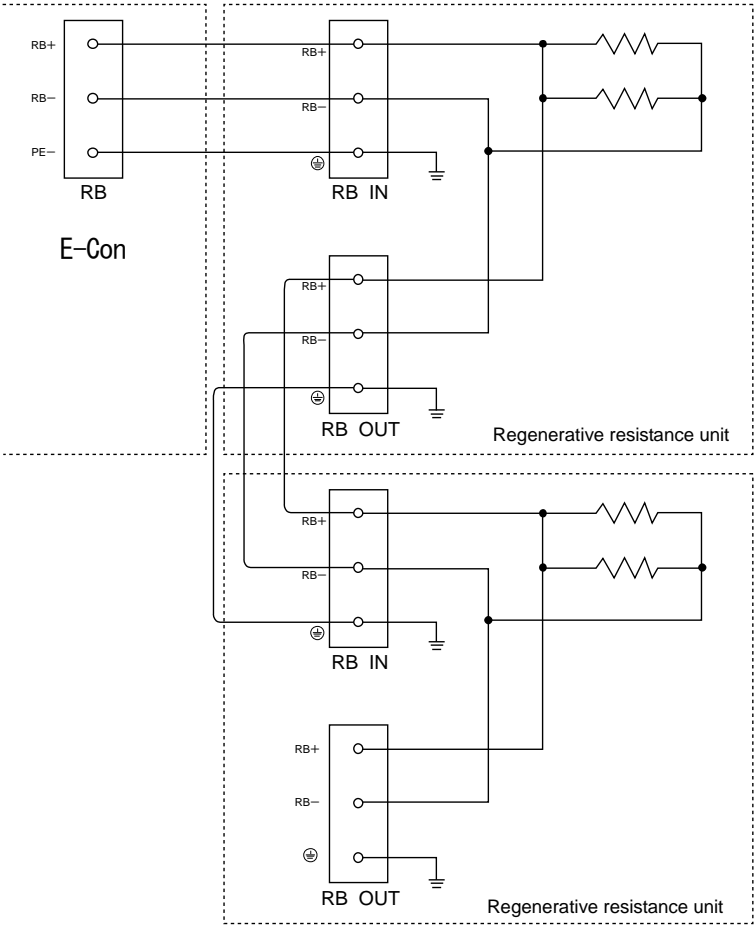
Connecting two units

Caution: Connecting two controllers to one regenerative resistance unit is not allowed.

7-3 Circuit Diagram



Connecting one unit



Connecting two units

* Appendix

Specification List of Supported Actuators

	Model	Stroke (mm), maximum speed (mm/sec) (Note 1)																Loading capacity (Note 2)		Rated acceleration				
		50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1000	Horizontal (kg)	Vertical (kg)	Horizontal (G)	Vertical (G)			
RCS (Slider type)	RCS-SS-□-60-H-□□□	600																470		15	4	0.3	0.2	
	RCS-SS-□-60-M-□□□	300																230		30	8			
	RCS-SM-□-100-H-□□□	1000																960 765 625 515		20	4			
	RCS-SM-□-100-M-□□□	500																480 380 310 255		40	8			
	RCS-SM-□-150-H-□□□	1000																960 765 625 515		30	6			
	RCS-SM-□-150-M-□□□	500																480 380 310 255		60	12			
	RCS-SSR-□-60-H-□□□	600																470		15	4			
	RCS-SSR-□-60-M-□□□	300																230		30	8			
	RCS-SMR-□-100-H-□□□	1000																960 765 625 515		20	4			
	RCS-SMR-□-100-M-□□□	500																480 380 310 255		40	8			
	RCS-SMR-□-150-H-□□□	1000																960 765 625 515		30	6			
	RCS-SMR-□-150-M-□□□	500																480 380 310 255		60	12			
RCS (Rod type)	RCS-RA55-□-60-H-□□□	800																755		12	2	0.3	0.2	
	RCS-RA55-□-60-M-□□□	400																377		25	5			
	RCS-RA55-□-60-L-□□□	200																188		50	11.5			
	RCS-RA55-□-100-H-□□□	800																755		15	3.5	0.3		
	RCS-RA55-□-100-M-□□□	400																377		30	9			
	RCS-RA55-□-100-L-□□□	200																188		60	18			
	RCS-RA55R-□-60-H-□□□	800																755		12	2	0.3		
	RCS-RA55R-□-60-M-□□□	400																377		25	5			
	RCS-RA55R-□-60-L-□□□	200																188		50	11.5			
	RCS-RB7530-I-60-H-□□□	600																505		10	2.5	0.15	0.15	
	RCS-RB7530-I-60-M-□□□	300																250		20	7	0.1	0.1	
	RCS-RB7530-I-60-L-□□□	150																125		40	15.5	0.05	0.05	
	RCS-RB7530-I-100-H-□□□	600																505		15	5.5	0.2	0.2	
	RCS-RB7530-I-100-M-□□□	300																250		30	12.5	0.1	0.1	
	RCS-RB7535-I-100-H-□□□	800																		10	3.5	0.25	0.25	
	RCS-RB7535-I-100-M-□□□	400																		22	9	0.17	0.17	
	RCS-RB7535-I-100-L-□□□	200																		40	19.5	0.1	0.1	
	RCS-RB7535-I-150-H-□□□	800																		15	6.5	0.3	0.3	
	RCS-RB7535-I-150-M-□□□	400																		35	14.5	0.2	0.2	
	RCS (Flat type)	RCS-F55-□-60-H-□□□	800																		-	2	0.3	0.2
RCS-F55-□-60-M-□□□		400																		5				
RCS-F55-□-60-L-□□□		200																		11.5				
RCS-F55-□-100-H-□□□		800																		3.5				
RCS-F55-□-100-M-□□□		400																		9				
RCS-F55-□-100-L-□□□		200																		18				

(Note 1) The figure in each elongated circle represents the maximum speed for the applicable stroke(s).
 (Note 2) The loading capacity is calculated by assuming actuator operation at the rated acceleration.

	Model number	Rated torque	Oscillation angle (deg)	Maximum speed (deg/sec)	Gear ratio	Rated acceleration
RCS (Rotary)	RCS-R10-I-60-18-300-□□	2.4N・m	300	500	18 : 1	2.76
	RCS-R20-I-60-18-300-□□	2.4N・m	300	500	18 : 1	2.76
	RCS-R30-I-60-4-300-□□	0.76N・m	300	500	4 : 1	2.76
	Model number	Stroke (mm)		Maximum return strokes (cpm)	Maximum gripping force (N)	
RCS (Gripper)	RCS-G20-I-60-5-□□	20, 40, 60, 80, 100, 120, 200		60	45.1 (Total of both fingers)	

	Model	Stroke (mm), maximum speed (mm/sec) (Note 1)																			Loading capacity (Note 2)		Rated acceleration				
		100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	2000	(kg)	(kg)	(G)	(G)						
ISA ISPA	ISA (ISPA)-SXM-□-60-16-□□□	800																			12	3	0.3	0.3			
	ISA (ISPA)-SXM-□-60-8-□□□	400																			25	6					
	ISA (ISPA)-SXM-□-60-4-□□□	200																			50	14	0.15	0.15			
	ISA (ISPA)-SYM-□-60-16-□□□	800																			12	3	0.3	0.3			
	ISA (ISPA)-SYM-□-60-8-□□□	400																			25	6					
	ISA (ISPA)-SYM-□-60-4-□□□	200																			50	14	0.15	0.15			
	ISA (ISPA)-SZM-□-60-8-□□□	400																			—	6	—	0.3			
	ISA (ISPA)-SZM-□-60-4-□□□	200																			—	14	—	0.15			
	ISA (ISPA)-MXM-□-100-20-□□□	1000										1000		795		645		540		20	5	0.3	0.3				
	ISA (ISPA)-MXM-□-100-10-□□□	500										480		380		310		255		40	9						
	ISA (ISPA)-MXM-□-100-5-□□□	250										220		175		145		120		80	19	0.15	0.15				
	ISA (ISPA)-MXM-□-200-30-□□□	1500										1500		1190		965		810		25	6	0.3	0.3				
	ISA (ISPA)-MXM-□-200-20-□□□	1000										1000		795		645		540		40	9						
	ISA (ISPA)-MXM-□-200-10-□□□	500										480		380		310		255		80	19						
	ISA (ISPA)-MXMX-□-200-30-□□□											1500				1425		1200		675				25	—		
	ISA (ISPA)-MXMX-□-200-20-□□□											1000				950		800		450		40	—	0.3	—		
	ISA (ISPA)-MYM-□-100-20-□□□	1000										1000		795		645		540		20	5	0.3	0.3				
	ISA (ISPA)-MYM-□-100-10-□□□	500										480		380		310		255		40	9						
	ISA (ISPA)-MYM-□-100-5-□□□	250										220		175		145		120		80	19	0.15	0.15				
	ISA (ISPA)-MYM-□-200-30-□□□	1500										1500		1190		965		810		25	6	0.3	0.3				
	ISA (ISPA)-MYM-□-200-20-□□□	1000										1000		795		645		540		40	9						
	ISA (ISPA)-MYM-□-200-10-□□□	500										480		380		310		255		80	19						
	ISA (ISPA)-MZM-□-100-10-□□□	500										480		380		310		255		—	9			0.15	0.15		
	ISA (ISPA)-MZM-□-100-5-□□□	250										220		175		145		120		—	19						
	ISA (ISPA)-MZM-□-200-10-□□□	500										480		380		310		255		—	19	—	0.3				
			100~500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700~2000	2100~2500	3000										
	ISA (ISPA)-LXM-□-200-40-□□□	1000										1000		830		690		585		500		40	9	0.3	0.3		
	ISA (ISPA)-LXM-□-200-20-□□□	500										470		385		320		270		235		80	19				
	ISA (ISPA)-LXM-□-400-40-□□□	2000										2000		1660		1390		1170		1000		40	9				
	ISA (ISPA)-LXM-□-400-20-□□□	1000										1000		830		690		585		500		80	19				
	ISA (ISPA)-LXMX-□-200-20-□□□											1000				950		830		740~540		490~340		40	—	0.3	—
	ISA (ISPA)-LXMX-□-400-40-□□□											2000				1800		1660		1480~1080		980~680		40	—		
	ISA (ISPA)-LXMX-□-400-20-□□□											1000				950		830		740~540		490~340		80	—		
ISA (ISPA)-LXUWX-□-200-20-□□□											1000				950		830		740~540		490~340		40	—			
ISA (ISPA)-LXUWX-□-400-40-□□□											2000				1900		1660		1480~1080		980~680		40	—			
ISA (ISPA)-LXUWX-□-400-20-□□□											1000				950		830		740~540		490~340		80	—			
ISA (ISPA)-LYM-□-200-20-□□□	1000										1000		830		690		585		500		40	9	0.3	0.3			
ISA (ISPA)-LYM-□-200-10-□□□	500										470		385		320		270		235		80	19					
ISA (ISPA)-LYM-□-400-40-□□□	2000										2000		1660		1390		1170		1000		40	9					
ISA (ISPA)-LYM-□-400-20-□□□	1000										1000		830		690		585		500		80	19					
ISA (ISPA)-LZM-□-200-10-□□□	500										470		385		320		270		235		—	19	—	39			
ISA (ISPA)-LZM-□-400-10-□□□	500										470		385		320		270		235		—	39					
ISP	ISP-WXM-□-600-40-□□□	2000										1670		1390		1170		1000		865		60	14	0.3			
	ISP-WXM-□-600-20-□□□	1000										835		695		585		500		430		120	29				
	ISP-WXM-□-600-10-□□□	500										415		345		290		215		150	60						
	ISP-WXM-□-750-40-□□□	2000										1670		1390		1170		1000		865		75	18				
	ISP-WXM-□-750-20-□□□	1000										835		695		585		500		430		150	37	0.3			
	ISP-WXMX-□-600-40-□□□											2000				1965		1725		1530		1365~1005				915~655	
	ISP-WXMX-□-600-20-□□□											1000				980		860		765		680~500		455~325		120	—
	ISP-WXMX-□-750-40-□□□											2000				1965		1725		1530		1365~1005		75	—		
ISP-WXMX-□-750-20-□□□											1000				980		860		765		680~500		150	—			

(Note 1) The figure in each elongated circle represents the maximum speed for the applicable stroke(s).

(Note 2) The loading capacity is calculated by assuming actuator operation at the rated acceleration.

	Model	Stroke (mm), maximum speed (mm/sec) (Note 1)															Loading capacity (Note 2)		Rated acceleration		
		100~500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700~2000	2100~2500	3000	Horizontal (kg)	Vertical (kg)	Horizontal (G)	Vertical (G)	
ISD	ISD-S-□-60-16-□□□	800	760														12	3	0.3	0.3	
	ISD-S-□-60-8-□□□	400	380														25	6			
	ISD-S-□-60-4-□□□	200	180														50	14	0.15	0.15	
	ISD-M-□-100-20-□□□	1000	915	735	600	500											20	5	0.3	0.3	
	ISD-M-□-100-10-□□□	500	455	365	300	250											40	9			
	ISD-M-□-100-5-□□□	250	225	180	150	125											80	19	0.15	0.15	
	ISD-M-□-200-20-□□□	1000	915	735	600	500											40	9			
	ISD-M-□-200-10-□□□	500	455	365	300	250											80	19	0.3	0.3	
	ISD-MX-□-200-20-□□□						1000				950	800	700				40	—	0.3	—	
	ISD-L-□-200-20-□□□	1000		930	765	640	545	465									40	9			
	ISD-L-□-200-10-□□□	500		465	380	320	270	230									80	19	0.3	0.3	
	ISD-L-□-400-20-□□□	1000		930	765	640	545	465									80	19			
	ISD-LX-□-200-20-□□□						1000				950	830					40	—			
ISD-LX-□-400-20-□□□						1000				950	830					80	—	0.3	—		
IF	IF-SA□□-□-60-□□□						1750										5	—			
	IF-SA□□-□-100-□□□						1750										10	—			
	IF-MA□□-□-200-□□□						1750										20	—	0.3	—	
	IF-MA□□-□-400-□□□						1750										40	—			
FS	FS-11NM-□-60-□□□			1250													2	—			
	FS-12NM-□-60-□□□			1250													5~9	—			
	FS-11NM-□-100-□□□			1250													3	—			
	FS-12NM-□-100-□□□			1250													9~15	—			
	FS-11WM-□-100-□□□						1250										3	—			
	FS-12WM-□-100-□□□						1250										9~15	—			
	FS-11WM-□-200-□□□						1250										6	—	0.3		
	FS-12WM-□-200-□□□						1250										18~30	—			
	FS-11LM-□-400-□□□								1250								15	—			
	FS-12LM-□-400-□□□								1250								28~60	—			
FS-11HM-□-400-□□□									2000							10	—				
FS-12HM-□-400-□□□										2000						20~40	—				
		50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1000				
DS	DS-SA4-□-20-10-□□□			665													4	1	0.3	0.3	
	DS-SA4-□-20-5-□□□			330													5	2.5			
	DS-SA4-□-20-2.5-□□□			165													5	4.5	0.2	0.2	
	DS-SA5-□-20-12-□□□				800						760						4	1	0.3	0.3	
	DS-SA5-□-20-6-□□□				400						380						8	2			
	DS-SA5-□-20-3-□□□				200						190						8	4	0.2	0.2	
	DS-SA6-□-30-12-□□□				800						760	640	540				6	1.5	0.3	0.3	
	DS-SA6-□-30-6-□□□				400						380	320	270				12	3			
	DS-SA6-□-30-3-□□□				200						190	160	135				12	6	0.2	0.2	
	DS-A4-□-20-10-□□□			330													—	2.5			
	DS-A4-□-20-5-□□□			165													—	4.5			
	DS-A5-□-20-12-□□□			400													—	2		0.2	
	DS-A5-□-20-6-□□□			200													—	4			
	DS-A6-□-30-12-□□□			400													—	3			
DS-A6-□-30-6-□□□			200													—	6				
		100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	2000				
SS	SS-S-□-60-12-□□□			600		470											15	4			
	SS-S-□-60-6-□□□			300		230											30	8			
	SS-M-□-100-20-□□□			1000			960	765	625	515							20	4	0.3	0.3	
	SS-M-□-100-10-□□□			500			480	380	310	255							40	8			
	SS-M-□-150-20-□□□			1000			960	765	625	515							30	6			
	SS-M-□-150-10-□□□			500			480	380	310	255							60	12			

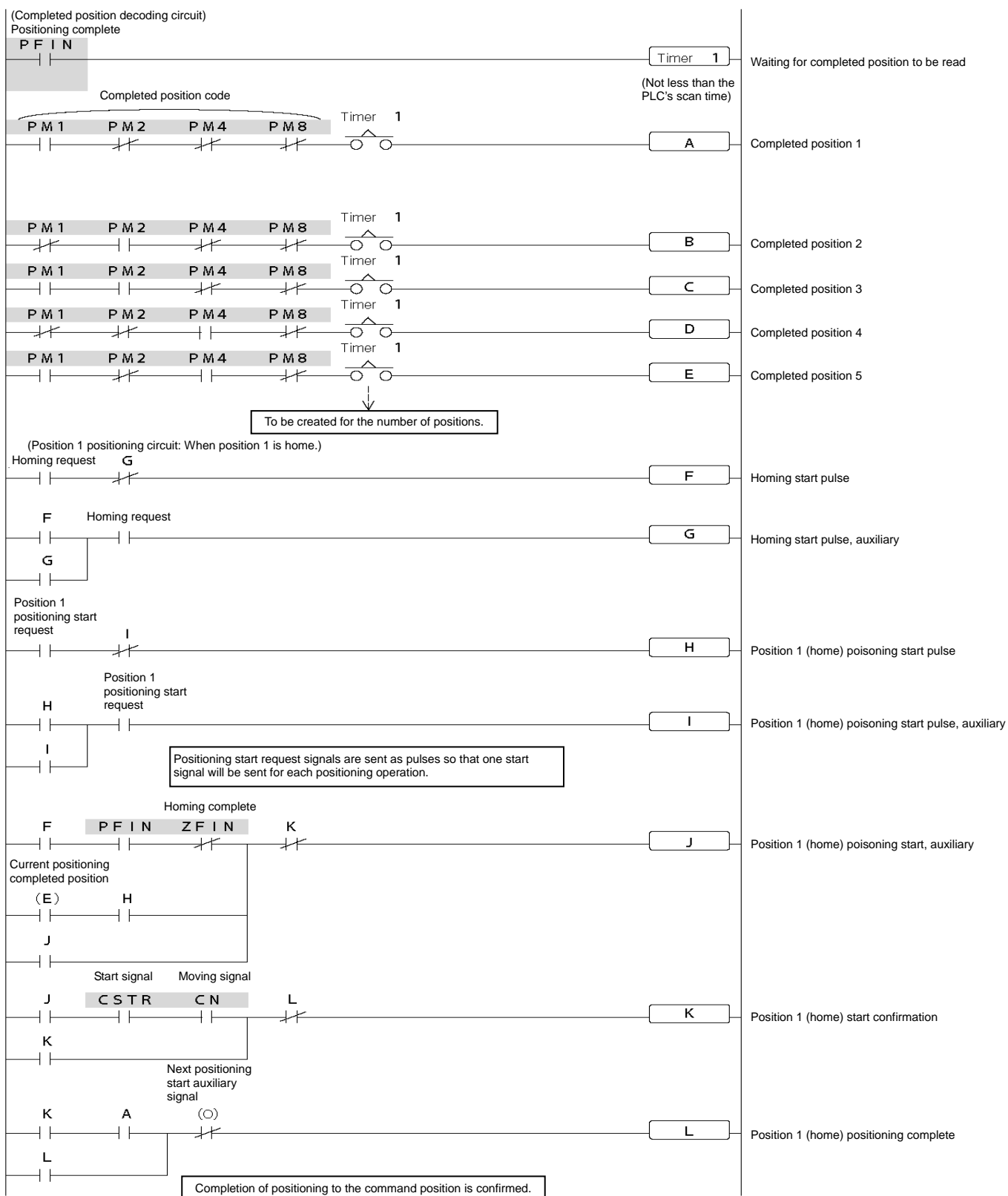
(Note 1) The figure in each elongated circle represents the maximum speed for the applicable stroke(s).

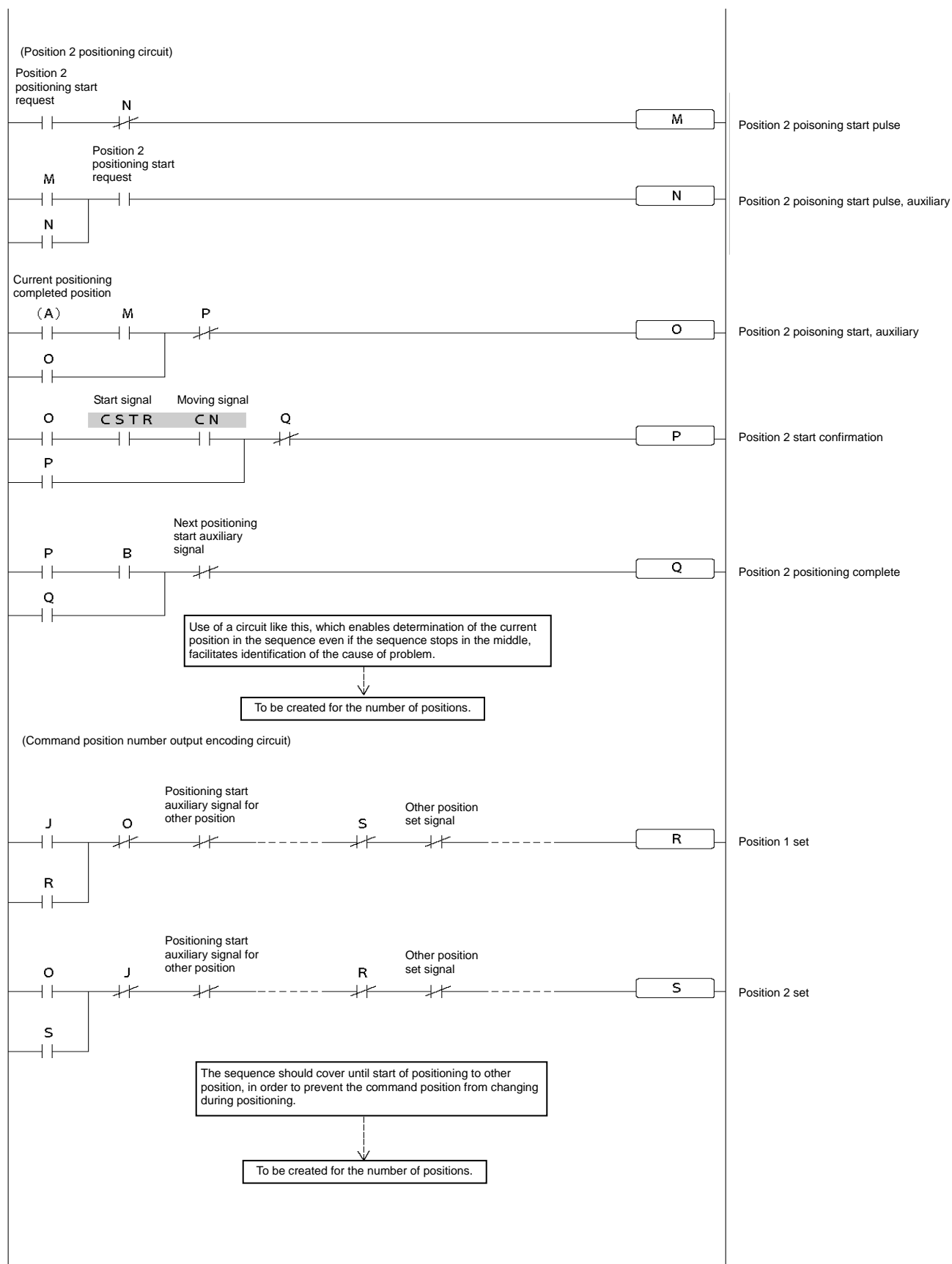
(Note 2) The loading capacity is calculated by assuming actuator operation at the rated acceleration.

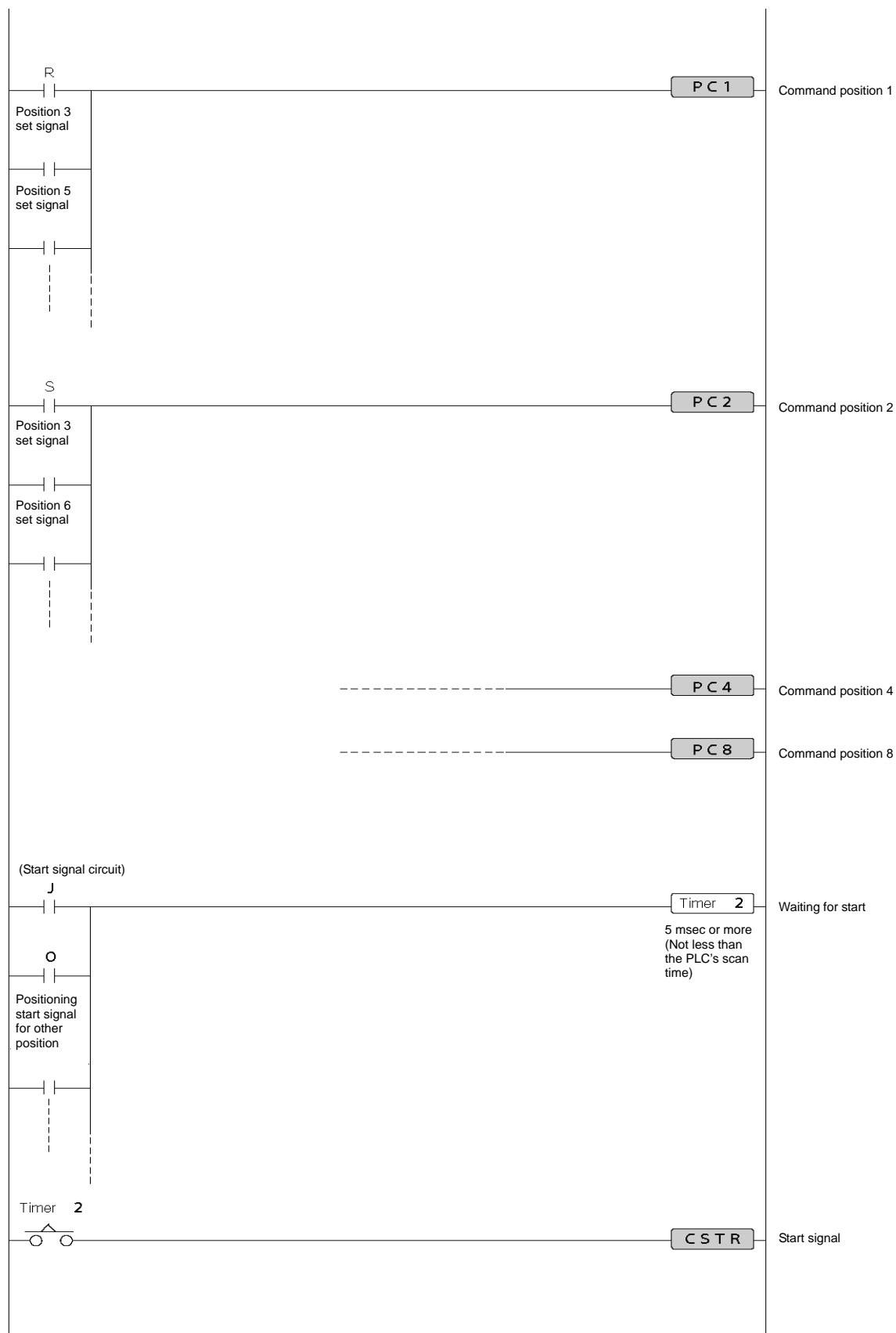
Example of Basic E-Con Positioning Sequence

An example of basic sequence is given below for reference when creating an E-Con positioning sequence.

indicates a PIO signal of the E-Con controller.







Position Table Record (1/2)

Recorded date: _____

No.	Position [mm]	Speed [mm/sec]	Acceleration/ deceleration [G]	Push [%]	Positioning band [mm]	Acceleration only MAX
0						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

Position Table Record (2/2)

Recorded date: _____

No.	Position [mm]	Speed [mm/sec]	Acceleration/ deceleration [G]	Push [%]	Positioning band [mm]	Acceleration only MAX
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						

Parameter Record

Recorded date: _____

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

No.	Type	Name	Unit	Data
1	a	Zone limit + side	mm	
2	a	Zone limit – side	mm	
3	a	Soft limit + side	mm	
4	a	Soft limit – side	mm	
5	a	Home direction [0: Reverse/1: Forward]	-	
6	b	Push & hold recognition time	msec	
7	d	Servo gain No.	-	
8	b	Initial speed setting	mm/sec	
9	b	Initial acceleration/deceleration setting	G	
10	b	Initial positioning band (in-position)	mm	
11	b	Initial acceleration only MAX flag	-	
12	b	Current limit value during positioning stop	%	
13	b	Current limit value during homing	%	
14	b	Movement flag during stop	-	
15	c	Hold input disable selection [0: Enable/1: Disable]	-	
16	c	Serial communication speed	bps	
17	c	Minimum delay before slave transmitter activation	msec	
18	b	Home sensor input polarity	-	
19	b	Overrun sensor input polarity	-	
20	b	Creep sensor input polarity	-	
21	c	Servo ON input disable selection [0: Enable/1: Disable]	-	
22	a	Home offset	mm	

Change History

Revision Date	Description of Revision
	First edition
February 2004	Tenth edition
April 2004	Eleventh edition
August 2004	Twelfth edition
	Thirteenth edition
	Fourteenth edition
	<ul style="list-style-type: none">• Changed the content of prohibited items relating to cable wiring.• Deleted the noise elimination measure in the form of connecting a surge absorber and surge killer in parallel.• Changed the table explaining the motor connector, power-supply terminal block and emergency-stop terminal block.• Changed the name of the input signal Servo ON (in Japanese; the English name remains the same).• Corrected the rated acceleration for the RCS-RB75 series, which was stated incorrectly.
June 2010	Fifteenth edition
	<ul style="list-style-type: none">• Added "Please Read Before Use" on the first page after the cover.• Deleted "Safety Precautions" before the table of contents and added "Safety Guide" immediately after the table of contents.• Deleted "Please Read Before Use" before the table of contents.• Specified "use environment of pollution degree 2" in 1.5.1, "Installation Environment" on p. 5.• Added "Change History" on the last page.• Updated the back cover. (Changed the addresses of the head office and sales offices, specified the 24-hour service of Eight, etc.)



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