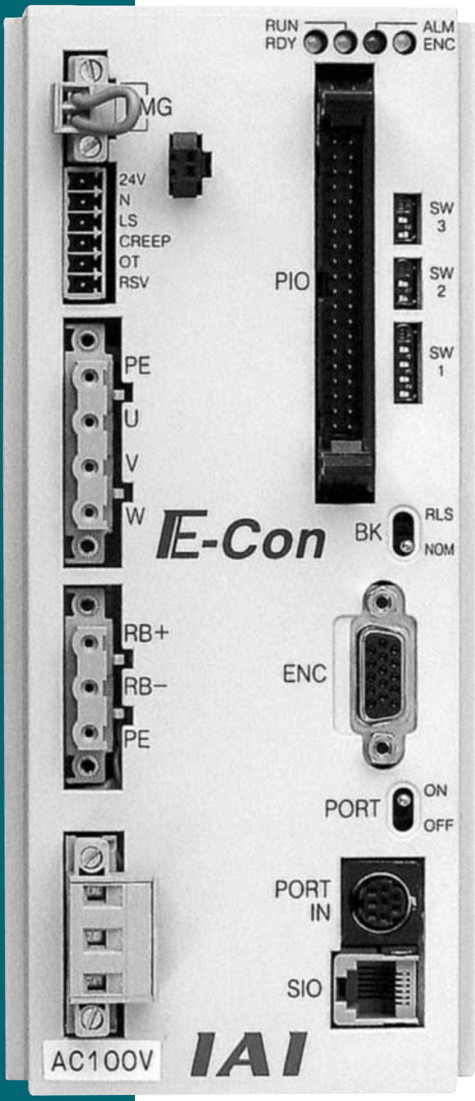
E-Con

# E-Con Controller

## Operation Manual 14th Edition



IAI America, Inc.

This publication was written to assist you in better understanding this part of your IA system. If you require further assistance, please contact IA Technical Support. For Central and East Coast Time Zones, please call our Itasca, IL office at 1-800-944-0333 or FAX 630-467-9912. For Mountain and Pacific Time Zones, please call our Torrance, CA office at 1-800-736-1712 or FAX 310-891-0815; Monday thru Friday from 8:30 AM to 5:00 PM.

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**Publication No: IAI-075**

# Before you Begin

Please be aware of the following before you begin operating the E-Con Controller:

## (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.**

## Table of Contents

# 1. Overview

## 1-1 Forward

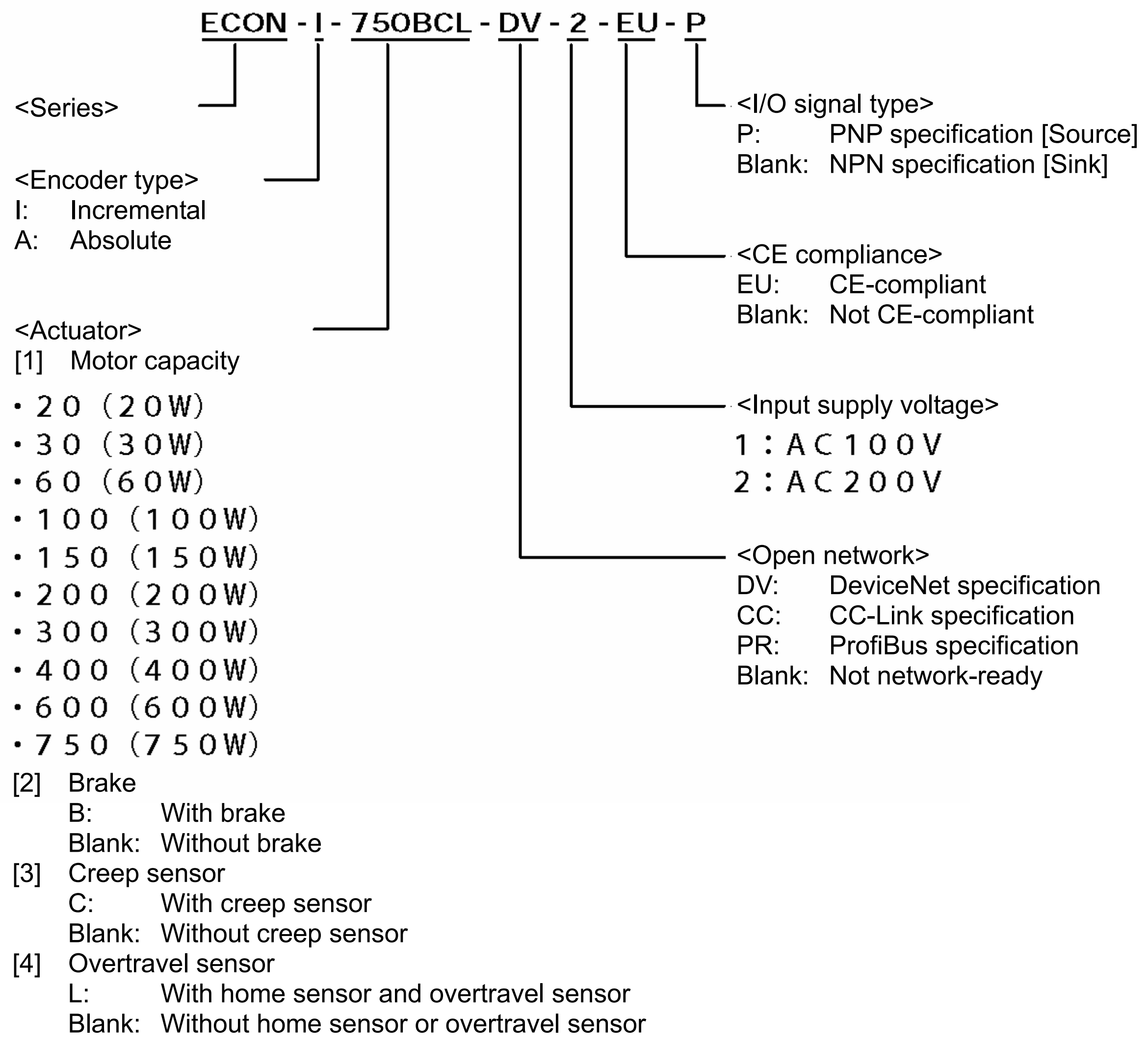
Thank you very much for purchasing the E-Con Controller. Without knowing beforehand how to correctly use or operate the controller, not only will the user be unable to take full advantage of all the functions built into this product but the user might also, inadvertently cause damage to the robot or 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.

Absolute Specifications:

- With the absolute home controller, once power is applied, and absolute reset is executed, you can execute positioning without the need to cycling 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 accuracy. The duty is calculated using the formula below:
  Duty (%) = Operating time / (Operating time + Stationary time) x 100

## 1-2 How to Read Model Name



ECON - I - 750BCL - DV - 2 - EU - P

<Series>

<Encoder type>
I: Incremental
A: Absolute

<Actuator>
[1] Motor capacity
- 20 (20W)
- 30 (30W)
- 60 (60W)
- 100 (100W)
- 150 (150W)
- 200 (200W)
- 300 (300W)
- 400 (400W)
- 600 (600W)
- 750 (750W)

[2] Brake
B: With brake
Blank: Without brake

[3] Creep sensor
C: With creep sensor
Blank: Without creep sensor

[4] Overtravel sensor
L: With home sensor and overtravel sensor
Blank: Without home sensor or overtravel sensor

<I/O signal type>
P: PNP specification [Source]
Blank: NPN specification [Sink]

<CE compliance>
EU: CE-compliant
Blank: Not CE-compliant

<Input supply voltage>
1：AC100V
2：AC200V

<Open network>
DV: DeviceNet specification
CC: CC-Link specification
PR: ProfiBus specification
Blank: Not network-ready

- 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 accuracy of the contents of this manual. However, if you become aware of any inaccuracies or discrepancies, please contact your IAI sales representative or technical service department.

## 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 torquing 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 the company 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. 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 is 12 months from the date the unit is shipped to the customer.

### 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.
- 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.

### 3. Service

The purchase price of the product does not include programming or expenses for sending technicians to the customer's site. Even if the product is still under the warranty period, separate charges will be assessed for the following services.

- Assistance with unit installation or trial operation.
- Inspection and maintenance.
- Technical training on controller operation, wiring or programming.
- Any other services or work for which IAI normally assesses separate charges.

## 1-5 Setting Environment and Noise Measures

**Please be careful for controller setting environment**

### 1-5-1 Installation Environment

(1) Do NOT block the air vents of your controller when installing your IA system.

(2) Your controller is NOT dust, water, or oil proof. Take steps to prevent foreign matter from getting into the controller air vents. 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 place it near a heat source.

(4) Avoid placing your IA system under conditions of extreme temperatures above 40°C or below 0°C (32°F). 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 IA system.

(6) Take steps to shield all cables and wires from electromagnetic noise.

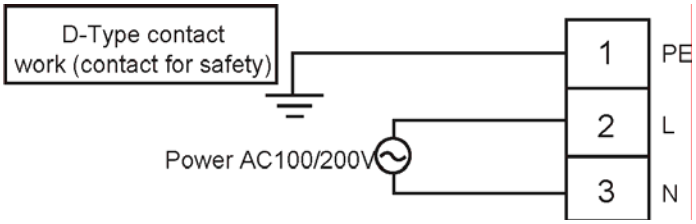
### 1-5-2 Power Source

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

### 1-5-3 Electromagnetic Noise Suppression

#### (1) Wiring and Power Supply

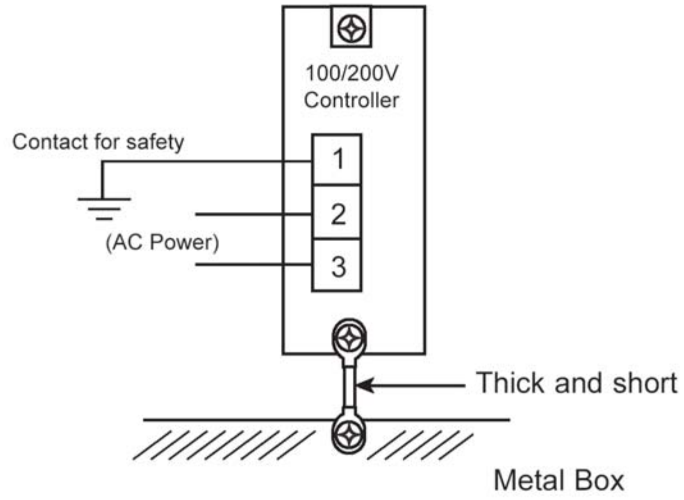
1. For grounding, please use a dedicated ground of Class 3 or better. The thickness of the cable should be 0.75 mm (#18AWG) or larger and above AC cables.



### (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

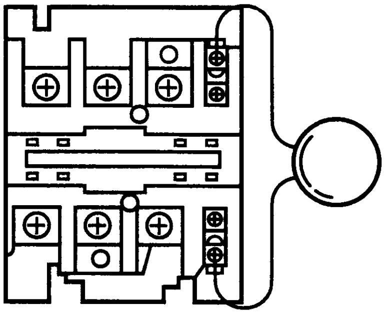
Isolate the controller cable from high power lines such as motor circuits (Do not bundle, and do not place in the same piping circuit). Consult with IAI if you need longer motor and encoder cables than what comes with the controller.

### (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

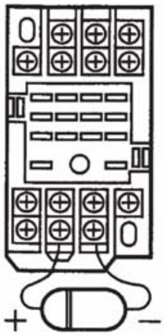
- Install a surge absorber parallel to the reactance load (solenoid and relay coils).



Note* Use the shortest possible wiring between the surge absorber and the noise-creating device. Use of excessively long wiring will decrease the performance of the surge absorber.

#### 2. DC solenoid valve · magnetic switch · relay

- Install a diode parallel with a reactive/inductive load.



- Select a diode with the proper voltage rating. The voltage rating is determined by the loading capacity of the system.
- When installing the diode, pay careful attention to the polarity of the diode. A diode installed in reverse polarity could damage your IA System's internal circuitry.

## 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 40ºC. As the diagram below shows, mount vertically (wall mounting). Since cooling is done according to natural convection, always mount in the vertical direction. Furthermore shown in Figure 1-6-2, make sure to leave more than 100mm of space above and 50mm of space below the controller so that enough natural convection may be attained. When mounting with several controllers lined up, also mount an agitator fan above the controllers in order to maintain ambient temperature. In addition, the spacing between the controller front side and wall (cover) should be more than 100mm, as shown in Figure 1-6-3.

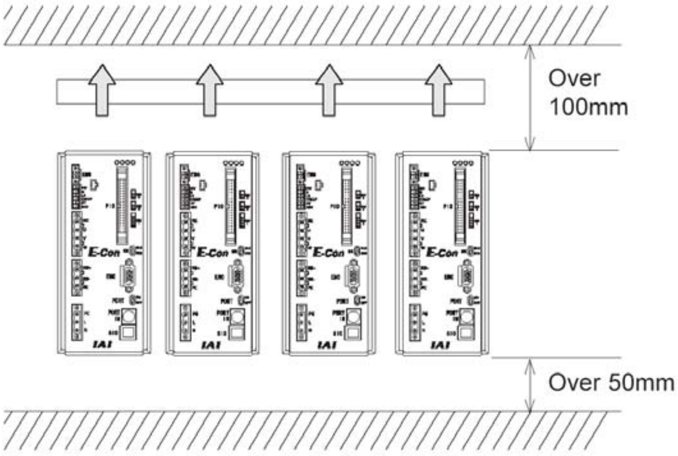


Figure 1-6-2

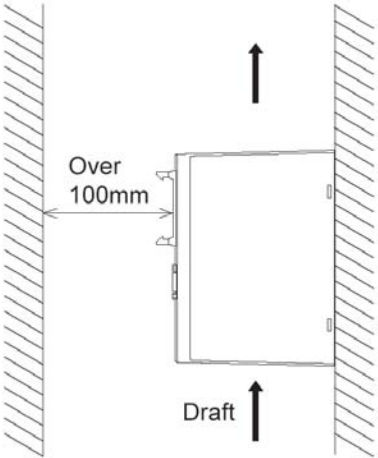


Figure 1-6-3

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 *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) *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) | |
| Ambient Temperature / Humidity | | | Temperature: 0 to 40°C, Humidity: Less than 85%RH | |
| Ambient Environment | | | IP 10 (No Corresive Gas) | |
| Protective Function | | | Circuit voltage abnormality, motor excessive current, Power stage abnormal heat, Encoder abnormality, Motor excessive load | |
| Withstand voltage *3 | | | 1500 VAC, 1 minute | |
| LED Display | | | RDY (green), RUN (green), ALM (red), ENC (orange) | |
| I/O Interface | | | 24 V DC Insulate | |
| I/O Signal | PIO | Exclusive Input 10 port | Start | |
| | | | Command Position Number (6 bit Binary) | |
| | | | Pause | |
| | | | 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 *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 | |

*1: Instantaneous value is 3 times more.

*2: Select a medium-speed NFB.

*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.

*4: Whether you need an external unit or not, it depends on condition of usage. Rough standard is 200 W.

### 2.1.1 Backup Battery (Absolute Specification)

(1) Battery Specifications

| Item | Description |
|---|---|
| Model | 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 ambient temperature of 20°C) |

*1: The current consumption during absolute data backup is approx. 100 μA (approx. 4 μA 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.

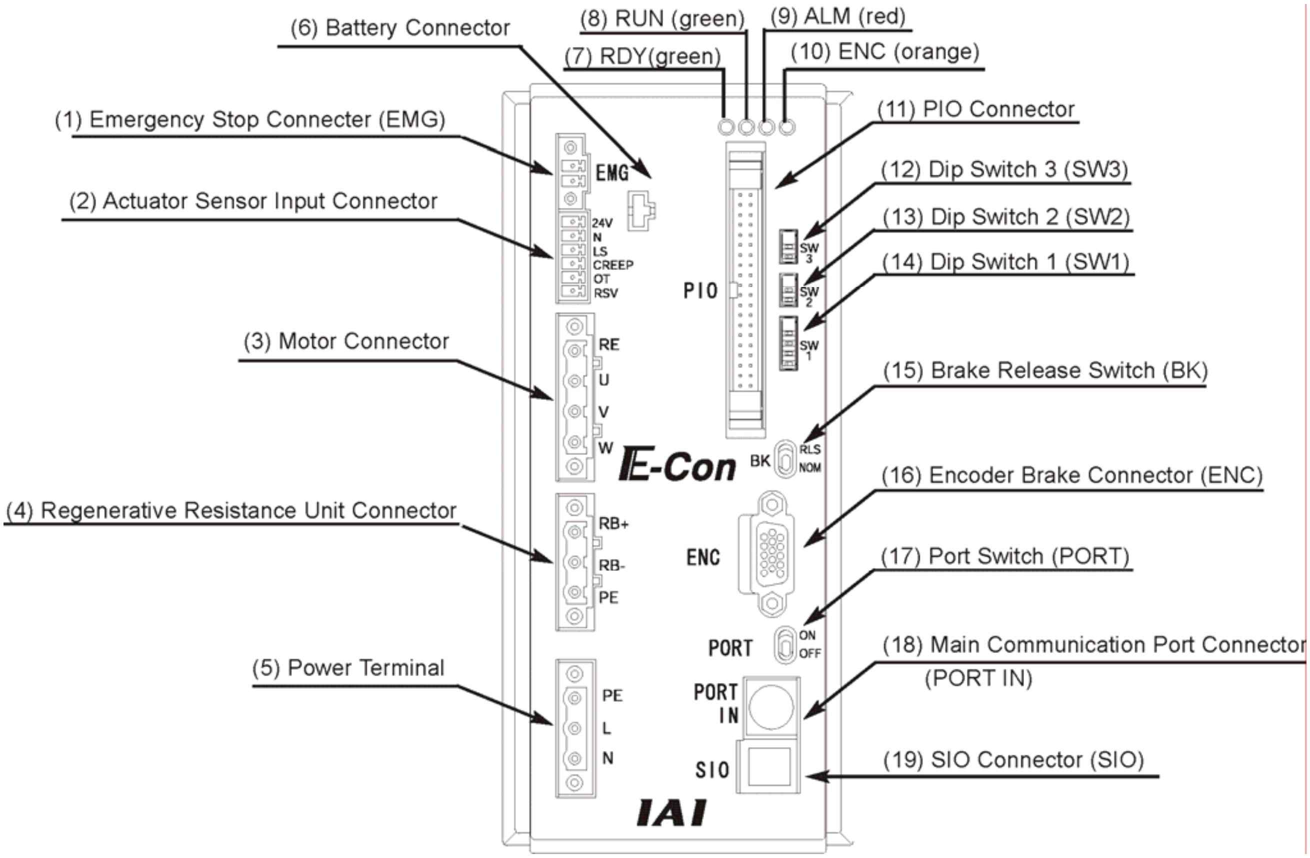
If the battery was replaced when the controller power was off, the retention condition of position information (absolute data) will vary as follows, depending on how long the controller has been out of battery.

| 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**

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. |

### (12) Dip Switch 3 (SW2)

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: Dip Switch number starts from the bottom side.

### (13) Dip Switch 2 (SW2)

1: Clears ABS-CLR and absolute encoder data. This is used when resetting the absolute: Normally OFF (Bottom)
2: FWR, Light Protect Switch. This is used during remote-UP: Normally OFF (Top)

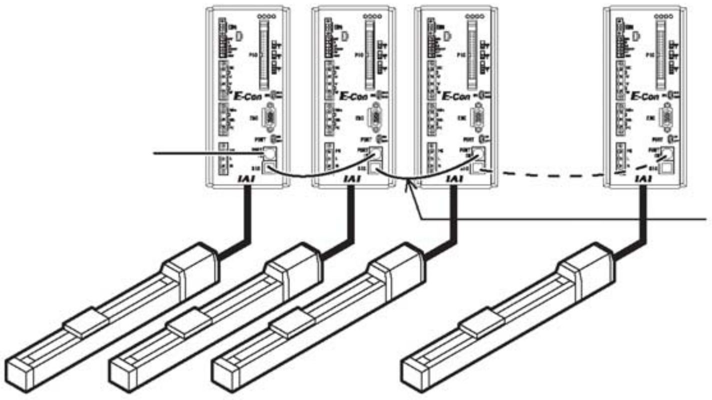
* The dip switch turns ON when tilted to right, and turns OFF when tilted to left, as viewed from the front side.

### (14) Dip Switch 1 (SW1)

Dip 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 dip switch and set the desired axis number. As for the number, make sure that the same number is not used for more than controller. If the number is specific, order is irrelevant. The controllers must be connected in consecutive sequence.

| Axis Number | Dip 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 RS 485 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 another controller (axis).

### (19) SIO Connector (SIO)

This is the connector for the serial controller link cable connection.

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

- SIO Connector

| Pin. No | Signal Name | Function |
|---|---|---|
| 1 | (+5 V) | DC 5V 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 | DC 5 V 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 | *Note 1 |
| 6 | 24 V | 24 V Power Point |
| 7 | GND | Ground |
| 8 | EMGB | *Note 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)

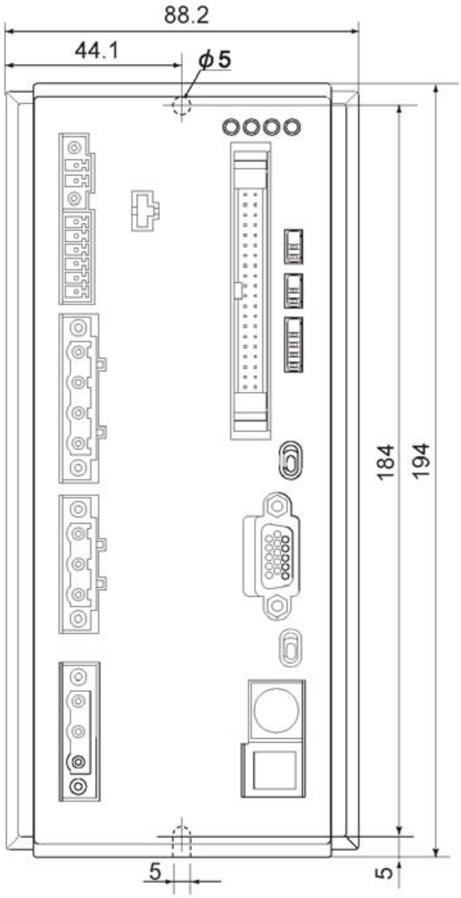
| Signal Name | Connection Line |
|---|---|
| PE | Ground |
| L | Live side of the AC single-phase power supply |
| N | Grounded side of the AC single-phase power supply |

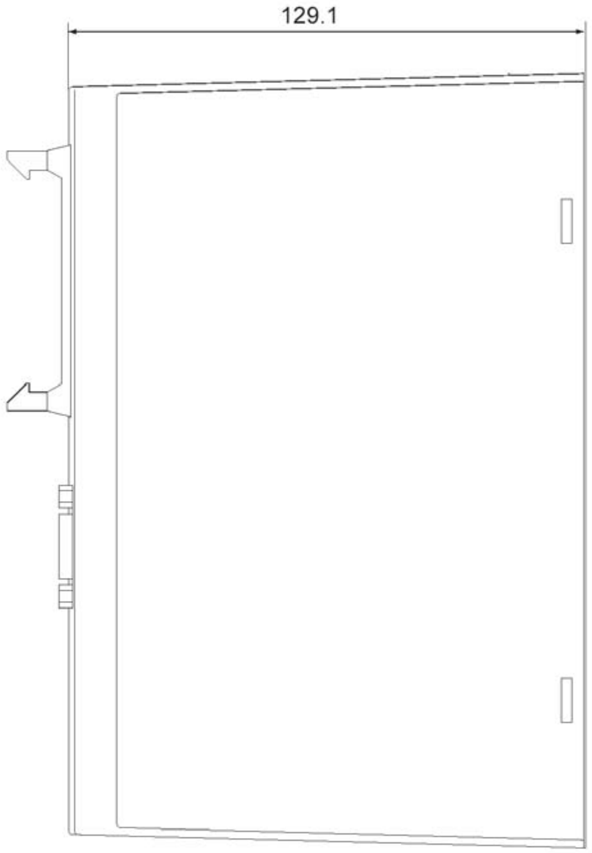
- Power and Emergency Stop Terminal Board (MC1.5/2-STF-3.81 Phoenix Contact)

| Signal Name | Connection Line |
|---|---|
| EMG | Connection to the emergency stop circuit<br>(The controller is shipped with this signal shorted.) |

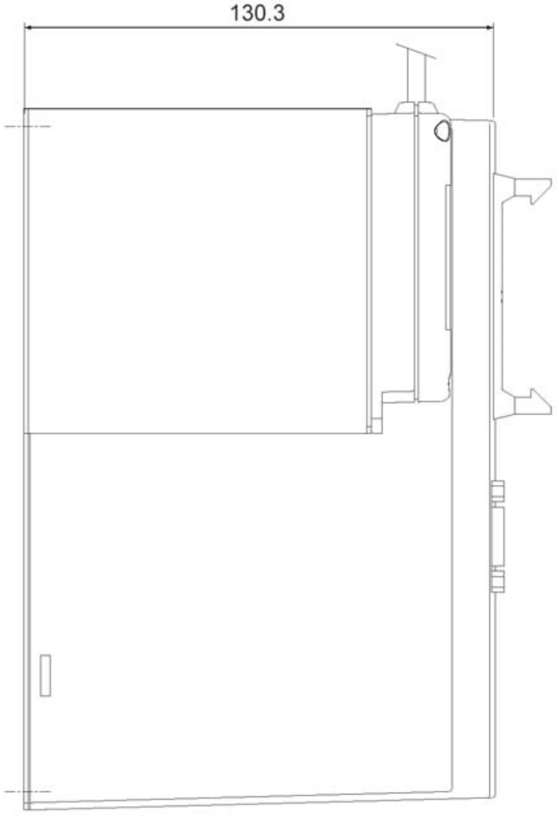
## 2-3 External Dimensional Diagram

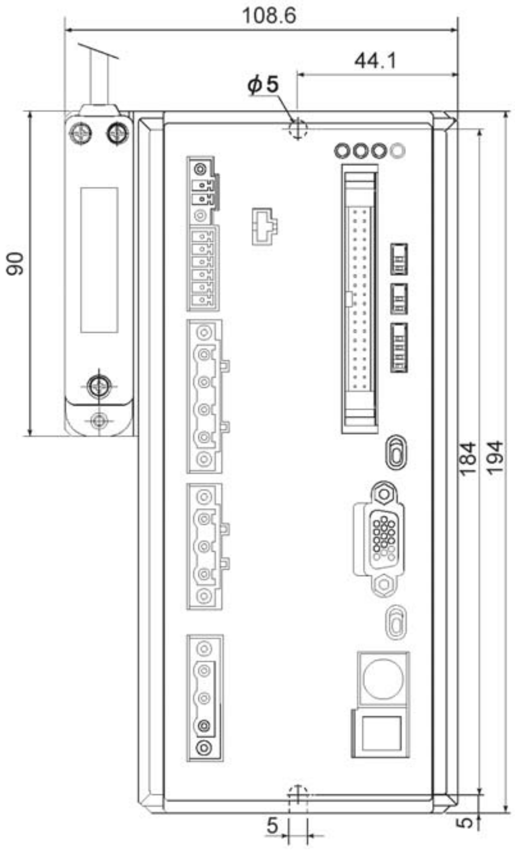
### 2-3-1 Standard Specifications

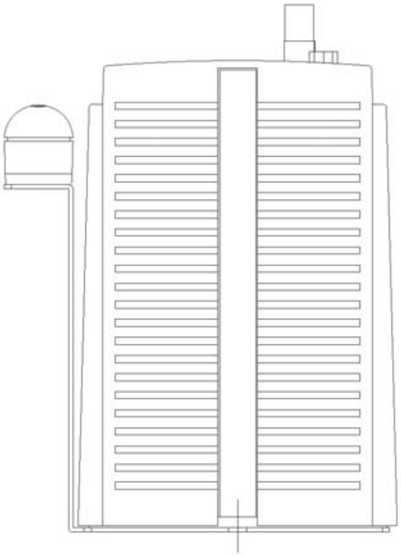




## 2-3-2 Absolute Specification

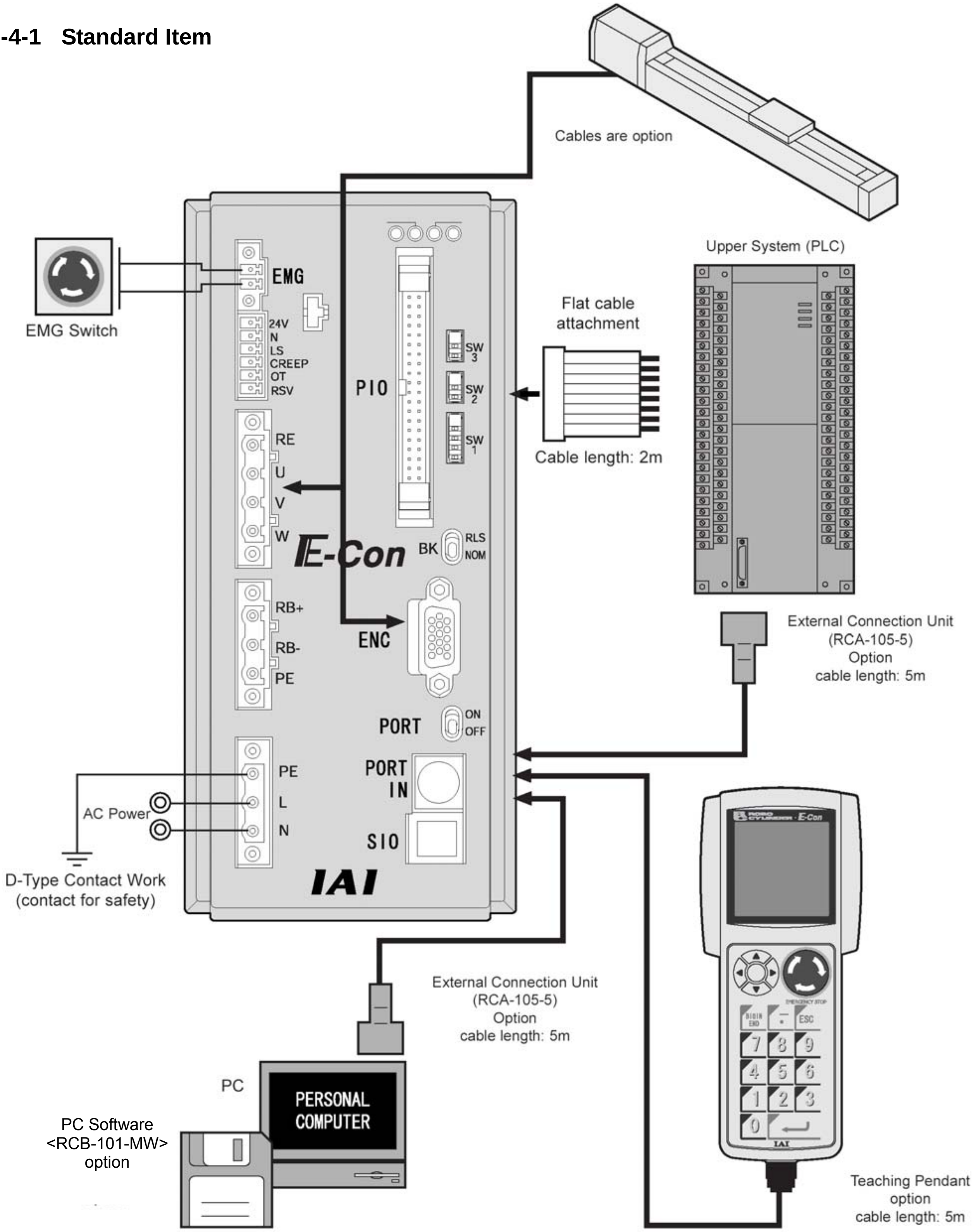






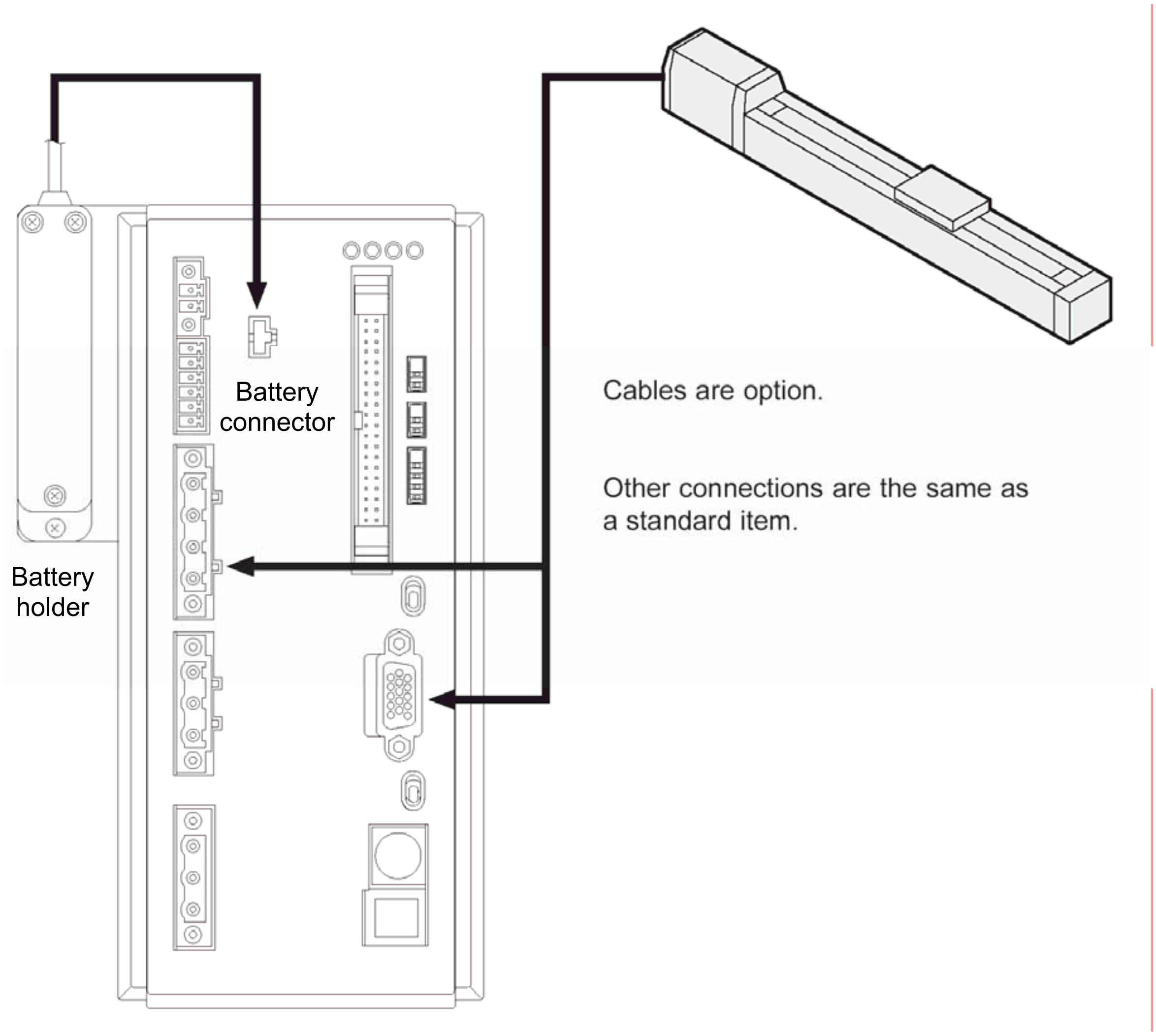
## 2-4 Connection Method

### 2-4-1 Standard Item



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

### 2-4-2 Absolute Specifications



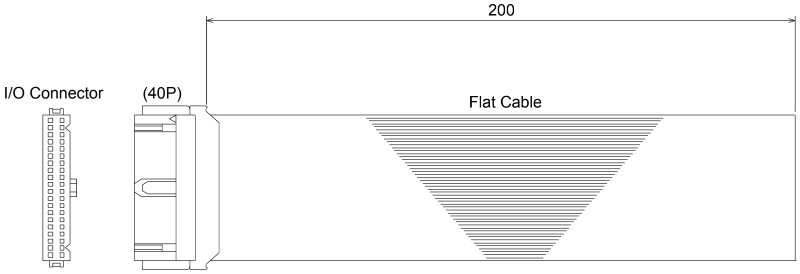
Cables are option.

Other connections are the same as a standard item.

## 2-5 Supplied Cables

### 2-5-1 I/O Flat Cable

* Accessory

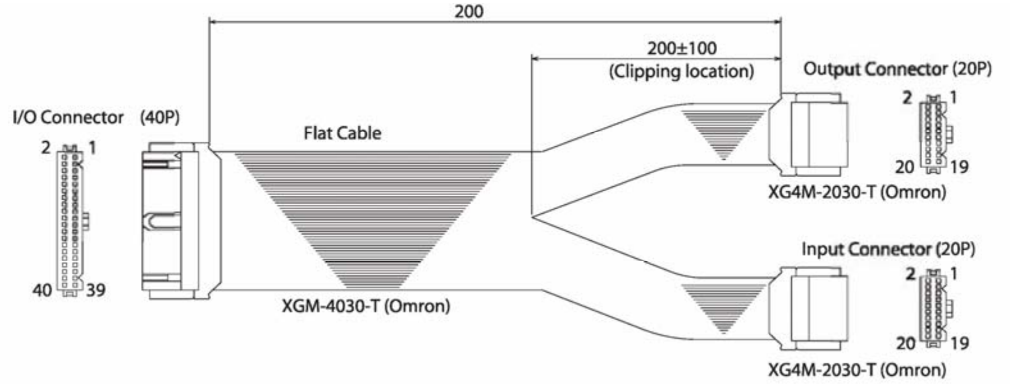


I/O Connector (40P)

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

| No. | Signal Name | Color | No. | Signal Name | Color |
|---|---|---|---|---|---|
| 21 | C OMIA | Brown - 3 | 31 | N C | Brown - 4 |
| 22 | C OMIA | Red - 3 | 32 | Command position 16 | Red - 4 |
| 23 | C OMIB | Orange - 3 | 33 | * Hold | Orange - 4 |
| 24 | C OMIB | Yellow - 3 | 34 | Command position 8 | Yellow - 4 |
| 25 | N C | Green - 3 | 35 | Servo ON | Green - 4 |
| 26 | N C | Blue - 3 | 36 | Command position 4 | Blue - 4 |
| 27 | N C | Purple - 3 | 37 | Reset | Purple - 4 |
| 28 | N C | Gray - 3 | 38 | Command position 2 | Gray - 4 |
| 29 | N C | White - 3 | 39 | S tart | White - 4 |
| 30 | Command position 32 | Black - 3 | 40 | Command position 1 | Black - 4 |

* Option



(A) Output Connector (20P)

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

(B) Input Connector (20P)

| No. | Signal Name | Color | No. | Signal Name | Color |
|---|---|---|---|---|---|
| 21 | C OMIA | Brown - 1 | 31 | N C | Brown - 2 |
| 22 | C OMIA | Red - 1 | 32 | Command position 16 | Red - 2 |
| 23 | C OMIB | Orange - 1 | 33 | * Hold | Orange - 2 |
| 24 | C OMIB | Yellow - 1 | 34 | Command position 8 | Yellow - 2 |
| 25 | N C | Green - 1 | 35 | Servo ON | Green - 2 |
| 26 | N C | Blue - 1 | 36 | Command position 4 | Blue - 2 |
| 27 | N C | Purple - 1 | 37 | Reset | Purple - 2 |
| 28 | N C | Gray - 1 | 38 | Command position 2 | Gray - 2 |
| 29 | N C | White - 1 | 39 | S tart | White - 2 |
| 30 | Command position 32 | Black - 1 | 40 | Command position 1 | Black - 2 |

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

### 2-5-2 Motor Relay Cables

Controller end

Actuator end

Single-axis robot type: CB-X-MA＊＊＊

Robo Cylinder type: CB-RCC-MA＊＊＊

| 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 |

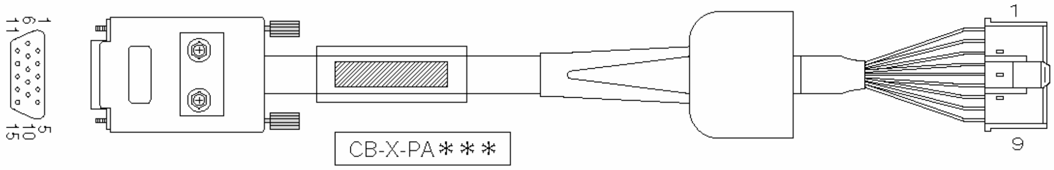
Reverse plug : GIC2. 5／4-STF-7.62 (Phoenix)

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

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

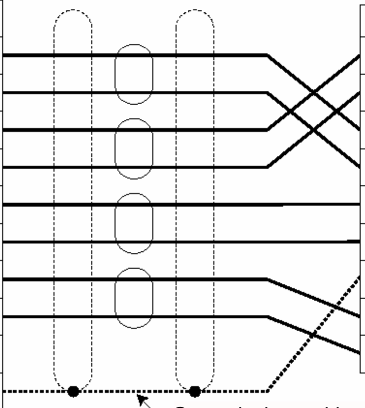
Controller end

Actuator end



CB-X-PA＊＊＊

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



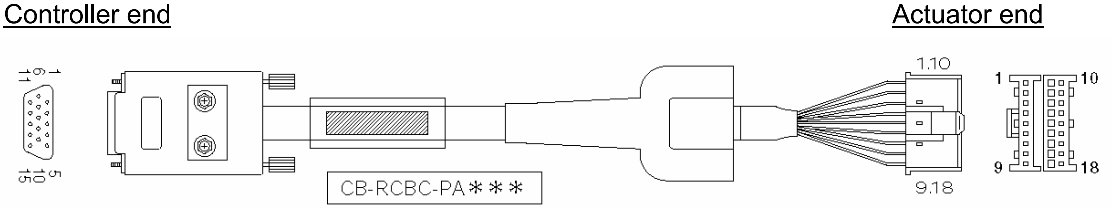
| Pin no. | Signal abbreviation | Cable color |
|---|---|---|
| 1 | BAT+ | Black |
| 2 | BAT– | Yellow |
| 3 | SD | Blue |
| 4 | $\overline{SD}$ | Orange |
| 5 | VCC | Green |
| 6 | GND | Brown |
| 7 | FG | Ground |
| 8 | BK– | Gray |
| 9 | BK+ | Red |

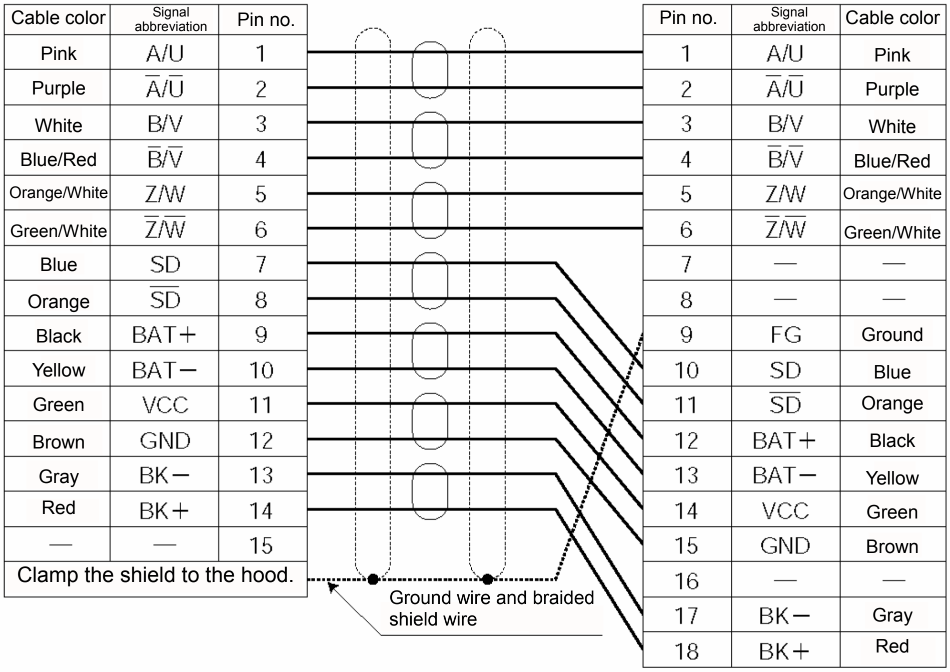
Ground wire and braided shield wire

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

### 2-5-4 Encoder Relay Cable (Robo Cylinder Type)





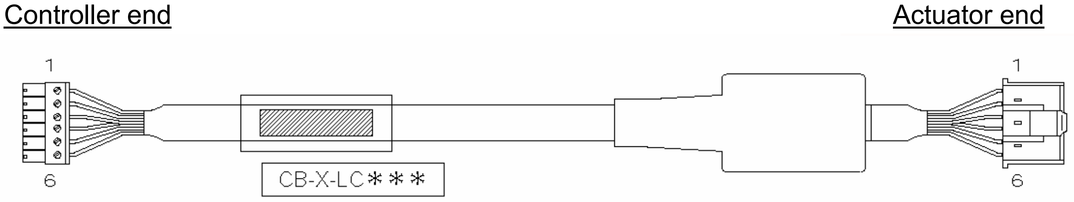
| Cable color | Signal abbreviation | Pin no. |
|---|---|---|
| Pink | A/U | 1 |
| Purple | $\overline{A}/\overline{U}$ | 2 |
| White | B/V | 3 |
| Blue/Red | $\overline{B}/\overline{V}$ | 4 |
| Orange/White | Z/W | 5 |
| Green/White | $\overline{Z}/\overline{W}$ | 6 |
| Blue | SD | 7 |
| Orange | $\overline{SD}$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

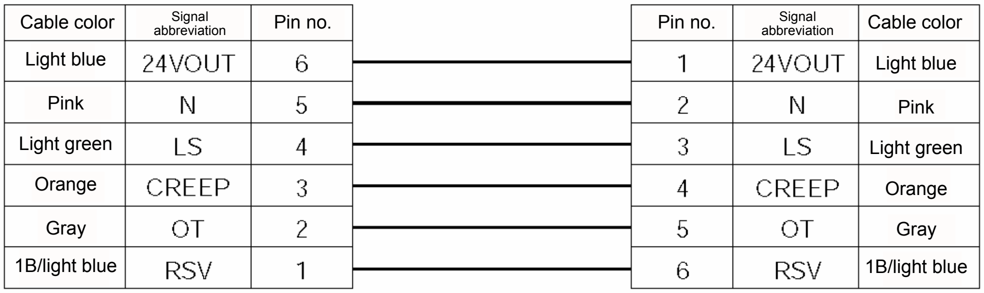
| Pin no. | Signal abbreviation | Cable color |
|---|---|---|
| 1 | A/U | Pink |
| 2 | $\overline{A}/\overline{U}$ | Purple |
| 3 | B/V | White |
| 4 | $\overline{B}/\overline{V}$ | Blue/Red |
| 5 | Z/W | Orange/White |
| 6 | $\overline{Z}/\overline{W}$ | Green/White |
| 7 | — | — |
| 8 | — | — |
| 9 | FG | Ground |
| 10 | SD | Blue |
| 11 | $\overline{SD}$ | Orange |
| 12 | BAT+ | Black |
| 13 | BAT− | Yellow |
| 14 | VCC | Green |
| 15 | GND | Brown |
| 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 Relay Cable





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

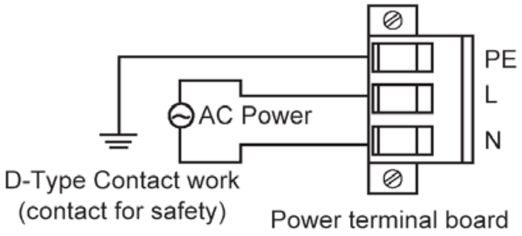
| Pin no. | Signal abbreviation | Cable color |
|---|---|---|
| 1 | 24VOUT | Light blue |
| 2 | N | Pink |
| 3 | LS | Light green |
| 4 | CREEP | Orange |
| 5 | OT | Gray |
| 6 | RSV | 1B/light blue |

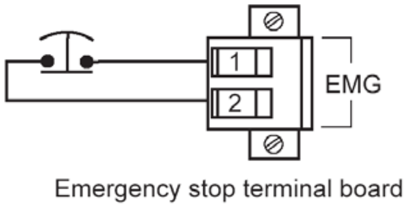
Note) 1B indicates one black dot.
Plug : MC1.5／6-ST-3.5 (Phoenix)

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





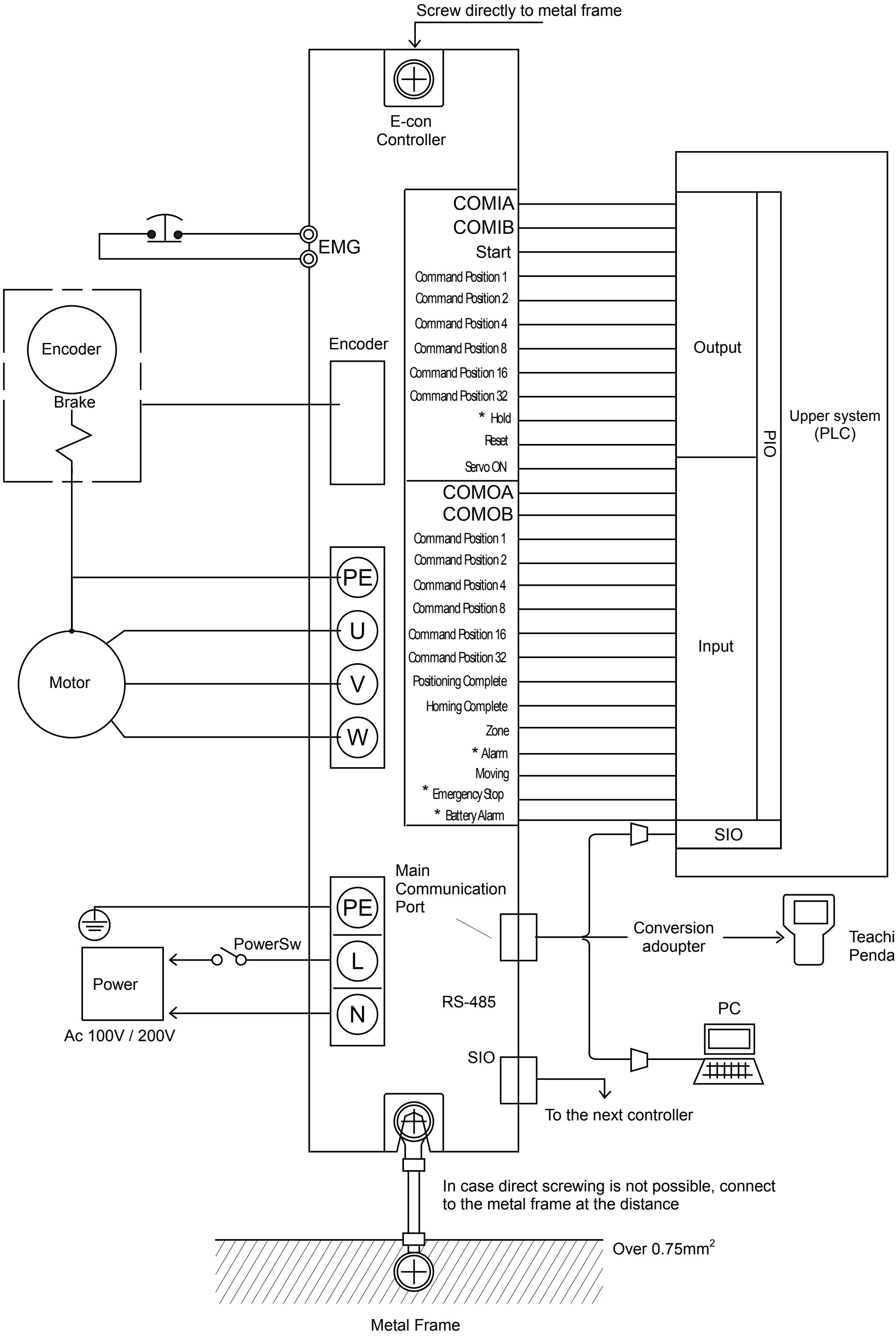
* The two EMG terminals are for connecting an emergency stop switch. At the time of shipment, a jumper is used to short the two terminals. Do not remove it! If you remove, replace with a switch that is normally closed, or the system will always be in emergency status. 24 VDC is output to pin 1.

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

| | |
|---|---|
| Applicable conduit | Single Line -∅1.0 (AWG18)<br>Stranded Line - 0.75 mm$^3$ (AWG18) |
| Specification possible conduit range | Single Line -∅0.4 (AWG26) to ∅1.2 (AWG16)<br>Stranded Line - 0.75 mm$^3$ (AWG18) to 1.25 mm$^3$ (AWG16)<br>Stranded Diameter - Over ∅0.18 mm |
| Length of un-sealed connect wire | 11 mm |
| Applicable tool for button operation | Minus Driver (axis diameter ∅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) | C OMOA | Brown - 1 | 2 | | (1) | C OMOA | Red - 1 |
| 3 | | (2) | C OMOB | Orange - 1 | 4 | | (2) | C OMOB | 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) | C OMIA | Red - 3 |
| 23 | | (12) | COMIB | Orange - 3 | 24 | | (12) | C OMIB | 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) | COM0A | Power for input port |
| (2) | COM0B | Power for input port<br>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. |
| (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.<br>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 width. 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.<br>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 | Power for input port |
| (12) COMIB | 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 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | 38 | Command Position 2 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| | 36 | Command Position 4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | 34 | Command Position 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 32 | Command Position 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 30 | Command Position 32 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Selected Position No. | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |

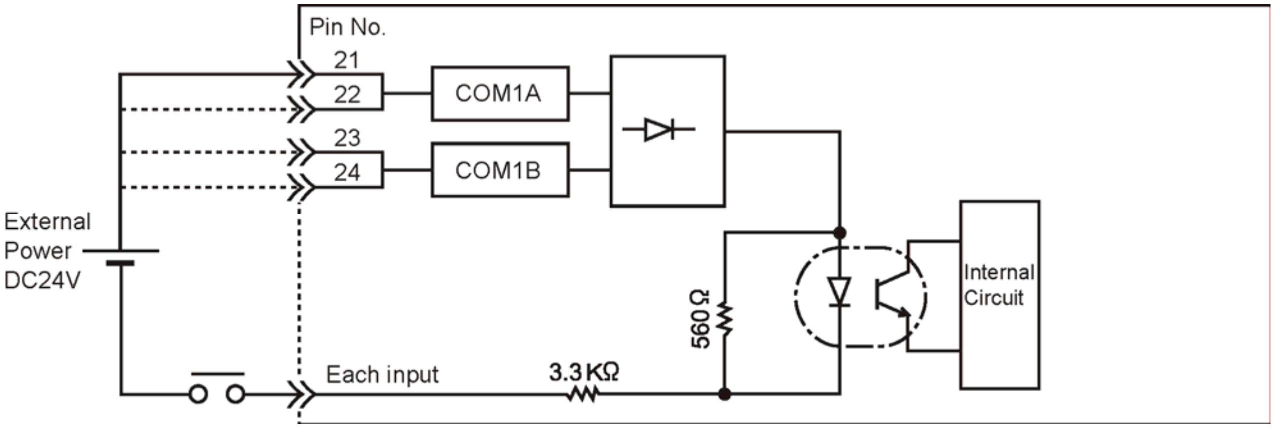
Caution: A controller operation error may occur when selecting an undefined position number and triggering the Start Input ON.

### 2-6-4 External I/O Specifications

Input Area

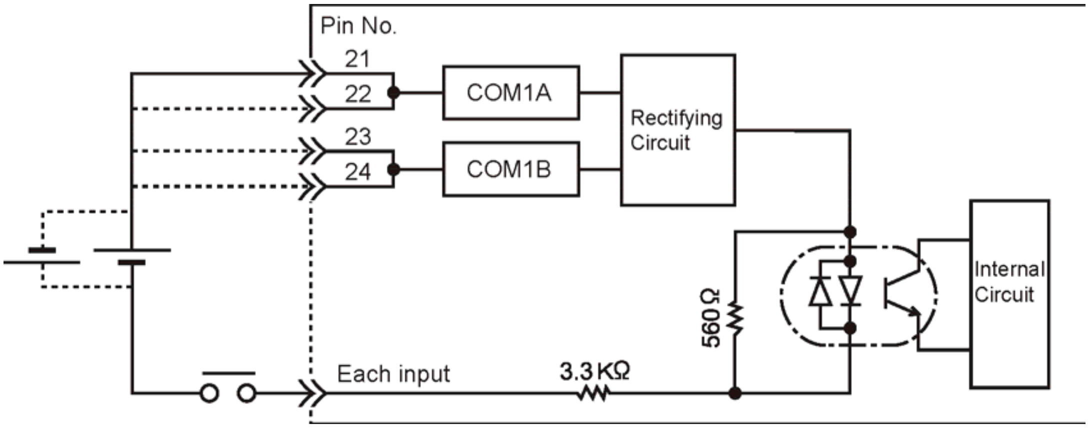
| Column | Specifications |
|---|---|
| Number of inputs | 10 points |
| Input Voltage | DC 24 V ±20% |
| Input Current | 7 mA/1 Circuit |
| Movement Voltage | ON Voltage . . . Minimum 16 V (4.5 mA)<br>OFF Voltage . . . Minimum 6 V (1.4 mA) |
| Insulation Method | Photo Coupler |

Internal Circuit Structure **(NPN Specifications)**



- Connect plus side of external power to Pins No. 21~24.
- As for the common side of input, connect to the minus side of the external power (ground).
- Pins No. 21 and 22 of COM 1A, and Pins No.23 and 24 of COM1B are connected, respectively internally.

Internal Circuit Structure **(PNP Specifications)**



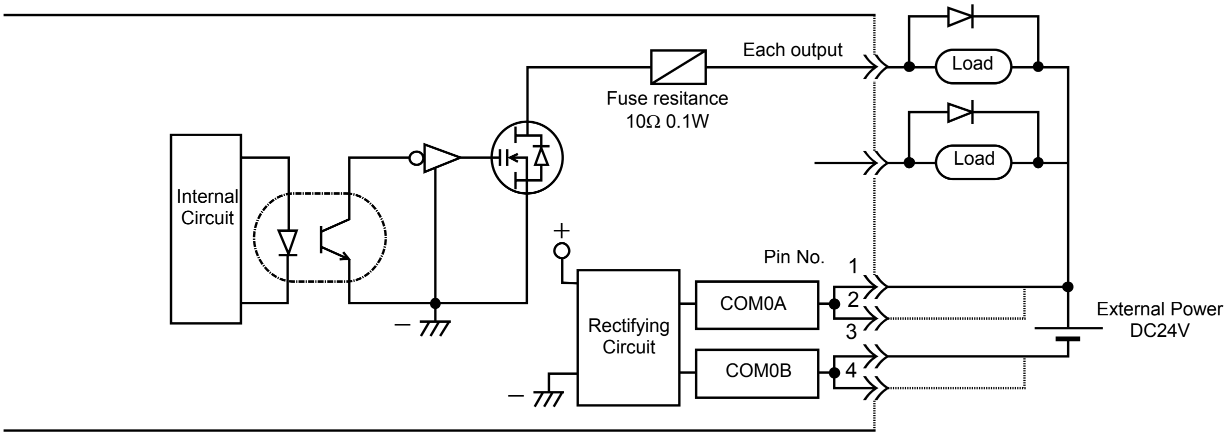
- Connect 24 VDC between COMIA and COMIB.
- As for the common side of input, connect to the plus side of the external power.
- Pins No. 21 and 22 of COMIA and pins No. 23 and 24 of COMIB are respectively connected internally.

Output Area

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

| Column | Specifications |
|---|---|
| Number of inputs | 12 points |
| Input Voltage | DC24 V/6 0V (peak) (No schottky diodes) |
| Input Current | 100 mA/1 Circuit |
| Movement Voltage | 1.8 V/100 mA |
| Insulation Method | Photo Coupler |
| Overcurrent Protection | Fuse resistance 10 & 0.1 W |

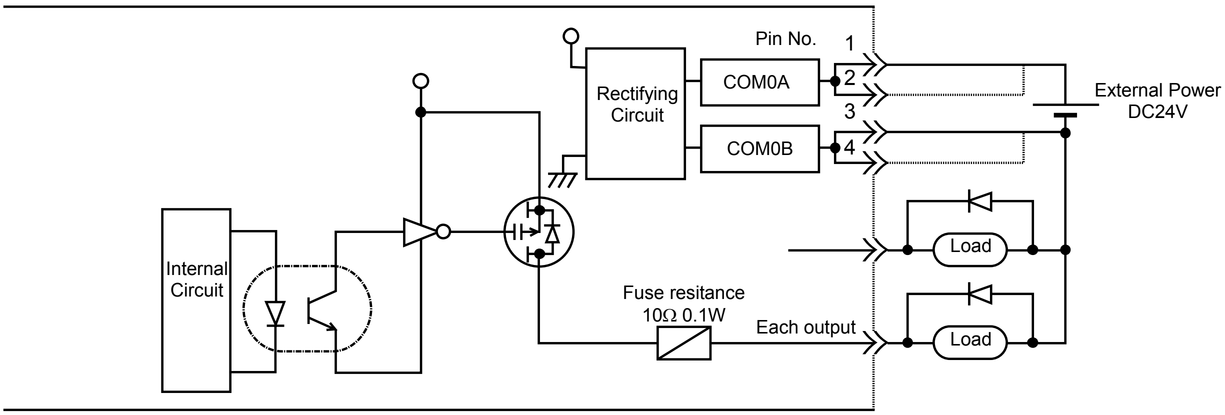
Internal Circuit Structure **(NPN Specifications)**



- Add DC24 V between COMOA and COM 0B. Polarity does not exist between COM0A 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 **(PNP Specifications)**



# 3. Data Input (Basic)

Since this controller does not have any commands, there is no needed to write any programs. In order to make the actuator move to the assigned position, all you need to do is input the position data into the position data table. In the position table, there are the following 7 columns: Position, Speed, Acceleration/Deceleration, Force, Positioning Width and Acceleration Only MAX & ABS/INC Flag. The position table below is displayed by the Teaching Pendant. If ABS/ INC flags are set to 0, executing a position will move the actuator an absolute distance from home. If ABS/INC flag is set to 1, then the more will be an incremental more. That is, the actual will more from the current position by the position data value. (This can be a positive or negative value.)

Position Table

| No. | Position | Speed | Acc/Dec | Push | Positioning Width | 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 |

Please make modifications as needed. When modifying the initial value, changes can be made on the "initial value" of the parameter. The initial value differs depending on the actuator type. When changing the initial value, please use the initial value of the parameter. The initial value will vary according to 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**

- The distance from home (in mm).
  **Absolute Coordinate Assign:** The distance from home (in mm). You may not input a negative value.
  **Relative Coordinate Assign:** The distance from current location (in mm). You may input a negative value.

| No. | Position | |
|---|---|---|
| 1 | 30 | |
| 2 = | 10 | |
| 3 = | -10 | |
| 4 | 100 | |
| | | |

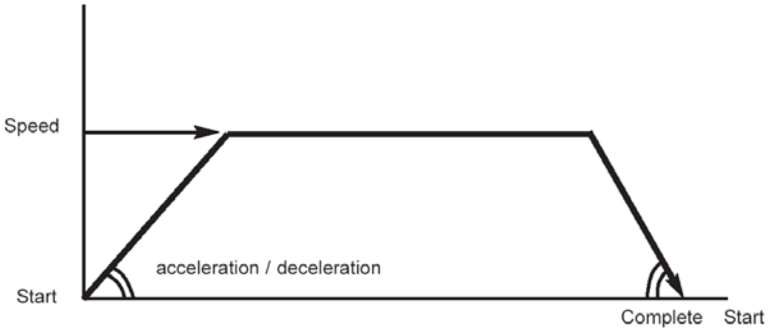
Absolute Coordinate Assign: 30 mm from home
Relative Coordinate Assign: Plus 10 mm from current location
Relative Coordinate Assign: -10 mm from current location
Absolute Coordinate Assign: 100 mm from home

**(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 takt 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 (%)

- In Push Mode, input the % of max current of the servomotor which determines the force at which you push to the end of specified travel.
**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 Width**

As for the positioning width, 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)

- The positioning mode uses position widths as a location to turn ON the position complete output prior to actual point data.
- 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 position width.

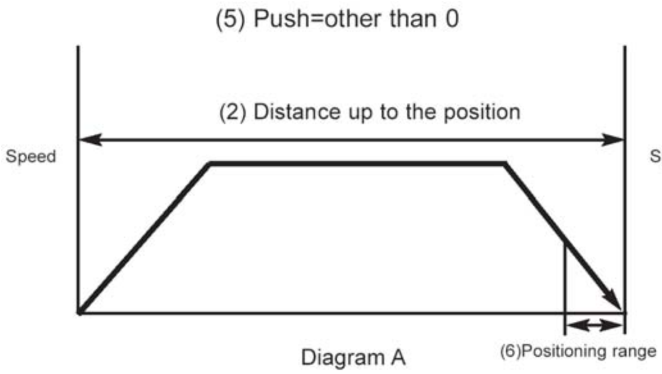


Diagram A

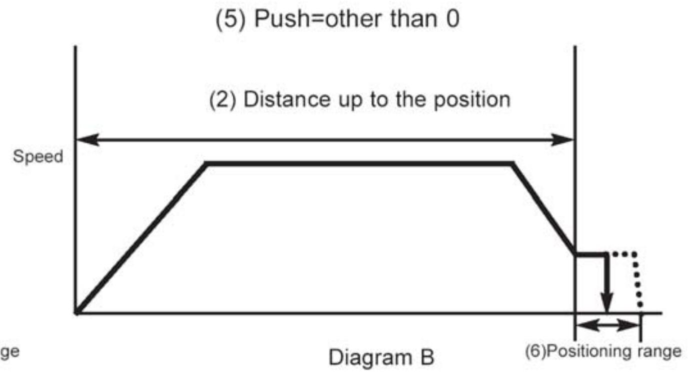
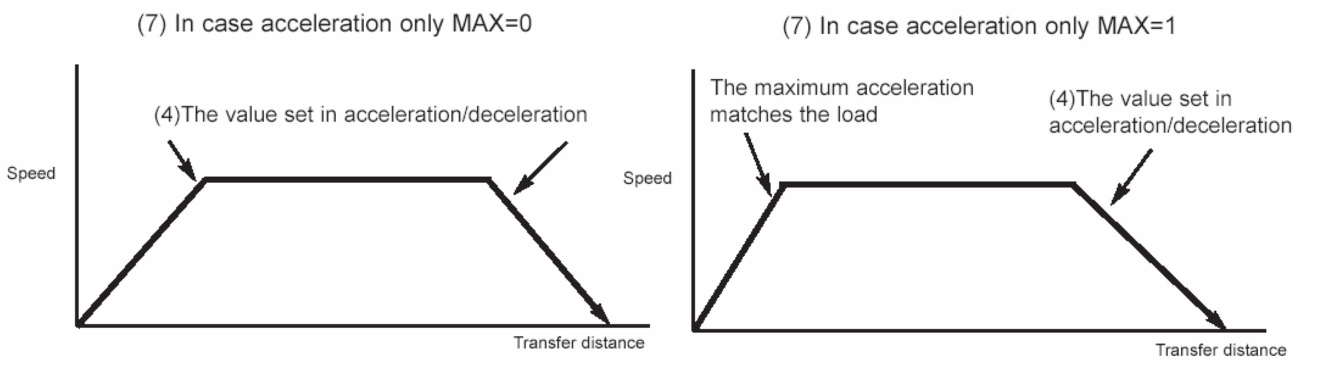


Diagram B

### (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 placed in the ACC/DEC Speed column will become the actual acceleration/deceleration value.
1: Maximum acceleration
This will automatically utilize the maximum acceleration matched to the load.
Deceleration remains as the assigned value.



| | |
|---|---|
| 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.<br>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

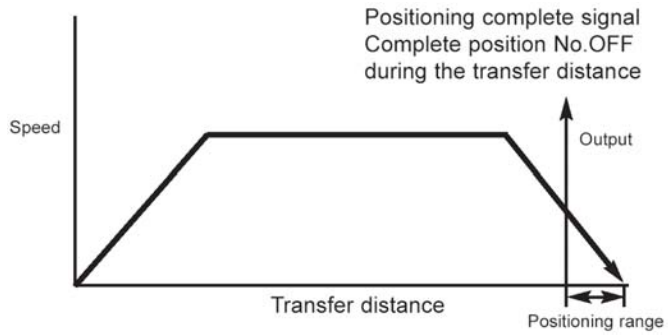
To operate the actuator in the push mode, enter a current limit value (%) in the “Push” field of the position data table.
With E-Con controllers, the push force at standstill must correspond to approx. 70% of the current limit value. You can increase/decrease the push force at standstill by increasing/decreasing 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） |
| | RB7535 | 100 | L | 296（30.3） |
| | | | M | 149（15.2） |
| | | | H | 74（7.6） |
| | | 150 | M | 222（22.7） |
| | | | H | 111（11.4） |
| Flat type | F55 | 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） |

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

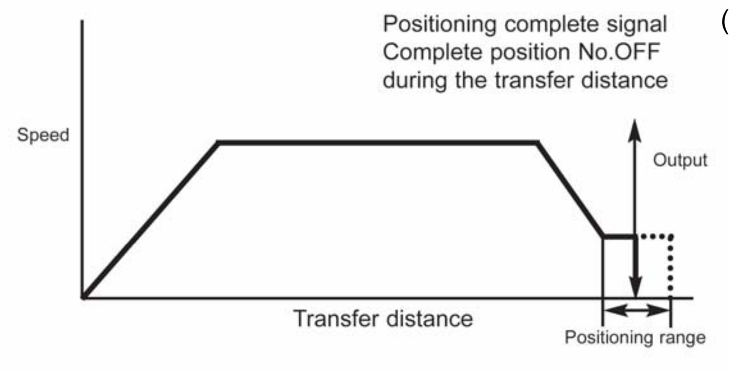
## 3-2 Mode Explanation

### 3-2-1 Positioning Mode Push=0



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

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



(1) After reaching the position shown, the actuator moves forward at a low rate speed (75RPM). Once the actuator pushes the work and the parameter passes a set time 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.

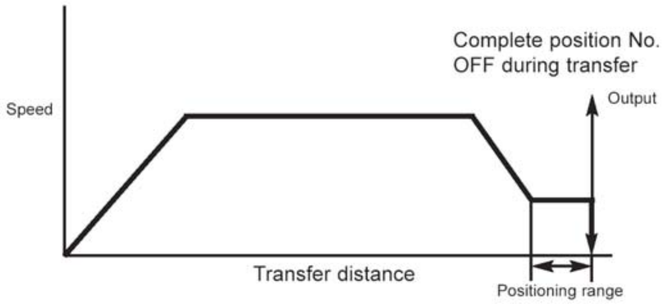
Note: If needed, set the “push recognition time” in the parameters. 255 msec is the default value.

**Warning:**
**The actuator will continue to push the work with set push force after push has been reached. Wait until positioning is complete.**

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 |

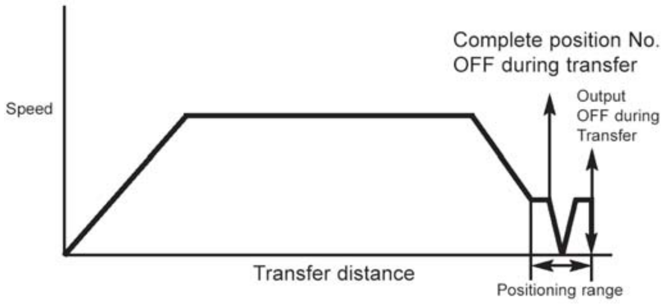
(2) When push fails (blank shot)



(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. To confirm stop status, check if output during transfer is OFF.

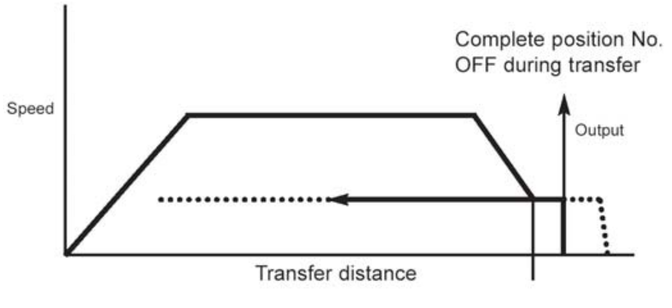
(3) Upon push, the moving work increases.

1. When the work moves in the push direction



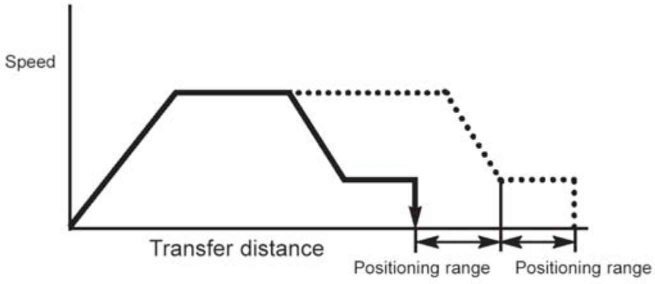
If the work moves to the push direction after the positioning complete output turns ON, the actuator will push the work within the positioning band range. The positioning complete ON and complete position number outputs will not change. In-motion output will remain ON. In-motion output will turn OFF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

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



When the reaction force of the work 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.

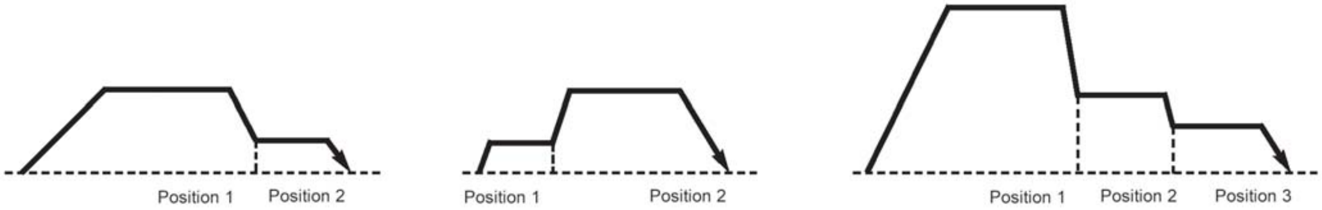
(4) When the input value of positioning width is wrong



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

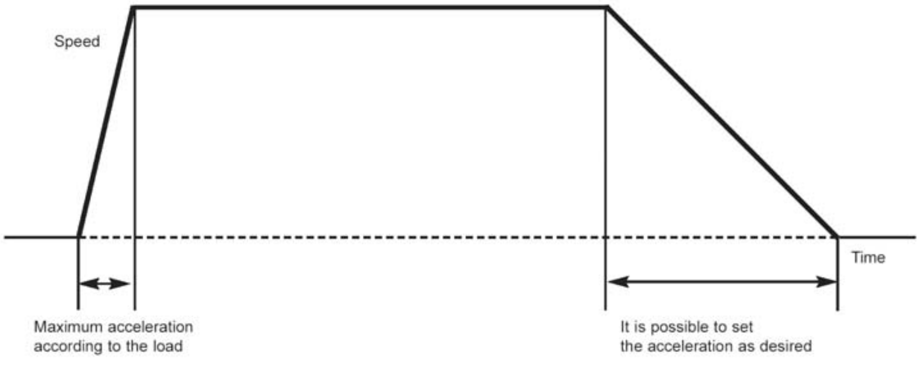
### 3-2-3 Speed Change Movement During Transfer

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

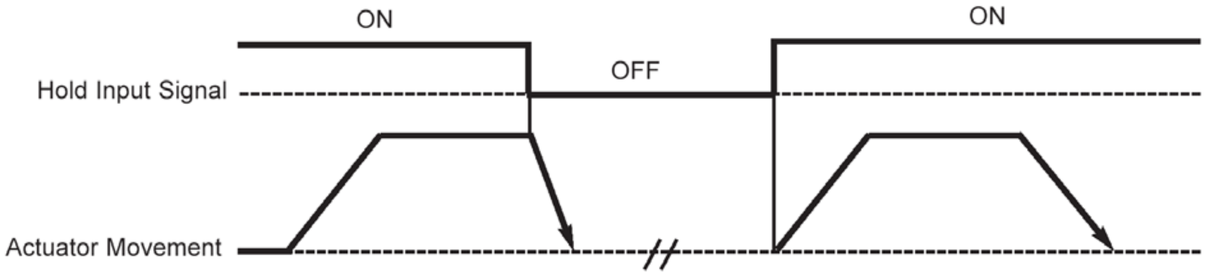
By inputting 1 into "MAX ACC Flag" the position data table, the transfer movement may operate with a variable range of acceleration and deceleration values. The acceleration value is the maximum speed that matches the load. The deceleration value is the value input in the "ACC" of the position data table.
The actuator will accelerate at the maximum acceleration and decelerate at the value entered in the "Acc/Dec" field of the position data table.



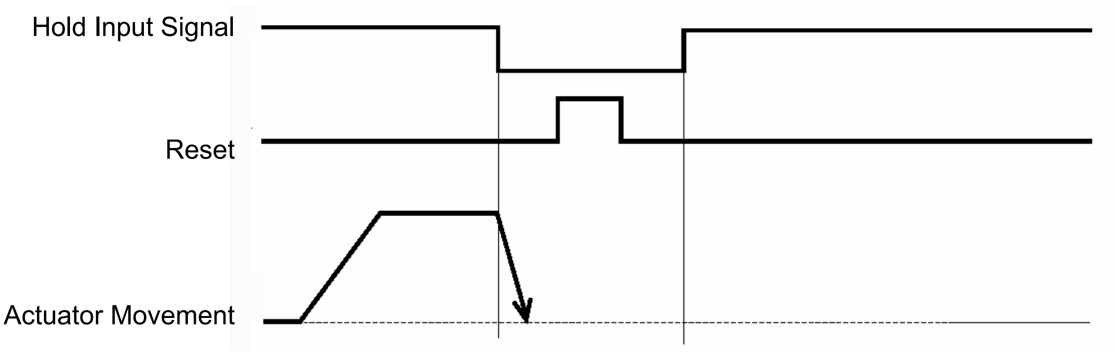
| | |
|---|---|
| Caution: | Although the specific value differs depending on the actuator, the maximum acceleration cannot be more than three times the rated acceleration.<br>Accordingly, this function should be enabled **only** when the payload is no more than one-third of the rated loading capacity and the actuator needs to be stopped gradually at slow deceleration.<br>If this function is enabled when the payload is equivalent to the rated loading capacity, an overload error may occur.<br>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.<br>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 make a quick stop according to the external input signal P I/O Pin 33 (Hold Input). 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.

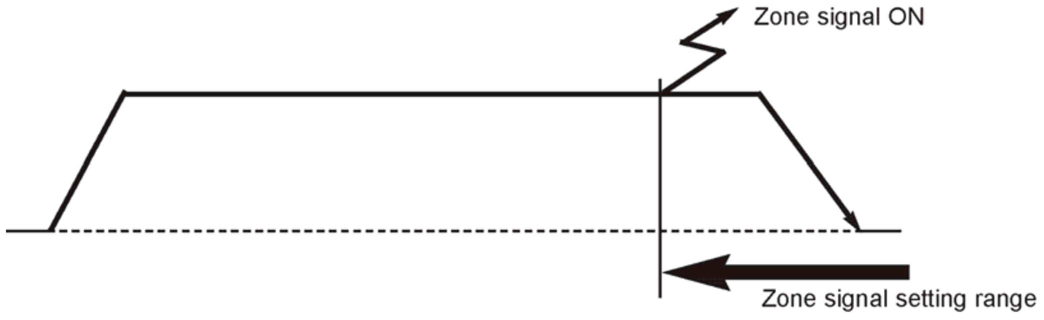


The remaining movement of the actuator can be cancelled by turning the reset input ON while the hold signal is being input (at the leading edge of the reset input signal).



### 3-2-6 Zone Signal Output

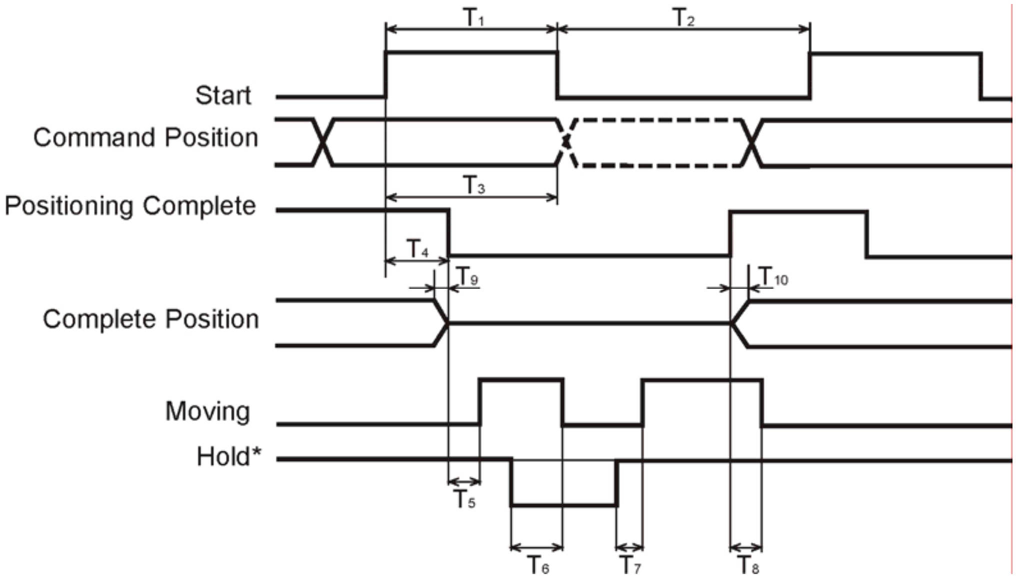
By setting the zone parameter beforehand, once a moving slider enters that territory, the zone signal output. turn ON and remain ON within the zone · territory setting. It is possible to assign even in the middle of the stroke.



### 3-2-7 Homing

During power-up or upon alarm release, you will need to home. After selecting the position number, and CSTR is applied, first homing is executed. 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)

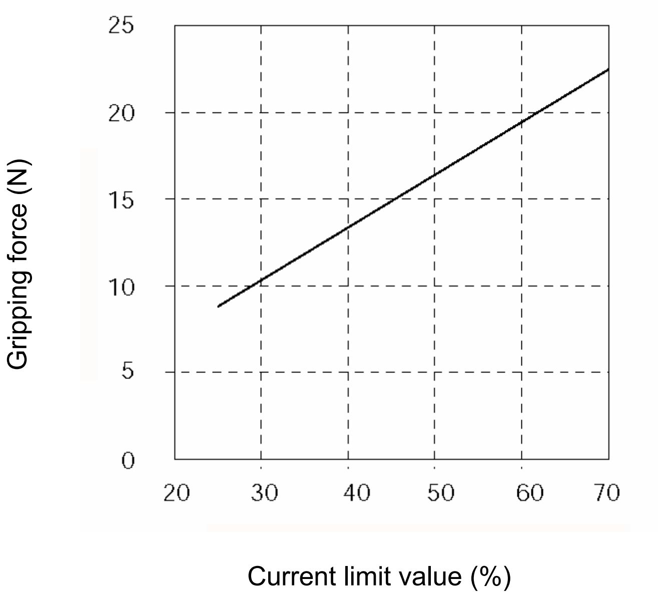
(1) Finger Operation

[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, 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 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)

**Power-Up**

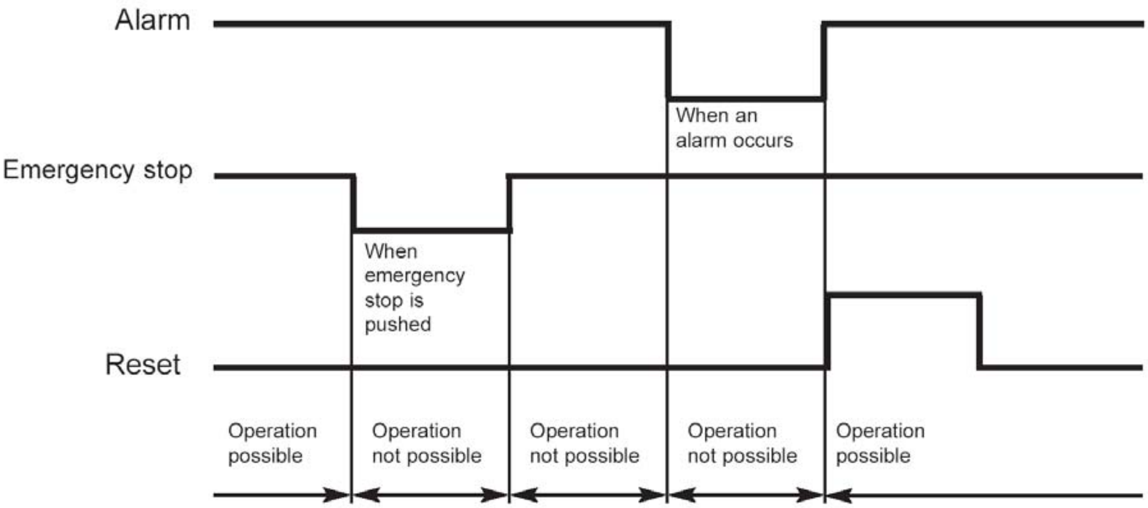
(1) Confirm that both Nos. 1 and 2 of dip switch 2 (SW2) are set to OFF. If these switches are set to ON, tilt them back to the OFF positions.
(2) Connect the motor · brake cable and encoder cable to the controller.
(3) Connect the upper PLC to the P I/O Connector using the attached flat cable.
(4) When connecting more than 2-axes, address each controller by using the dip switches. For details, please refer to the “specifications” section under the dip 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 Error Code List located on page 63 in this manual. LED Display is not lit during emergency stop.

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.

### 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 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 dip 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 dip 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 dip 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 dip 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.

*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.

* Absolute reset is executed by supplying main power with No.1 switch of SW2 ON.

Caution: 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.

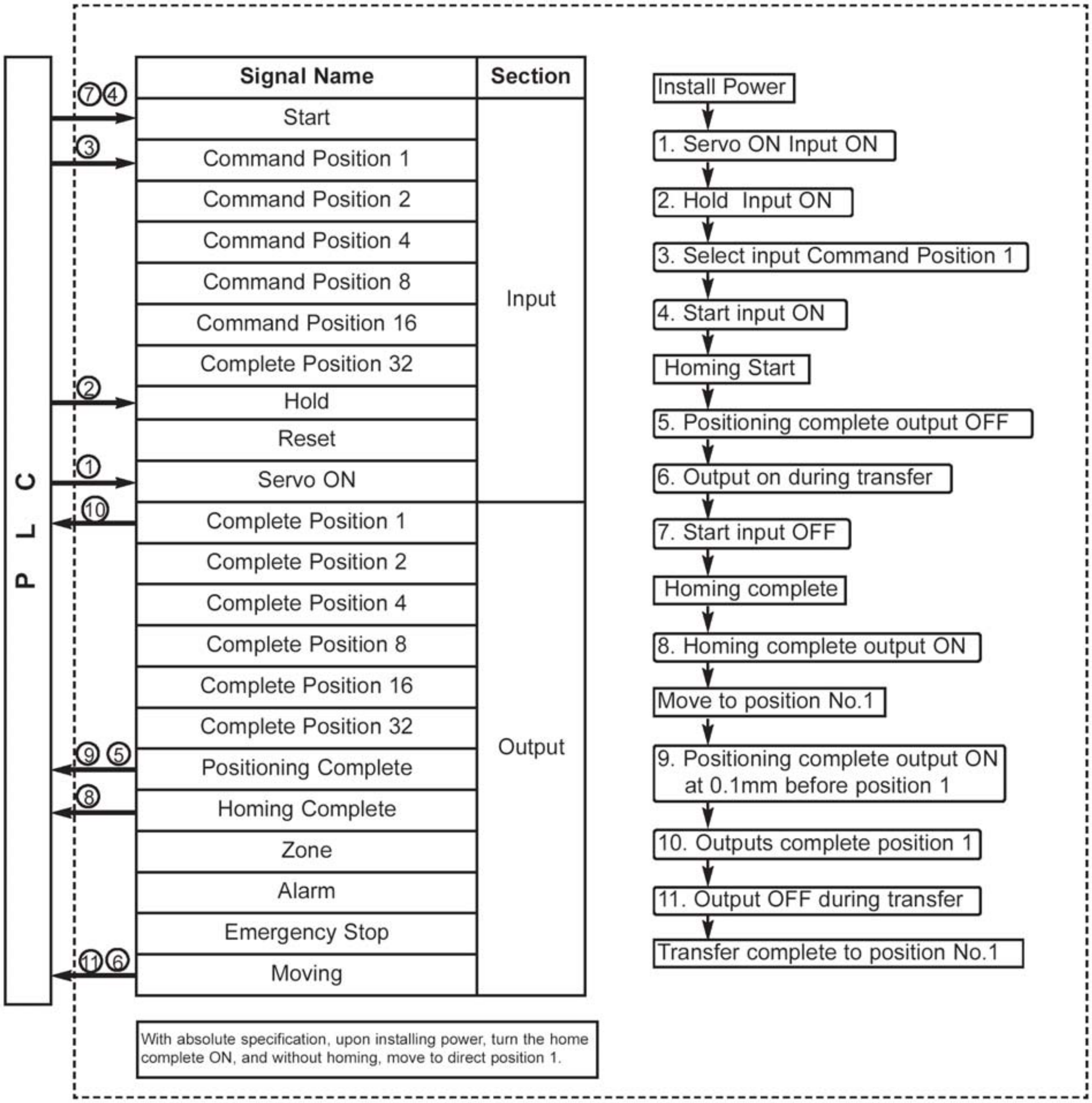
## 4-3 Move After Power-Up (Standard)

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

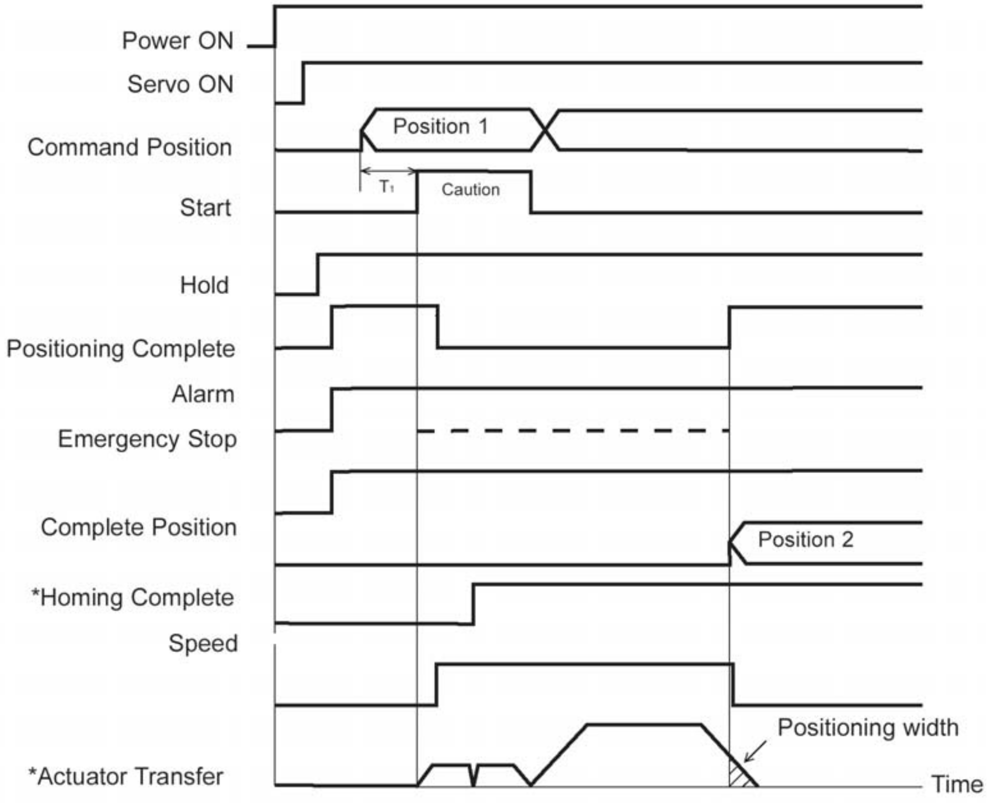
Position data table (column with dark line indicate the input insert)

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

E-Con Controller



With absolute specification, upon installing power, turn the home complete ON, and without homing, move to direct position 1.

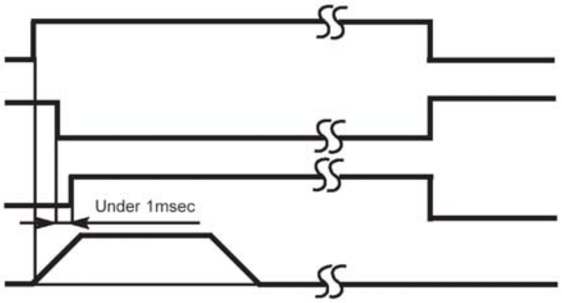


After Power-Up and operation preparation is ready, positioning complete output will turn ON. (If servo ON input is OFF, positioning complete output will not turn ON.) To confirm system is RDY, check if positioning complete output is on. When system is RDY and positioning is complete, positioning complete 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 controller)

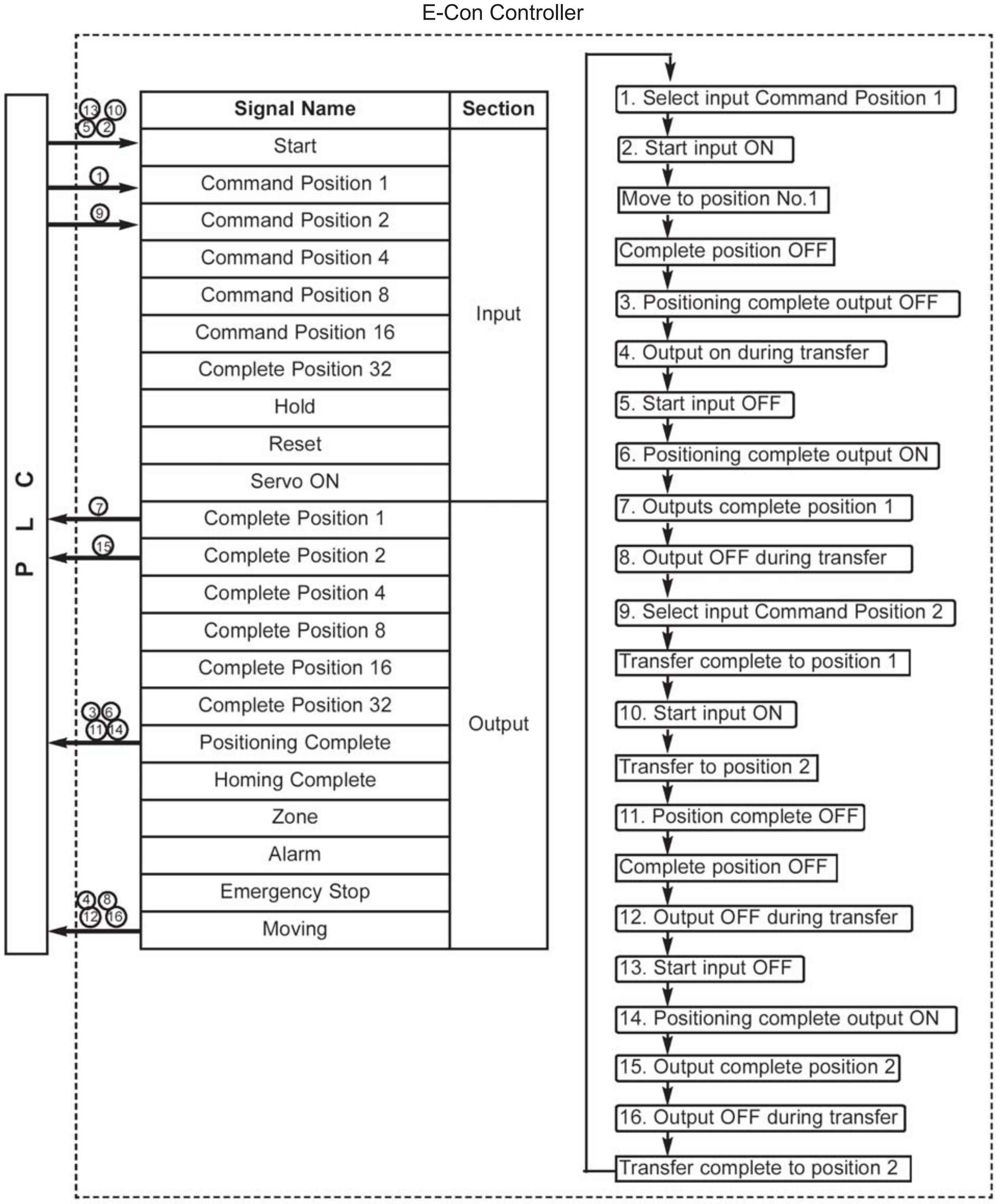
* For absolute specification, homing complete signal turns ON after supply power and homing is not executed.

Caution: Positioning complete Output will turn OFF once the start signal turns ON.
You may execute the Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.
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.



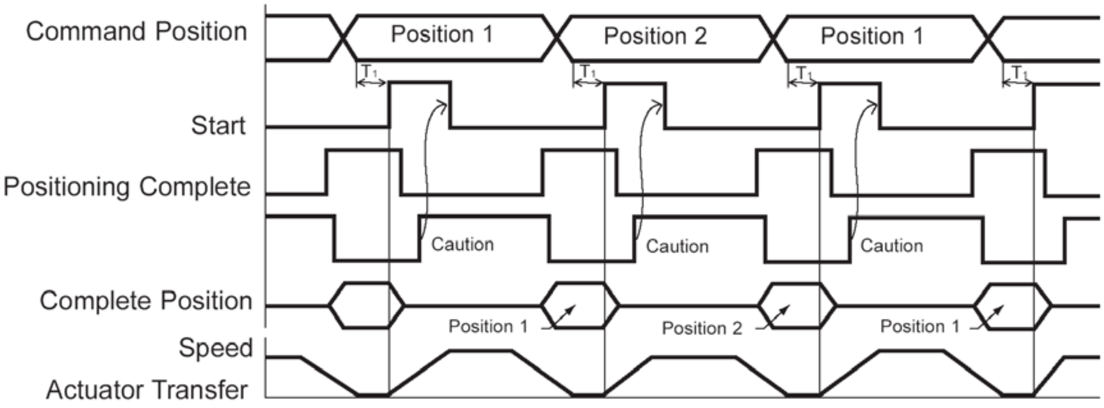
## 4-4 Positioning Mode (2 point space reciprocation)

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. For both positions, assign the positioning width to 0.



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

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

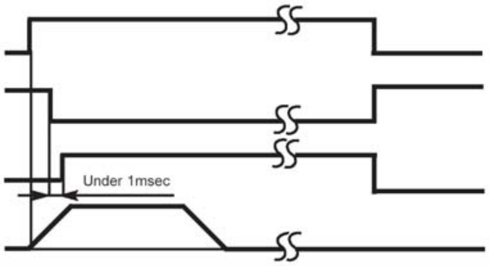


T1: Over 6 msec  Time from Command Position Select Input to Start Signal ON

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

Please input Command Positron after previous positioning complete turns ON.

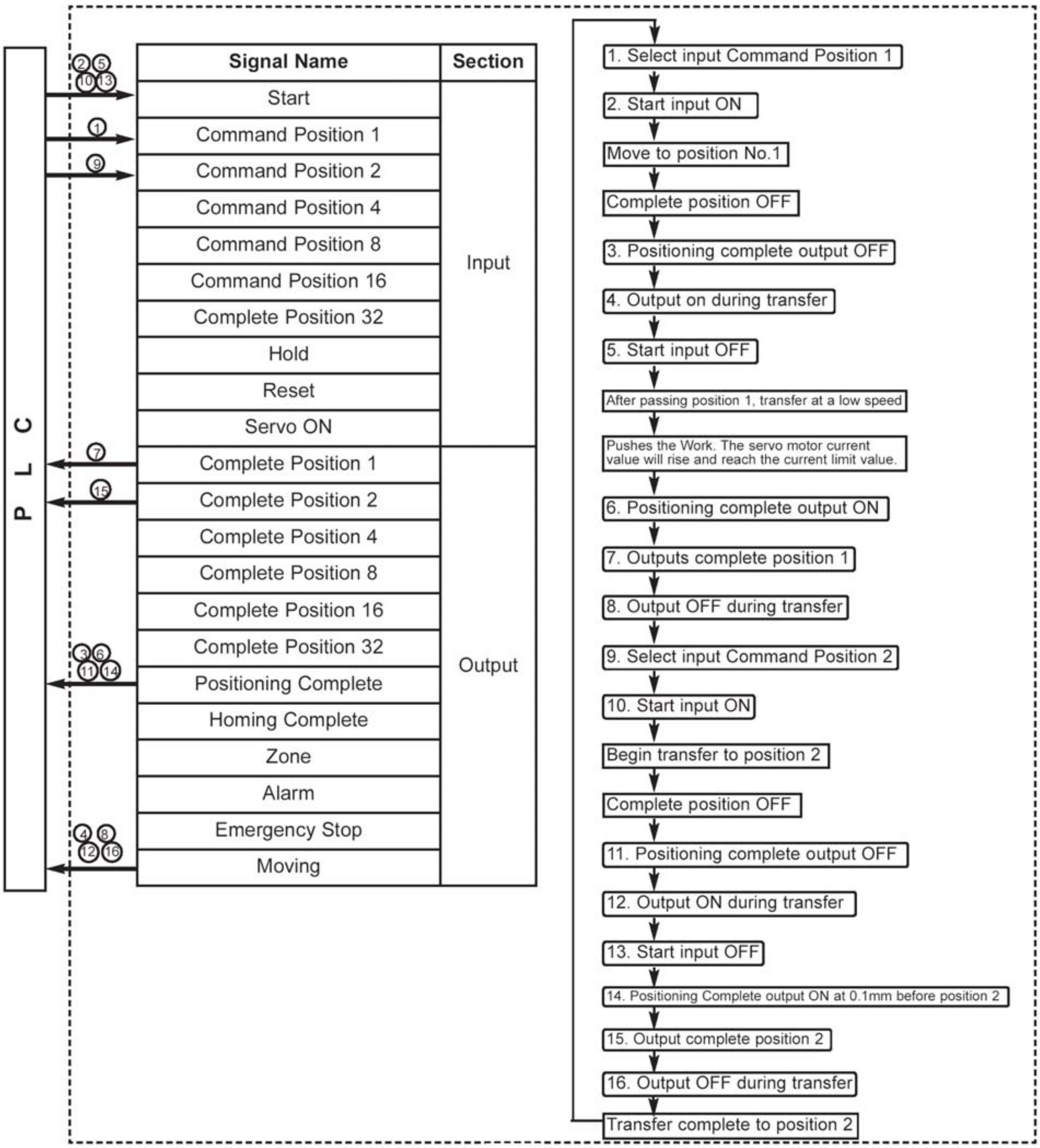
Caution: Positioning complete Output will turn OFF once the start signal turns ON.
You may execute the Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.
A the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.



## 4-5 Push Mode

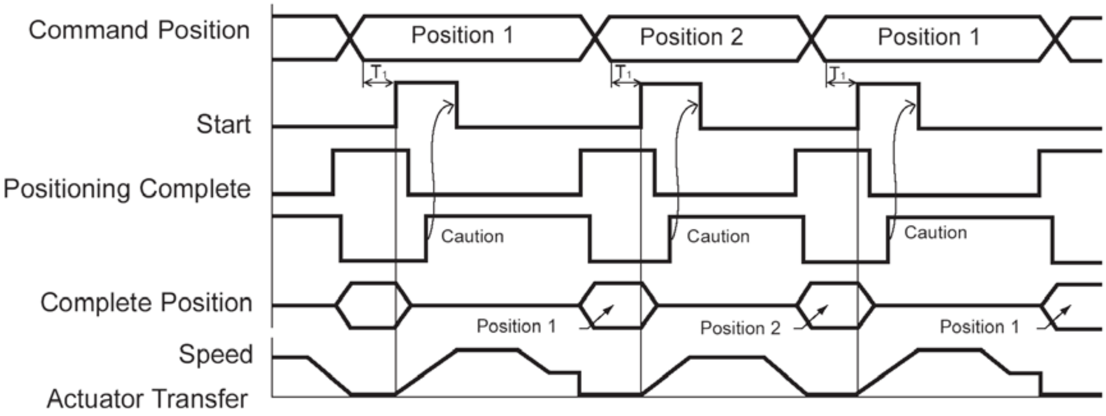
Movement Example: Use via Push Mode and Positioning Mode. Assign Position 1 to 280 mm from home and Position 2 to 50 mm from home. Move to Position 1 in Push Mode. Use the Push Mode to move to Position 2 (match to opposite motor side direction). Assign the maximum push to 2 mm, and the current limit 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.

E-Con Controller



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

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

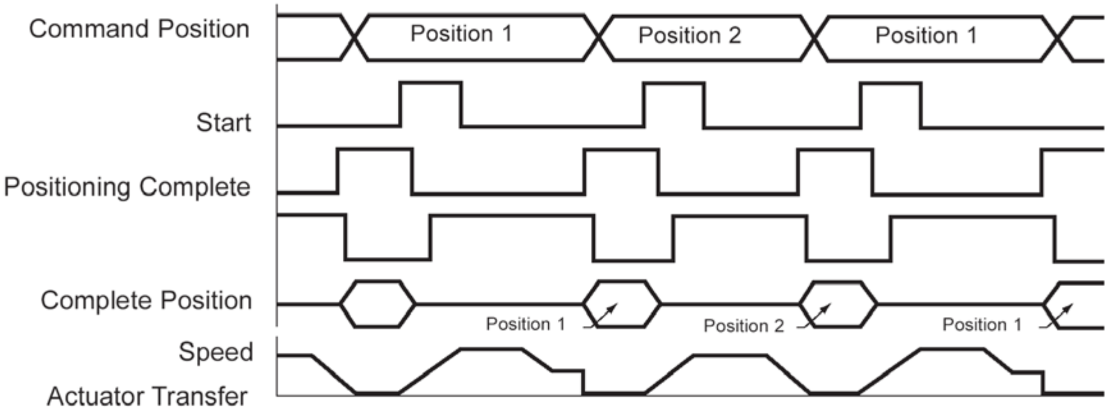


T1: Over 6 msec Time from Command Position Select Input to Start Signal ON

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

Please input Command Positron after previous positioning complete turns ON.

Caution: When the push completes stroke, as the diagram below shows, the Positioning Complete Output will not turn ON, only the Complete Position outputs, turn ON. Please turn OFF start signal only after confirming that output turns on during transfer with start signal ON status. If it doesn't succeed, positioning complete output will not turn on as shown the diagram below. Complete position output and the output during transfer will turn OFF.

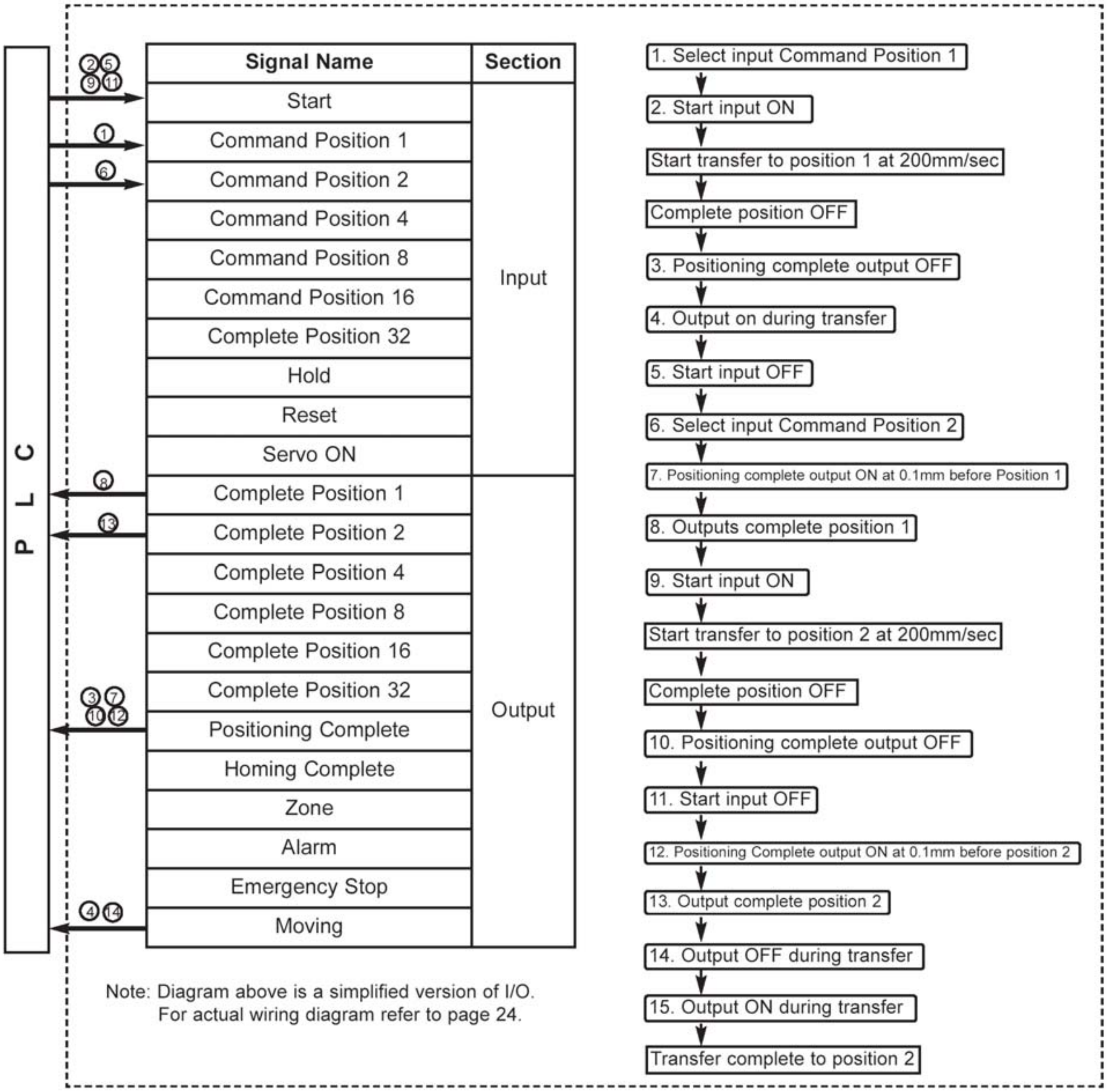


## 4-6 Speed Change Movement During Transfer

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

E-Con Controller

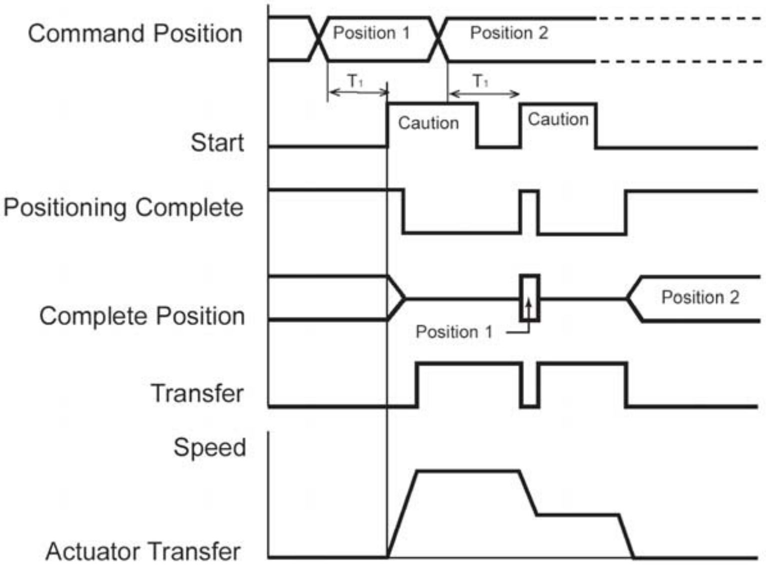


| Signal Name | Section |
|---|---|
| Start | Input |
| Command Position 1 | |
| Command Position 2 | |
| Command Position 4 | |
| Command Position 8 | |
| Command Position 16 | |
| Complete Position 32 | |
| Hold | |
| Reset | |
| Servo ON | |
| Complete Position 1 | Output |
| Complete Position 2 | |
| Complete Position 4 | |
| Complete Position 8 | |
| Complete Position 16 | |
| Complete Position 32 | |
| Positioning Complete | |
| Homing Complete | |
| Zone | |
| Alarm | |
| Emergency Stop | |
| Moving | |

Note: Diagram above is a simplified version of I/O.
For actual wiring diagram refer to page 24.

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

| No. | Position | Speed | Acc/Dec | Push | Positioning Width | 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.)

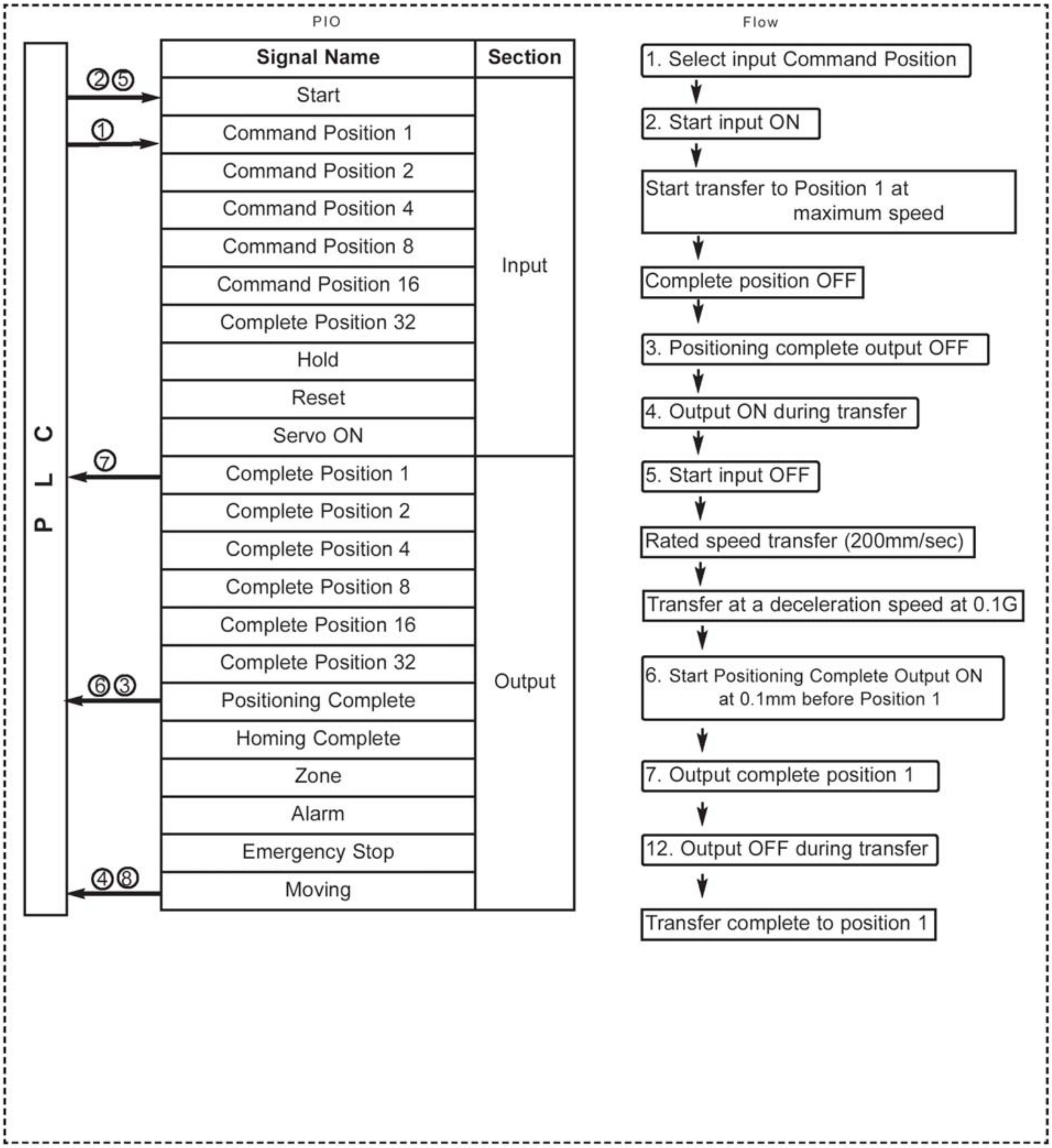
| | |
|---|---|
| Caution: | Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving out put turns ON with Start Signal ON status. |

## 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.

E-Con Controller



| Signal Name | Section |
|---|---|
| Start | Input |
| Command Position 1 | |
| Command Position 2 | |
| Command Position 4 | |
| Command Position 8 | |
| Command Position 16 | |
| Complete Position 32 | |
| Hold | |
| Reset | |
| Servo ON | |
| Complete Position 1 | Output |
| Complete Position 2 | |
| Complete Position 4 | |
| Complete Position 8 | |
| Complete Position 16 | |
| Complete Position 32 | |
| Positioning Complete | |
| Homing Complete | |
| Zone | |
| Alarm | |
| Emergency Stop | |
| Moving | |

1. Select input Command Position

2. Start input ON

Start transfer to Position 1 at maximum speed

Complete position OFF

3. Positioning complete output OFF

4. Output ON during transfer

5. Start input OFF

Rated speed transfer (200mm/sec)

Transfer at a deceleration speed at 0.1G

6. Start Positioning Complete Output ON at 0.1mm before Position 1

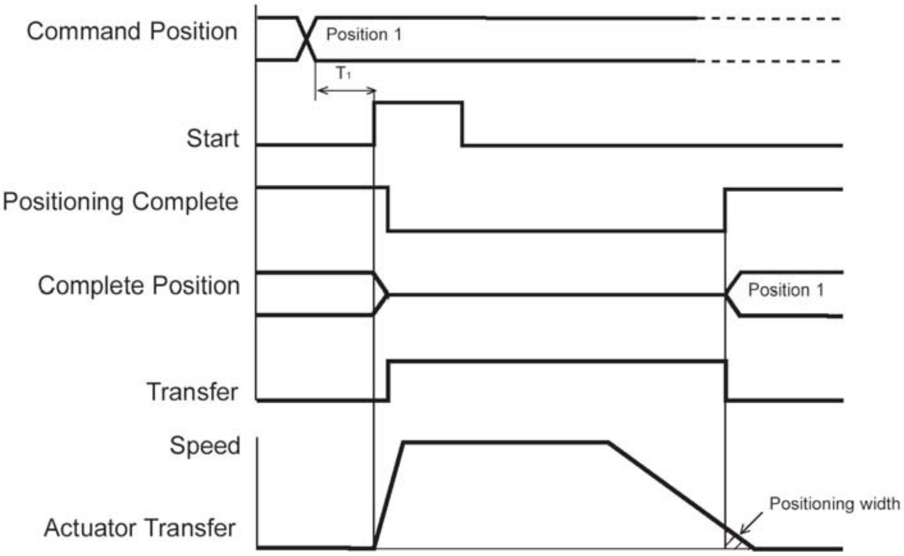
7. Output complete position 1

12. Output OFF during transfer

Transfer complete to position 1

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

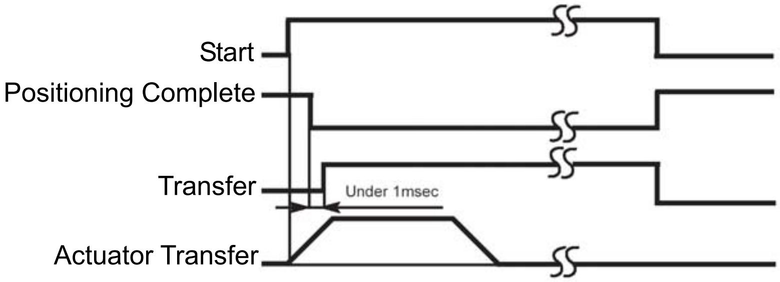
| No. | Position | Speed | Acc/Dec | Push | Positioning Width | Acc. only Max |
|---|---|---|---|---|---|---|
| 0 | * | * | * | * | * | * |
| 1 | 150 | 200 | 0.3 | 0 | 1 | 0 |
| : | | | | | | |



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

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

Caution: Positioning complete Output will turn OFF once the start signal turns ON.
You ay execute Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.
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.



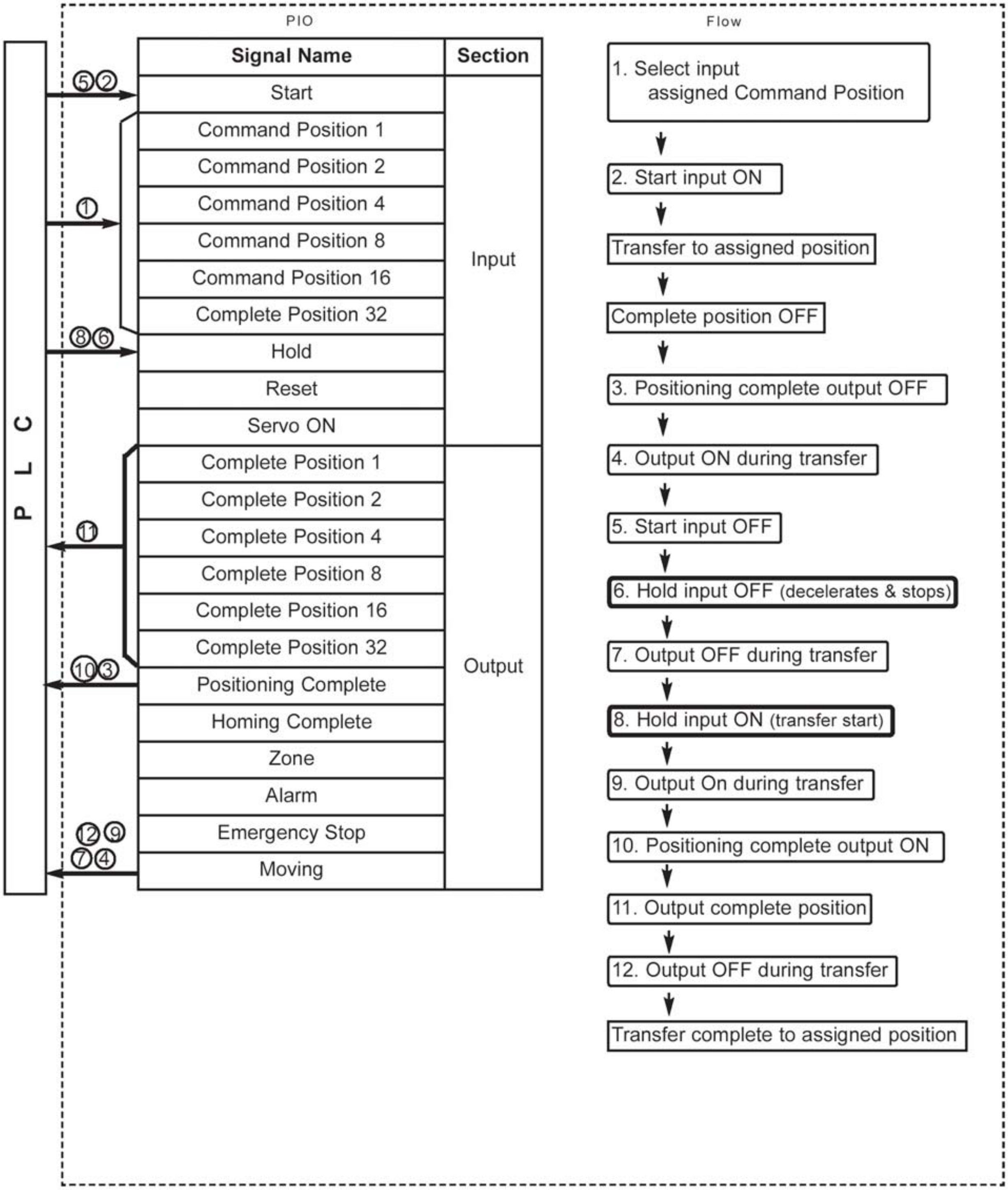
If an overload alarm occurs frequently when this function is used, disable the “acceleration only MAX” function.

## 4-8 Hold

Movement Example: Temporary stops the movement of the actuator.

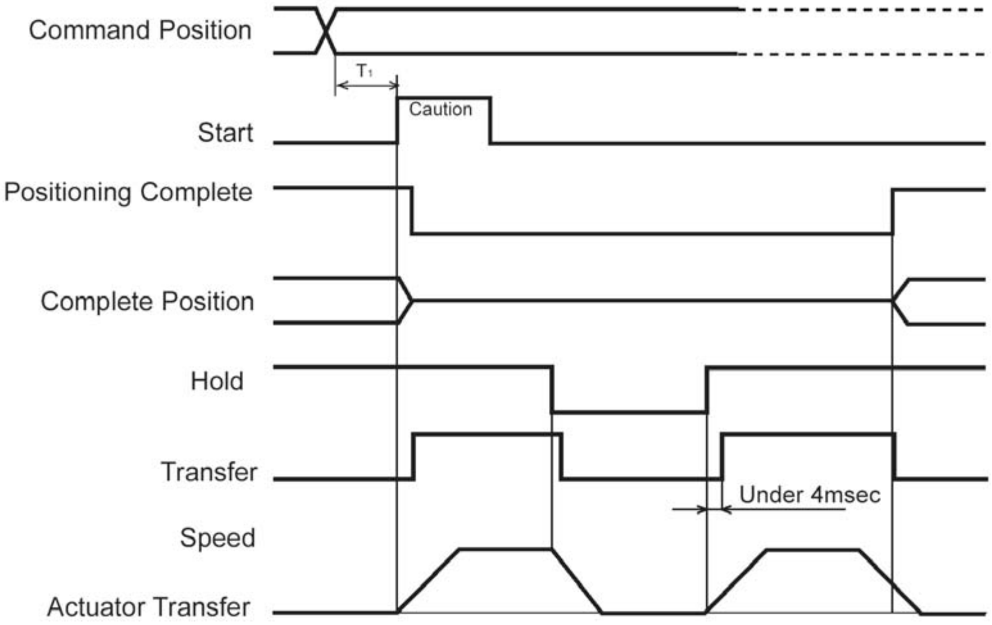
Method: Uses the Hold Input.

E-Con Controller



| Signal Name | Section |
|---|---|
| Start | Input |
| Command Position 1 | |
| Command Position 2 | |
| Command Position 4 | |
| Command Position 8 | |
| Command Position 16 | |
| Complete Position 32 | |
| Hold | |
| Reset | |
| Servo ON | |
| Complete Position 1 | Output |
| Complete Position 2 | |
| Complete Position 4 | |
| Complete Position 8 | |
| Complete Position 16 | |
| Complete Position 32 | |
| Positioning Complete | |
| Homing Complete | |
| Zone | |
| Alarm | |
| Emergency Stop | |
| Moving | |

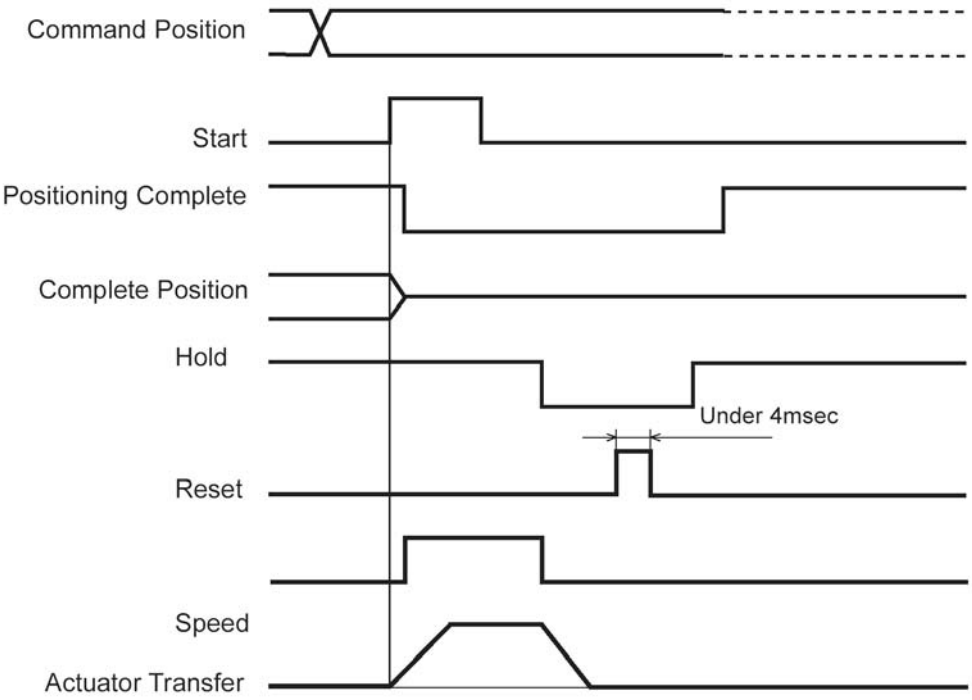
1. Select input assigned Command Position
2. Start input ON
Transfer to assigned position
Complete position OFF
3. Positioning complete output OFF
4. Output ON during transfer
5. Start input OFF
6. Hold input OFF (decelerates & stops)
7. Output OFF during transfer
8. Hold input ON (transfer start)
9. Output On during transfer
10. Positioning complete output ON
11. Output complete position
12. Output OFF during transfer
Transfer complete to assigned position



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. |



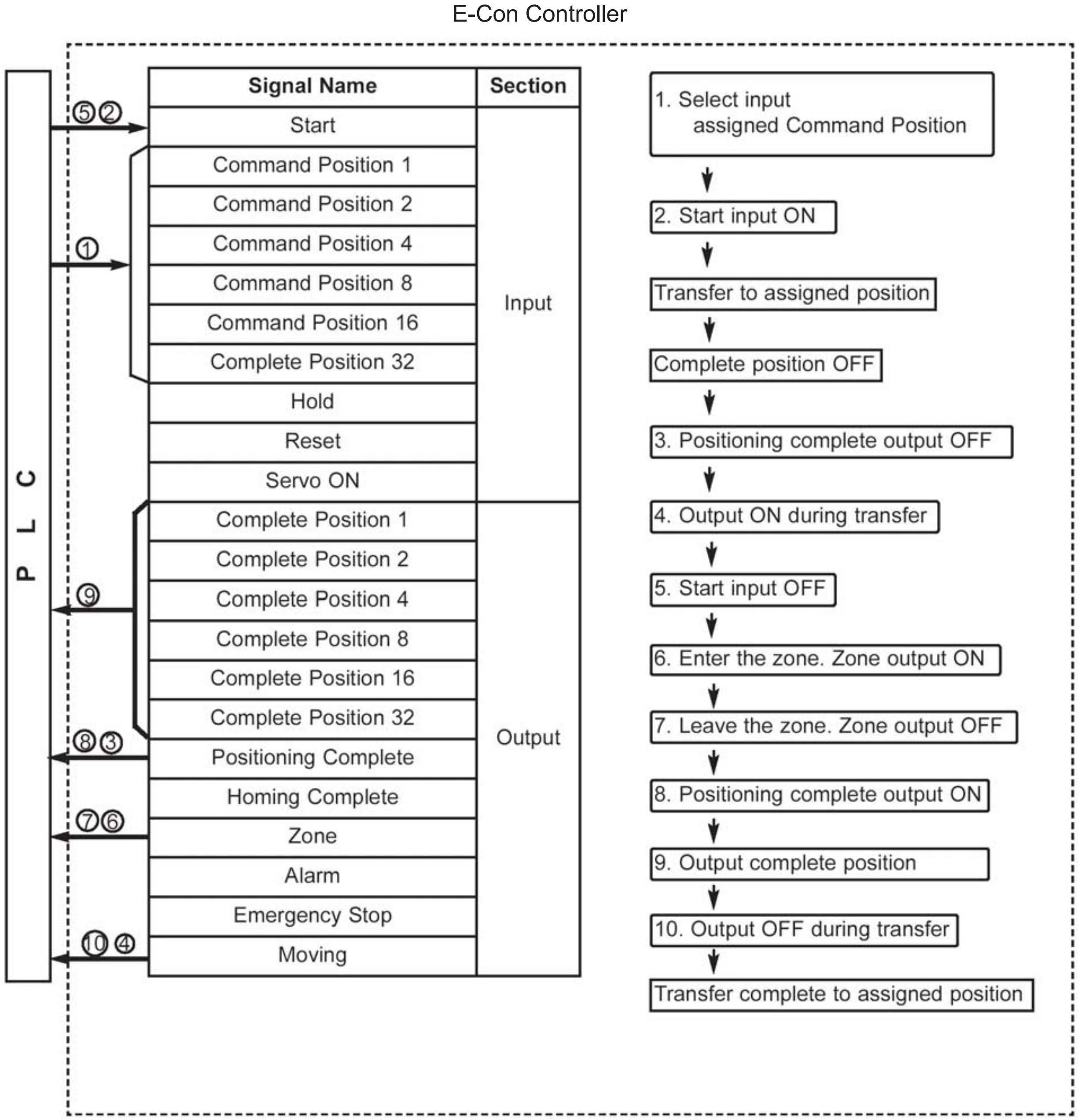
## 4-9 Zone Signal Output

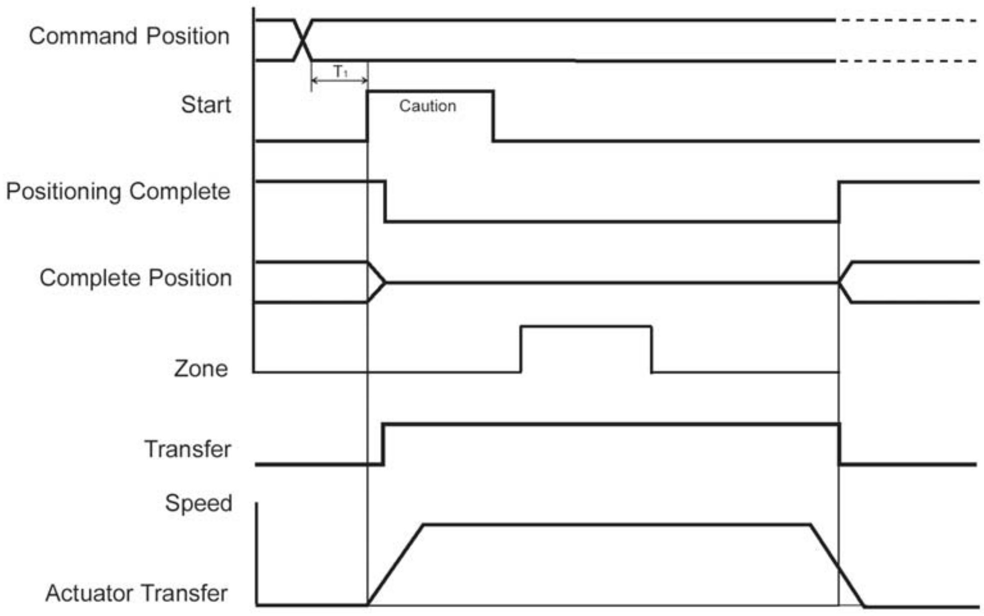
Movement example: During motion, the Zone Signal output will turn ON from 40 mm from home to position 120 mm from home, then turns OFF (40 mm < Zone Signal Output < 120 mm).

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 |



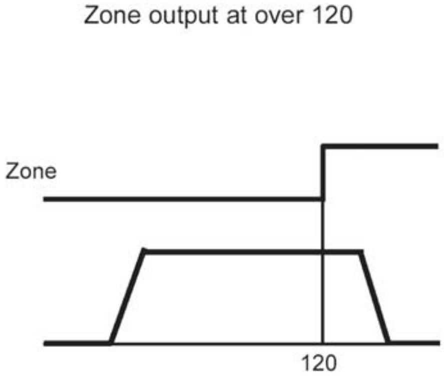


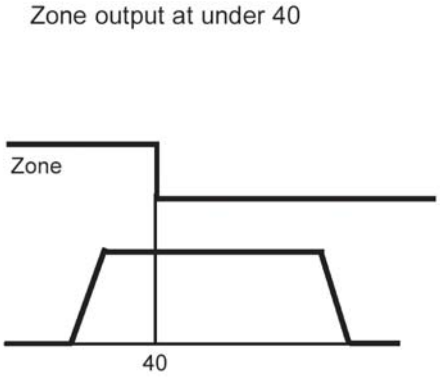
T1: Over 6 msec    Time from command position select input to start input ON

(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 out put turns ON with Start Signal ON status. |

Other zone output (example):





| | |
|---|---|
| Zone Boundary value + | Maximum Stroke Length |
| Zone Boundary value - | 40 |

| | |
|---|---|
| Zone Boundary value + | 120 |
| Zone Boundary value - | 40 |

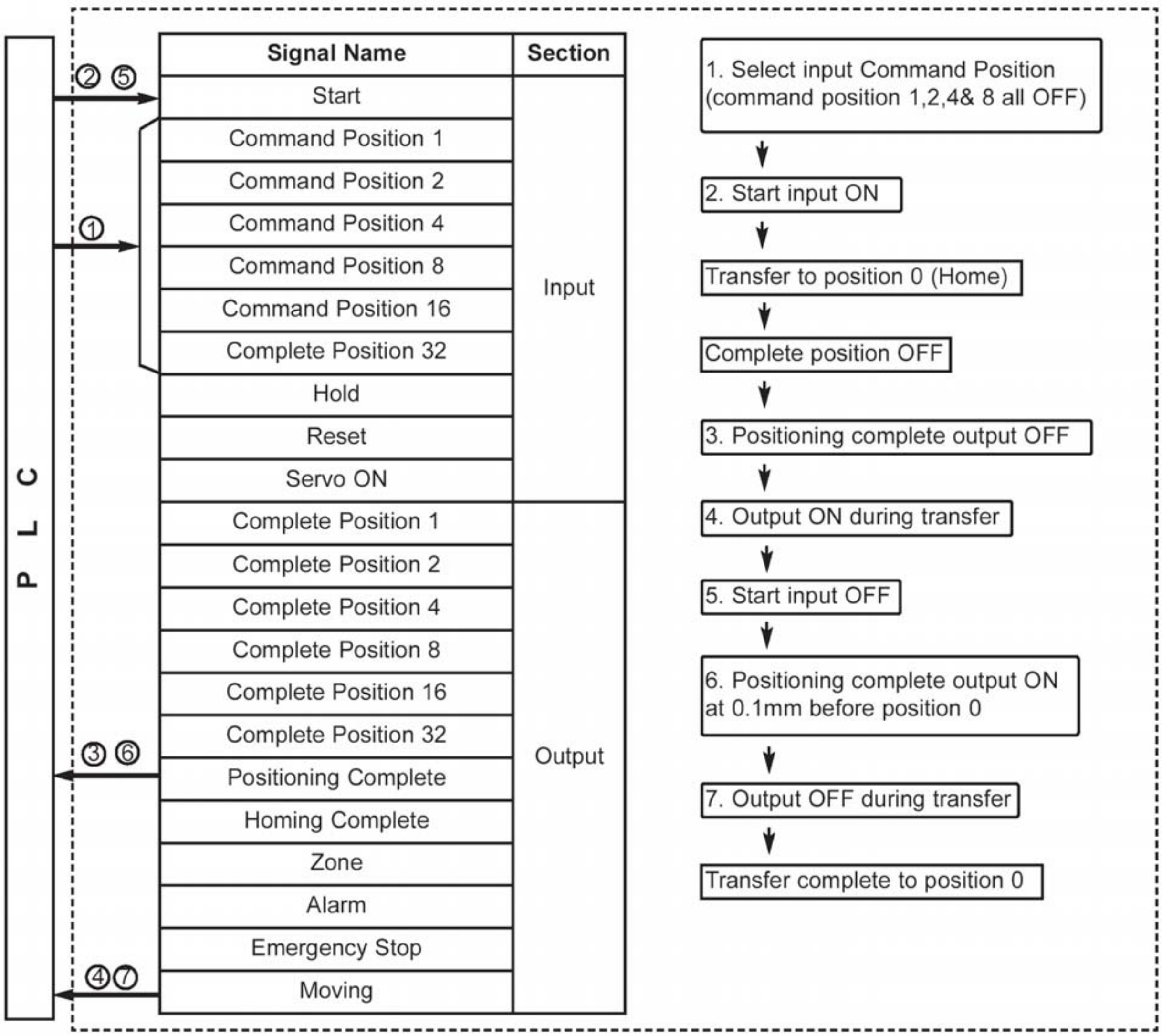
## 4-10 Transfer to Home

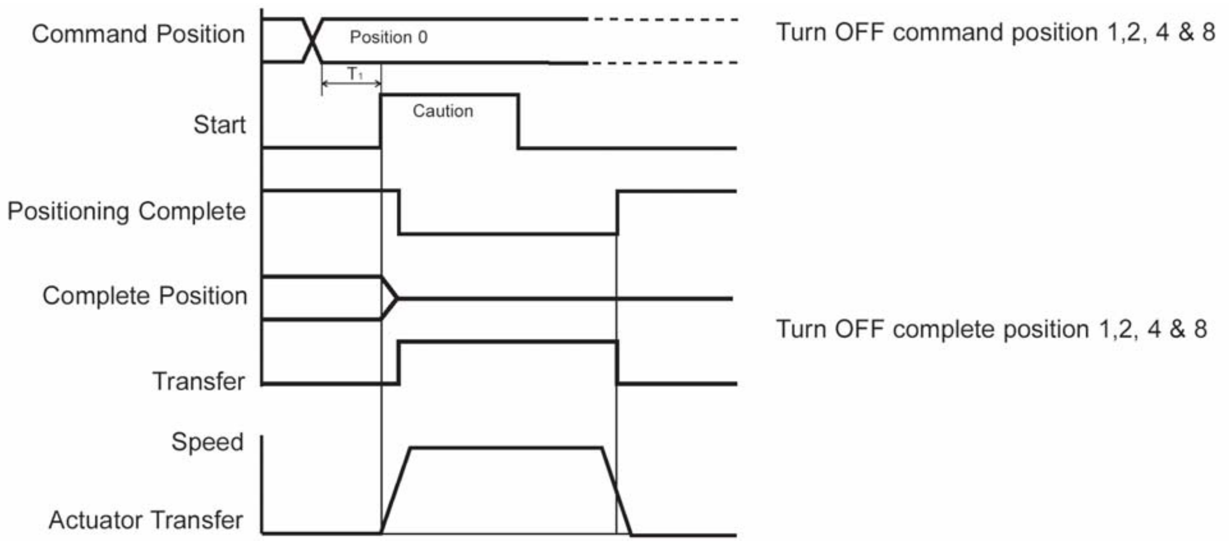
Movement Example: You can not home using the position data table (position 0 at 0 mm). Homing occurs when controller is told to move to a point when the actuator has not been homed yet.
Method: This is a method which forces a point data of distance 0 from the home, and moves to that location after homing is complete.

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

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

E-Con Controller



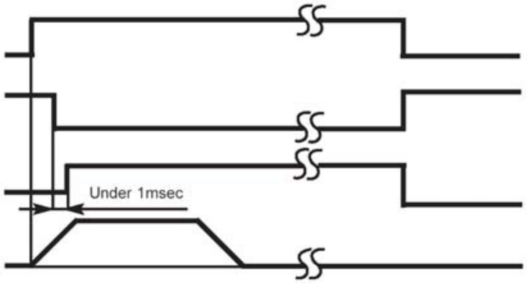


T1: Over 6 msec Time from command position select input to start input ON

(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.

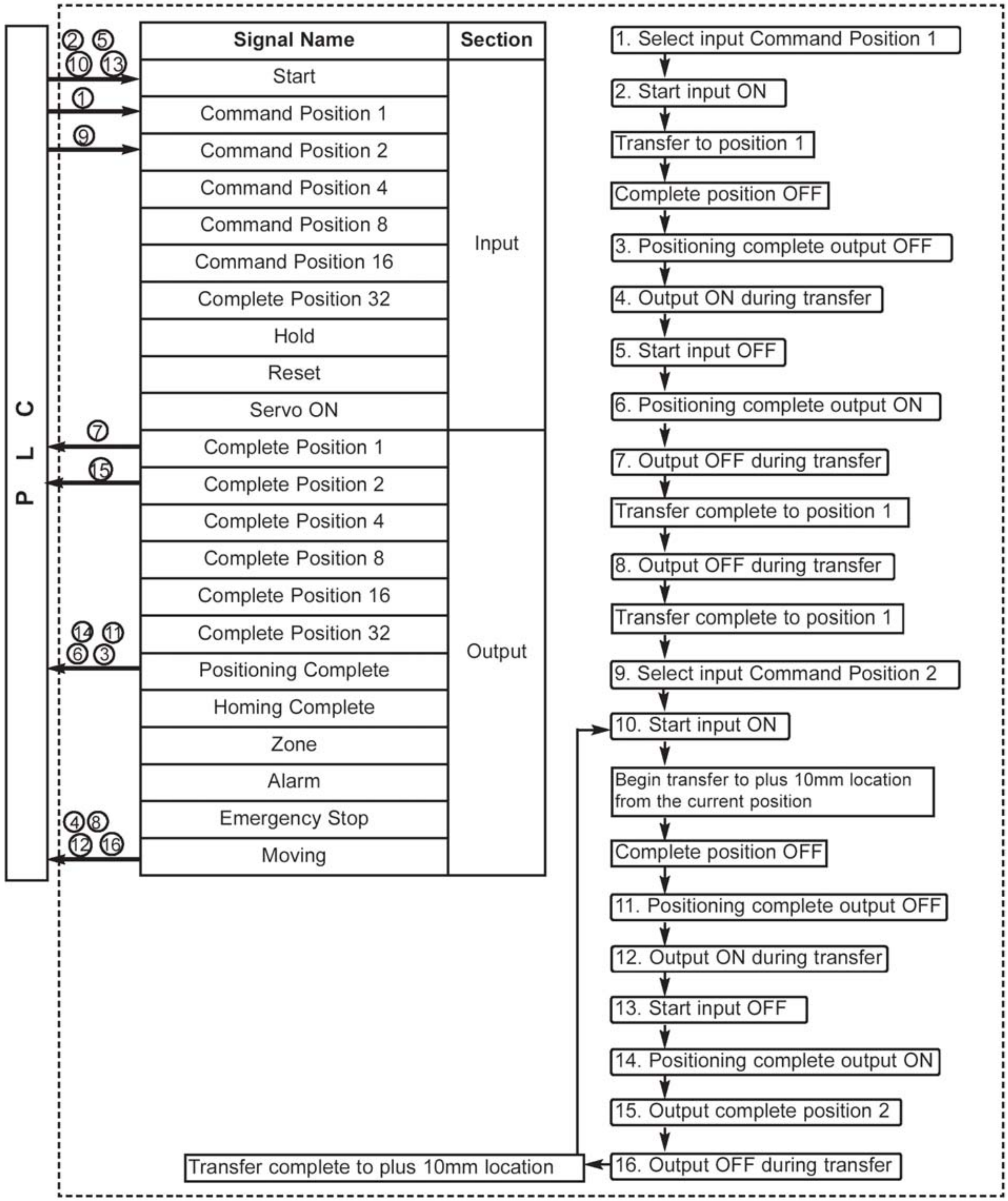
Caution: Positioning complete Output will turn OFF once the start signal turns ON.
You ay execute Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.
As the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.



## 4-11 Incremental Movement in Relative Coordinate

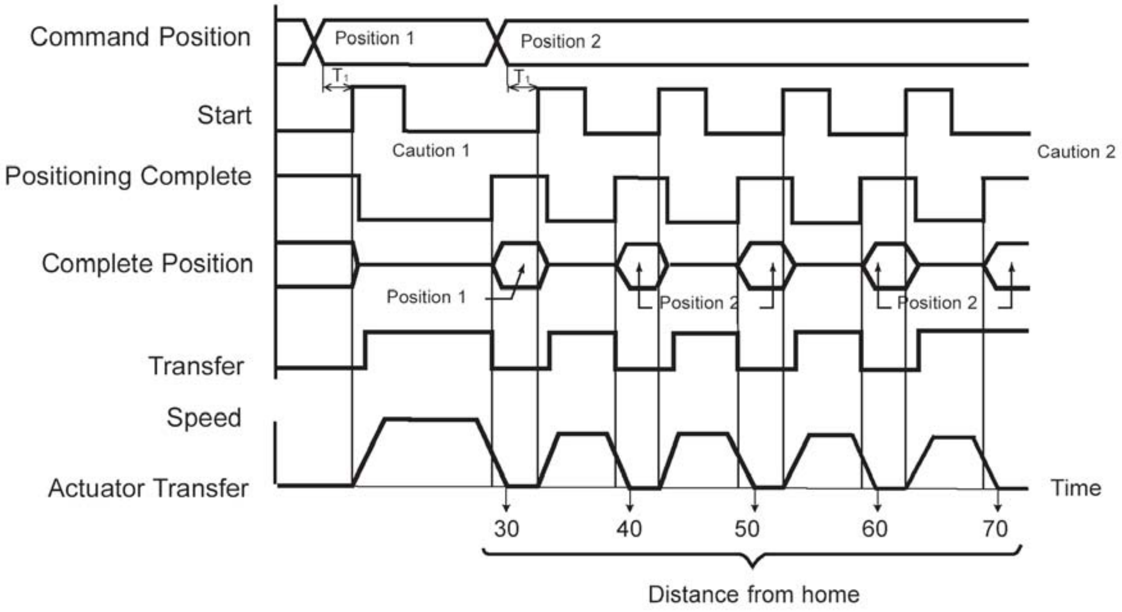
Movement example: Move to position 30 mm from home, and from there, move the actuator in increments of 10 mm. The transfer speed from home to the 30 mm location is set at 100 mm/sec, and the 10 mm incremental movements are set at 20 mm/s.

E-Con Controller



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

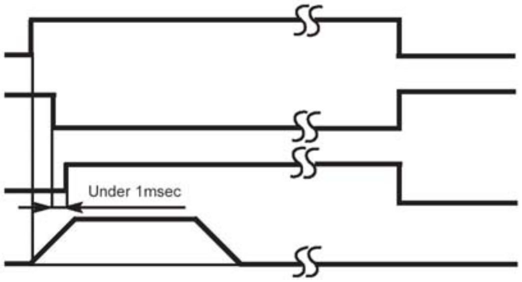
| No. | Position | Speed | Acc/Dec | Push | Positioning Width | Acc. only Max |
|---|---|---|---|---|---|---|
| 0 | * | * | * | * | * | * |
| 1 | 30 | 100 | 0.3 | 0 | 0.1 | 0 |
| 2 | 10 | 20 | 0.3 | 0 | 0.1 | 0 |
| : | | | | | | |



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

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

Note 1: As the diagram below shows, if you leave the Start Input ON, even if the actuator completes transfer, positioning output will not turn ON.



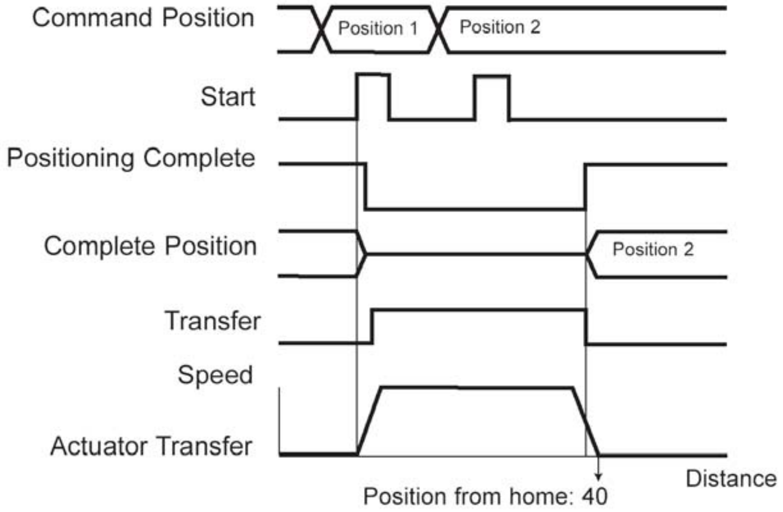
Note 2: In case a soft limit is reached when relative transfer is executed consecutively, the actuator will stop at the soft limit and the positioning complete signal will turn ON.

## 4-12 Caution Regarding Relative Coordinate Assign

### (1) Caution During Positioning Movement

When selecting a relative or incremental position through the I/O and toggling the Start Input, during motion towards another point, the distance of the next point selected will be added to the initial position of the point. If the next point is in the negative direction relative to the first point, the actuator moves to a position as the result of the subtraction of the 2 positions.

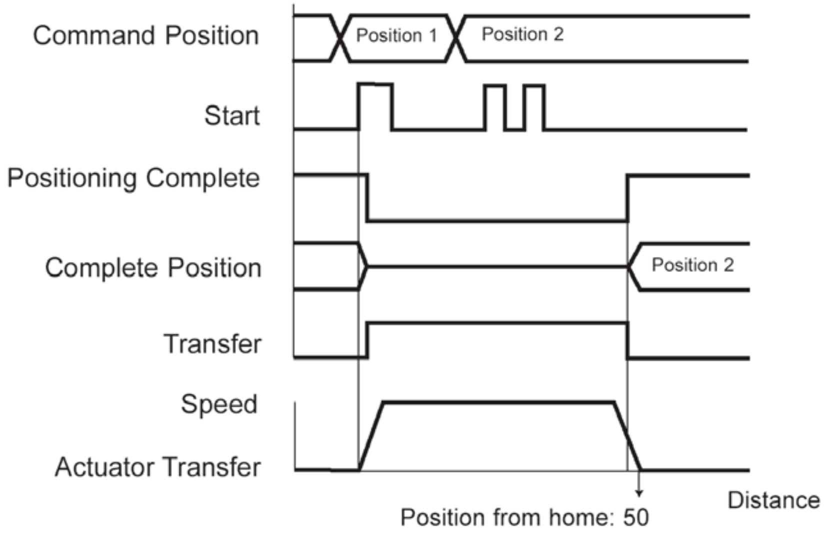
Example: When the Start Input of Position 2 is executed during movement to Position 1 (Table 5-12-1), the actuator moves to a position 40 mm away from home.



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

Position from home: 40 In addition, when the Start Input is executed numerous times during position movement, the actuator moves to a position that is five times the distance of the initial position input.

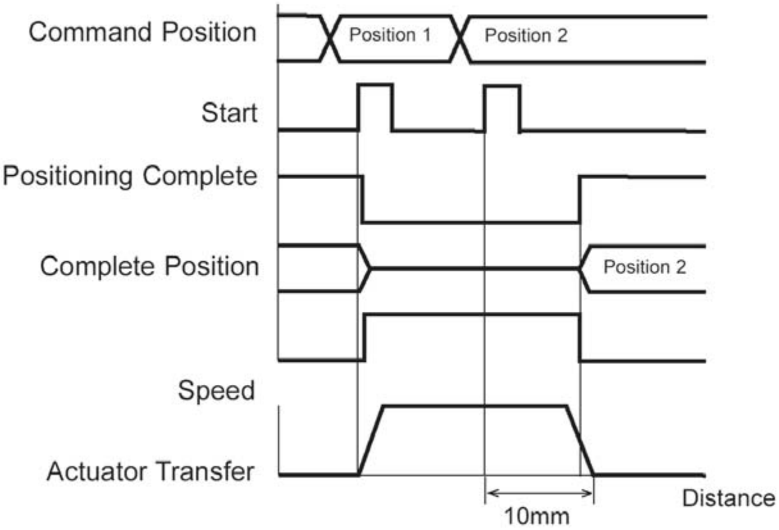
Example: In case Start Input of Position 2 is executed twice during movement towards Position 1, the actuator moves to a position approximately 50 mm away from home.



### (2) Caution During Push Movement

If a relative position is selected while the actuator is in motion to another position during Push Mode, the actuator moves to a position that is the summation of the primary and secondary positions.

Example: The Start Input Position 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. Total displacement is 60 mm from home.



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

**(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.

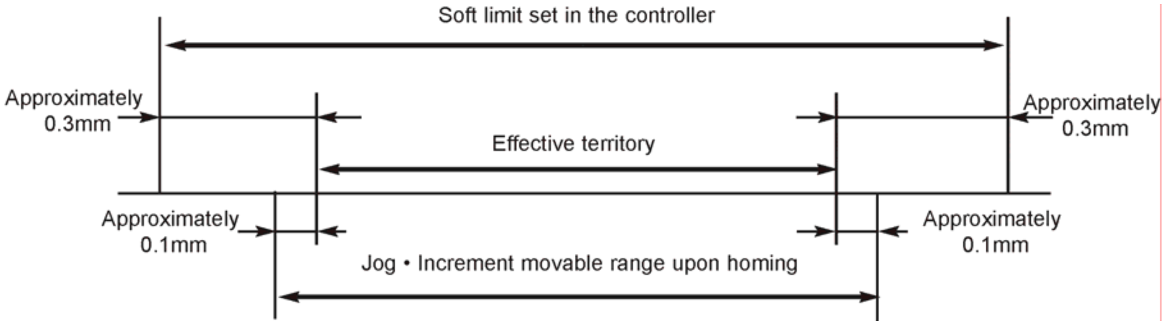
### 5-3-1 Parameters Relating to Actuator Stroke Range

- 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.

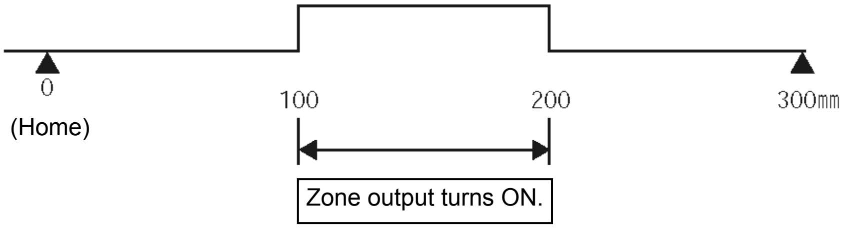
Example) Set the effective range to between 0 and 80 mm
Parameter No. 3 (+ side): 80.3
Parameter No. 4 (– side): -0.3



- 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, change 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)

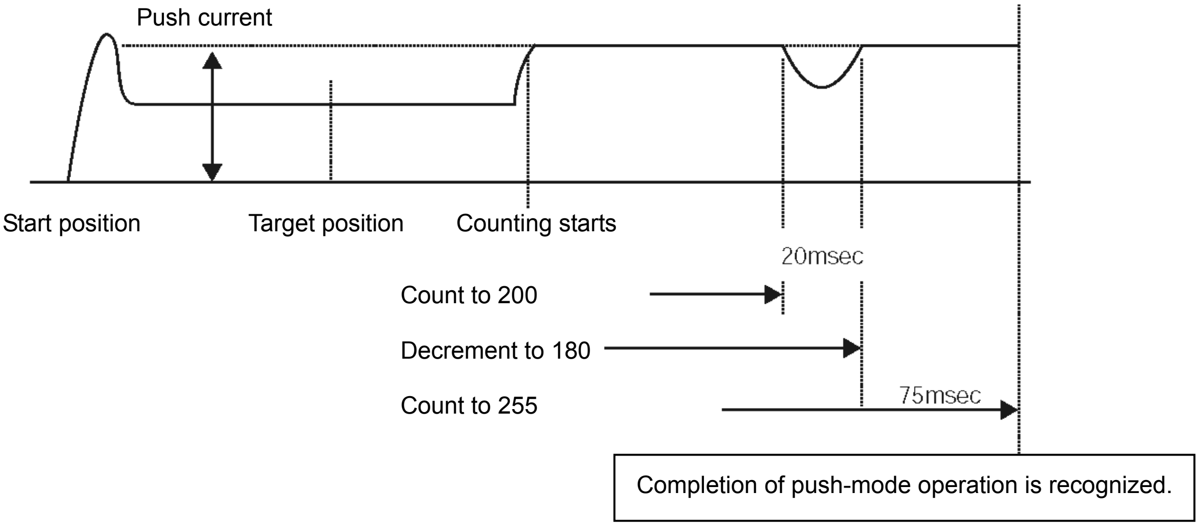
This parameter has been set to "0.10" mm at the factory.
If a target position was written to an unregistered position table or the current position was acquired in the teaching mode, the controller regards the value of this parameter as the positioning band data corresponding to the applicable position 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 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, 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 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) |

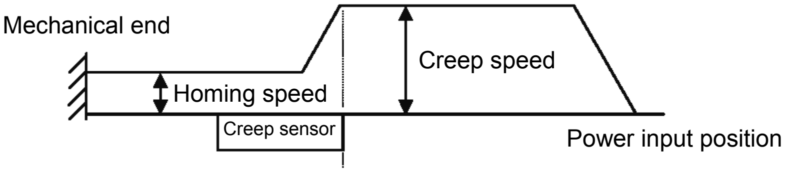
- Overrun sensor input polarity

Actuators of the standard specification do not come with an overtravel 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 overtravel detection sensor; sensor polarity conforming to "contact a" logic) |
| | 2 (Use overtravel 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 and servo gain. 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.<br>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 | 0E4 to 0E7 |
| ● | ○ | ○ | ○ | ○ | Corruption of EEPROM data | 0F8 |

* The alarm codes are displayed at teaching pendant and PC interface software. If PIO complete position does not output.

## 6-4 Alarms, Causes and Actions

### (1) Message Alarms

| Code | Error | Cause/action |
|---|---|---|
| 040 | Emergency stop | Cause: An emergency stop status was detected.<br>(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.<br>Cause: [1] Garbage data due to noise<br>[2] Duplicate slave numbers when multiple actuators are controlled via serial communication<br>Action: [1] Revise the wiring, equipment layout, etc., to eliminate noise.<br>[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.<br>Cause: An undefined command or out-of-range data was received.<br>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.<br>(This alarm does not occur during normal operation.)<br>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.<br>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.<br>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.<br>(This alarm does not cover PIO commands.)<br>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.<br>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.<br>Action: Replace the battery as soon as possible. |

## (2) Operation Cancellation Alarms

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

| Code | Error | Cause/action |
|---|---|---|
| 0CA | Overheat | The ambient temperature of the power transistor in the controller rose excessively (to 95$$°$$C or above).<br>Cause: [1] High ambient temperature of the controller<br>[2] Defective internal part of the controller<br>Action: [1] Lower the ambient temperature of the controller.<br>If the ambient temperature is normal, please contact IAI. |
| 0CC | Abnormal control power voltage | The voltage of the 24-V input power supply dropped (by 20% or more, or to 19.2 V or below).<br>Cause: [1] Low voltage of the 24-V input power supply<br>[2] Faulty internal part of the controller<br>Action: Check the voltage of the input power-supply.<br>If the voltage is normal, please contact IAI. |
| 0DC | Out of push operation range | The actuator was “pushed back” during push-motion operation in the push mode.<br>Cause: Strong external force is applied to the work.<br>Action: Revise the mechanism around the work so that strong external force will not apply to the work.<br>Or, increase the current limit value. |
| 0E0 | Overload | Cause: [1] The load increased due to external force.<br>[2] The brake cannot be released on the actuator with brake.<br>[3] The slide resistance of the actuator increased locally.<br>Action: [1] Review the area around the work. If abnormal external force is being applied, correct the situation.<br>[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.<br>[3] Move the controller by hand, if possible, to check for points where large slide resistance is felt.<br>In the case of [2] or [3], please contact IAI.<br>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. |

## (3) Cold Start Alarms

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

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

| Code | Error | Cause/action |
|---|---|---|
| 0E5 | Encoder receive error | The controller and encoder exchange position data via serial communication.<br>This error occurs when the encoder did not return correct data in response to a request from the controller, or the battery voltage became law.<br>Cause: [1] Law battery voltage<br>(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.)<br>[2] Open encoder relay cable or supplied actuator cable, or poor connector contact<br>[3] Garbage data due to noise<br>[4] Faulty communication IC mounted on the encoder board<br>[5] Faulty communication IC mounted on the controller board<br>Action: [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.”)<br>If the I/O output signal “*Battery alarm” is OFF, the battery voltage is low. Replace the battery as soon as possible.<br>[2] Check the connector for possibility of open circuit, and examine the connection condition.<br>(Perform a continuity check by referring to 2-5, “Supplied Cables.”)<br>[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.<br>In the case of [4] or [5], the encoder or controller must be replaced.<br>If the cause cannot be specified, please contact IAI. |
| 0E6 | Encoder count error | The ASIC mounted on the encoder board is unable to detect position information correctly.<br>Cause: [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.<br>(This error does not occur in normal conditions of use, but it may occur if the work received external force from above.)<br>[2] Foreign deposit on the cable wheel<br>[3] The position relationship of cable wheel and photo-sensor changed due to axis center run-out caused by excessive external force, etc.<br>[4] Faulty component mounted on the encoder board<br>Action: If [1] is suspected, perform an absolute reset.<br>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.<br>In any case, please contact IAI. |

| Code | Error | Cause/action |
|---|---|---|
| 0E7 | Phase A/B/Z open | Encoder signal cannot be detected properly.<br>Cause: [1] Open encoder relay cable or supplied actuator cable, or poor connector contact<br>[2] Faulty encoder<br>Action: [1] Check the connector for possibility of open circuit, and examine the connection condition.<br>(Perform a continuity check by referring to 2-5, “Supplied Cables.”)<br>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.<br>Cause: [1] Faulty nonvolatile memory<br>[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.)<br>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.<br>Cause: [1] Malfunction due to noise, etc.<br>[2] Faulty RAM<br>[3] Faulty circuit component around RAM<br>Action: Reconnect the power.<br>If the alarm occurs again, check for effect of noise.<br>If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected.<br>If the cause cannot be specified, please contact IAI. |
| 0FA | Abnormal CPU | The CPU is not operating properly.<br>Cause: [1] Malfunction due to noise, etc.<br>[2] Faulty CPU<br>[3] Faulty circuit component around CPU<br>Action: Reconnect the power.<br>If the alarm occurs again, check for effect of noise.<br>If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected.<br>If the cause cannot be specified, please contact IAI. |
| 0FB | Abnormal FPGA | The FPGA (gate array) is not operating properly in the absolute controller.<br>Cause: [1] Malfunction due to noise, etc.<br>[2] Faulty FPGA<br>[3] Faulty circuit component around FPGA<br>[4] The board in the controller is not installed properly.<br>Action: Reconnect the power.<br>If the alarm occurs again, check for effect of noise.<br>If you have a spare controller, change to the spare controller. If the alarm still occurs, noise is suspected.<br>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.<br>(Example) "9601" was input as the serial communication speed by mistake.<br>Input an appropriate value again. |
| 113<br>114 | Input value too small<br>Input value too large | The input value is under the setting range.<br>The input value is over the setting range.<br>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.<br>Perform homing first. |
| 116 | Last position data available | When new data is added, data already exists in the last position of the position table.<br>Clear or delete the data in the last position first. |
| 117 | No movement data | No target position is set under the selected position number.<br>Input a target position first. |
| 11E | Inconsistent data pair | The magnitude relationship of a pair of data is inappropriate.<br>(Example) The same value is set in both the + and – soft limit parameters.<br>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.<br>This message indicates that the input target position is less than this minimum travel.<br>(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).<br>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.<br>No harm is done as long as the actuator contacts the work. If it misses the work, however, the actuator will reach the soft limit and this message will be displayed.<br>Change either the target position or positioning band. |
| 122 | Multiple axes connected at assignment | An axis number was assigned when multiple axes were connected.<br>Always assign an axis number when only one axis is connected. |
| 180<br>181<br>182 | Axis number change OK<br>Controller initialization OK<br>Home change all clear | This is an operation check message.<br>(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 in push-motion operation | The actuator missed the work in push-motion operation.<br>Check the work condition and review the target position/positioning band settings. |
| 301<br>302<br>304<br>305<br>306<br>308<br>30A<br>30B | Overrun error (M)<br>Framing error (M)<br>SCIR-QUE OV (M)<br>SCIS-QUE OV (M)<br>R-BF OV<br>Response timeout (M)<br>Packet R-QUE OV<br>Packet S-QUE OV | An error occurred in serial communication with the controller.<br>Cause: [1] Garbage data due to noise<br>[2] Duplicate slave numbers when multiple actuators are controlled via serial communication<br>Action: [1] Revise the wiring, equipment layout, etc., to eliminate noise.<br>[2] Change the slave numbers to eliminate duplication.<br>If the message persists, please contact IAI. |
| 307<br>309 | Memory command denied<br>Write address error | A command was denied in serial communication with the controller.<br>An indeterminable write address error occurred in serial communication with the controller.<br>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.<br>Also contact IAI. |
| 30C | No connected axis | The controller axis number cannot be recognized.<br>Cause: [1] The controller is not operating properly.<br>[2] Only the communication line of the supplied cable (SGA/SGB) is open.<br>[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.<br>[4] The dip switches are set to the same number on multiple controllers being linked.<br>Action: [1] Check if the RDY LED on the controller is lit. If this LED is not lit, the controller is faulty.<br>[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.<br>[3] Connect all pairs of converter and controller using link cables, and then supply the power.<br>[4] Do not set the dip switches to the same number on multiple linked controllers.<br>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.

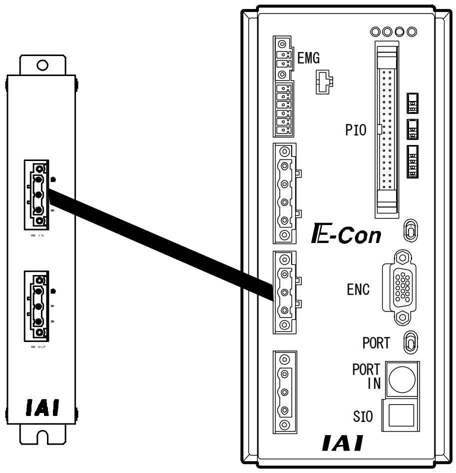
## 7-1 Number of Units Connected

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

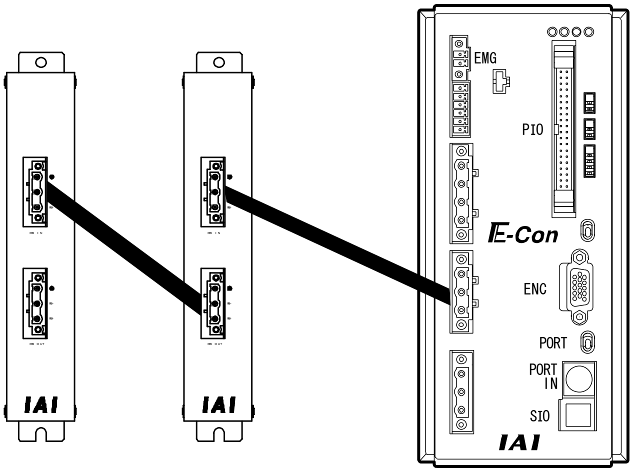
| Motor wattage | Horizontal application | Vertical application |
|---|---|---|
| 0 to 150 W | Not required | Not required |
| 200 to 600 W | | 1 unit |
| 750 W | | 2 units |

## 7-2 Connection Method

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



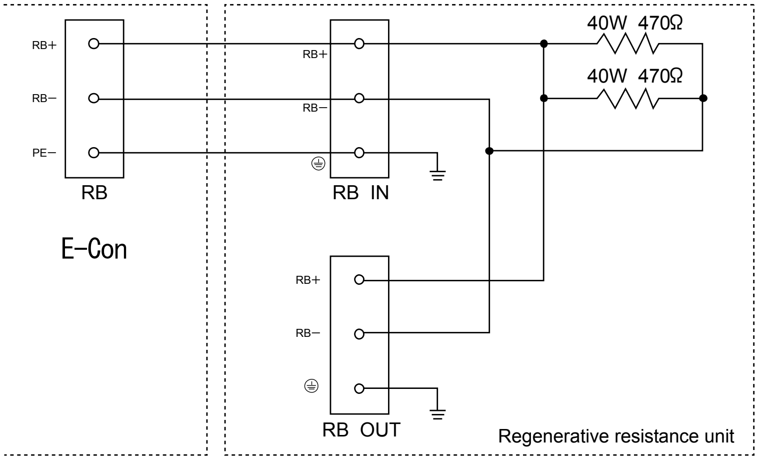
Connecting one unit



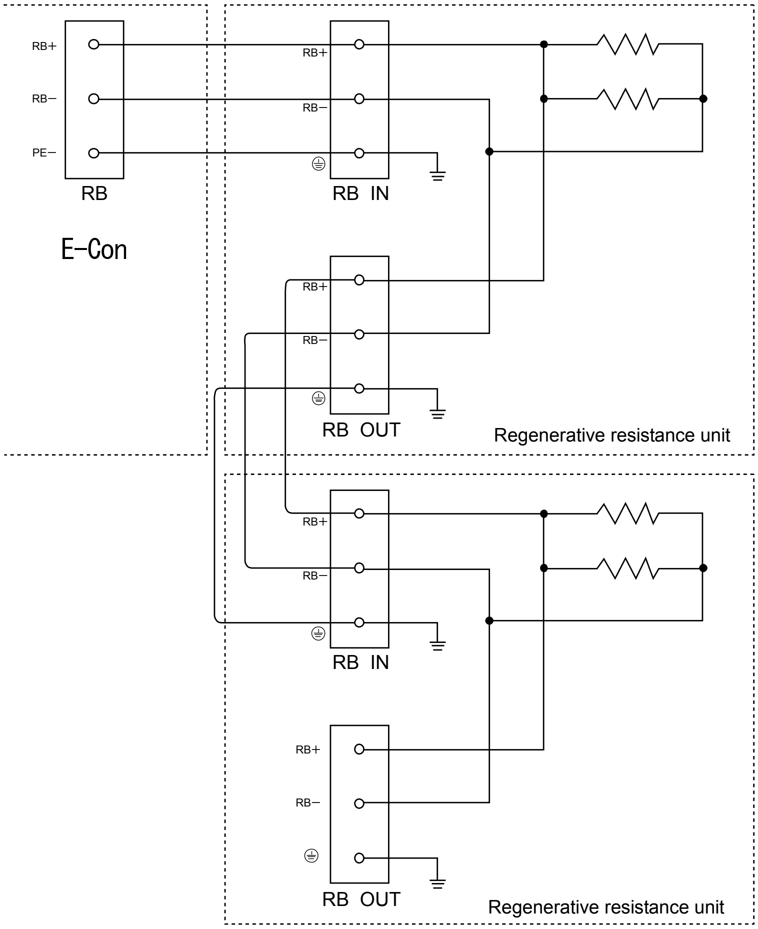
Connecting two units

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) *1 | | | | | | | | | | | | | | | | Loading capacity *2 | | Rated acceleration | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | Horizontal | Vertical | Horizontal | Vertical |
| | | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 700 | 800 | 900 | 1000 | (kg) | (kg) | (G) | (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 | 0.2 | |
| | 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 | 0.2 | |
| | 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 | 0.2 | |
| | 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 | 0.2 | |
| | RCS-F55-□-100-H-□□□ | 800 | | | | | | | | | | | | | | | | | 3.5 | 0.3 | |
| | RCS-F55-□-100-M-□□□ | 400 | | | | | | | | | | | | | | | | | 9 | | |
| | RCS-F55-□-100-L-□□□ | 200 | | | | | | | | | | | | | | | | | 18 | 0.2 | |

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

| | Model | 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 | 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<br>(Total of both fingers) |

| | Model | Stroke (mm), maximum speed (mm/sec) *1 | | | | | | | | | | | | | | | | Loading capacity *2 | | Rated acceleration | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | Horizon-tal | Vertical | Horizon-tal | Vertical |
| | | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 | 2000 | (kg) | (kg) | (G) | (G) |
| ISA<br>ISPA | ISA(ISPA)-SXM-□-60-16-□□□ | 800 | 800 | 800 | 800 | 800 | 800 | | | | | | | | | | | 12 | 3 | 0.3 | 0.3 |
| | ISA(ISPA)-SXM-□-60-8-□□□ | 400 | 400 | 400 | 400 | 400 | 400 | | | | | | | | | | | 25 | 6 | | |
| | ISA(ISPA)-SXM-□-60-4-□□□ | 200 | 200 | 200 | 200 | 200 | 200 | | | | | | | | | | | 50 | 14 | 0.15 | 0.15 |
| | ISA(ISPA)-SYM-□-60-16-□□□ | 800 | 800 | 800 | 800 | 800 | 800 | | | | | | | | | | | 12 | 3 | 0.3 | 0.3 |
| | ISA(ISPA)-SYM-□-60-8-□□□ | 400 | 400 | 400 | 400 | 400 | 400 | | | | | | | | | | | 25 | 6 | | |
| | ISA(ISPA)-SYM-□-60-4-□□□ | 200 | 200 | 200 | 200 | 200 | 200 | | | | | | | | | | | 50 | 14 | 0.15 | 0.15 |
| | ISA(ISPA)-SZM-□-60-8-□□□ | 400 | 400 | 400 | 400 | 400 | 400 | | | | | | | | | | | – | 6 | – | 0.3 |
| | ISA(ISPA)-SZM-□-60-4-□□□ | 200 | 200 | 200 | 200 | 200 | 200 | | | | | | | | | | | – | 14 | – | 0.15 |
| | ISA(ISPA)-MXM-□-100-20-□□□ | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 795 | 645 | 540 | | | | | | | 20 | 5 | 0.3 | 0.3 |
| | ISA(ISPA)-MXM-□-100-10-□□□ | 500 | 500 | 500 | 500 | 500 | 500 | 480 | 380 | 310 | 255 | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-MXM-□-100-5-□□□ | 250 | 250 | 250 | 250 | 250 | 250 | 220 | 175 | 145 | 120 | | | | | | | 80 | 19 | 0.15 | 0.15 |
| | ISA(ISPA)-MXM-□-200-30-□□□ | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1190 | 965 | 810 | | | | | | | 25 | 6 | 0.3 | 0.3 |
| | ISA(ISPA)-MXM-□-200-20-□□□ | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 795 | 645 | 540 | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-MXM-□-200-10-□□□ | 500 | 500 | 500 | 500 | 500 | 500 | 480 | 380 | 310 | 255 | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-MXMX-□-200-30-□□□ | | | | | | | | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1425 | 1200 | 675 | 25 | – | | – |
| | ISA(ISPA)-MXMX-□-200-20-□□□ | | | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 950 | 800 | 450 | 40 | – | | |
| | ISA(ISPA)-MYM-□-100-20-□□□ | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 795 | 645 | 540 | | | | | | | 20 | 5 | | 0.3 |
| | ISA(ISPA)-MYM-□-100-10-□□□ | 500 | 500 | 500 | 500 | 500 | 500 | 480 | 380 | 310 | 255 | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-MYM-□-100-5-□□□ | 250 | 250 | 250 | 250 | 250 | 250 | 220 | 175 | 145 | 120 | | | | | | | 80 | 19 | 0.15 | 0.15 |
| | ISA(ISPA)-MYM-□-200-30-□□□ | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1190 | 965 | 810 | | | | | | | 25 | 6 | 0.3 | 0.3 |
| | ISA(ISPA)-MYM-□-200-20-□□□ | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 795 | 645 | 540 | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-MYM-□-200-10-□□□ | 500 | 500 | 500 | 500 | 500 | 500 | 480 | 380 | 310 | 255 | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-MZM-□-100-10-□□□ | 500 | 500 | 500 | 500 | 500 | 500 | 480 | 380 | 310 | 255 | | | | | | | – | 9 | | |
| | ISA(ISPA)-MZM-□-100-5-□□□ | 250 | 250 | 250 | 250 | 250 | 250 | 220 | 175 | 145 | 120 | | | | | | | – | 19 | 0.15 | 0.15 |
| | ISA(ISPA)-MZM-□-200-10-□□□ | 500 | 500 | 500 | 500 | 500 | 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 | 1000 | 1000 | 830 | 690 | 585 | 500 | | | | | | | | 40 | 9 | 0.3 | 0.3 |
| | ISA(ISPA)-LXM-□-200-20-□□□ | 500 | 500 | 500 | 470 | 385 | 320 | 270 | 235 | | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-LXM-□-400-40-□□□ | 2000 | 2000 | 2000 | 2000 | 1660 | 1380 | 1170 | 1000 | | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-LXM-□-400-20-□□□ | 1000 | 1000 | 1000 | 1000 | 830 | 690 | 585 | 500 | | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-LXMX-□-200-20-□□□ | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 950 | 830 | 740~540 | 490~340 | | 40 | – | 0.3 | – |
| | ISA(ISPA)-LXMX-□-400-40-□□□ | | | | | | 2000 | 2000 | 2000 | 2000 | 2000 | 1900 | 1660 | 1480~1080 | 980~680 | | 40 | – | | |
| | ISA(ISPA)-LXMX-□-400-20-□□□ | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 950 | 830 | 740~540 | 490~340 | | 80 | – | | |
| | ISA(ISPA)-LXUWX-□-200-20-□□□ | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 950 | 830 | 740~540 | 490~340 | | 40 | – | | |
| | ISA(ISPA)-LXUWX-□-400-40-□□□ | | | | | | 2000 | 2000 | 2000 | 2000 | 2000 | 1900 | 1660 | 1480~1080 | 980~680 | | 40 | – | | |
| | ISA(ISPA)-LXUWX-□-400-20-□□□ | | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 950 | 830 | 740~540 | 490~340 | | 80 | – | | |
| | ISA(ISPA)-LYM-□-200-20-□□□ | 1000 | 1000 | 1000 | 1000 | 830 | 690 | 585 | 500 | | | | | | | | 40 | 9 | 0.3 | 0.3 |
| | ISA(ISPA)-LYM-□-200-10-□□□ | 500 | 500 | 500 | 470 | 385 | 320 | 270 | 235 | | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-LYM-□-400-40-□□□ | 2000 | 2000 | 2000 | 2000 | 1660 | 1380 | 1170 | 1000 | | | | | | | | 40 | 9 | | |
| | ISA(ISPA)-LYM-□-400-20-□□□ | 1000 | 1000 | 1000 | 1000 | 830 | 690 | 585 | 500 | | | | | | | | 80 | 19 | | |
| | ISA(ISPA)-LZM-□-200-10-□□□ | 500 | 500 | 500 | 470 | 385 | 320 | 270 | 235 | | | | | | | | – | 19 | | |
| | ISA(ISPA)-LZM-□-400-10-□□□ | 500 | 500 | 500 | 470 | 385 | 320 | 270 | 235 | | | | | | | | – | 39 | | |
| ISP | ISP-WXM-□-600-40-□□□ | 2000 | 2000 | 2000 | 2000 | 1670 | 1390 | 1170 | 1000 | 865 | | | | | | | 60 | 14 | 0.3 | 0.3 |
| | ISP-WXM-□-600-20-□□□ | 1000 | 1000 | 1000 | 1000 | 835 | 695 | 585 | 500 | 430 | | | | | | | 120 | 29 | | |
| | ISP-WXM-□-600-10-□□□ | 500 | 500 | 500 | 500 | 415 | 345 | 290 | 250 | 215 | | | | | | | 150 | 60 | | |
| | ISP-WXM-□-750-40-□□□ | 2000 | 2000 | 2000 | 2000 | 1670 | 1390 | 1170 | 1000 | 865 | | | | | | | 75 | 18 | | |
| | ISP-WXM-□-750-20-□□□ | 1000 | 1000 | 1000 | 1000 | 835 | 695 | 585 | 500 | 430 | | | | | | | 150 | 37 | | |
| | ISP-WXMX-□-600-40-□□□ | | | | | 2000 | 2000 | 2000 | 2000 | 2000 | 1965 | 1725 | 1530 | 1365~1005 | 915~655 | | 60 | – | | – |
| | ISP-WXMX-□-600-20-□□□ | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 980 | 860 | 765 | 680~500 | 455~325 | | 120 | – | | |
| | ISP-WXMX-□-750-40-□□□ | | | | | 2000 | 2000 | 2000 | 2000 | 2000 | 1965 | 1725 | 1530 | 1365~1005 | | | 75 | – | | |
| | ISP-WXMX-□-750-20-□□□ | | | | | 1000 | 1000 | 1000 | 1000 | 1000 | 980 | 860 | 765 | 680~500 | | | 150 | – | | |

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

| | Model | Stroke (mm), maximum speed (mm/sec) *1 | | | | | | | | | | | | | | | Loading capacity *2 | | Rated acceleration | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100~500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 | 1600 | 1700~2000 | 2100~2500 | 3000 | Horizon-tal (kg) | Vertical (kg) | Horizon-tal (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 | 190 | | | | | | | | | | | | | | 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 | 0.3 | 0.3 |
| | ISD-M-□-200-10-□□□ | 500 | | 455 | 365 | 300 | 250 | | | | | | | | | | 80 | 19 | | |
| | ISD-MX-□-200-20-□□□ | | | | 1000 | | | | | | 950 | 800 | 700 | | | | 40 | – | 0.3 | – |
| | ISD-L-□-200-20-□□□ | 1000 | | | 930 | 765 | 640 | 545 | 465 | | | | | | | | 40 | 9 | 0.3 | 0.3 |
| | ISD-L-□-200-10-□□□ | 500 | | | 465 | 380 | 320 | 270 | 230 | | | | | | | | 80 | 19 | | |
| | ISD-L-□-400-20-□□□ | 1000 | | | 930 | 765 | 640 | 545 | 465 | | | | | | | | 80 | 19 | | |
| | ISD-LX-□-200-20-□□□ | | | | | | 1000 | | | | | 950 | 830 | | | | 40 | – | 0.3 | – |
| | ISD-LX-□-400-20-□□□ | | | | | | 1000 | | | | | 950 | 830 | | | | 80 | – | | |
| IF | IF-SA□□-□-60-□□□ | 1750 | | | | | | | | | | | | | | | 5 | – | 0.3 | – |
| | IF-SA□□-□-100-□□□ | 1750 | | | | | | | | | | | | | | | 10 | – | | |
| | IF-MA□□-□-200-□□□ | 1750 | | | | | | | | | | | | | | | 20 | – | | |
| | IF-MA□□-□-400-□□□ | 1750 | | | | | | | | | | | | | | | 40 | – | | |
| FS | FS-11NM-□-60-□□□ | 1250 | | | | | | | | | | | | | | | 2 | – | 0.3 | – |
| | 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 | – | | |
| | 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 | – | 0.2 |
| | DS-A4-□-20-5-□□□ | 165 | | | | | | | | | | | | | | | | – | 4.5 | | |
| | DS-A5-□-20-12-□□□ | 400 | | | | | | | | | | | | | | | | – | 2 | | |
| | DS-A5-□-20-6-□□□ | 200 | | | | | | | | | | | | | | | | – | 4 | | |
| | DS-A6-□-30-12-□□□ | 400 | | | | | | | | | | | | | | | | – | 3 | | |
| | DS-A6-□-30-6-□□□ | 200 | | | | | | | | | | | | | | | | – | 6 | | |

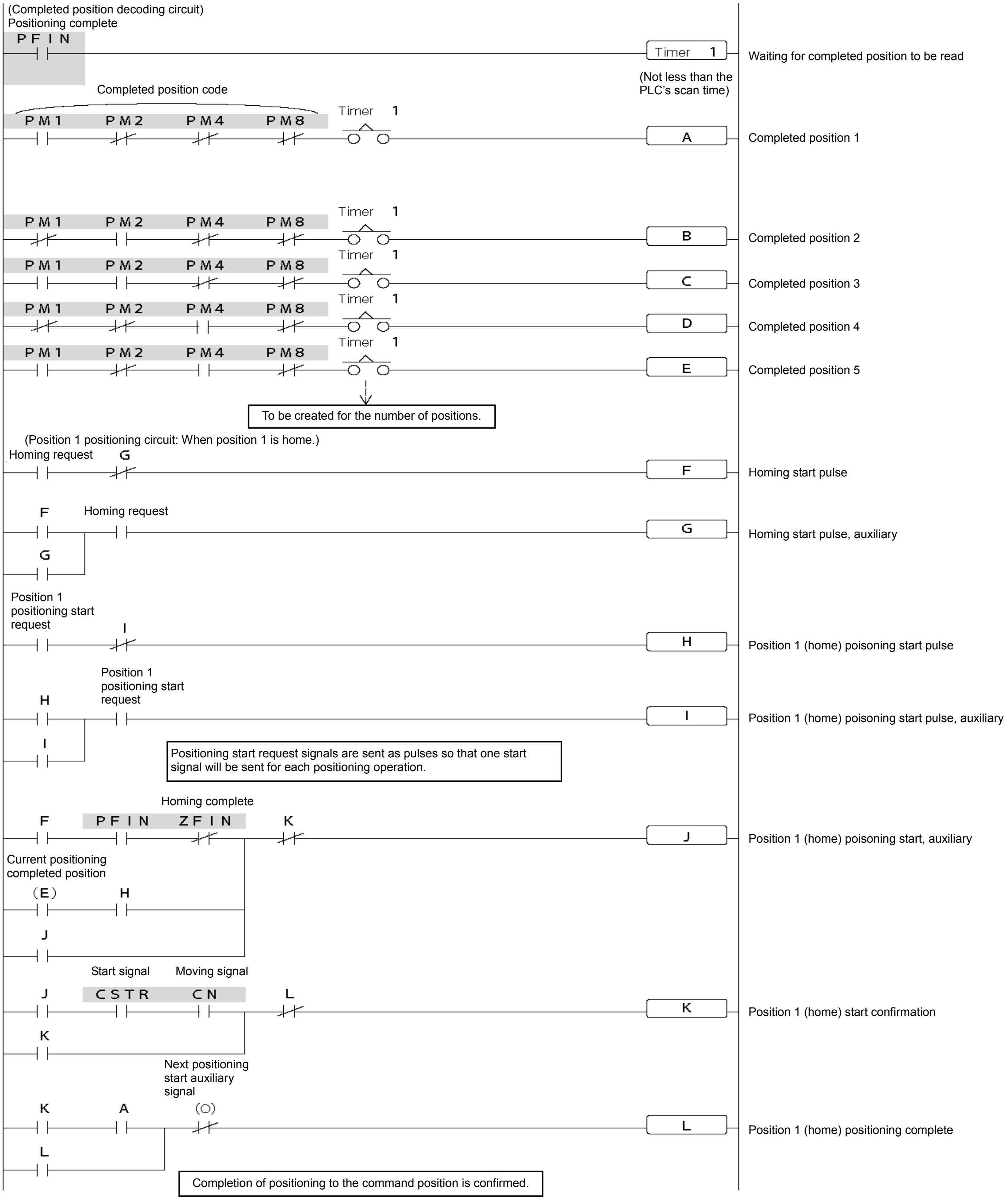
| | | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 | 2000 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SS | SS-S-□-60-12-□□□ | 600 | | | | | 470 | | | | | | | | | | | 15 | 4 | 0.3 | 0.3 |
| | SS-S-□-60-6-□□□ | 300 | | | | | 230 | | | | | | | | | | | 30 | 8 | | |
| | SS-M-□-100-20-□□□ | 1000 | | | | | | 960 | 765 | 625 | 515 | | | | | | | 20 | 4 | | |
| | 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 | | |

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

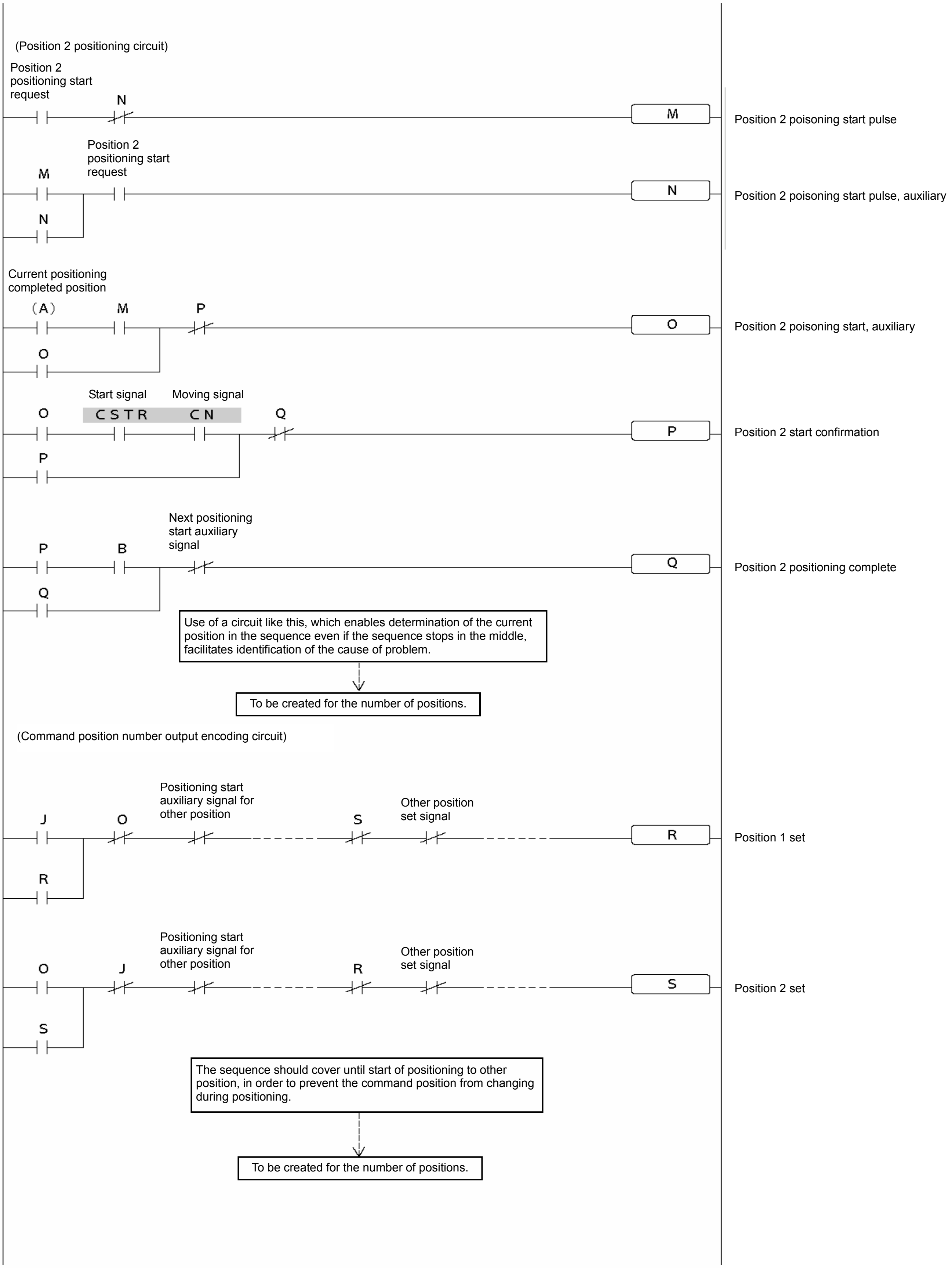


To be created for the number of positions.

Positioning start request signals are sent as pulses so that one start signal will be sent for each positioning operation.

Completion of positioning to the command position is confirmed.

(Position 2 positioning circuit)



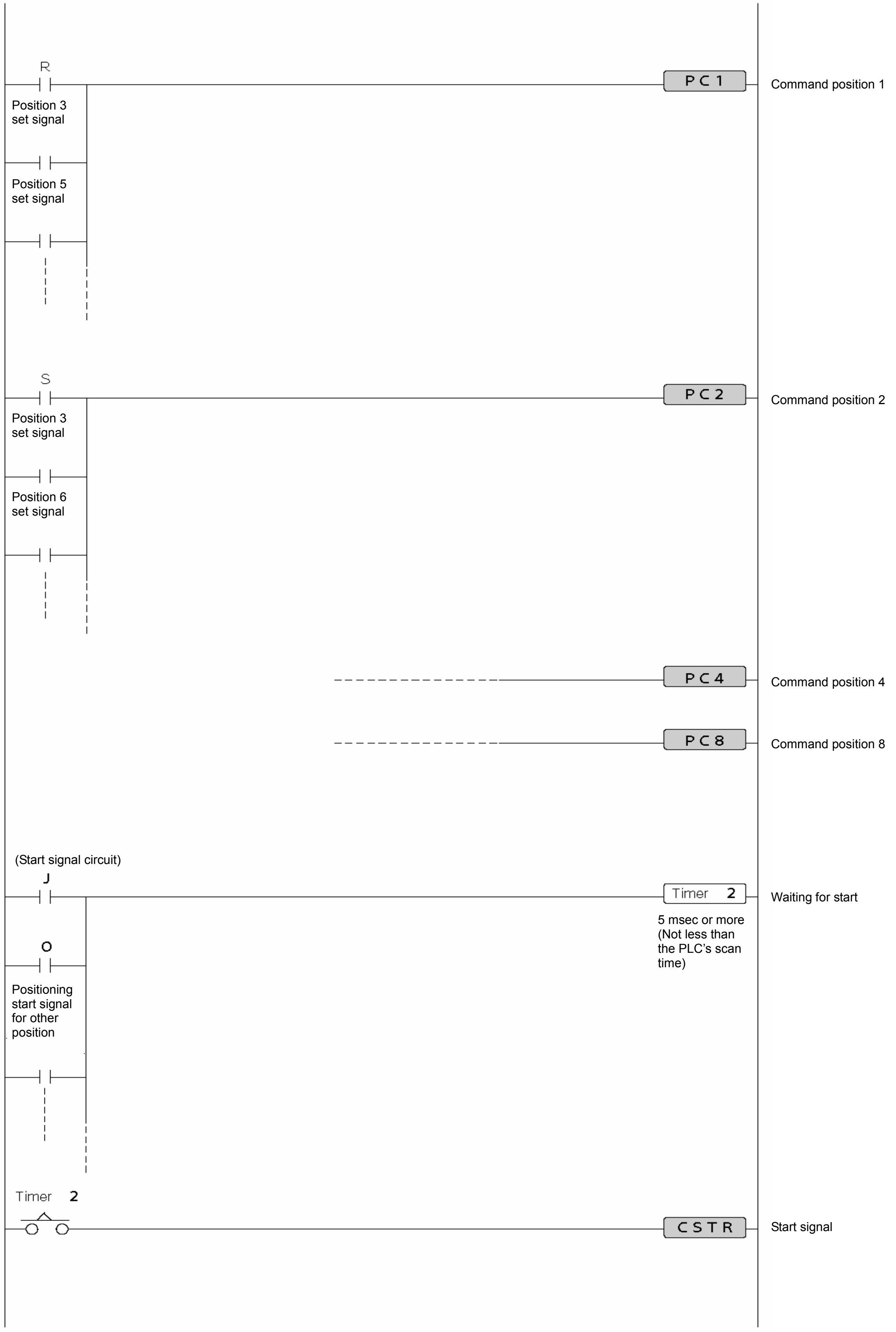
Use of a circuit like this, which enables determination of the current position in the sequence even if the sequence stops in the middle, facilitates identification of the cause of problem.

To be created for the number of positions.

(Command position number output encoding circuit)

The sequence should cover until start of positioning to other position, in order to prevent the command position from changing during positioning.

To be created for the number of positions.


R
Position 3 set signal
Position 5 set signal
PC1
Command position 1
S
Position 3 set signal
Position 6 set signal
PC2
Command position 2
PC4
Command position 4
PC8
Command position 8
(Start signal circuit)
J
O
Positioning start signal for other position
Timer 2
5 msec or more (Not less than the PLC's scan time)
Waiting for start
Timer 2
CSTR
Start signal

## 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 | | | | | | |
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| 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 | |

Catalog No.: MJ0122-14A (Aug. 2005)

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