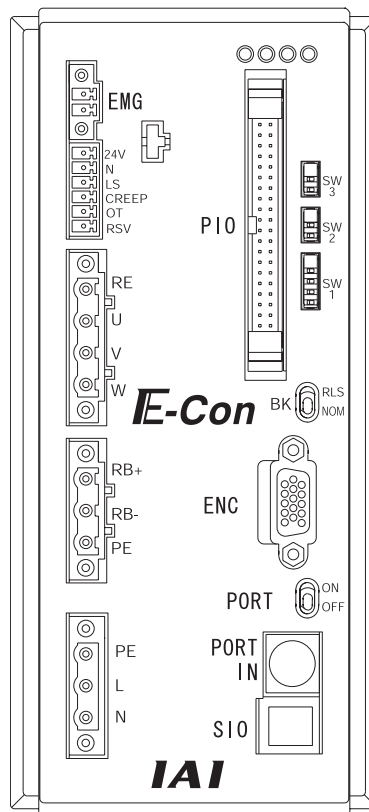


# E-Con Controller

## Operating Manual (provisional)



This publication was written to assist you in better understanding this part of your IA system. If you require further assistance, please contact IAI Technical Support.



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### Disclaimer

The information and technical data contained herein are subject to change without notice. IAI Industrieroboter GmbH assumes no responsibility for any errors or omissions regarding the accuracy of the information contained in this publication.

# Before you Begin

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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 ON, E-CON will not move due to hold status. Therefore, please be careful.

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

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# 1. Safety Precautions

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## 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.

\* 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. Safety Precautions

---

## 1-2 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. Safety Precautions

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## 1-3 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. Safety Precautions

## 1-4 Setting Environment and Noise Measures

**Please be careful for controller setting environment**

### 1-4-1 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.

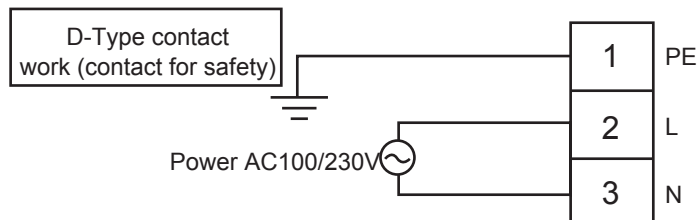
### 1-4-2 Power Source

There are AC100V and AC230V depends on the controller specification.

### 1-4-3 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 0.75mm (#18AWG) or larger and above AC cables.

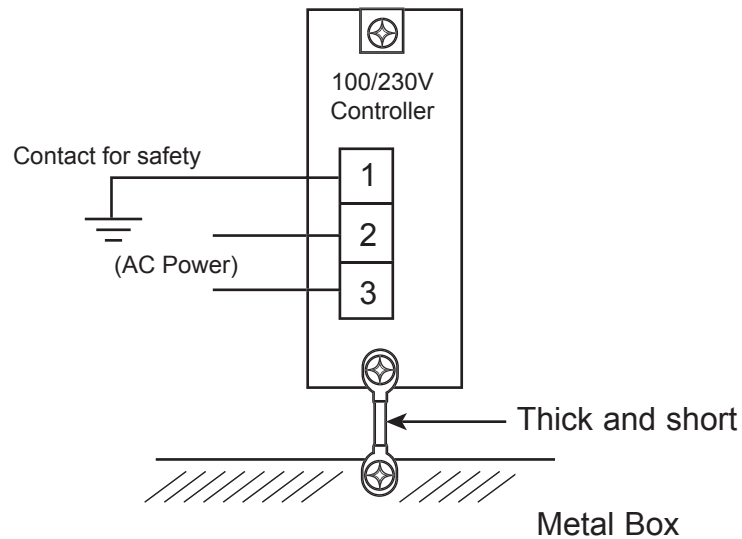


# 1. Safety Precautions

## (2) Noise Source and Noise Suppression

You will need to set noise compliance and grounding whether AC100 or 230V.

### 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.

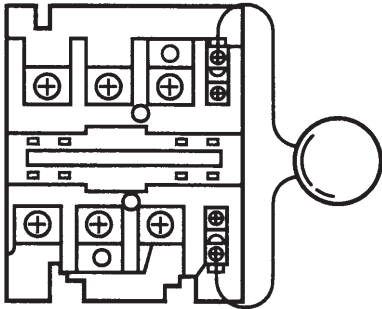
# 1. Safety Precautions

## (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.

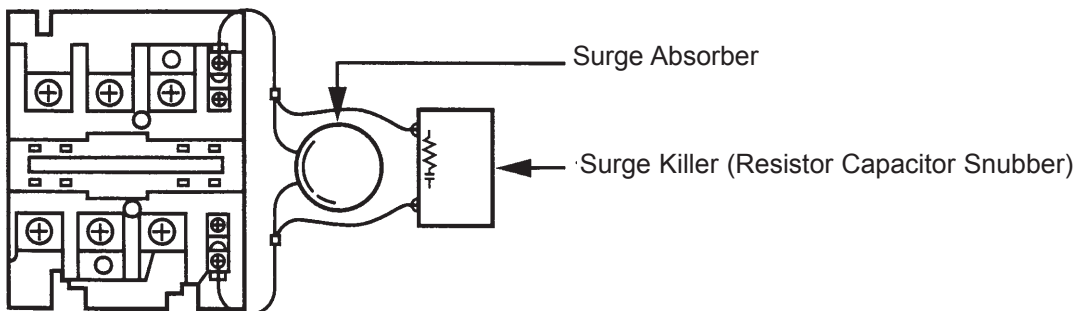
### 1. AC solenoid valve · magnetic switch · relay

- 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.

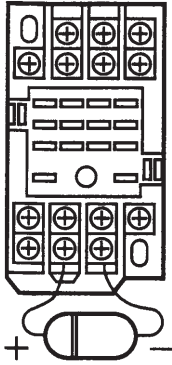
The most effective method is to install a surge absorber and surge killer in parallel to the reactance load (solenoid and relay coils). This will reduce noise in a wide band of frequencies.



# 1. Safety Precautions

## 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.

## 1-5 Heat Dissipation and Mounting

The size of the controller panel, controller position and cooling method should all be designed so that the controller boundary temperature remains under 40°C. As the diagram below shows, mount vertically (wall mounting). Since cooling is done according to natural convection, always mount in the vertical direction. Furthermore shown in Figure 1-5-2, 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 1-5-3.

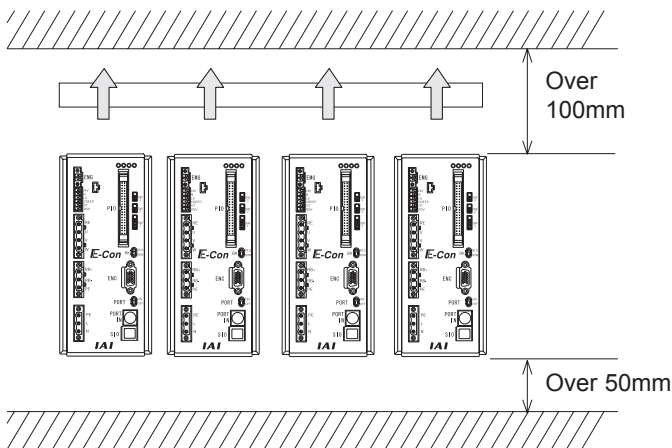


Figure 1-5-2

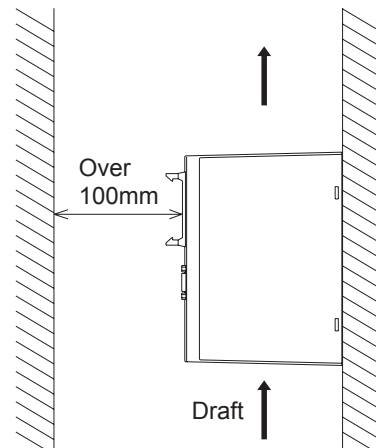


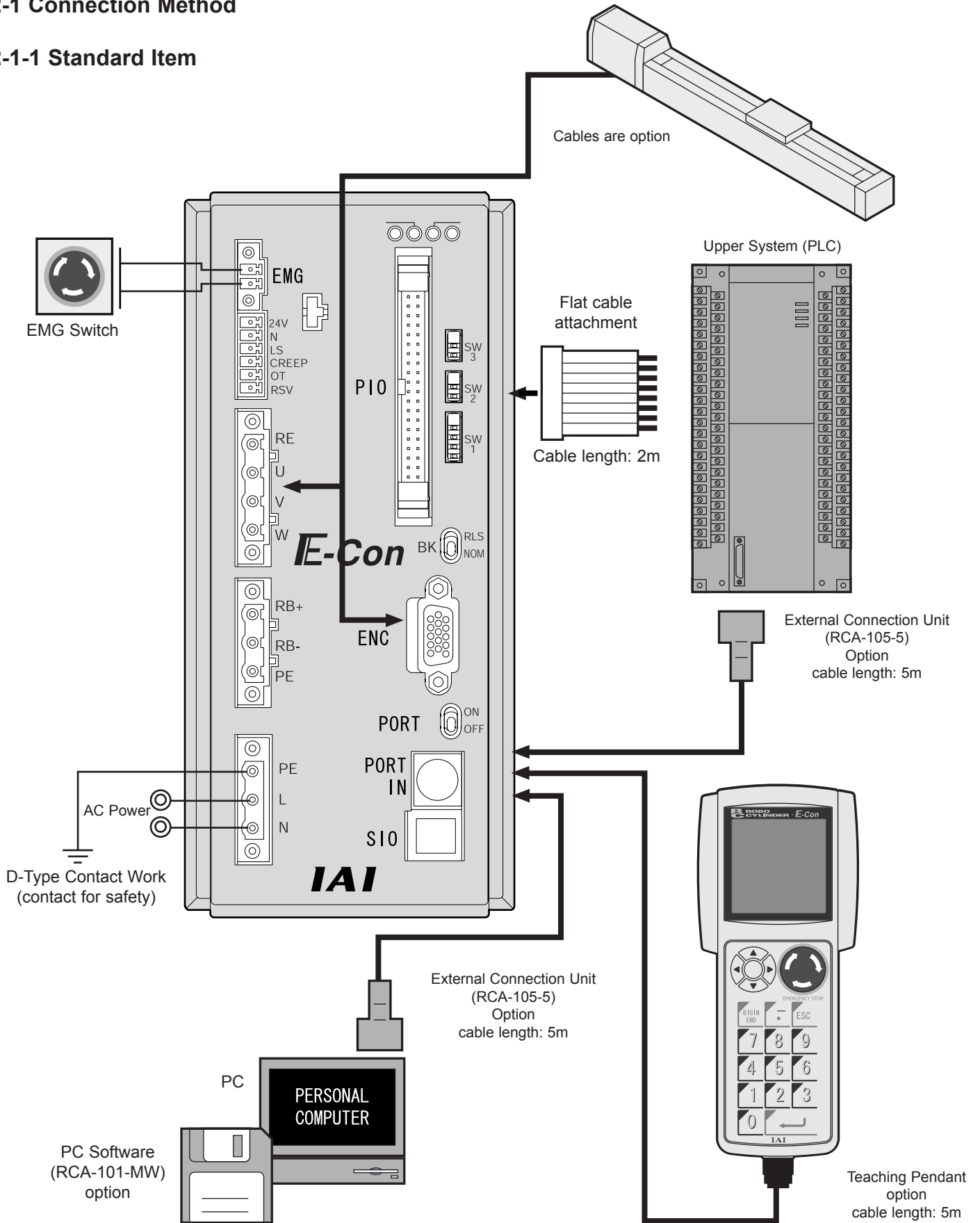
Figure 1-5-3

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. Specification

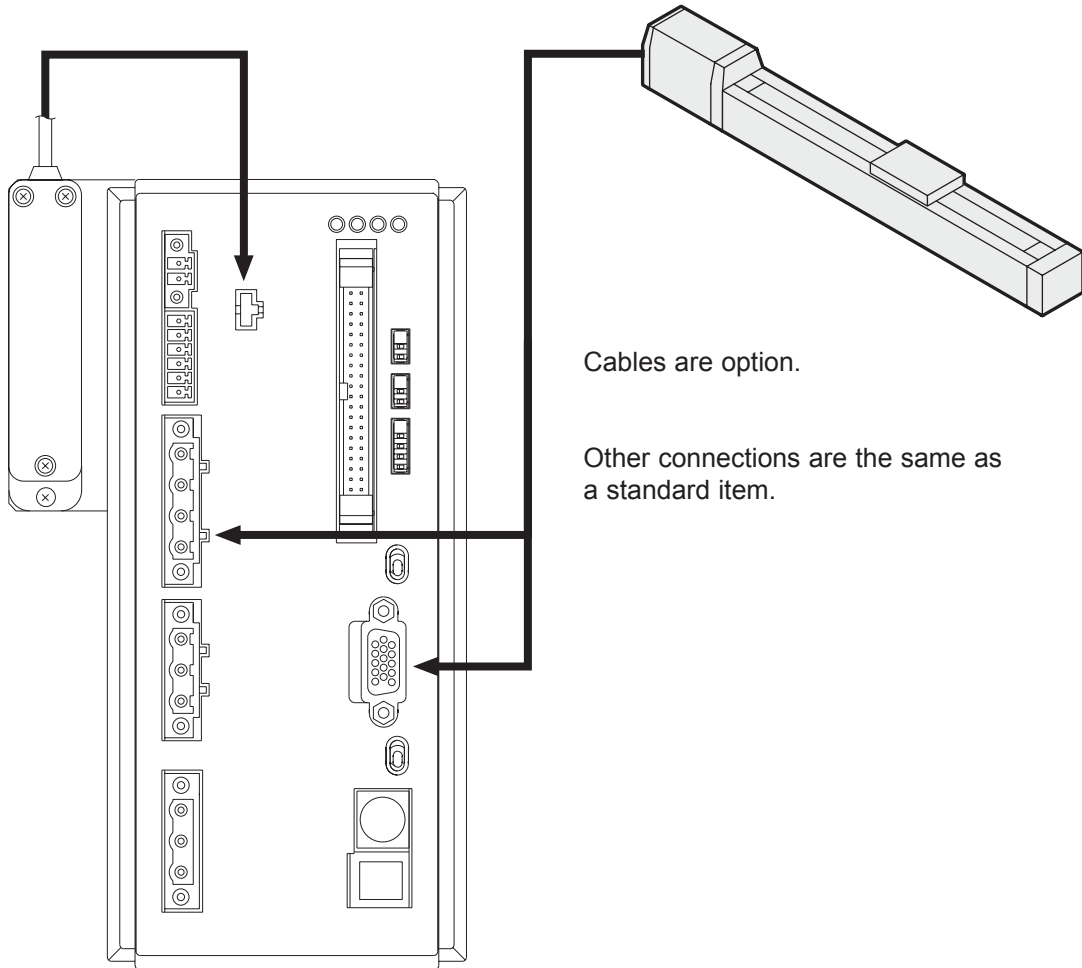
## 2-1 Connection Method

### 2-1-1 Standard Item



## 2. Specification

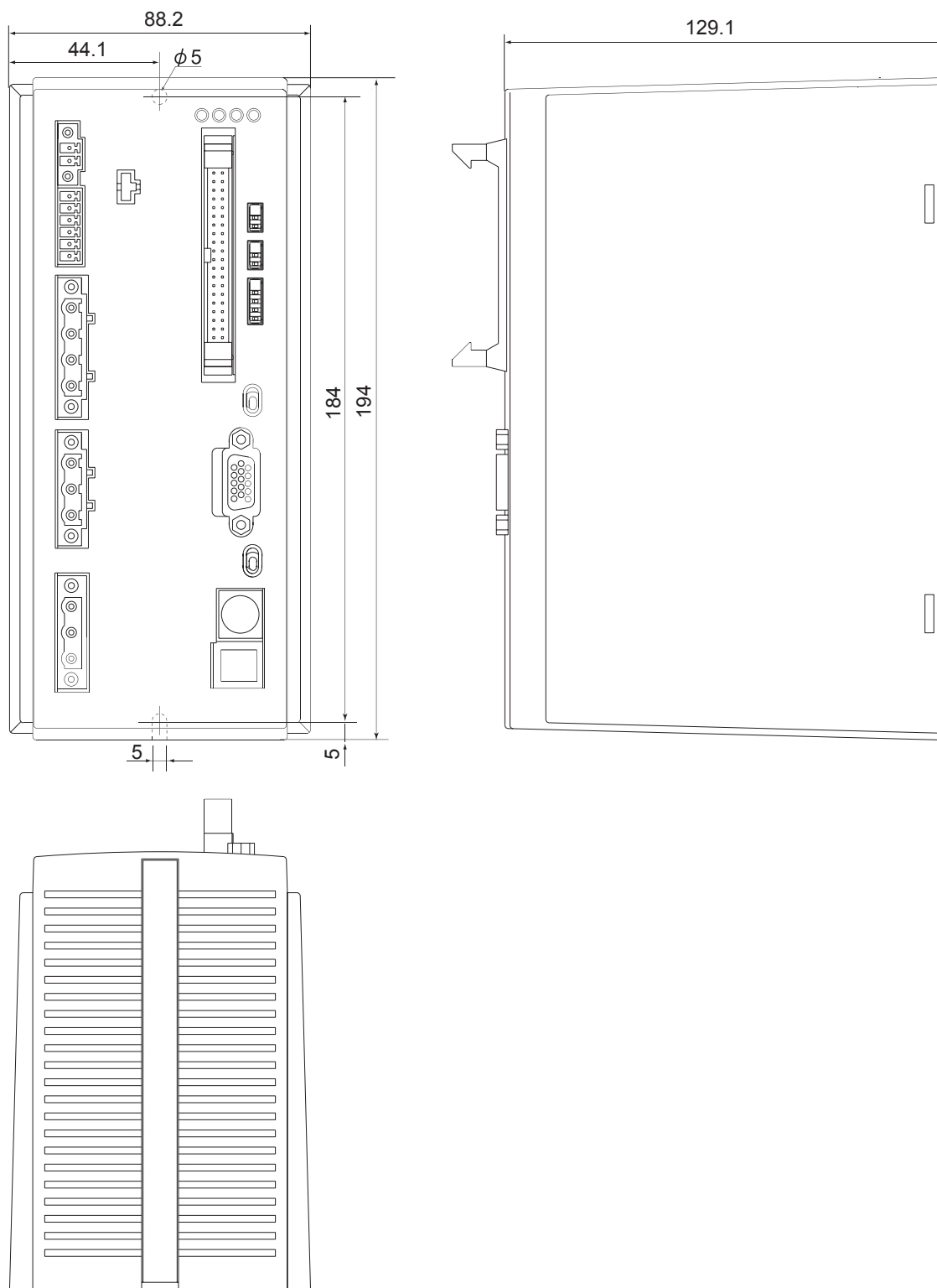
### 2-1-2 Absolute Specifications



## 2. Specification

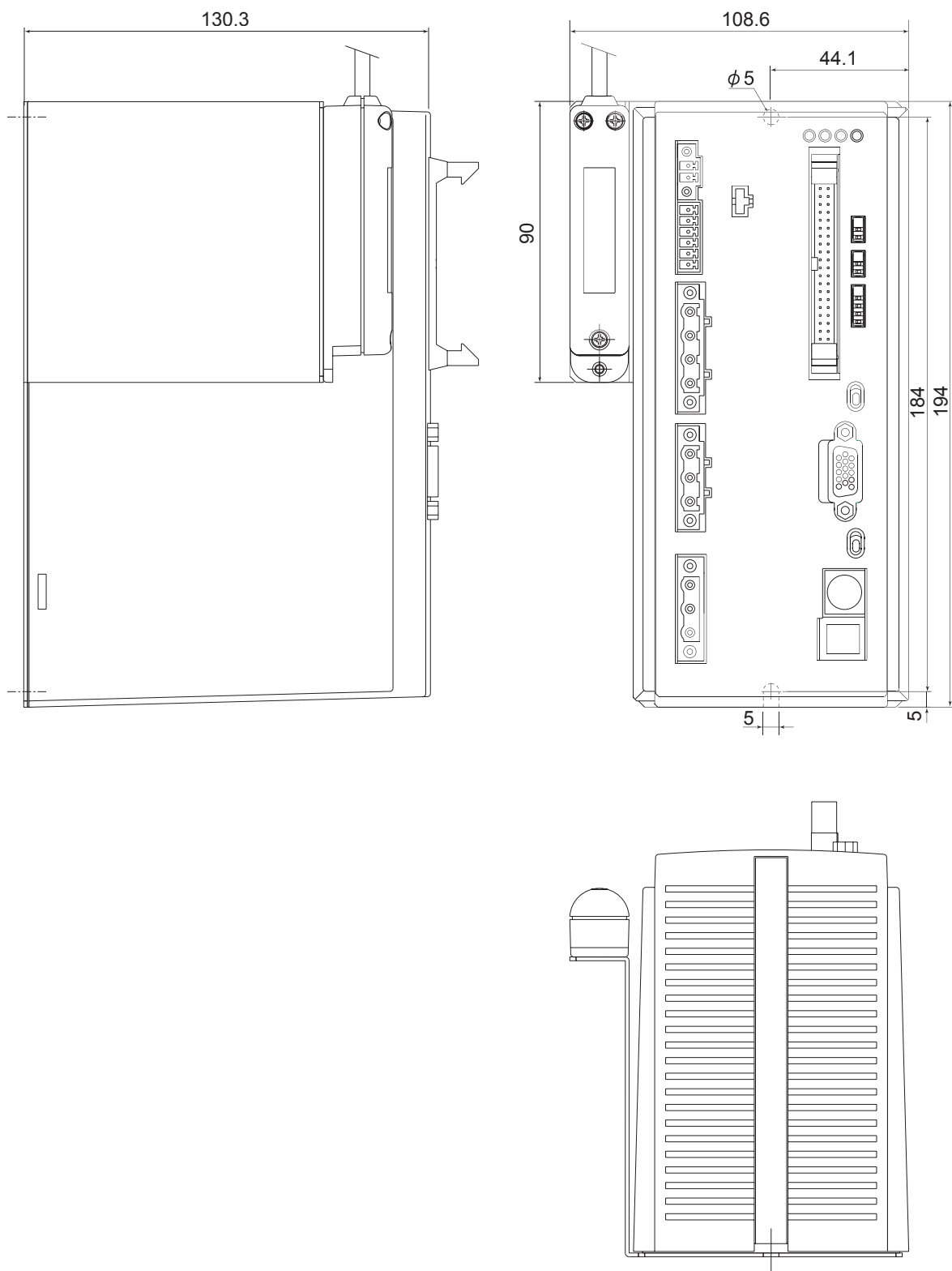
### 2-3 External Dimensional Diagram

#### 2-2-1 Controller Outer Shape (Standard)



## 2. Specification

### 2-2-2 Absolute Specification



## 2. Specification

### 2-3 Specification

Item		Specification		
Power Volatage		Motor Capacity		
		60~200W	single phase AC90~125V	
		60~400W	single phase AC180~250V	
Power Current / Capacity *1		Motor Capacity	Standard Power Current	
		60W	100W / 160VA	
		100W	150W / 240VA	
		150W	210W / 350VA	
		200W	270W / 450VA	
		400W	520W / 870VA	
		600W	770W / 1300VA	
		750W	1000W / 1600VA	
Unit Weight		Standard	1200g	
		Sbsolute	1500g	
Ambient Temperature · Humidity		Temperature 0~40C° · Humidity less than 85%RH		
Ambient Enviroment		IP 10 (No Corresive Gas)		
Protective Function		Circuit voltage abnormality, motor excessive current, Power stage abnoraml heat, Encoder abnormality, Motor excessive load		
LED Display		RDY (green) RUN (green) ALM (red) ENC (orange)		
I / O Interface		24V DC Insulate		
I/O Signal	PIO	Exclusive Input 10 port	Start	
			Command Position Number (6 bit Binary)	
			Pause	
			Reset	
			Servo ON	
		Exclusive Output 12 port	Complete Position Number (6 bit Binary)	
			Complete Positioning	
			Complete Homing	
			Zone	
			Emergency Stop	
	SIO	Termi-Bus communication protocol		
		Moving		
	Position Number		64 points	
	Data Input Method		Teaching Pendant or PC Interface Software	
Regenerative Resistance Unit *2		Motor Capacity		
		60~200W	integrated into the controller	
		400~600W	external unit	
Accessories		PIO Flat Cable · Power Connector · EMG Connector		

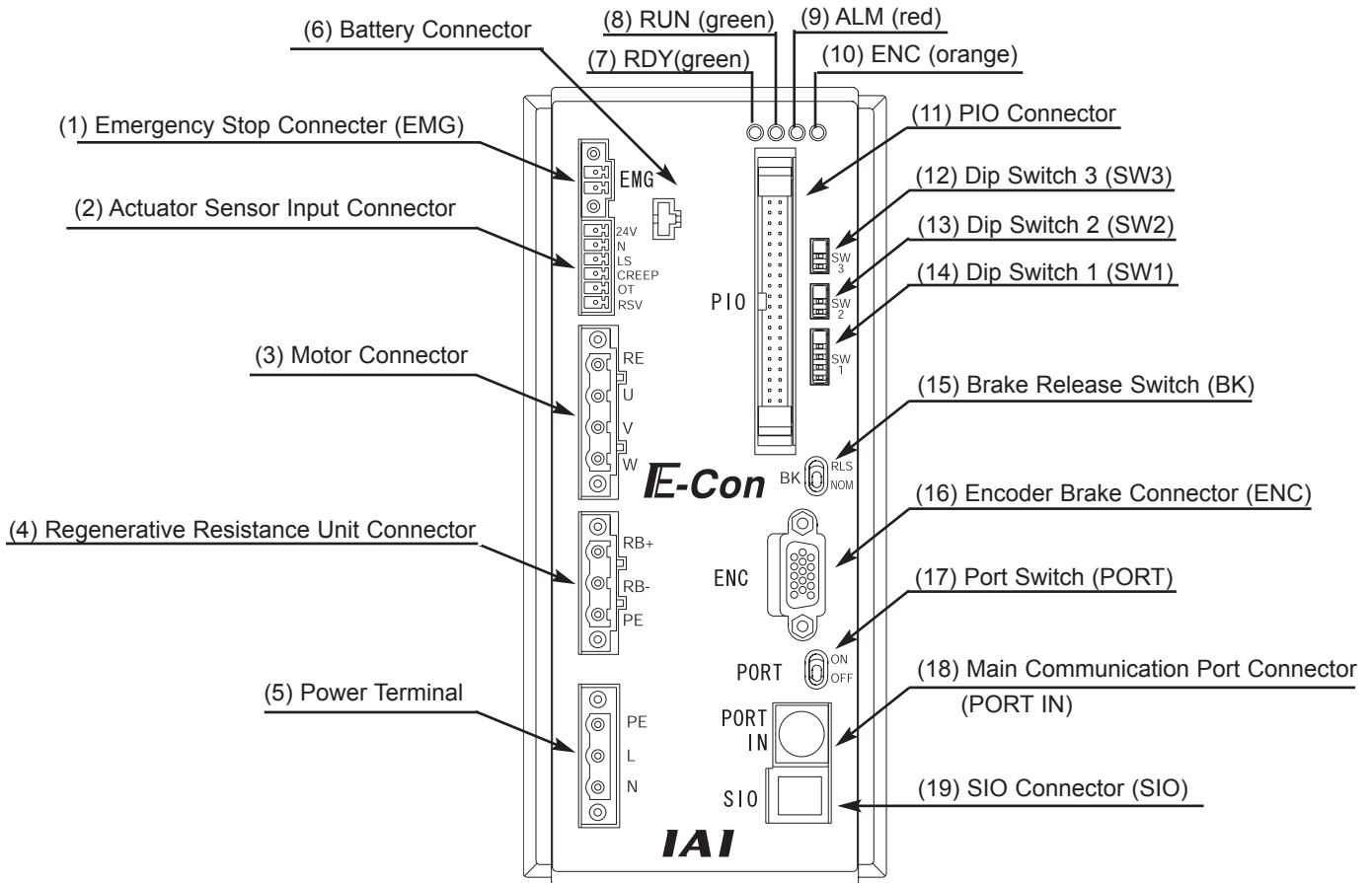
\*1 : Instantaneous value is 3 times more.

\*2 : Whether you need an external unit or not, it depends on condition of usage.  
Rough standard is 200W.

## 2. Specification

### 2-4 Absolute Specifications

#### 2-4-1 Names



#### 2-4-2 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.

## 2. Specification

---

### (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) : This indicates that the CPU is in normal operation.

(8) RUN (green) : This indicates normal operation during motion.

(9) ALM (red) : Turns On during alarm and during emergency stop.

(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	Aplicable Cable Length
ON	OFF	~15m
OFF	ON	15~25m
ON	ON	25~30m

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)

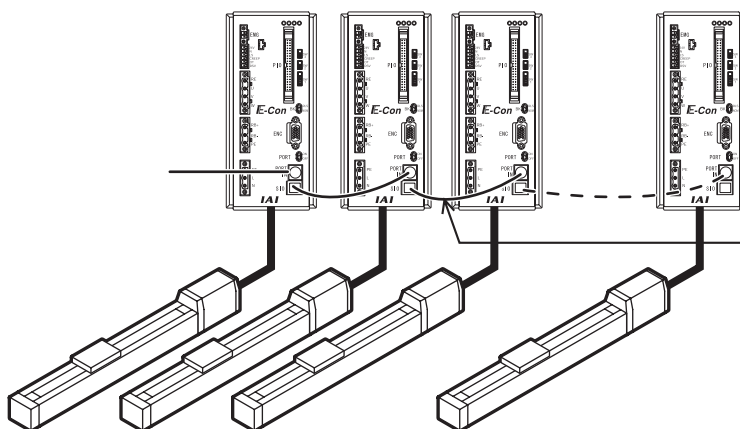
## 2. Specification

### (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.

## 2. Specification

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### (15) Brake Release Switch (M)

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. Specification

### 2-4-3 Main Communications

#### SIO Connector Pin Assignment

Pin.No	Signal Name	Function
1	(+5V)	DC 5V Power Output or Reserve Signal Terminal
2	SGA	Line transceiver I/O positive logic side
3	GND	Ground for communication
4	SGB	Line Transceiver I/O Negative Logic Side
5	GND	Ground for communication
6	+5V	DC5V Power Output

#### Main Communication Port Pin Assign

Pin.No	Signal Name	Function
1	SGA	Serial Communication
2	SGB	Serial Communication
3	5V	5V Power Output
4	EMGS	Emergency Stop Status
5	EMGA	*Note 1
6	24V	24V 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.

### 2-4-4 Specifications for Each Connector Pins and Terminal Board

#### Motor / Brake Connector (178303-5: AMP)

Pin No.	Signal Name	Connection Line
1	PE	Motor FG
2	U	Motor U Phase
3	V	Motor V Phase
4	W	Motor W Phase

## 2. Specification

---

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

Pin No.	Signal Name	Connecting 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	EN 5	Encoder 5V+
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)

Pin No.	Connecting line
1	PE (Earth)
2	L (AC)
3	N (AC)

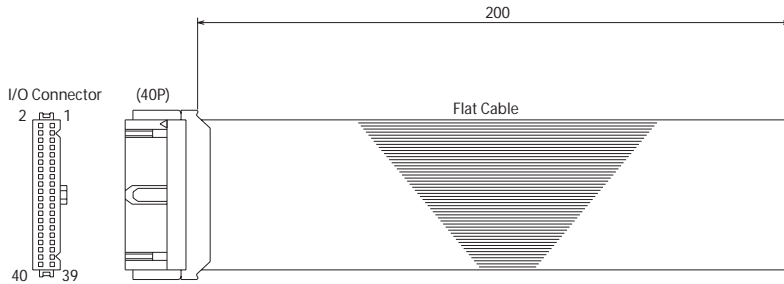
Power and Emergency Stop Terminal Board (MC1.5/2-STF-3.81 Phoenix Contact)

Pin No.	Connecting line
1	EMG 1 (24V)
2	EMG 2

# 2. Specification

## 2-4-5 I/O Flat Cable

\* Accessory

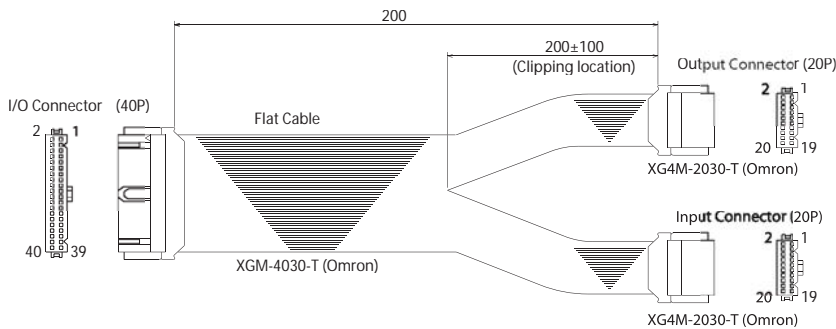


I/O Connector (40P)

No.	Signal Name	Colour	No.	Signal Name	Colour
1	COM-0A	Brown - 1	11	*Emergency Stop	Brown-2
2	COM-0A	Red - 1	12	Complete position 16	Red - 2
3	COM-0B	Orange - 1	13	*Alarm	Orange - 2
4	COM-0B	Yellow - 1	14	Complete position 8	Yellow - 2
5	NC	Green - 1	15	Zone	Green - 2
6	NC	Blue - 1	16	Complete position 4	Blue - 2
7	NC	Purple - 1	17	Complete homing	Purple - 2
8	NC	Grey-1	18	Complete position 2	Grey - 2
9	Moving	White - 1	19	Complete positioning	White - 2
10	Complete position 32	Black - 1	20	Complete position 1	Black - 2

No.	Signal Name	Colour	No.	Signal Name	Colour
21	COM-1A	Brown - 3	31	NC	Brown - 4
22	COM-1A	Red - 3	32	Command position 16	Red - 4
23	COM-1B	Orange - 3	33	*Hold	Orange - 4
24	COM-1B	Yellow - 3	34	Command position 8	Yellow - 4
25	NC	Green - 3	35	Servo on	Green - 4
26	NC	Blue - 3	36	Command position 4	Blue - 4
27	NC	Purple - 3	37	Reset	Purple - 4
28	NC	Grey - 3	38	Command position 2	Grey - 4
29	NC	White - 3	39	Start	White - 4
30	Command position 32	Black - 3	40	Command position 1	Black - 4

\* Option



(A) Output Connector (20P)

(B) Input Connector (20P)

No.	Signal Name	Colour	No.	Signal Name	Colour
1	COM-0A	Brown - 1	11	*Emergency Stop	Brown - 2
2	COM-0A	Red - 1	12	Complete position 16	Red - 2
3	COM-0B	Orange - 1	13	*Alarm	Orange - 2
4	COM-0B	Yellow - 1	14	Complete position 8	Yellow - 2
5	NC	Green - 1	15	Zone	Green - 2
6	NC	Blue - 1	16	Complete position 4	Blue - 2
7	NC	Purple - 1	17	Complete homing	Purple - 2
8	NC	Grey - 1	18	Complete position 2	Grey - 2
9	Moving	White - 1	19	Complete positioning	White - 2
10	Complete position 32	Black - 1	20	Complete position 1	Black - 2

No.	Signal Name	Colour	No.	Signal Name	Colour
1	COM-1A	Brown - 1	11	NC	Brown - 2
2	COM-1A	Red - 1	12	Command position 16	Red - 2
3	COM-1B	Orange - 1	13	*Hold	Orange - 2
4	COM-1B	Yellow - 1	14	Command position 8	Yellow - 2
5	NC	Green - 1	15	Servo on	Green - 2
6	NC	Blue - 1	16	Command position 4	Blue - 2
7	NC	Purple - 1	17	Reset	Purple - 2
8	NC	Grey - 1	18	Command position 2	Grey - 2
9	NC	White - 1	19	Start	White - 2
10	Command position 32	Black - 1	20	Command position 1	Black - 2

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

## 2. Specification

### 2-4-6 Battery Backup (Absolute Specifications)

#### (1) Battery Specifications

Column	Content
Type	Lithium Battery
Manufacturer	Toshiba Denchi
Model	ER3VP
Nominal Voltage	3.6V
Rated Capacity	1000mAh
Weight	Approximately 8.5g
Battery Sustain Time *1	Approximately 10000 hours (when ambient temperature is 20°C)

Note 1) The consumed current during absolute data backup is approximately 100mA (approximately 4mA when controller main power is ON).

\*To avoid breakdown, do not attempt to machine or extend the wire.

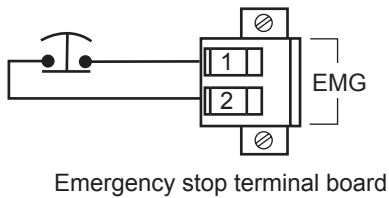
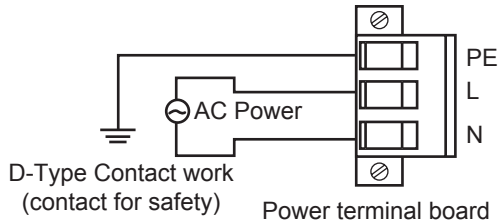
\* Please use IAI specified battery only. Battery exchange is between the battery board.  
It is not an exchange with the battery unit.

\*When exchanging the battery, you will need to reset the absolute encoder.

## 2. Specification

### 2-5 Wiring

#### 2-5-1 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.

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

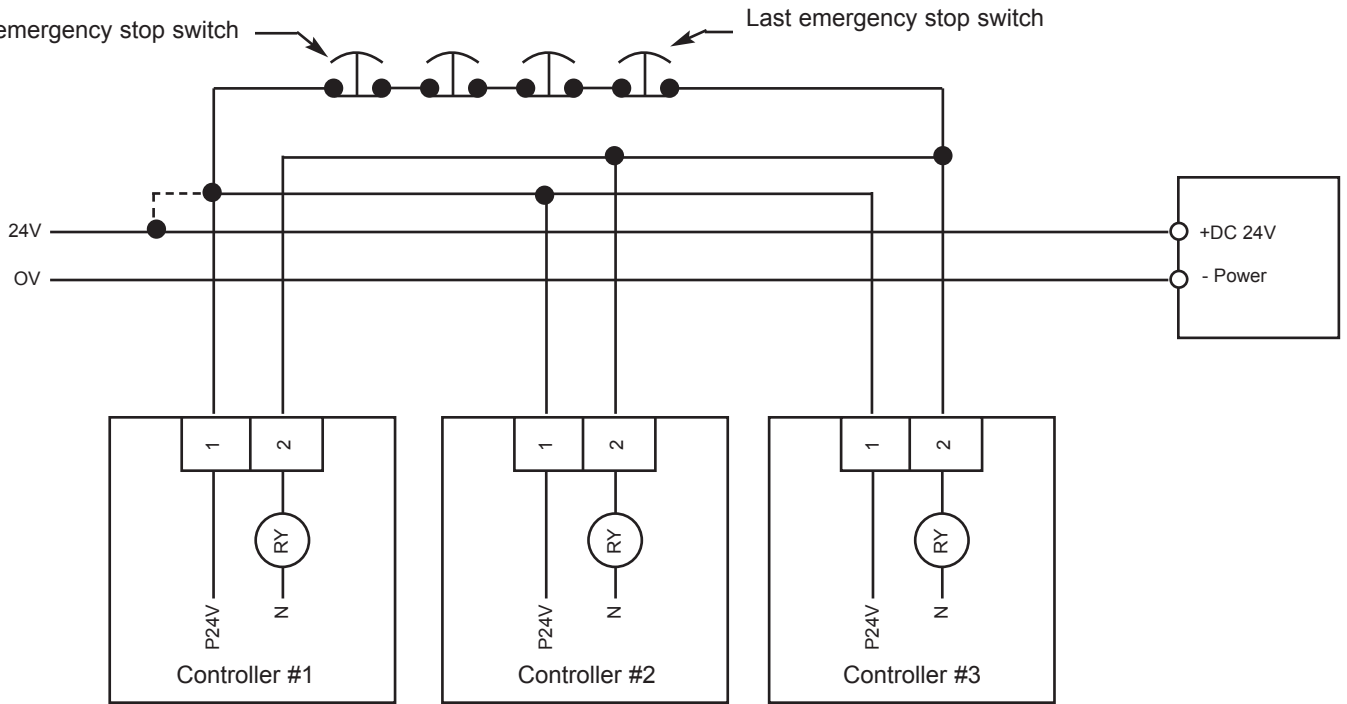
Applicable conduit	Single Line - $\Phi$ 1.0 (AWG18) Stranded Line - $0.75\text{mm}^3$ (AWG18)
Specification possible conduit range	Single Line - $\Phi$ 0.4 (AWG26)~ $\Phi$ 1.2 (AWG16) Stranded Line - $0.75\text{mm}^3$ (AWG18)~ $1.25\text{mm}^3$ (AWG16) Stranded Diameter - Over $\Phi$ 0.18mm
Length of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

Caution: This controller does not have a power switch.

## 2. Specification

### 2-5-2 Wiring Method for Connecting Multiple E-Stop Switches onto Multiple Controllers

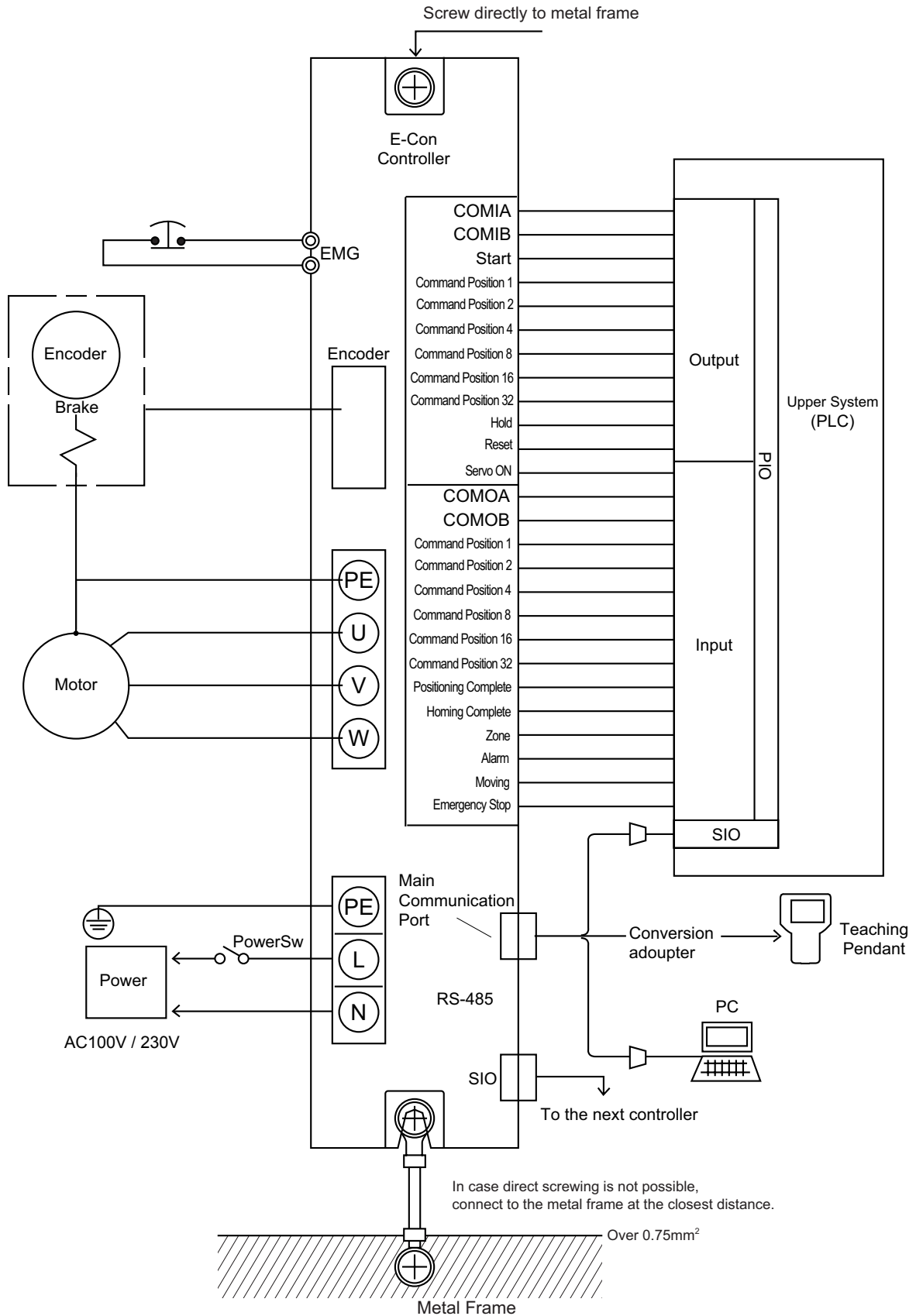
Connect the controller side in parallel and the emergency switch in series as following figure.



- As for the last emergency stop switch input, always connect it to the number 2 terminal of each controller.
- Connect number 1 terminal (24V) of each controller onto the first emergency stop switch.
- Each controller's internal power source (P24) can be connected to external power (24V).

# 2. Specification

## 2-5-3 External Connection Diagram



## 2. Specification

### 2-5-4 PIO Interface

PIO Interface list for controllers with PNP 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 Colour
1		(1)	COMOA	Brown - 1
3		(2)	COMOB	Orange - 2
5	Output		NC	Green - 1
7				Purple - 1
9		(3)	Moving	White - 1
11		(4)	*Emergency Stop	Brown - 2
13		(5)	*Alarm	Orange - 2
15		(6)	Zone	Green - 2
17		(7)	Complete Homing	Purple - 2
19		(8)	Complete Positioning	White - 2

Pin No.	Section	Reference Number	Signal Name	Cable Colour
2		(1)	COMOA	Red - 1
4		(2)	COMOB	Yellow - 1
6	Output		NC	Blue - 1
8				Grey - 1
10		(9)	Complete Position 32	Black - 1
12			Complete Position 16	Red - 2
14			Complete Position 8	Yellow - 2
16			Complete Position 4	Blue - 2
18			Complete Position 2	Grey - 2
20			Complete Position 1	Black - 2

21		(10)	COMIA	Brown - 3
23		(11)	COMB	Orange - 3
25	Input		NC	Green - 3
27				Purple - 3
29				White - 3
31				Brown - 4
33		(12)	*Hold	Orange - 4
35		(13)	SERVO ON	Green - 4
37		(14)	Reset	Purple - 4
39		(15)	Start	White - 4

Pin No.	Section	Reference Number	Signal Name	Cable Color
22		(10)	COMIA	Red - 3
24		(11)	COMB	Yellow - 3
26	Input		NC	Blue - 3
28				Grey - 3
30		(16)	Complete Position 32	Black - 3
32			Complete Position 16	Red - 4
34			Complete Position 8	Yellow - 4
36			Complete Position 4	Blue - 4
38			Complete Position 2	Grey - 4
40			Complete Position 1	Black - 4

#### Caution

Ports with \* mark indicate B contact. (always ON)

Never connect to unused port.

## 2. Specification

---

(1) COM0A Power for input port

(2) COM0B Power for input port

Connect a DC24V potential across COM0A & COM0B, for output functionality.

Polarity does not exist between COM0A & COM0B.

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 home location is taught, upon applying power, homing complete signal will turn ON. In case home complete signal turns OFF due to an alarm occurrence, you will need to teach the home location 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) 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.

(10) COM1A Power for input port

(11) COM1B Power for input port

Connect DC24V power plus side to Pin Numbers. 21 ~24 (COM1A · COM1B) (NPN specifications).

Pin Numbers. 21 and 22 are connected internally and Pin Numbers. 23 and 24 are also connected internally.

(12) Hold

This is a B-contact input. During movement, remains ON. Turns OFF to HOLD or freeze motion.

(13) Servo ON

When this signal is turned ON, servo is turned ON.

## 2. Specification

### (14) 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.

### (15) Start

Input for movement start signal.

### (16) 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~position 63.

1 : ON 0 : OFF

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



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

#### Caution:

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

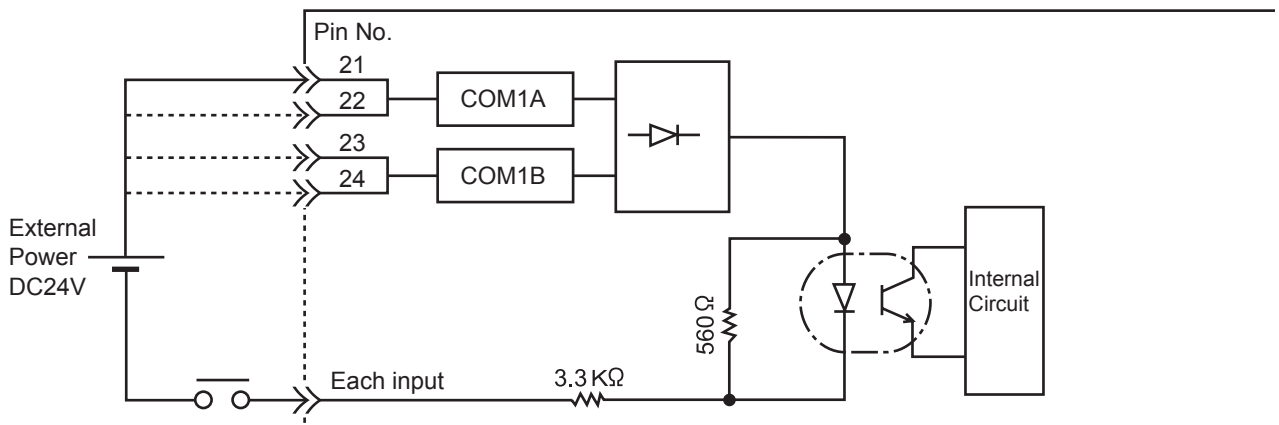
## 2. Specification

### 2-5-5 External I/O Specifications

Input Area

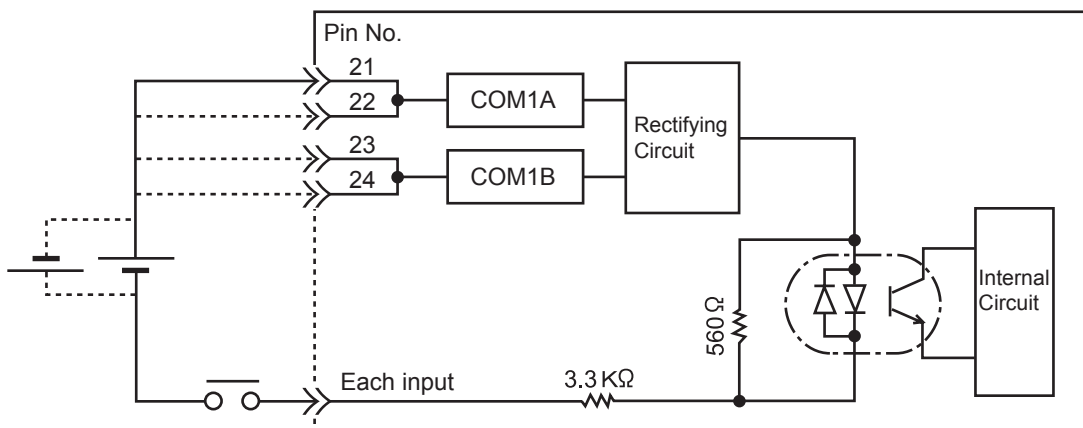
Column	Specifications
Number of inputs	10 points
Input Voltage	DC24V $\pm$ 20%
Input Current	7mA/1 Circuit
Movement Voltage	ON Voltage ··· Minimum 16V (4.5mA) OFF Voltage ··· Minimum 6V (1.4mA)
Insulation Method	Photo Coupler

#### 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)



- Pins No. 21 and 22 of COMI A , and Pins No. 23 and 24 of COMIB are connected, respectively internally.
- Connect the external power (plus or minus) to either one of pins 21~24 of COMIA. Connect opposite polarity of pin numbers 21~24 to the common side of input.

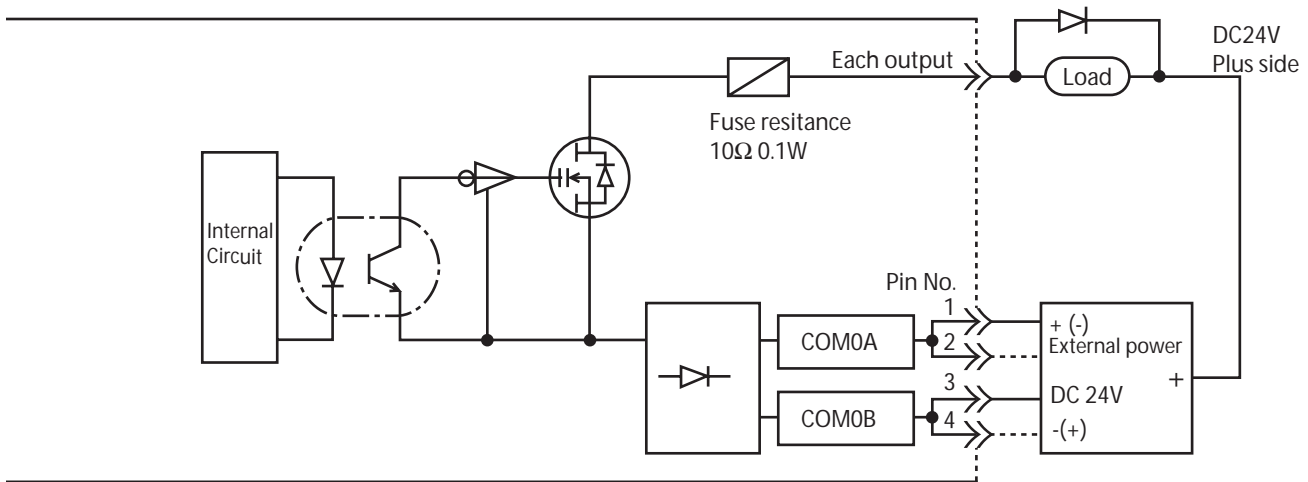
## 2. Specification

### Output Area

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

Column	Specifications
Number of inputs	12 points
Input Voltage	DC24V/60V (peak) (No schottky diodes)
Input Current	100mA/1 Circuit
Movement Voltage	1.8V/100mA
Insulation Method	Photo Coupler
Overcurrent Protection	Fuse resistance $10\Omega 0.1W$

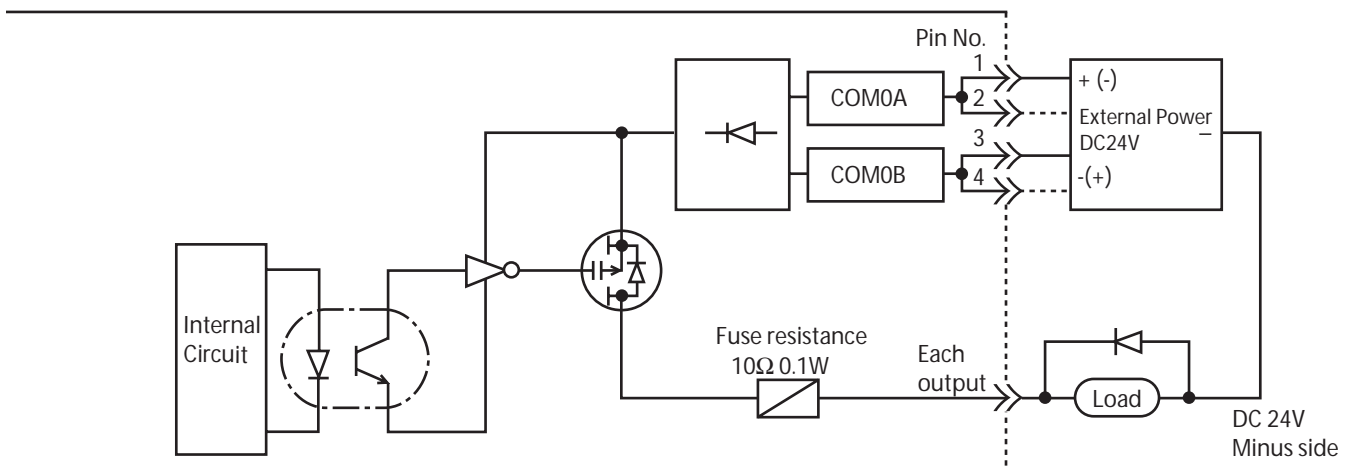
### Internal Circuit Structure (NPN Specifications)



- Add DC24V between COM0A and COM 0B. Polarity does not exist between COM0A and COM0B.
- 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. Data Input (Basic)

## 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	

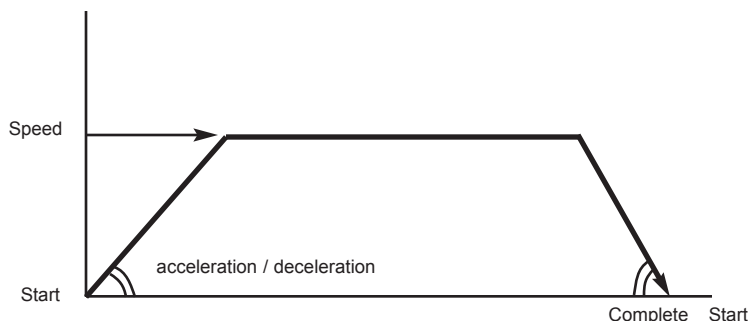
Absolute Coordinate Assign 30mm from home  
 Relative Coordinate Assign Plus 10mm from current location  
 Relative Coordinate Assign -10mm from current location  
 Absolute Coordinate Assign 100mm from home

### (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). Initial value will differ according to the actuators.



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

### (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 servo motor 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%.

### 3. Data Input (Basic)

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.

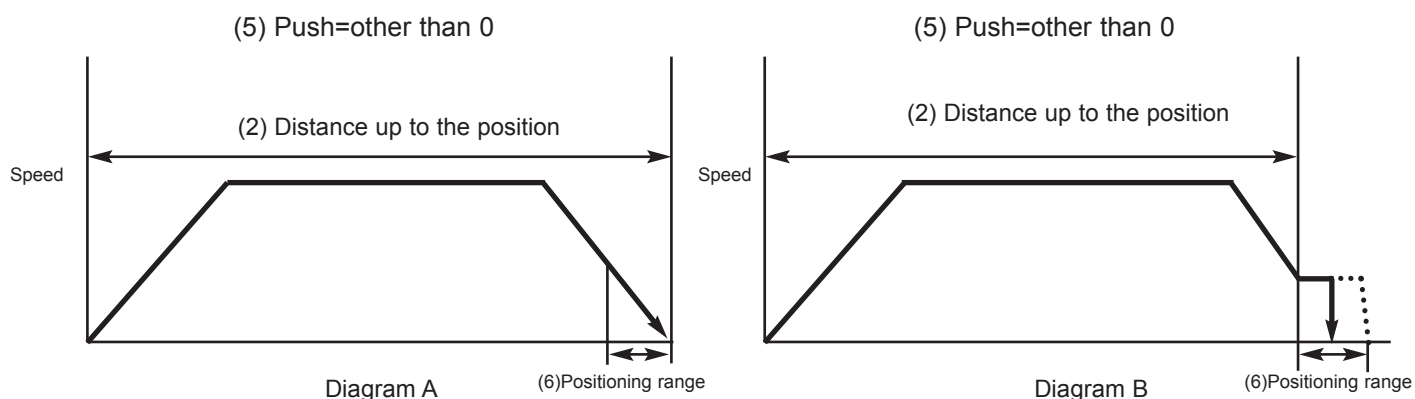
- Positioning complete signal will output when the actuator arrives at the designed position in the point table.

The initial value is set as 0.1mm (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.



#### (7) Acceleration only MAX

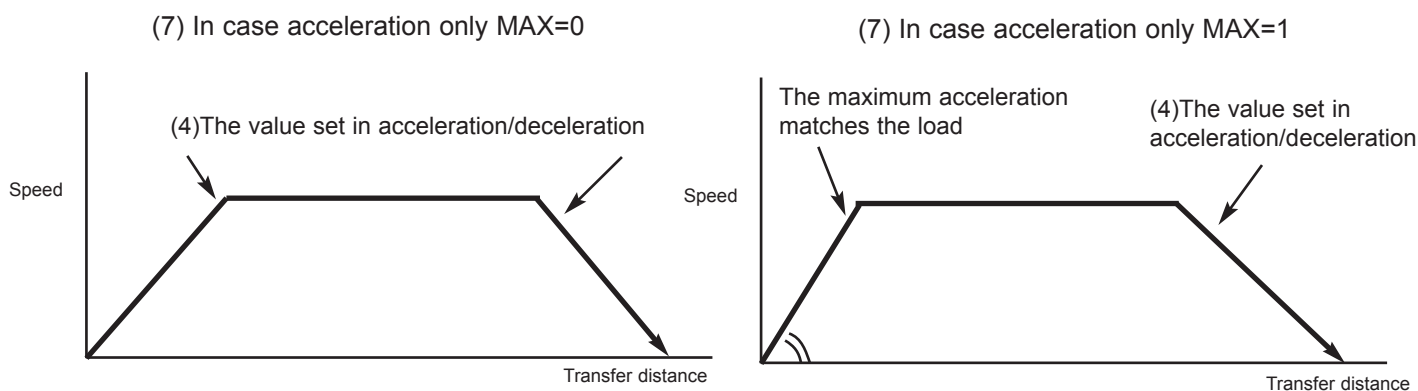
- Selects either the assigned acceleration or the maximum acceleration. Inputs are either 1 or 0. The initial value is set as 0.

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.

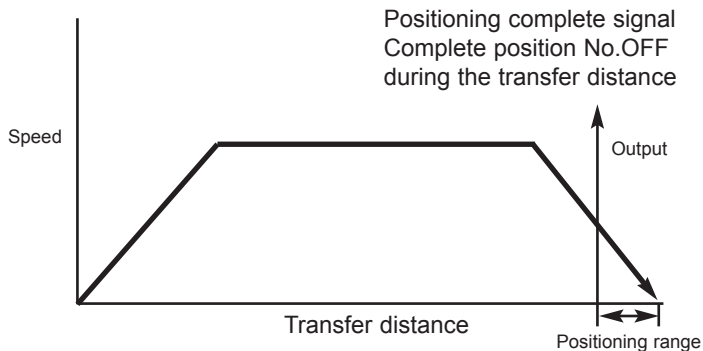


# 3. Data Input (Basic)

## 3-2 Mode Explanation

### 3-2-1 Positioning Mode

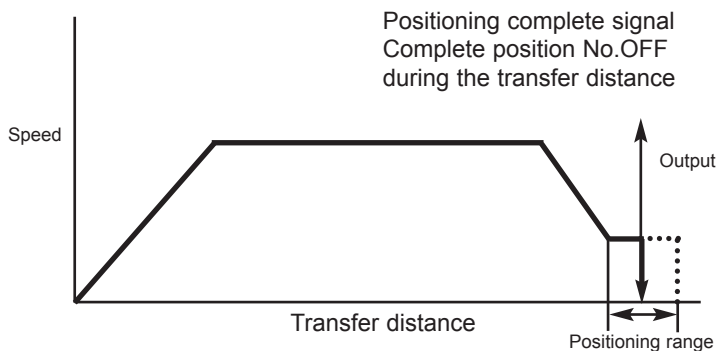
Push=0



(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. 255msec is the default value.

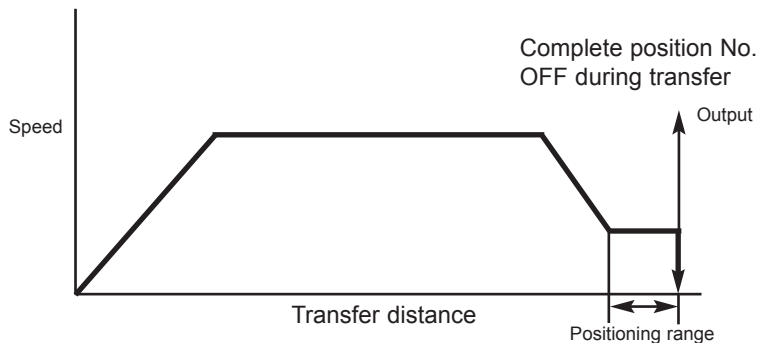
#### Warning:

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

Caution: The low speed during push movement is fixed and can not be increased.

### 3. Data Input (Basic)

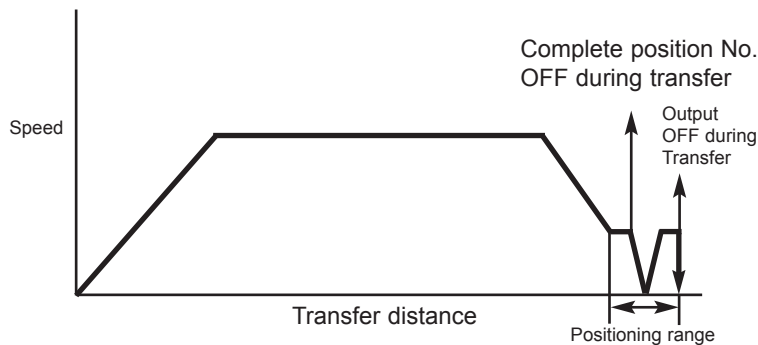
#### (2) When push fails (blank shot)



(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.

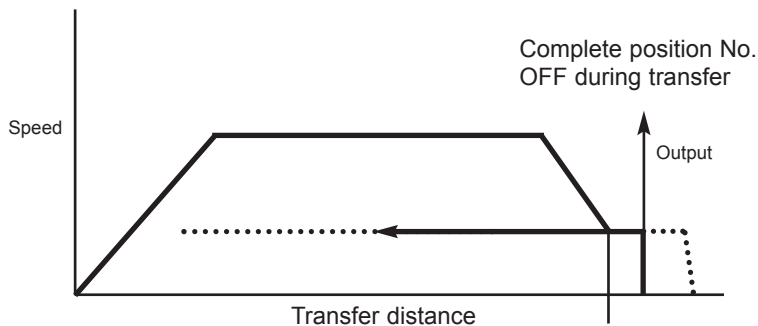
#### (3) Upon push, the moving work increases.

##### 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.

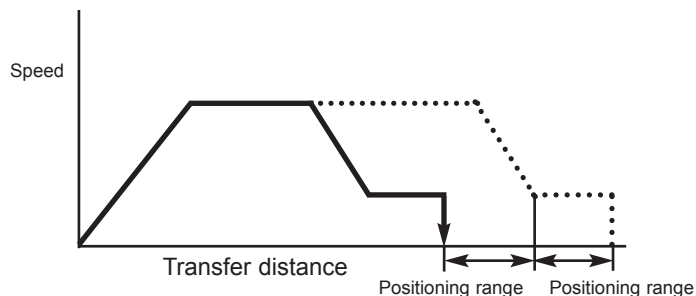
##### 2. When the work moves in the opposite of push direction (when the actuator is pushed back due to a reaction force from work)



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.

### 3. Data Input (Basic)

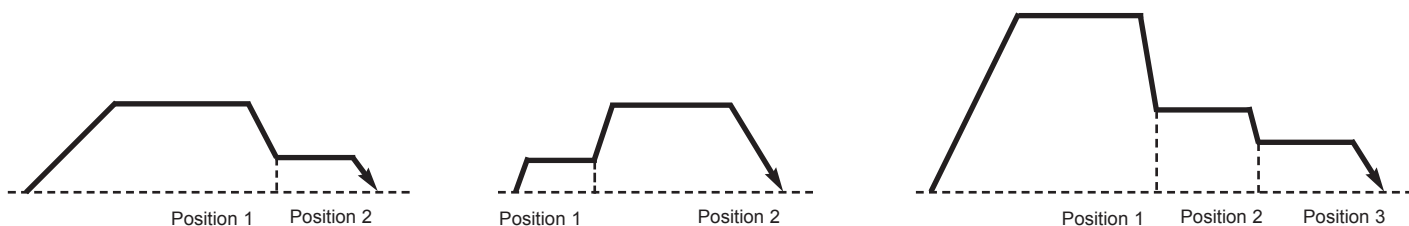
#### (4) When the input value of positioning width is wrong



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

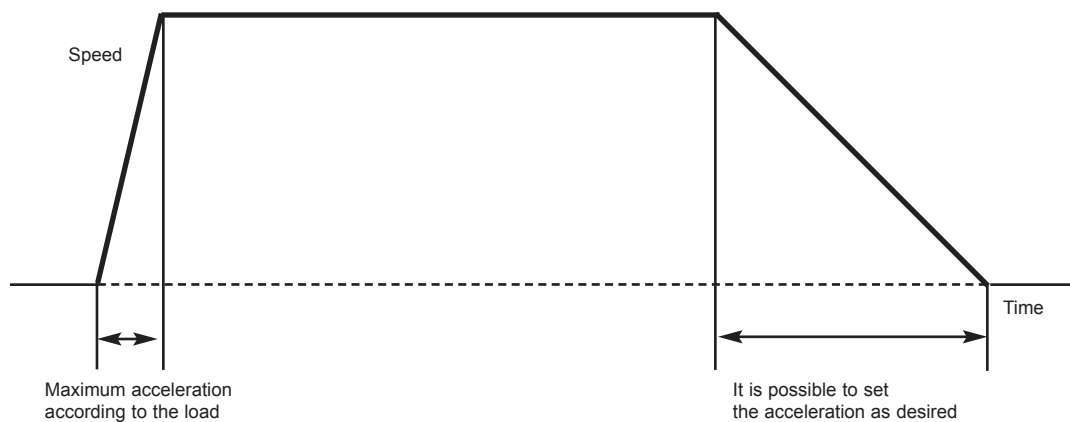
#### 4-2-3 Speed Change Movement During Transfer

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.



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

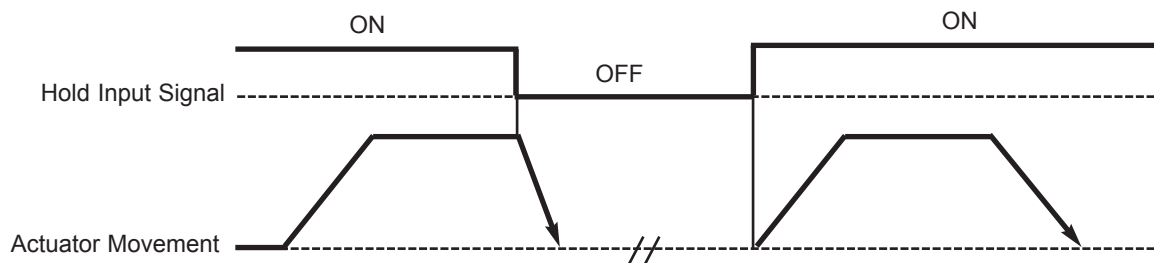
By inputting 1 into "MAX ACC Flag" the position data table, the transfer movement may operate with a variable range of acceleration and deceleration values. The acceleration value is the maximum speed that matches the load. The deceleration value is the value input in the "ACC" of the position data table.



### 3. Data Input (Basic)

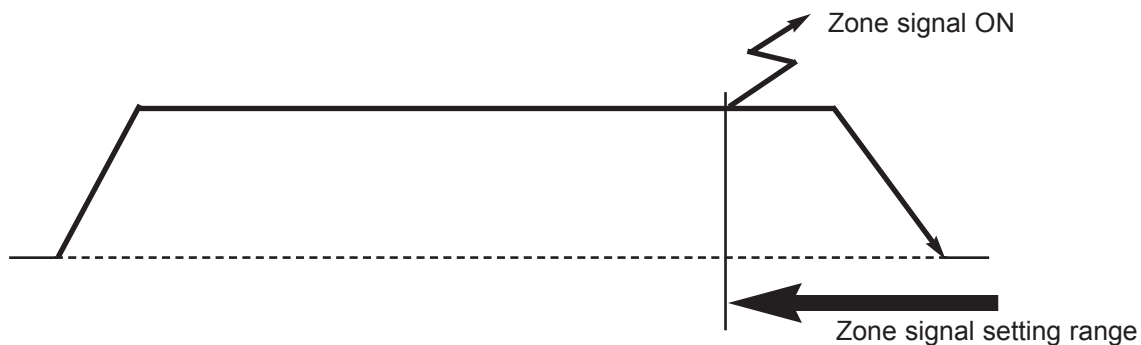
#### 3-2-5 Hold Input

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.



#### 3-2-6 Zone Signal Output

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

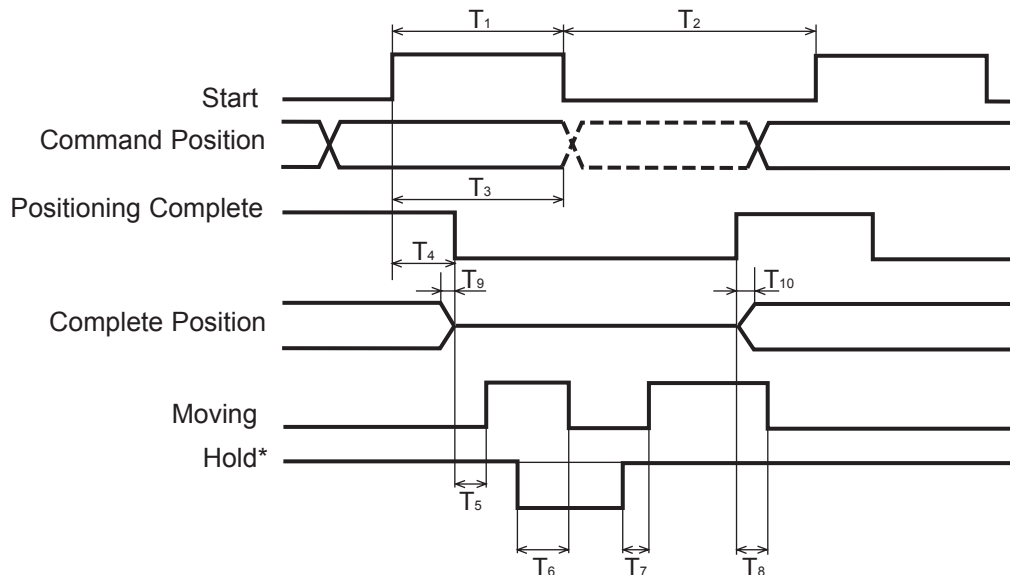


#### 3-2-7 Homing

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. Data Input (Basic)

#### 3-3 Timing Chart



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

\*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.

# 4. Application

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## 4-1 Power-Up (Standard Specification)

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

### Power-Up

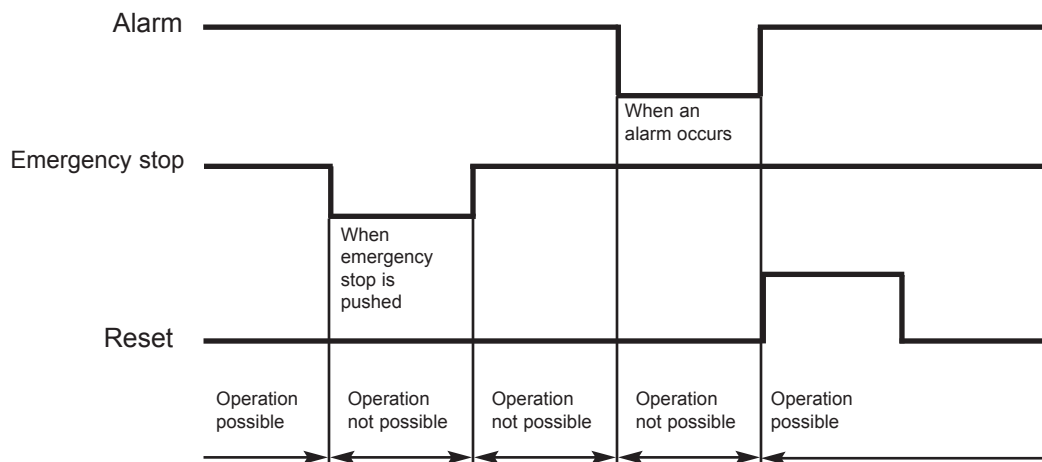
- (1) Connect the motor · brake cable and encoder cable to the controller.
- (2) Connect the upper PLC to the P I/O Connector using the attached flat cable.
- (3) When connecting more than 2-axes, address each controller by using the dip switches.  
For details, please refer to the “specifications” section under the dip switch settings.
- (4) Supply main power to the controller terminal board.
- (5) Supply P I/O Power (24V). (Input COMIA or COMIB. Output across COMOA and COMOB)
- (6) **Turn the P I/O Hold Input ON**
- (7) 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 62 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 1msec. As for signal to the Input I/O, please execute after the Positioning Completion Signal turns ON after power-up.

# 4. Application

## 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. Application

## 4-2 Absolute Reset Procedure (Absolute Specifications)

### Initial Homing

- (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, please refer to the “specifications” section under the dip switch settings. (page 15)
  - (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 1: The absolute actuators are the only actuators that can operate using E-Con Absolute specification.  
The standard actuators can not be used with the absolute controllers.

# 4. Application

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

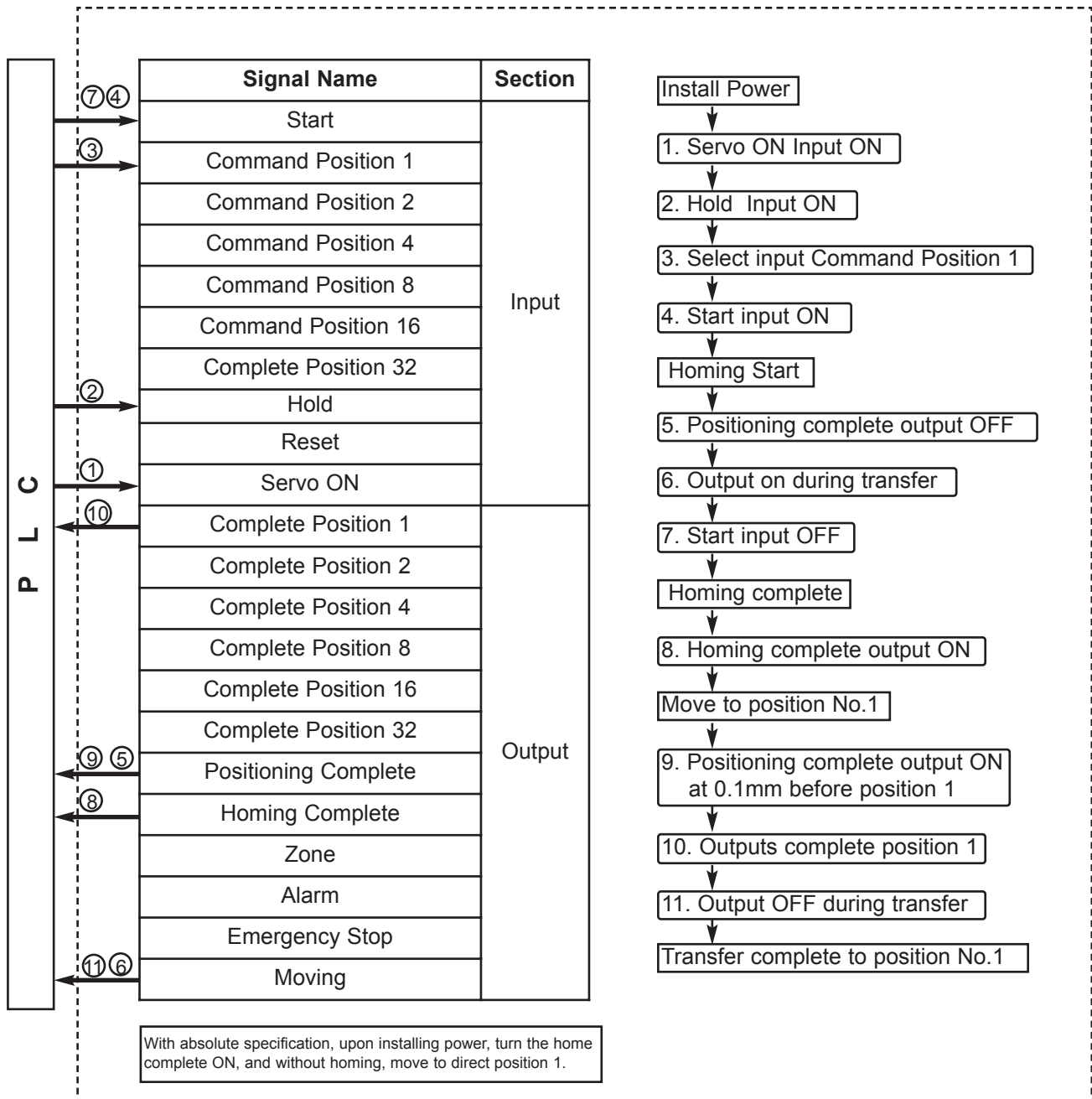
Operation application example:

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

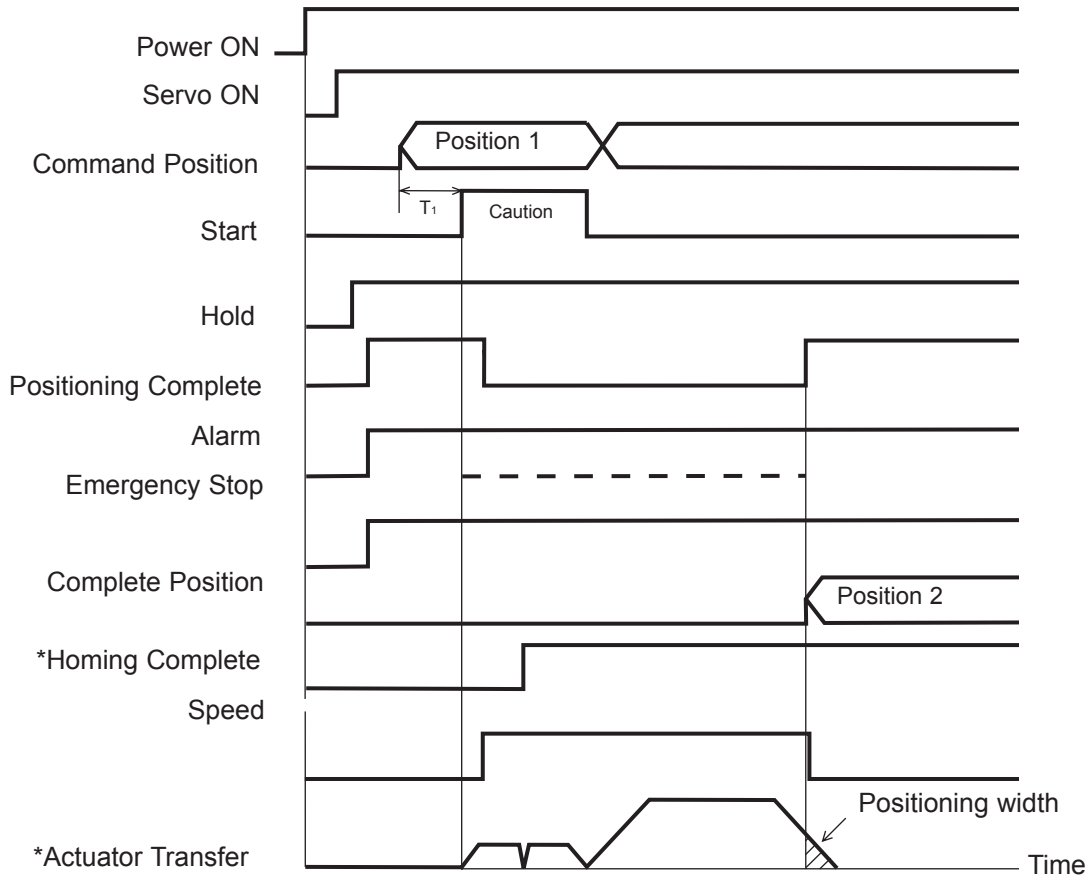
Position data table (column with dark line indicate the input insert)

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



# 4. Application



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 6msec      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.

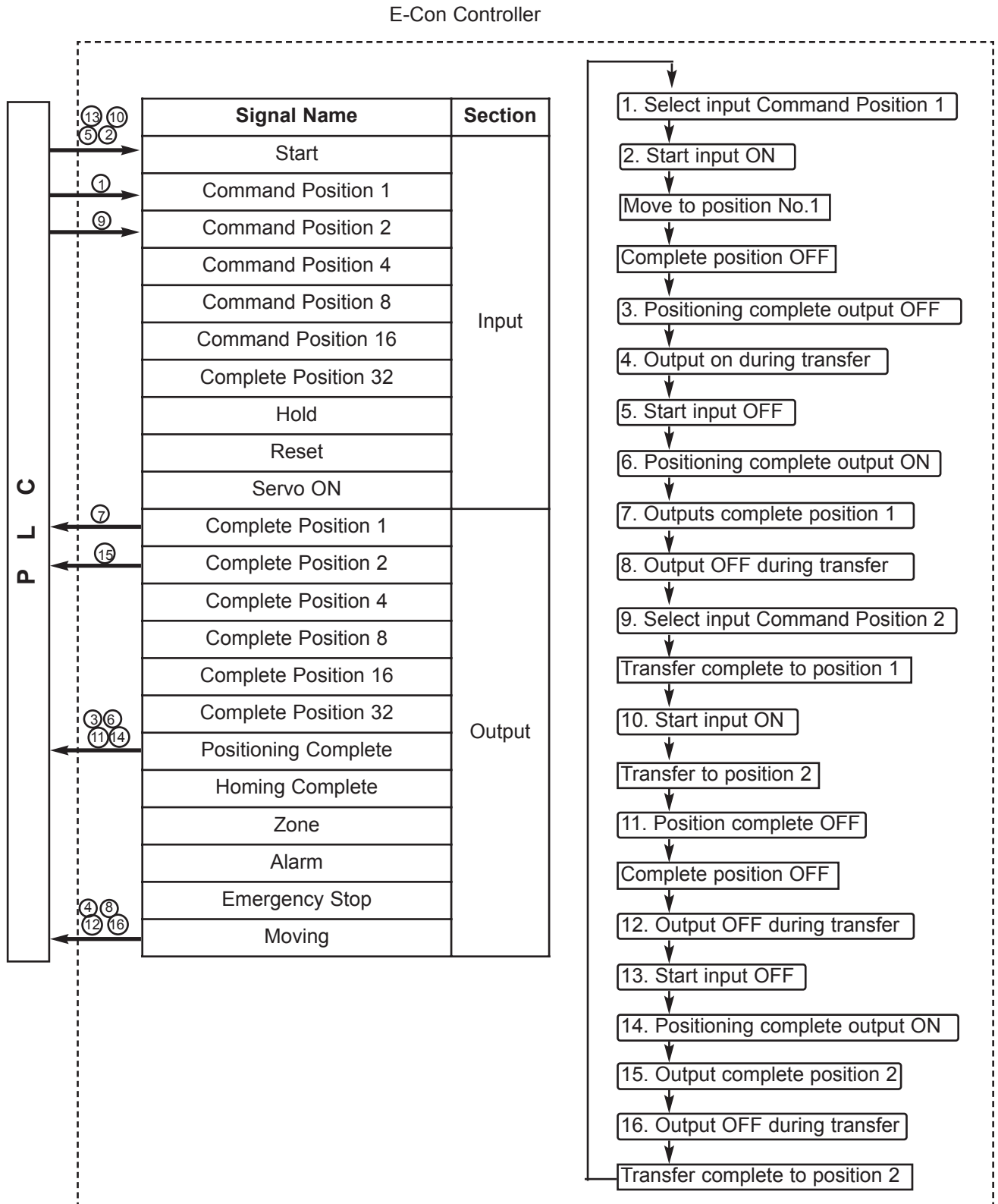
**Caution:** Positioning complete Output will turn OFF once the start signal turns ON.  
 You may execute the Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.  
 As the diagram below shows, if you leave the Start Input ON, the Positioning Complete Output will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

The diagram shows a Start signal (top trace) that is held ON. The Positioning Complete output (bottom trace) remains OFF throughout the entire duration of the Start signal being ON, even after the actuator has completed its movement. A time interval of 'Under 1msec' is indicated for the Start signal's rise time.

# 4. Application

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

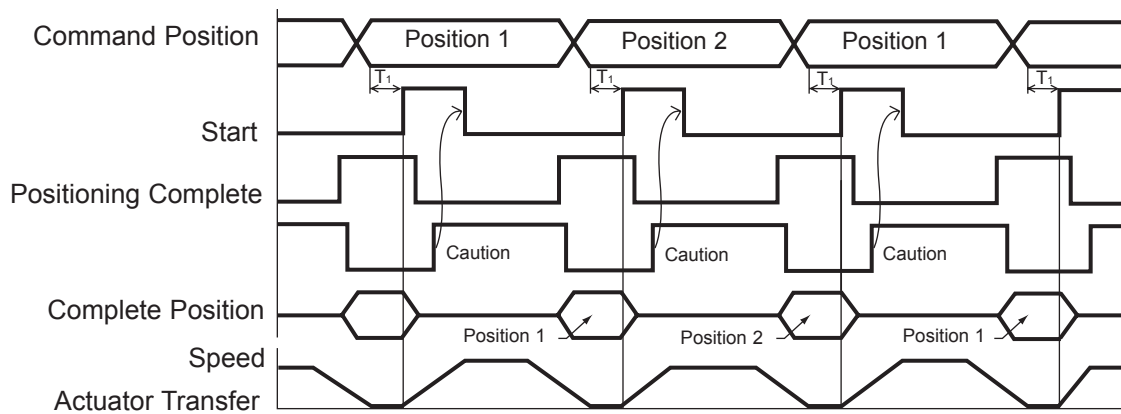
Movement example: Reciprocate 2 positions. Assign the position 1 at 250mm from home, and Position 2 at 100mm from home. Set speed to 200mm/sec for Position 1 and 100mm/sec for Position 2. For both positions, assign the positioning width to 0.



# 4. Application

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

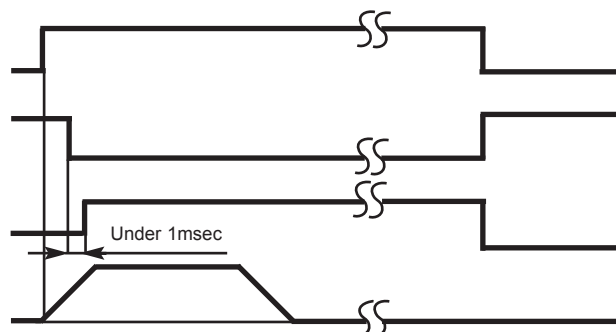
(However, please consider the scan time of the upper controller.)

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 Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.**

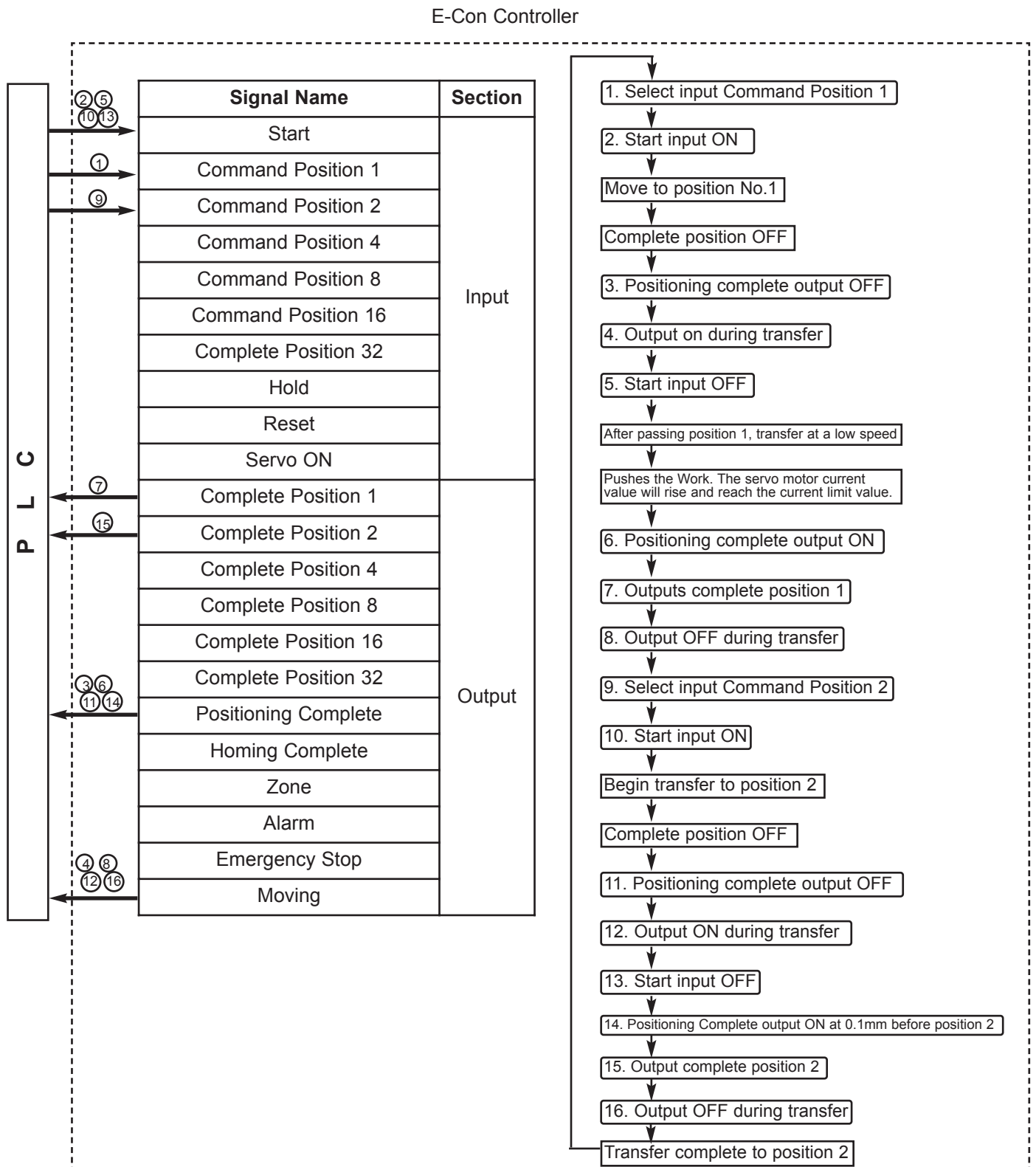
**As the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.**



# 4. Application

## 4-5 Push Mode

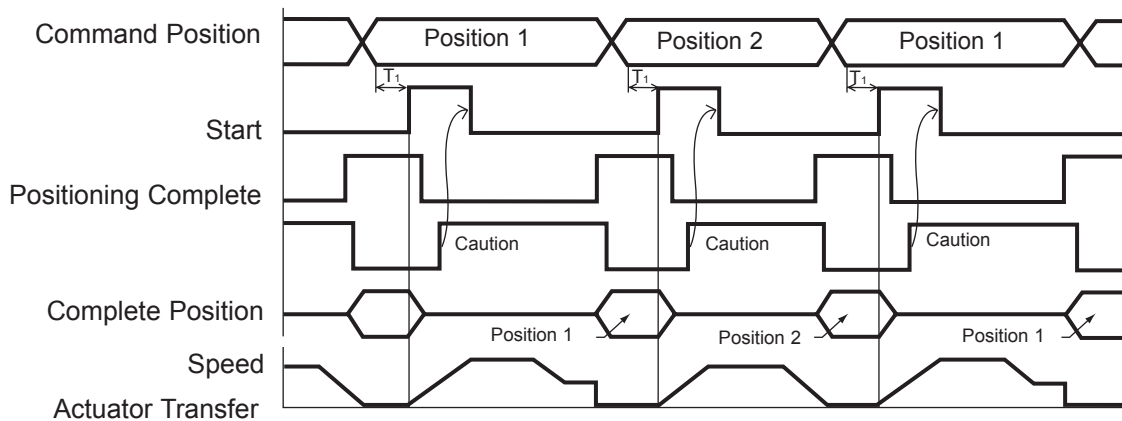
Movement Example: Use via Push Mode and Positioning Mode. Assign Position 1 to 280mm from home and Position 2 to 50mm from home. Move to Position 1 in Push Mode. Use the Push Mode to move to Position 2 (match to opposite motor side direction). Assign the maximum push to 2mm, and the current limit value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



# 4. Application

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
⋮						

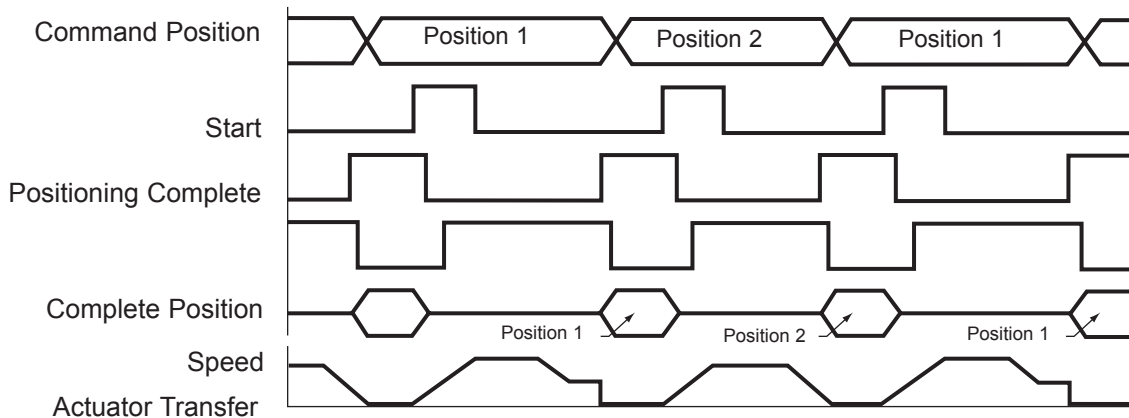


T1: Over 6msec      Time from Command Position Select Input to Start Signal ON

(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.



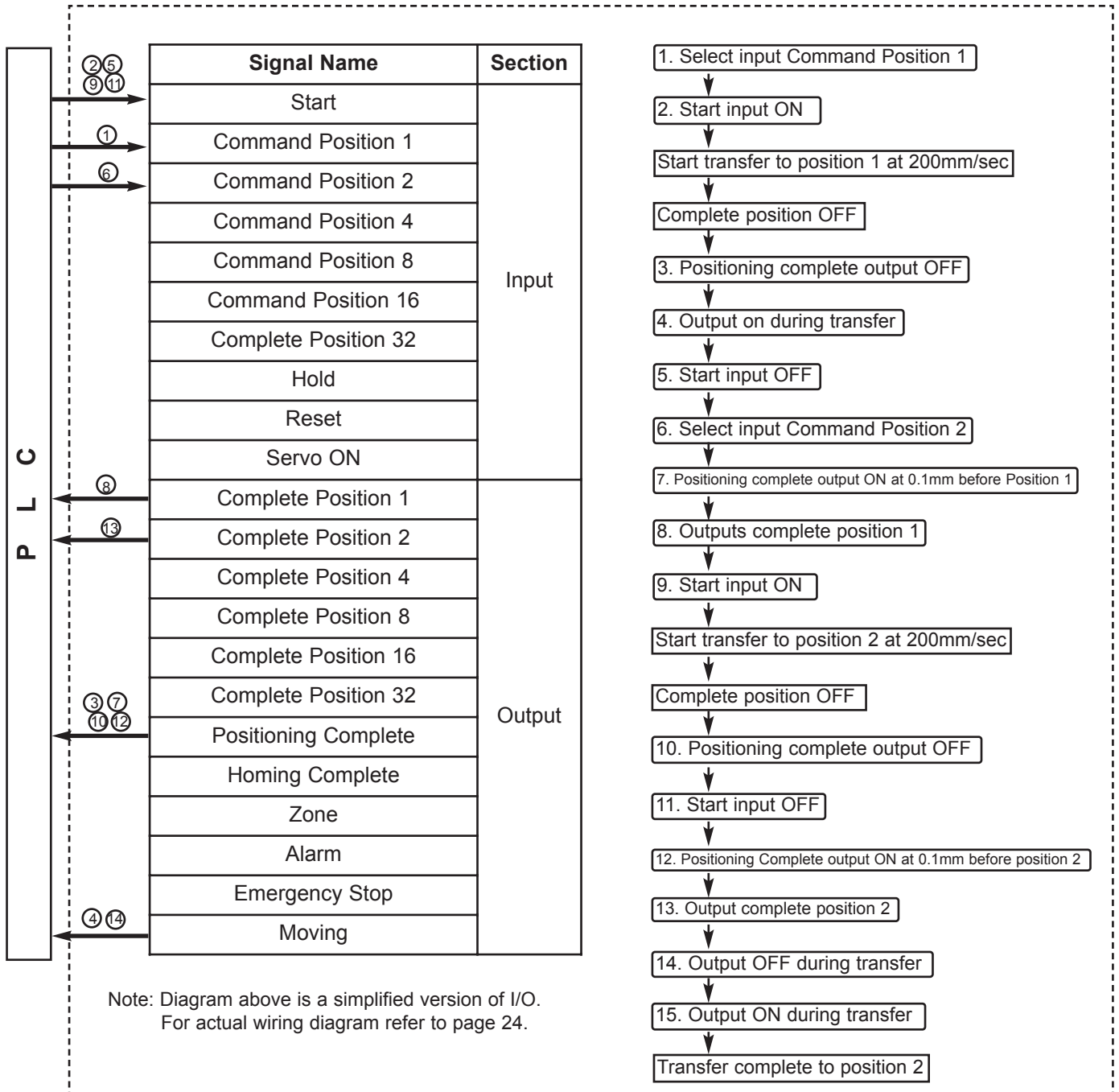
# 4. Application

## 4-6 Speed Change Movement During Transfer

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

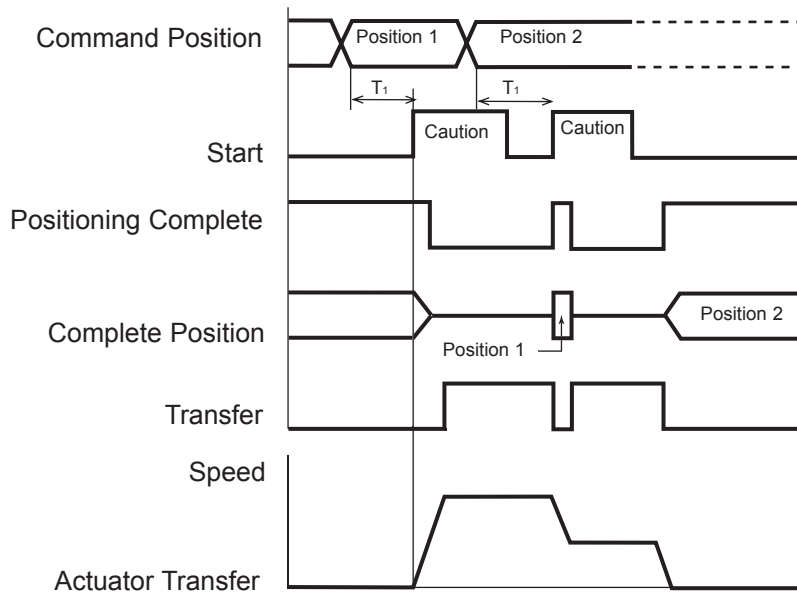
E-Con Controller



# 4. Application

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 6msec      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.

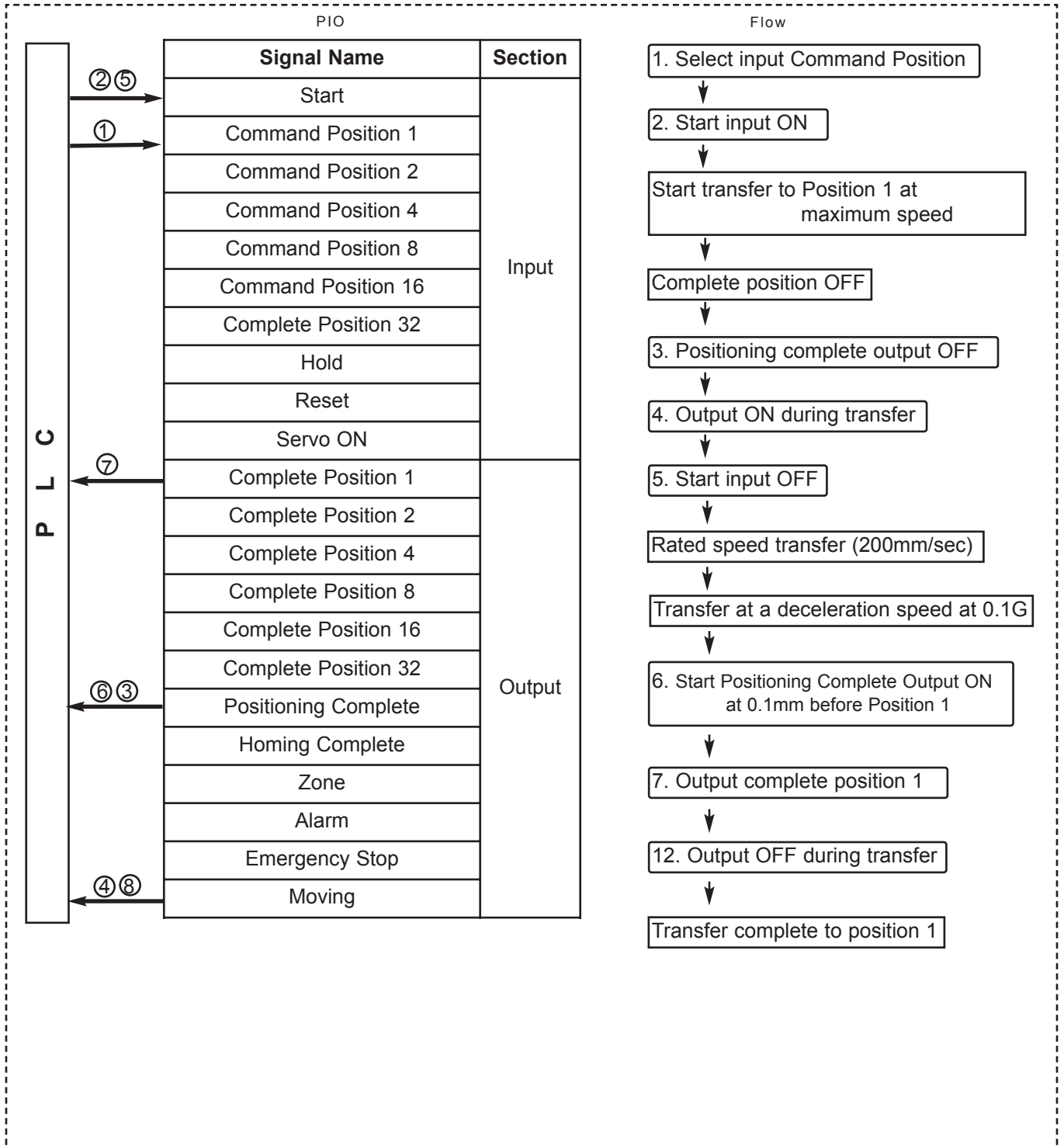
# 4. Application

## 4-7. Movement Using Different Acceleration Value • Deceleration Value

Movement Example: Positioning is executed at a speed of 200mm/sec to a location (Position 1) 150mm away from home. Acceleration is transferred at a maximum acceleration and deceleration of 0.1G that is matched to the load.

Method: By inputting "1" into MAX ACC of the position data, the acceleration will be the maximum acceleration for the load.

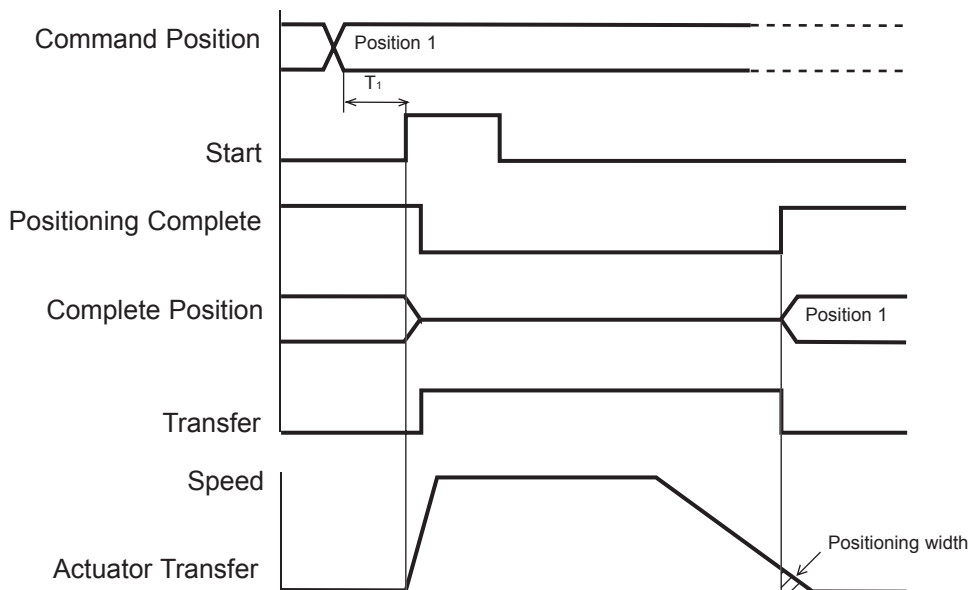
### E-Con Controller



# 4. Application

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

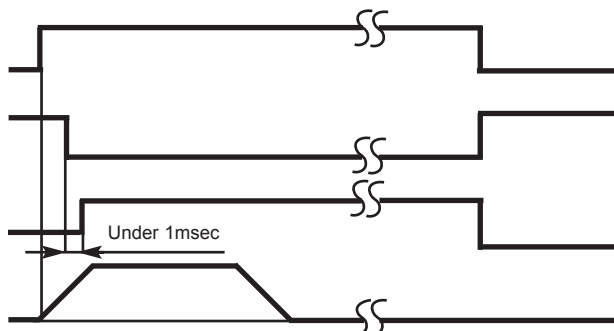
No.	Position	Speed	Acc/Dec	Push	Positioning Width	Acc. only Max
0	*	*	*	*	*	*
1	150	200	0.3	0	1	0
⋮						



$T_1$ : Over 6msec      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 may 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.

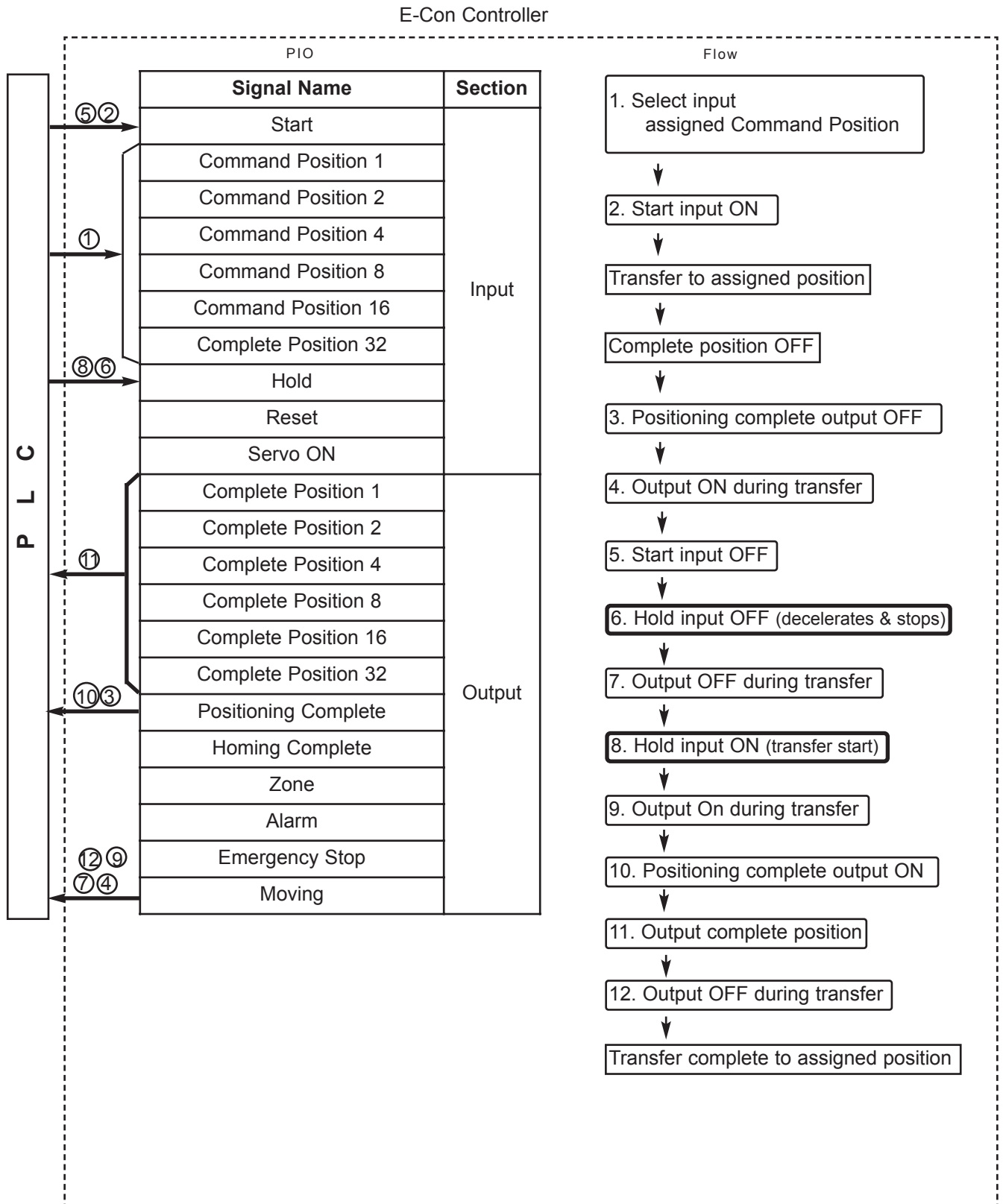


# 4. Application

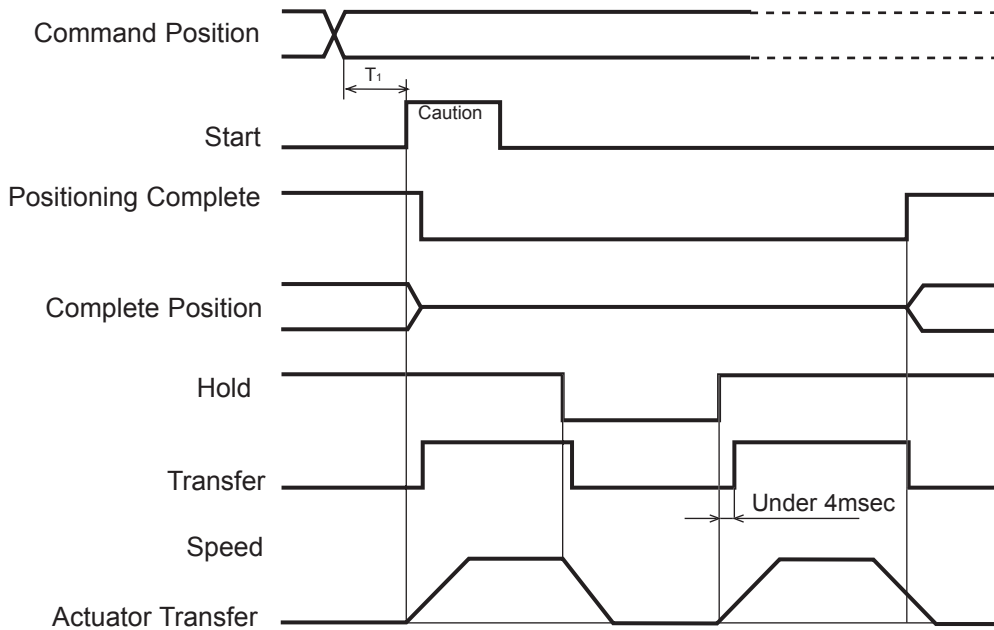
## 4-8 Hold

**Movement Example:** Temporary stops the movement of the actuator.

**Method:** Uses the Hold Input.



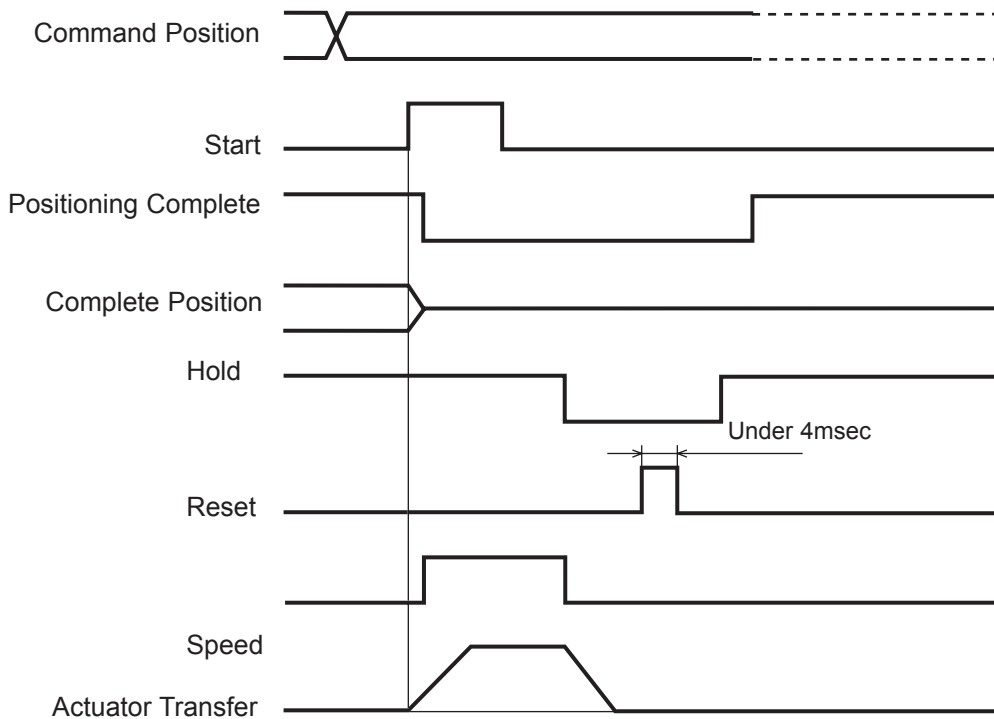
# 4. Application



$T_1$ : Over 5msec      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. Application

## 4-9 Zone Signal Output

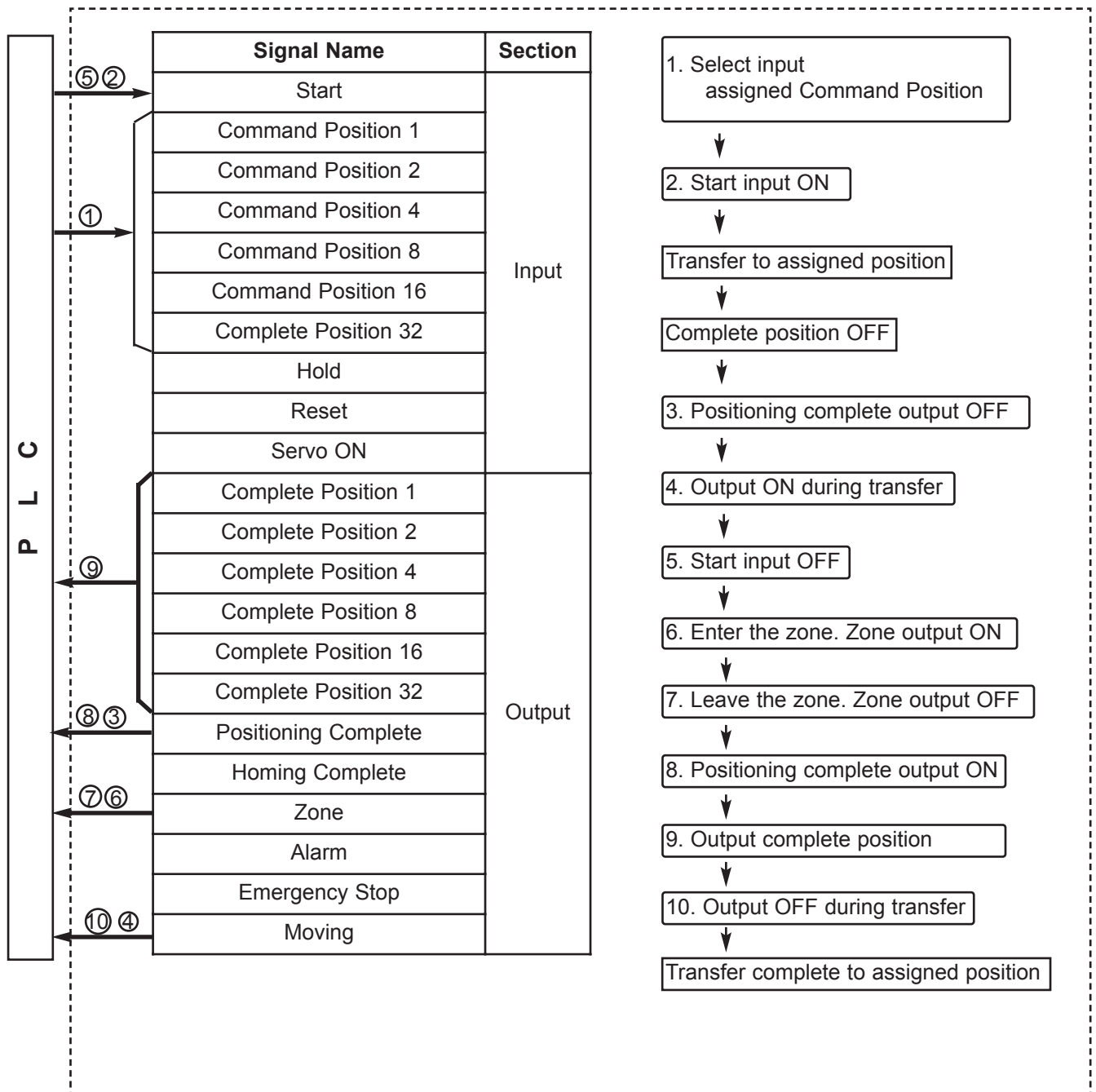
Movement example: During motion, the Zone Signal output will turn ON from 40mm from home to position 120mm from home, then turns OFF ( $40\text{mm} \leq \text{Zone Signal Output} \leq 120\text{mm}$ ).

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

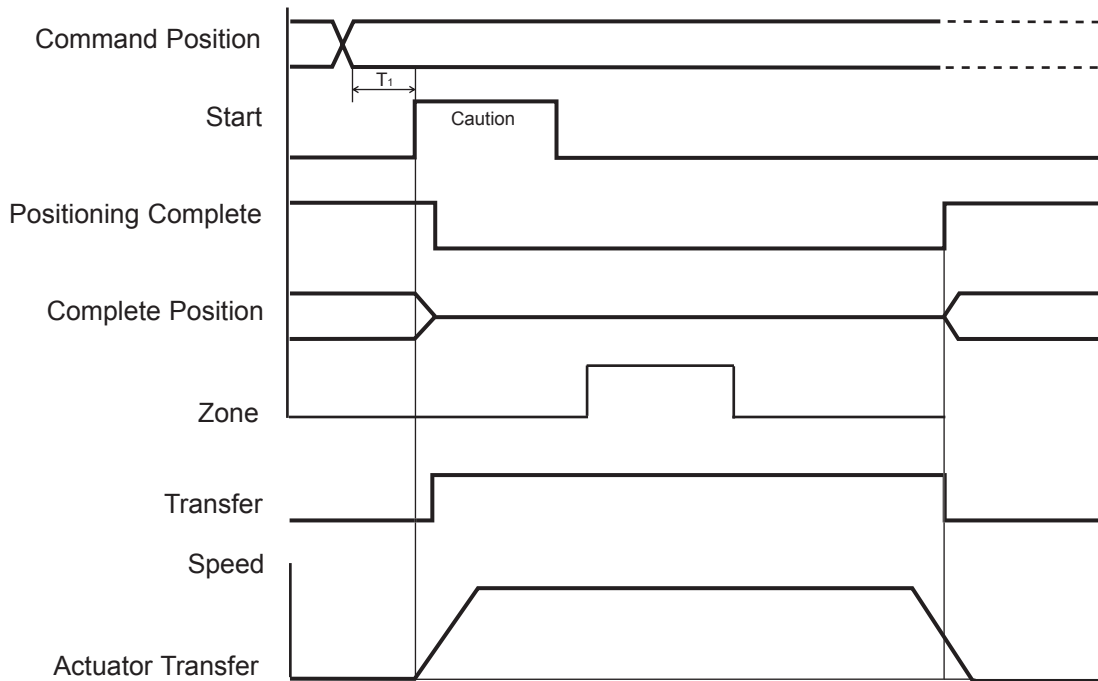
Input as the following:

Zone Boundary value +	120
Zone Boundary value -	40

E-Con Controller



# 4. Application



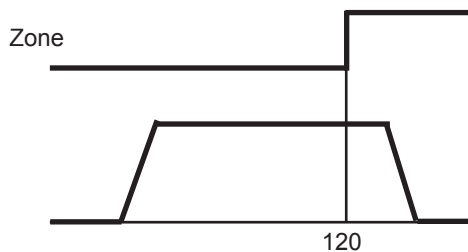
T1: Over 6msec      Time from command position select input to start input ON

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

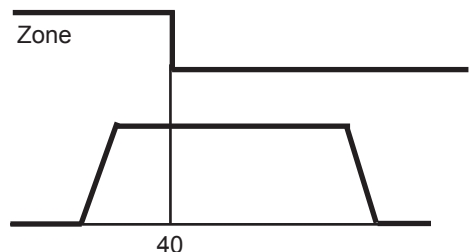
Caution: Positioning complete Output will turn OFF and moving output will turn on once the start signal turns ON. Please execute Start Signal OFF only after confirming that moving out put turns ON with Start Signal ON status.

Other zone output (example):

Zone output at over 120



Zone output at under 40



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

Zone Boundary value +	40
Zone Boundary value -	0

# 4. Application

## 4-10 Transfer to Home

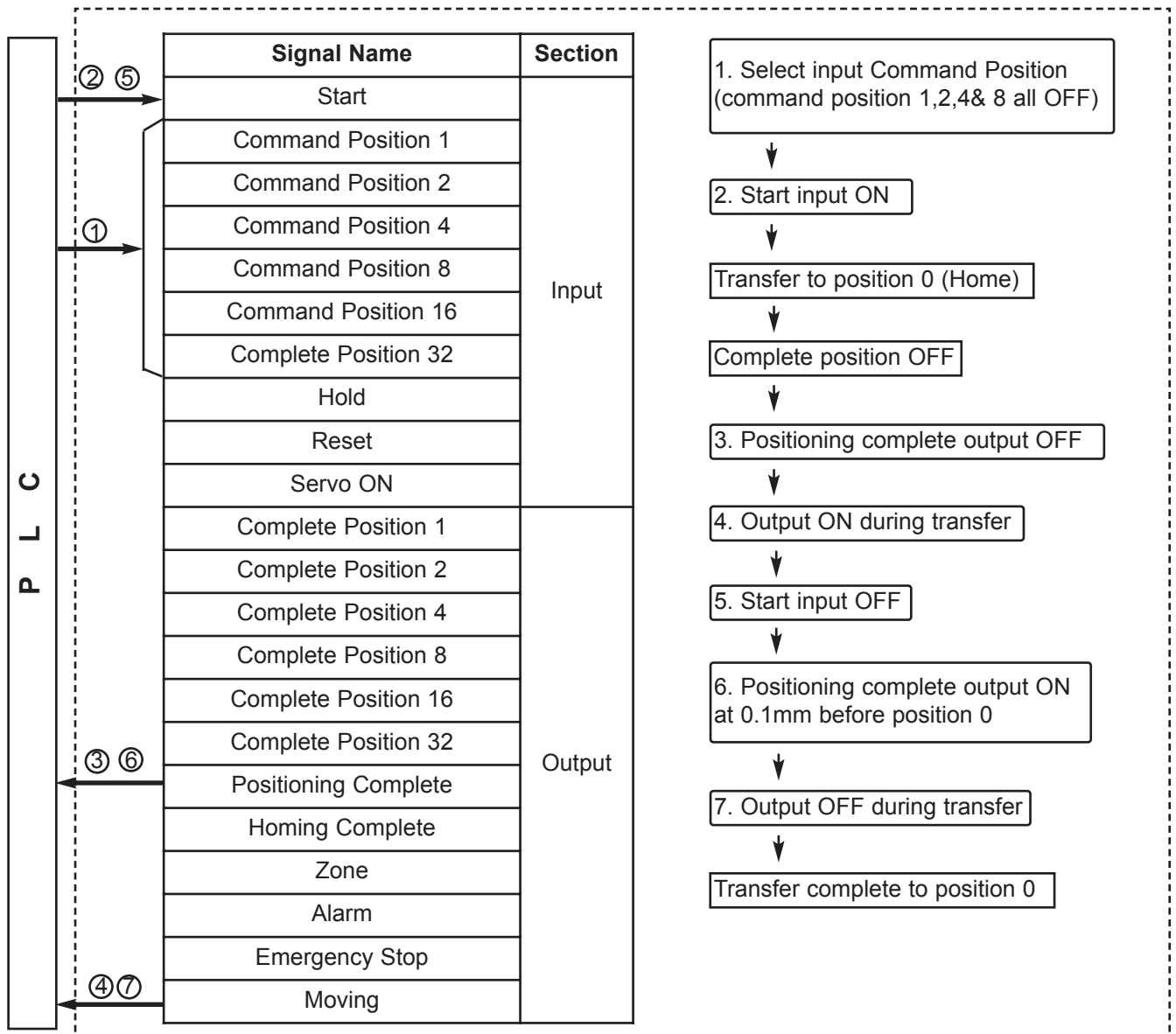
**Movement Example:** You can not home using the position data table (position 0 at 0mm). Homing occurs when controller is told to move to a point when the actuator has not been homed yet.

**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.

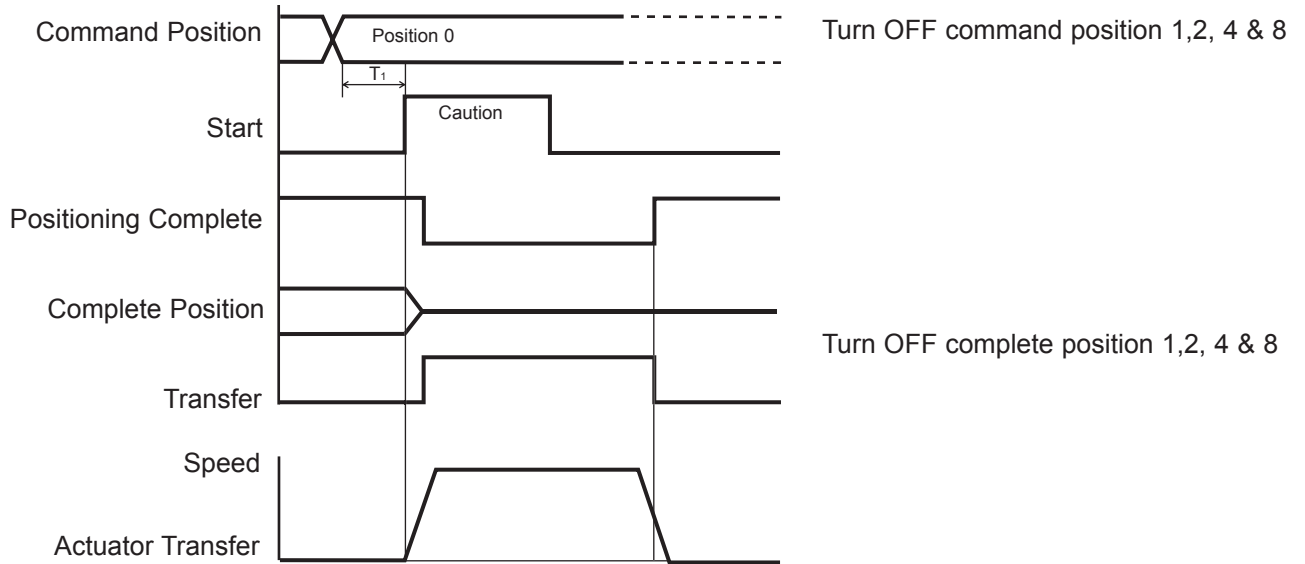
Position Data Table (Columns with the thick lines indicate the input insert)

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

E-Con Controller



# 4. Application



$T_1$ : Over 6msec      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 0mm from home to position 0. The data of distance 0mm from home is input to position 0mm 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 may 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.**

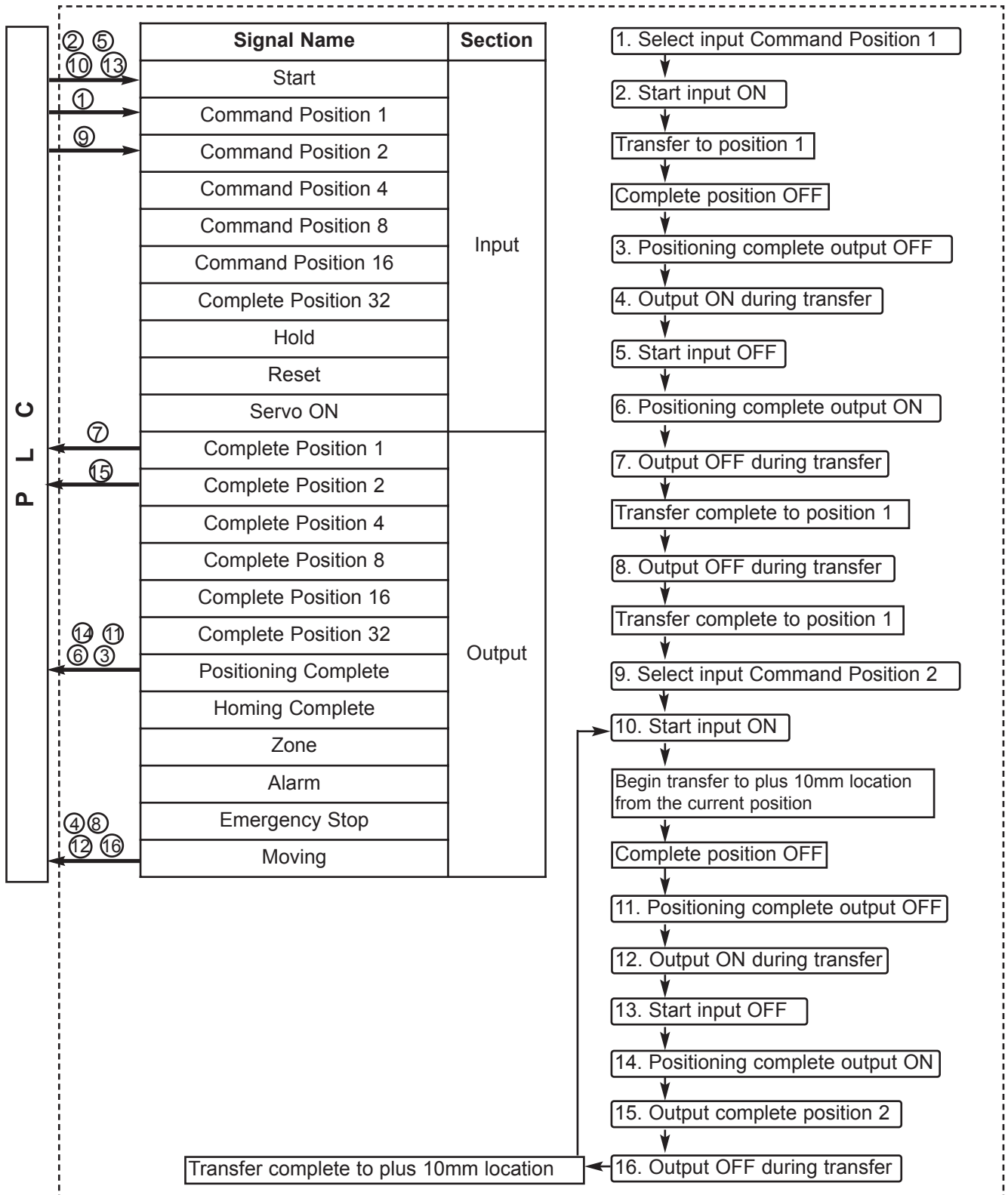
The diagram shows a sequence of events where the Start signal remains ON. The Actuator Transfer signal completes its cycle, but the Positioning Complete output signal does not turn ON. Only after the Start signal is turned OFF does the Positioning Complete output signal turn ON. A note indicates a delay of 'Under 1msec' between the start signal turning OFF and the positioning complete output turning ON.

# 4. Application

## 4-11 Incremental Movement in Relative Coordinate

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

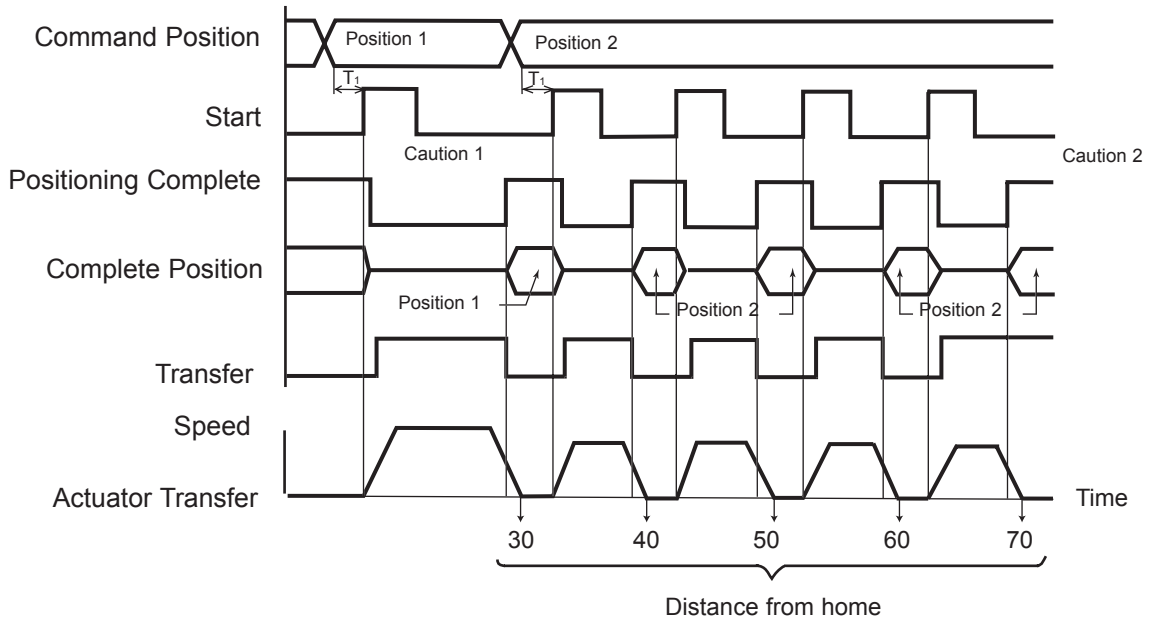
E-Con Controller



# 4. Application

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

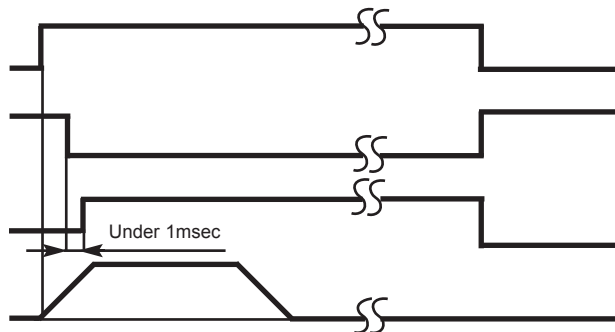
No.	Position	Speed	Acc/Dec	Push	Positioning Width	Acc. only Max
0	*	*	*	*	*	*
1	30	100	0.3	0	0.1	0
2	10	20	0.3	0	0.1	0
⋮						



T1: Over 6msec      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 soft limit exceeds parameter value, the positioning complete signal will turn ON. In addition, the alarm output will not change.

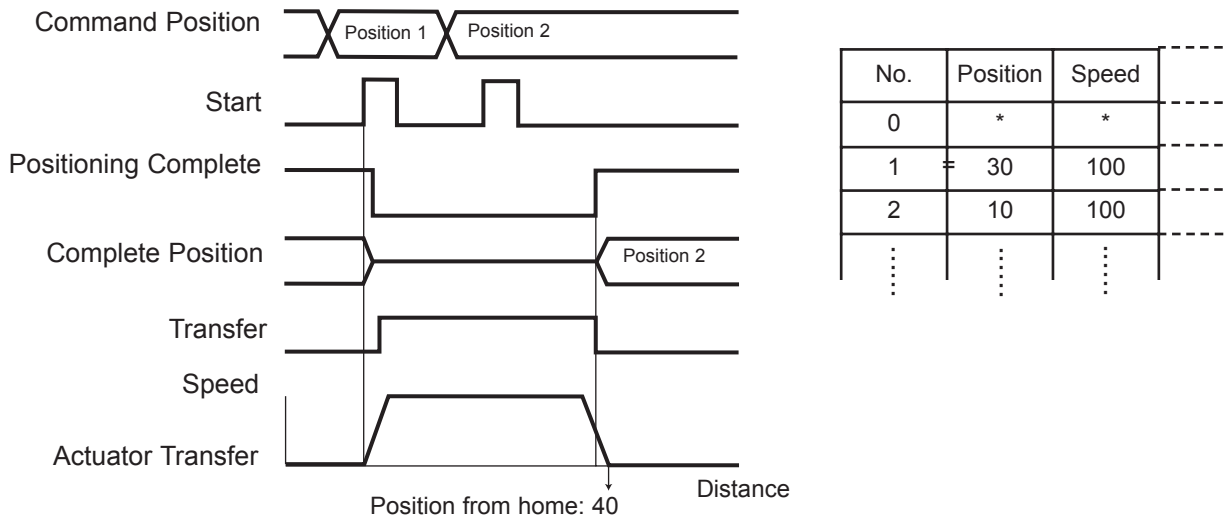
# 4. Application

## 4-12 Caution Regarding Relative Coordinate Assign

### (1) Caution During Positioning Movement

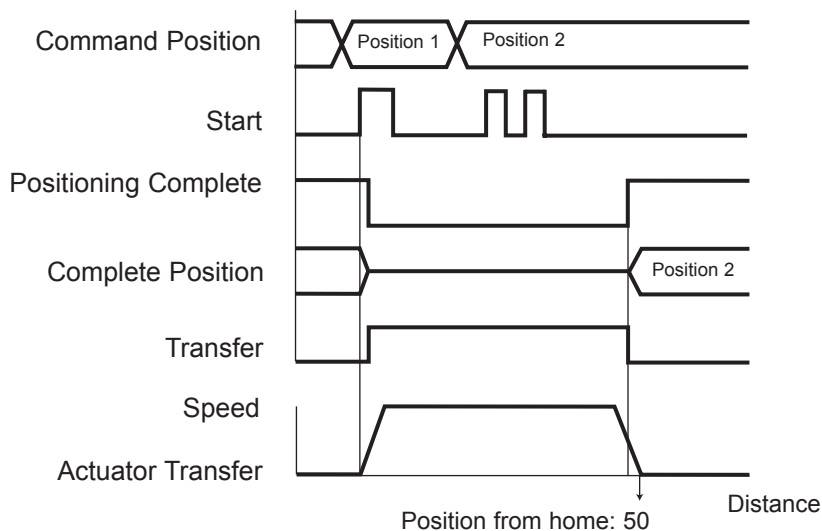
When selecting a relative or incremental position through the I/O and toggling the Start Input, during motion towards another point, the distance of the next point selected will be added to the initial position of the point. If the next point is in the negative direction relative to the first point, 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 40mm away from home.



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 50mm away from home.

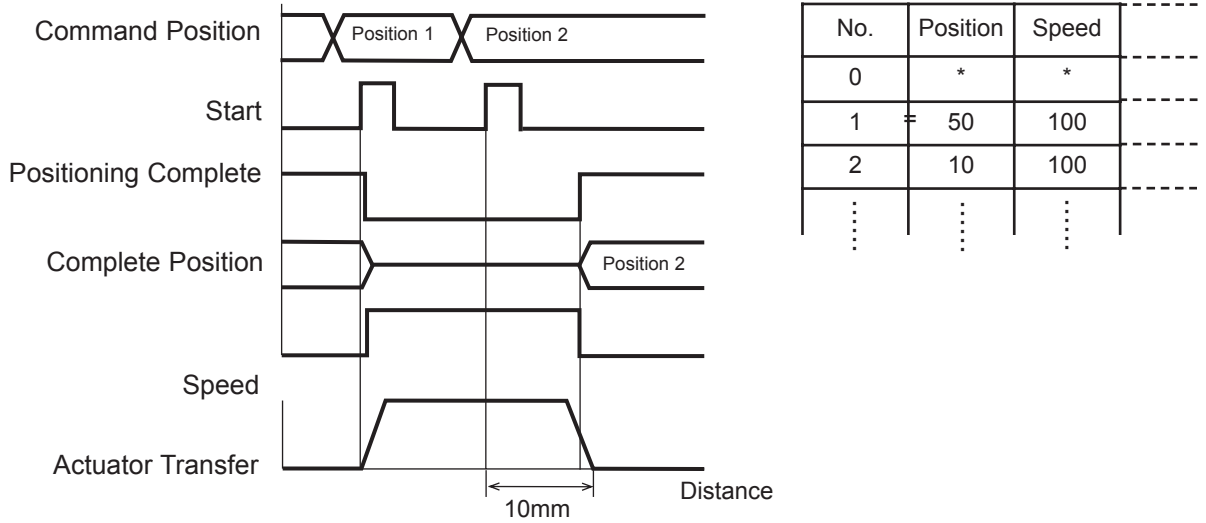


### (2) Caution During Push Movement

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.

# 4. Application

Example: The Start Input Position is executed during movement towards Position 1 during Push Mode and the actuator moves to a position that is 10mm away from the Input Position 1. Total displacement is 60mm from home.



### (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.

## 5. Parameter List

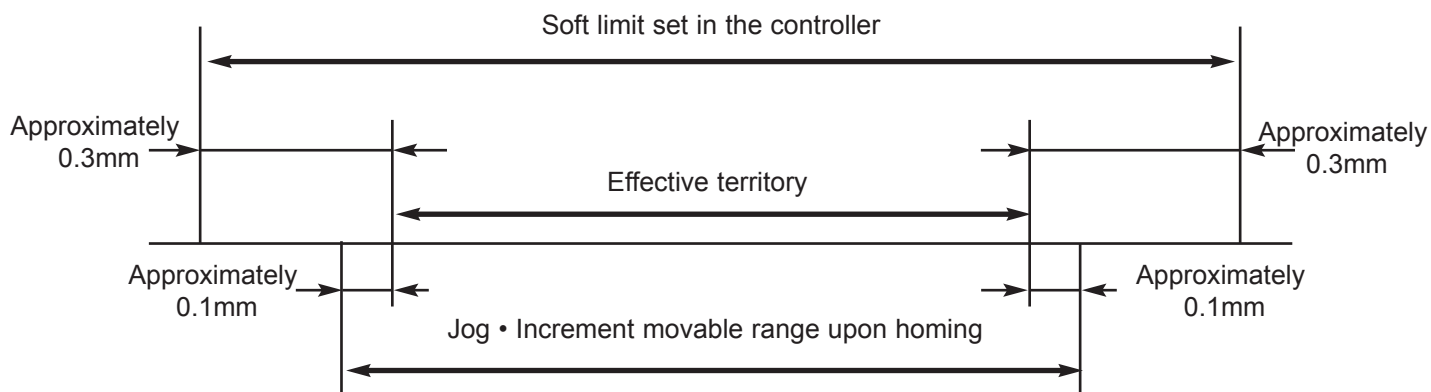
Zone Limit + side (mm)	Maximum value of zone output.
Zone Limit - side (mm)	Minimum value of zone output.
Soft Limit + side (mm) (maximum = stroke length)	Sets the soft limit value in the plus direction.
Soft Limit - side (mm)	Sets the soft limit value in the minus direction.
HOME Direction (0:Motor/1: Reverse)	Sets the homing direction.
Push Recognition Time (msec) (default = 255mm)	During a move, if the push % is sustained for this amount of time, the position complete output turns ON.
Servo Gain No.	Sets the servo gain.
Initial Speed Setting (mm/sec)	Initial speed value of position data table.
Initial Acceleration Setting (G)	Acc in position data table.
Initial Position Band (mm)	Acc in position data table.
Acceleration Only Max's Flag Initial Amount	MAX Acc initialization of position data table.
Current limit value during positioning stop (%)	Determines the stop maintenance after positioning
Current limit value during homing (%)	Sets the current limit value during machine end impact due to homing (at the time of shipment 100%)
Movement flag during stop	Sets effect · no effect of dynamic brake during stop. 0: no effect 1: Effect (at the time of shipment, 1)

\* : To change the value, please contact your IA representative.

To change the soft limit on the user side, please set a value that extends 0.3mm on the outer side of the effective territory.

Example: In case of setting the effective territory from 0mm~80mm

Soft limit + side 80.3  
Soft limit - side -0.3



# 7. Alarm List

- In case you wish to change the home direction, position data already input will all clear. As needed, please record the data.

Caution: Upon executing parameter changes, please cycle the controller power.  
 The parameter will overwrite but some may not be effected by simply turning OFF · ON the emergency stop switch and PORT switch.

## 7. Alarm List

When an alarm occurs, ALM of the Controller LED Display will blink. The alarm content can be understood by the combination of the PIO Alarm Output and Complete Position Output.

Alarm	Complete Position No.				Alarm Content	Alarm Code*
	8	4	2	1		
○	/	/	/	/	Normal	/
●	●	○	●	○	CPU abnormal	0F1
●	●	○	○	●	Wrong EEPROM Data Setting	0B0, 0B1
●	●	○	○	○	Homing abnormal	0BE
●	○	●	●	●	Servo malfunction	0C0
●	○	●	●	○	Electric conversion area abnormal	0B8~0CA
●	○	●	○	○	Excessive deviation abnormal	0D8, 0DC
●	○	○	●	●	Excessive load abnormal	0ED
●	○	○	●	○	Encoder breakage	0E4~0E7
●	○	○	○	○	Corruption of EEPROM data	0F8

1. Cycle power to clear the alarm.
2. If the alarm does not clear by the above procedure, the controller or the encoder cable may be damaged.

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

## 7. Alarm List

If a malfunction is encountered while using the PC software or teaching pendant, an error will appear. Please refer to the Error Table below.

Caution: When connecting to the host using the SIO, please make sure to refer to the error code list of the "Robo Cylinder Communication Protocol List."

Code	Error Description	Common Solutions
040	Emergency Stop	Emergency stop status.
05A	Transmission Error	Abnormal Communication, Check for noise. Inspect all serial ports and cables involved.
05B	Transmission Framing Error	
05C	Transmission Time out Error	
05D	Start Text Error	
05E	End Text Error	
07F	BCC Error	
061	FNCCHR, W Address Error	Serial string needs to be formatted correctly.
062	1 Operand Error	Incorrect Data Command (possibly an operation not allowed with the controller type).
063	2 Operand Error	Incorrect Data Command (possibly an operation not allowed with the controller type). In case of another linked controller, there could be parameter data which exceeds 2000rpm set by SW7-ON, and SW8-off located on against the controller. Incorrect Data Command Rejection (could be an operation not allowed with that controller type).
064	3 Operand Error	Incorrect Data Command (possibly an operation not allowed with the controller type).
067	BCC Error	Incorrect Data Command. Characters other than 0~9 are included in the BCC.
070	RUN-OFF, Transfer Command	Execution Requirement Incompatible Command Rejection (possibly due to External POP command).
071	No homing, PTP	
073	Servo ON, Error Reset	
074	Communication Error	
075	During homing, movement command	

## 7. Alarm List

0B0	Bank 30 Error (Parameter)	Execute a common parameter edit or initialize the controller.
0B1	Bank 31 Error (Point)	When release is not possible with the controller power supplied, you will need to either execute a common parameter edit or initialize the controller. Also, this error occurs when you try to execute a point through I/O in the data table that does not exist.
0BA	Homing Sensor not found	When homing, mechanic end is found before sensor was detected. Please check sensor, wiring
0BE	Homing Time out	Check physical connection of the motor and actuator. Actual movement may not be happening.
0BF	Creep Sensor not found	Found home sensor or mechanic end before creep sensor was detected while when homing. Check sensor, wiring, and for mechanical binding.
0C0	Excess Speed	Please reduce the payload and or speed.
0C2	Over Run (servo)	<p>Find over run sensor. Please check the following:</p> <ul style="list-style-type: none"> <li>· Exceeding of the valid stroke range by external force in the servo OFF status. (regular detection)</li> <li>· Exceeding of the valid stroke range by a forward jog at incremental encoder system. (coordinate not settled) (regular detection)</li> <li>· Exceeding of the valid stroke range due to connecting an actuator with a different lead from controller setting.</li> <li>· Abnormal homing operation of Incremental encoder system. Or by absolute set positioning fault, coordinate is out of alignment. Therefore, it doesn't stop at soft limit and exceeds the valid stroke range.</li> <li>· By soft limit setting fault, soft limit is set higher than the valid stroke limit. Therefore, it doesn't stop at the soft limit and exceeds the valid stroke range.</li> <li>· Regardless of valid stroke length, due to abnormal sensor behavior &amp; wiring, it is in the overrun sensor detection status.</li> <li>· Regardless of valid stroke length, due to a sensor related parameter (use/not use, a contact/b contact) setting fault, it affects the overrun sensor detection.</li> </ul>
0C8	Overcurrent	Motor circuit may have shorted, due to excessive load. This alarm will not clear unless you cycle power.
0C9	Excess Power Voltage	The load is too heavy. Check for mechanical binding.
0CA	Excess Heat	Ambient temperature may be too high.

## 7. Alarm List

0CB	Current Sensor Error	Abnormal current sensor off set
0CC	Control Voltage Error	Shortage of AC. Supply voltage below threshold.
0CD	Emergency Stop Relay Error	Need to change for mechanical binding.
0D8	Deviation Overflow	Please check the mechanical binding.
0DC	Excess Push Movement Range	Possible excess movement range during push movement.
0E0	Excess Load	Load may be too big. Please check for mechanical binding.
0E4	Encoder Transmission Error	This is the transmission error of encoder reception. Either the noise or the reception IC board may have broken down.
0E5	Encoder Reception Error	
0E6	Encoder Counter Error	This is the counter error of the encoder. This occurs when number of rotation exceeds 5000rpm.
0E7	No A, B and Z Feedback	Please check the encoder/cable.
0F8	No A and B Pulse Feedback	
0FA	Fixation Memory Breakage	Controller initialization memory clear & procedure is needed.
0FB	Abnormal CPU	CPU shows abnormal movement. Noise may be the cause.
101	Over Run Error (S)	Make sure the dip switches for the controllers that are linked all different settings. And also, they must be connected in consecutive sequence. A maximum of 15 controllers plus the main controller can be linked to them.
102	Framing Error (S)	
104	SCI S-QUE OV (S)	Receiving external excessive data (during update).
105	SCI S-QUE OV (S)	SCI transmission QUE over flow (during update)
106	Termi R-BF OV (S)	Receiving external excessive data (during update).
10A	Motorola Sum Error	Abnormal update program file (during update).
10B	Motorola S Record Error	
10C	Motorola S Address Error	
10D	Motorola S File Name Error	
10E	Timing Limit (W) (S)	Please check TEaCHInG PENDANT-CPU Base Flash ROM address setting DIP-SW (during update).
10F	Timing Limit (E) (S)	
111	Timing Limit (P) (S)	
112	Input Data Error	Input value is irregular. Please input allowable data.

## 7. Alarm List

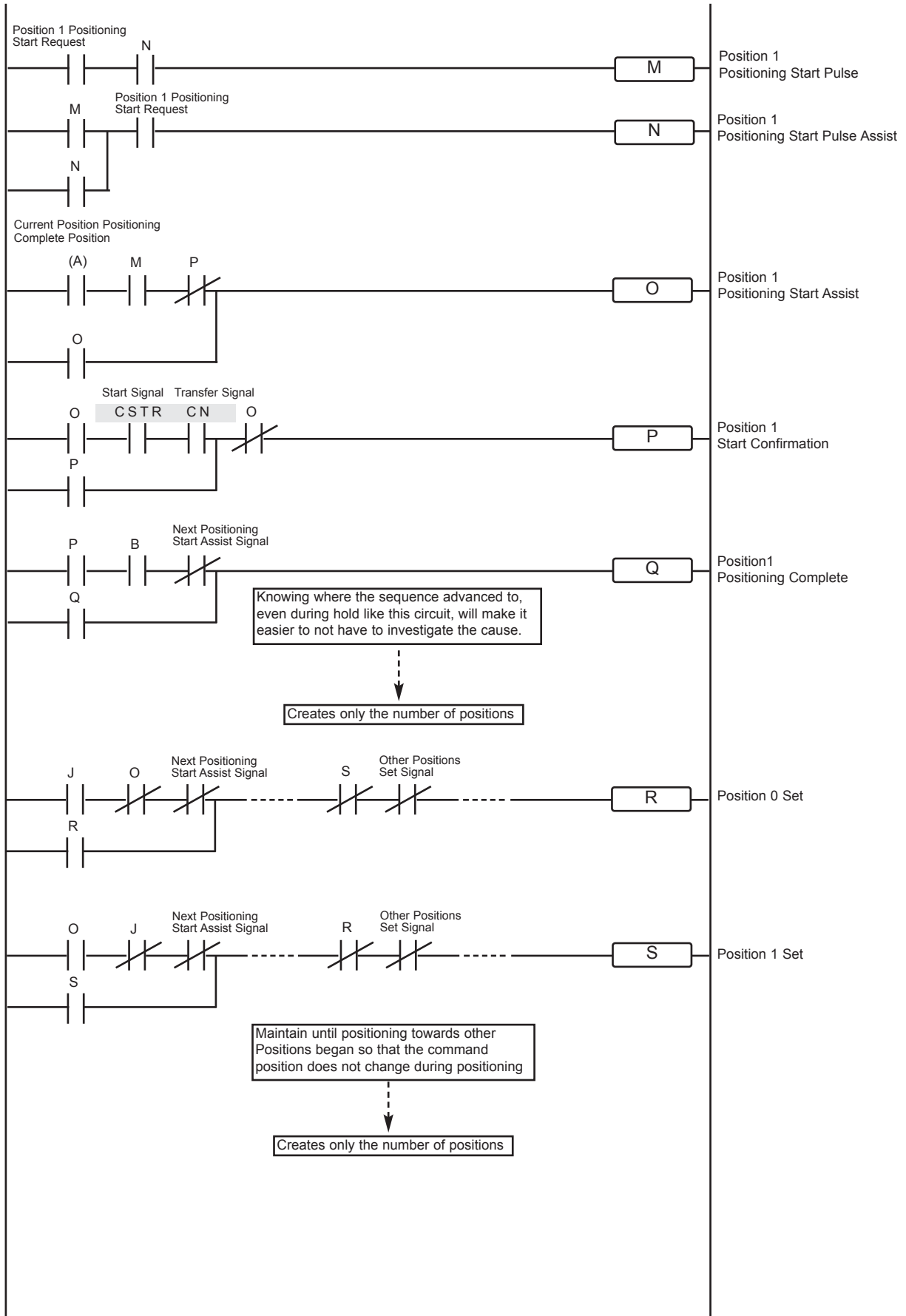
113	Input Under Error	Value input is too low. Please input within the allowable data range.
114	Input Over Error	Value input is too high. Please input within the allowable data range.
115	Homing Incomplete	Prohibited operation is being executed during homing status. First execute homing. Then execute operation.
116	Test Position Data Exist	During position addition, first delete or clear the final position data.
117	No Movement Data	When movement must be done through the software or teaching pendant, position data is not available.
118	Non-connect Axis Selection	Non-connect axis has been selected (there's no error).
119	Teaching pendant Parameter Excess Rotating Number	Teaching Pendant internal area parameter allowable rotating number after update has exceeded.
11A	Flash Verify Error: S	Please check Teaching Pendant-CPU Base Flash ROM address setting DIP-SW.
11B	Flash ACK Time Out: S	
11C	Flash Verify Error: M	
11D	Flash ACK Time Out: M	
11E	Pair Data Mismatch Error	Please input data with relationships.
11F	Absolute Value Under Error	The absolute data for input is too low. Please input within the allowable data range.
120	Initial Factor Error	The factor input data during controller initialization is abnormal. Please input allowable data.
121	Push Search End Over	Excess stroke in the push search end location. Please modify the positioning width.
122	During distribution, multiple axes connection	Axis No. distribution must always be executed with a single axis being connected.
180	Axis No. changes is OK	(No error).
181	Controller initialization is OK	
182	Home change all clear	
201	Emergency Stop	
20A	Servo OFF during movement	Servo was turned OFF during movement.
20C	Servo was turned OFF during movement.	Start was turned ON during movement. (Hold)
20D	During movement, STP-OFF	PNP 24V DC to Pin No. 33 / NPN Ground Pin No. 33. (Hold)
20E	Soft Limit Over	Soft Limit Over is detected during movement using the Teaching Pendant
301	Over Run Error (M)	Please check the number of linked controllers and their sequence.
302	Framing Error (M)	Please check the SIO link cable(s) of the primary controller to the sub-linked controllers.
304	SCI R-QUE OV (M)	Receiving excessive data.
305	SCI S-QUE OV (M)	SCI transmission QUE over flow (during main station mode)
306	Termi R-BF OV (M)	Receiving excessive data.

## 7. Alarm List

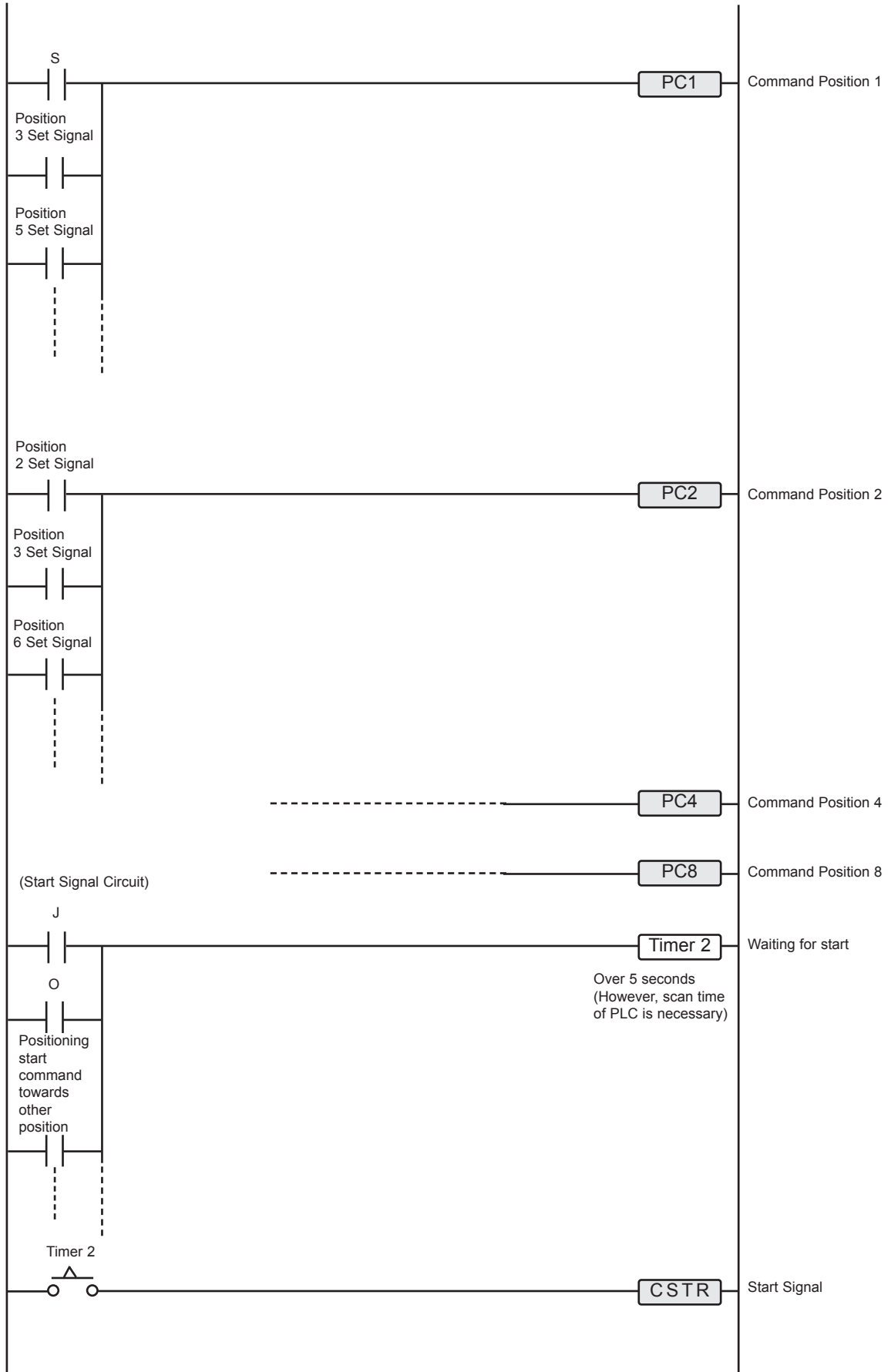
307	Memory Command Breakage	Command from the controller is broken now. Due to unknown cause, please record all error list before Teaching Pendant power OFF.
308	Response Time Out	Please check the completion for cable controller power · SIO main station · subordinate stations.
309	Termi Right Address Error	Termi right address unestablished error.
30A	Packet R-QUE OV	Receiving external excessive data.
30B	Packet S-QUE OV	Packet transmission QUE over flow
30C	No connection error	Please check the competition for cable controller · SIO main station subordinate stations.



# 8. Supplement\*



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NOTE

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