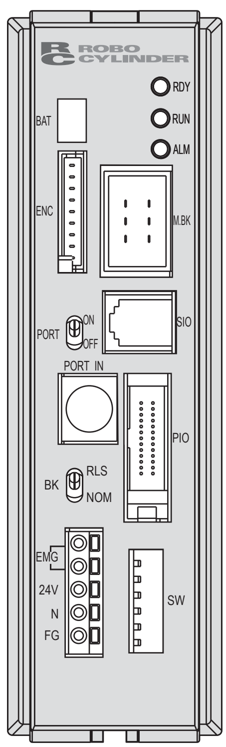
RCP
Robo Cylinder Controller
Operating Manual



Intelligent Actuator, 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 310-891-6015; Monday thru Friday from 8:30AM to 5:00PM.

INTELLIGENT ACTUATOR

Intelligent Actuator, Inc.
U.S. Headquarters
2690 W. 237th Street
Torrance, CA 90505
310-891-6015 / 310-891-0815 FAX

Intelligent Actuator, Inc.
Midwest Regional Office
1261 Hamilton Parkway
Itasca, IL 60143
630-467-9900 / 630-467-9912 FAX

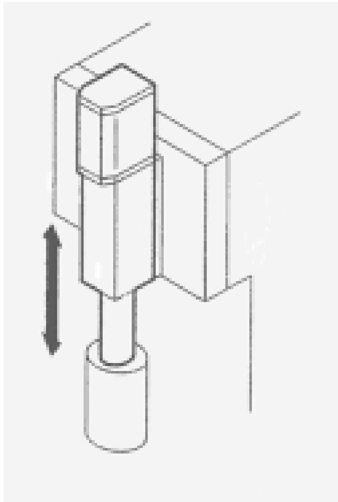
www.intelligentactuator.com

Before You Begin

Please be aware of the following before you begin operating the RCP Controller:

(1) When using your RCP Controller vertically (motor upper side application):

Homing problem may occur due to payload. In case this problem occurs, please change the current limit value during homing to **75%**.



(2) You must turn ON the Hold Input Signal of PIO, in order for the actuator to move. For NPN P10, input is connected to ground, and for PNP P10, input is connected to +24V.

Table of Contents

1. Safety Precautions

1-1 Forword

Thank you very much for purchasing the RCP 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 RCP Controller, once power is applied, and home position is taught, you can execute positioning without homing after reapplying the power. Other basic functions are same as the standard RC Controller.

- Actuators for Absolute are the only actuator that can operate using RCP Controller absolute specifications. You may not use a standard RC Actuator.
- (During storage), always remove the battery connector from the controller. Otherwise, battery will discharge.
- Data will be affected when the actuator experiences outside input or oscillation (during 24V main power OFF) need to be homed on power-up.
- Do not move the slider or rod.

* 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.

1-3 Warranty Period and Scope of Warranty

The RC 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.

1-4 Setting Environment and Noise Measures

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 tempr
eratures 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.

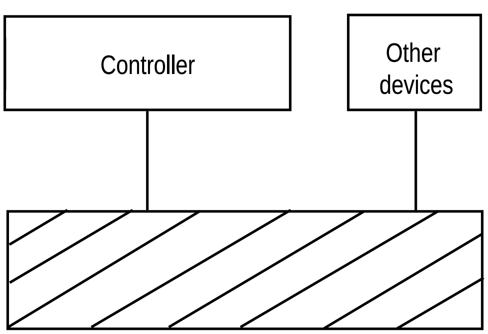
1-4-2 Power Source

Make certain that 110/120 VAC or 24 VDC (rated 20.4 ~ 26.4VDC) is maintained.
If the power supply tends to fluctuate substantially, use a constant-voltage transformer.

1-4-3 Electromagnetic Noise Supression

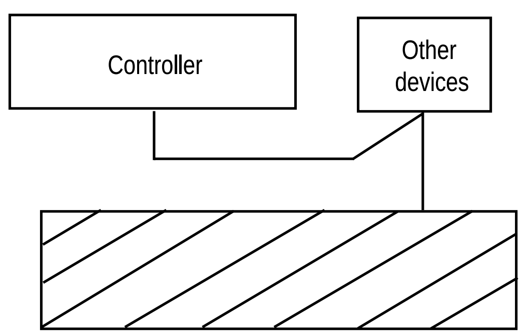
(1) Wiring and Power Supply

① For grounding, please use a dedicated ground of Class 3 or better. The thickness of the cable should be 2.0~5.5mm^2 or larger.



Class D Connection

Correct



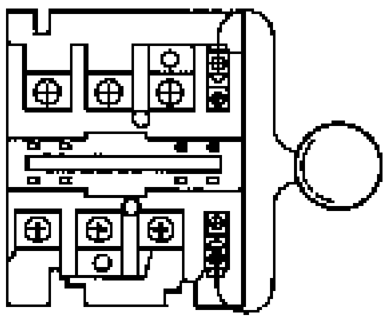
Avoid this method

(2) Noise Source and Noise Suppression

When using electrical components such as electromagnets, solenoids, or relays which create electromagnetic noise, some type of noise supression device should be used.

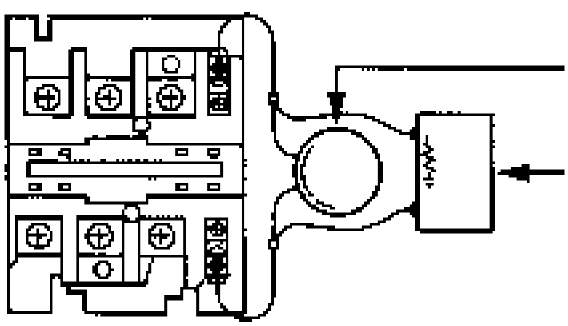
① AC solenoid valve · magnetic switch · relay

- 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.



② DC solenoid valve · magnetic switch · relay
- Install a diode parallel with a reactive/inductive load.

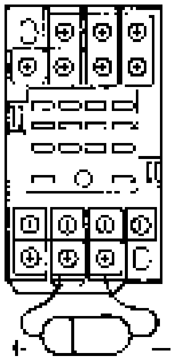


Figure 1-4-3

- 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 vertical direction. Furthermore, as shown in Figure 1-5.2, make sure to leave more than 50mm of space above and 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 95mm, as shown in Figure 1-5.3.

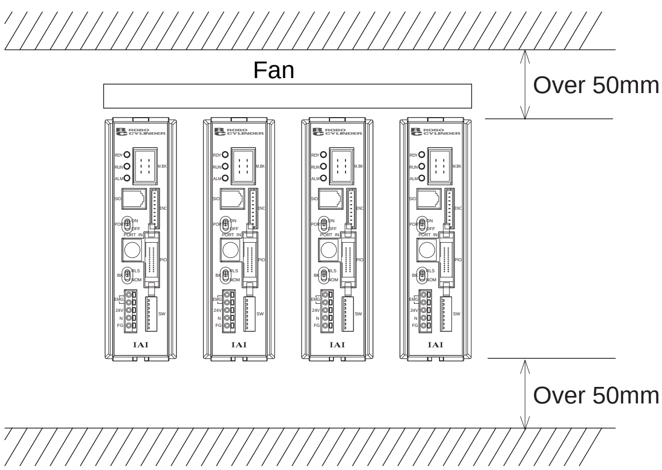


Figure 1-5-2

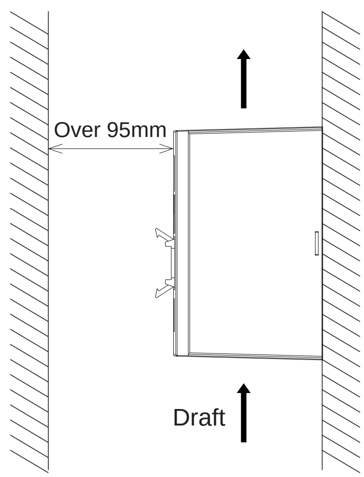


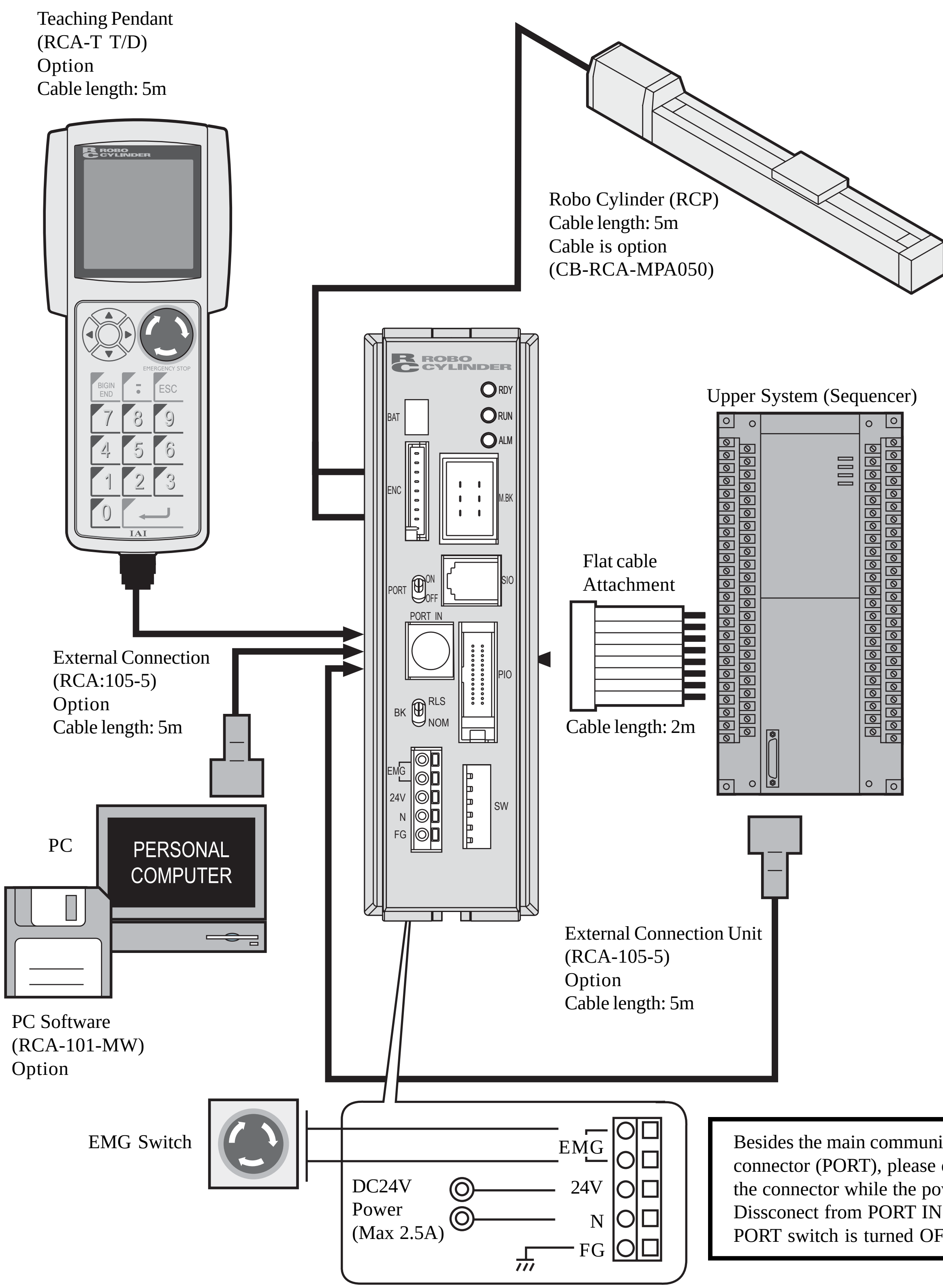
Figure 1-5-3

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. Specifications

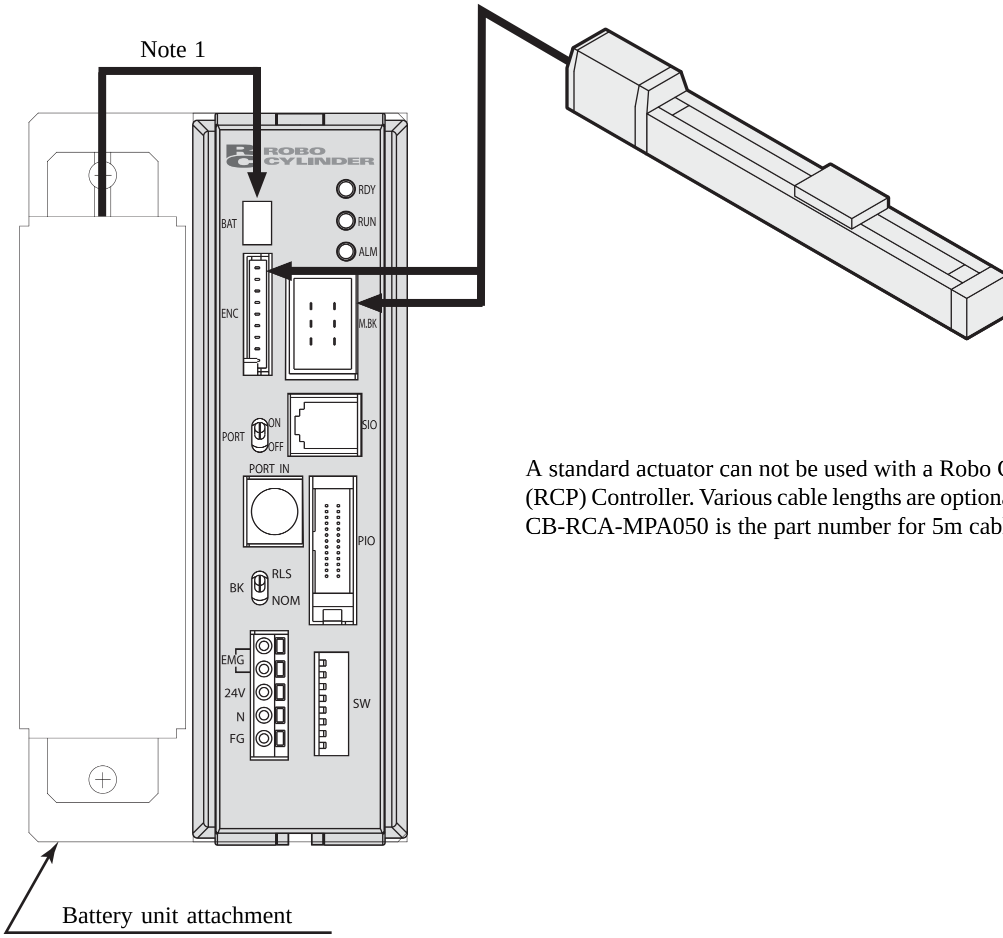
2-1 Connection Method

2-1-1 Standard Item



Besides the main communication port connector (PORT), please do not pull the connector while the power is ON. Dissconect from PORT IN only after PORT switch is turned OFF.

2-1-2 Absolute Specifications

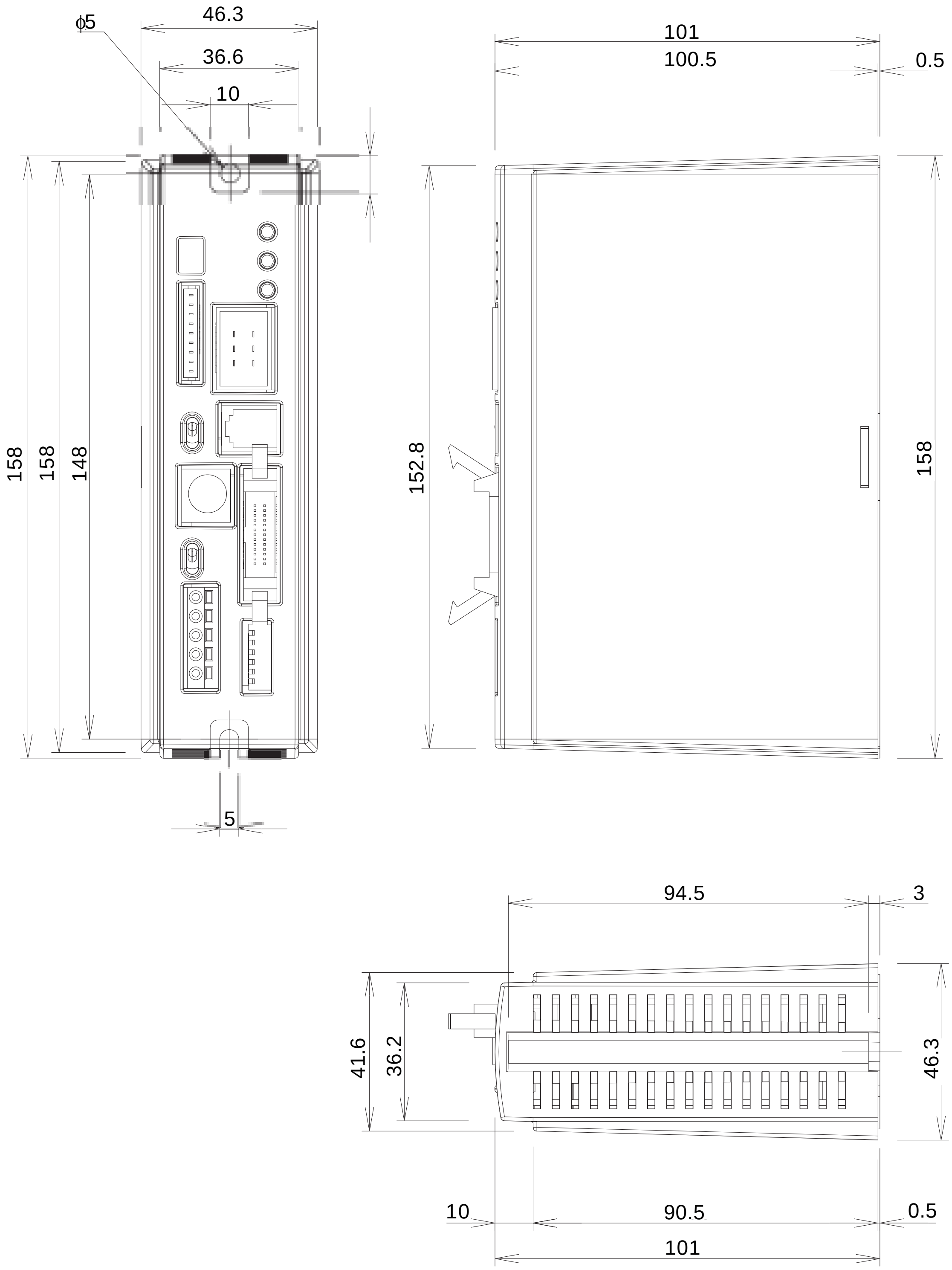


A standard actuator can not be used with a Robo Cylinder (RCP) Controller. Various cable lengths are optional (Example: CB-RCA-MPA050 is the part number for 5m cable).

> ***Note 1:***
> ***When long term power is not supplied to the controller, make sure to remove the battery connector from the controller. Otherwise, the battery will discharge.***

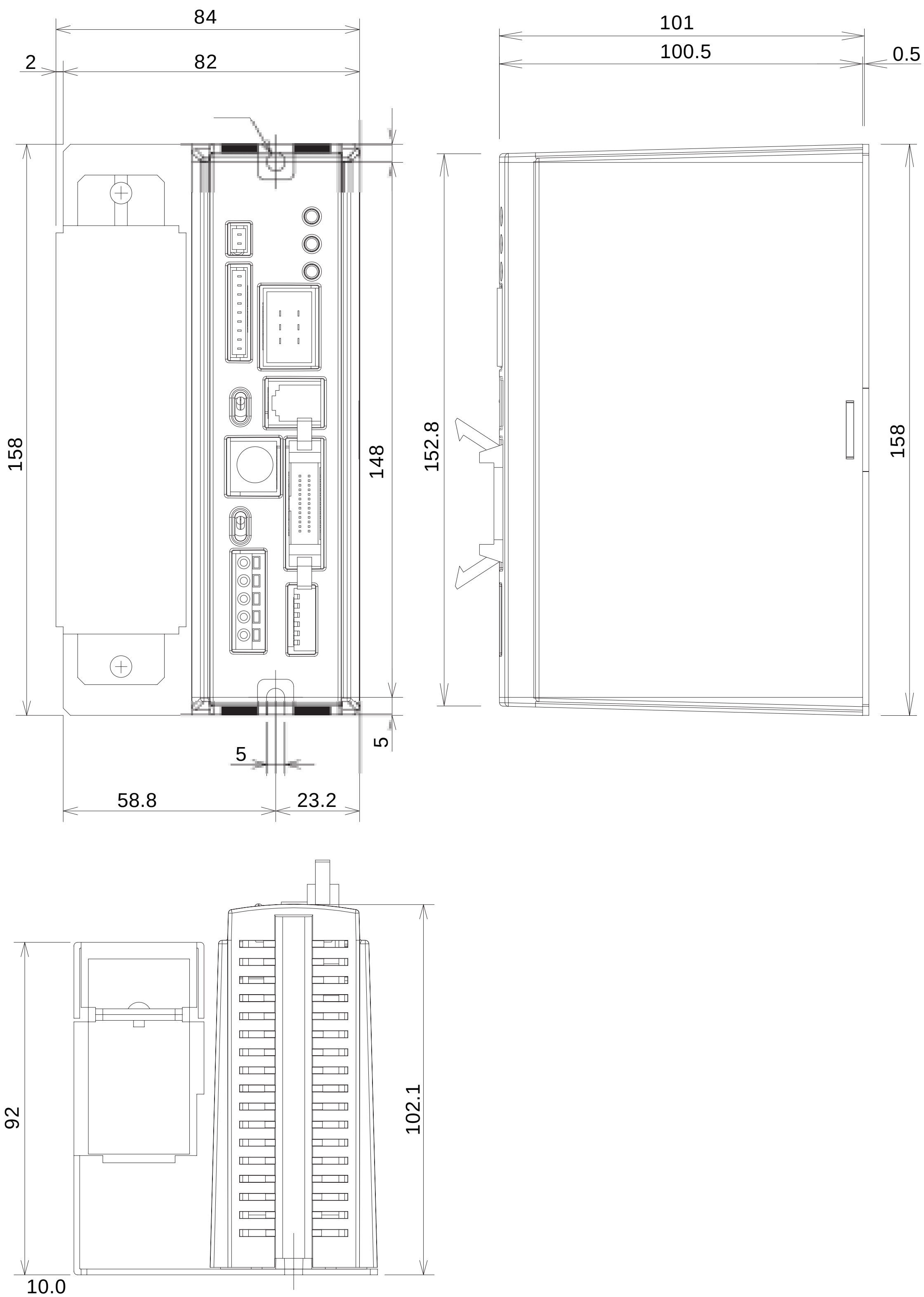
2-2 External Dimenional Diagram

2-2-1 Controller Outer Shape (Standard)



2. Specifications

2-2-2 Controller Outer Shape (Includes Absolute Specifications and Battery)



2. Specifications

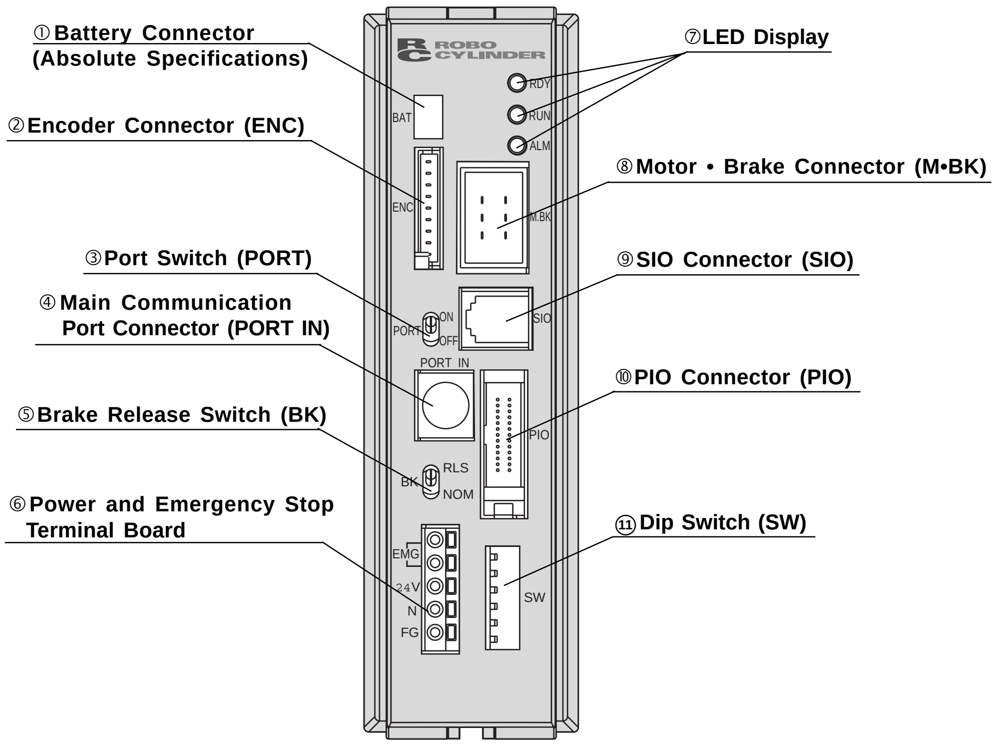
2-3 Controller Specifications

<table>
<tr><th>Item</th><th colspan="3">Specifications</th></tr>
<tr><td>Power Voltage</td><td colspan="3">DC 24V +/-10% (Maximum 2.5A)</td></tr>
<tr><td>Ambient Temperature • Humidity</td><td colspan="3">0 ~ 40°C Humidity under RH 85%</td></tr>
<tr><td>Ambient Environment</td><td colspan="3">No corrosive gas, especially no excessive gas</td></tr>
<tr><td rowspan="2">Weight</td><td colspan="2">Standard</td><td>360g</td></tr>
<tr><td colspan="2">Absolute Specifications</td><td>1200g (includes battery unit)</td></tr>
<tr><td>Protective Funtions</td><td colspan="3">E²EPROM check sum error, bank data error, encoder stop determination error, encoder counter compensation disable error, Encoder breakage, Speed abnomal, excessive current, main power voltage abnormal, cuircuit voltage abnormal, absolute counter abnormal (absolute specifications)</td></tr>
<tr><td>LED Display</td><td colspan="3">RDY (ready) RUN ALM (alarm)</td></tr>
<tr><td rowspan="4">Inputs
and
Outputs</td><td colspan="3">DC 24V Type (ready) RUN ALM (alarm)</td></tr>
<tr><td>INPUTS</td><td>(Inputs)
Start
Command Position Number (4 bit binary)
Hold</td><td>Exclusive
6 Ports</td></tr>
<tr><td>OUTPUTS</td><td>Complete Position Number (4 bit binary)
Positioning complete
Homing complete
Zone
Alarm
Emergency Stop</td><td>Exclusive
9 Ports</td></tr>
<tr><td colspan="3">Serial Interface I/O</td></tr>
<tr><td>Number of Positions</td><td colspan="3">16</td></tr>
<tr><td>Data Input Method</td><td colspan="3">Teaching Pendant or PC Software</td></tr>
<tr><td>Memory Device</td><td colspan="3">E²PROM</td></tr>
</table>

Caution: Applying voltage over the specifications to the I/O Port will lead to a breakdown.

2-4 Names of Parts and Functions

2-4-1 Names



2-4-2 Functions

① Battery Connector

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

② Encoder Connector (ENC)

This is the connector for the encoder cable connection.

③ Port Switch (PORT)

ON: PORT IN Port (Teaching Pendant • PC Software) will be activated.
However, in case of exclusive teaching pendant and exclusive non-connection, 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).

④ 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).

⑤ **Brake Release Switch** (BK) Effective only for brake option.

RLS: Release position turns the brake OFF.
NOM: Normal position makes the brake active.

⑥ **Power and Emergency Stop Terminal Block**

FG: This is the terminal for connecting earth ground.
N: This is the ground side for 24V power.
24V: This is the DC 24V Power terminal.
EMG: Both of the two terminals are terminals for emergency stop switch connection.

⑦ **LED Display**

RDY: This indicates that the CPU is in normal operation.
RUN: This indicates normal operation.
ALM: This indicates an alarm and or an emergency stop status.

⑧ **Motor • Brake Connector** (M • BK)

This is the connector for actuator motor power / brake power cable connection.

⑨ **SIO Connector** (SIO)

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

⑩ **PIO Connector** (PIO)

This is the connector for parallel I/O connection.

⑪ **Dip Switch** (SW)

The dip switch has up to 6 numbers, each of the switch functions are listed below.

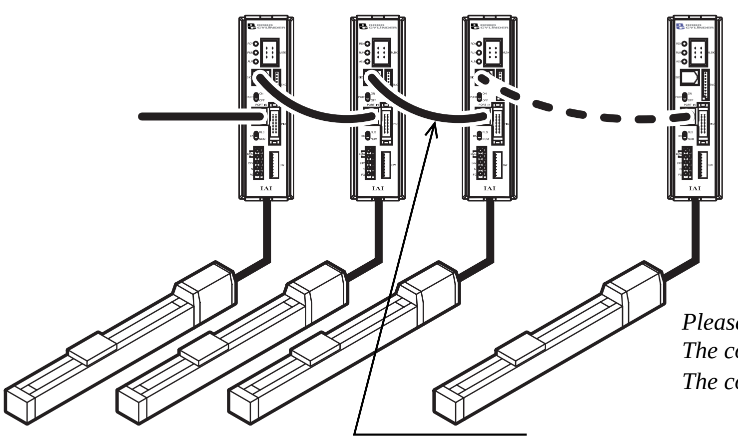
Number of Dip Switch	Function
1	Setting switch for actuator addressing (determines axis #).
2	
3	
4	
5	***Do not attempt to adjust setting.***
6	

2. Specifications

Dip Switch Number 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 1 axis, single unit).

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	0N	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	0FF	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 controller can connect up to a maximum of 16 units.

Caution:
Please do not adjust dip switch numbers 5 &6. ***Please do not adjust the setting that was done at the time of shipping.*** *Any missetting will not only limit basic functions, but will also, lead to a breakdown.*

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.

2-4-3 Main Communications

SIO Connector Pin Assignment

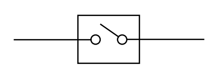
PIN No.	Signal Name	Functions
1	+5V	DC 5V Power Output
2	SGA	Line transceiver
3	GND	Ground for Communication
4	SGB	Line Transceiver I/O Negative Logic Side
5	GND	Ground for Communication
6	+5V	DC5V Power Output

Main Communication Port Pin Assign

PIN No.	Signal Name	Functions
1	SGA	Serial Communication Channel A
2	SGB	Serial Communication Channel B
3	5V	5V Power Output
4	EMGS	Emergency Stop Status
5	EMGA	*Note 1
6	24V	24V Power Output
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.

PORT SW



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

Motor / Brake Connector (178303-5: AMP)

Pin No.	Signal Name
1	B
2	$\overline{A}$
3	A
4	BK -
5	BK +
6	$\overline{B}$

Battery Connector (Absolute Specifications)

Pin No.	Signal Name
1	BAT +
2	BAT -

2. Specifications

Encoder Connector (5484-09AX: Molex)

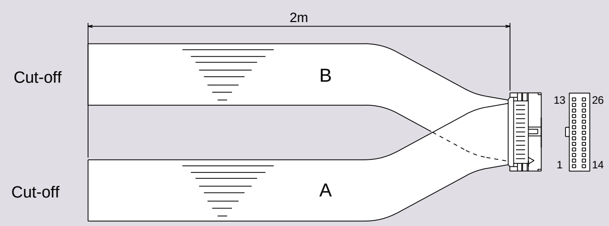
Pin No.	Signal Name
1	ENA
2	$\overline{\text{ENA}}$
3	ENB
4	$\overline{\text{ENB}}$
5	ENC
6	$\overline{\text{ENC}}$
7	5V
8	GND
9	FG

Power and Emergency Stop Terminal Block

Pin No.	Connection
1	FG
2	N
3	24V
4	EMG 1 (24V)
5	EMG 2

**Note: Number 3 and number 4 are connected internally.*

2-4-5 I/O Flat Cable



Model Type: CB-RCA-P10020	Length: 2m

No.	Signal	Color	Cable	No.	Signal	Color	Cable
1	+24V	Brown-1	Flat Cable (A)	14	—	Yellow-2	Flat Cable (B)
2	24G	Red-1		15	—	Green-2	
3	CSTR	Orange-1		16	PM1	Blue-2	
4	PC1	Yellow-1		17	PM2	Purple-2	
5	PC2	Green-1		18	PM4	Gray-2	
6	PC4	Blue-1		19	PM8	White-2	
7	PC8	Purple-1		20	PFIN	Black-2	
8	—	Gray-1		21	ZFIN	Brown-3	
9	—	White-1		22	ZONE	Red-3	
10	ILK	Black-1		23	ALM	Orange-3	
11	—	Brown-2		24	EMG	Yellow-3	
12	—	Red-2		25	—	Green-3	
13	—	Orange-2		26	—	Blue-3	

2-4-6 Battery Backup (Absolute Specifications)

(1) Battery Specifications

Column	Content
Type	Nickel Cadmium Battery
Manufacturer	Matsushita Denki Kogyo
Model	P-23H/F4G1
Nominal Voltage	4.8 (1.2Vx4)
Rated Capacity	2300mAh
Weight	Approx. 320g
Average Life Span	Approx. 4 years
Charged Time	Approx. 48 hours (when ambient temperature is 20°C)
Battery Sustain Time *1	Approx. 250 hours (when ambient temperature is 20°C)

Note 1) This time represents the battery maintenance time from fully charged status.
* Please use IAI specified battery only.
* To avoid breakdown, do not attempt to machine or extend the wire.

(2) Charging the Battery

Always charge the battery during installation and battery exchange. Since the charge to the battery is automatically supplied from the power supply to the controller, please continue to supply main power for more than 48 hours. You may change the parameters and move the actuator during charge (In addition, be sure to charge for over 40 hours when leaving the power OFF for a long time (within fixed maintenance time)).

(3) Exchanging the Battery

Please change the battery when it wears out. Although changing the battery depends on the ambient temperature and full discharge requirements, it is about 4 years after controller connection. There's a sticker which has 4 years added to the shipment date labeled to the battery unit. Please refer to the date as a standard.

* During battery exchange, it is not necessary to home again as the exchange is done while main power is connected.

* Please only use IAI specified battery.

2. Specifications

Absolute Specifications:

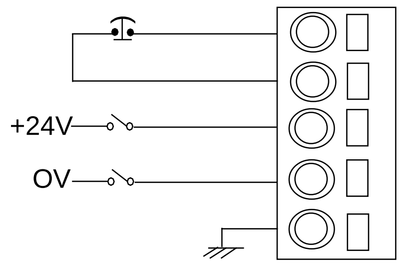
With the RCP Controller, once power is applied, and home position is taught, you can execute positioning without homing after reapplying the power. Other basic functions are same as the standard RC Controller.

- Actuators for Absolute are the only actuator that can operate using RCP Controller absolute specifications. You may not use a standard RC Actuator.
- (During storage), always remove the battery connector from the controller. Otherwise, battery will discharge.
- Data will be affected when the actuator experiences outside input or oscillation (during 24V main power OFF) need to be homed on power-up.
- Do not move the slider or rod.

2. Specifications

2-5 Wiring

2-5-1 Wiring for Power • Emergency Stop



Power and emergency stop terminal board

The two EMG terminals are for connecting an emergency stop switch, and is b-contact input. At the time of shipment, a jumper is used to short the two terminals. Do not remove it!

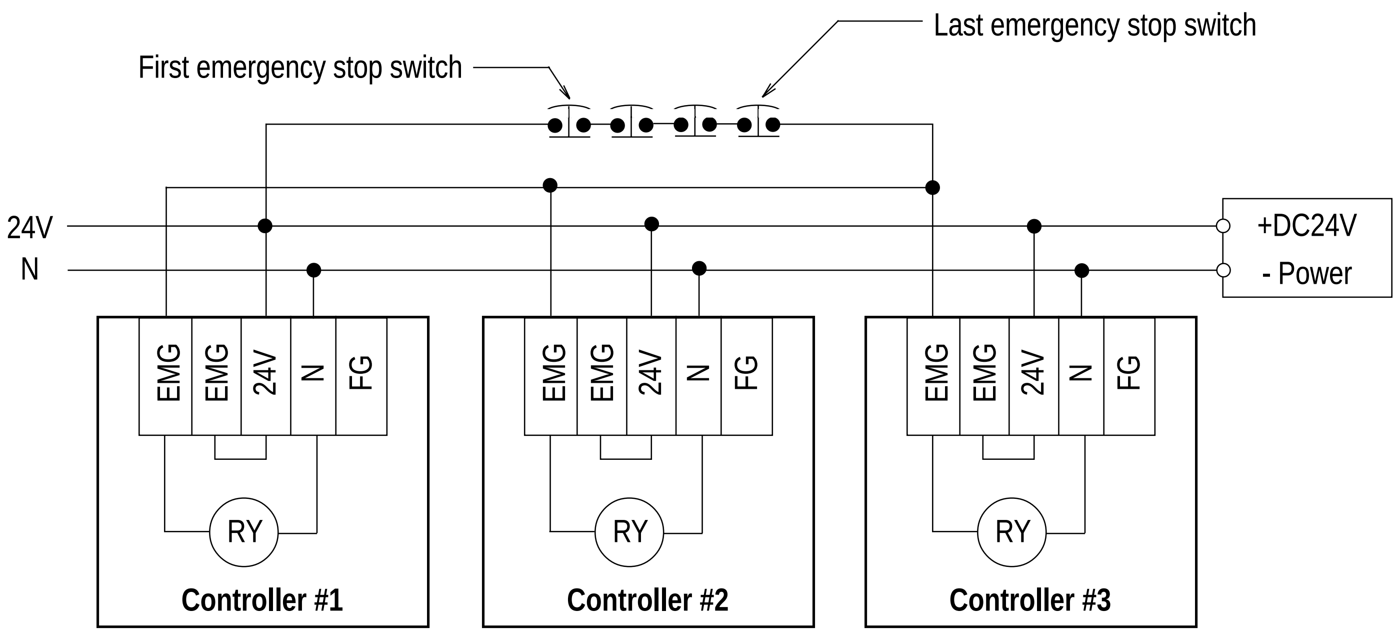
Caution: When wiring power on the customer site, please make sure that the following specifications are met.

Applicable conduit	Single line	ϕ1.2 (AWG16) 1.25mm² (AWG16)
Specifications possible conduit range	Single line Stranded line Strand diameter	ϕ0.4 (AWG26) ~ ϕ1.2 (AWG16) 0.3mm² (AWG22) ~ 1.25mm² (AWG16) Over ϕ0.18mm
Standard type line length	11mm	
Applicable tool for button operation	Minus Driver (axis diameter ϕ3, blade point width 2.6)	

Caution: This controller does not have a power switch.

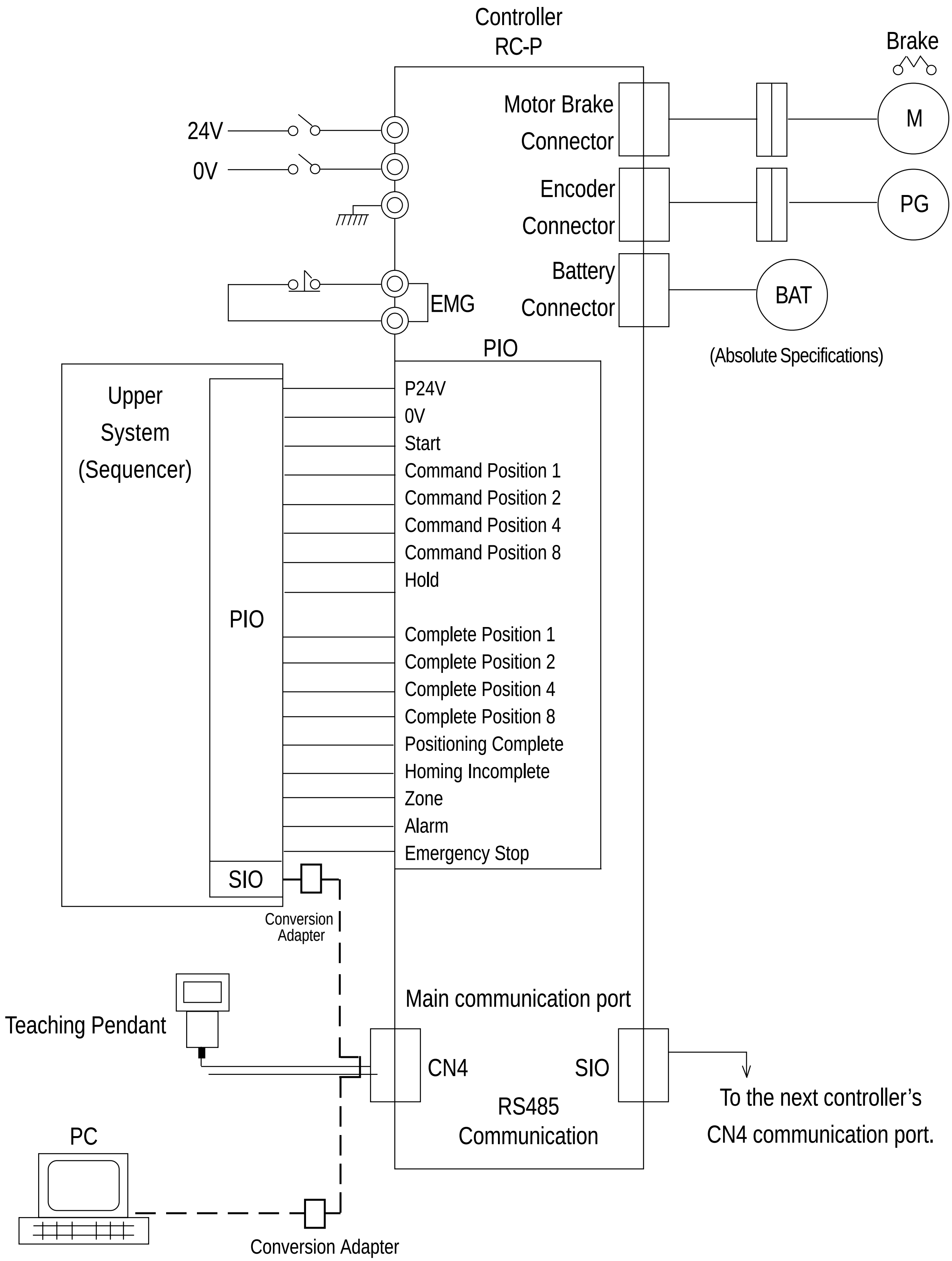
Caution: Do not remove jumper across Emergency Stop!

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



- As for the last emergency stop switch input, always connect it to the number 5 terminal of each controller.
- Connect number 3 terminal (24V) of each controller onto the first emergency stop switch.

2-5-3 External Connection Diagram



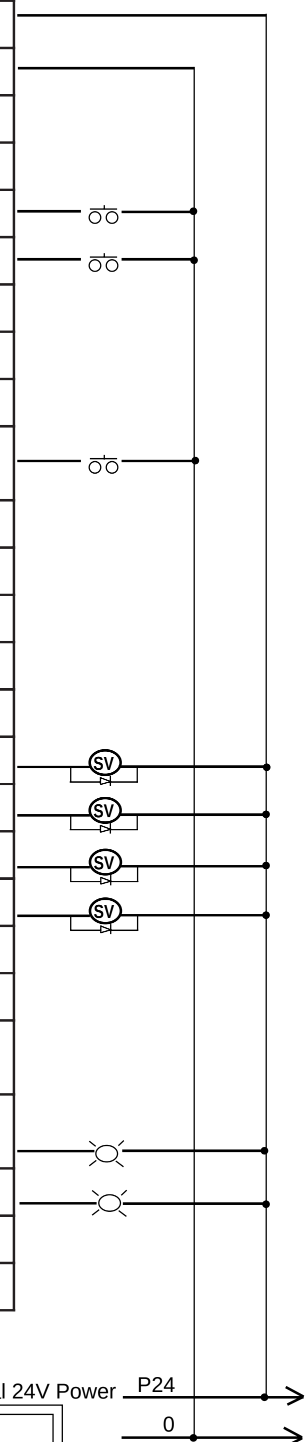
2-5-4 PIO Interface

PIO Interface list for controllers with NPN I/O is indicated as below:
In addition, the PIO cable is unplugged on the external device side for flat cable specifications.

PIO Connector (26 Pin) NPN - (standard unless otherwise indicated)

②

Pin	Section	Signal Name		Cable Color
1	P24	+24V	Connect power 24.	Brown-1
2	N	OV	Connect power OV.	Red-1
3	Input	Start	Motion start input.	Orange-1
4		Position 1	Motion start input position Number. ①	Yellow-1
5		Position 2		Green-1
6		Position 4		Blue-1
7		Position 8		Purple-1
8		Unused	Do not connect.	Gray-1
9				White-1
10		* Hold	Makes a sudden stop on a moving actuator. Normally closed.	Black-1
11		Unused	Do not connect.	Brown-2
12				Red-2
13				Orange-2
14				Yellow-2
15				Green-2
16	Output	③Completion position 1	Outputs motion complete position number. During an alarm, outputs the alarm number (see page 59 in this manual).	Blue-2
17		③Completion position 2		Purple-2
18		③Completion position 4		Gray-2
19		③Completion position 8		White-2
20		④ Positioning complete	Outputs upon transfer complete.	Black-2
21		⑤ Homing Complete	Outputs after homing	Brown-3
22		Zone	Outputs within the range set in the parameter.	Red-3
23		⑥*Alarm	Outputs during controller abnormality.	Orange-3
24		⑦*Emergency Stop	Outputs during an emergency stop.	Yellow-3
25	Unused		Do not connect	Green-3
26				Blue-3



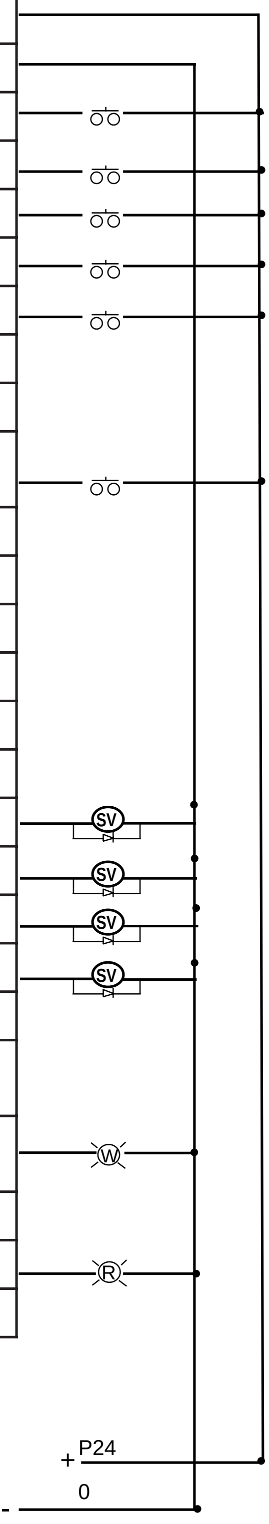
Connector model name on the controller side: Hirose HIF 6-26 P A-1.27 D S
* Each output should not exceeed 20 MA/point.

Caution
Ports with * mark indicate negative logic. Never connect to unused port.
Please be extra careful in connecting to a 24V power. Breakdown will occur if reversed connection occurs.

PIO Interface list for controllers with PNP I/O is indicated as below:
In addition, the PIO cable is unplugged on the external device side for flat cable specifications.

PIO Connector (26 Pin) PNP

Pin	Section	Signal Name		Cable Color
1	P24	+24V	Connect power 24.	Brown-1
2	N	OV	Connect power OV.	Red-1
3	Input *2	Start	Motion start input.	Orange-1
4		Position 1	Motion start input position Number. ①	Yellow-1
5		Position 2		Green-1
6		Position 4		Blue-1
7		Position 8		Purple-1
8		Unused	Do not connect.	Gray-1
9				White-1
10		② * Hold	Makes a sudden stop on a moving actuator. Normally closed.	Black-1
11		Unused	Do not connect.	Brown-2
12				Red-2
13				Orange-2
14				Yellow-2
15				Green-2
16	Output	③ Completion position 1	Outputs motion complete position number. During an alarm, outputs the alarm number.	Blue-2
17		③ Completion position 2		Purple-2
18		③ Completion position 4		Gray-2
19		③ Completion position 8		White-2
20		④ Positioning complete	Outputs upon transfer complete.	Black-2
21		⑤ Homing Complete	Outputs after homing	Brown-3
22		Zone	Outputs within the range set in the parameter.	Red-3
23		⑥ Alarm *1	Outputs during controller abnormality.	Orange-3
24		⑦ Emergency Stop	Outputs during an emergency stop.	Yellow-3
25	Unused		Do not connect	Green-3
26				Blue-3



Caution
****1 Indicates negative logic. Never connect to unused port. Please be extra careful in connecting to a 24V power.***
**** 2 Each input not to exceed 20 mA/Point.***

① **Command Position**

This is the relationship between the input pin No. and selected positon No. (4 bit binary)

You may input select 16 positions of position 0~position 15.

1 : ON 0 : OFF

PIN No.																		
PIN No.	4	Command Position 1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	5	Command Position 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	6	Command Position 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	7	Command Position 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Selected Positon Number			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Caution:
Error operation may occur when selecting an undefined position number and pressing the Start Input ON.

② **Hold**

This is a B-contact input. While in motion, Hold input must be ON. If Hold is OFF, motion will be stopped.

③ **Completion Position**

PNP (Sourcing) - When the actuator completes motion to a desired point or position, the output pins will go high in a binary type sequence which is dependant on which position is completed (NPN [Sinking] will cause pins to go low). For example, when the actuator completes motion to position 10, this will correspond to the following output (Logic 0/1 =Low/High). See table below:

Pin	19 (pos.8)	18 (pos 4)	17 (pos. 2)	16 (pos. 1)
Logic	1	0	1	0

④ **Positioning Completion**

Turns ON when the actuator completes desired position.

⑤ **Homing Complete**

Turns ON once the initial homing completes. After that, as long as an alarm or power OFF do not occur, it will remain ON.

⑥ **Alarm**

This will turn OFF during an alarm and will turn ON while in normal operation.

⑦ **Emergency Stop**

This will turn OFF during emergency stop and will turn ON while in normal operation.

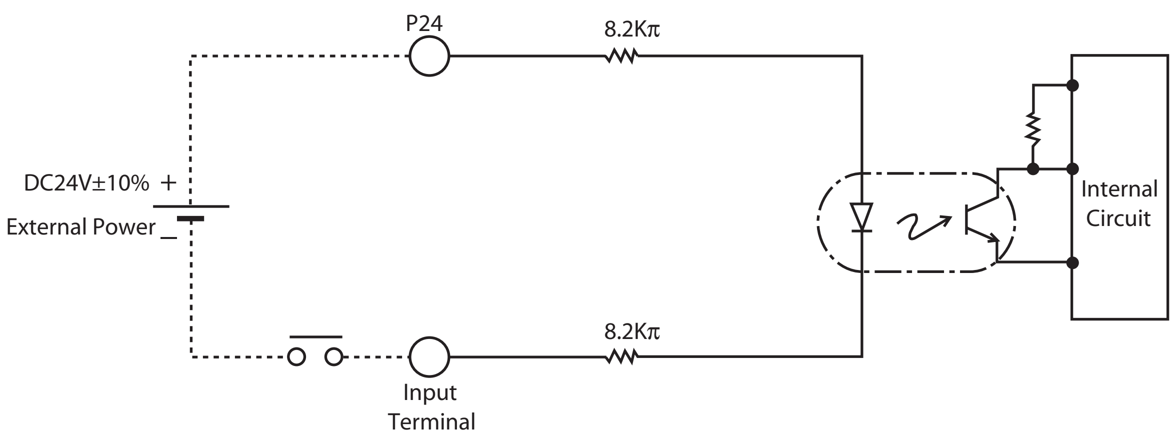
Caution:
With the Absolute Specifications, once home is taught, Homing Complete Signal will turn ON once power is installed. In case Homing Complete Signal turns OFF due to an alarm occurrence, you will need to teach the home location again.

2-5-5 External I/O Specifications

External input specifications

Item	Specifications
Input Voltage	24V DC +/-10%
Input Current	Maximum 2mA/1 Port
Leakage	Under 0.1mA (Caution)
Insulation Method	Photocoupler Insulation

Input circuit



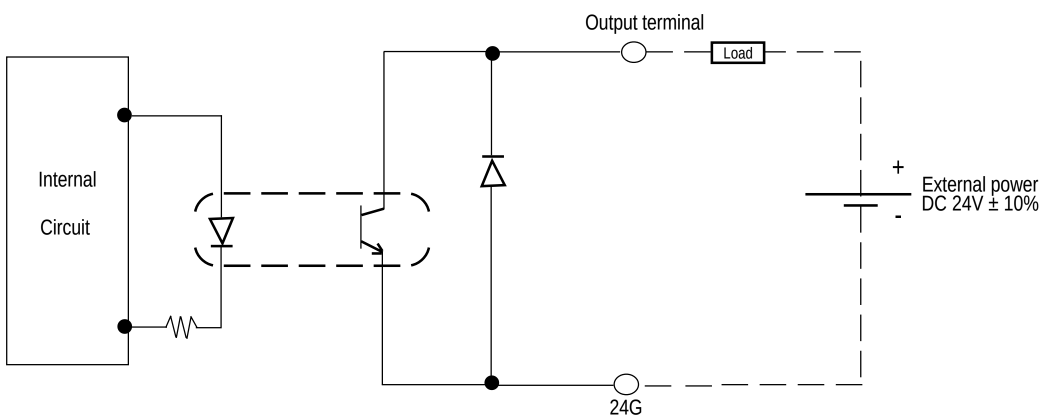
Caution: Do not use 2-line method sensor.

2. Specifications

External Output Specifications

Item	Specifications
Load Voltage	DC 24V
Max. Load Current	20mA / 1 Port
Leakage Current	Max 0.1mA / 1 point
Insulation Method	Photocoupler Insulation

Output Circuit



3. Data Input (Basic)

Since this controller does not have any commands, there is no need to write any programs. In order to make the actuator move to the assigned position, all you need to do is input the position data into the position data table. In the position table, there are 8 columns: Position, Speed, Acc (G), Push (%), Pos. Band, MAX ACC Flag (0/1), ABS/INC Flag (0/1) and Comments. The position table below is displayed by the Teaching Pendant. In the position data, there is Absolute which inputs distance from home, and Incremental which inputs relative transfer load from the current position.

Position Table

No.	Position (mm)	Speed (mm/s)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC Flag (0/1)	Comments
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		
.	.	.	.	.	.	.		
.	.	.	.	.	.	.		
15	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 "~initial value" of the parameter. The initial value will vary according to actuator type.

* "=" indicates that this is an Incremental Move (This is diplayed by the Teaching Pendant. With a PC, incremental assigned column will display).

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 grider 2 fraction. However, data of position is only recognizes as a multiplier of minimum resolution. In addition, the minimum resolution will vary according to the lead of the actuator. Therefore, the grider 2 fraction of position data that was inputted will write over according to actuator lead.

Example: Inputted value ➔ Recorded value

50.01 ➔ 50.03

3. Data Input (Basic)

3-1 Position Data Table

①No

• Indicates the position number. In case of inputting the relative transfer load, type the Minus Key. In case of input operation using the teaching pendant, "=" will be displayed between the number and position. In case of Absolute, there is no need for operation here.

②Position

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

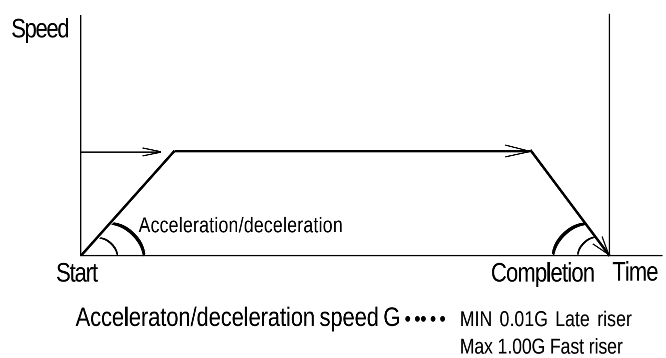
No.		Position			
0		30		Absolute Coordinate Assign	30mm from home
1	=	10		Relative Coordinate Assign	Plus 10mm from current location
2	=	-10		Relative Coordinate Assign	Minus 10mm from current location
3		100		Absolute Coordinate Assign	100mm from home

③
Speed

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

④
Acc (G)

• Inputs the acceleration/deceleration of when the actuator



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 at which you would like the push to end.

> ***Caution:***
> ***The relationship of Push Power (kgf) during stop towards work per type and current limit value is listed in Pages 30~31.***

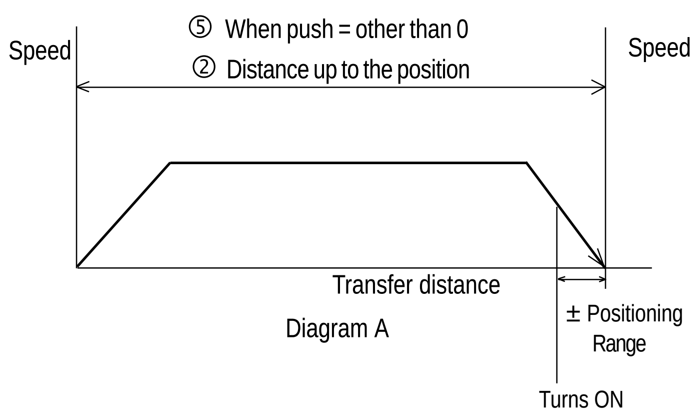
> ***Caution:***
> ***When the push power is too small, push malfunction may occur due to driven resistance, so please be careful.***

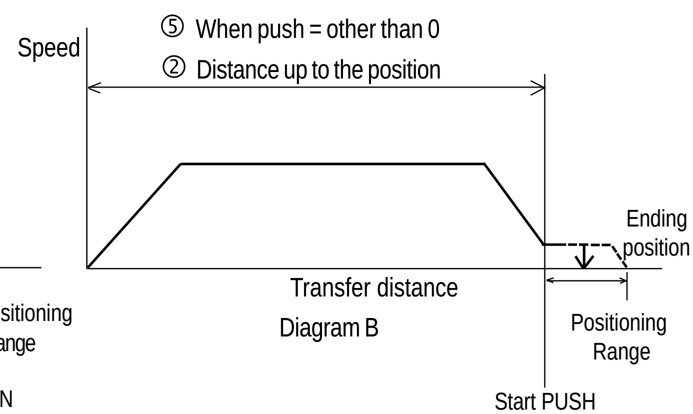
⑥ **Pos. Band**

- As for the positioning width, depending on the setting value of 5th column (refer to the table shown on Page 26 of this manual) either 0 or other than 0, its function will vary.

  3(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.
- The initial value is set as 0.1mm (see diagram A).

  (B) Push = besides 0 (Push Mode)
- Inputs the maximum push load (distance from the final point) in the push mode (mm) (see diagram B).
- When the push direction is a negative direction from the displayed coordinate, a “minus”sign should be placed next to the position width.



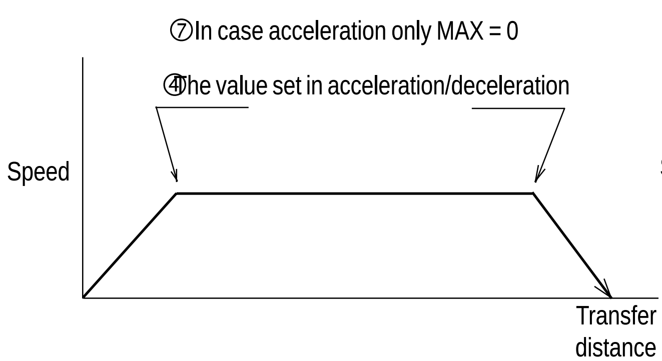


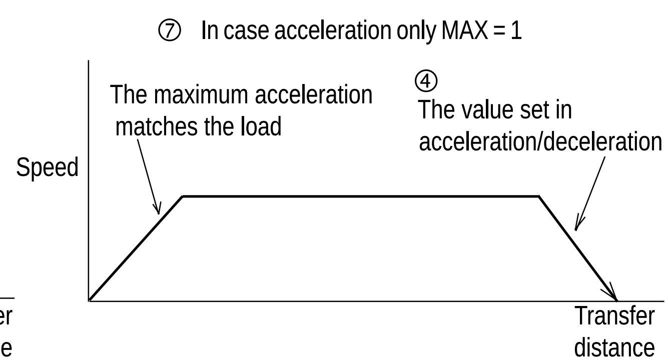
⑦ **MAX ACC Flag (0/1)**

- 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)

3-1-1 The Relationship Between the Push Power During Stop and Current Restriction Value

When executing the push mode, input the current restriction value as a % of the max value into the “Push %” column of the position data table. Based on the push power required during stop towards work, determine the % current restriction by using Tables 3-1 through 3-6 (shown on pages 30 and 31 of this manual). Figures 3-1 through 3-6 show the relationship between the current restriction value and push power during stop for each actuator type.

Table 3-1

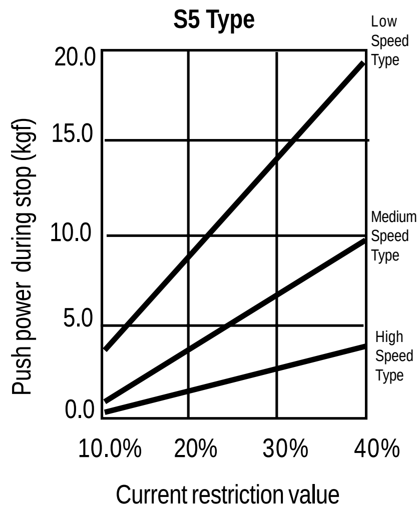
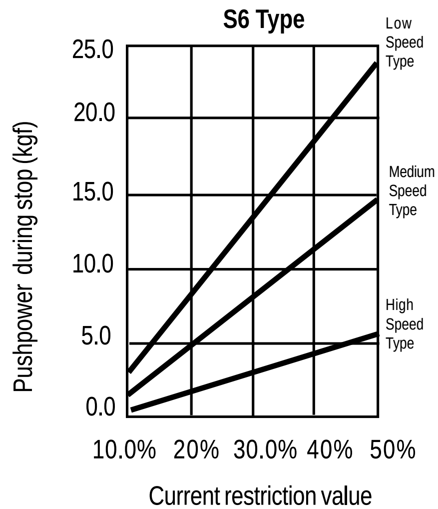


Table 3-2



Type / Lead	S5
Low Speed Type	40% or less
Middle Speed Type	40% or less
High Speed Type	40% or less

Figure 3-1

Type / Lead	S6
Low Speed Type	50% or less
Middle Speed Type	50% or less
High Speed Type	50% or less

Figure 3-2

Caution:
Please be aware that the push power during stop is a standard, and is not guaranteed. When the push power is too small, push malfunction may occur due to driven resistance, so please be careful. The maximum amount of the current restriction value is listed in the table below.

3. Data Input (Basic)

Table 3-3

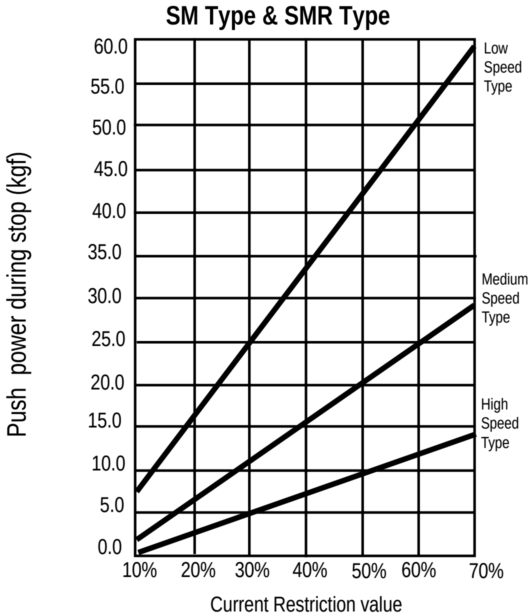


Table 3-4

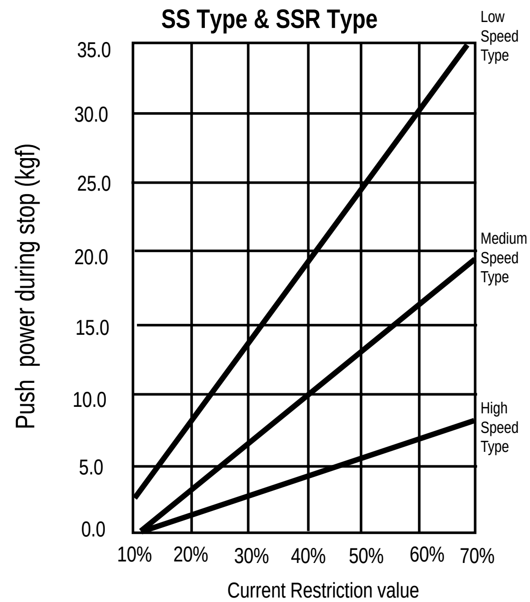


Table 3-5

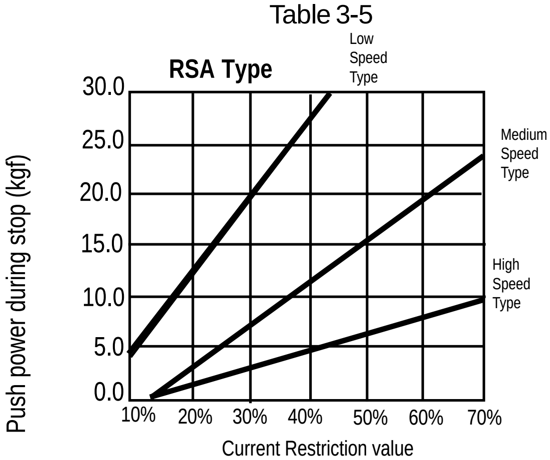
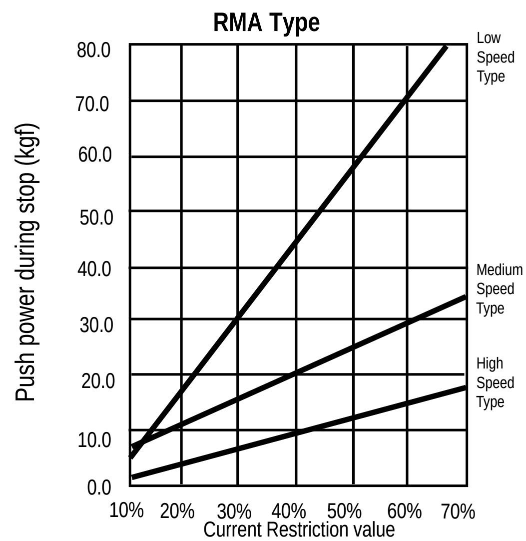


Table 3-6



Lead \ Type	SS • SSR
Low Speed Type	70% or less
Middle Speed Type	70% or less
High Speed Type	70% or less

Figure 3-3

Lead \ Type	SM • SMR
Low Speed Type	70% or less
Middle Speed Type	70% or less
High Speed Type	70% or less

Figure 3-4

Lead \ Type	RSA • RSW RSI (W) • RSGB RSGS • RSGD
Low Speed Type	45% or less
Middle Speed Type	70% or less
High Speed Type	70% or less

Figure 3-5

Lead \ Type	RMA • RMW RM (W) • RMGB RMGS • RMGD
Low Speed Type	65% or less
Middle Speed Type	70% or less
High Speed Type	70% or less

Figure 3-6

***Caution:** Please be aware that the push power during stop is standard, and is not guaranteed. When the push power is too small, push malfunction may occur due to driven resistance, so please be careful. The maximum amount of the current restriction value is listed in the tables below.*

3-2 Positioning Mode (Push) = 0

3-2-1 Positioning Mode (Push) = 0

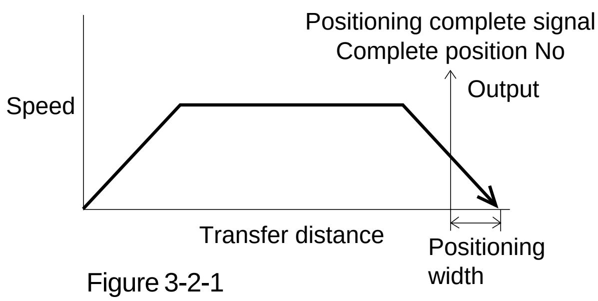


Figure 3-2-1

From the position shown in Figure 3-2-3 (Page 33 of this manual), the positioning complete output turns ON prior to the positioning width portion. Also, this location activates the position number outputs.

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

(1) When push is successful

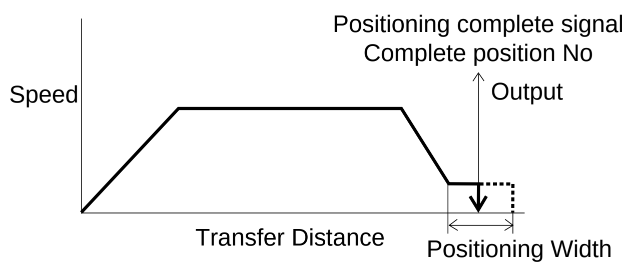


Figure 3-2-2

After reaching the position shown in Figure 3-2-3, actuator moves forward at 75 RPM. Once the actuator pushes the work and the parameter passes the setting time with the servo motor current achieving the push value, the completion position turns ON. The completion position number outputs also turn ON.

Note: If needed, set the "push determination time" on the parameter. 255msec is inserted as the initial value.

Actuator will continue to push work.

Warning:
The actuator will continue to push the work with set power after push % has been reached. The push amount is determined by the push value in point table.

Caution: The low speed during push movement is fixed and can not be changed (75 RPM).

(2) When push fails (blank shot)

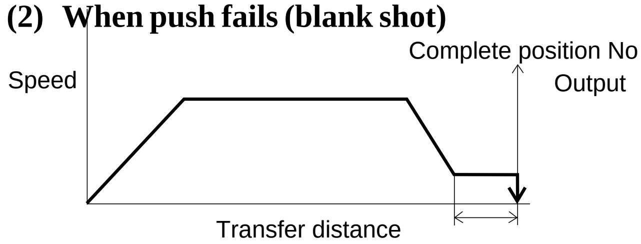


Figure 3-2-3

Upon reaching the position shown in Figure 3-2-2 (Page 32 of this manual), the actuator moves forward at low speed When the servo motor current does not reach current restriction value, the positioning width, the positioning completion output will not turn ON even when the actuator moves to the positioning width range. In this case, only the complete position number outputs turn ON (please allow for enough time-out check trreatment).

(3) Upon push, work rate increases.

1. When the work increases in the push direction

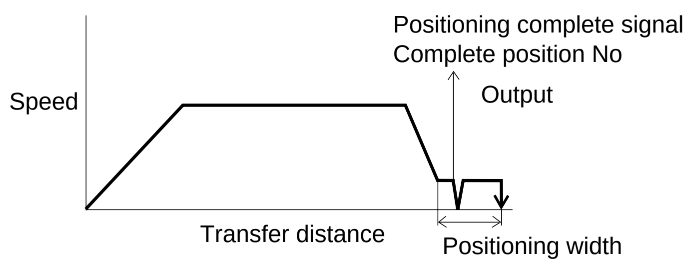


Figure 3-2-4

After the positioning complete output turns ON, and the work increases in the push direction, the actuator increases the work rate within the positioning width range. The positioning complete turns ON, however complete position number does not change while output.

2. When the work increases towards the reversed push direction (when the actuator pushes back due to a reversed power from work)

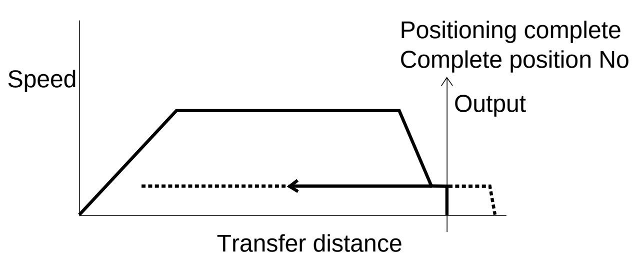
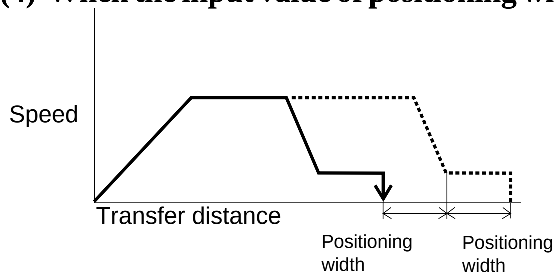


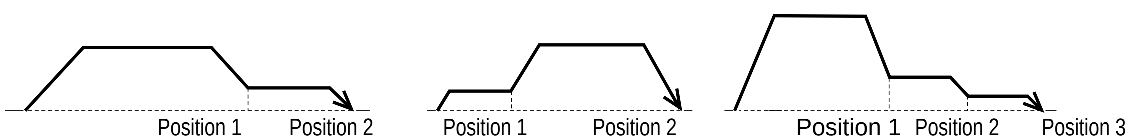
Figure 3-2-5

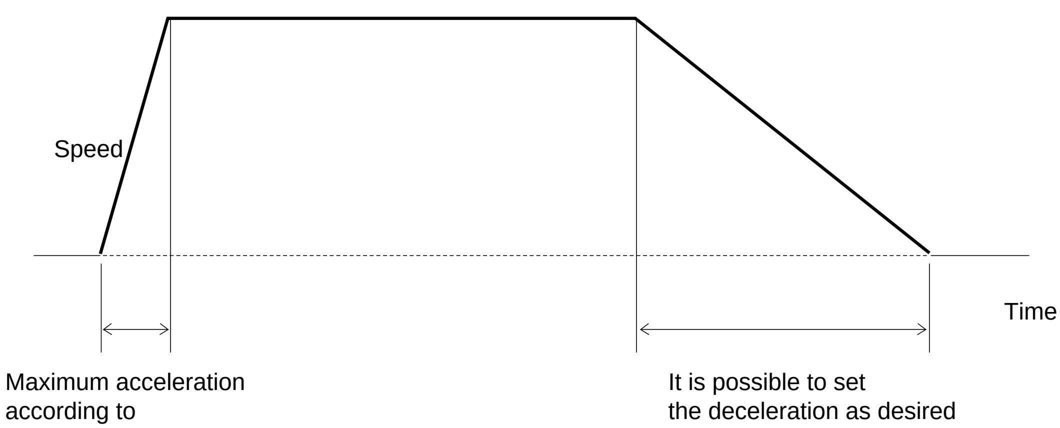
After the positioning complete output turns ON, and the thrust of the actuator is lost to reversed polarity from the and the actuator pushes back, the actuator will continue to push back until the thust of the actuator and the reversed polarity from the completed work done, balances. The positioning complete turns ON, however, complete position number output does not change while output.

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



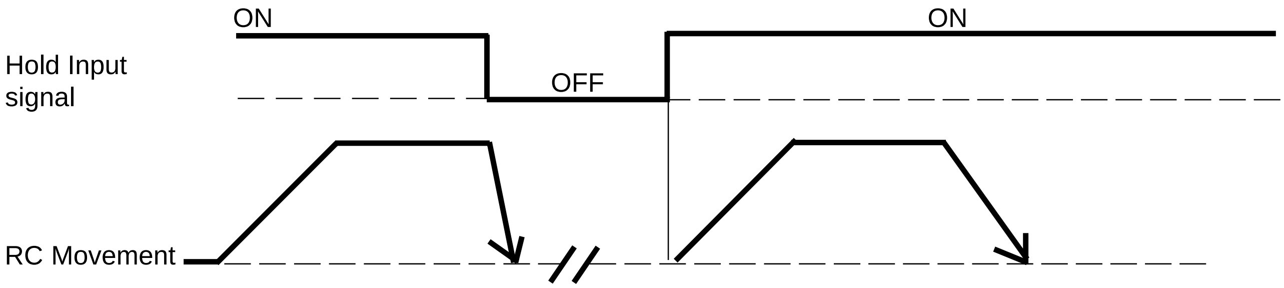
When a mistake is made on the code of the positioning width, as the left diagram shows, only the width (positioning complete width x 2) will be off, so please be careful.





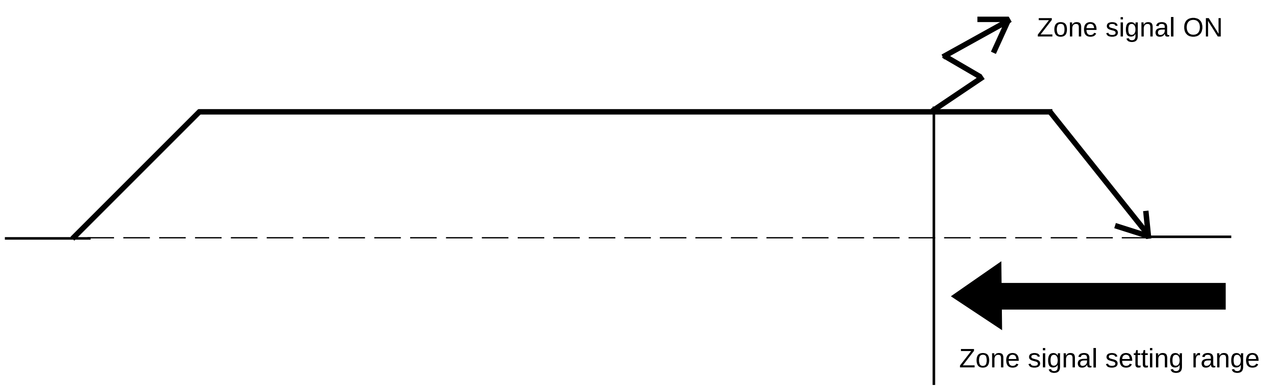
3-2-5 Hold Input

This is used for temporary stop. The actuator will make a quick stop according to the external input signal P I/O Pin 10 pin 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

The zone, as shown below, is an area set to output a signal when the actuator enters its boundaries. By setting the zone parameter beforehand, once a moving slider enters that territory, the zone signal P I/O Pin 22 will turn ON and remain ON within the zone territory setting. It is possible to assign even during 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 START (PNP - toggle + 24 VDC to Pin 3: NPN - toggle GND to Pin 3) to is applied, first homing is executed. Upon homing, homing complete output P I/O Pin 21 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 connecting power.

4. Application (Practice)

4-1 Power-Up

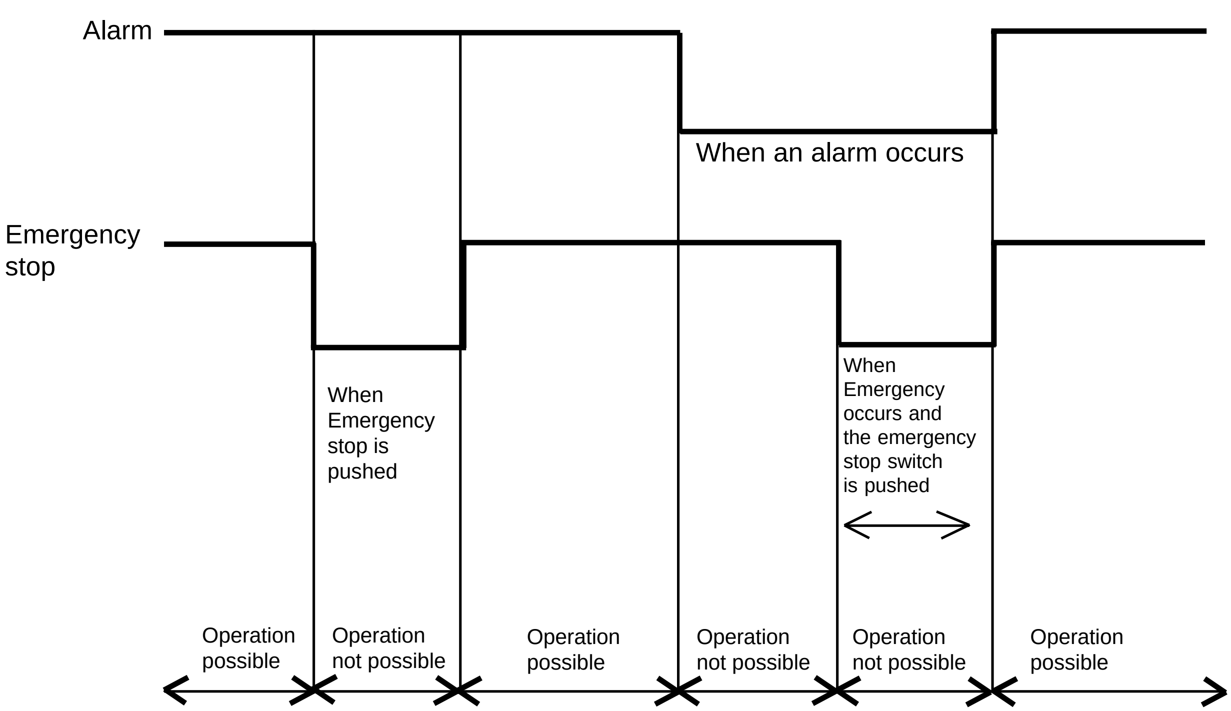
(1) Connnect the motor • brake cable and encoder cable to the controller.
(2) Connect the upper PLC to the P I/O Connector using the attached flat cable.
(3) When connecting more than 1-axis, address each by using the dip switch.
For details, please refer to the “specifications” section under the dip switch settings.
(4) Supply main power (24V) onto the controller terminal board.
(5) Supply P I/O Power (24V).
(6) **Turn the P I/O Hold Input ON. (NPN) GND Pin 10 24V (PNP)**
(7) Normal status is when the RDY, RUN LED turns ON, and abnormal status is when the ALM turns ON.
Please refer to the Error Code List located on Page 59 and so on in this manual.

After the above operation, preparation is completed.

> ***Caution:***
> ***When the P I/O power inputs before the main power or when the power is common, upon installing power, the P I/O output may be in an unstable status for approximately 1msec. As for signal into 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 the same time the power is turned ON. Once the power-Up is complete, the positioning completion output turns ON.
(2) The relationship of P I/O alarm • emergency stop output and the operation status is indicated in the diagram below:



4-2 Procedure for Initial Homing (Absolute Specifications)

4-2-1 Power-UP Procedure

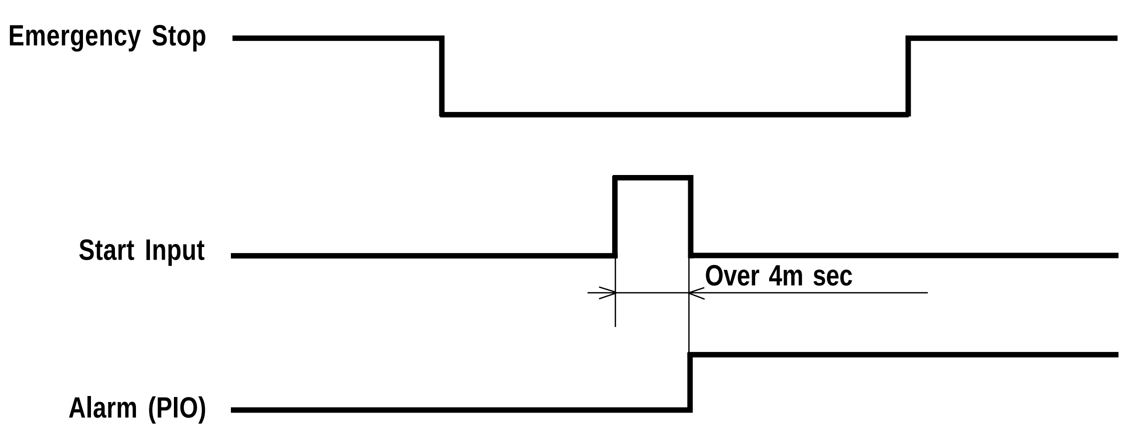
(1) Connnect the motor • brake cable and encoder cable to the controller (Note 1).
(2) Connect the upper PLC to the P I/O Connector using the attached flat cable.
(3) When connecting more than 1-axis, address each by using the dip switch.
For details, please refer to the “specifications” section under the dip switch settings.
(4) Supply main power (24V) to the controller terminal board.
(5) Supply P I/O Power (24V).
(6) Connect the battery.
(7) Turn the P I/O of Hold Input ON (GND Pin 10 [NPN] - Supply 24V [PNP]).
(8) Reset the alarm (Refer to Section 4-2-2, “Alarm Reset” in this manual).
(9) Normal status is RDY, RUN LED turns ON, and abnormal status is when ALM LED is ON.
(10) Begin homing (Refer to Section 4-2-3, “Homing,” in this manual).

Caution (1):
The actuators for absolute are the only actuators that can operate using RCP Controller Absolute specifications.

Caution (2):
During the inital power installation, abnormal detection for absolute encoder always outputs. This is not abnormal.

4-2-2 Alarm Reset (Absolute Specifications)

Alarm reset occurs during emergency stop status, after start signal input, and when E-stop is released.
Or, you may reset the alarm using the optional PC software.



4-2-3 Homing (Absolute Specifications)

During the initial power-UP, you will need to perform homing via either P I/O, Teaching Pendant or PC Software.

By inputting position 0 to the I/O port, you can accomplish homing.

The "Home Complete Signal" will turn ON once homing is complete, and position will be 0. At this time, even if power is reinstalled, power will not turn OFF. Once home location is taught, upon installing power, positioning can be executed without homing.

Caution:

- *When homing through the P I/O, input position data that is within actuator's limits. If no data is input, you can not home.*

- *You will need to charge the battery when using the controller for the first time. Also, charging needs to be done around the maintenance scheduling. To charge the battery, supply power to the controller for at least 48 hours. You may utilize full functionality of the system during charge time. If you keep power off for a substantial length of time, recharge for at least 48 hours. You may utilize full functionality of the system during charge time. If you keep power off for a substantial length of time, recharge for at least 48 hours.*

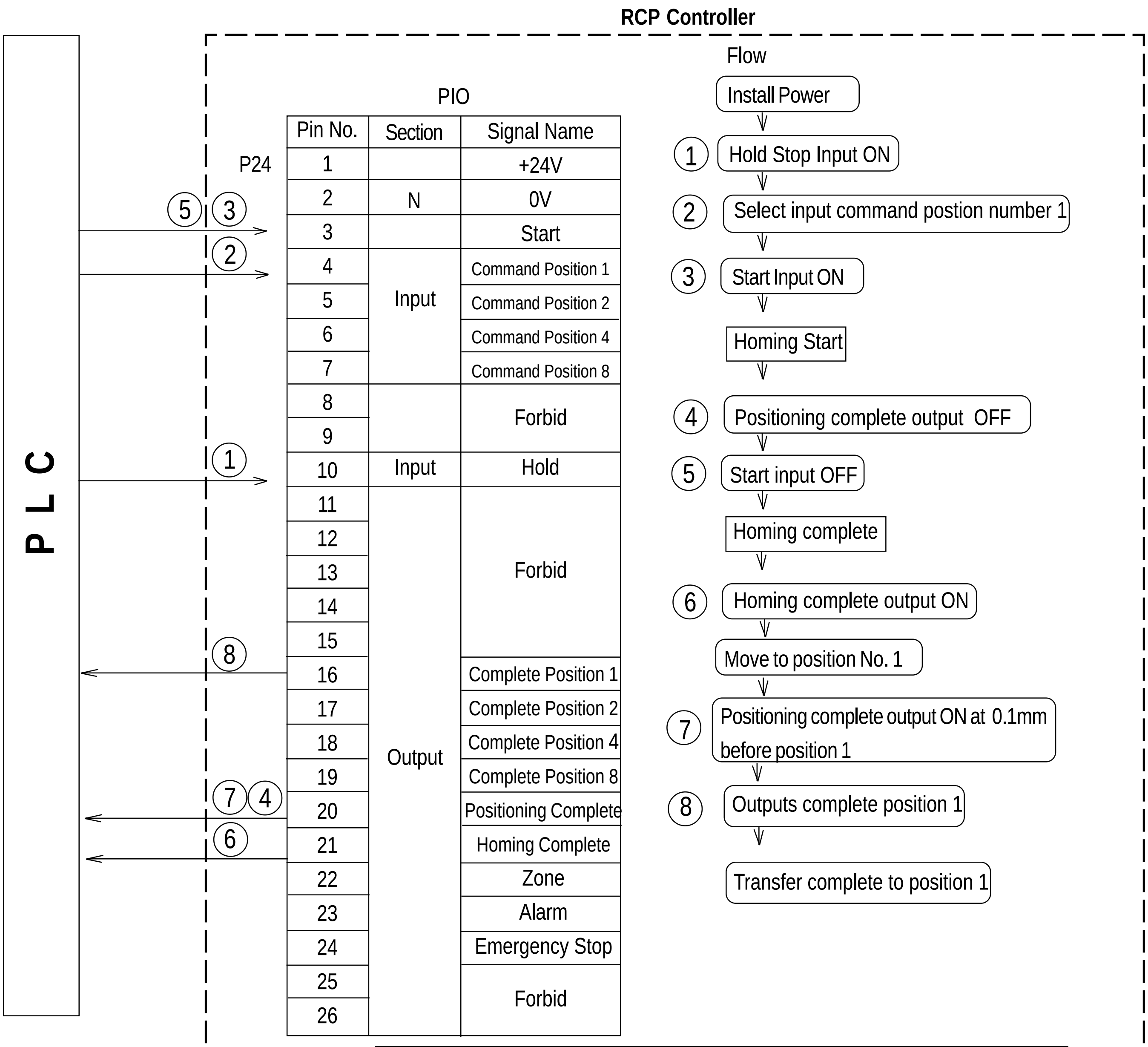
4. Application (Practice)

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.

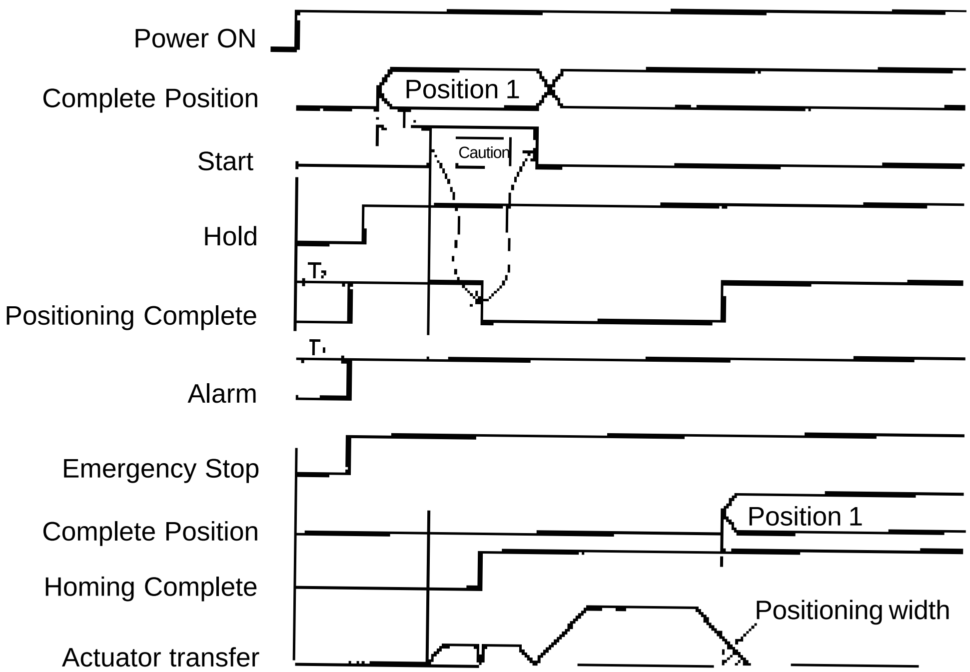
Position data table (column with dark line indicate the input insert)

No.	Position (mm)	Speed (mm/s)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	0	100	0.3	0	0.1	0		
1	**150**	**200**	0.3	0	0.1	0		
⋮								



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

4. Application (Practice)



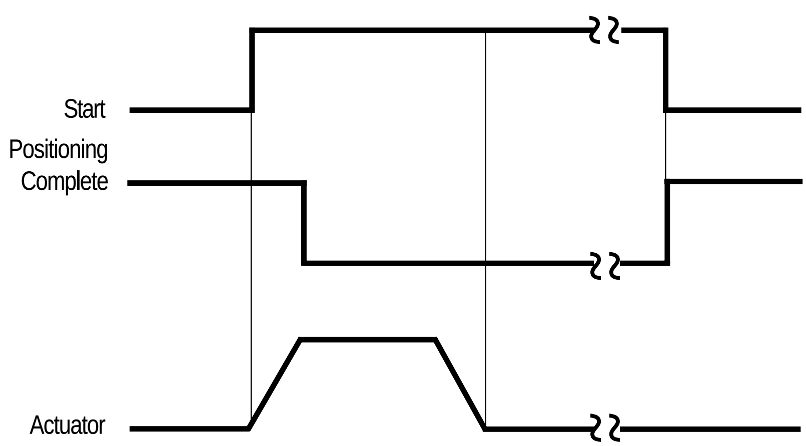
While moving towards a position output will turn OFF, when the actuator completes position, positioning complete turns ON.

When system is RDY and positioning is complete, positioning complete output turns ON.

T1:	Over 5msec	Time from Command Position Select Input to Start Input ON.
T2:	Over 250msec	Time from PowerON to Operation Preparation Complete.
T3:	Over 50msec	Time from Power ON to Alarm Output 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.



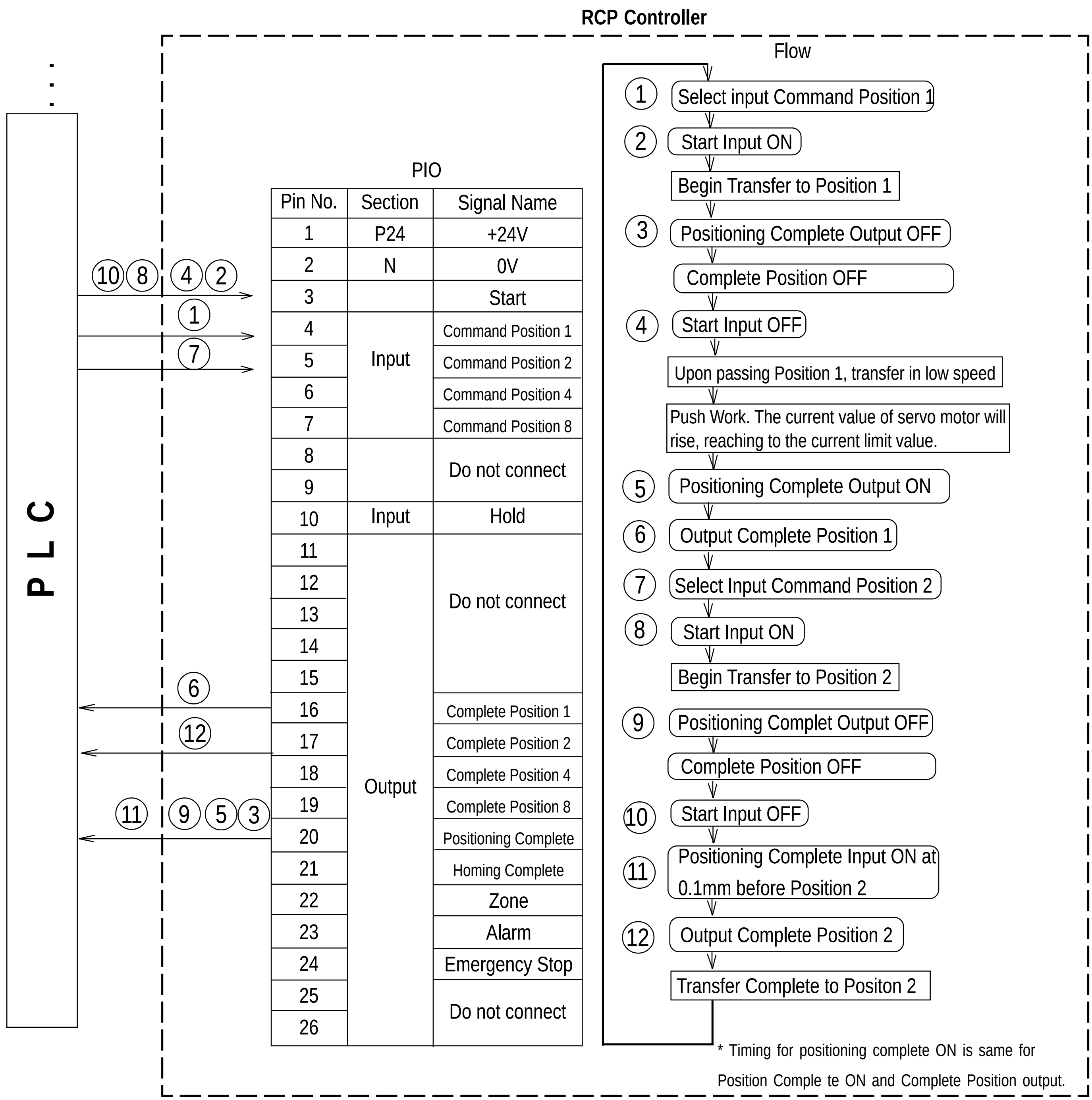
4. Application (Practice)

4-4 Positioning Mode (2 point space reciprocation)

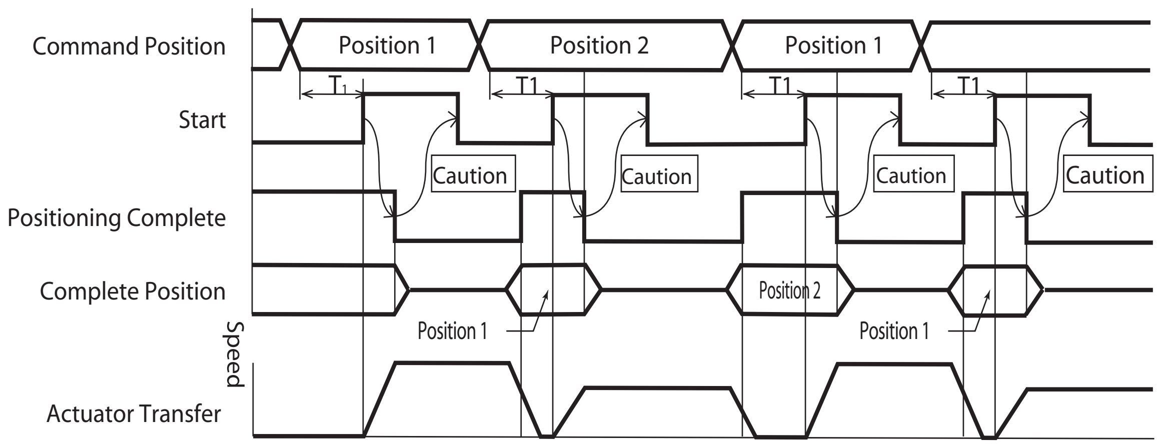
Movement example: Reciprocate 2 positions. Assign the position 1 at 250mm from home, and Position 2 at 100mm from home. Set speed to 200mm/sec for Position 1 and 100mm/sec for Position 2. For both positions, assign the positioning width to 0.

Position Data Table (Columns with thick line indicate input insert)

No.	Position (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	*	*	*	*	*	*		
1	150	200	0.3	0	0.1	0		
2	100	100	0.3	0	0.1	0		



4. Application (Practice)

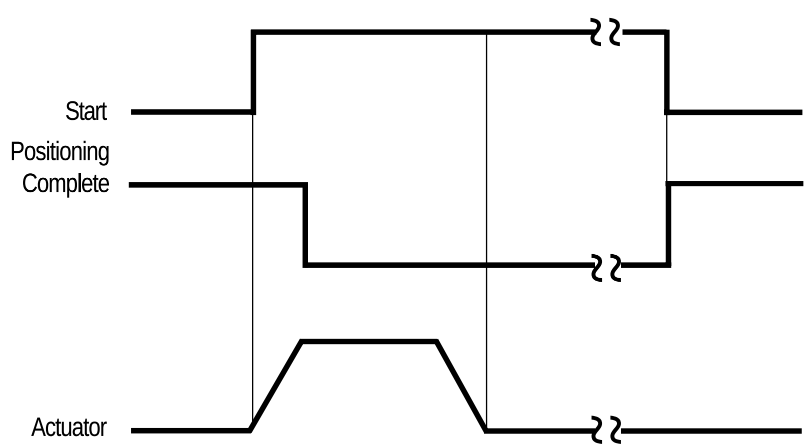


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

Caution:
Positioning complete Output will turn OFF 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.

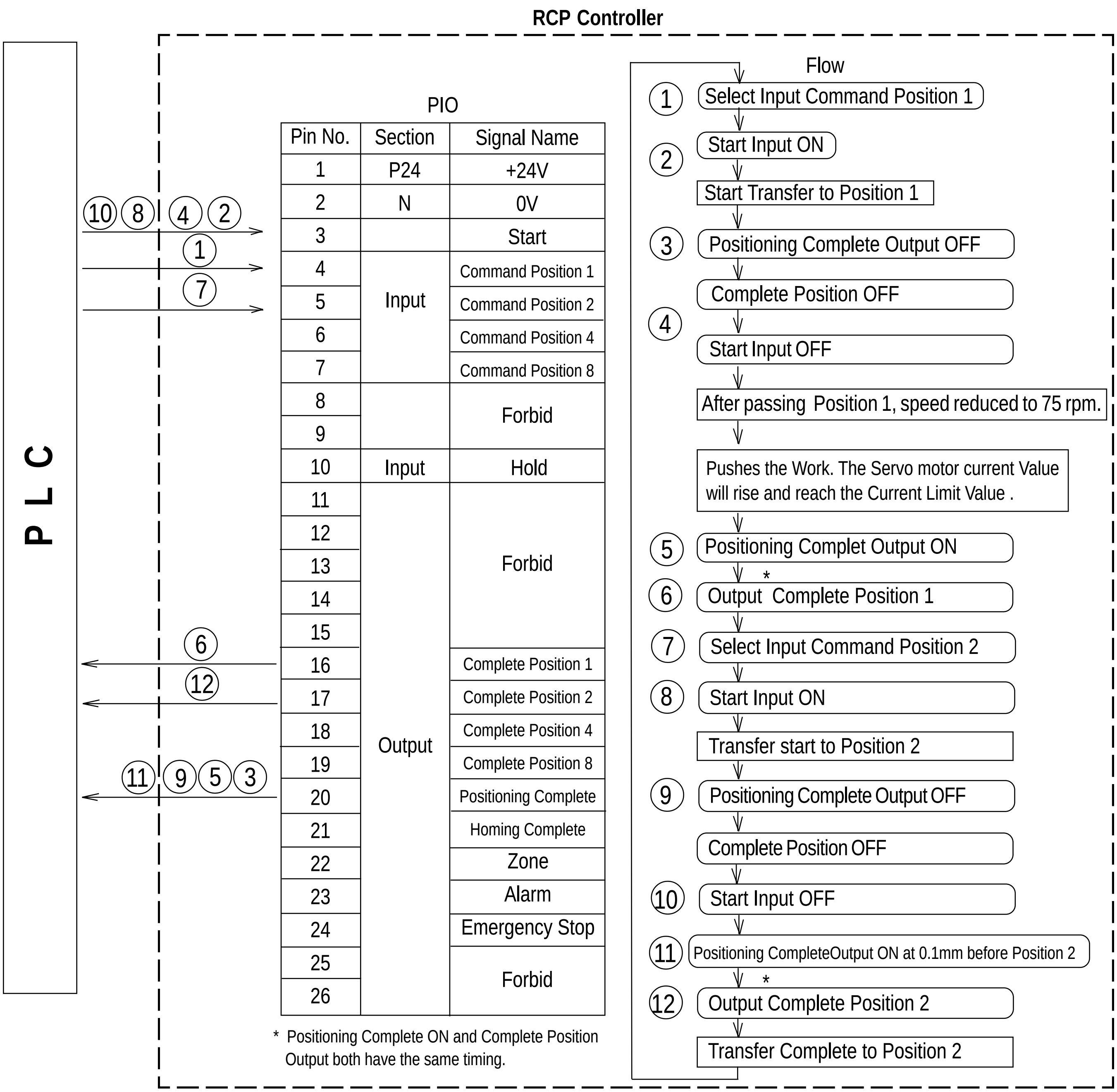


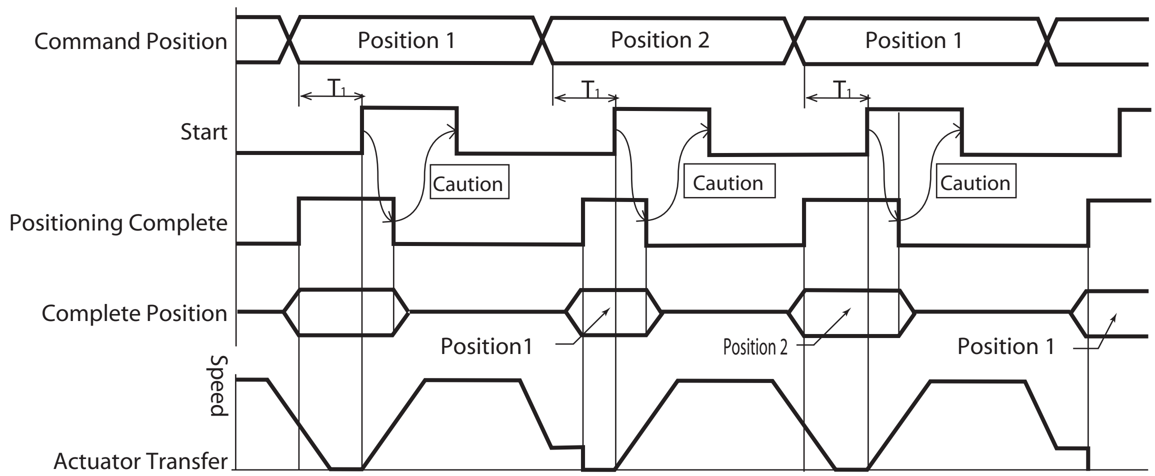
4-5 Push Mode

Movement Example: Use via Push Mode and Positioning Mode. Assign the Position 1 at 280mm from home and the 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%.

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

No.	Position (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	*	*	*	*	*	*		
1	280	200	0.3	50	2	0		
2	50	100	0.3	0	0.1	0		
⋮								



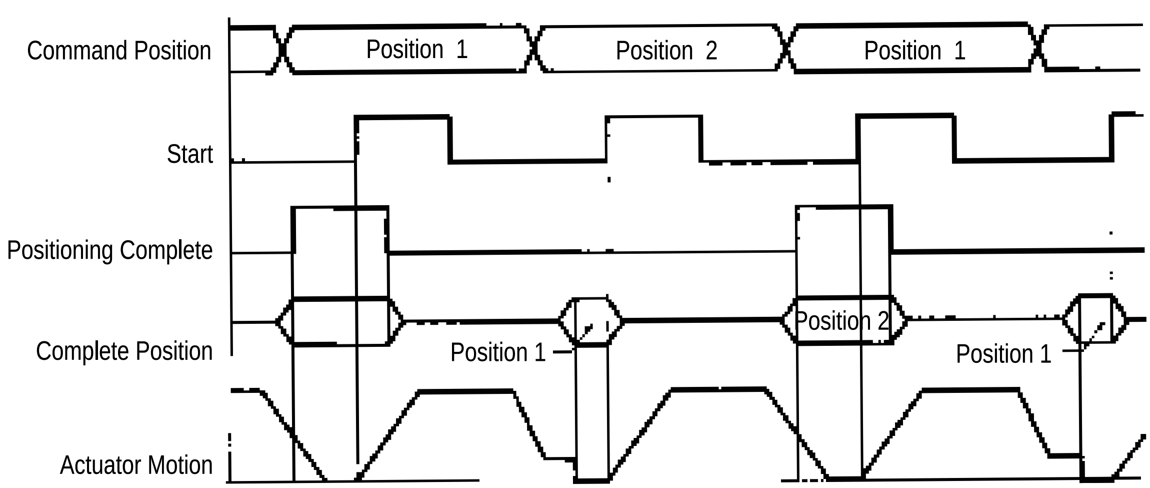


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

> ***Caution:***
> ***Once the Start Signal turns ON, the Positioning Complete Output will turn OFF. Please execute Start Signal OFF only after confirming that the Positioning Complete Output turns OFF.***

> ***Caution:***
> ***When the push completes stroke, as the diagram below shows, the Positioning Complete Output will not turn ON, only the Complete Position outputs.***



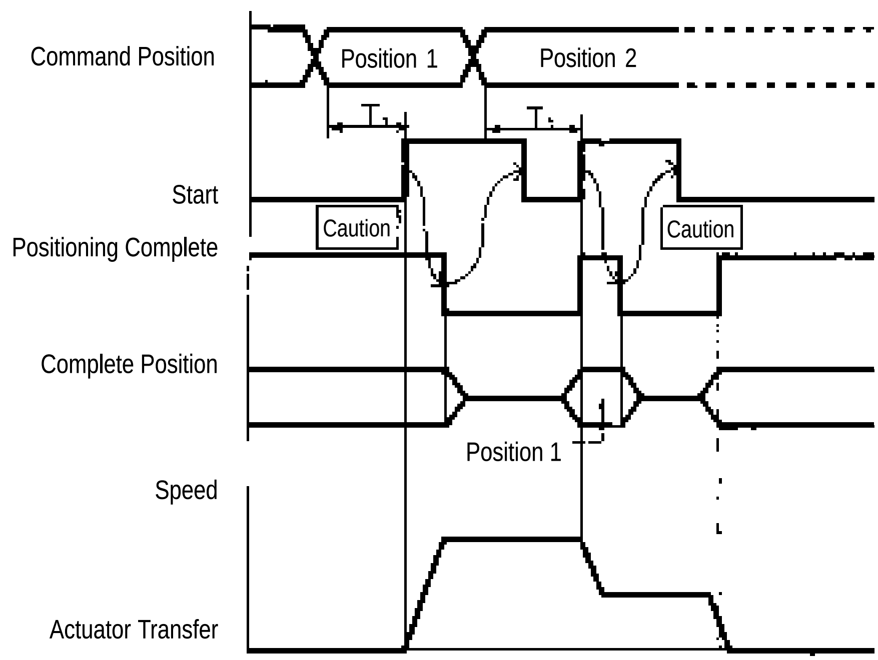
4-6 Speed Change Movement During Transfer

Movement Example: During movement, speed decreases towards given location. Assign Position 1 at 150mm away from home, and Position 2 at 200mm away from home. The location will be near the home away from the initial position. 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 consecutively, first with Position 1, then followed by Position 2. However, before stopping at Position 1, it is necessary to first execute Select Input 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)

No.	Position (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	*	*	*	*	*	*		
1	150	200	0.3	0	1	0		
2	200	100	0.3	0	0.1	0		
⋮								



T1: Over 5msec   Time from Command Position Select Input to Start Signal ON

> ***Caution:***
> ***Once the Start Signal turns ON, the Positioning Complete Output will turn OFF.***
> ***Please execute Start Signal OFF only after confirming that the Positioning Complete Output turns OFF.***

4. Application (Practice)

RCP Controller

P L C

PIO

Pin No.	Section	Signal Name
1	P24	+24V
2		0V
3		Start
4	Input	Command Position 1
5		Command Position 2
6		Command Position 4
7		Command Position 8
8		Connection Forbid
9		
10	Input	Hold
11		Do not connect
12		
13		
14		
15		
16	Output	Complete Position 1
17		Complete Position 2
18		Complete Position 4
19		Complete Position 8
20		Positioning Complete
21		Homing Complete
22		Zone
23		Alarm
24		Emergency Stop
25		Connection Forbid
26		

* Positioning Complete ON and Complete Position Output both have the same timing.

Flow

① Select Input Command Position 1

② Start Input ON

Start Transfer to Position 1 at 200mm/sec.

③ Positioning Complete Output OFF

Complete Position OFF

④ Start Input OFF

⑤ Select Input Command Position 2

⑥ Positioning Complete Output ON at 1mm before Position 1

⑦ Output Complete Position 1

*

⑧ Start Input ON

Start Transfer to Position 2

⑨ Positioning Complete Output OFF

Complete Position OFF

⑩ Start Input OFF

⑪ Positioning Complete Output ON at 0.1mm before Position 2

⑫ Positioning Complete Output ON

Transfer Complete to Position 2

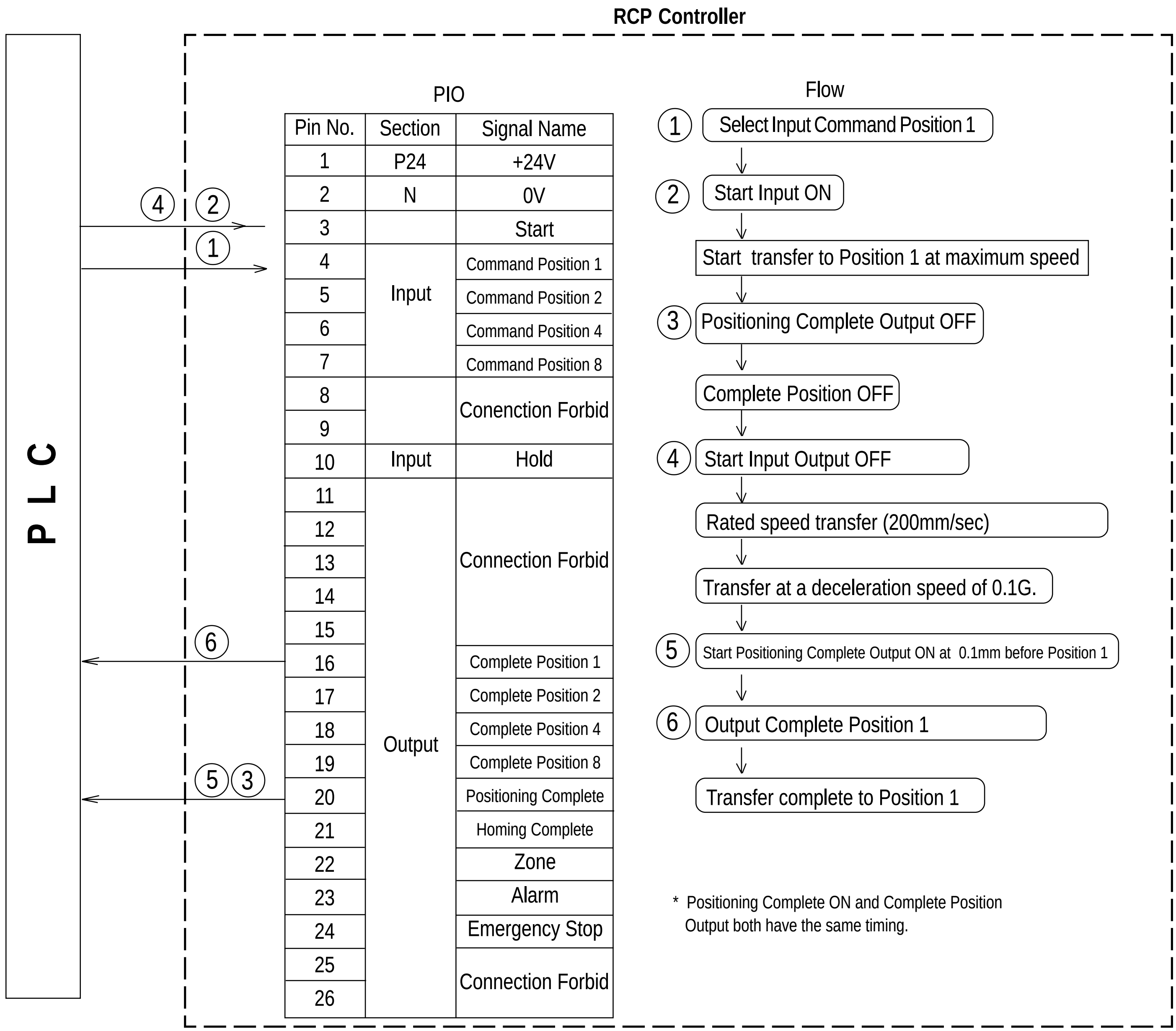
4-7 Movement Using Different Acceleration Value • Deceleration Value

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

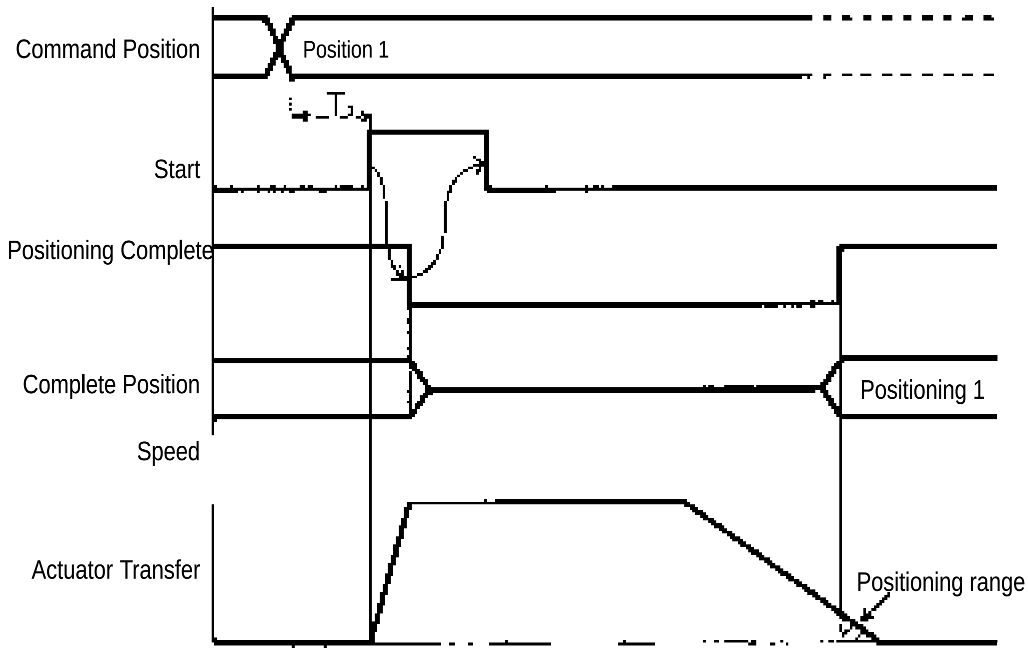
Method: By inputting “1” into MAX ACC of the position data, the acceleration will be the maximum acceleration which matches the load.

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

No.	Position (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	*	*	*	*	*	*		
1	150	200	0.1	0	0.1	1		
:								



4. Application (Practice)

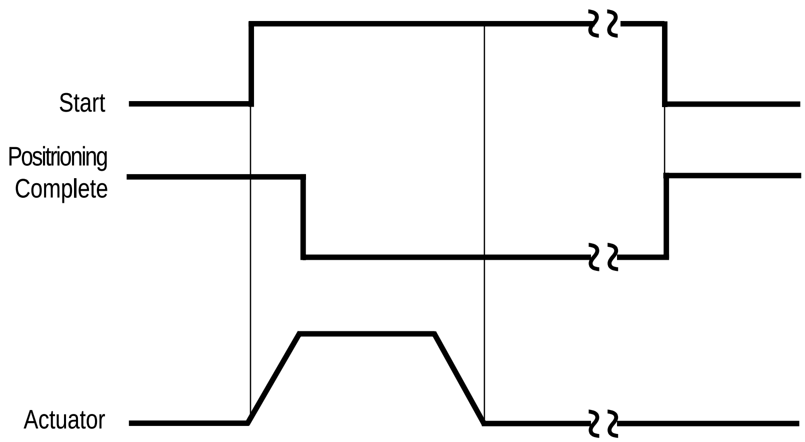


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

Caution:
Once the Start Signal turns ON, the Positioning Complete Output turns OFF.
Please execute Start Signal OFF only after confirming that the Positioning Complete Output turns OFF.

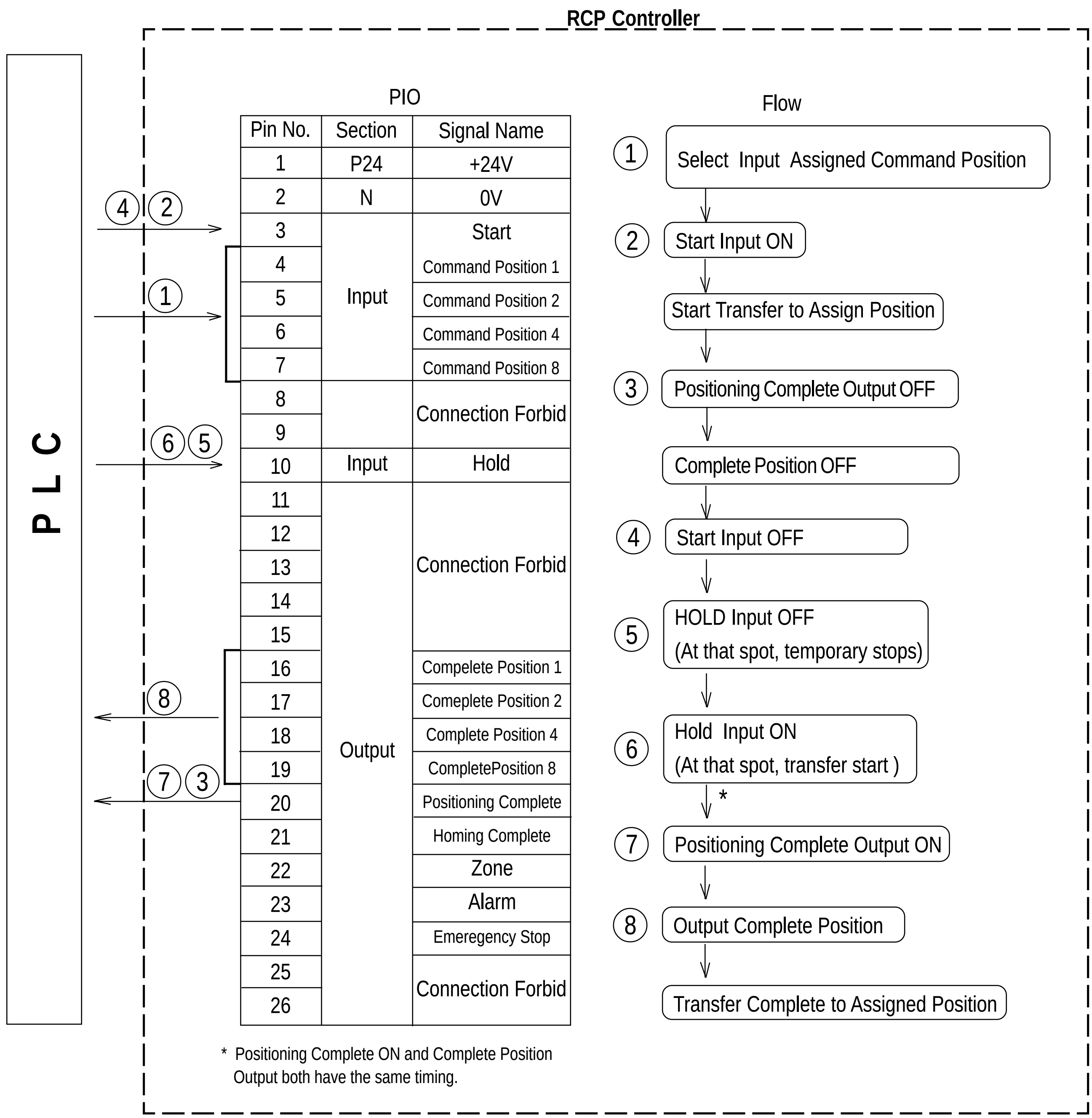
Caution:
As the diagram below shows, if you leave the Start Input ON, even if the actuator completes transfer, positioning output will not turn ON.



4-8 Hold Input

Movement Example: Temporary stops the movement of the actuator.

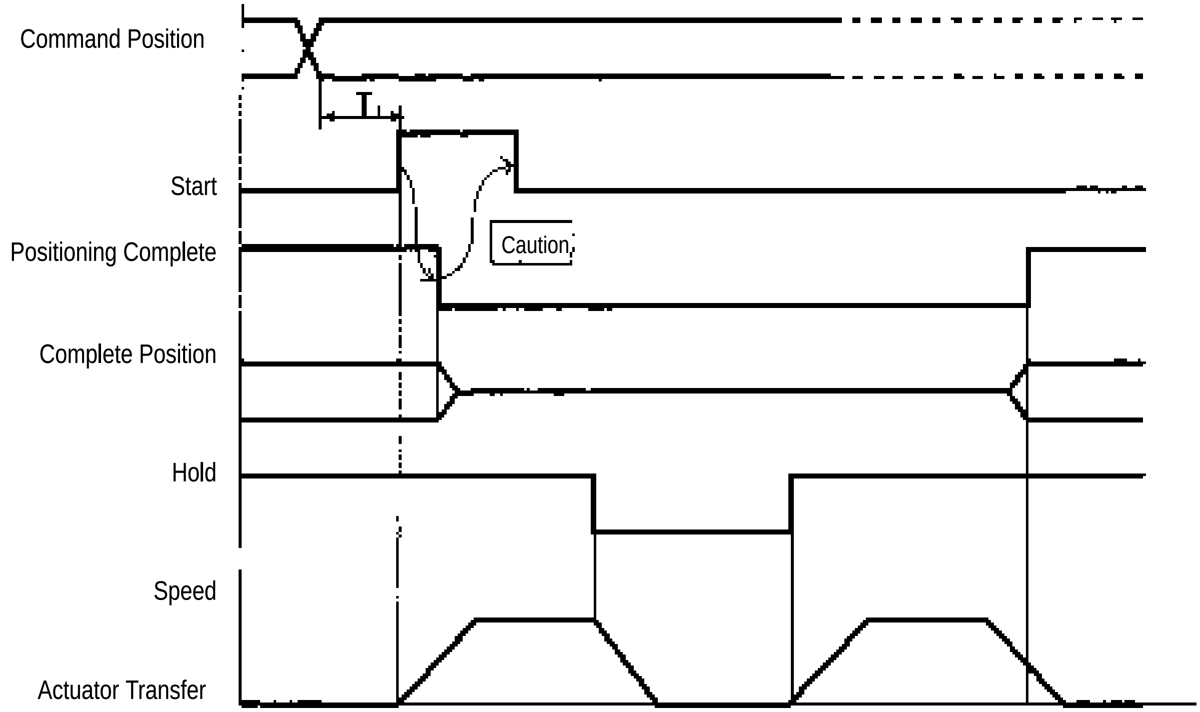
Method: Uses the Hold Input.



Pin No.	Section	Signal Name
1	P24	+24V
2	N	0V
3	Input	Start
4		Command Position 1
5		Command Position 2
6		Command Position 4
7		Command Position 8
8		Connection Forbid
9		
10	Input	Hold
11	Output	Connection Forbid
12		
13		
14		
15		
16		Compelete Position 1
17		Comepelete Position 2
18		Complete Position 4
19		CompletePosition 8
20		Positioning Complete
21		Homing Complete
22		Zone
23		Alarm
24		Emeregency Stop
25		Connection Forbid
26		

* Positioning Complete ON and Complete Position Output both have the same timing.

4. Application (Practice)



T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

> ***Caution:***
> ***Once the Start Signal turns ON, the Positioning Complete Output turns OFF.***
> ***Please execute Start Signal OFF only after confirming that the Positioning Complete Output is turned OFF.***
> ***Frequent use of Sudden Stop Input will shorten the actuator's life span.***

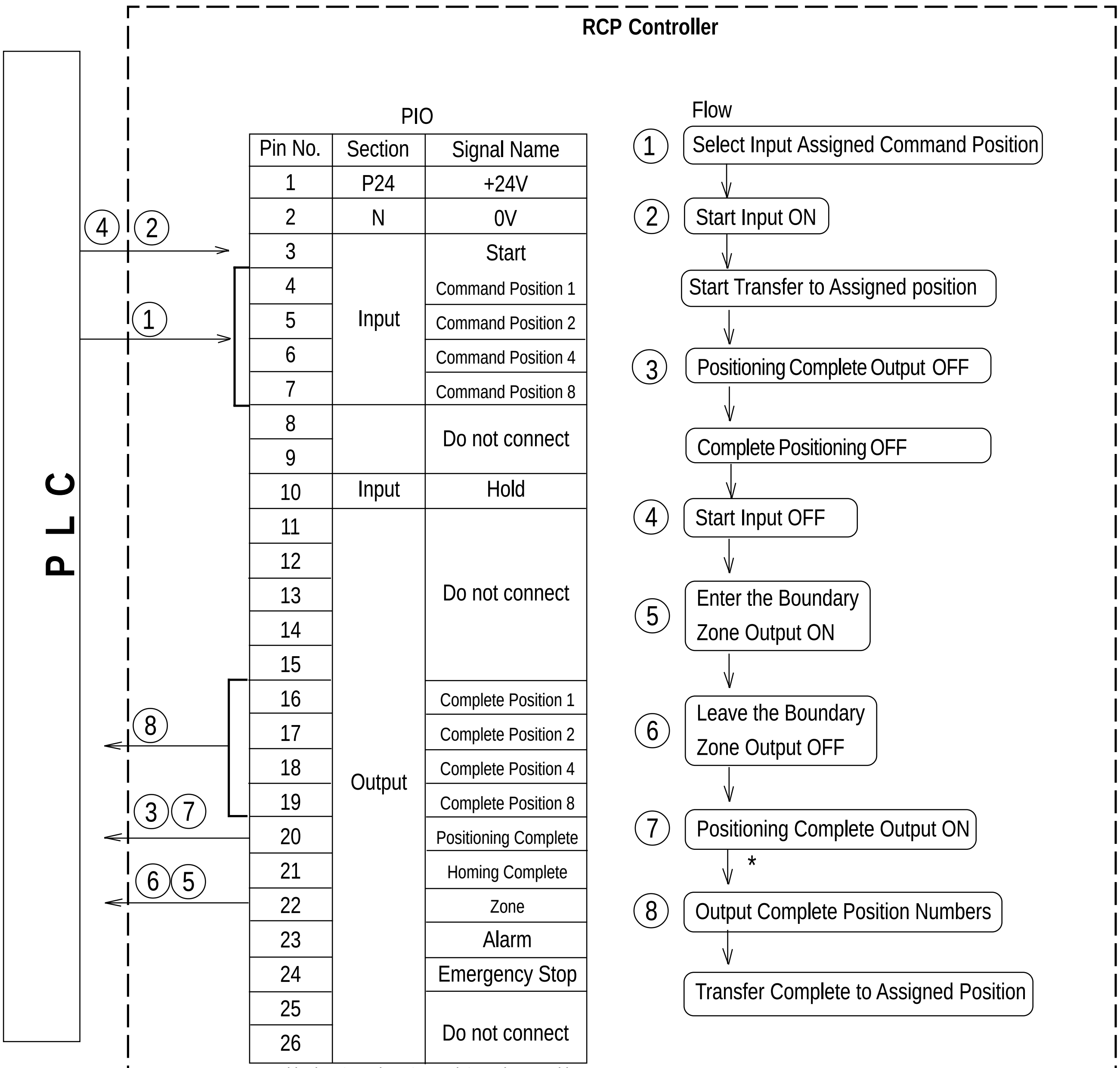
4-9 Zone Signal Output

Movement Example: During motion, Zone Signal transmit output from 40mm position to 120mm position zone, then turns OFF (400mm≤Zone Signal Output≤120mm).

Method: Zone Signal Output boundary is set in the Parameter Zone Value and Zone Boundary Value -.

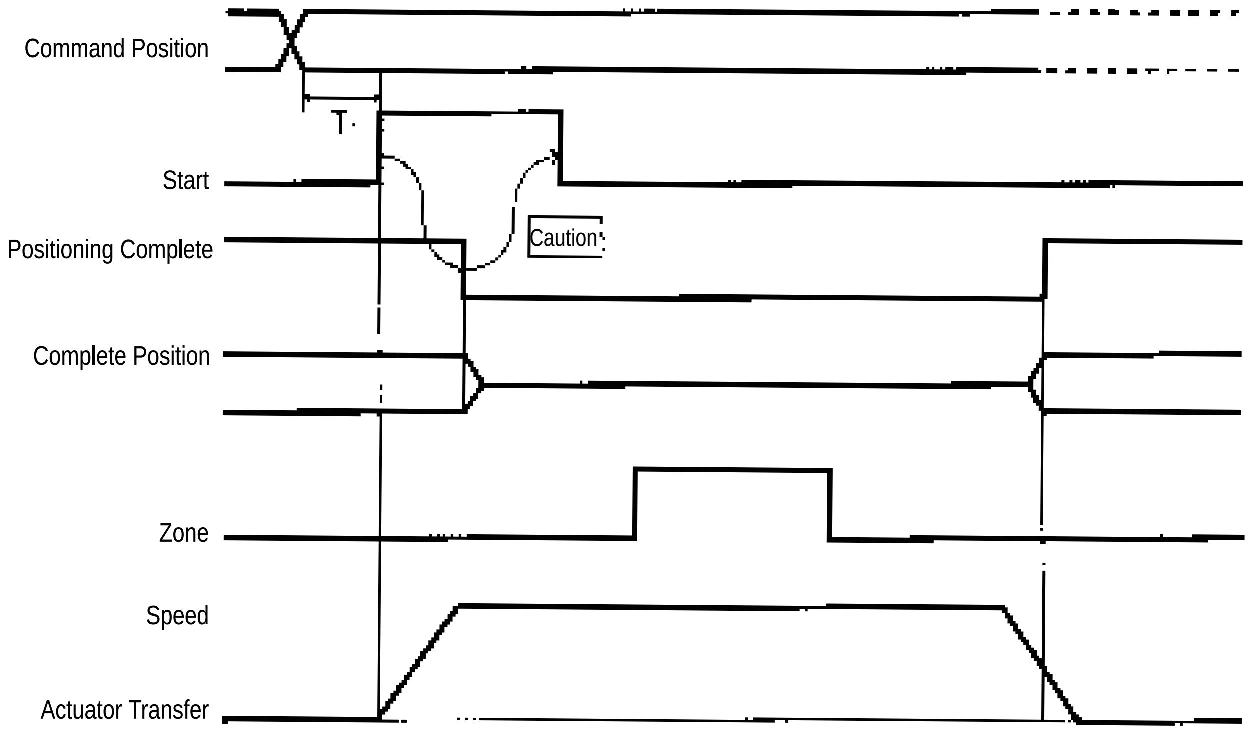
Input as the following:

Zone Boundary Value +	120
Zone Boundary Value -	40



* Positioning Complete ON and Complete Position Output both have the same timing.

4. Application (Practice)



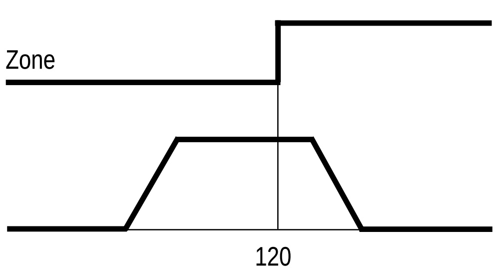
T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

Caution:
Once the Start Signal turns ON, the Positioning Complete Output turns OFF.
Please execute Start Signal OFF only after confirming that the Positioning Complete Output has turned OFF.

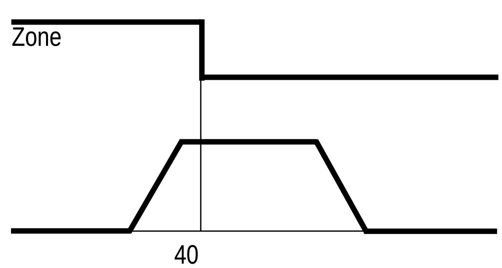
Other zone outputs (examples):

Zone Output at over 120



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

Zone output at under 40



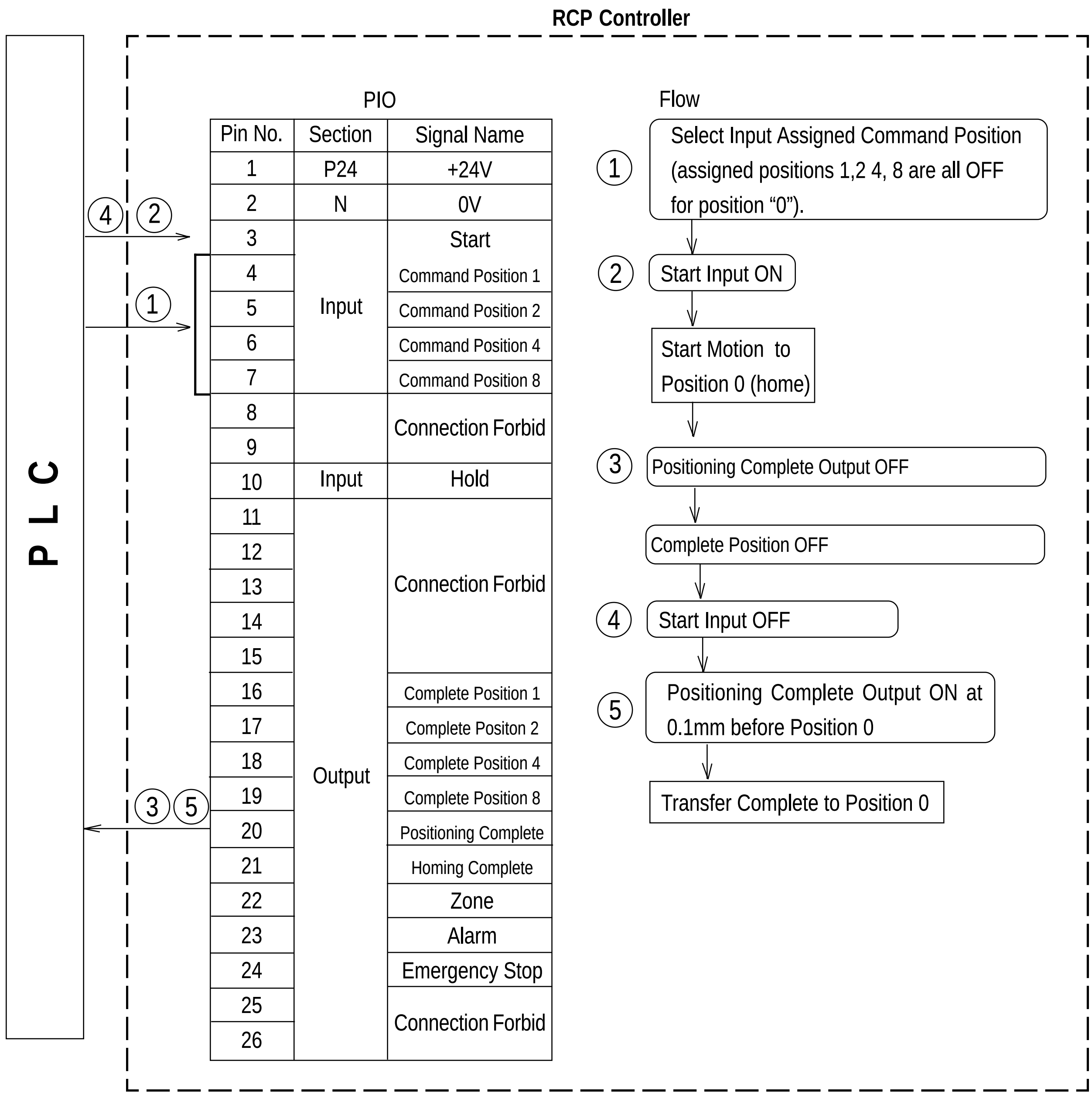
Zone Boundary Value +	40
Zone Boundary Value -	0

4-10 Transfer to Home

Movement Example: You cannot home using only PIO. Homing occurs when controller is told to move to a point prior to homing.
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 (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	0	100	0.3	0	0.1	0		
1	*	*	*	*	*	*		
⋮								



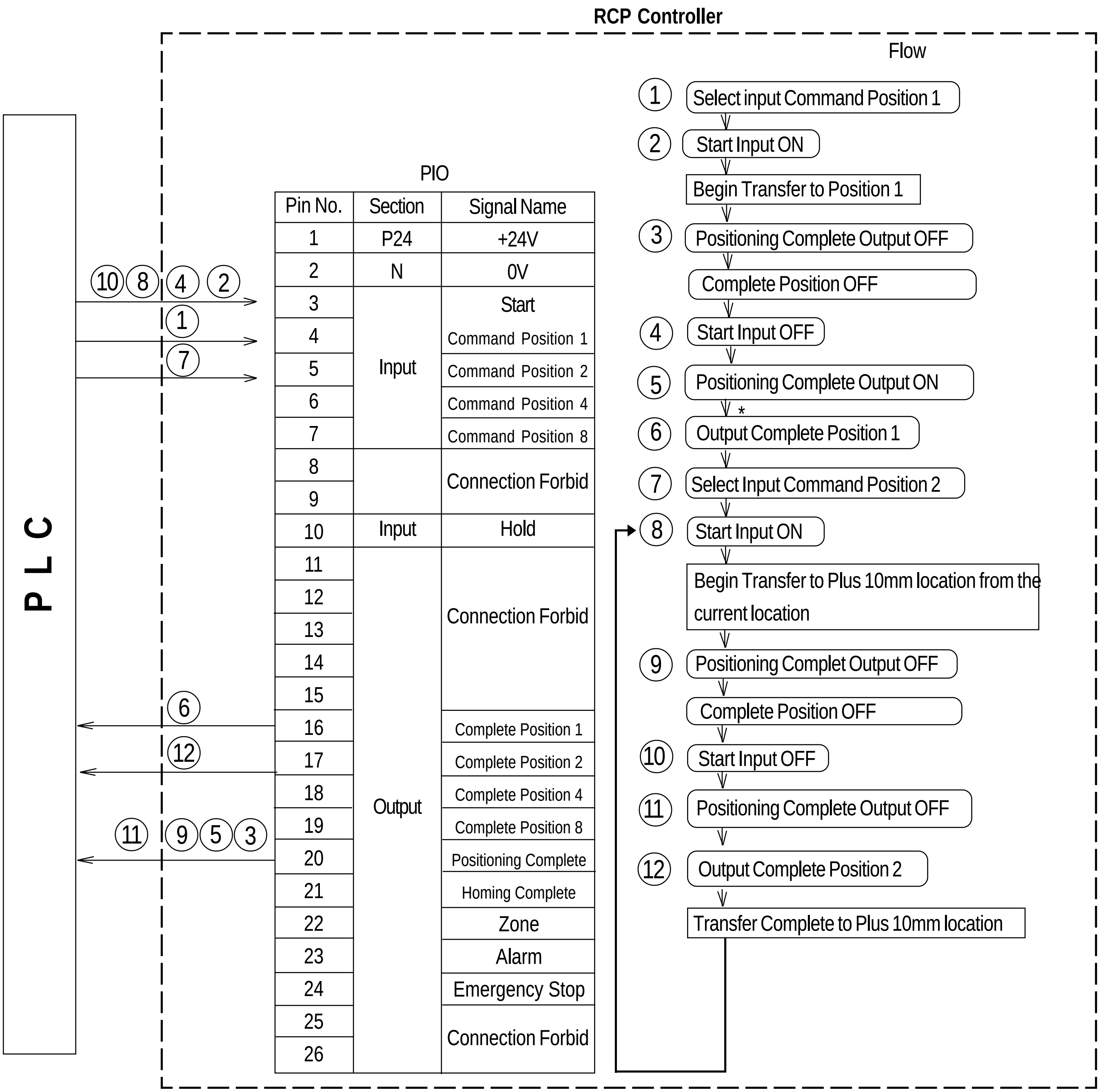
4. Application (Practice)

4-11 Pitch Transfer According to Relative Coordinate Assign

Movement example: Transfer from home to 30mm location, and from there, transfer the actuator at a pitch of 10mm.
The transfer speed from home to the 30mm location is set at 100mm/sec, and the transfer speed is 20mm/sec at a pitch of 10mm.

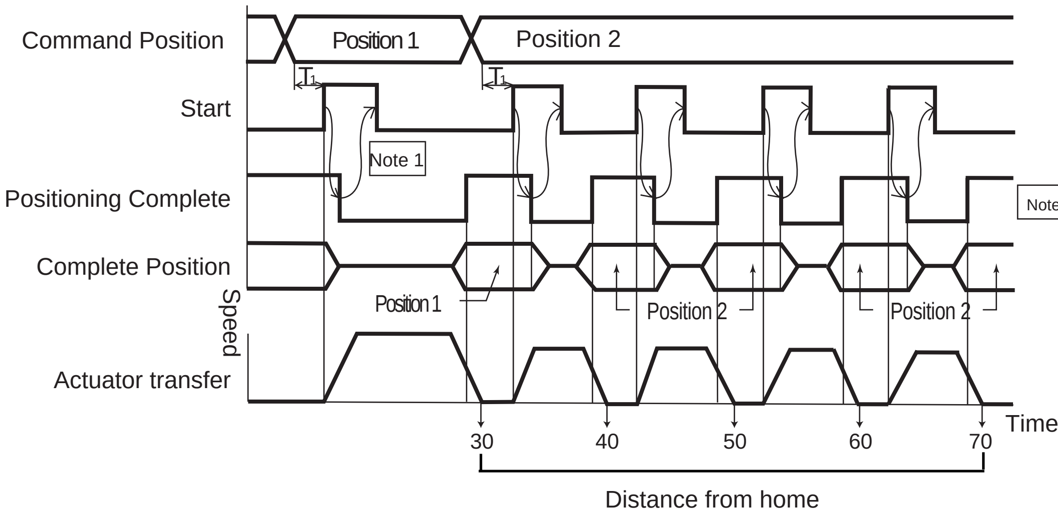
Position Data Table (Columns with thick line indicate input insert)

No.	Position (mm)	Speed (mm)	Acc (G)	Push (%)	Pos. Band (mm)	Max ACC Flag (0/1)	ABS/INC (0/1)	Comments
0	*	*	*	*	*	*		
1	30	100	0.3	0	0.1	0		
2 =	10	20	0.3	0	0.1	0		
	⋮							



* Positioning Complete ON and Complete Position Output both have the same timing.

4. Application (Practice)

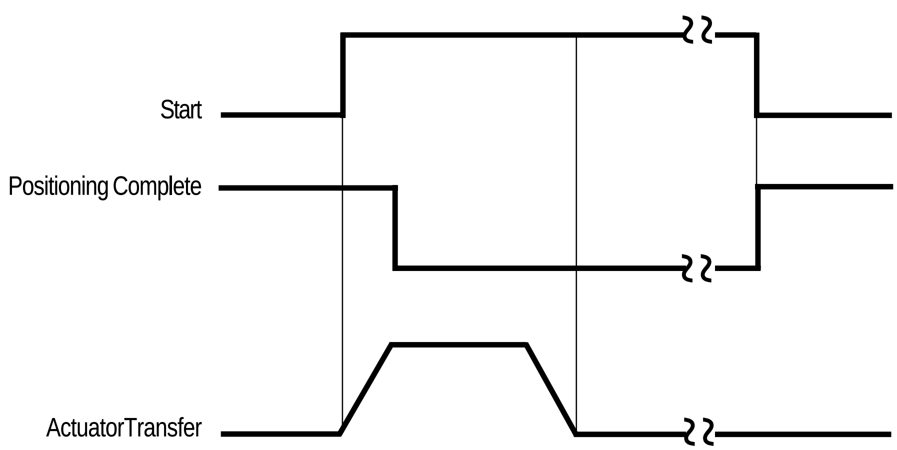


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

Caution:
Once the Start Signal turns ON, the Positioning Complete Output turns OFF.
Please execute Start Signal OFF only after confirming that the Positioning Complete Output has turned OFF.

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 (Practice)

4-12 Caution Regarding Relative Coordinate Assign

(1) Caution During Positioning Movement

When selecting a relative posisition through the I/O and toggling the Start Input, during actuator motion towards another point, the distance of the next point selected will be added on to the initial point the actuator was moving towards. 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 4-12-1), moves to the position 40mm away from home.

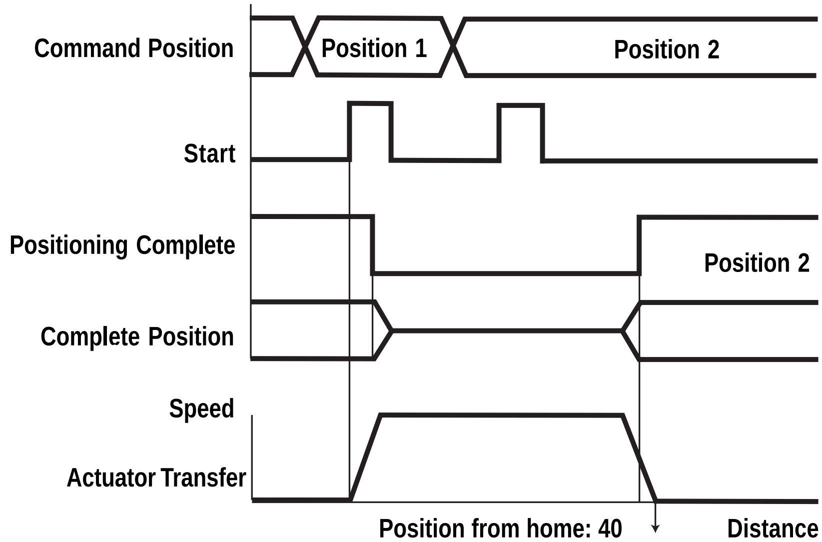
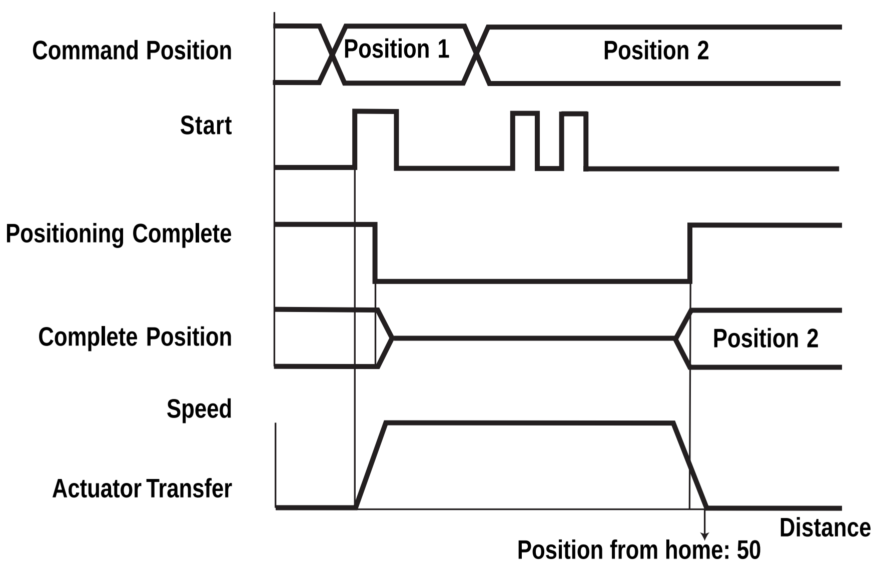


Table 4-12-1

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

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 inital position input.

Example: In case Start Input of Position 2 is executed (Table 4-12-1 above) twice during movement towards Position 1, the actuator moves to a position approximately 50mm away from home (five times Position 2 which is 10mm).



(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 summation of the primary and secondary positions.

Example: The Start Input of Position (Table 4-12-1) 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.

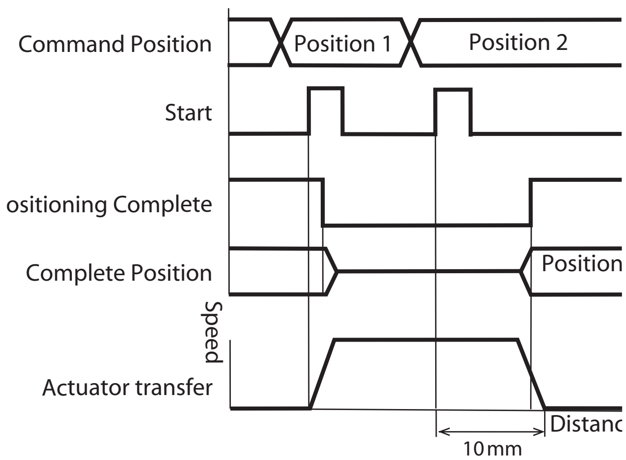


Table 4-12-2

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 pulse. Therefore, an error may occur between the value input in the position and the corresponding movement of the actuator. When a relative transfer is executed consecutively, this error will accumulate.

The maximum error range per each actuator type is listed in the table below:

RC Model Type	Speed Type	Lead mm	Maximum Error Range mm
RC - S5 - S6 - SS (R)	L	3	0.00375
	M	6	0.0075
	H	12	0.015
RC - SM - SMR	L	5	0.00625
	M	10	0.0125
	H	20	0.025
RC -RSA -RSW -RSI -RSIW -RSGB -RSGS -RSGD	L	2.5	0.003125
	M	5	0.00625
	H	10	0.0125
RC -RMA -RMW -RMI -RMIW -RMGB -RMGS -RMGD	L	4	0.005
	M	8	0.01
	H	16	0.02

Example: When movement is executed ten times consecutively using the RCP-SM-H type, a maximum of 0.025X10=0.025mm may occur in the final position.

To eliminate this accumulation error, you will need to first execute Absolute Value Coordinate Assign before exceeding the allowable value and then, eliminate the accumulate error.

(4) Ball Screw Accuracy

The accuracy of the ball screw used for the RCP is JIS specified C10.

5. Parameter List

Parameter List

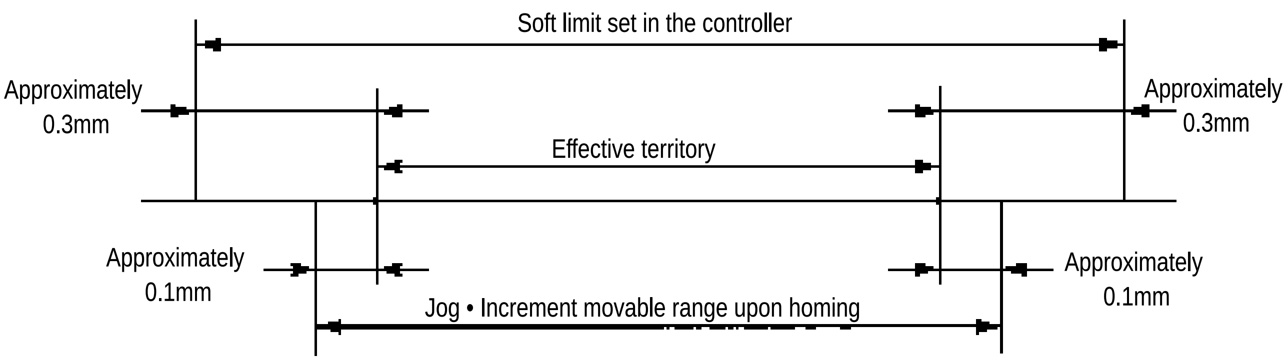
<table>
<tr><td>Zone Limit + side (mm)</td><td>Maximum value of zone output.</td><td></td></tr>
<tr><td>Zone Limit - side (mm)</td><td>Minimum value of zone output.</td><td></td></tr>
<tr><td>Soft Limit + side (mm)</td><td>Sets the soft limit value in the plus direction.</td><td></td></tr>
<tr><td>Soft Limit - side (mm)</td><td>Sets the soft limit value in the minus direction.</td><td></td></tr>
<tr><td>HOME Direction (0:Motor/1: Reverse)</td><td>Sets the homing direction.</td><td></td></tr>
<tr><td>Push Recognition Time (msec)</td><td>During a move, if the push % is sustained for this amount of time, the position complete output turns ON.</td><td></td></tr>
<tr><td>Servo Gain No.</td><td>Set the servo gain.</td><td></td></tr>
<tr><td>Initial Speed Setting (mm/sec)</td><td>Speed initial value of position data table.</td><td></td></tr>
<tr><td>Initial Acceleration Setting (G)</td><td>Acc in position data table.</td><td></td></tr>
<tr><td>Initial Position Band (mm)</td><td>Positioning width initial value in position data table.</td><td></td></tr>
<tr><td>Acceleration Only Max's Flag Initial Amount</td><td>MAX Acc initialization of position data table.</td><td></td></tr>
<tr><td>Current Limit at P-end (%)</td><td>Determines the power during stop upon homing.</td><td>*</td></tr>
<tr><td>Current Limit During Home (%)</td><td>Sets the current limit value of machine end match during home movement. During vertical setting • motor upper side usage, and while homing via load, there's a chance that homing incompletes until returning to the normal position .
In the case, please change the value as follows:
<table><tr><th>Initial setting value</th><th>Modified value</th></tr><tr><td>25</td><td rowspan="3">75</td></tr><tr><td>35</td></tr><tr><td>50</td></tr></table></td><td>*</td></tr>
</table>

** : 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



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

• Reveresed homing direction is not possible for the Rod Type Actuators (RSA • RMA types).

• The homing direction setting for the In-Line Type Actuators (SSR • SMR types) is opposite.
(0: Correct 1: Reverse)

***Caution: Upon executing parameter changes, please reinstall the controller power.
The parameter will write over but some may not be effective by simply turning OFF • ON the emergency stop switch and PORT switch.***

6. 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.

○ = ON ● = OFF

Alarm	Complete Position No				Alarm Content	Alarm Code*
	8	4	2	1		
○					Normal	
●	●	○	○	●	Wrong EEPROM Data Setting	0B0, 0B1
●	●	○	○	○	Commutation and/or forming procedure related alarm	0B8~0BE
●	○	●	●	●	Servo Malfunction	0C0, 0C1
●	○	●	○	●	Alarm in Reference to Other Electrical Conversion Abnormalities	0D0, 0D1
●	○	○	●	○	Encoder Breakage	0E8, 0EC
●	○	○	○	○	Corruption of EEPROM Data	0F8

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

* This is an alarm displayed in the Teaching Pendant and PC software.
Complete position of PIO will not output even when an alarm other than the ones listed on the above alarm code occurs.

Regarding Absolute Encoder Abnormality:

1) Battery Voltage Drop
2) Actuator move during battery backup (See Page 18 in this manual)
3) Absolute location data abnormality (due to noise)
4) Encoder cable breakage

In any case, after resolving the cause, you will need to reset the alarm (refer to Page 36 in this manual) and home again.

6. 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."

Error Table

Code	Error Description	Common Solutions
05A	Transmission Error	Abnormal Communication, Check for noise. Inspect all serial ports and cables involved.
05B	Transmission Framing Error	
05D	Start Text Error	
05E	End Text Error	
07F	BCC Error	
061	FNCCHR, W Address Error	Serial string needs to be formated 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 placed controller, there could be an initialization of rotation numbers which surpasses 2000rpm against the SW7-ON, SW8-off against the controller. Incorrect Data Command Rejection (could be an operation not allowed with the 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 is 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	When release is not possible with the controller power reinstalled, you will need to either execute a common parameter edit or initialize the controller.
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 installed, you will need to either execute a common parameter edit or initialize the controller. 1. Cycle power to controller 2. Possibly, parameters need to be set correctly.
0B8	Communication Error 1	Please check the following: • Make sure that the payload is within specification. • Make sure that the external power source works well. Check the motor encoder cable.
0B9	Communication Error 2	
0BB	ORG - Search C Error	Abnormal Z-Phase.

6. Alarm List

Code	Error Description	Common Solution
0BC	ORG-Search A,B Error	Abnormal Z and B Pulse
0BD	Speed prior to ORG Search Error	During homing, already moving over the rated speed.
0BE	Homing Time Out Error	Check the motor and encoder cables. Make sure that the slider is not jammed against the hard stop.
0C0	Over Speed	Please reduce the payload or lower the velocity and ACC/DEC.
0C1	Servo Error	
0D0	Excess Main Power Voltage	Please check the main power voltage.
0D1	Deviation Over Flow	Please check the mechanical binding.
0E8	No A and B Pulse Feedback	Please check the encoder/cable.
0E9	No A Pulse Feedback	
0EA	No B Pulse Feedback	
0EB	No C Phase Feedback	
0EC	No PS Phase Feedback	
0EE	ABS Error 2	Reset the alarm (refer to Page 36 in this manual). In case reset is not possible, please check the encoder cable and charge or replace the battery.
0F8	Fixation Memory Breakage	Controller initialization is needed.
0F9	Abnormal PLD	PLD(mounted on the base) shows abnormal movement.
101	Over Run Error (S)	Check the competition in baud rate • SIO main station subordinatestations (during update)
102	Framing Error (S)	Check the competition in baud rate cable • short • noise SIO main station • subordinate stations
104	SCI R-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	Update program file is abnormal (during update).
10B	Motorola S Record Error	Update program file is abnormal (during update).

6. Alarm List

Code	Error Description	Common Solution
10C	Motorola S Address Error	Abnormal update program file (during update).
10D	Motorola S File Name Error	Abnormal update program file (during update).
10E	Timing Limit (W) (S)	Please check TB-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.
113	Input Under Error	Input value is under. Please input allowable data.
114	Input Over Error	Input value is over. Please input allowable data.
115	Homing Incomplete	Unallowed operation is being executed during the homing incomplete status. First execute homing.
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, position data is not available.
118	Non-connnect Axis Selection	Non-connect axis has been selected (there's no error).
119	TB Parameter Excess Rotating Number	TB internal area parameter allowable rotating number after update has exceeded.
11A	Flash Verify Error: S	Please check TB-CPU Base Flash ROM address setting DIP-SW.
11B	Flash ACK Time Out: M	
11C	Flash Verify Error M	
11D	Flash ACK Time Out	
11E	Pair Data Mismatch Error	Please input while being cautious about the matching data's large • small relationship.
11F	Absolute Value Under Error	The absolute value of the input value is under. Please input allowable data.
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).

6. Alarm List

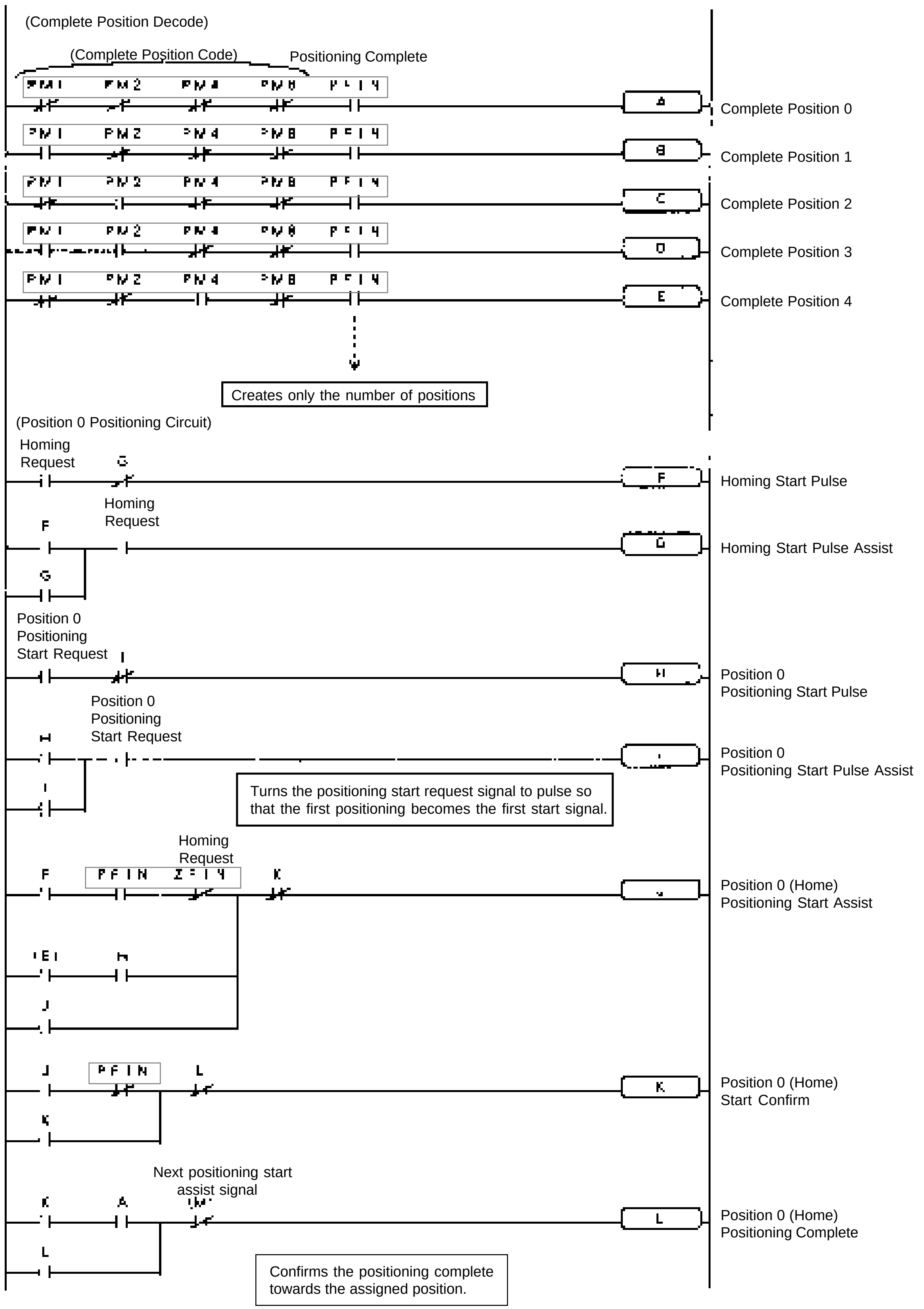
Code	Error Description	Common Solution
181	Controller initialization OK	(This is not an error).
182	Home Change All Clear	(This is not an error).
201	Emergency Stop	(This is not an error).
20A	During movement, Servo OFF	During movement., Servo has been turned OFF.
20C	During movment, Start ON	During movement, Servo has been turned ON.
20D	During movement, STP-OFF	During movement, STP has been turned OFF.
20E	Soft Limit Over	Soft Limit Over is detected during movement in the Teaching Pendant.
20F	Push Blank -Shot Detection	Push Blank-Shot was detected during movement using the Teaching Pendant.
301	Over Run Error (M)	Please check for cable short noise • SIO main station •
302	Framing Error (M)	Please check the comptetion for cable controller power • SIO main station • subordinate stations.
304	SCI R-QUE OV (M)	Receiving external excessive data.
305	SCI S-QUE OV (M)	SCI transmission QUE over flow (during main station mode).
306	Termi R-BF OV (M)	Receiving external excessive data.
307	Memory Comman breakage	Command from the controller is broken down. Due to unknown cause, please record all error list before TB power OFF.
308	Response Time Out (M)	Please check the comptetion 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 comptetion for cable controller power • SIO main station • subordinate stations.

7. *Supplement

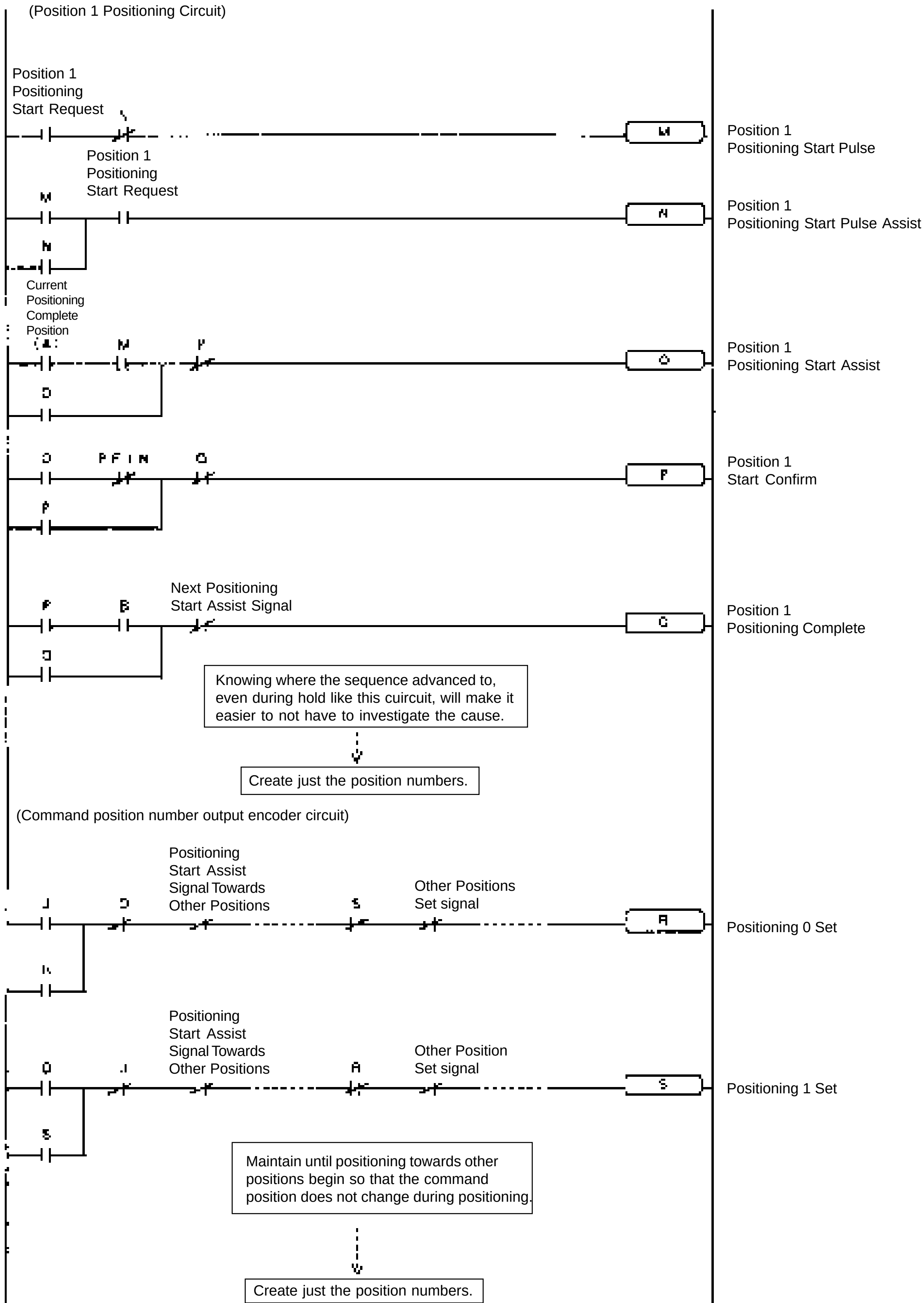
RCP Positioning Sequence Basic Examples:

The following are basic sequence examples to create positioning sequence for the RC.

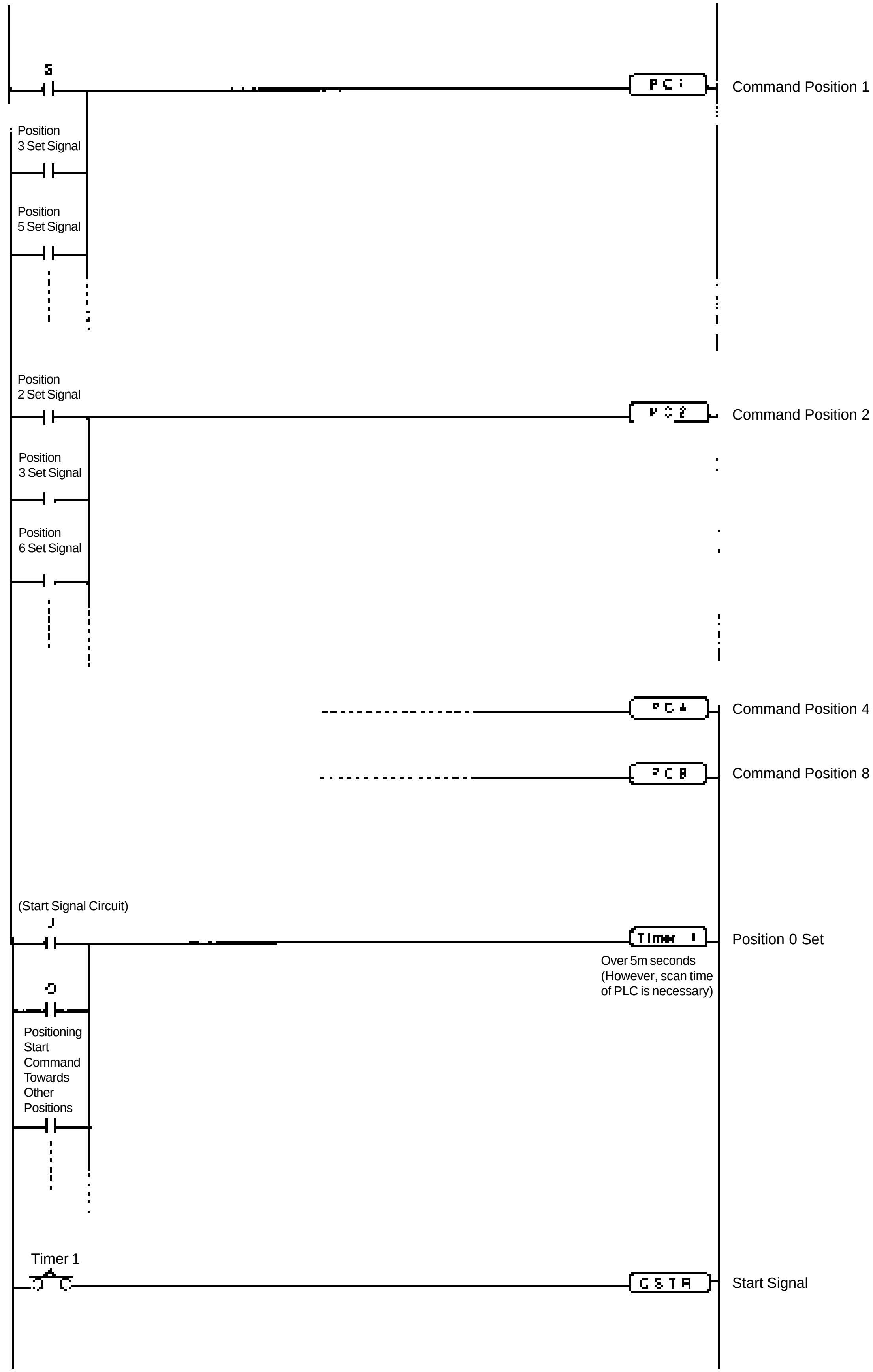
[ ] indicates PIO signal for the RC Controller.



7. *Supplement



7. *Supplement



Intelligent Actuator, Inc.
2690 W. 237th Street
Torrance, CA 90505
310-891-6015 310-891-0815 (Fax)
www.intelligentactuator.com

Publication Date: Feb 2001
Publication No.: IAI-068C
(Second edition)