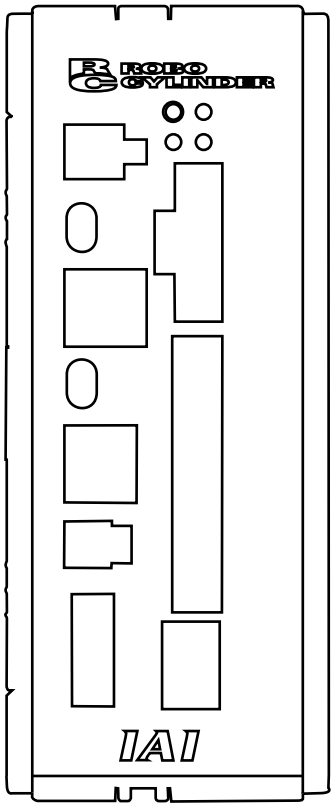
INTELLIGENT ACTUATOR

RCS-E

Robo Cylinder Controller

Operating Manual



Intelligent Actuator, Inc.

This publication was written to assist you in better understanding this part of your Intelligent Actuator system. If you require further assistance, please contact Intelligent Actuator 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.

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Publication No.: IAI-073C

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Disclaimer

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Please read this Important Safety Instructions before using or selecting your machine type. Four different symbols listed below are used in this catalog to help prevent personal injury to the user and surrounding personnel or property damage to equipment. Please observe all the safety rules in this catalog. The following types of symbols, [Danger], [Warning], [Caution], and [Notice] are classified by the level of danger and damage presented.

Danger
If mishandled or ignored, the situation will result in a loss of human
life or cause serious injuries.

Warning
If mishandled or ignored, the situation could result in death or serious injuries.

Caution
If mishandled or ignored, the situation is potentially hazardous and may result in property damage.

Notice
Information to assist in the proper use of the product and will not cause death or injury.

This product has been designed and manufactured as parts for use in general industrial machinery. The selection and use of a product must be performed only by qualified and experienced personnel (such as the project leader or system designer) after they have thoroughly read the product catalogs, the owner's manuals, and especially this safety information. Misuse of the products can be dangerous. Please read the instruction manuals of all of the products used, including the instruction manual for the controller, not just the manual of a particular part. Compatibility between the parts and the customer's system must be carefully evaluated for proper and responsible use of the products. After reading the owner's manuals, they must be placed in a location that is readily accessible to the operator of the machine. Store all catalogs and owner's manuals with the machine so any new operator or owner will be able to learn the safe and proper use of the products in the event the machine is sold, loaned, or transferred at some time.

This safety instructions document is not intended to cover all possible situations or all products. Please read each products' owner's manual for safe and proper use of the products.

DANGER

GENERAL
Do not use for one of the following:

1. Medical devices used to support, monitor, or maintain life.
2. Transportation devices to carry or transport people from one place to another.
3. As critical components of safety mechanisms

This product is not designed for use in devices that require the highest degree of safety. Warranty covers only
the replacement of the components | products, not the mechanism they are used in or the consequences of the actions from the mechanism.

INSTALLATION
Do not install in areas with flammable, incendiary, or explosive materials.
Always install the devices securely. There is a risk of injury if the device |tips, falls, or malfunctions.
Do not use the components or the controller in areas where there is exposure to water or oil.
Do not cut or splice the cable in order to shorten or increase its length. Such actions may create the risk of fire.

OPERATION
Do not enter operating range during operation, in order to avoid injury. People with pacemakers and other such devices should not come within 3 feet of the device. Pacemakers may malfunction due to the strong magnetic field generated by the device.
Do not expose the device to water. Exposing the device to water, washing the device, or using the device underwater may cause injury from device malfunction, electrocution, or fire.

SERVICE, INSPECTION, AND REPAIR
Do not modify the device. Modifications may cause injury from malfunctions, electrocution, or fire.
Do not perform unauthorized disassembly or re-assembly of any functional components in the device. It may cause injury, electrocution, or fires.

WARNING

GENERAL

Do not use the product beyond its specifications. If the product is used outside the specifications, the product may break or malfunction. Also, it may dramatically shorten its service life. Particularly, heed the limits on maximum load and minimum speed.

CAUTION

Please design a safety mechanism or safety circuit to reduce the risk of accidents and injury resulting from power outages and emergency stops.
Actuators and controller must conform to D-type code (3rd of former construction codes, less than 100 Ohms resistance to ground). In the event of a current leak, there is the possibility of electrocution and malfunctions.
Before supplying electrical power or operating the unit, always perform a safety check. Improper transfer of power may result in electrocution or injury from moving parts. Always verify the wiring of the device with the owner's manual to insure
there are no mistakes in the circuits. Make absolutely sure the connections of the cables and connectors are not disconnected or loose.
Malfunctions and fires may result.

OPERATION

After electrical power is applied to the device, do not touch the terminals or switches. There is the risk of electrocution or
malfunction. When handling moving parts by hand (when aligning or adjusting guides) confirm the device is in the "servo off" state. Otherwise injuries may result. Highly flexible cables may be used, but they may not be robot-cables. Do not enclose them in the duct with less than the minimum clearance space specified/required. Do not damage the cables. Short circuits and poor connections may occur if the cables are damaged by excessive bending, stretching, wrapping, binding, or bearing heavy weights on them, resulting in electrocution, malfunction, or fires. Cut power to the device if there is a power outage. Sudden movements by the device when power is restored may cause injuries or damage to the device. Immediately cut power to the device if excessive heat, smoke, or strange odor is detected. If the device is allowed to continue operation, there is a possibility of damage or fires. If there is excessive noise or vibration, stop the device. If the device is allowed to continue operation, violent movements may result. Cut power to the device if the alarm sounds. Injuries from sudden movements or damage to the device may occur. Determine the cause of the alarm, fix the problem, and then restore power. If the LEDs of the device fail to light when power is restored, immediately cut power to the device. Do not stand on the device or use it as a footrest. Do not place objects on the device. Injuries may occur from falling off the device, damage to the device, malfunctions, or violent movements may result

SERVICE, INSPECTION, AND REPAIR

Make sure power to the device is disconnected when servicing, inspecting, or repairing the device. Please observe the rules below:

1. When service is being performed, to prevent another person from accidentally turning power on to the device, post a sign, "Down for maintenance. Do not turn power on" in a visible location.
2. When there are multiple persons performing maintenance on the device, always confirm with the other coworkers when performing certain actions such as turning the power ON and move the axis.

DISPOSAL

Do not incinerate the device. The device may explode or produce toxic gases.

CAUTION

INSTALLATION

Do not operate the device in areas of direct sunlight, direct ultraviolet, or air with high concentration of salts, moisture or chemicals.
Effects may include loss of functionality in a very short period of time, poor performance, shortening of service life, and malfunctions.
Do not operate the device in the presence of corrosive gases (sulfuric acid, hydrochloric acid, etc.). Rust may form and weaken the device's structure.
When using the device under the following conditions, make sure there is adequate shielding or malfunctions may occur:
Areas of large electrical currents, high voltage, or intense magnetic fields.
Areas where electrical arcing is present, such as a welding environment.
Areas with electrical noise is present, such as static electricity.
Areas where radiation may be present.

Install the device in areas with air free of dust and metallic particles. Malfunctions may occur if installed in such areas.
Do not install in areas with excessive vibration (4.9m/S) or large ground disturbances (shock). Large ground disturbances may cause malfunctions. Install emergency stop button(s) in a readily visible and accessible area. Otherwise injuries may result.
Install the device with sufficient floor space clearances to permit access for maintenance and repair. Without sufficient space, daily inspections and maintenance cannot be performed and may result in personal injury or breakdowns of the device.
To insure the safety of the personnel when installing or moving the device, use an adequate number of personnel with the proper equipment and perform the operation carefully.

During installation, do not handle or move the device by pulling on the cables or moveable parts. Please do not use 3rd part cables for the connections between the actuators and the controller. Use only genuine components (actuators, controller, and teaching box) from this manufacturer. Braking system consist of a vertical axle and/with nani nani . Please do not use this as part of the emergency stop system. To prevent power from being turned on accidentally during installation, place a sign, “Maintenance being performed. Do not turn power ON.” If power is turned on without warning, electrocution or injuries may result.

OPERATION

When turning power on to the device, start by supplying power to the topmost component first and proceed downward. The order must be followed, otherwise, injuries or damage to the device may occur when the lower component suddenly begins moving.
Do not insert objects or fingers in the device’s openings. Fires, electrocution, or injuries may result. Do not bring magnetic media such as floppy disks within 3 feet of the device. There is the possibility of destruction to magnetic media due to the magnetic field generated by the device.

SERVICE, INSPECTION, AND REPAIR

Always wear protective goggles when lubricating the actuators. If any lubrication or grease becomes airborne and splashes into the eyes, it will cause inflammation. When performing maintenance such as the replacement of batteries located internally within the device, do not touch the terminals of the condensers for at least 30 seconds after main power is cut to the device. The charge remaining on the condensers can cause electrocution.

When performing electrical resistance testing of the insulation, do not touch the terminals. It can result in electrocution. (However, do not perform the voltage resistance insulation test on the DC models.)

NOTICE

GENERAL

If the device may be operated in an environment or conditions not covered in the catalog or the owner’s manual, and places with potential impact to human safety and economic consequences such as air navigation facilities, incineration facilities, entertainment facilities, clean rooms facilities, and anzen kiki “safety machinery”, need to consider modest operation and fail-safe contingency plans. Please consult with one of our sales representatives.

INSTALLATION

Do not block air flow to and around the controller. It may cause the controller to malfunction. When installing this device for vertical installation, please use the vertical model (with brakes). Please place covers on the device to prevent contact with moving parts.
Do not build the controller system such that work falls during power failure. Built an-anti fall compliance of tables and work in event of power failure or emergency stop. To accurately move forward and for smooth action on the linear guides, consider the following:.

The installation must be within 0.05m parallism.
Maintain In order to attain actuator rigidity, maintain sufficient actuators installation space

INSTALLATION, OPERATION, AND SERVICE

When servicing the device, make sure gloves, goggles, and steel-toe boots are worn for safety.

MAINTENANCE, INSPECTION, AND REPAIR

For maintenance, please use only the specified ball-screw lubricant/grease. If fluorine-based grease/lubricants and lithium-based grease/lubricants are mixed, lubrication qualities are compromised and damage to the device will occur.

DISPOSAL

When this device is no longer serviceable or needs to be scrapped, please dispose the device properly as industrial waste.
The controller contains nickel-cadmium batteries. When disposing the controller device, please remove the batteries and contact your IA sales representative.

OTHER

This company will not be responsible if the customer fails to follow the safety rules printed in this document.
Please contact your IA sales representative for any questions.

Before You Begin

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

(1) Hold · Servo ON Signal

When operating the RCS (Robo Cylinder), 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, RC will not move due to hold status. Therefore, please be careful.

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

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1. Safety Precautions

1-1 Foreword

Thank you very much for purchasing the RCS 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 RCS 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.
- Absolute reset is not done at the time of shipment. Absolute reset needs to be done by the user.

* 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

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. Safety Precautions

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 tempreratures 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.

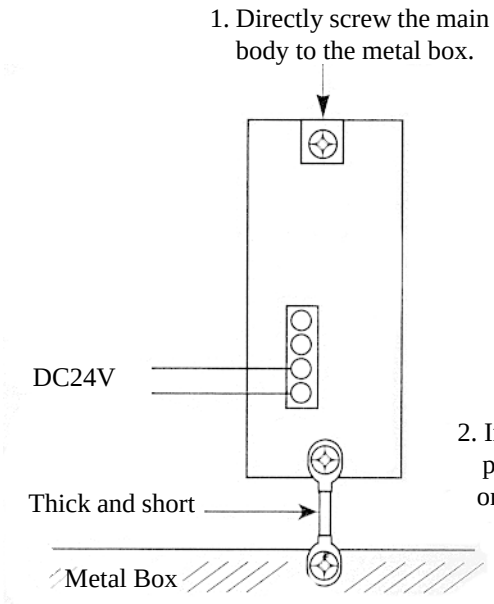
(6) Take steps to shield all cables and wires from electromagnetic noise.

1-4-2 Power Source

Make certain that DC24V±10 % maintained.

1-4-3 Electromagnetic Noise Supression

(1) Grounding for noise compliance



2. In case screwing to the box is not possible, please follow the connection method shown on the left diagram.

3. Wiring Notes

1. Twist the cable for the DC24V external power.

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

3. The controller encoder cable is particularly sensitive to noise so make sure to keep it separate from load wiring for other equipment.

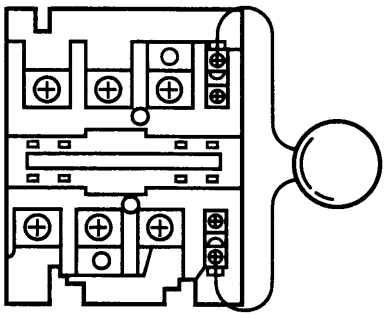
4. Consult with IAI if you need longer motor and encoder cables than what comes with the controller.

(3) Noise Source and Noise Suppression

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

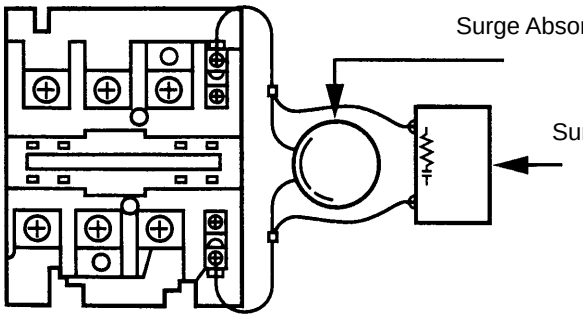
1. AC solenoid valve · magnetic switch · relay

- 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.



By setting-up as shown, you can prevent the noise of all ranges.

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

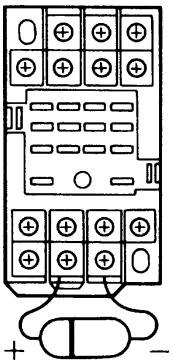


Figure 1-4-3

- 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.

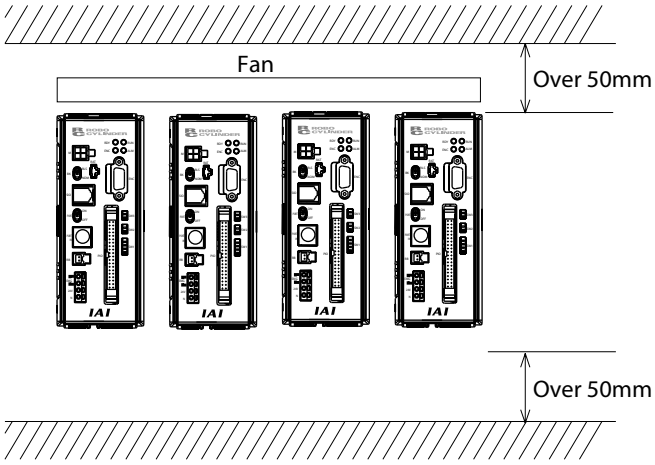


Figure 1-5-2

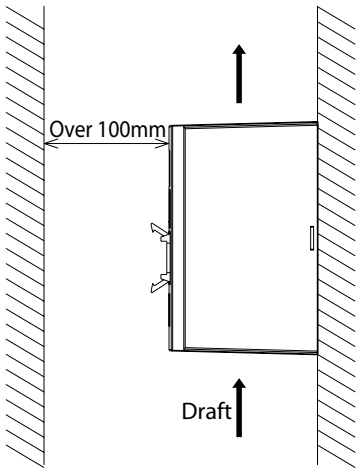


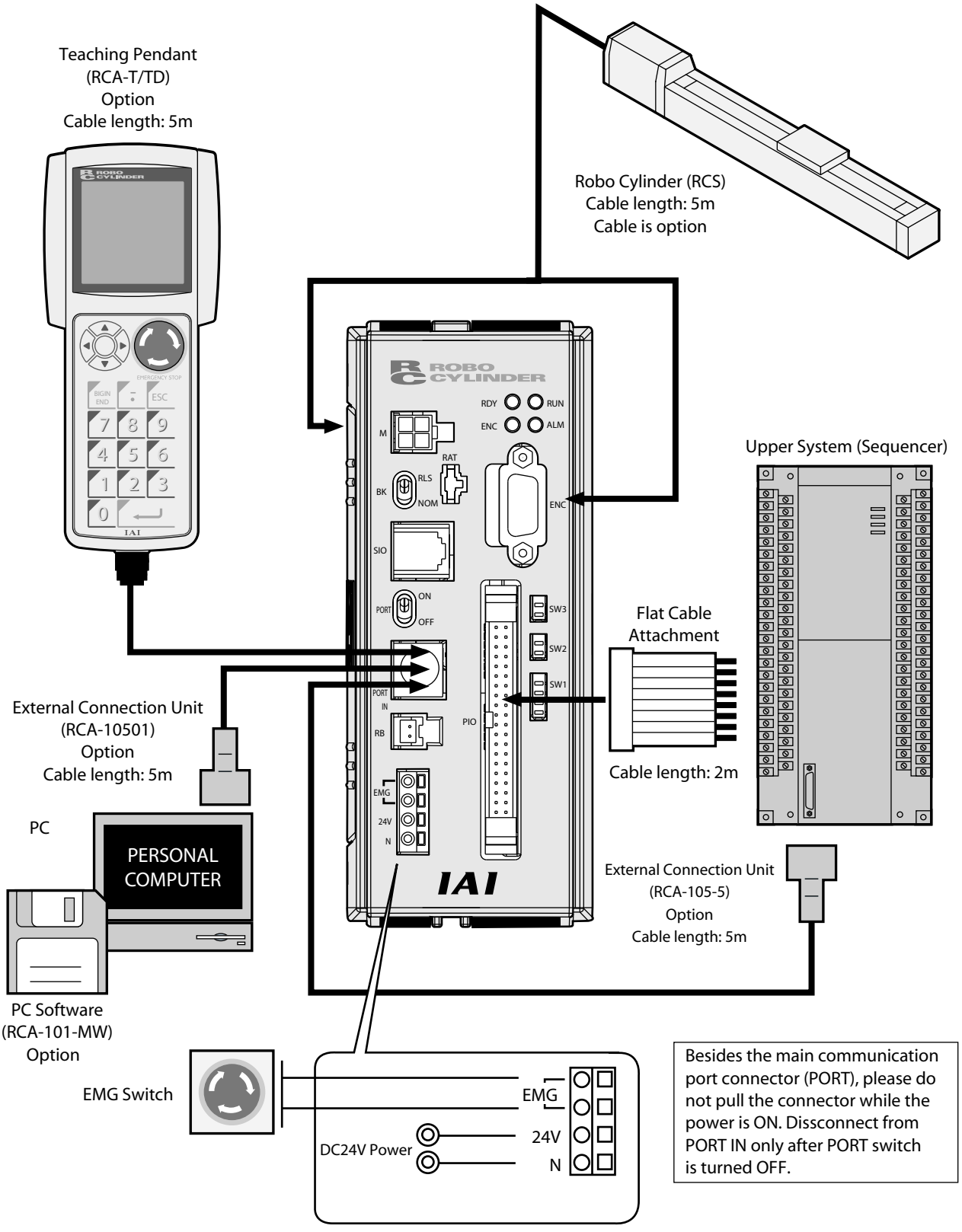
Figure 1-5-3

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

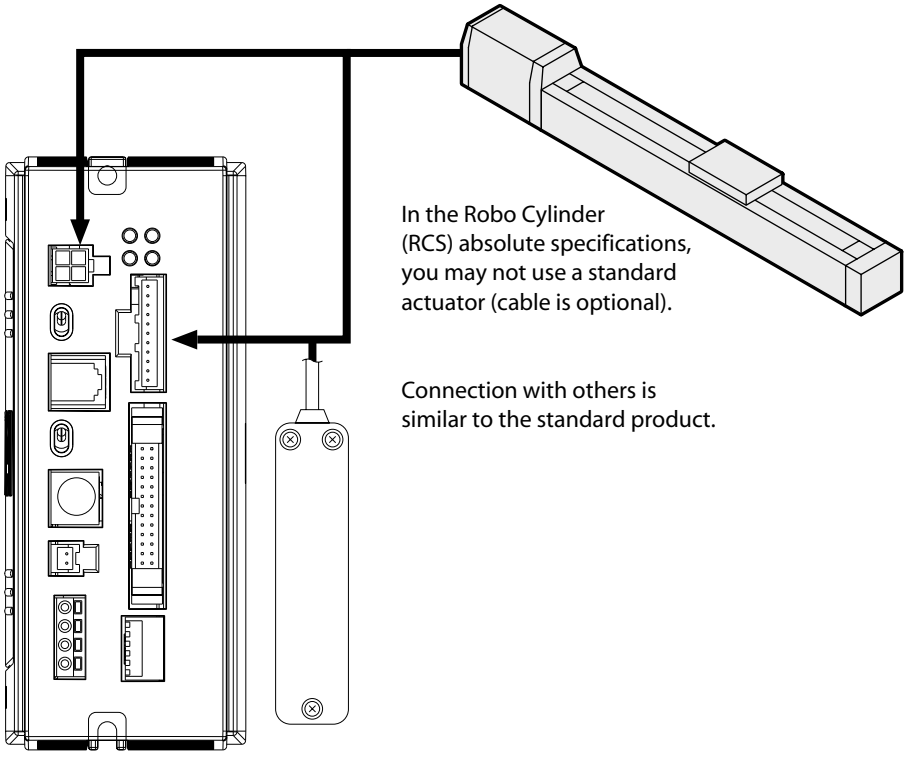
2-1 Connection Method

2-1-1 Standard Item



2. Specifications

2-1-2 Absolute Specifications



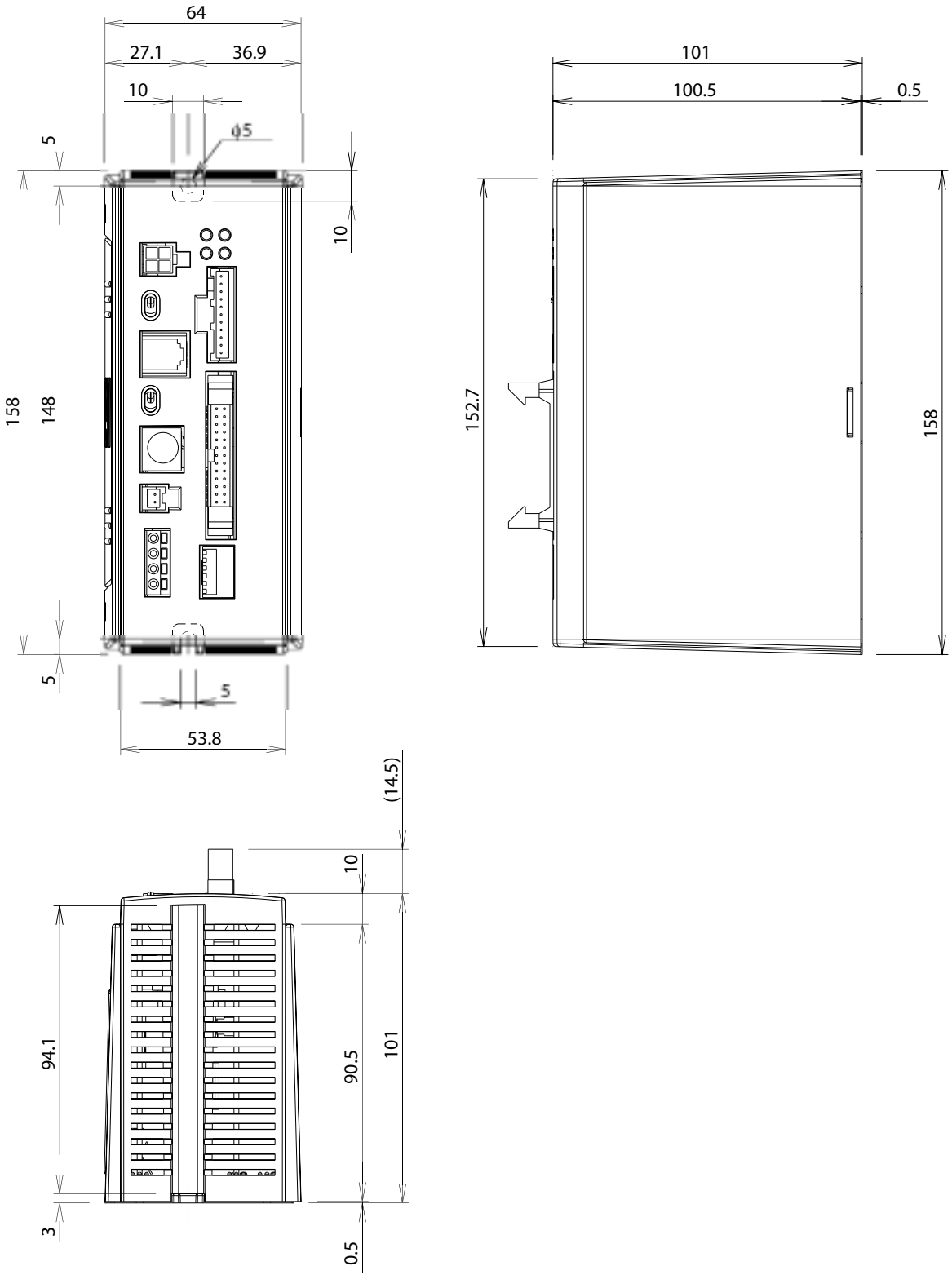
In the Robo Cylinder (RCS) absolute specifications, you may not use a standard actuator (cable is optional).

Connection with others is similar to the standard product.

2. Specifications

2-2 External Dimenional Diagram

2-2-1 Controller Outer Shape



2. Specifications

2-3 24V Type Controller

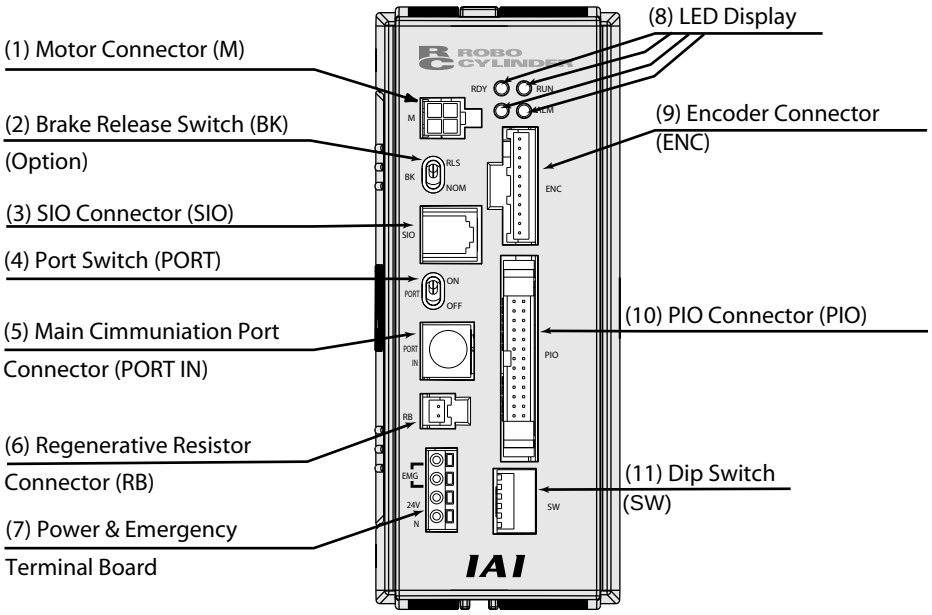
Column		Specifications
Type		24V Type
Power Voltage		DC24V±10%
Power Current/Capacity		3A (during 60W rated) / 7.3A (60W peak)
Maximum Motor Output		60W (Torque limit double) Others (triple)
Ambient Temperaure • Humidity		Temperaure 0°C~40°C Humidity less than 85%RH
Ambient Environment		I P10 No corrosive gas
Weight		540g
Protective Function		Circuit voltage abnormality, motor excessive current, power stage abnormal heat, encoder abnormality, motor excessive load, excessive speed
LED Display		RDY (ready) RUN ALM (alarm) ENC (Encoder abnormality)
DI/DIO Interface		DC24V insulate
I/O	Exclusive Input 8 port	Start, command position number (4 bit binary), hold, reset, servo ON
	Exclusive Output 10 port	Complete position number (4-bit binary) positioning complete, homing complete, zone, alarm, emergency stop, transfer
		Serial interface I/O
Number of Positions		16
Data Input Method		Teaching Pendant PC Interface Software
Memory Capacity		EEPROM 8K byte S-RAM 128K byte

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

2. Specifications

2-4 Names of Parts and Functions

2-4-1 Names



2-4-2 Functions

(1) Motor Connector (M · BK)
This is the connector for the motor power cable of the actuator.

(2) Brake Release Switch (BK)
RLS: Release position turns the brake OFF.
NOM: Normal position makes the brake active.

(3) SIO Connector (SIO)
This is the connector for the seial controller link cable connection.

(4) Port Swith (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).

(5) Main Communication Port Connector (PORT IN)
This is the connector for the teaching pendant or external device coomunication cable. This is also the connector for the controller link cable for connection with another controller (axis).

(6) Circuit Resistor Connector (RB)

This is the connector for connecting circuit discharge resistor. The circuit resister comes with actuator its wattage is more than 30 W. Connect it when circuit discharge abnormality occurs. The error code of circuit dischange abnormality is '0C9'.

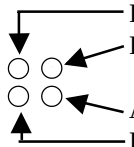
(7) Power and Emergency Terminal Board

N: This is the ground side for 24V power.
PIO output circuit becomes COMMON.

24V: This is the DC24V Power terminal.
PIO imput circuit becomes COMMON.

EMG: Both of the two terminals are terminals for emergency stop switch connection.

(8) LED Display



RDY: This indicates that the CPU is in normal operation.
RUN: This indicates normal operation.
ALM: Turns on during alarm eruption and during emergency stop.
ENC: This will turn ON when voltage drops for the battery used in absolute data backup.

(9) Encoder • Brake Connector (ENC)

This is the connector for encoder • Brake power cable.

(10) PIO Connector (PIO)

This is the connector for PIO cable connection

(11) Dip Switch (SW)

There are 6 dip switches and each function is as follows:

Dip Switch No.	Function
1	Set actuator's axis NO.
2	
3	
4	
5	ABS-CLR: Absolute data clear switch (absolute specification)
6	FWP: Light protect switch

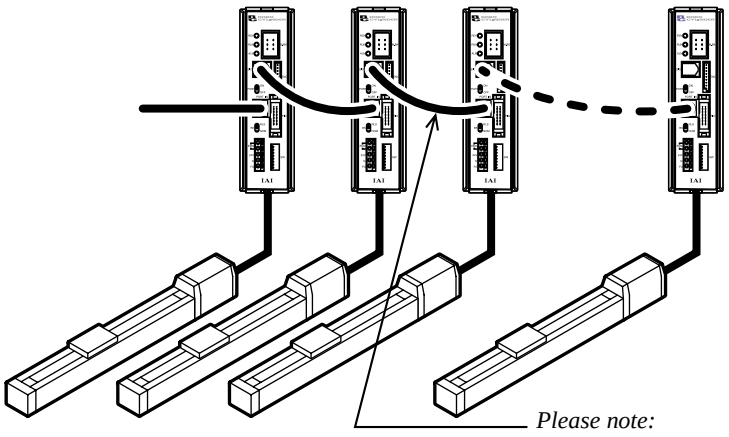
Caution: Dip Switch No. started from the bottom side.

2. Specifications

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 does not fit into multiple controller.

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.

Dip Switch No.5 ABS-CLR (absolute specification)
(Second one from top)
Clears the data of absolute encoder. Use this switch when executing absolute reset - Normally OFF

Dip Switch No. 6 FWP
(First one from top)
This is the Write Protection Switch. Use this switch when executing remote update - Normally OFF

2-4-3 Main Communications

SIO Connector Pin Assignment

PIN No.	Signal Name	Functions
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	Functions
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 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.

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

Motor / Brake Connector (178303-5: AMP)

Pin No.	Signal Name	Connection Line
1	U	Motor U Phase
2	V	Motor V Phase
3	W	Motor W Phase
4	(NC)	

2. Specifications

Encoder · Brake Connector (S11B-XASK-1)

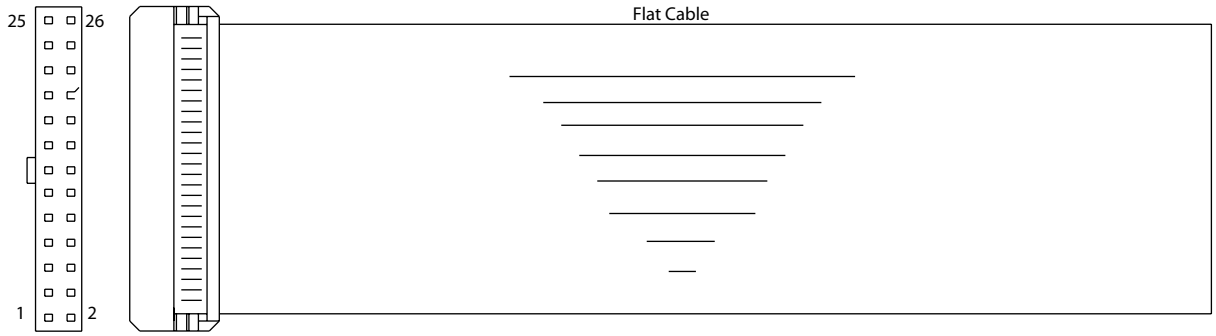
Pin No.	Signal Name	Connecting Line
1	EN A+	Encoder A+
2	EN B+	Encoder B+
3	EN Z+	Encoder Z+
4	EN Z-	Encoder Z-
5	SD+	Encoder SD+
6	SD-	Encoder SD-
7	EN 5V	Encoder 5V+
8	EN GND	Encoder COM-
9	BK N	Blake -
10	BK P	Blake +
11	FG	Shield

Power and Emergency Stop Terminal Block

Pin No.	Signal Name	Connecting line
1	N (OV)	24V Power ground
2	24V	24V Power plus side
3	EMG (24V)	Emergency stop switch (shorted at the time of shipment)
4	EMG	

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

2-4-5 I/O Flat Cable



No.	Signal Name	Color	No.	Signal Name	Color
1	-	Brown - 1	14	-	Yellow - 2
2	-	Red - 1	15	-	Green - 2
3	Start	Orange - 1	16	Complete position 1	Blue - 2
4	Command position 1	Yellow - 1	17	Complete position 2	Purple - 2
5	Command position 2	Green - 1	18	Complete position 4	Grey - 2
6	Command position 4	Blue - 1	19	Complete position 8	White - 2
7	Command position 8	Purple - 1	20	Positioning complete	Black - 2
8	-	Grey - 1	21	Home complete	Brown -3
9	-	White - 1	22	Zone	Red -3
10	*Hold	Black - 1	23	*Alarm	Orange -3
11	Reset	Brown - 2	24	*Emergency stop	Yellow -3
12	Servo On	Red - 2	25	Moving	Green -3
13	-	Orange - 2	26	-	Blue -3

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 1000 hours (when ambient temperature is 20°C)

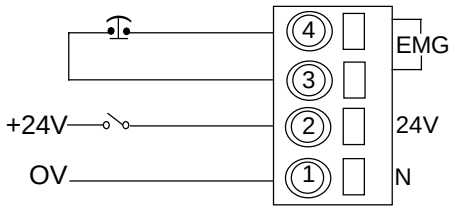
Note 1) The consumed current during absolute data backup is approximately 100μA (approximately 4μA when controller main power is ON).

* 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.

2. Specifications

2-5 Wiring

2-5-1 Wiring for Power • Emergency Stop



Power and emergency stop terminal board

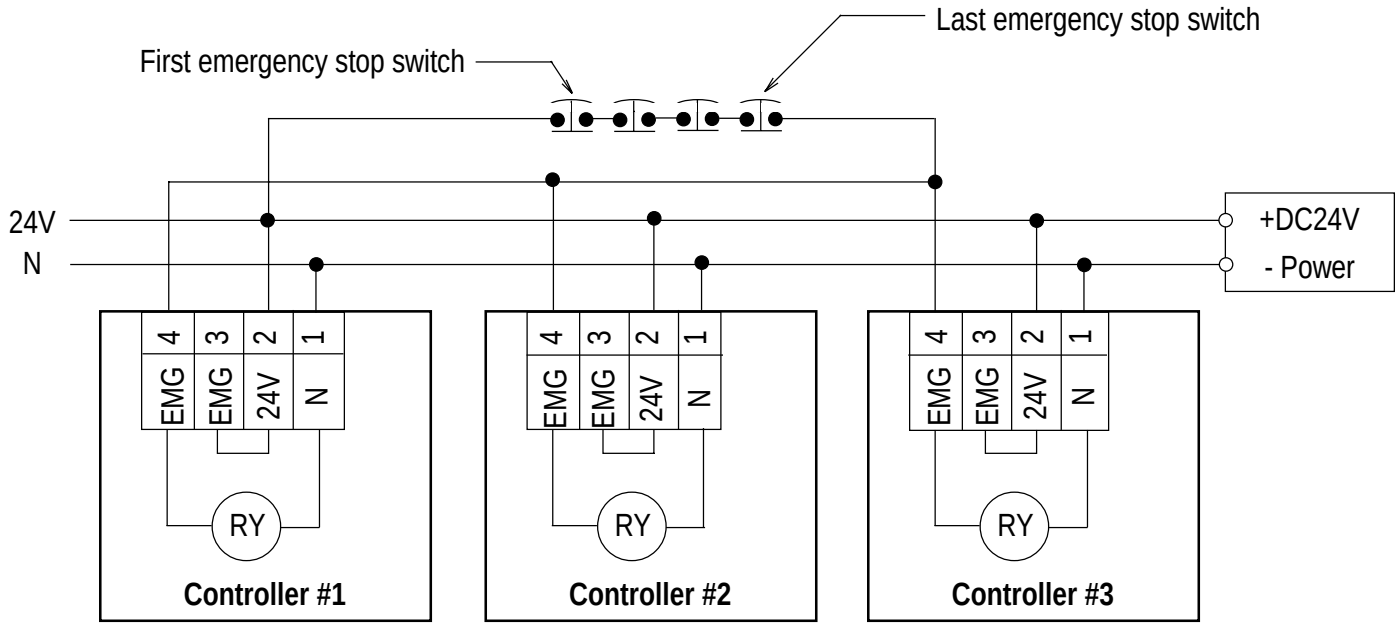
The two EMG terminals are for connecting an emergency stop switch, and is b-contact input. At the time of shipment, a jumper is used to short the two terminals. Do not remove it!

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

Applicable conduit	Single line	ϕ1.0 (AWG18) 1.75mm^2 (AWG18)
Specifications possible Conduit range	Single line Stranded line Strand diameter	ϕ0.4 (AWG26) ~ ϕ1.2 (AWG16) 0.3mm^2 (AWG22) ~ 1.25mm^2 (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.

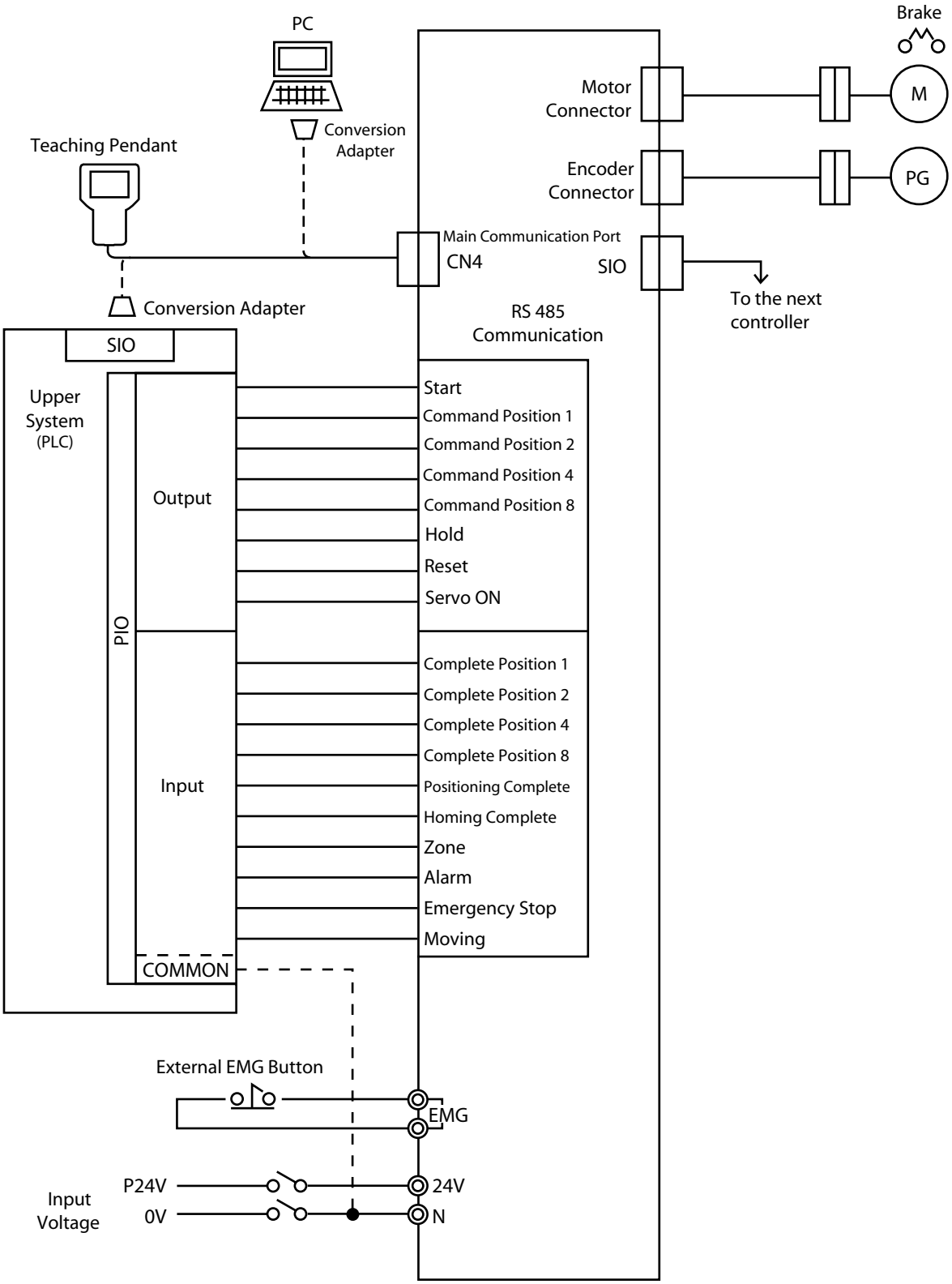
2-5-2 Wiring Method for Connecting Multiple E-Stop Switches onto Multiple Controllers



- 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. Specifications

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

Pin No.	Section	Signal Name		Cable Color
1	Input	Unused	Do not connect	Brown - 1
2				Red -1
3		Start	Input moving start signal	Orange -1
4		Command position 1	Input selecting position No.	Yellow - 1
5		Command position 2		Green - 1
6		Command position 4		Blue - 2
7		Command position 8		Purple - 2
8		Unused	Do not connect	Grey - 2
9				White - 2
10		2 *Hold	*Hold moving actuator	Black - 2
11		3 Reset	Execute alram reset	Brown -2
12		4 Servo on	Servo on	Red- 2
13		Unused	Do not connect	Orange -2
14	Output	Unused	Do not connect	Yellow - 2
15				Green - 2
16		Complete position 1	Outpu t Position No.which completed moving. 5 or output No.	Blue - 2
17		Complete position 2		Purple - 2
18		Complete position 4		Grey - 2
19		Complete position 8		White -2
20		6 Positioning complete	Output after positioning complete	Black -3
21		7 Homing complete	Output after homing complete	Brown -3
22		Zone	Outpu t within set by parameter	Red -3
23		8 *Alarm	Output at controller abnormality	Orange -3
24		9 *Emergency stop	Output at emergency stop	Yellow -3
25		10 Moving	Output during motor rotating	Green -3
26	Unused		Do not connect	Blue -3

Controller side connecter type: HIF6-26PA-1.27DS

> ***Caution***
> ***Ports with * mark indicate negative logic. Never connect to unused port.***

2. Specifications

(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.	40	Command Position 1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
	38	Command Position 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	36	Command Position 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	34	Command Position 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Selected Positon Number			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Caution:

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

(2) Hold

This is a B-contact input. During movement, remains ON. Turn OFF during HOLD.

(3) Reset

Once signal riser is detected, executes alarm reset. In case alarm source is not resolved, alarm will reoccur even after resetting the alarm (you will need to reapply power to “over current alarm (alarm code: C8).” Cancels remaining movment during hold.

(4) Servo ON

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

(5) 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.

(6) 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.

(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) Alarm

Turns OFF during an alarm. During normal operation, stays ON. Homing method is done during power reinstallation. Alarm will remain ON in case of excessive work load, and when movement is not possible due to collision with an obstacle. Take sufficient time for time check.

(9) Emergency Stop
Turns OFF during emergency stop. Turns ON during normal operation. Homes during emergency stop release.

(10) In-motion
Turns ON during movement.
This signal us used when you want to detect motor stop during hold.

2-5-5 Insulation Type External Imput/Output Specification

Input area

Column	Specifications
Number of inputs	8 points
Input Voltage	DC24V ±10%
Input Current	7mA/1 Circuit
Movement Voltage	ON Voltage · · · Minimum 18V OFF Voltage · · · Minimum 6V
Insulation Method	non-insulated

Output area:
There are 2 kinds (group 1 and group 2) of specifications in the output area.
Group 1 TD62084 Output circuit (8 points)

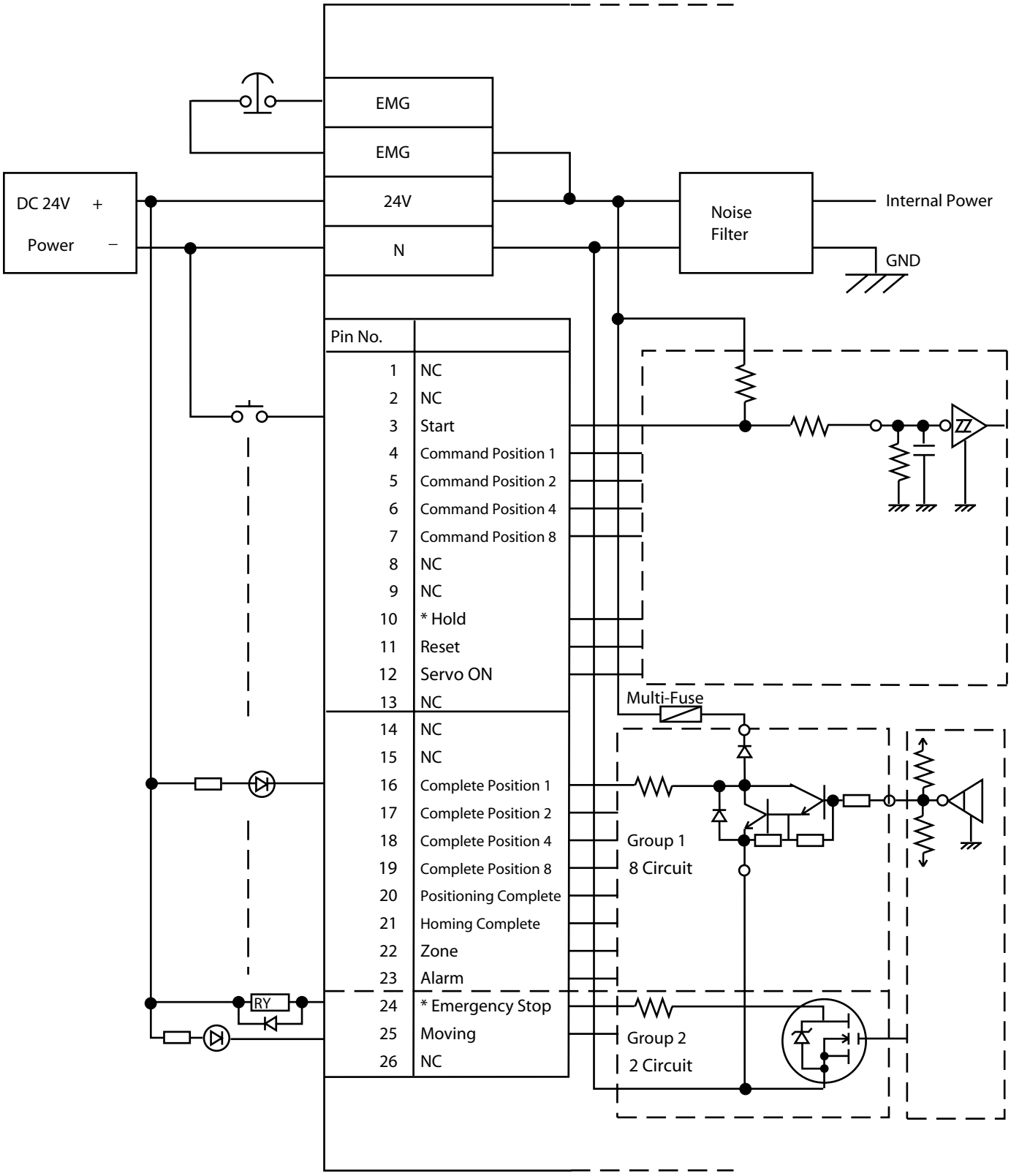
Column	Specifications
Signal name	Complete position 1, 2, 4, 8, Positioning complete Homing complete Zone Alarm
Rated Load Voltage	DC24V (equipped with fly wheel diode)
Rated load Current	40mA/ 1 point
Recommended Load Current	20mA/ 1 point
Leak Current	0.1mA (maximum)
Residual Voltage	3.1V/40
Insulation Method	non-insulated
Overcurrent protection	47 0.1W fuse resistance

Group 2 MOSFET 100mA Output circuit (2 points)

Column	Specifications
Signal name	Emergency stop
Maximum Output Voltage	60V (peak) (open drain, fly wheel diode)
Maximum Load Current	100mA/ 1 point
Residual Voltage	1.1V/100mA
Insulation Method	non-insulated
Overcurrent protection	10 0.1W fuse resistance

2. Specifications

Input/Output Circuit Structure



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 6 columns: Position, Speed, Acceleration/Deceleration, Force, Positioning Width and Acceleration Only MAX. 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	Acc	Push	Positioning width	Max only ACC
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 Absolute (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

(1) No.

• 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

(2) Position

• 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 home (in mm). You may also input negative value.

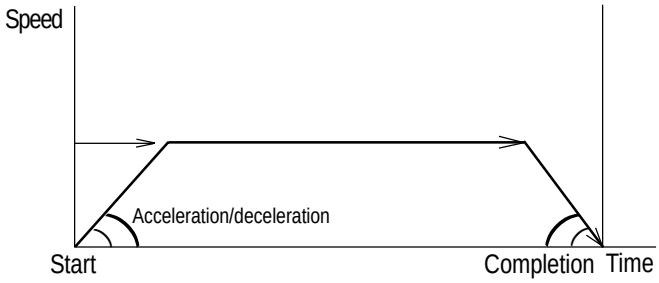
No.	Position		
0	30	◄►	Absolute Coordinate Assign 30mm from home
1	10	◄►	Relative Coordinate Assign Plus 10mm from current location
2	-10	◄►	Absolute Coordinate Assign -10mm from current location
3	100	◄►	Absolute Coordinate Assign 100mm from current location

(3) Position

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

(4) Acceleration/Deceleration

• Inputs the acceleration/deceleration of when the actuator



Acceleraton/deceleration speed G •••• MIN 0.01G slow rise
Max 1.00G 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 at which you would like the push to end.

Push force during stop at 70% of current limited value are written down on every page. Refer to them by all means.

3. Data Input (Basic)

Caution:
When the push power is too small, push malfunction may occur due to driver

(6) Positioning Width

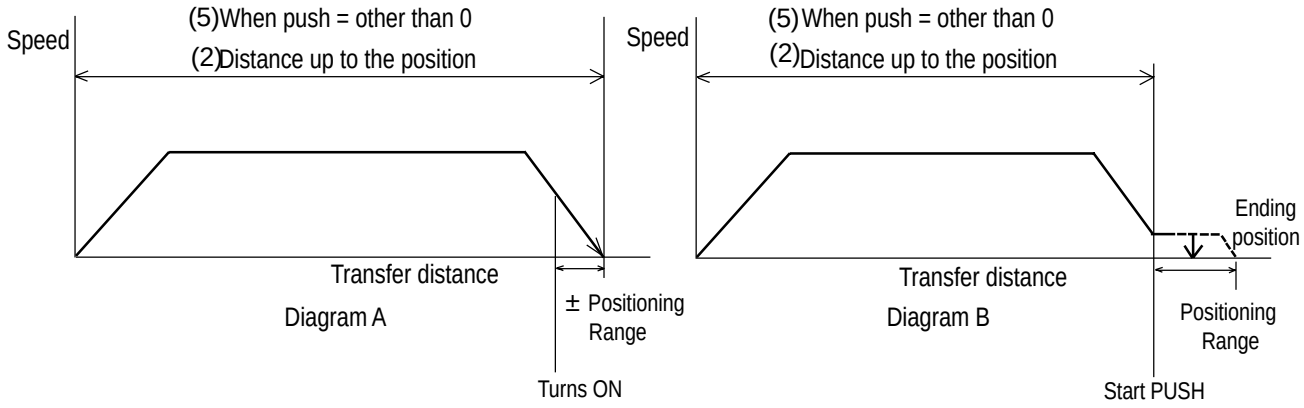
As for the positioning width, depending on the setting value of 5th column, either 0 or other than 0, its function will vary.

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.

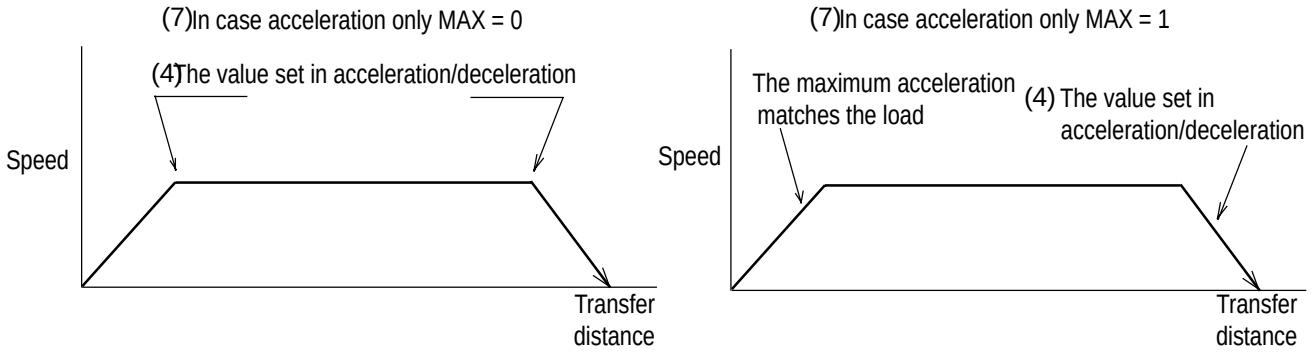


(7) Acceleration only MAX

- 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)

3-1-1 Push Force During Stop

When executing push mode, input current limit value (%) into push of the position data table. With the RCS, push force be at a current limit value of 70%. Although by increasing/decreasing the current limit value, you can increase/decrease the push force during stop, normal operation is not possible under 30%. See the chart below in regards to push force at a current limit value of 70% according to type.

	Type	Motor W	Speed Type	Push Power N (kgf)
Rod Type	RA 35	20	L	95 (9.7)
			M	47 (4.8)
			H	23 (2.4)
	RA 45	30	L	142 (14.5)
			M	70 (7.2)
			H	35 (3.6)
	RB7525	30	L	142(14.5)
			M	70(7.2)
			H	35(3.6)
		60	M	143(14.6)
			H	71(7.3)
Flat Type	F45	30	L	142 (14.5)
			M	70 (7.2)
			H	35 (3.6)

Caution: The accuracy for push force is not guaranteed. The above is standard only.

3-2 Explanation on Mode

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

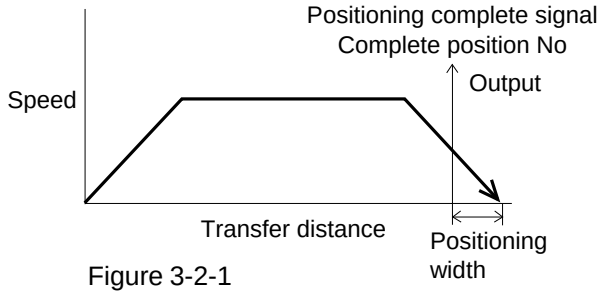


Figure 3-2-1

From the position shown in Figure3-2-3, 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

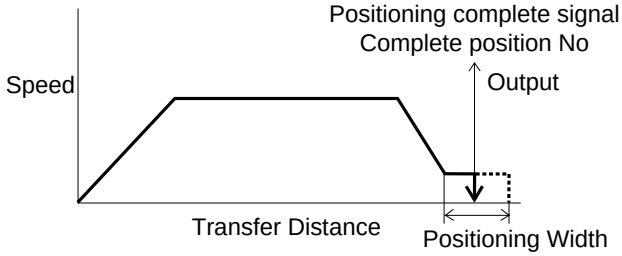


Figure 3-2-2

After reaching the position shown in Figure 4-2-3, 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 default 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)

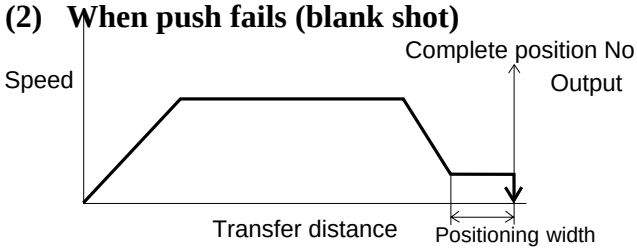


Figure3-2-3

Upon reaching the position shown in Figure 3-2-2, the actuator moves forward at low speed. When the servo motor current does not reach 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 (please allow for enough time-out check trreatment).

(3) Upon push, work moves increases.

1. When the work moves in the push direction

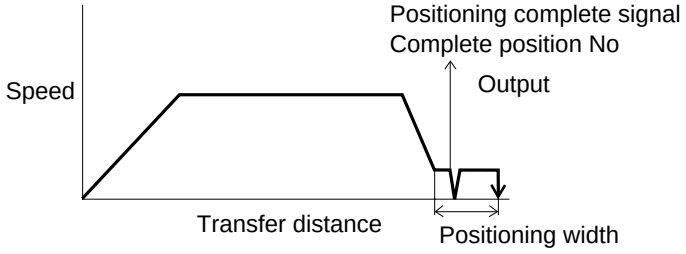


Figure3-2-4

If the work moves in 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)

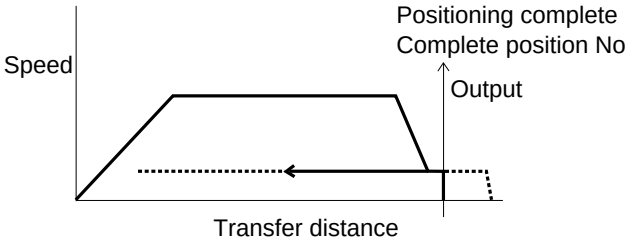
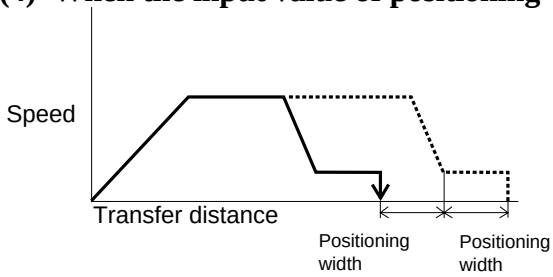


Figure 3-2-5

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

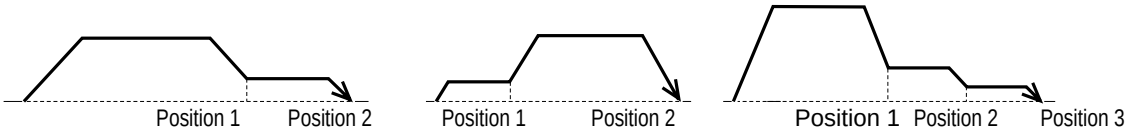
(4) When the input value of positioning width is wrong



When a mistake is made 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.

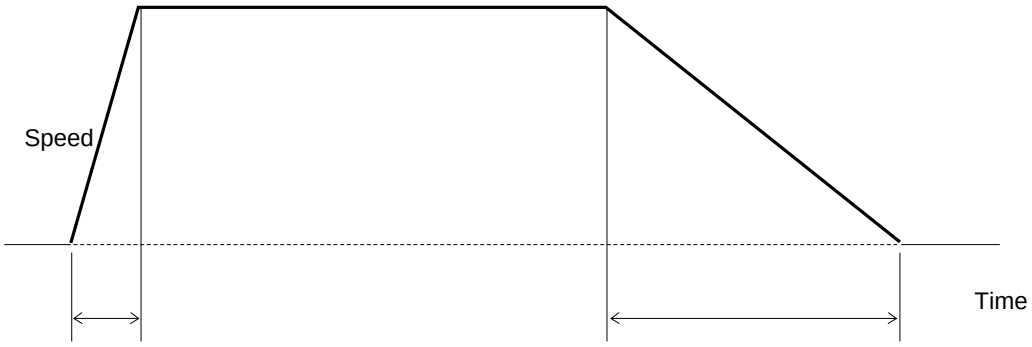
3-2-3 Speed Change Movement During Transfer

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



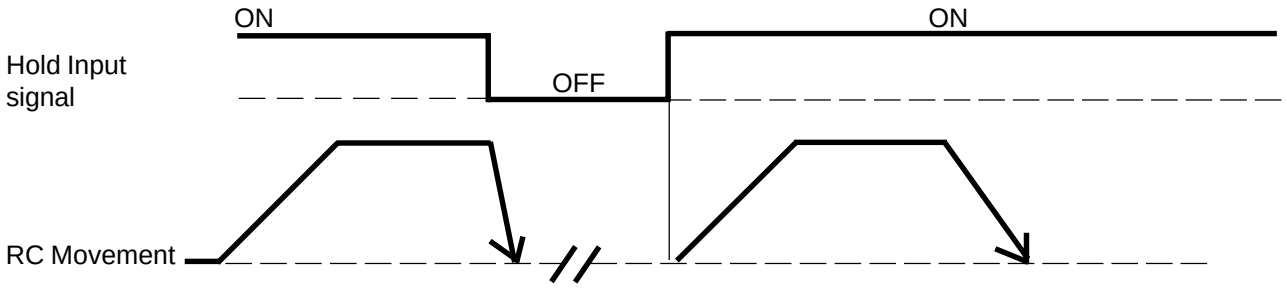
3-2-4 Movement with Variable Acceleration · Deceleration Values

By inputing 1 into “MAX ACC Flag (0/1)” of position data, transfer movement may be made using variabl acceleration and deceleration values. The acceleration value is the maximum speed that matches the load. The deceleration is the value input in the “ACG(G)” of the position data table.

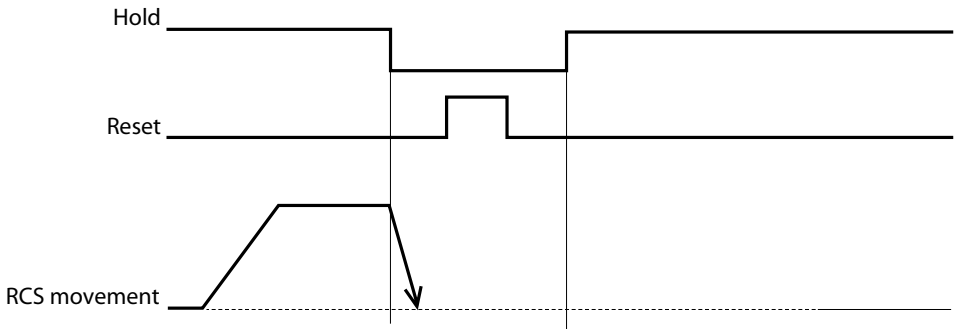


3-2-5 Hold Input

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.

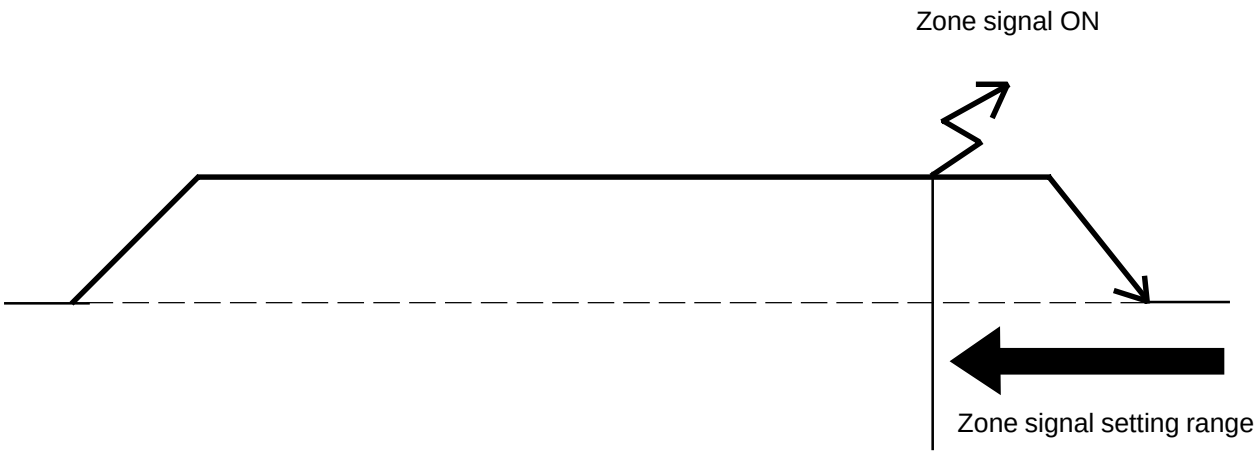


By turning ON the reset input during hold (and after recovering input signal), you may cancel the remaining movement of the actuator.



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).



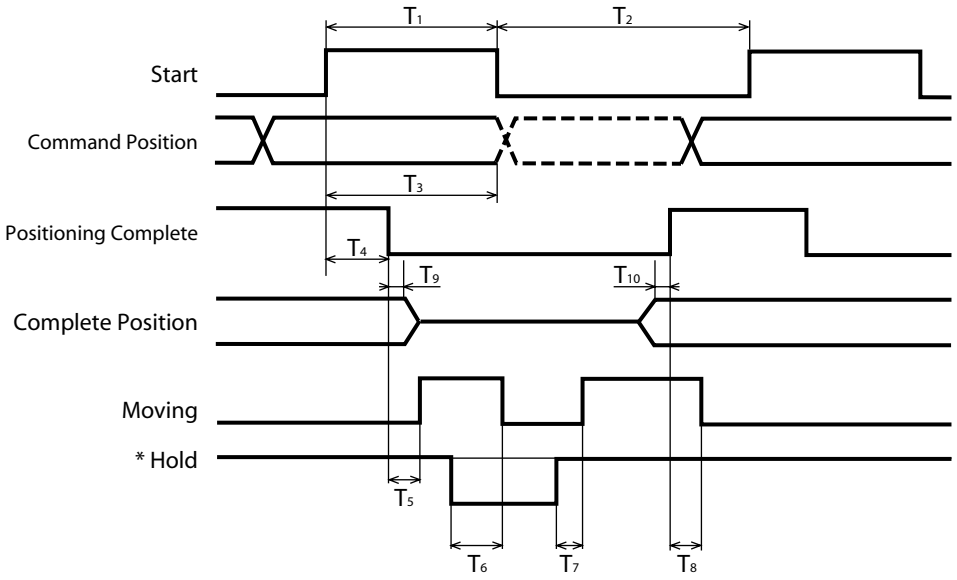
3. Data Input (Basic)

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.

3-3 Timing Chart



ACC./DEC.	Content	Minimum value	Maximum value
T1	Start ON minimum time width	4msec	--
T2	Start OFF minimum time width	4msec	--
T3	Start ON → Command position hold time	4msec	--
T4	Start ON → Positioning complete OFF delay time	--	4msec
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	--	4msec
T8	Positioning complete ON → OFF during moving delay time	--	1msec
T9	Positioning complete OFF → OFF during moving delay time	0.1msec	1msec
T10	Complete position output → Positioning complete ON 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 for time more than scan time of the sequencer.

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 controller by using the dip switchs.
For details, please refer to the “specifications” section under the dip switch settings.
(4) Supply main power (24V) to the controller terminal board.

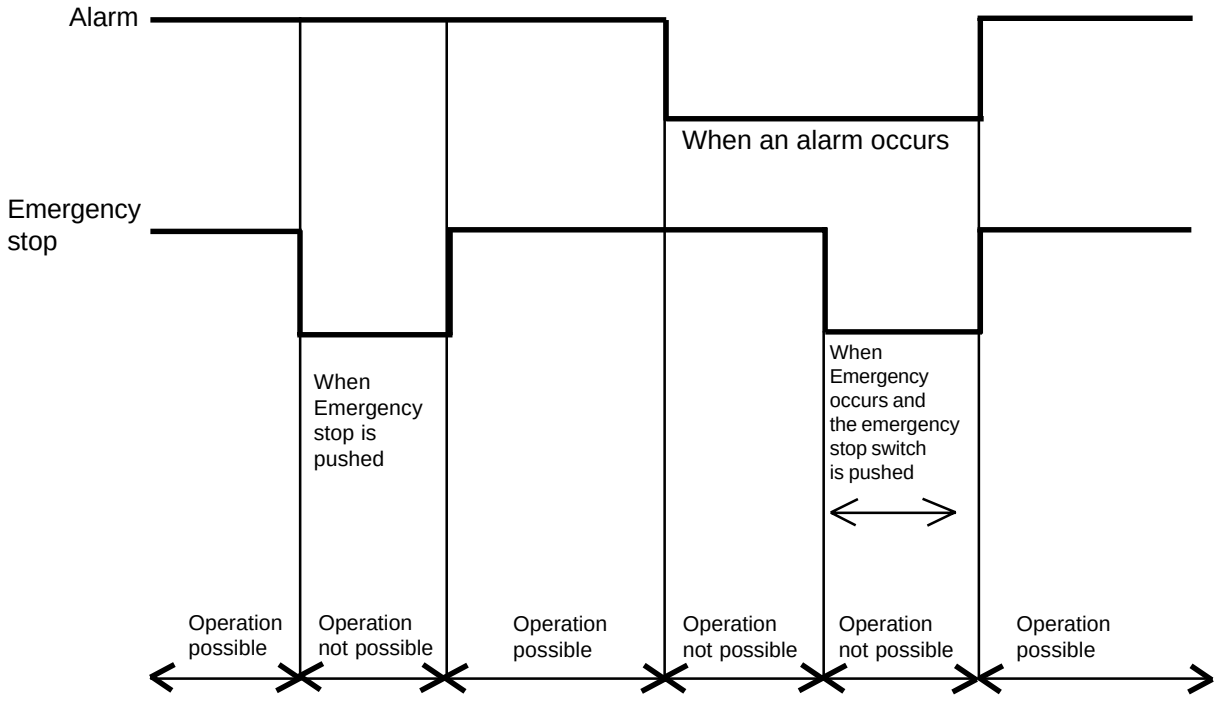
(5) **Turn the P I/O Hold Input ON. (NPN) GND Pin 10 24V (PNP)**
(6) Normal status is when the RDY, RUN LED turns ON, and abnormal status is when the ALM turns ON.
Please refer to the Error Code List located on Page 59 and so on in this manual.

After the above operation, preparation is completed.

> ***Caution:***
> ***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. Application (Practice)

4-2 Procedure For Initial Homing (Absolute Specifications)

How to initiate absolute reset:

(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 1-axis, address each controller by using the dip switchs.
For details, please refer to the “specifications” section under the dip switch settings.
(4) Place slider or rod of actuators on the mechanical end of the home direction.
(5) Turn ON No.5 dip switch on the controller (turn over to the right side).
(6) Turn ON the main power of the controller.
(7) RDY light of LED display will turn ON.
(8) Turn OFF No.5 dip switch on the controller (turn over to the left side) See Caution*
By following the above, absolute reset is complete. Home is set few millimeters ahead of the current position (mechanical end).
(9) To continuosly operate the actuator, turn ON the servo ON input and hold of PIO.

Caution*: If No.5 dip switch stays ON, the next time power is applied, absolute reset will be executed at that position.

*Absolute reset is executed according to the main power-up of the controller while the No.5 dip switch is turned ON.

Warning:
The actuators for absolute are the only actuators that can operate using RCP Controller Absolute specifications.

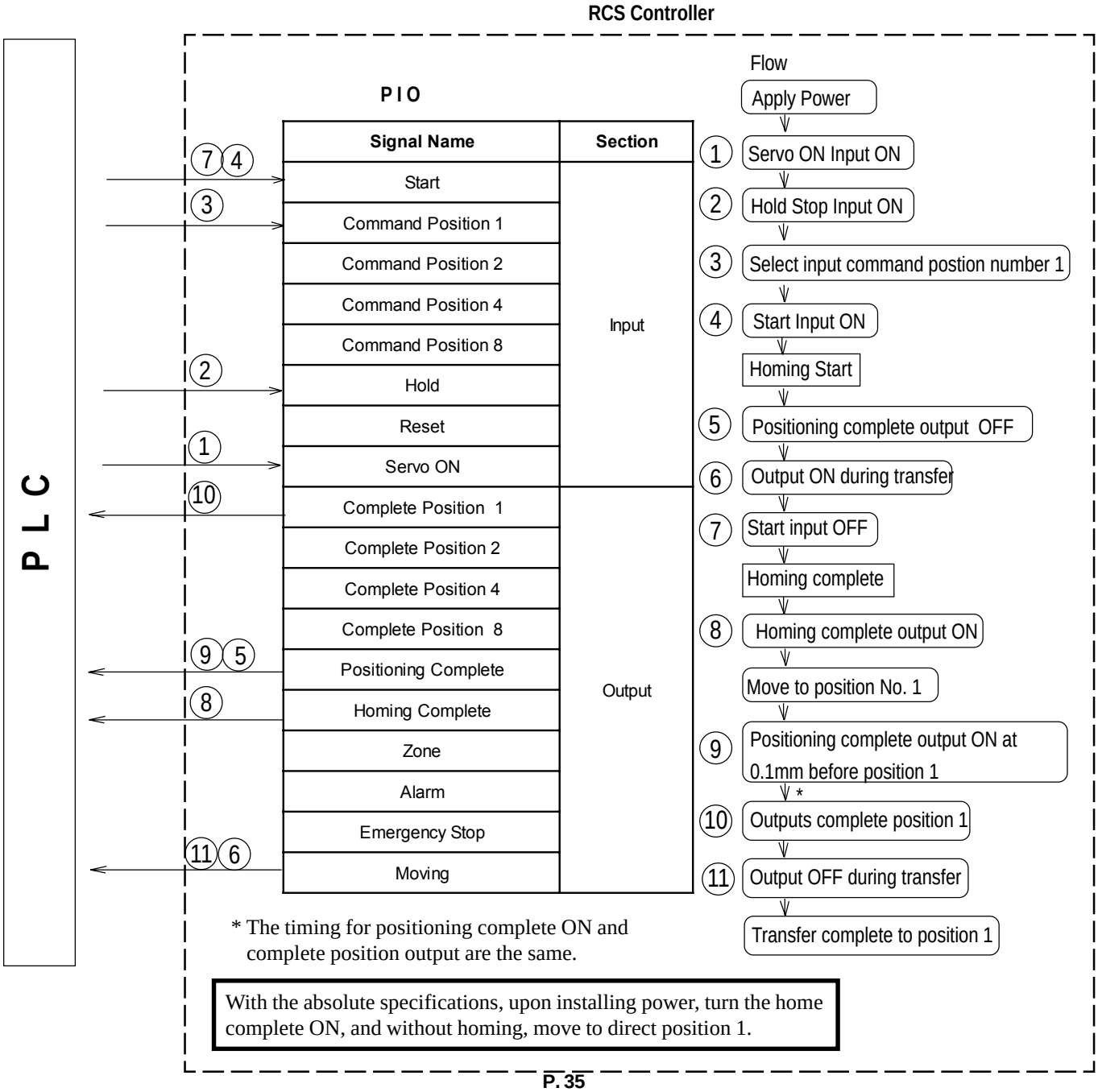
4. Application (Practice)

4-3 Move After Power-Up (Standard)

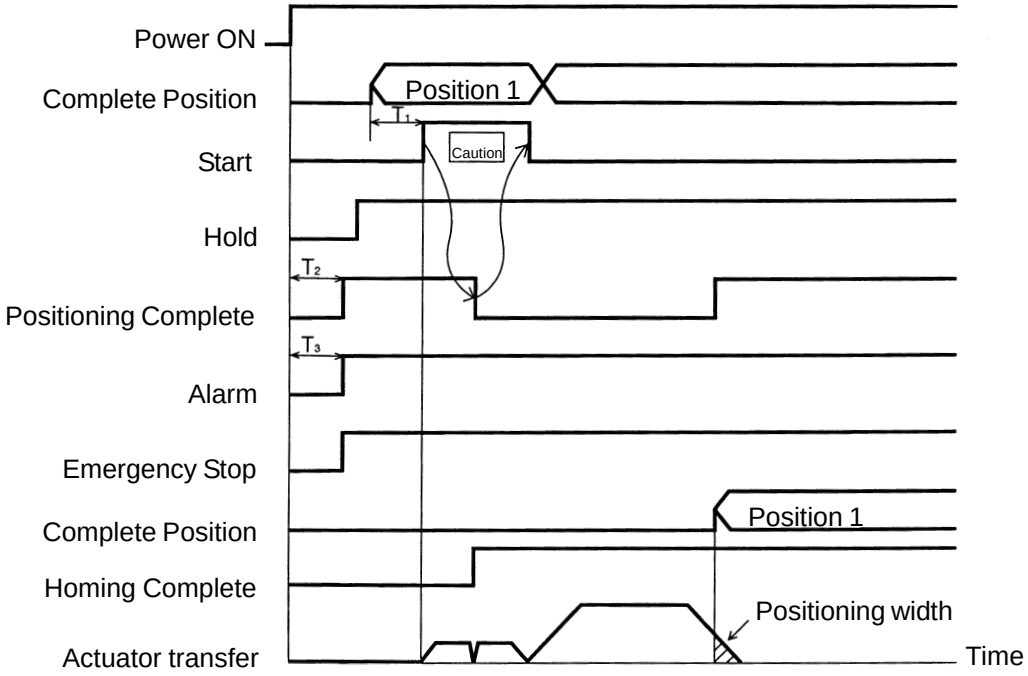
Operation application example:
After Power-Up, move to point 150mm from home at a speed of 200mm/sec.

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

No.	Position	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
⋮						



4. Application (Practice)



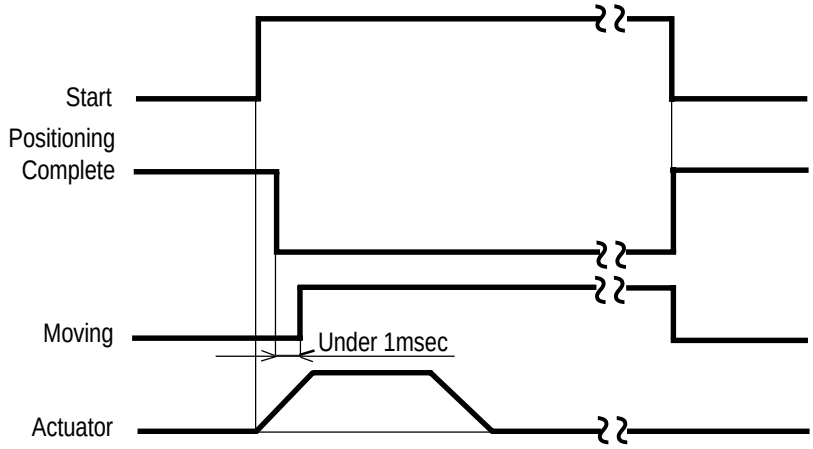
After applying the main power and completing the preparation for operation, positioning completion output will turn ON (If servo ON input is OFF, positioning completion output will not turn ON). To confirm the completion of preparation for operation, make sure that the positioning completion output is ON. After applying power, positioning complete output will be OFF. Upon movement completion, positioning complete will turn ON. When commad move to position No.10 is executed, complete position will remain OFF and not change. Actuators will not move, if hold input is not ON.

T1: Over 5msec — Time from Command Position Select Input to Start Input ON (However, please consider the scan time of the upper controller)

* In regards to absolute specifications, homing signal will turn ON after applying power, and homing will not be possible.

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.

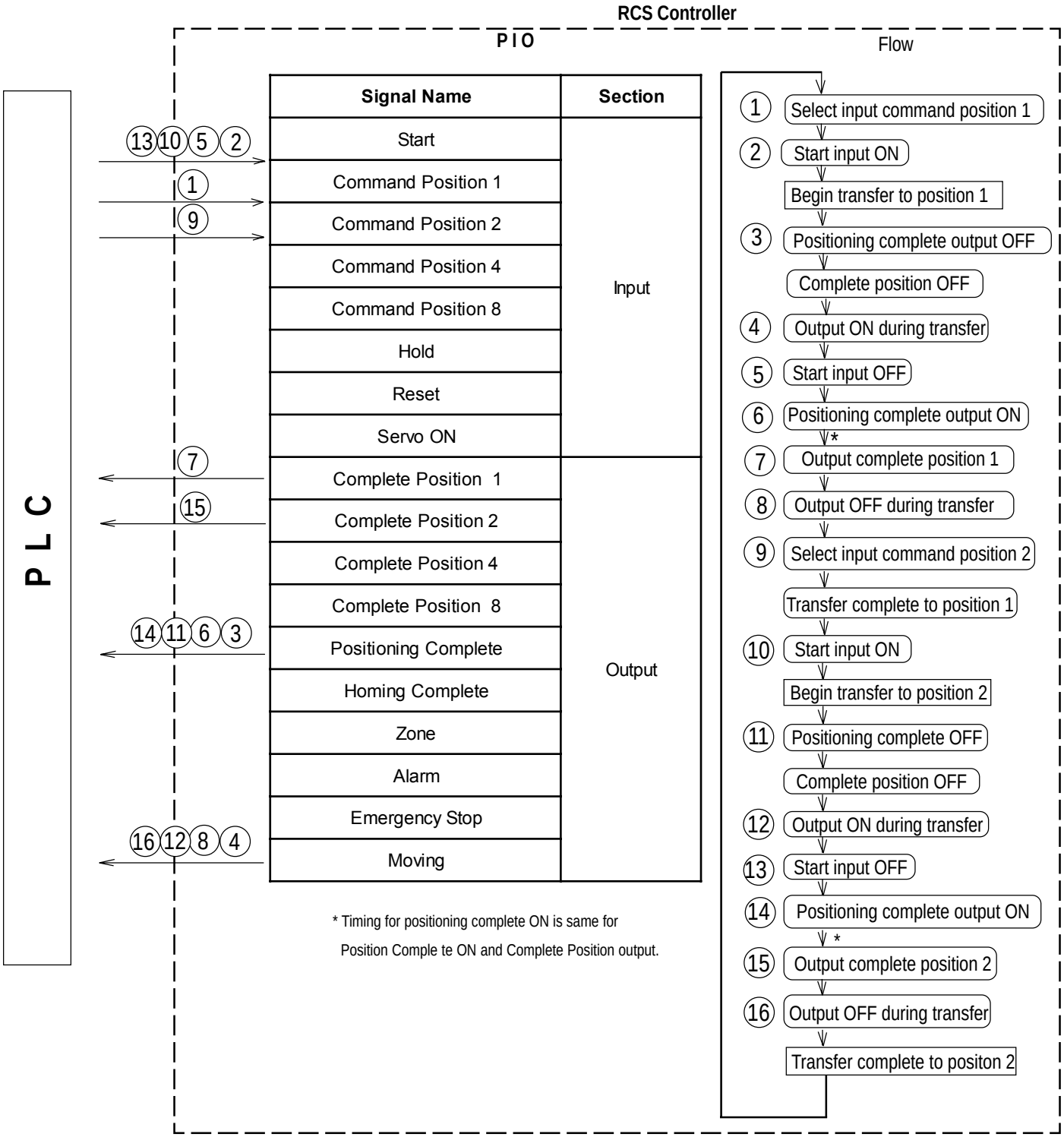
As the diagram below shows, if you leave the Start Input as ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.



4. Application (Practice)

4-4 Positioning Mode (2 point space reciprocation)

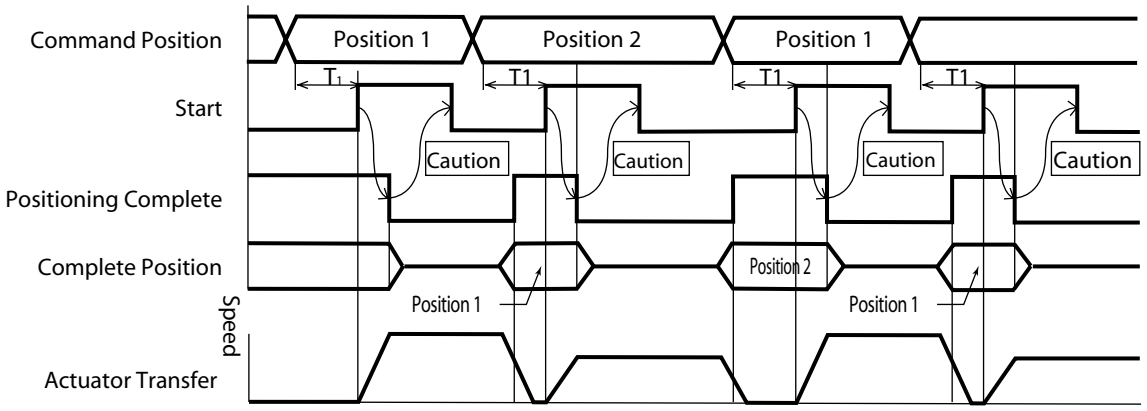
Movement example: Reciprocate 2 positions. Assign the position 1 at 250mm from home, and Position 2 at 100mm from home. Set speed to 200mm/sec for Position 1 and 100mm/sec for Position 2. For both positions, assign the positioning width to 0.



4. Application (Practice)

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

No.	Position	Speed	Acc./Dec.Speed	Push	Positioning Width	Acc. only MAX
0	*	*	*	*	*	*
1	250	200	0.3	0	0.1	0
2	50	100	0.3	0	0.1	0

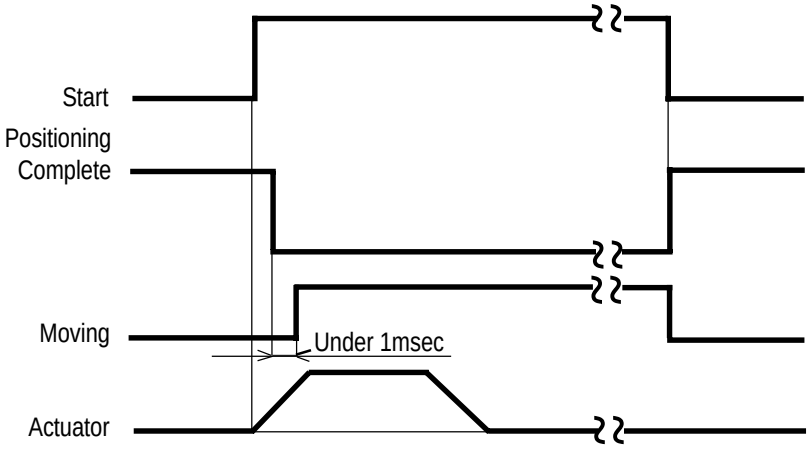


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

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

Caution:
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.

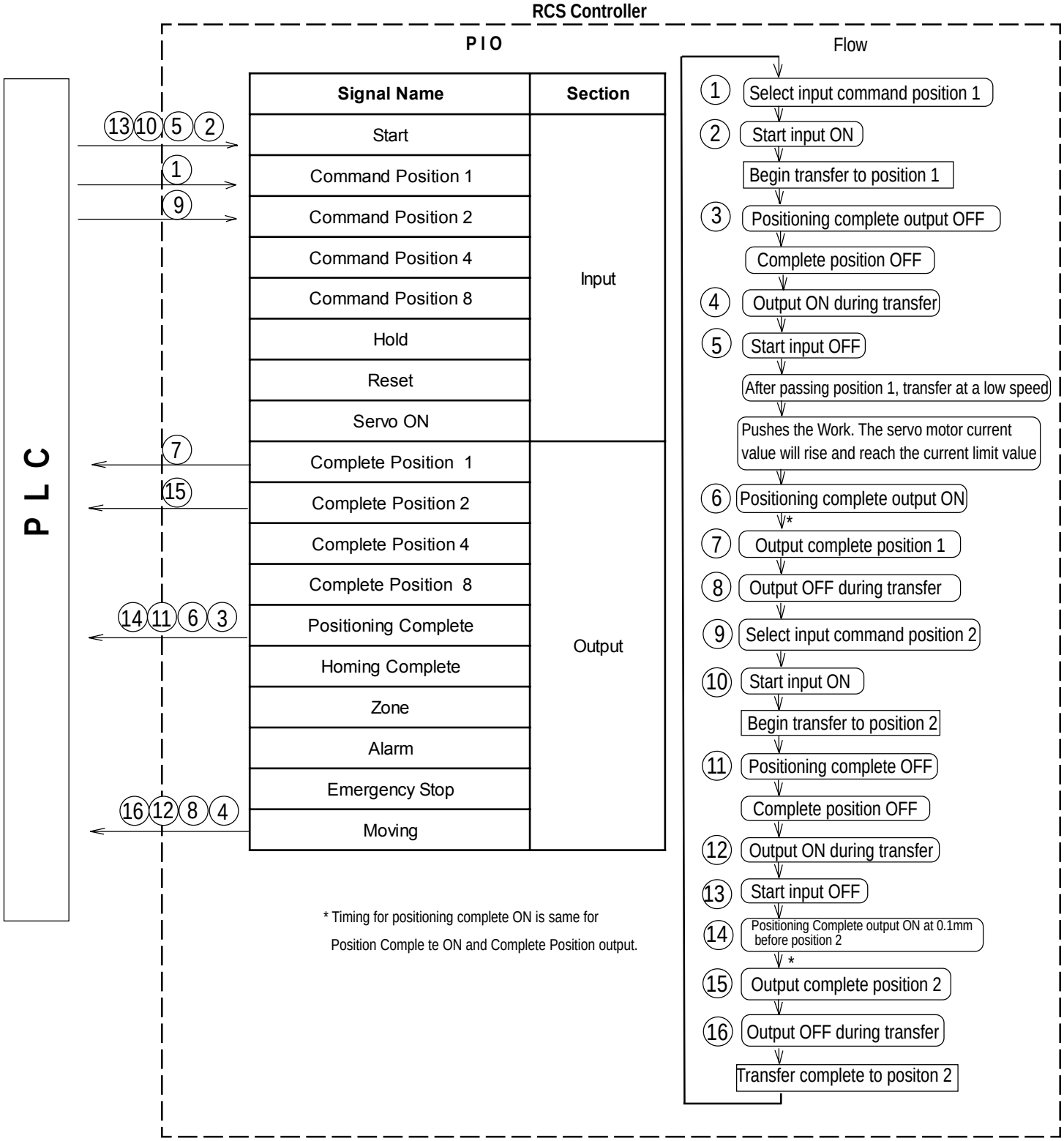
As the diagram below shows, if you leave the Start Input ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.



4. Application (Practice)

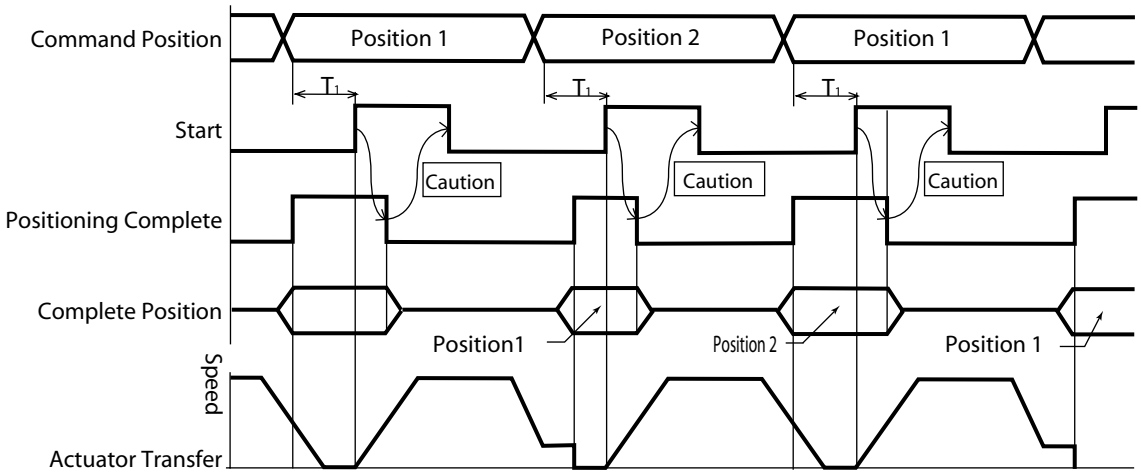
4-5 Push Mode

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%.



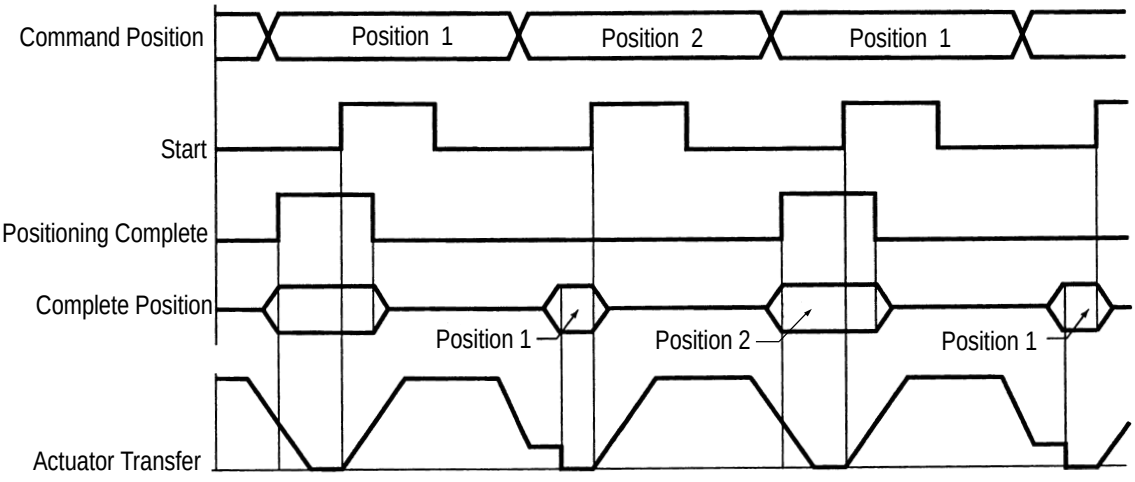
5. Application (Practice)

No.	Position	Speed	Acc./Dec.Speed	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 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.
When the push completes stroke, as the diagram below shows, the Positioning Complete Output will not turn ON, only the Complete Position outputs.



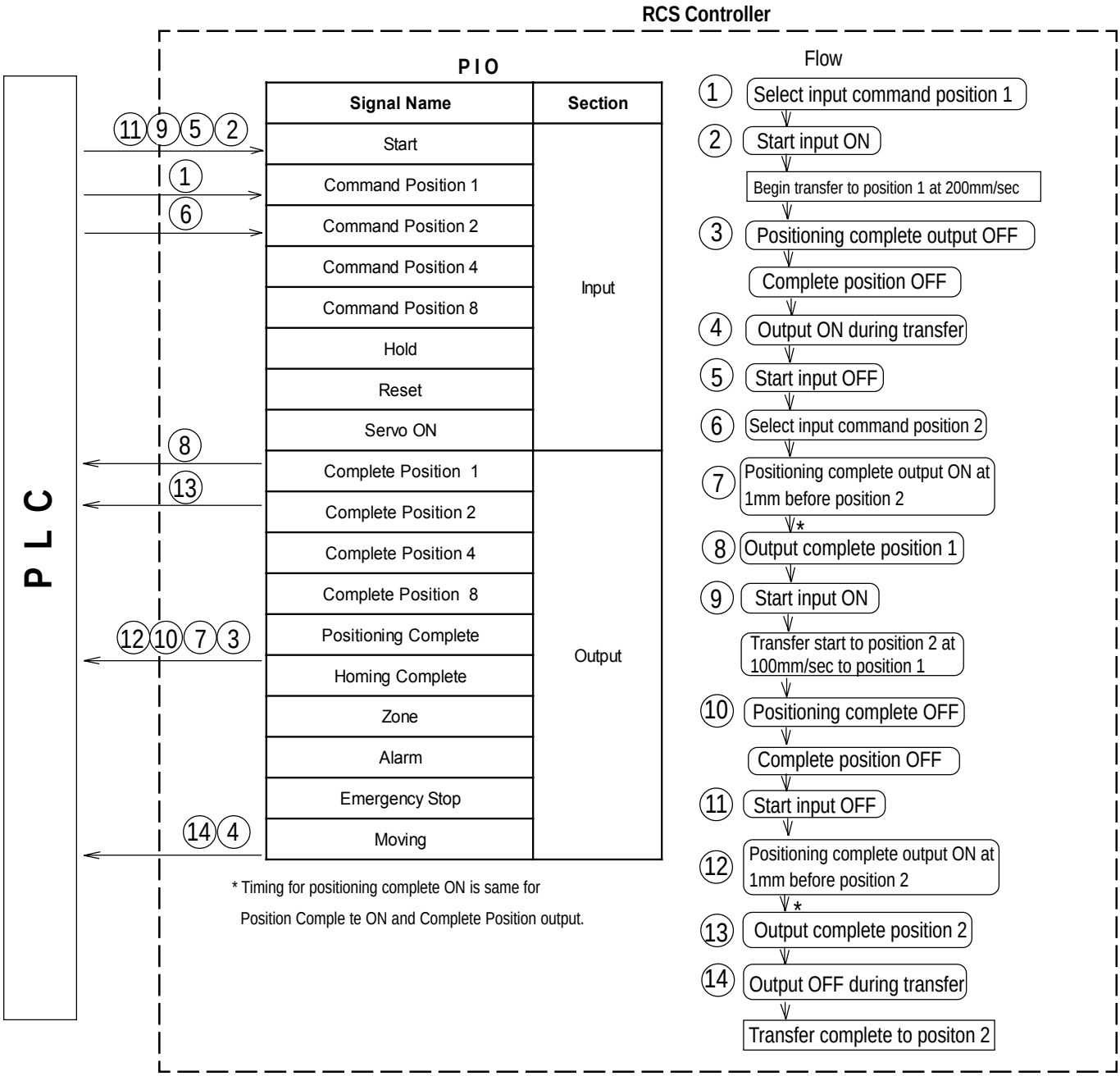
4. Application (Practice)

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).

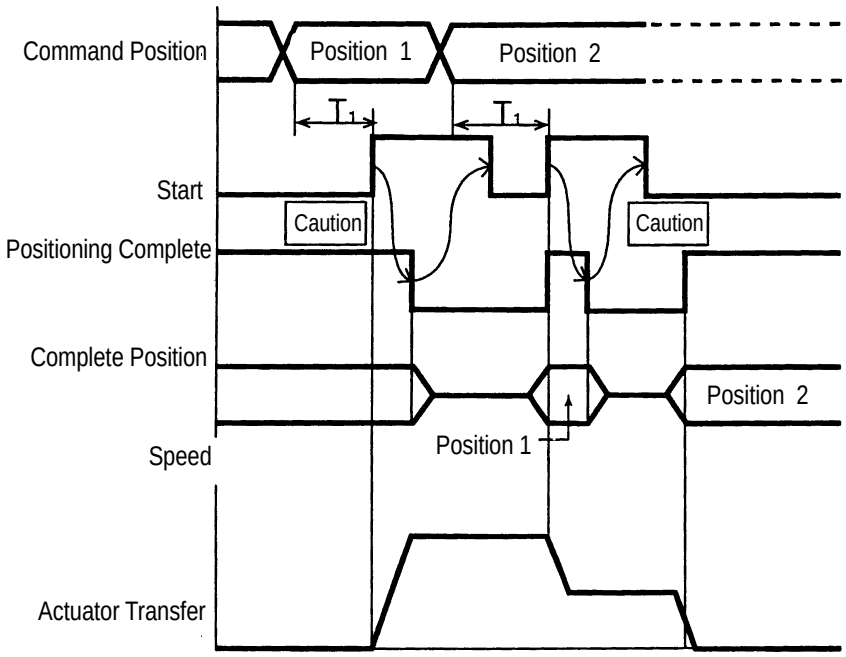
Position Data Table (Columns with thick lines indicate input insert)



4. Application (Practice)

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

No.	Position	Speed	Acc	Push	Pos. Band	MAX ACC	ABS/INC
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
(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.

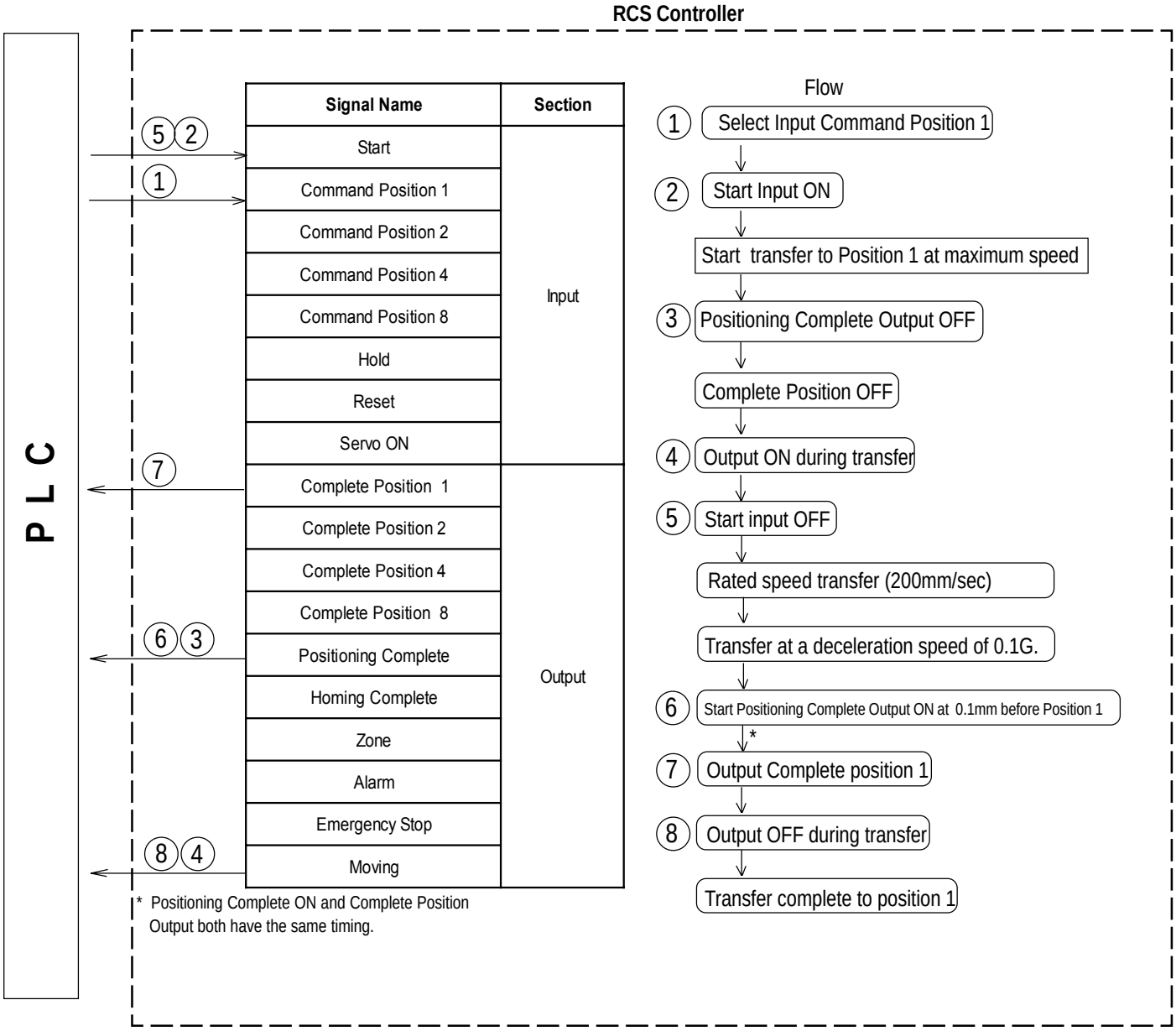
4. Application (Practice)

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.

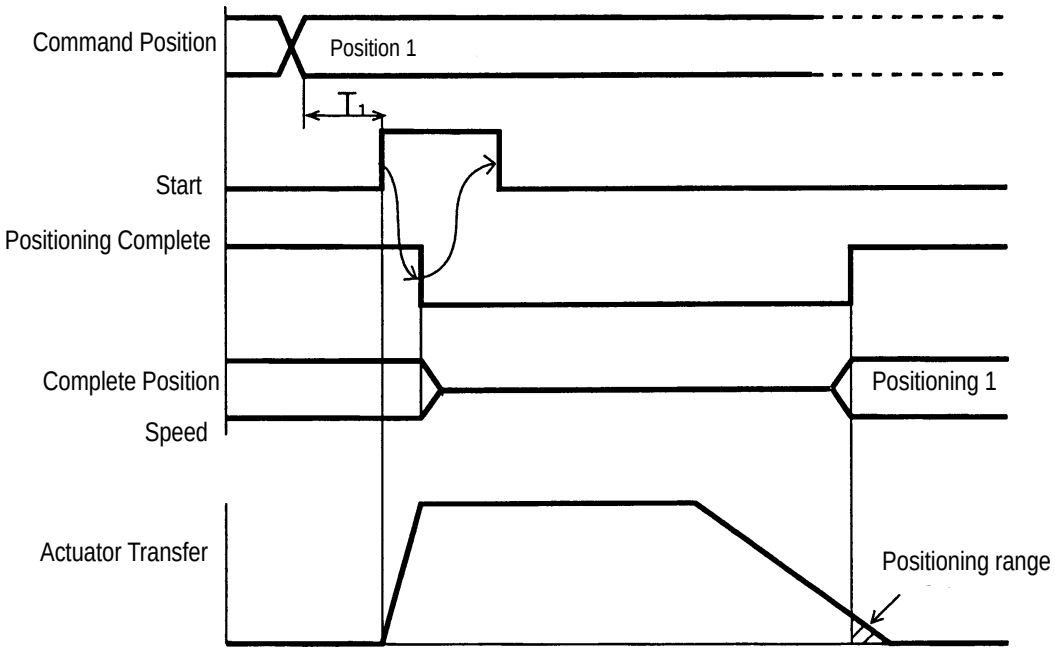
Position Data Table (Columns with thick lines indicate input insert)



4. Application (Practice)

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

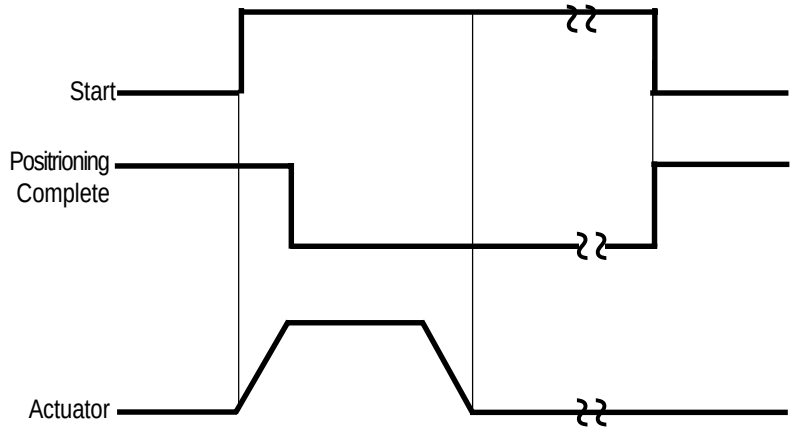
No.	Position	Speed	Acc	Push	Pos. Band	MAX ACC
0	*	*	*	*	*	*
1	150	200	0.1	0	1	1
⋮						



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

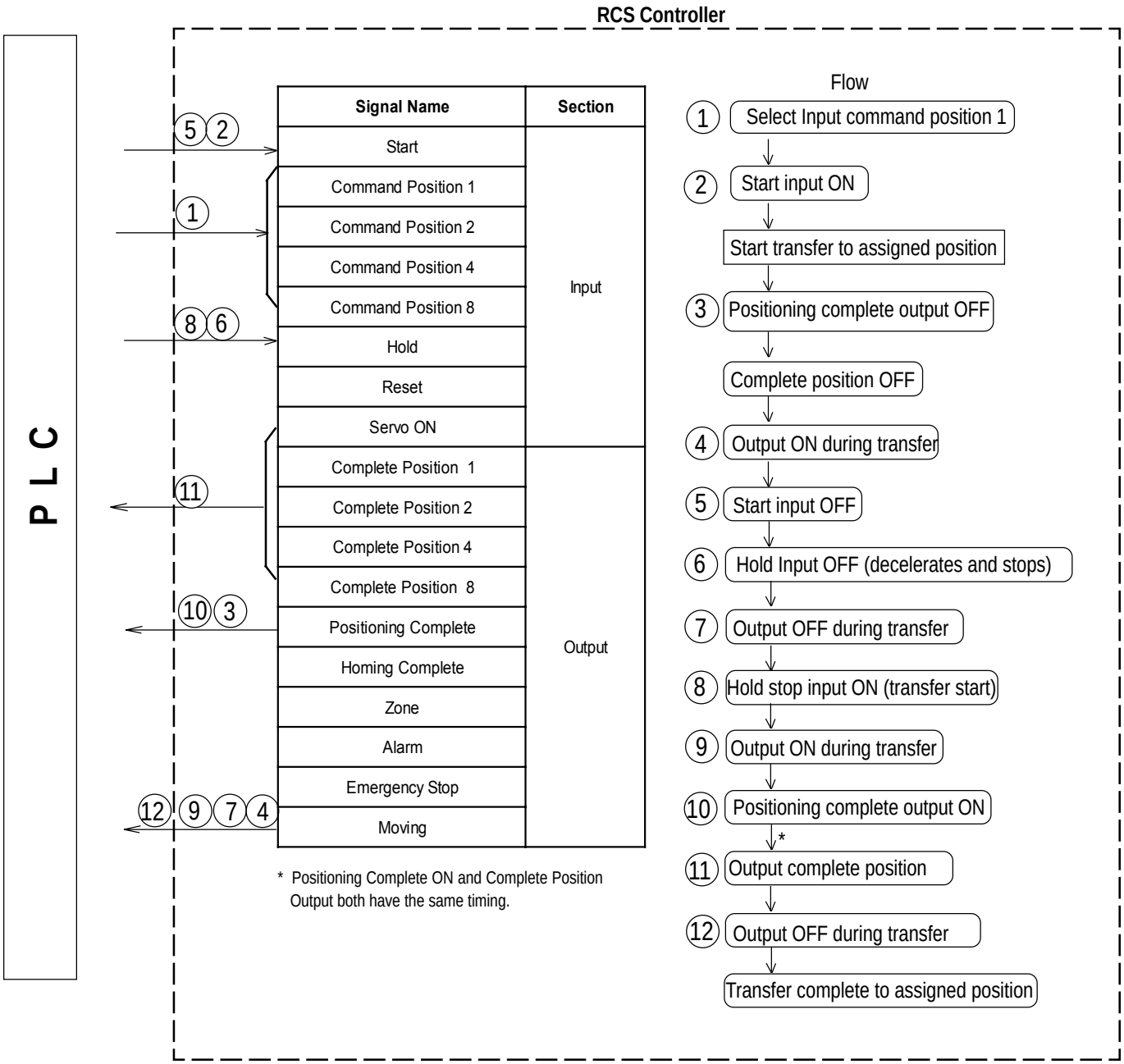


4. Application (Practice)

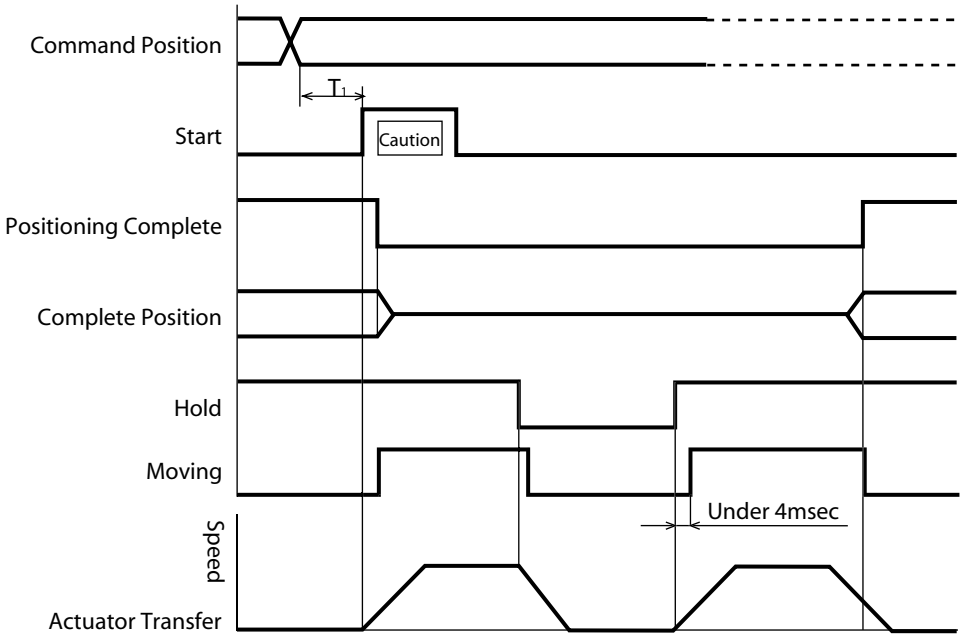
4-8 Hold Input

Movement Example: Temporary stops the movement of the actuator.

Method: Uses the Hold Input.



4. Application (Practice)

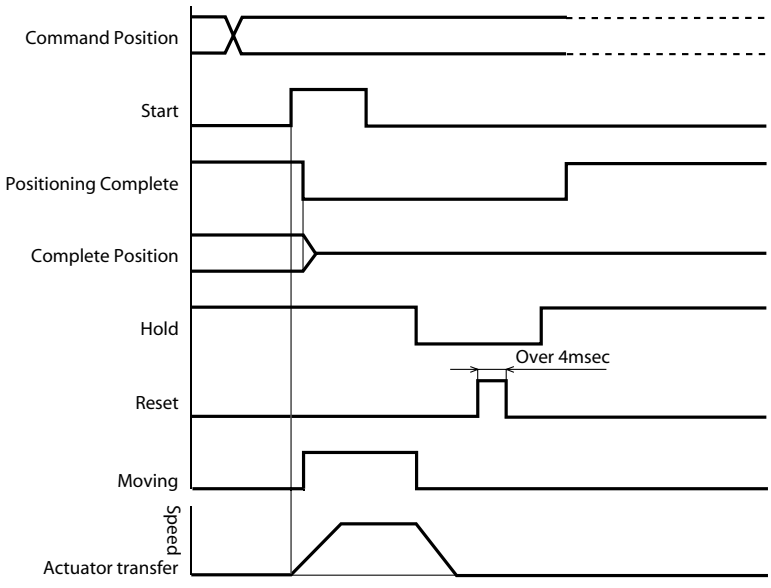


T1: Over 5msec Time from Command Position Select Input to Start Signal ON

(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.

You can cancel the remaining transfer load by turning ON the reset input during hold (you can detect and cancelreset signal riser).



4. Application (Practice)

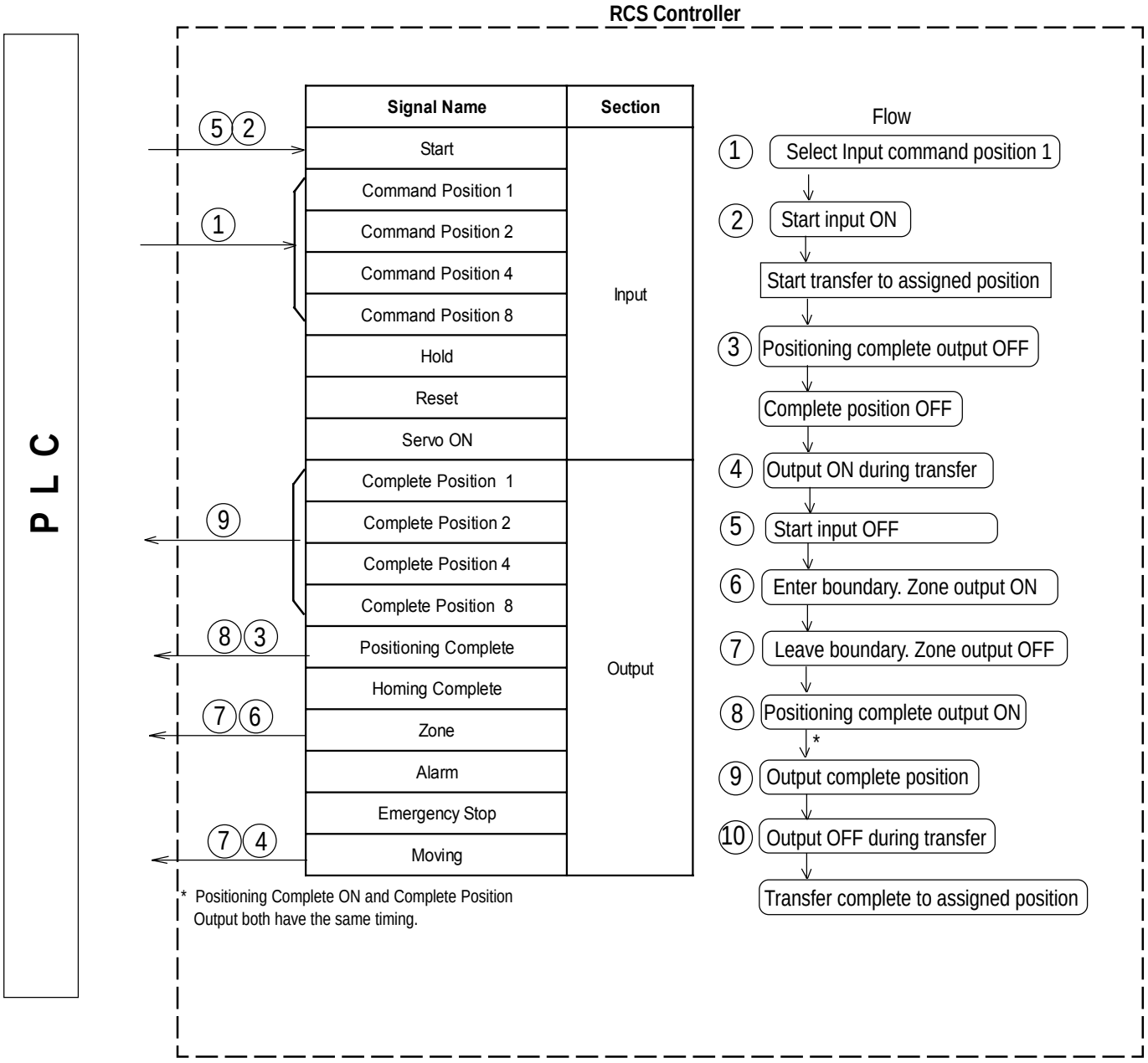
4-9 Zone Signal Output

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

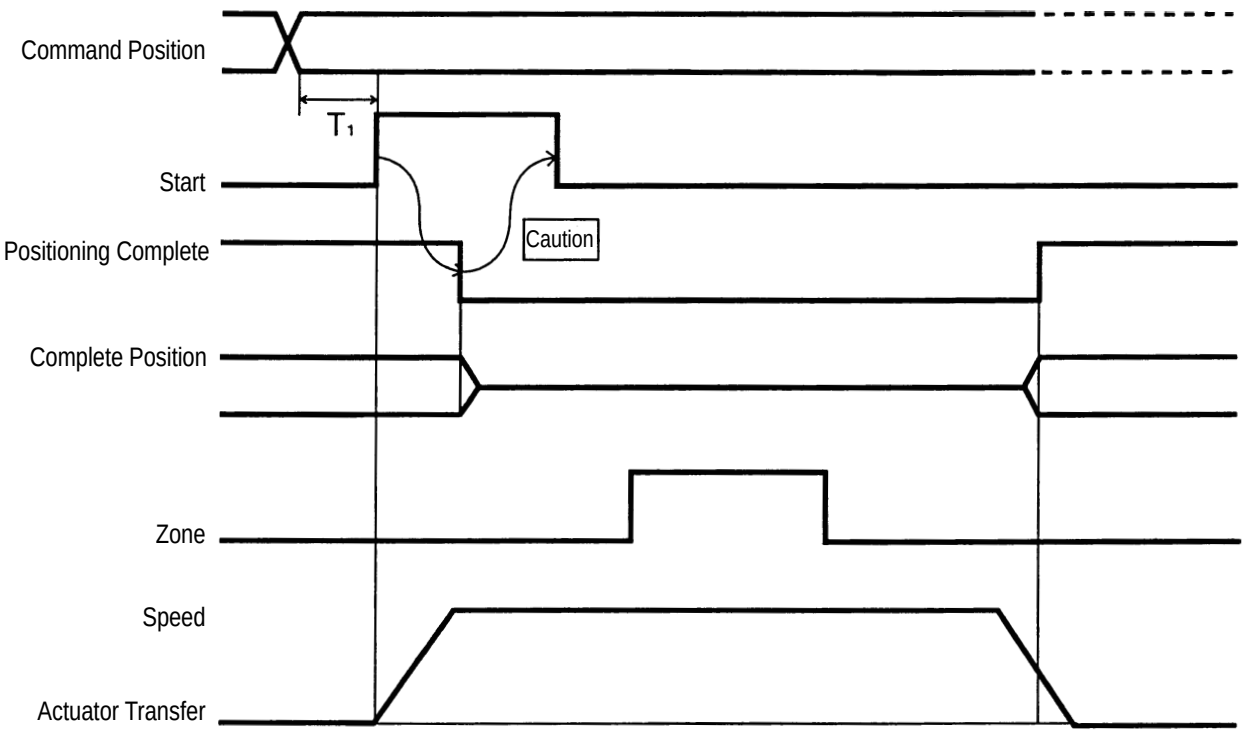
Method: Zone Signal Output boundary is set in the Parameter Zone Value and Zone Boundary Value -.

Input as the following:

Zone Boundary Value +	120
Zone Boundary Value -	40



4. Application (Practice)



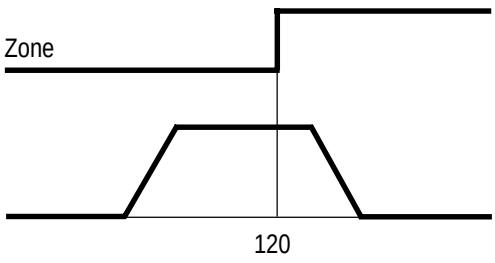
T1: Over 5msec Time from Command Position Select Input to Start Signal ON

(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.

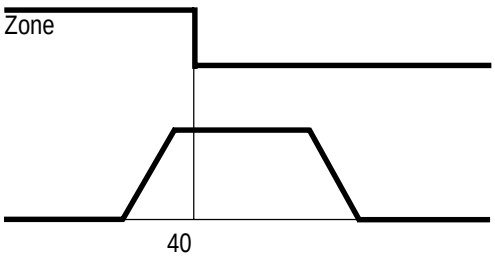
Other zone outputs (examples):

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

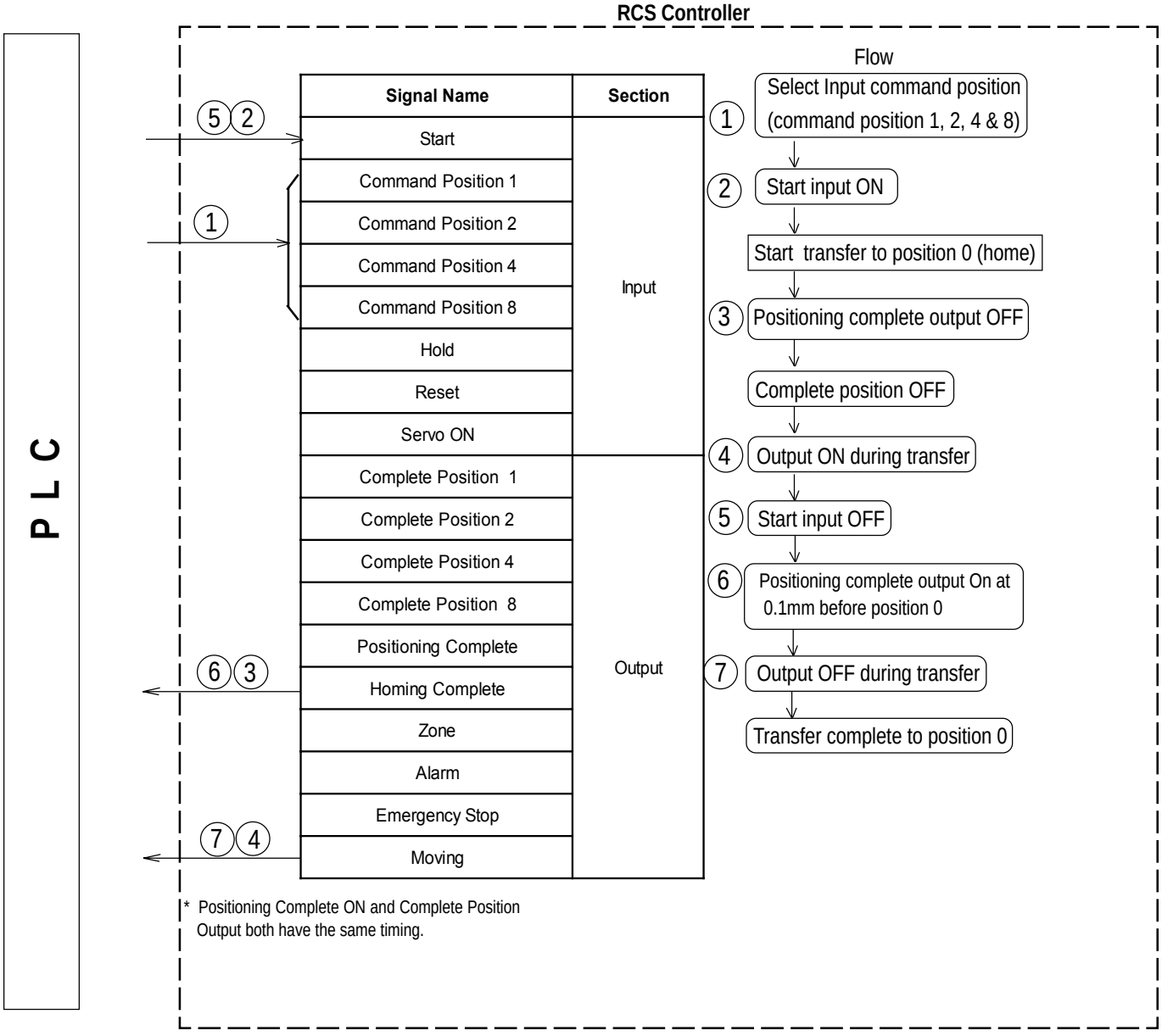
4. Application (Practice)

4-10 Transfer to Home

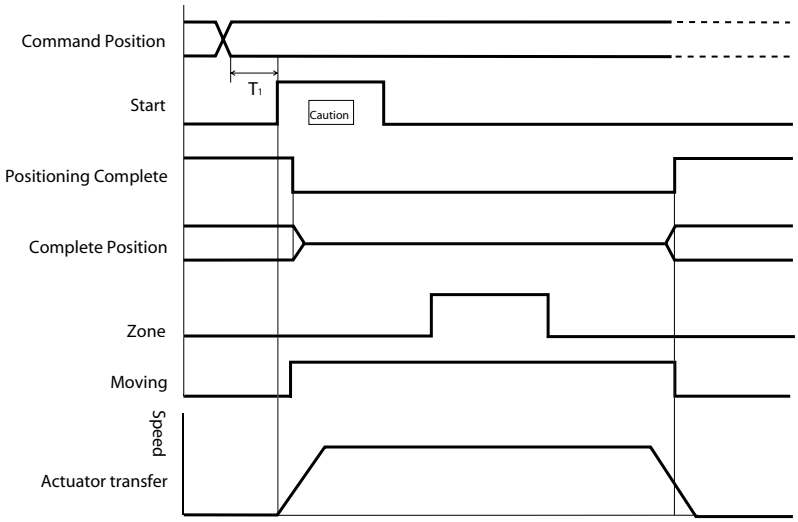
Movement Example: You cannot home using only PIO. Homing occurs when controller is told to move to a point prior to homing.
Method: This is a method which forces a point data of distance 0 from the home, and moves to that location after homing is complete.

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

No.	Position	Speed	Acc	Push	Pos. Band	Max Acc	ABS/INC
0	0	100	0.3	0	0.1	0	
1	*	*	*	*	*	*	
⋮							



4. Application (Practice)



Command Positions 1, 2, 4, 8 are all turned OFF.

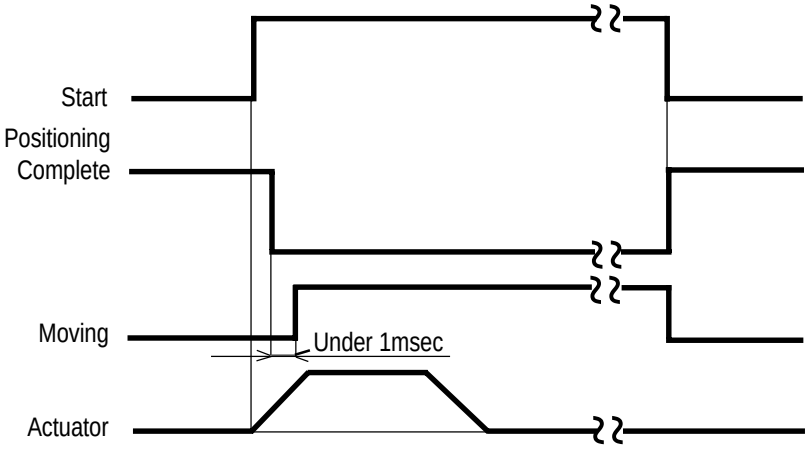
Complete Positions 1, 2, 4, 8 are all turned OFF.

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.

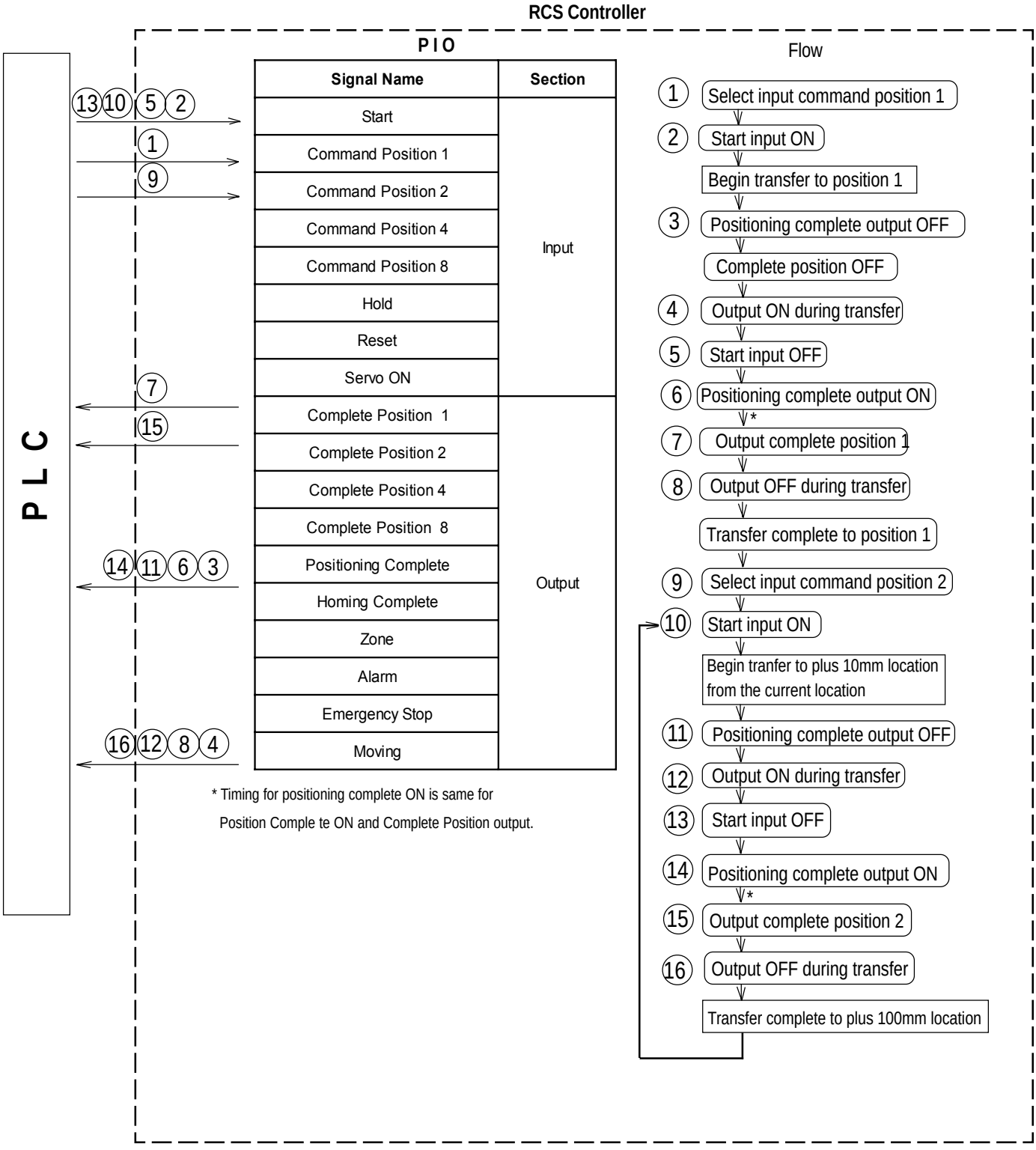
As the diagram below shows, if you leave the Start Input ON, the Positioning Complete Output will not turn ON even after the actuator transfer completes.



4. Application (Practice)

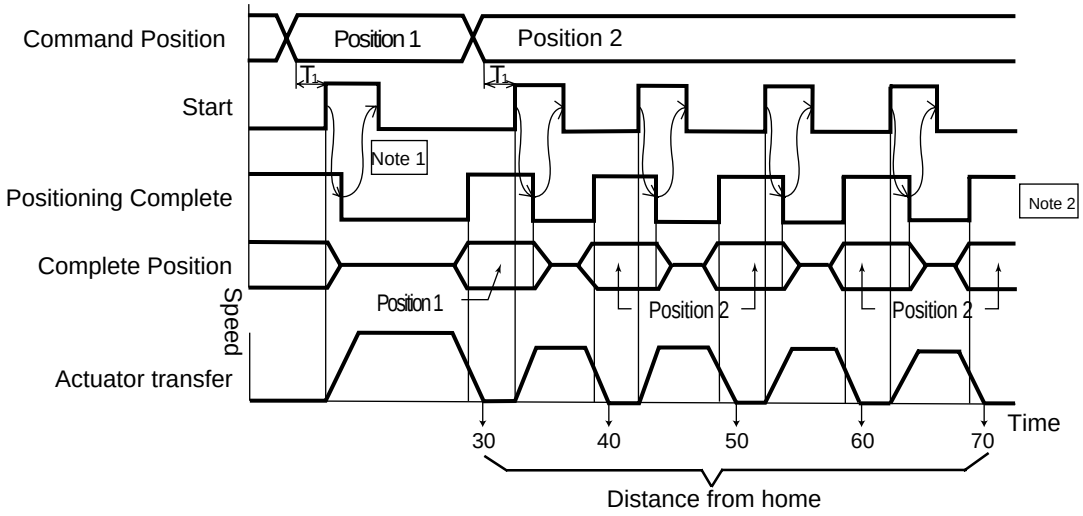
4-11 Incremental Movement in Relative Coordinate

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



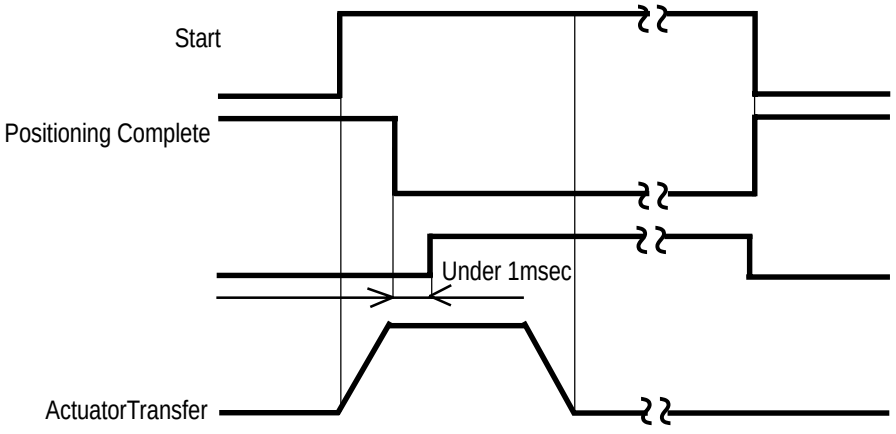
4. Application (Practice)

No.	Position	Speed	Acc	Push	Pos. Band	MAX ACC	ABS/INC
0	*	*	*	*	*	*	
1	30	200	0.3	0	0.1	0.1	0
2	10	20	0.3	0	0.1	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)

Note 1:
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.
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 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), moves to the position 40mm away from home.

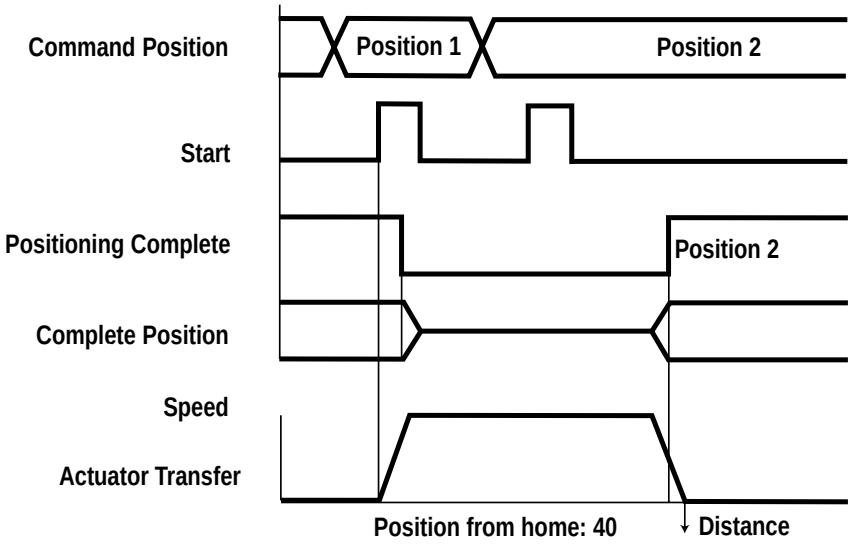
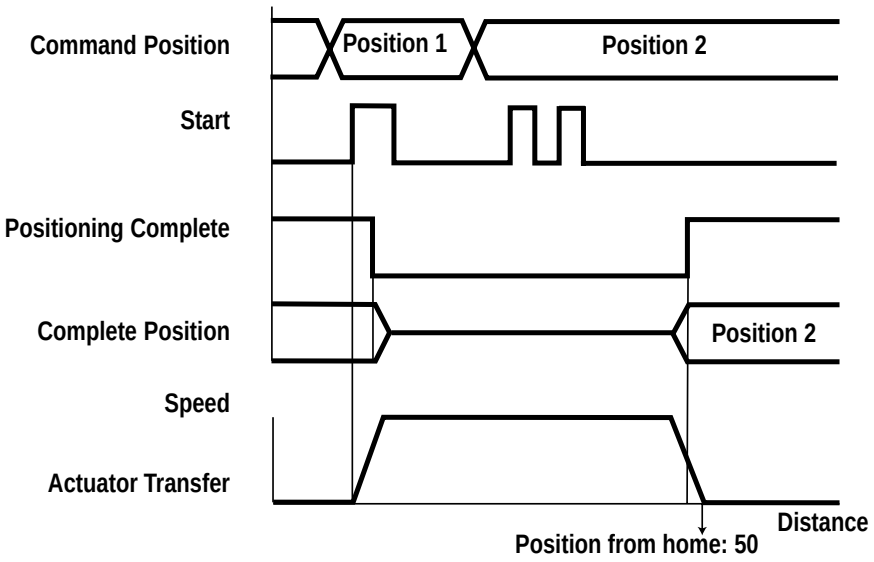


Table 4-12-1

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.



5. Application (Practice)

Example: The Start Input of Position (Table 5-12-1) 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.

(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.

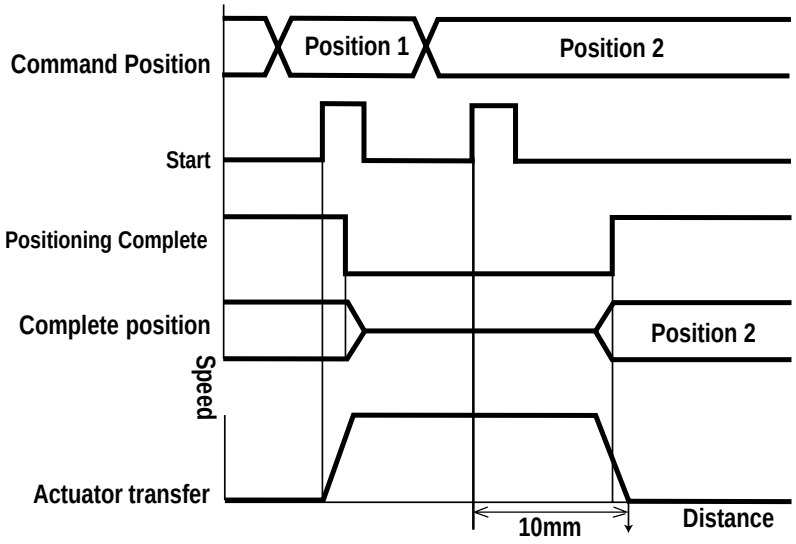


Table 4-12-2

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 tables below:

	Type	Motor W	Speed Type	Screw Lead	Maximum error μ
Slider Type	SA4	20	L	2.5	0.2
			M	5	0.3
			H	10	0.6
	SA5	20	L	3	0.2
			M	6	0.4
			H	12	0.7
	SA6	30	L	3	0.2
			M	6	0.4
			H	12	0.7
Flat Type	F45	30	L	2.5	0.2
			M	5	0.3
			H	10	0.6

	Type	Motor W	Speed Type	Screw Lead	Maximum error μ
Rod Type	RA35	20	L	2.5	0.3
			M	5	0.6
			H	10	1.2
	RA45	30	L	2.5	0.2
			M	5	0.3
			H	10	0.6
	RB7525	30	L	2.5	0.8
			M	5	1.6
			H	10	3.3
		60	M	5	1.6
			H	10	3.3

5. Parameter List

Parameter List

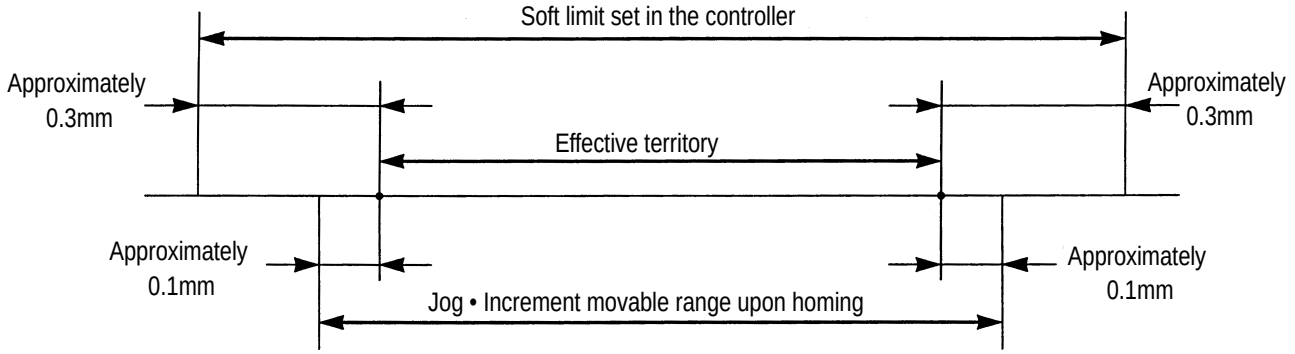
Zone Limit + side (mm)	Maximum value of zone output.	
Zone Limit - side (mm)	Minimum value of zone output.	
Soft Limit + side (mm)	Sets the soft limit value in the plus direction.	
Soft Limit - side (mm)	Sets the soft limit value in the minus direction.	
HOME Direction (0:Motor/1: Reverse)	Sets the homing direction.	
Push Recognition Time (msec)	During a move, if the push % is sustained for this amount of time, the position complete output turns ON.	
Servo Gain No.	Set the servo gain.	
Initial Speed Setting (mm/sec)	Speed initial 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 · ineffect of dynamic brake during stop. 0: Ineffect 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



6. Alarm List

• In case you wish to change the home direction, position data already input 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: Normal 1: Reverse)

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.

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	
●	●	○	●	○	CPU abnormal	0FA
●	●	○	○	●	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.

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
040	Emergency Stop	Emergency stop status.
05A	Transmission Over Run Error	Abnormal Communication, Check for noise. Inspect all serial ports and cables involved.
05B	Transmission Framing Error	
05C	Transmission Timeout Error	
05D	Header Error	
05E	Delimiter Erroa	
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 ssurpasses 2000rpm against the SW7-ON, SW8-off against the controller. Incorrect Data Command Rejection (could be an operation not wllowed 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.
0BE	Homing Timeout	Check physical connection of the motor and actuator. Actual movement may not be happening.

6. Alarm List

Code	Error Description	Common Solution
0C0	Excess Speed	Please reduce the payload or lower the velocity and ACC/DEC.
0C1	Servo Error	
0C8	Overcurrent	Motor main circuit may have short circuited., due to a spontaneous excessive load. This alarm will not home unless reapplying power.
0C9	Excess Voltage	Load may be too big. Please check also for mechanical binding.
0CA	Excess Heat	Ambient temperature may be too high.
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 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.
0E8	No A and B Pulse Feedback	
0F8	Fixation Memory Breakage	Controller initialization is needed.
0FA	Abnormal CPU	CPU shows abnormal movement. Noise may have entered.
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

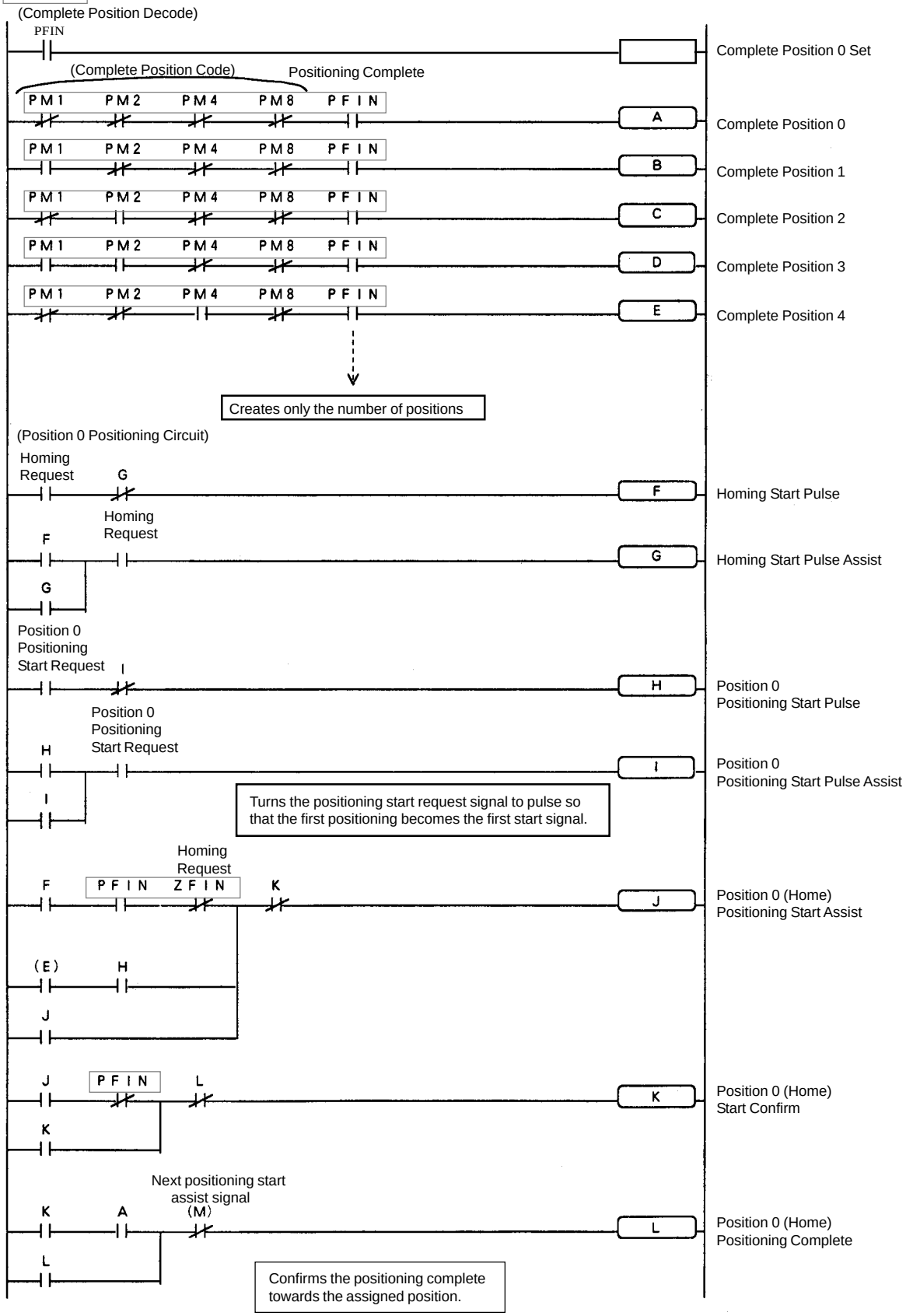
Code	Error Description	Common Solution
181	Controller initialization OK	(This is not an error).
182	Home Change All Clear	(This is not an error).
201	Emergency Stop	(This is not an error).
20A	During movement, Servo OFF	During movement., Servo has been turned OFF.
20C	During movment, Start ON	During movement, Servo has been turned ON.
20D	During movement, STP-OFF	During movement, STP has been turned OFF.
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

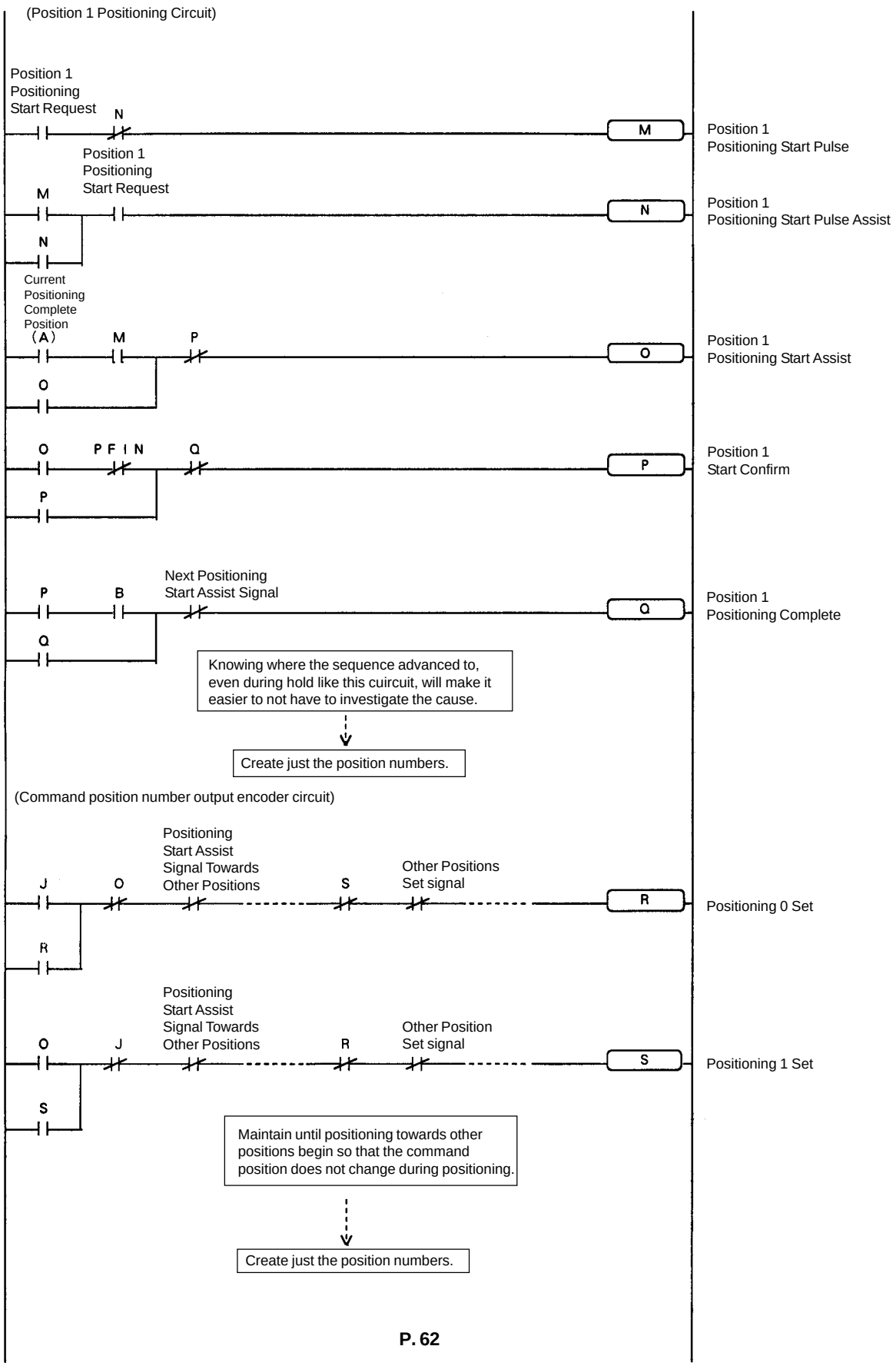
RCS Positioning Sequence Basic Examples:

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

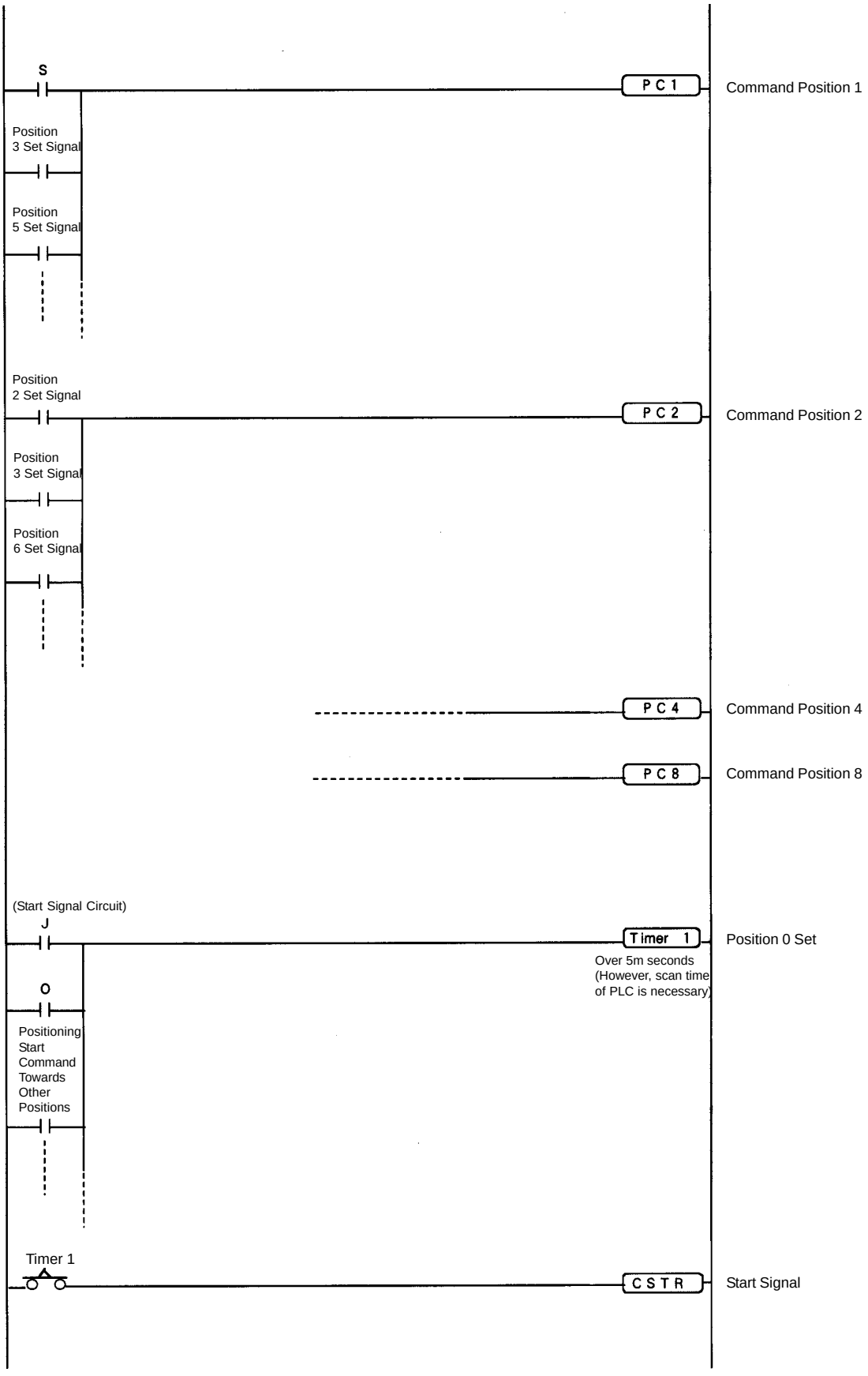
[ ] indicates PIO signal for the RCS Controller.



7. *Supplement



7. *Supplement



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Publication Date: May 2001
Publication No.: IAI-070C