

**RS** OEMax

# X8 Position Module User Manual

## User Manual

Catalog Number(s): X8-POS1\_UMxxx  
X8-POS2\_UMxxx  
X8-POS4\_UMxxx

## Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

<b>WARNING</b> 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
<b>IMPORTANT</b>	Identifies information that is critical for successful application and understanding of the product.
<b>ATTEN-</b> 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
<b>SHOCK HAZ-</b> 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
<b>BURN HAZ-</b> 	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

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***Table of Contents***

---

Important User Information..... 2

About This Publication ..... 5

Who Should Use This Manual ..... 5

Additional Resources..... 5

## ***Summary of Change***

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You will see change bars to the left or right of a paragraph throughout this manual to help you quickly identify revisions.

Manual Revision	Changes	Date
A	N/A	April 2013

## About This Publication

This manual provides detailed system installation for user of X8 PLC Series using the analog combo module, X8 Position Module.

## Who Should Use This Manual

This manual is intended for engineers or technicians directly involved in the installation and wiring of the X8 Position Module, and programmers directly involved in the operation, field maintenance, and integration of the X8 Position Module.

If you do not have a basic understanding of the X8 Series PLC or X8 Position Module, contact your local RS Automation sales representative before using this product, for information on available training courses.

## Additional Resources

The following documents contain additional information concerning related X8 Series PLC products.

Manual	About
X8 Position Module Installation Instruction	Installation Instruction for X8 Position Module
X8 Position Module User Manual	User Information for X8 Position Module
XGPC User Manual	User Information for XGPC(S/W)

You can view or download publications at <http://www.rsautomation.biz>  
To order paper copies of technical documentation, contact your local RS Automation Korea distributor or sales representative

***Table of Contents***

---

**1. Summary of Position Module .....2**

    Features .....2

    Function Specifications .....2

    Purpose .....5

    Operation Flow-chart .....5

    Feature Overview .....6

    Control Overview ..... 12

# **1. Summary of Position Module**

This chapter describes the X8 position module.

## **Features**

RS Automation X8 PLC, X8 Positioning modules support 1 axis, 2 axes, 4 axes for X8-POS1, X8-POS2 and X8-POS4 respectively. This module allows high-speed and high-precision positioning at the speed command of 4 Mpps in maximum. The start-up time is 1ms or less and flexible start-up/stop is achieved by S-curve acceleration/deceleration. This module includes a pulse generator feature that allows real-time output (Open Collector or Line Drive) to the manual pulse generator (MPG).

## **Function Specifications**

X8 Positioning Module supports following functions:

- Able to choose the output type of pulse(Open Collector or Line Drive)
- High-speed, high-precision positioning with maximum 4M pulse/s
- Able to control multiple axes with 1 unit which can be mounted up to 4 axes.
- Reduce the Tact-Time with high start-up time
- Simplification of parameter settings such as index flags
- Allows real-time output with manual pulse generator(MPG)
- Various built-in I/O ports, requiring no separate I/O modules
- Smooth start-up/stop realized by S-curve acceleration/deceleration

## General Specifications

Item		Specification
Ambient Temperature	Operating Temperature	-20 ~ 60 ℃
	Storage Temperature	-40 ~ 85 ℃
Ambient Humidity	Operating Humidity	5 ~ 95 % (Non-condensing)
	Storage Humidity	5 ~ 95 % (Non-condensing)
Vibration Immunity		5~8.4Hz peak amplitude 3.5mm 1 sweep/1 minute, 8.4~150Hz acceleration 9.8m/s <sup>2</sup> 1sweep/1minute, 10 minutes on 3 axes( X, Y, Z)
Operating Shock		15G
Non-operating Shock		DIN-Rail mounted: 25G, Panel mounted:30G
Emission		CISPR 11 Group 1, Class A
ESD immunity		4kV Contact Discharge, 8kV Atmospheric discharge
Radiation RF		10V/m, 1 kHz Sign 80% AM, 80M ~1 GHz 10V/m, 1 kHz Sign 80% AM, 1~2.7 GHz 10V/m, 200 Hz 50% Pulse 100% AM @ 900 MHz
ESD/B immunity		POWER: ±2 kV @ 5 kHz I/O, (Communication): ±1 kV @ 5 kHz
Surge transient immunity		±1 kV (DM), ±2 kV (CM)
Conductive RF immunity		10V RMS, 1 kHz Sign 80% AM, 150 kHz~80 MHz
Ambience		No corrosive gas, No excessive dust
Altitude		2,000m or less
Pollution Degree		2 or less
Compliance		cULus, CE, KC

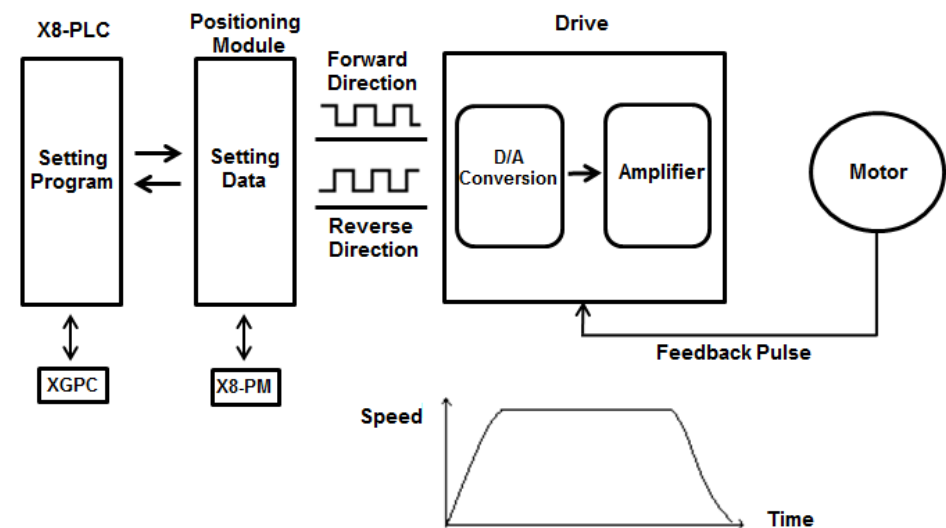
## Function Specifications

Item		4-axes module (X8-POS4)	2-axes module (X8-POS2)	1-axis module (X8-POS1)
Number of I/Os		124 words (Input 44, Output 80)	62 words (Input 22, Output 40)	31words (Input 11, Output 20)
Mountable Slots		All slots are mountable		
Number of Control Axis		2-axes, 3-axes, 4-axes linear Interpolation 2-axes circular interpolation 3-axes helical interpolation	2-axes linear interpolation 2-axes circular interpolation	Independent 1 axis
Position Command	Command Pulse Unit	Pulse unit (Increment, Absolute) is programmatically commanded		
	Command Range	Signed 32-bit integer (-2,147,483,648~ + 2, 147, 483, 647 pulse)		
Speed Command	Command Range	Using line driver : 1 pulse/s ~ 4M pulse/s (Adjustable by pps module)		
	Acceleration/ Deceleration Method	Linear acceleration/deceleration, S-curve acceleration/deceleration		
	Acceleration/ Deceleration Time	0 ~ 32,767 ms		
Return to Zero	Return to Zero Rate	Adjustable (Return to zero rate and search rate can be changed)		
	Input Terminal	Zero input, zero proximity inputs		
Limit Sensor		3 (Home, Positive, Negative)		
Operation Mode		E point control(selectable either of Linear or S-curve acceleration/deceleration) <sup>1</sup> P point control(selectable either of Linear or S-curve acceleration/deceleration) <sup>1</sup> Linear/circular interpolation control Return to zero function(selectable either of Linear or S-curve acceleration/deceleration) JOG operation function(selectable either of Linear or S-curve acceleration/deceleration) <sup>1</sup> Pulse generator input function		
Start-up Time		0.1ms or less		
Output Mode		Pulse/Sign mode, CW/CCW mode (Switched by S/W)		
More Features		Deviation counter clear signal output contacts		
External Power Supply		24V DC(21.6 ~ 26.4V DC)		

<sup>1</sup> E point control and P point control means the acceleration/deceleration control as shown in the following figure, respectively.

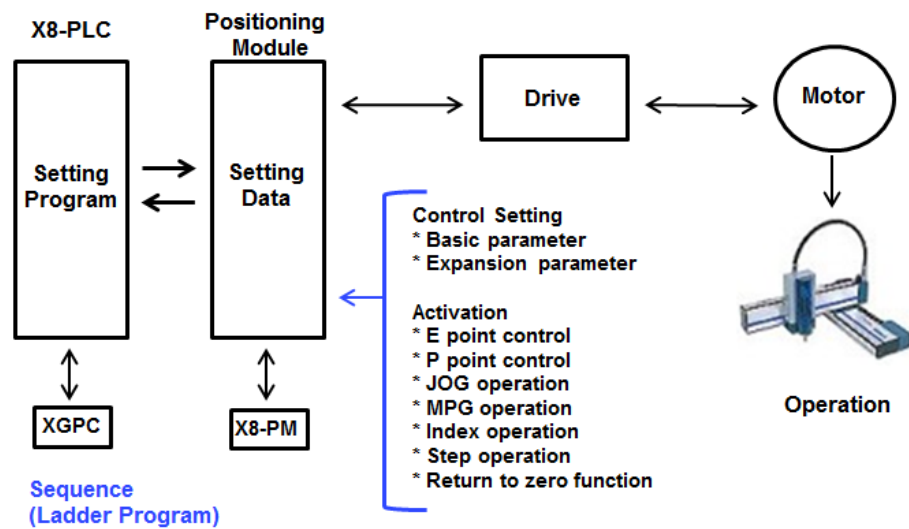
# Purpose

Positioning module can be used extensively such as Semiconductor Assembly Machine, Grinding Machine, Small Machine, Machine tool and Lifter..etc.



# Operation Flow-chart

External devices and software in PLC system using the positioning module have the flow structure as show below

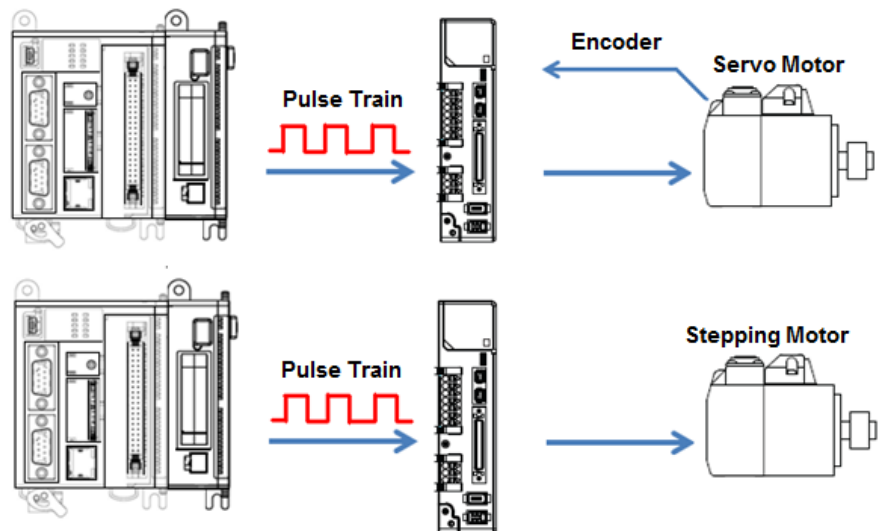




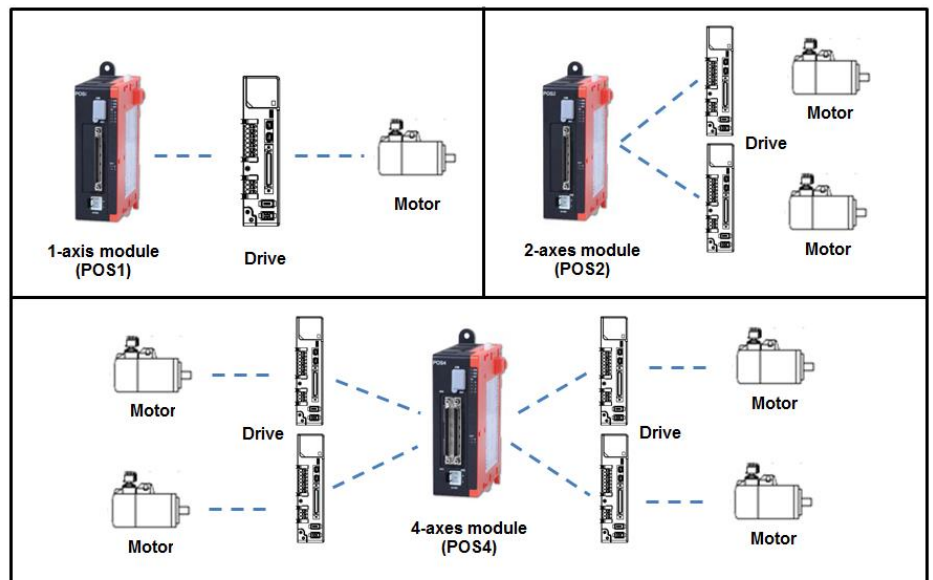
## Feature Overview

### Features of positioning module

- Position control is possible by connecting to servo motor and stepping motor equipped with drive of pulse type input mode

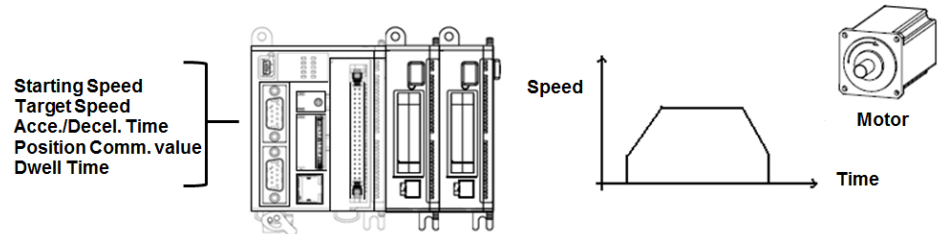


- In X8 PLC, there are 1-axis, 2-axes, 4-axes positioning modules

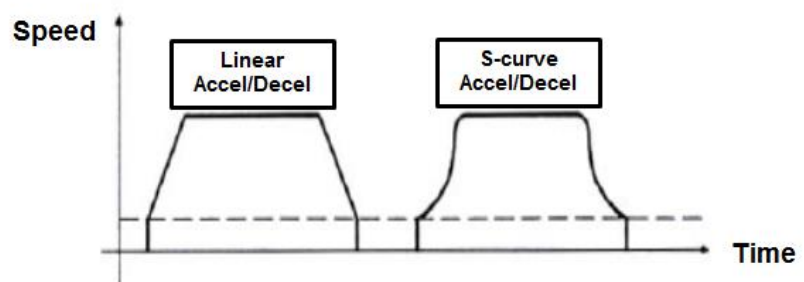


■ Line drive output is supported.

■ Acceleration/Deceleration can be controlled when the starting speed, acceleration/deceleration time, and position command value are set as data.



■ Linear acceleration/deceleration and S-curve acceleration/deceleration can be selected only by parameter setting and easily respond to controls that require acceleration and deceleration.

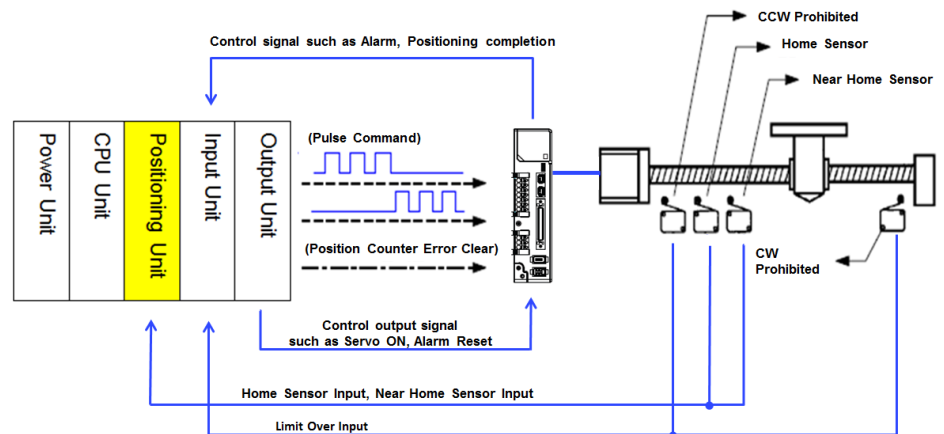


■ Linear interpolation is also possible with the user program.

Since the positioning unit can be started simultaneously from multiple axes, synchronous control such as linear interpolation can be realized by the program.

Operation and overview of positioning module

## Configuration of positioning module



### ■ Interface with positioning module

In addition to the pulse command output, the positioning module has a deviation counter clear output for the origin and servo drive.

### ■ Use input unit, output unit for the PLC Safety Circuit and Control Signal Interface.

Use the input unit and output unit in addition to the positioning unit to connect the input of the limit over input circuit, the servo ON signal, and the drive or external output.

### ■ Number of output pulse is counted by the internal high-speed counter.

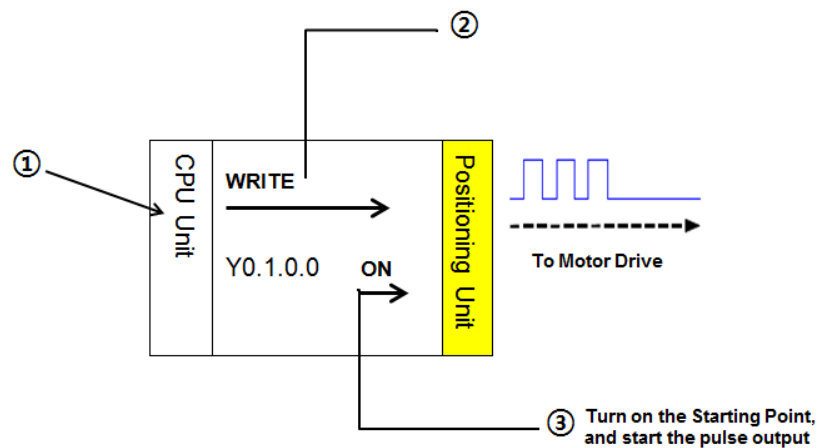
It is counted at the absolute value by the internal high-speed counter as the “elapsed value”. When elapsed value of command range - 2,147,483,648 ~ +2,147,483,647 (Signed 32-bit) is over the maximum(minimum) value, it continuously counts after automatically returned to minimum(maximum) value. At this time, the motor does not stop or error occurs.

## Basic operation of positioning module

It is controlled by ON / OFF of output data table and start contact point.

[illegible][illegible]

Timing diagram for Motion Command Write (1) showing the sequence of signals for a 1A2 profile speed select. The diagram includes signals for X1 I/O, X2-PG04, 1A2 profile select (B1 I/O, EOR), EN, CALL, EMO, SUBS0, 1A2: E-Motion Run, Y1 I/O, and Y2-PG04. The sequence starts with X1 I/O and X2-PG04, followed by 1A2 profile select, then EN, CALL, EMO, SUBS0, 1A2: E-Motion Run, Y1 I/O, and finally Y2-PG04.



- Data type to insert on positioning modules are Control code, Starting speed, Target speed, Acceleration time, Deceleration time, and Position command value, the type and number of data required depends on the desired behavior. These data must be programmed to be input to arbitrary data registers.

- ② Transfer to output data table

Data stored in the data register is transfer command; it is sent to the positioning module and waits in it. Memory area with data stored is called internal memory of positioning module. This area is commonly used on each control of E point control, P point control, JOG operation, Return to zero function, and Pulse generator input operation and prepared on each axis.

## ③ Start of control operation

To execute the queued data, Turn ON the starting contact point for each operation mode.

In the program example described above, Y0.1.0.0 is applicable. Y0.1.0.0 is the contact point number for starting 1-axis when a unit is mounted in slot 1. Contact points for E point control, P point control, Return to zero function, and JOG operation are provided for each axis at the starting contact point.

## Configuration and expansion of positioning module

### ■ Configuration Limit

The internal current consumption of the positioning module (5V current) is as follows. When building the system, be sure to use it in the capacity range of the power module according to the usage condition of other modules.

Name	Catalog	Current Consumption (5V current)	Remark
Positioning Module(1-axis)	POS1	370mA	
Positioning Module(2-axes)	POS2	380mA	
Positioning Module(4-axes)	POS4	400mA	UL

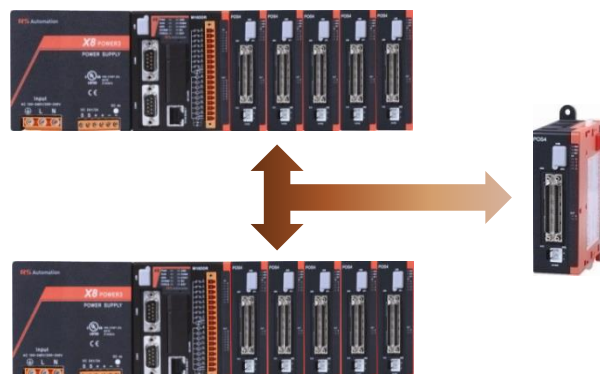
### ■ Module Expansion

Positioning modules can be extended/ mounted on the right side of CPU.

When connecting 1 power module and CPU module, up to 5 modules (4 axes basis).

- The extension of the positioning module in the PLC is limited by the maximum size of the I / O memory on the CPU side.

(If you need to use the maximum expansion module in X8 series, you need to add CPU module.)



Reference :

Positioning module can be used only on X8-BASE CPU module(X8-16DDR, X8-14DDT, X8-32DDT OS FRN 2.0 or higher)

Positioning module has the following control functions.

## Control Overview

### ■ Position Control

Controls positioning of the specified axis from starting point (Current located point) to the target point (Location of the point to move).

#### ● Control by Relative(Incremental) Coordinates Type

It controls the positioning from the current point of the axis to the target point. It is not the point value specified for the target point but the actual movement amount of the axis

Moving direction is decided according to the sign of movement amount.

If target point value is positive (+ or without sign) : Positioning operation in forward direction(Current position increase direction)

If target point value is negative (- or without sign) : Positioning operation in reverse direction(Current position decrease direction)

#### ● Control by Absolute Coordinates Type

It controls the positioning from the current point of the axis to the target point (location of the point to move). Positioning control is performed by the motion of the axis to the target point based on the current axis point.

Moving direction is decided according to the sign of movement amount.

Current position of axis < Target position  
: Positioning operation in forward direction  
Current position of axis > Target position  
: Positioning operation in reverse direction

### ■ Speed Control

It is executed by the positioning start command (Direct start, In-direct start, Simultaneous start), operates with setting speed until deceleration stop command (VMOVE) is inserted.

### ■ Interpolation Control

#### ● Linear interpolation control (L\_RMOVE, L\_AMOVE)

It controls the linear interpolation at the position of current axis using the specified coordinate.

➤ Linear interpolation control by Relative Coordinates Type

Based on the current position of each axis, linear interpolation is performed with the movement direction and amount according to the target position for each axis

Moving direction is decided according to the sign of movement amount.

If target point value is positive (+ or without sign) : Positioning operation in forward direction(Current position increase direction)

If target point value is negative (- or without sign) : Positioning operation in reverse direction(Current position decrease direction)

➤ Linear interpolation control by Absolute Coordinates Type

It performs linear interpolation from the current axis position to the target position. Positioning control interpolates to the target position based on the current position of the axis.

Moving direction is decided according to the sign of movement amount

Current position of axis < Target position  
: Positioning operation in forward direction  
Current position of axis > Target position  
: Positioning operation in reverse direction

● Circular interpolation control

The interpolation operation is performed along the circle trajectory towards to each setting axis by using 2-axes.

There are 3 types of circular interpolation such as route type for passing through the specified location, type for centering the specified position and type which is based on rotation angle.

➤ Circular Interpolation Control passing through the specified location (C\_RMOVE\_XY ,AMOVE\_XY)

Starts the operation at the current axis position and circular interpolates to the target position along the circular trajectory with the radius to the specified center point position as the radius

The position of the center point should be the same distance from the starting position of the axis to the target position.

If you set the target position to be the same as the current position, you can drive a circle with the current position and the center point of the arc as radius. The direction of movement will be determined by the direction (ON center point CW, center point CCW) set in "CW / CCW Direction" of the In / Out parameter.



Circular Interpolation Control centering the specified position (C\_RMOVE\_PATH, AMOVE\_PATH)

Start operating from the current position of axis, circular interpolate through the specified position till the target position.

An arc is created with the center point of the inter-section of the vertical bisector of the position of the current axis and the waypoint position and the position of the target point and the perpendicular line of the waypoint position.

The movement direction is determined automatically according to the set target position and circular interpolation passing point.

- Circular Interpolation Control based on rotation angle(C\_RMOVE\_DEG, AMOVE\_DEG)

Start operating at the current position of the axis and circular interpolation to the target position via the specified rotation path. An arc is created with the current axis position and the distance to the target point as radius

# Table of Contents

---

<b>2. Part Names and Functions .....</b>	<b>2</b>
Part Names and functions .....	2
Size .....	2
LED Specifications .....	4
Connector Pin Map and I/O Specifications.....	7
68 Pin Map (I/O Terminal) .....	7
Electrical Specifications of I/O Signals .....	9
MMC-MI10 Wiring Specification .....	11
I/O Board Wiring Specification .....	13
Power Supply for Driving Internal Circuit .....	13
Connection of Pulse Output Signal.....	14
Connection of Position Counter Error Clear.....	14
Connection of Home Sensor Input.....	15
Connection of Limit Over.....	16
Connection of Pulse Generator.....	16
Encoder Input Wiring.....	17
Installation of H/W .....	17
Communication with CSD Servo System.....	18
Communicate with Line Driver .....	19
CSD Communication via MI10 Board .....	20
Installation, Wiring and Maintenance .....	21
Installation Environment .....	21
Precautions for Wiring .....	21
Precautions for Maintenance and Repair .....	21

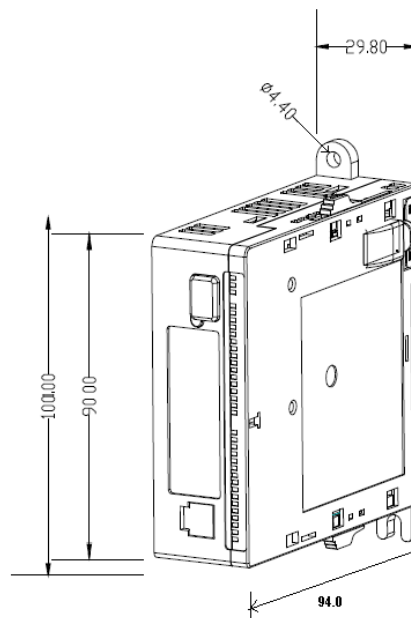
## 2. Part Names and Functions

This chapter describes part names and functions of X8 positioning module.

### Part Names and functions

#### Size

\* Detailed image of the product below may be different from the actual.





X8-POS1

1-axis module



X8-POS2

2-axes module



X8-POS4

4-axes module

### Part names and functions

① LED Status

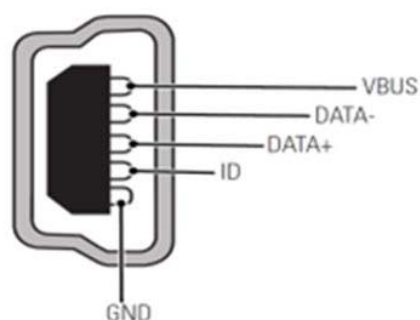
It shows the operation status of the positioning module

② User Interface Connector

68 pin connector for connection of motor driver (Servo, Stepping) and external interface

③ USB Port

Port for communication with network software. USB Mini B Type Connector



### PLC PORT1 USB(MINI B TYPE)

**ATTEN-**



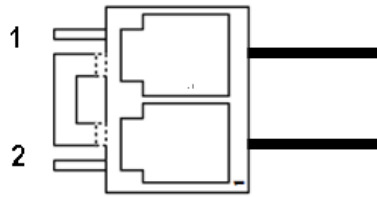
Please observe the following guidelines.

- USB ports are used only for temporary local programming, and not for permanent connection..
- USB should not exceed 3.0 m (9.84 ft)..

Use a USB cable with Ferrite Core as much as possible.

## ④ External Power Supply Port

This port is for external 24VDC SMPS power connection.



Pin	Signal
1	24V(+)
2	G24V(-)

**ATTEN-**



Please observe following guidelines for all cabling.

- Shield must be connected on FG.

Check the power input +, - position and connect.

## ⑤ Expansion Connectors and Cover

## ⑥ DIN Rail Mounting Latch

## ⑦ Panel Fixing Screw Hole

## LED Specifications

### LED Status

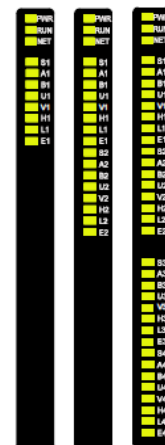
LED Status for each axis as follows,



X8-POS1  
1-axis module

X8-POS2  
2-axes module

X8-POS4  
4-axes module



### Status Display LED

LED	Function
PWR	Power Input State
RUN	Access State
NET	Module connection State

### Operation Status Display LED

LED		Function
Order	Signal	
0	S	Amplifier ON
1	A	Pulse Output A*1
2	B	Pulse Output B*1
3	U	Encoder A*2
4	V	Encoder B *2
5	H	Home sensor *3
6	L	Limit Sensor*3
7	E	Error



\*1. During pulse output (A) and (B), Because it flashes at the output frequency (speed), it appears to light up at high speed.

\*2. The pulse generator signal inputs (U) and (V) indicate the input status. Lights up when nothing is connected to the pulse generator input circuit

\*3. Home sensor input (H) and limit (L) input lights when each input is valid. The input logic is specified by the control code in the program. The LED (D) turns off and the LED (Z) turns on when the power is turned on.

In case of 4- axes positioning module

LED		Function
Order	Signal	
50	S1	1-axis Amplifier ON
1	A1	1-axis Pulse Output A
2	B1	1-axis Pulse Output B
3	U1	1-axis Encoder A
4	V1	1-axis Encoder B
5	H1	1-axis Home sensor
6	L1	1-axis Limit sensor (+,- Regardless of sensor ON)
7	E1	1-axis Error
8	S2	2-axes Amplifier ON
9	A2	2-axes Pulse Output A
10	B2	2-axes Pulse Output B
11	U2	2-axes Encoder A
12	V2	2-axes Encoder B
13	H2	2-axes Home sensor
14	L2	2-axes Limit sensor (+,- Regardless of sensor ON)
15	E2	2-axes Error
16	S3	3-axes Amplifier ON
17	A3	3-axes Pulse Output A
18	B3	3-axes Pulse Output B
19	U3	3-axes Encoder A
20	V3	3-axes Encoder B
21	H3	3-axes Home sensor

## Table of Contents

22	L3	3-axes Limit sensor (+,- Regardless of sensor ON)
23	E3	3-axes Error
24	S4	4-axes Amplifier ON
25	A4	4-axes Pulse Output A
26	B4	4-axes Pulse Output B
27	U4	4-axes Encoder A
28	V4	4-axes Encoder B
29	H4	4-axes Home sensor
30	L4	4-axes Limit sensor (+,- Regardless of sensor ON)
31	E4	4-axes Error

Operation Status Display LED

Details about the pulse output signal A,B.

LED		Function	
Axis	Mode	A	B
1	Direction of rotation		
	Pulse Output		
2	Direction of rotation		
	Pulse Output		
3	Direction of rotation		
	Pulse Output		
4	Direction of rotation		
	Pulse Output		

**ATTEN-**



The factory default setting is ON  
Setting is valid when the power is ON

## Connector Pin Map and I/O Specifications

### 68 Pin Map (I/O Terminal)

The connector (68 Pin Honda Connector) for the positioning module is the same regardless of the number of the axes.

- Since the Honda connector hood is built into the BOX as many as the number of axes, use for wiring.

MPG A/B is supported only 1 EA through all axes, Catch In 1~4 are applicable for 1~4 axes.

#### ■ AX1 AX2

Pin	Signal	Axis	Pin	Signal	Axis
1	G5V (GND)	1	2	G5V (GND)	2
3	5V (+5V)	1	4	5V (+5V)	2
5	EZ- (Encoder)	1	6	EZ- (Encoder)	2
7	EZ+ (Encoder)	1	8	EZ+ (Encoder)	2
9	EB- (Encoder)	1	10	EB- (Encoder)	2
11	EB+ (Encoder)	1	12	EB+ (Encoder)	2
13	EA- (Encoder)	1	14	EA- (Encoder)	2
15	EA+ (Encoder)	1	16	EA+ (Encoder)	2
17	ABS- (Encoder)	1	18	ABS- (Encoder)	2
19	ABS+ (Encoder)	1	20	ABS+ (Encoder)	2
21	Catch In 1	1	22	Catch In 2	2
23	Home Sensor Input	1	24	Home Sensor Input	2
25	G24V (EX GND)	1	26	G24V (EX GND)	2
27	Servo Drive Alarm Input	1	28	Servo Drive Alarm Input	2
29	Servo Drive In-position Input	1	30	Servo Drive In-position Input	2
31	Positive Limit Sensor Input	1	32	Positive Limit Sensor Input	2
33	24V (EX +24V)	1	34	24V (EX +24V)	2
35	G5V (GND)	1	36	G5V (GND)	2
37	-	1	38	-	2
39	Catch In 3	1	40	Catch In 4	2
41	-	1	42	-	2
43	CCW- (Sign-)	1	44	CCW- (Sign-)	2
45	CCW+ (Sign+)	1	46	CCW+ (Sign+)	2
47	CW- (Pulse-)	1	48	CW- (Pulse-)	2
49	CW+ (Pulse+)	1	50	CW+ (Pulse+)	2
51	5V TTL Output-	1	52	5V TTL Output-	2
53	5V TTL Output+	1	54	5V TTL Output+	2
55	-	1	56		2
57	MPG A*	1	58	MPG B*	2



## Table of Contents

59	G24V (EX GND)	1	60	G24V (EX GND)	2
61	Servo Drive On Output	1	62	Servo Drive On Output	2
63	Servo Drive Reset Output	1	64	Servo Drive Reset Output	2
65	Negative Limit Sensor Input	1	66	Negative Limit Sensor Input	2
67	24V (EX +24V)	1	68	24V (EX +24V)	2

### ■ AX3 AX4

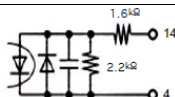
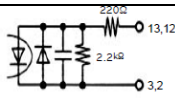
Pin	Signal	Axis	Pin	Signal	Axis
1	G5V (GND)	3	2	G5V (GND)	4
3	5V (+5V)	3	4	5V (+5V)	4
5	EZ- (Encoder)	3	6	EZ- (Encoder)	4
7	EZ+ (Encoder)	3	8	EZ+ (Encoder)	4
9	EB- (Encoder)	3	10	EB- (Encoder)	4
11	EB+ (Encoder)	3	12	EB+ (Encoder)	4
13	EA- (Encoder)	3	14	EA- (Encoder)	4
15	EA+ (Encoder)	3	16	EA+ (Encoder)	4
17	ABS- (Encoder)	3	18	ABS- (Encoder)	4
19	ABS+ (Encoder)	3	20	ABS+ (Encoder)	4
21	Compare Out 1-1	3	22	Compare Out 1-2	4
23	Home Sensor Input	3	24	Home Sensor Input	4
25	G24V (EX GND)	3	26	G24V (EX GND)	4
27	Servo Drive Alarm Input	3	28	Servo Drive Alarm Input	4
29	Servo Drive In-position Input	3	30	Servo Drive In-position Input	4
31	Positive Limit Sensor Input	3	32	Positive Limit Sensor Input	4
33	24V (EX +24V)	3	34	24V (EX +24V)	4
35	G5V (GND)	3	36	G5V (GND)	4
37	-	3	38	-	4
39	Compare Out 2-1	3	40	Compare Out 2-2	4
41	Compare Out 3-1	3	42	Compare Out 3-2	4
43	CCW- (Sign-)	3	44	CCW- (Sign-)	4
45	CCW+ (Sign+)	3	46	CCW+ (Sign+)	4
47	CW- (Pulse-)	3	48	CW- (Pulse-)	4
49	CW+ (Pulse+)	3	50	CW+ (Pulse+)	4
51	5V TTL Output-	3	52	5V TTL Output-	4
53	5V TTL Output+	3	54	5V TTL Output+	4
55	Compare Out 4-1	3	56	Compare Out 4-2	4
57	-	3	58	-	4
59	G24V (EX GND)	3	60	G24V (EX GND)	4
61	Servo Drive On Output	3	62	Servo Drive On Output	4
63	Servo Drive Reset Output	3	64	Servo Drive Reset Output	4
65	Negative Limit Sensor Input	3	66	Negative Limit Sensor Input	4
67	24V (EX +24V)	3	68	24V (EX +24V)	4

## Electrical Specifications of I/O Signals

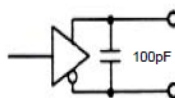


68 Pin Connector

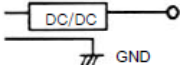
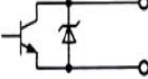
### ■ Input Terminal

Pin	Signal	Pin	Signal	Pin Map	Specification
5	EZ- (Encoder)	6	EZ- (Encoder)		
7	EZ+ (Encoder)	8	EZ+ (Encoder)		
9	EB- (Encoder)	10	EB- (Encoder)		
11	EB+ (Encoder)	12	EB+ (Encoder)		
13	EA- (Encoder)	14	EA- (Encoder)		
15	EA+ (Encoder)	16	EA+ (Encoder)		
17	ABS- (Encoder)	18	ABS- (Encoder)		
19	ABS+ (Encoder)	20	ABS+ (Encoder)		
21	Catch In 1	22	Catch In 2		
23	Home Sensor Input	24	Home Sensor Input		
27	Servo Drive Alarm Input	28	Servo Drive Alarm Input		
29	Servo Drive In-position Input	30	Servo Drive In-position Input		
31	Positive Limit Sensor Input	32	Positive Limit Sensor Input		
57	MPG A*	58	MPG B*		
65	Negative Limit Sensor Input	66	Negative Limit Sensor Input		

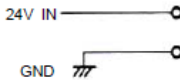
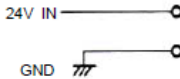
### ■ Output Terminal

Pin	Signal	Pin	Signal	Pin Map	Specification
43	CCW- (Sign-)	44	CCW- (Sign-)		
45	CCW+ (Sign+)	46	CCW+ (Sign+)		
47	CW- (Pulse-)	48	CW- (Pulse-)		
49	CW+ (Pulse+)	50	CW+ (Pulse+)		

## Table of Contents

51	5V Output- TTL	52	5V TTL Output-		
53	5V Output+ TTL	54	5V TTL Output+		
61	Servo Drive On Output	62	Servo Drive On Output		
63	Servo Drive Reset Output	64	Servo Drive Reset Output		

### ■ Power Terminal

Pin	Signal	Pin	Signal	Pin Map	Specification
1	G5V (GND)	2	G5V (GND)		
3	5V (+5V)	4	5V (+5V)		4.75V ~ 5.25VDC Average of 4-axes Type, 100mA or less
25	G24V (EX GND)	26	G24V (EX GND)		
33	24V (EX +24V)	34	24V (EX +24V)		
35	G5V (GND)	36	G5V (GND)		
59	G24V (EX GND)	60	G24V (EX GND)		
67	24V (EX +24V)	68	24V (EX +24V)		

# MMC-MI10 Wiring Specification

## Interface Module for Wiring



## Positioning Module Connector(J11, J12, J21, J22) Pin Map

MI 10 Connector on MMC J11~J22 Pin MAP						
MMC Con	Signal				Group	Description
	J11(0-axis)	J12(1-axis)	J21(2-axes)	J22(3-axes)		
1	GND	GND	GND	GND	Power Source	5V GND
2	VCC	VCC	VCC	VCC	Power Source	5V GND
3	A0-Z	A1-Z	A2-Z	A3-Z	Encoder	Encoder Z-
4	A0+Z	A1+Z	A2+Z	A3+Z	Encoder	Encoder Z+
5	A0-B	A1-B	A2-B	A3-B	Encoder	Encoder B-
6	A0+B	A1+B	A2+B	A3+B	Encoder	Encoder B+
7	A0-A	A1-A	A2-A	A3-A	Encoder	Encoder A-
8	A0+A	A1+A	A2+A	A3+A	Encoder	Encoder A+
9	ABS0-	ABS1-	ABS2-	ABS3-	Encoder	Encoder Abs
10	ABS0+	ABS1+	ABS2+	ABS3+	Encoder	Encoder Abs
11	Input0	Input1	Output0	Output1	I/O	User I/O
12	HOME0	HOME1	HOME2	HOME0	Sensor	Home Sensor Input
13	G24V	G24V	G24V	G24V	Power Source	External 24V GND
14	SV0ERR	SV1ERR	SV2ERR	SV3ERR	Motion I/O	AMP Fault Input
15	PCIN0	PCIN1	PCIN2	PCIN3	Motion I/O	In-Position Input

MI 10 Connector on MMC J11~J22 Pin MAP						
MMC Con	Signal				Group	Description
	J11(0-axis)	J12(1-axes)	J21(2-axes)	J22(3-axes)		
16	PLIM0	PLIM1	PLIM2	PLIM3	Sensor	Positive Limit Input
17	+ 24V	+24V	+24V	+24V	Power Source	External 24V Power
18	GND	GND	GND	GND	Power Source	5V GND
19	SV0AO	SV1AO	SV2AO	SV3AO	I/O	Analog Signal Output
20	Input 2	Input 3	Output 2	Output 3	I/O	User I/O
21	Input 4	Input 5	Output 4	Output 5	I/O	User I/O
22	A0-DIR	A1-DIR	A2-DIR	A3-DIR	Pulse Output	CCW Pulse & Direction Signal Output(/CCW)
23	A0+DIR	A1+DIR	A2+DIR	A3+DIR	Pulse Output	CCW Pulse & Direction Signal Output(CCW)
24	A0-CLK	A1-CLK	A2-CLK	A3-CLK	Pulse Output	CW Pulse & Pulse Output(/CW)
25	A0+CLK	A1+CLK	A2+CLK	A3+CLK	Pulse Output	CW Pulse & Pulse Output(CW)
26	PCLR0-	PCLR1-	PCLR2-	PCLR3-	Pulse Output	Position Clear Output(/P-CLR)
27	PCLR0+	PCLR1+	PCLR2+	PCLR3+	Pulse Output	Position Clear Output(P-CLR)
28	Input 6	Input 7	Output 6	Output 7	I/O	User I/O
29	Input 8	Input 9	Output 8	Output 9	I/O	User I/O
30	G24V	G24V	G24V	G24V	Power Source	External 24V GND
31	SV0ON	SV1ON	SV2ON	SV3ON	Motion I/O	AMP Enable(Servo On) Output
32	SV0RST	SV1RST	SV2RST	SV3RST	Motion I/O	AMP Fault Reset Output
33	NLIM0	NLIM1	NLIM2	NLIM3	Sensor	Negative Limit Input
34	+ 24V	+24V	+24V	+24V	Power Source	External 24V Power

# Table of Contents

\*AMP(Servo) Connector (AX0, AX1, AX2, AX3) Pin MAP

**MI 10 AMP(Servo) Connector on MMC AX0~AX3 Pin MAP**

Limit Con (5 Pin)	Connector				Group	Description
	AX0	AX1	AX2	AX3		
1	SV0AO	SV1AO	SV2AO	SV3AO	Motion I/O	Analog Signal Output
2	GND	GND	GND	GND	Power Source	5V GND
3	A0+Z	A1+Z	A2+Z	A3+Z	Encoder	Encoder Z+
4	A0-Z	A1-Z	A2-Z	A3-Z	Encoder	Encoder Z-
5	A0+B	A1+B	A2+B	A3+B	Encoder	Encoder B+
6	A0-B	A1-B	A2-B	A3-B	Encoder	Encoder B-
7	A0+A	A1+A	A2+A	A3+A	Encoder	Encoder A+
8	A0-A	A1-A	A2-A	A3-A	Encoder	Encoder A-
9	ABS0+	ABS1+	ABS2+	ABS3+	Encoder	Encoder Abs
10	ABS0+	ABS1+	ABS2+	ABS3+	Encoder	Encoder Abs
11	PCLR0+	PCLR1+	PCLR2+	PCLR3+	Pulse Output	Position Clear Output(P-CLR)
12	PCLR0-	PCLR1-	PCLR2-	PCLR3-	Pulse Output	Position Clear Output(/P-CLR)
13	A0+DIR	A1+DIR	A2+DIR	A3+DIR	Pulse Output	CCW Pulse & Direction Signal Output(CCW)
14	A0-DIR	A1-DIR	A2-DIR	A3-DIR	Pulse Output	CCW Pulse & Direction Signal Output(/CCW)
15	A0+CLK	A1+CLK	A2+CLK	A3+CLK	Pulse Output	CW Pulse & Pulse Output(CW)
16	A0-CLK	A1-CLK	A2-CLK	A3-CLK	Pulse Output	CW Pulse & Pulse Output(/CW)
17	-	-	-	-	-	Non Connection
18	-	-	-	-	-	Non Connection
19	SV0ON	SV1ON	SV2ON	SV3ON	Motion I/O	AMP Enable(Servo On) Output
20	SV0ERR	SV1ERR	SV2ERR	SV3ERR	Motion I/O	AMP Fault Input
21	SV0RST	SV1RST	SV2RST	SV3RST	Motion I/O	AMP Fault Reset Output
22	PCIN0	PCIN1	PCIN2	PCIN3	I/O	In-Position Input
23	-	-	-	-	-	Non Connection
24	-	-	-	-	-	Non Connection
25	G24V	G24V	G24V	G24V	Power Source	External 24V GND
26	+24V	+24V	+24V	+24V	Power Source	External 24V Power

\*Limit Connector (LIMIT0, LIMIT1, LIMIT2, LIMIT3) Pin MAP

**MI 10 Limit Sensor Connector (LIMIT0 ~ LIMIT3) Pin MAP**

Limit Con (5 Pin)	Connector				Description
	Limit0	Limit1	Limit2	Limit3	
1	+24V	+24V	+24V	+24V	External 24V
2	PLMT0	PLMT1	PLMT2	PLMT3	Positive Limit
3	HOME0	HOME1	HOME2	HOME3	Home Sensor
4	NLMT0	NLMT1	NLMT2	NLMT3	Negative Limit
5	GND	GND	GND	GND	24V GND

\* MPG Input Pin MAP (MPGA)

Limit Con (5 Pin)	Connector	Description	MPGA Con (5 Pin)	Connector	Description
	Limit0			Limit0	
1	+24V	EXT 24V	4	-	Non Connection
2	User In 8	MPG Input Phase-A(or B)	5	GND	24V GND
3	User In 9	MPG Input Phase-B(or A)			

## I/O Board Wiring Specification

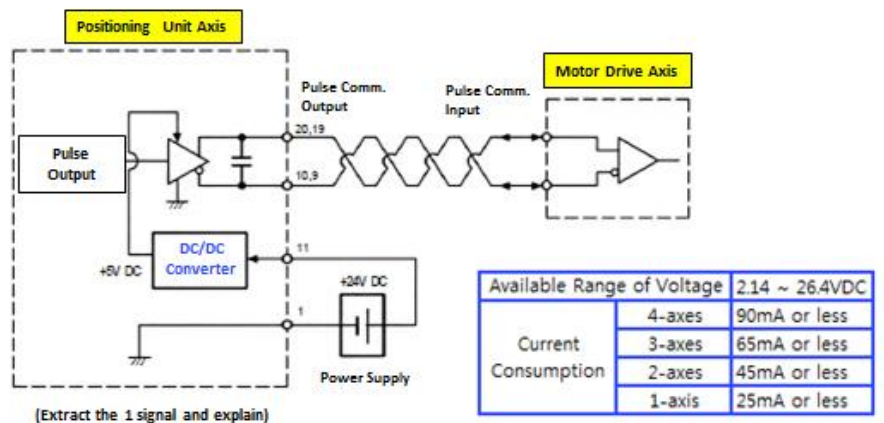
* User I/O Connector Pin MAP(ICON)							
<b>ICON Connector Pin MAP</b>							
Pin No.	User I/O	Pin No.	User I/O	Pin No.	User I/O	Pin No.	User I/O
1	User Out 0	8	User Out 7	15	User In 4	22	Non Connection
2	User Out 1	9	User Out 8	16	User In 5	23	24V GND
3	User Out 2	10	User Out 9	17	User In 6	24	EXT 24V
4	User Out 3	11	User In 0	18	User In 7	25	24V GND
5	User Out 4	12	User In 1	19	User In 8	26	EXT 24V
6	User Out 5	13	User In 2	20	User In 9		
7	User Out 6	14	User In 3	21	Non Connection		

## Power Supply for Driving Internal Circuit

Be sure to connect +24VDC external power to the external input power supply terminal.

The input 24VDC voltage is converted to 5V DC voltage through the built-in DC / DC converter and supplied to each internal circuit by power supply for driving the internal circuit of the pulse output terminal.

Output of line drive

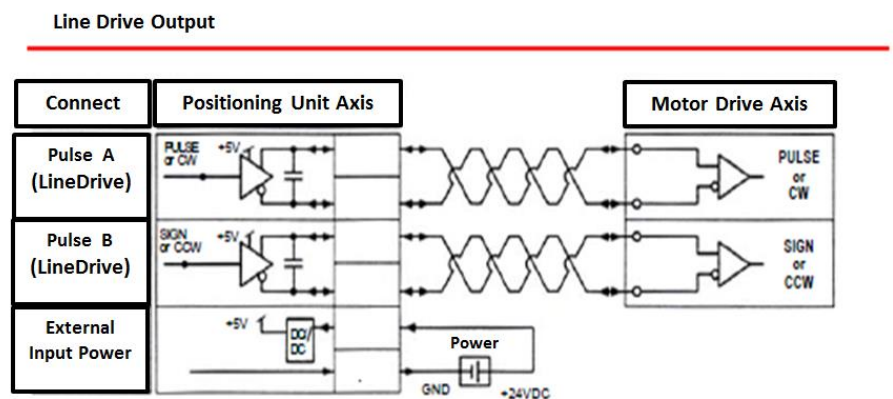


## Connection of Pulse Output Signal

Positioning Unit is configured with 2 types of Motor Drive and Interface. Select either one according to the motor drive and interface to be used.

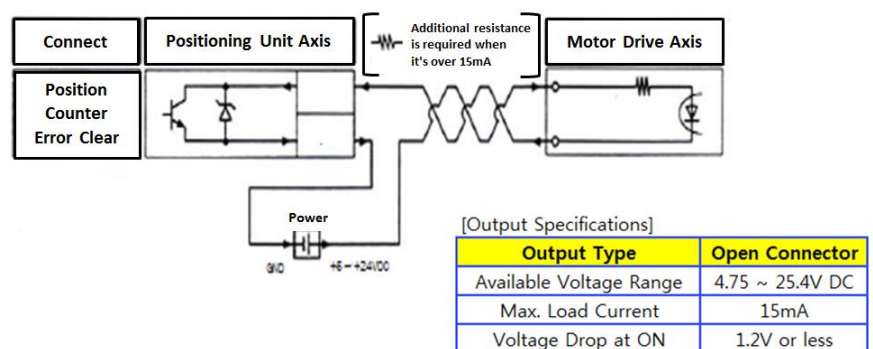
Caution :

Recommended to use twisted cable or twist the cable while wiring between output of positioning unit and motor drive.



## Connection of Position Counter Error Clear

Example for connection of Servo Drive Counter Clear Input. External Power (+5V DC ~ +24V DC) is needed for connection.



Caution :

- Must use twisted pair cable for wiring
- The current that can flow as position counter input signal is up to 15mA. When it's over 15mA, additional resistance is required.

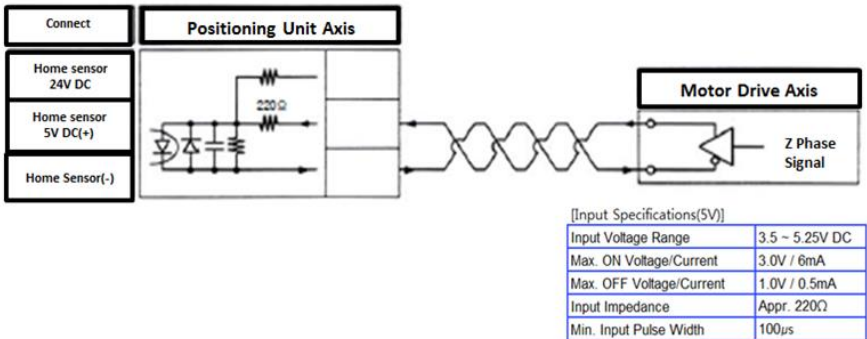
# Connection of Home Sensor Input

Connection for Home Sensor Input.  
Motor Drive Z Phase Output(Line Drive Output or Transistor Output),  
or External Switch · Sensor.

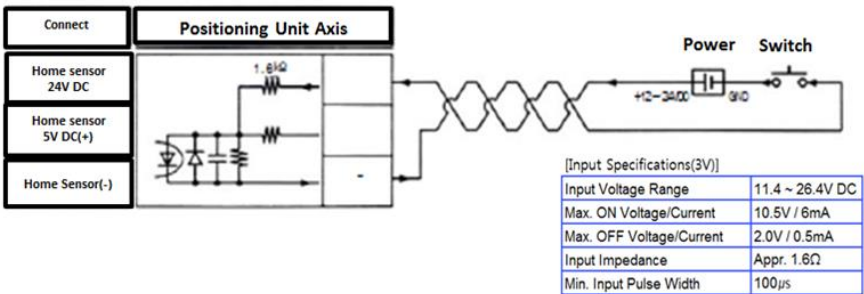
Caution :

Recommended to use twisted cable or twist the cable while wiring  
between output of positioning unit and motor drive.

Communication of Home Sensor Input(with Motor Drive Z Phase Output)



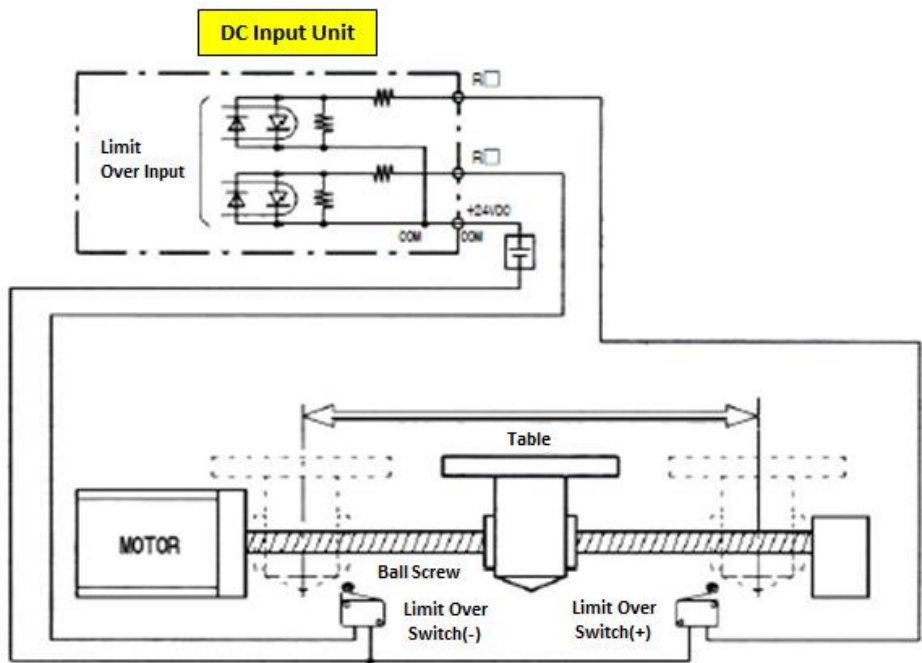
Communication of Home Sensor Input(with an External Switch · Sensor)





Connection of Limit Over

Use input unit for Limit Over Input to PLC.  
Please install the circuit recommended by other motor manufacturer externally.



Reference :  
Program the emergency stop circuit corresponding to the system.  
For more detailed information about “The Over Run”, please refer to “Chapter 11”.

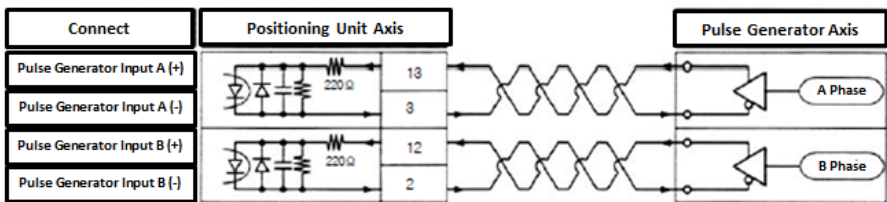
Connection of Pulse Generator

Since the signal output format differs depending on the pulse generator, connect it according to the type of pulse generator.  
There are 3 types for Output, such as Line Drive Type, Transistor Open Collector Type and Transistor Resistance Full-up Type.

Caution :

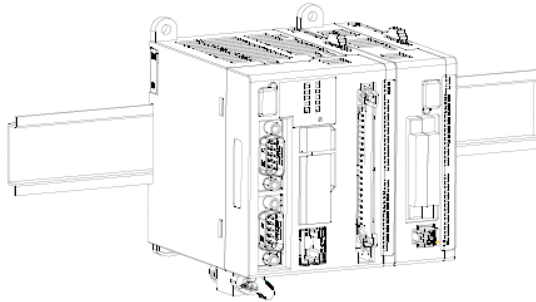
Recommended to use twisted cable or twist the cable while wiring

For Line Drive Type



## Encoder Input Wiring

### Installation of H/W



#### ■ Precautions regarding system design

In certain applications, malfunction may occur for the following reasons :

- The timing difference between opening and closing of the PLC power supply, the I/O modules and power equipment.
- An operation time lag when a momentary power failure occurs
- Abnormality in the PLC, external power supply, or other devices
- In order to prevent a malfunction resulting in system shutdown choose the adequate safety measures listed in the following :
  1. Interlock circuits on the outside of PLC

When a motor clockwise/counter-clockwise operation is controller, provide an interlock circuit that prevents clockwise and counter-clockwise signals from inputting into the motor at the same time.
  2. Emergency Stop Circuits on the outside of PLC

Install the emergency stop circuits outside the PLC to stop the power supply of the output device.
  3. Start PLC after other devices (Start-up sequence)

The PLC should be operated after all of the I/O devices and the power equipment are energized.

    - Switch to the RUN mode after operating the PLC.
    - Use the timer circuit to delay PLC operation.
  4. Watchdog timer

The watchdog timer is a program error and hardware error detection timer.

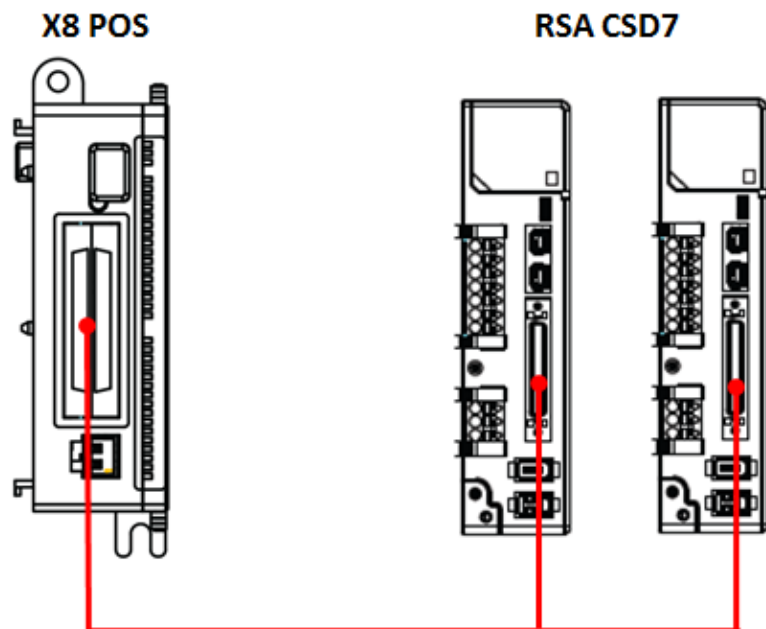
It goes ON when the scan time exceeds 640ms.

When the watchdog timer is activated, at the same time the ERROR LED lights, the ERROR contacts on the power supply module turn to ON, all output modules are turned OFF and the module is put in halted state (The system is in a non-processing state that includes communications with programming tools as well).

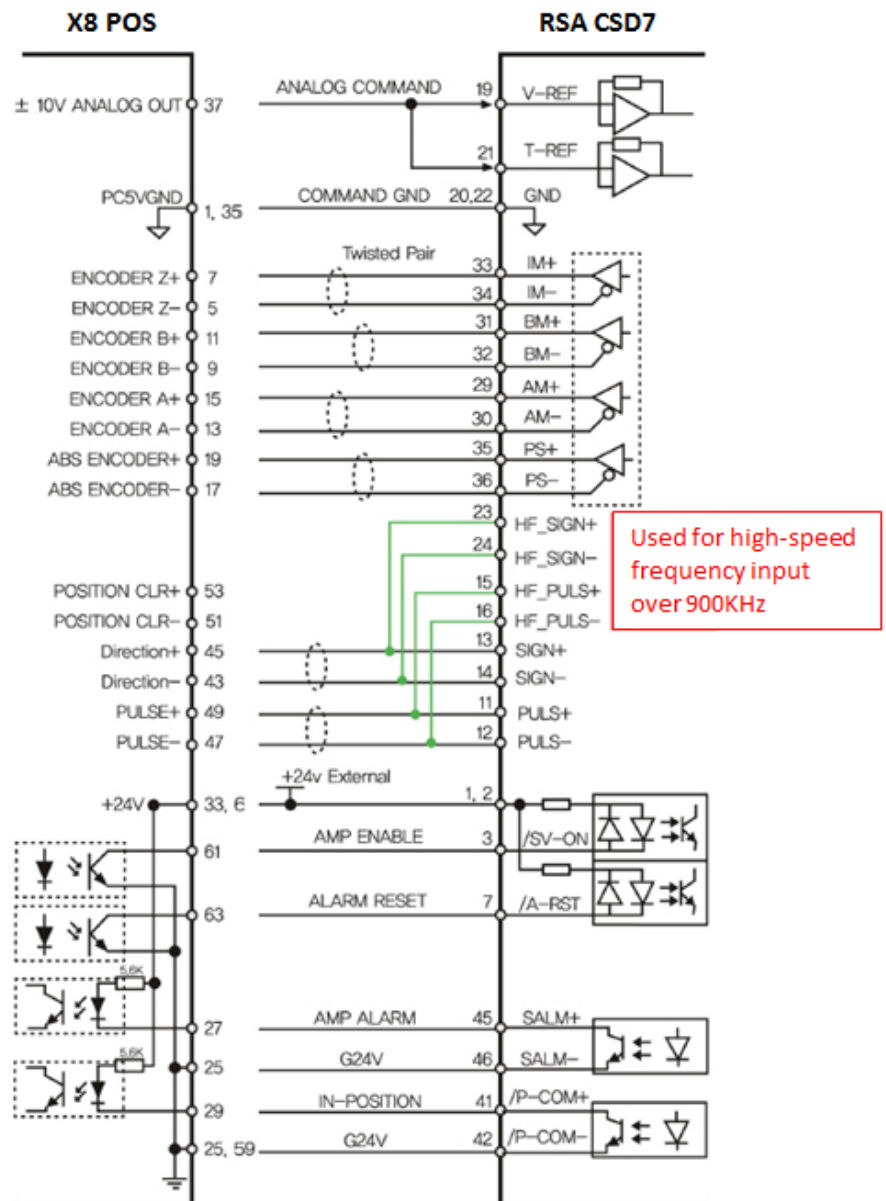
### Communication with CSD Servo System

The X8 POS module and our CSD7 products can be connected directly using the cable provided by RSA.

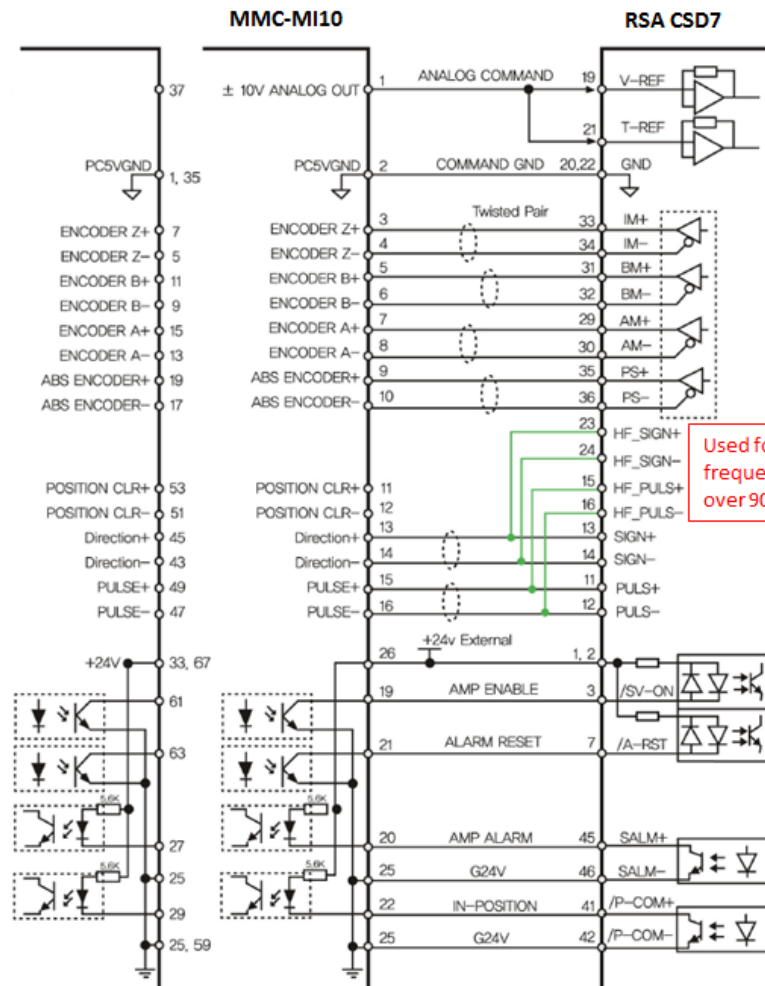
Please refer to the MMC-MI10 module for more convenient use when connecting 4-axes Limit / Home sensor, User I / O, and MPG Input



## Communicate with Line Driver



## CSD Communication via MI10 Board



## Installation, Wiring and Maintenance

### Installation Environment

### Precautions for Wiring

Please connect within the wiring distance below for wiring between positioning unit and motor drive. Also, Use the twisted pair cable that is less affected by noise.

Signal	Wiring Distance
Line Drive	10m
Open Collector(Transistor)	3m
Position Counter Error Clear	3m

### Precautions for Maintenance and Repair

- Do not disassemble or remodel the product. Any damage caused after the user disassembles or remodels the product will be excluded from the company's warranty.
- The company bears no responsibility for injuries or physical damage caused by remodeling of this product.
- Life-limited Parts by mechanical friction or heat requires regular.
- In case of a failure that cannot be dealt with, please contact the company's technical support team or after-sales services center.

# Table of Contents

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**3. Module Configuration and Design..... 2**

    Select of Pulse Output Mode ..... 2

    Confirmation of slot number and I / O number assignment..... 5

    Increment and Absolute ..... 8

    Selection of acceleration / deceleration..... 9

### 3. Module Configuration and Design.

This chapter describes the design and configuration of the positioning module.

#### Select of Pulse Output Mode

It can be selected according to the pulse input mode of the servo drive.

There are 2 types of pulse output that can be selected.

##### ■ Pulse/ Sign Output Type

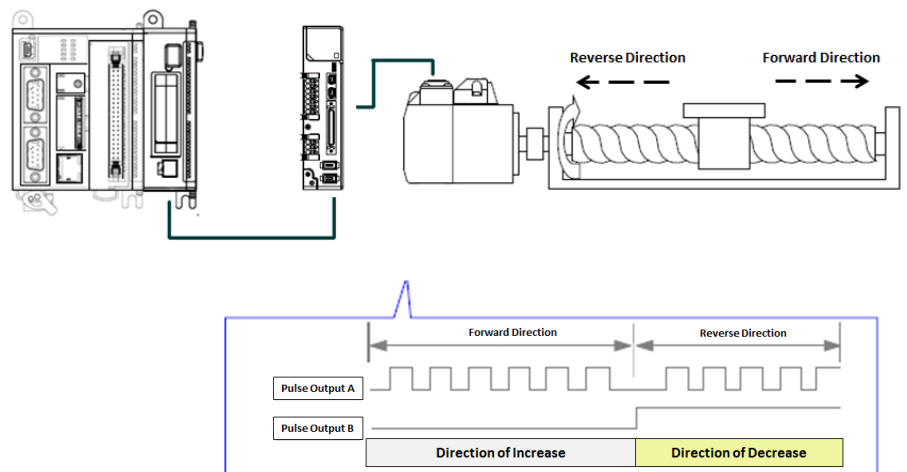
A method of outputting a pulse output signal (signal for determining the rotation speed of the motor) for motor drive and a signal for determining the motor rotation direction.

Output the pulse signal at A and signal which determine the rotation direction at B.

Forward direction selection of Pulse/Sign mode

At Forward Direction, Elapsed value increases.

At Reverse Direction, Elapsed value decreases.

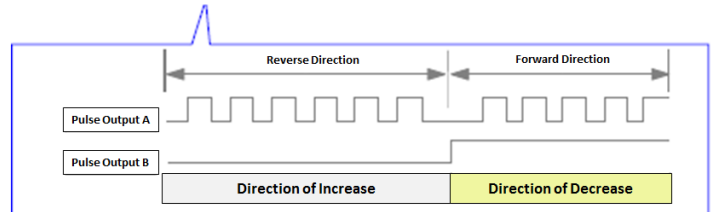
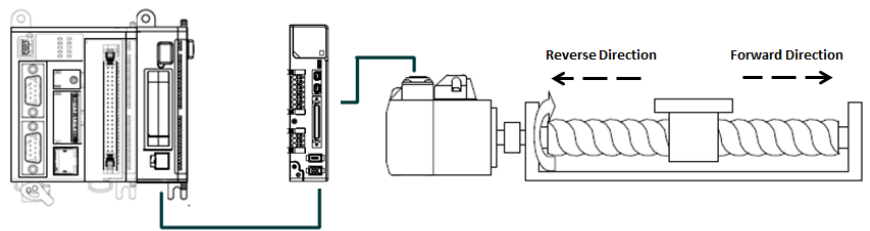


Pulse / Sign mode Reverse Direction Selection :

During forward rotation, Elapsed value decreases.

During reverse rotation, Elapsed value increases.





## ■ CW / CCW Output Type

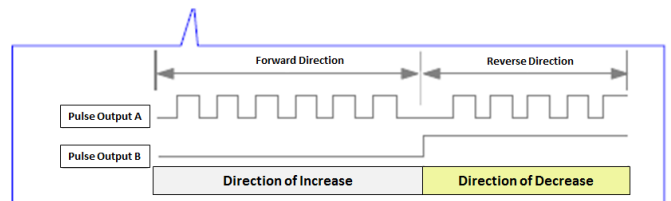
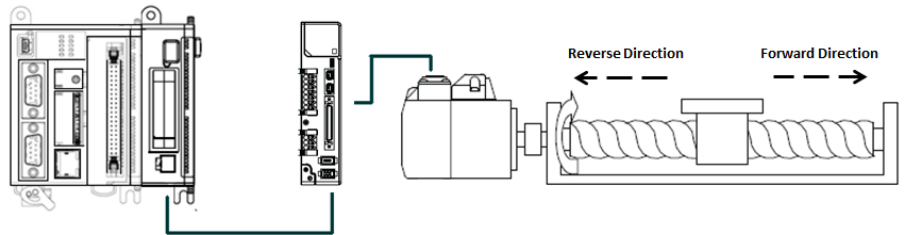
It corresponds to the motor rotation direction (CW / CCW), and outputs the fixed pulse output signal and the reverse pulse output signal.

When the rotation direction switch is set to the normal setting (ON), the pulse output A outputs the CW pulse signal and the pulse output B outputs the CCW pulse signal.

CW/CCW mode Forward Direction Selection:

During forward rotation, Elapsed value increases.

During reverse rotation, Elapsed value decreases.

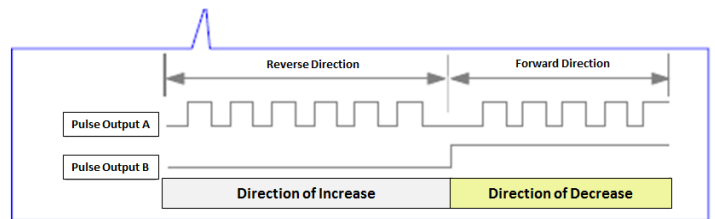
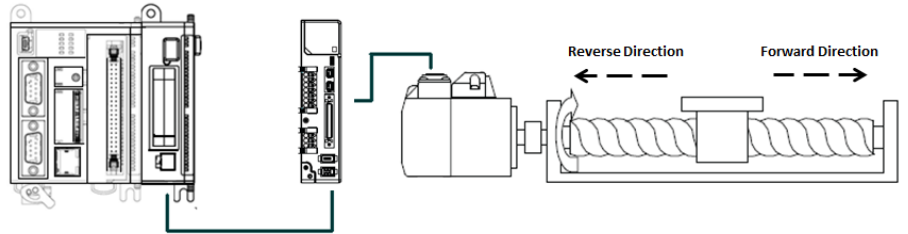


## Table of Contents

CW/CCW mode Reverse Direction Selection:

During forward rotation, Elapsed value decreases.

During reverse rotation, Elapsed value increases.



## Confirmation of slot number and I / O number assignment

### ■ I/O Word

Positioning module also uses input (X) / output (Y) address as same as other I / O module.

- The positioning module uses 11 words for each axis and 31 words for 20 words of output.
- Therefore, 62 words (input 22 words, output 40 words) are used for 2-axes type, and 124 words (input 44 words, output 80 words) are used for 4 axes type.
- The error information is located 1 word at the end for each axis.
- Occupied I / O numbers and their composition are as follows.



X8-POS1

1-axis



X8-POS2

2-axes



X8-POS4

4-axes

(Mounted at Slot 1)

1<sup>st</sup> axis = Input X0.1.0 ~ X0.1.9,    Output Y0.1.0 ~ Y0.1.19

2<sup>nd</sup> axis = Input X0.1.10 ~ X0.1.19, Output Y0.1.20 ~ Y0.1.39

3<sup>rd</sup> axis = Input X0.1.20 ~ X0.1.29, Output Y0.1.40 ~ Y0.1.59

4<sup>th</sup> axis = Input X0.1.30 ~ X0.1.39, Output Y0.1.60 ~ Y0.1.79

Error information for each axis = Input X0.4.40 ~ X0.1.43

# Table of Contents

## ■ I/O Contact Point Assignment

Contact Pont						
1-axis	2-axes	3-axes	4-axes In case of POS4	Title	Simplified Form	Type
X1.□.0	X1.□.10	X1.□.20	X1.□.30	Status Display	Status	Bits
X1.□.1	X1.□.11	X1.□.21	X1.□.31	Speed Feedback	Velocity Feedback	Float
X1.□.2	X1.□.12	X1.□.22	X1.□.32			
X1.□.3	X1.□.13	X1.□.23	X1.□.33	Command Pulse	Position Command	Float
X1.□.4	X1.□.14	X1.□.24	X1.□.34			
X1.□.5	X1.□.15	X1.□.25	X1.□.35	Encoder Feedback	Encoder Feedback	Float
X1.□.6	X1.□.16	X1.□.26	X1.□.36			
X1.□.7	X1.□.17	X1.□.27	X1.□.37	MPG Input Pulse	MPG Input Pulse	Float
X1.□.8	X1.□.18	X1.□.28	X1.□.38			
X1.□.9	X1.□.19	X1.□.29	X1.□.39	M Code	M Code	Integer
X1.□.10	-	-	-	1-axis Error Code	1AX Error Code	Integer
X1.□.20	X1.□.21	-	-	1,2-axes Error Code	1,2AX Error Code	Integer
X1.□.40	X1.□.41	X1.□.42	X1.□.43	1,2,3,4-axes Error Code	12,3,4AX Error Code	Integer

Contact Pont						
1-axis	2-axes	3-axes	4-axes	Title	Simplified Form	Type
Y0.△.0	Y0.△.20	Y0.△.40	Y0.△.60	Start Command Flag	Bit Command	Bits
Y0.△.1	Y0.△.21	Y0.△.41	Y0.△.61	Control Code	Motion Type	Integer
Y0.△.2	Y0.△.22	Y0.△.42	Y0.△.62	Expansion Control Code	Motion Type Detailed	Integer
Y0.△.3	Y0.△.23	Y0.△.43	Y0.△.63	Acceleration Time	Acceleration Time	Integer
Y0.△.4	Y0.△.24	Y0.△.44	Y0.△.64	Deceleration Time	Deceleration Time	Integer
Y0.△.5	Y0.△.25	Y0.△.45	Y0.△.65	Position Command Value	Target Position	Float
Y0.△.6	Y0.△.26	Y0.△.46	Y0.△.66			
Y0.△.7	Y0.△.27	Y0.△.47	Y0.△.67	Start Speed	Start Velocity	Float
Y0.△.8	Y0.△.28	Y0.△.48	Y0.△.68			
Y0.△.9	Y0.△.29	Y0.△.49	Y0.△.69	Target Speed	Target Velocity	Float
Y0.△.10	Y0.△.30	Y0.△.50	Y0.△.70			
Y0.△.11	Y0.△.31	Y0.△.51	Y0.△.71	Circular interpolation via point	Arc Path Point	Float
Y0.△.12	Y0.△.32	Y0.△.52	Y0.△.72			
Y0.△.13	Y0.△.33	Y0.△.53	Y0.△.73	Dwell Time	Dwell Time	Integer
Y0.△.14	Y0.△.34	Y0.△.54	Y0.△.74	Step Start Number	Step Number	Integer

Y15	Y35	Y55	Y75	Index Start : Index Point Step Start : 15 words - Step End Number 16words - Repeat Number	Index Go Command	Long
Y16	Y36	Y56	Y76			
Y17	Y37	Y57	Y77	Reserved	-	
Y18	Y38	Y58	Y78	Reserved	-	
Y19	Y39	Y59	Y79	Reserved	-	

Note 1) It turns ON during pulse output in E point control, P point control, Home-sensor return and JOG operation, and turns ON until each operation is completed.

Note 2) It turns ON when each operation of E point control, P point control, JOG operation and pulse generator input operation is completed. It also turns ON when deceleration stop and forced stop are completed. Next, when all the operations of E point control, P point control, JOG operation, home return, and pulse generator input operation are started, it turns OFF.

Note 3) The number actually used depends on the mounting position of the module.

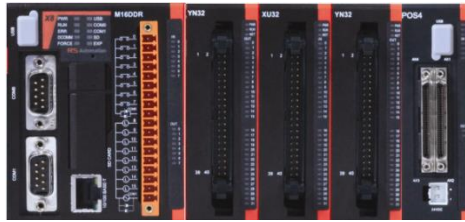
#### ■ Confirmation of assigned I/O numbers and Slot numbers

- The I / O number and slot number are required at program creation.
- The I / O number changes depending on the mounting position. Be sure to check that it is designed.
- For detailed information about I/O assignment, refer to the 「Chapter 3. I/O number assignment」 of 「X8 User Manual」.

#### (1) Verification of I/O number assignment

Check the occupied I / O area of all modules installed between CPU module and positioning module. The consecutive numbers are assigned to the I / O area of the positioning module

Example ] When a 4-axes type module is actually mounted after 3 I / O modules.



(Mounted at Slot 4)

1<sup>st</sup> axis = Input X0.4.0 ~ X0.4.9, Output Y0.4.0 ~ Y0.4.19

2<sup>nd</sup> axis = Input X0.4.10 ~ X0.4.19, Output Y0.4.20 ~ Y0.4.39

3<sup>rd</sup> axis = Input X0.4.20 ~ X0.4.29, Output Y0.4.40 ~ Y0.4.59

4<sup>th</sup> axis = Input X0.4.30 ~ X0.4.39, Output Y0.4.60 ~ Y0.4.79

Error information for each axis = Input X0.4.40 ~ X0.4.43

(2) Verification of Slot No.

Set the slot number on the right side of the CPU module to "1" and count the order.

Caution :

- If there is an empty slot between the CPU module and the positioning module, check that the I / O number is assigned to the empty slot.

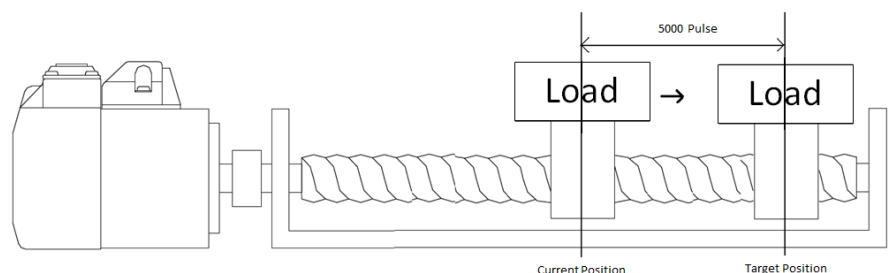
## Increment and Absolute

### ■ Increment (Relative value control)

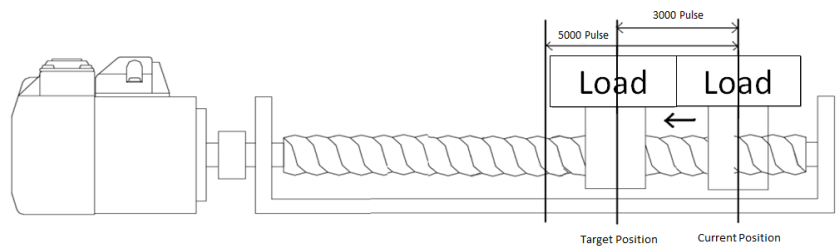
「Position Command Value」 is always specify the relative position as the number of pulses in the current position (INCREMENT)

Example Move from current position to position of +5000 pulses.

「+5000」pulse is set as position command value and moved



Set 「-3000pulse」 again as the position command value and move.

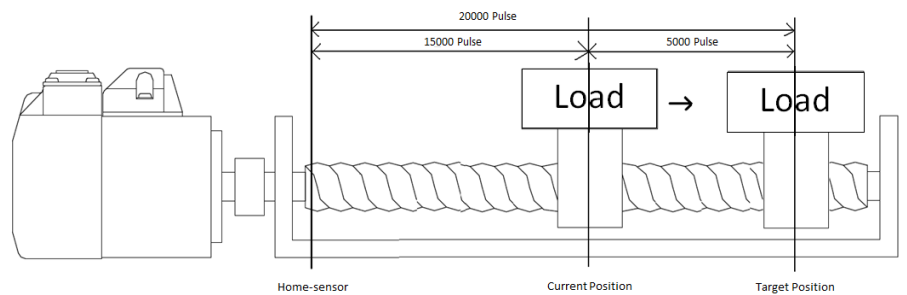


## ■ Absolute (Absolute value control)

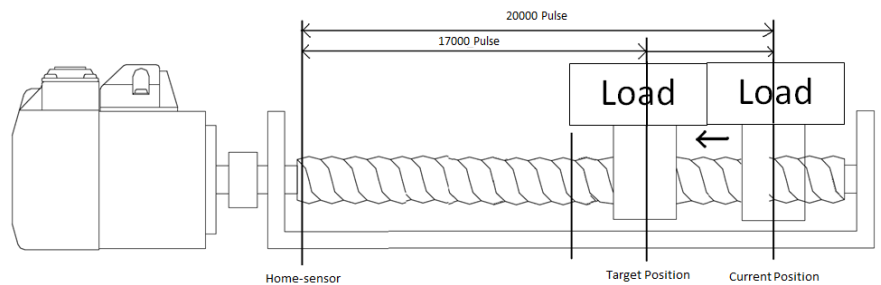
「Position Command Value」 is always specify the absolute position as the number of pulses from the home-sensor. (ABSOLUTE)

Example ] +5000 pulse move when 15000 pulses are away from home-sensor.

「+20000 pulse」 is set as position value and move.



Set 「+17,000 pulse」 again as the position command value and move.



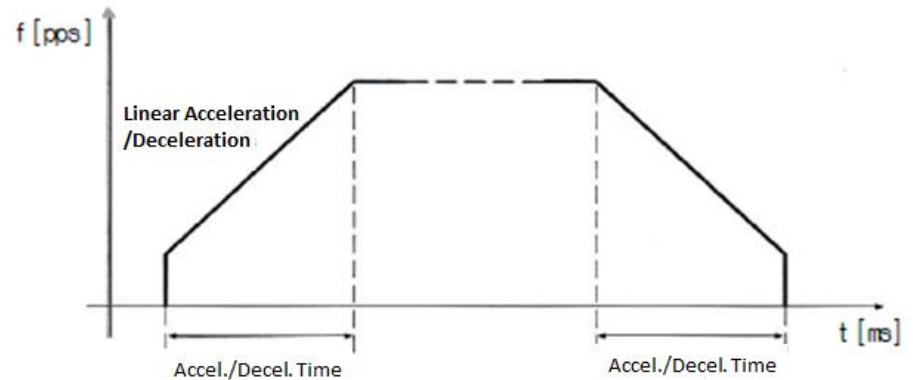
## Selection of acceleration / deceleration

### ■ Linear accel./decel. and S-curve accel./decel.

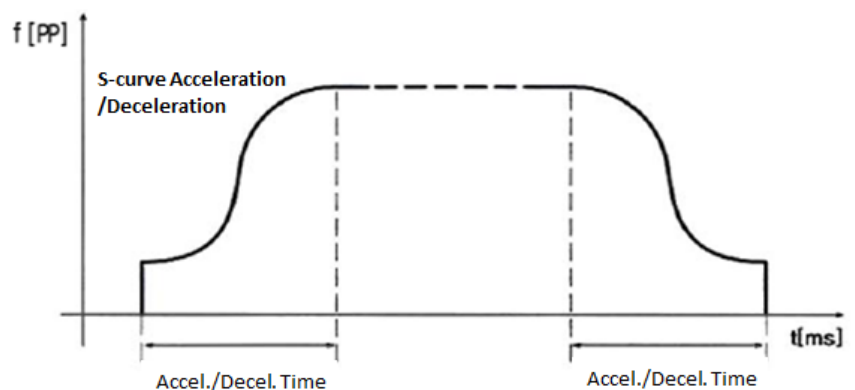
The positioning unit can select either "linear acceleration / deceleration" or "S-acceleration / deceleration".

Linear acceleration / deceleration linearly performs accel./decel. (Acceleration from the starting speed to the target speed or vice versa).

(Acceleration and deceleration at a constant rate.)



S-curve acceleration / deceleration perform in curve. At the start of acceleration / deceleration, it is relatively slow and gradually accelerates. When it is close to the end, make acceleration / deceleration slow. Shows relatively smooth movement.



### ■ Acceleration / Deceleration Setting

Specify the control code and extended control code according to the program.



Data Table : Y0 -- OUTPUT					
아드레스	데이터 타입	값	의미	설명	
Y0.0.0	Output	0000 0000 0000 0000	Bits, Base		
Y0.0.1	Output	0000 0000 0000 0000	Bits, Base		
Y0.0.2	Output	0000 0000 0000 0000	Bits, Base		
Y0.0.3	Output	0000 0000 0000 0000	Bits, Base		
Y0.1.0	Output	0010 0000 0000 0000	Bits, Slot #1	1AX: Bit Command	
Y0.1.1	Output	0000 0000 0000 0001	Bits, Slot #1	1AX: Motion Type	
Y0.1.2	Output	0000 0000 0000 0001	Bits, Slot #1	1AX: Motion Type Detailed	
Y0.1.3	Output	0000 0000 0110 0100	Bits, Slot #1	1AX: Acceleration Time	
Y0.1.4	Output	0000 0000 0110 0100	Bits, Slot #1	1AX: Deceleration Time	
Y0.1.5	Output	0101 0000 0000 0000	Bits, Slot #1	1AX: Target Position Low	
Y0.1.6	Output	0100 0111 1100 0011	Bits, Slot #1	1AX: Target Position High	
Y0.1.7	Output	0101 0000 0000 0000	Bits, Slot #1	1AX: Start Velocity Low	
Y0.1.8	Output	0100 0111 1100 0011	Bits, Slot #1	1AX: Start Velocity High	
Y0.1.9	Output	0101 0000 0000 0000	Bits, Slot #1	1AX: Target Velocity Low	
Y0.1.10	Output	0100 0111 1100 0011	Bits, Slot #1	1AX: Target Velocity High	
Y0.1.11	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Arc Path Point Low	
Y0.1.12	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Arc Path Point High	
Y0.1.13	Output	0000 0000 0110 0100	Bits, Slot #1	1AX: Dwell Time	
Y0.1.14	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Step Start Nmuber	
Y0.1.15	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Index Go Command Low	
Y0.1.16	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Index Go Command High	
Y0.1.17	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Reserved	
Y0.1.18	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Reserved	
Y0.1.19	Output	0000 0000 0000 0000	Bits, Slot #1	1AX: Reserved	

The control method changes according to the specification of the control code and the extended control code..

When Y0.1.1 is “1” and Y0.1.2.0 is “0”, Increment / Linear acceleration· deceleration.

When Y0.1.1 is “1” and Y0.1.2.0 is “1”, Increment / S-curve acceleration· deceleration.

When Y0.1.1 is “2” and Y0.1.2.0 is “0”, Absolute / Linear acceleration· deceleration.

When Y0.1.1 is “2” and Y0.1.2.0 is “1”, Absolute / S-curve acceleration· deceleration.

**4. Power ON/OFF and Operation..... 2**

Design of Safety Circuit..... 2

Check list before Power input..... 3

Procedure of Power Opening ..... 4

Operation Procedure ..... 5

- Confirmation of External Safety Circuit 5
- Confirmation of Safety Circuit by PLC 5
- Confirmation of Rotation, Movement Direction and Movement Distance 6
- Confirm the operation of Near Home-sensor Switch and Home-sensor Switch 7

Notes on Basic Operation ..... 8

- When the power is turned off, the table value of output data will be cleared. 8
- Operation when CPU module is in RUN-> PROG mode. 9
- When one of the actions is activated, the other action is not executed. 9

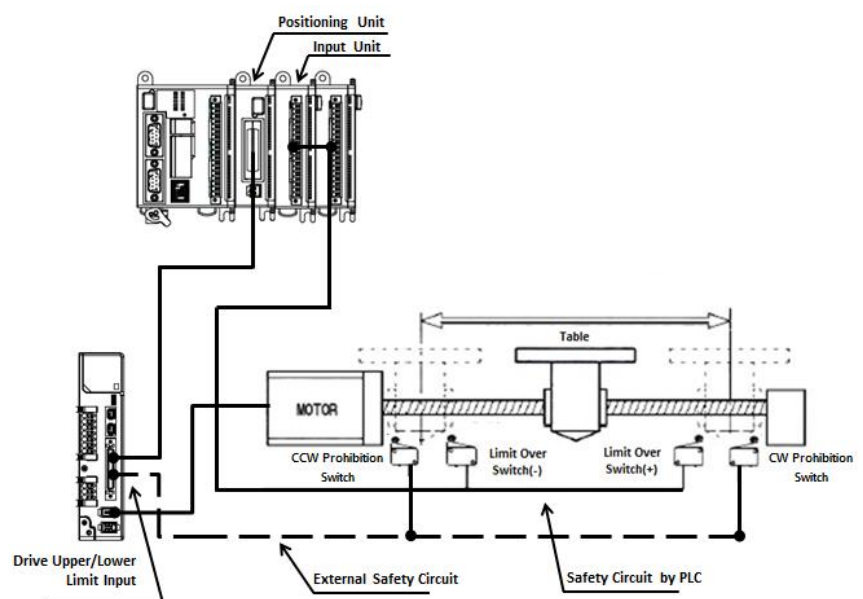
# 4. Power ON/OFF and Operation

This chapter describes the operation and design of positioning module while power ON/OFF.

## Design of Safety Circuit

### ■ Example of Safety Circuit

Installation of Limit-Over Switch



### ■ Safety Circuit by PLC

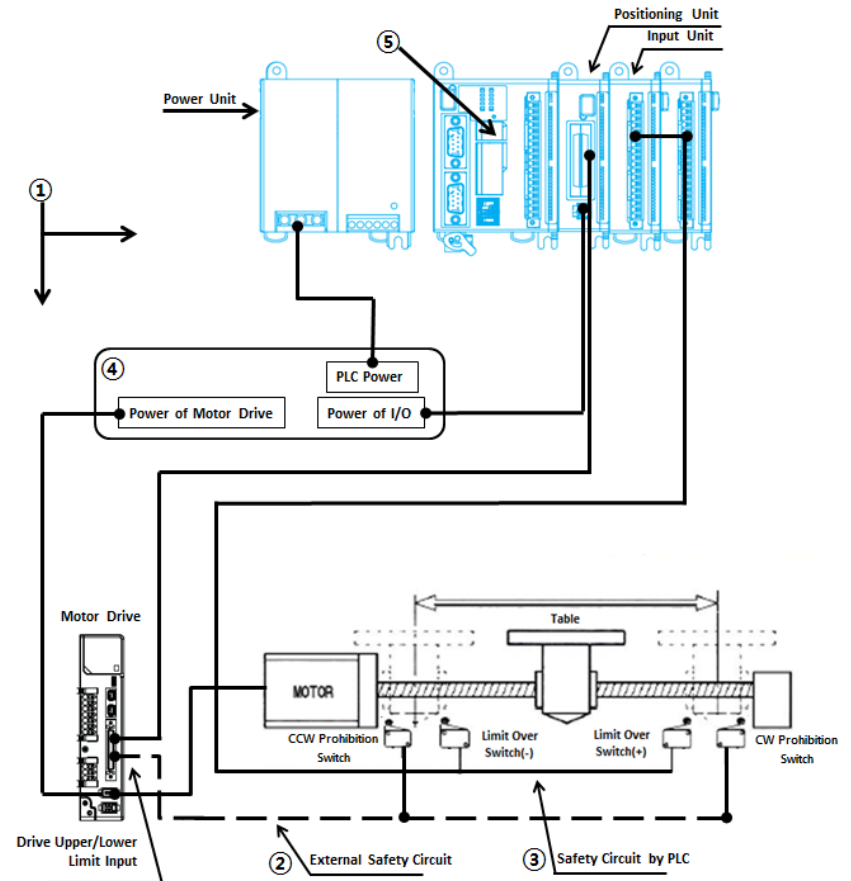
Install the Limit-Over Switch as the above image.

### ■ Safety Circuit by External Circuit

Install a safety circuit recommended by the maker of the motor you are using.

## Check list before Power input

### System Design



#### 1. Connection of each devices

Make sure that each device is connected as designed.

#### 2. Installation of External Security Circuit

Make sure that the safety circuit (wiring and installation of limit-over switch) by external circuit is securely installed.

#### 3. Installation of Security Circuit by PLC

Check the connection of PLC input unit and limit-over switch  
Also, check the installation of the limit over switch

#### 4. Power-on Sequence Setting

Make sure that the power-on sequence is set to match the "power-on sequence"

#### 5. CPU Mode Switch

Set the CPU module as PROG mode. In RUN mode, you can perform operations that are not ready.

Caution :

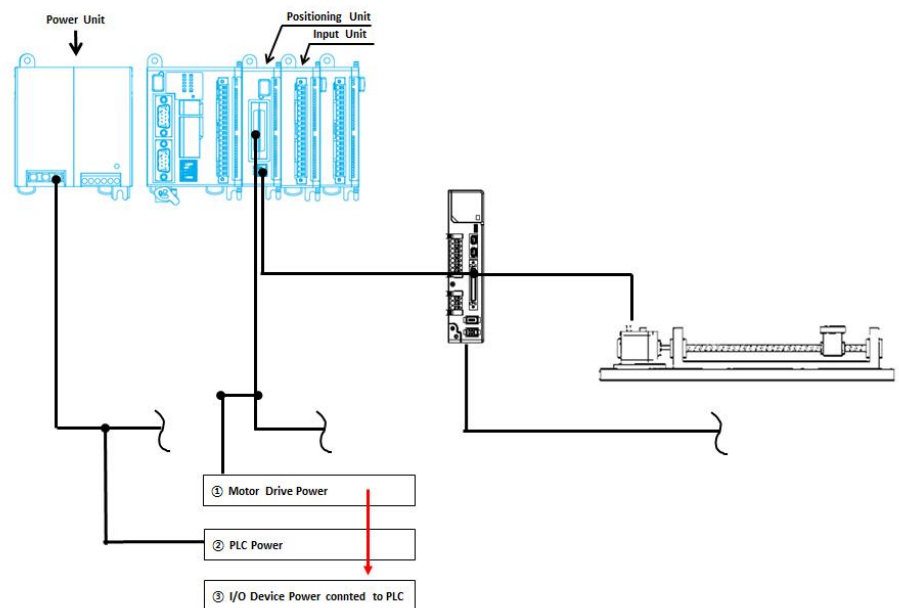
When the PLC is powered on, the internal data of the shared memory is cleared to zero (0).

Check that each operation starting point of the positioning unit is not ON. If the data is not set in the shared memory when the module is turned ON, it becomes a positioning unit setting value error

### Procedure of Power Opening

Procedure :

1. Check that the rotation of the motor is stopped and turn off the motor drive power.
2. Turn off the PLC power.
3. Turn off the power for the input / output devices connected to PLC.



Caution for restarting :

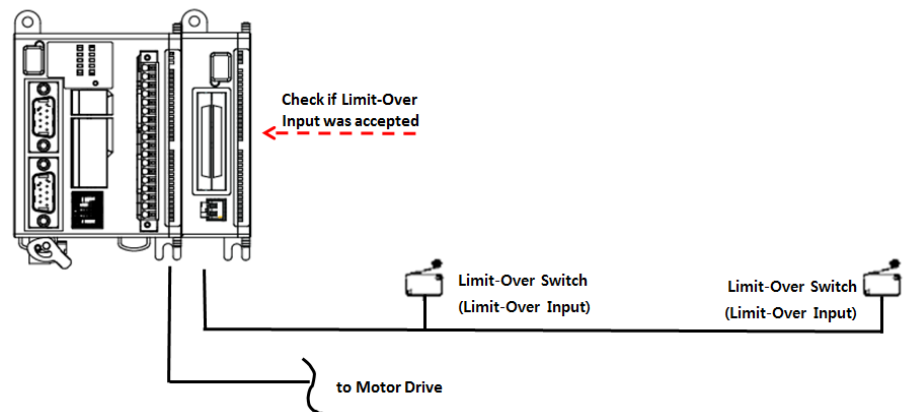
When the CPU unit is initialized, the contents of the operation memory are initialized too. However, the shared memory of the positioning unit keeps its contents. If the positioning operation continues in that state, it may operate at the set value that remains. When the power is turned off, the contents of the shared memory are erased.

When the Limit-Over Input is activated as required, input the program that activates the Emergency Stop Circuit of the positioning unit and perform JOG operation. Forcibly operate the limit input to check the operation

### Step 3.

Confirm that the Limit-Over Input is operating normally by JOG operation..

※ For detailed information about JOG operation, refer to the「chapter 8. JOG Operation」



## ■ Confirmation of Rotation, Movement Direction and Movement Distance

### Step 1.

Confirm that the direction of rotation and movement is correct by JOG operation or automatic acceleration / deceleration operation.

#### Check Point

The direction of rotation is determined by the drive wiring, the DIP switch setting on the bottom of the unit, and the setting data by the program.

※ For detailed information about automatic acceleration/ deceleration, refer to the chapter 7 or 8.

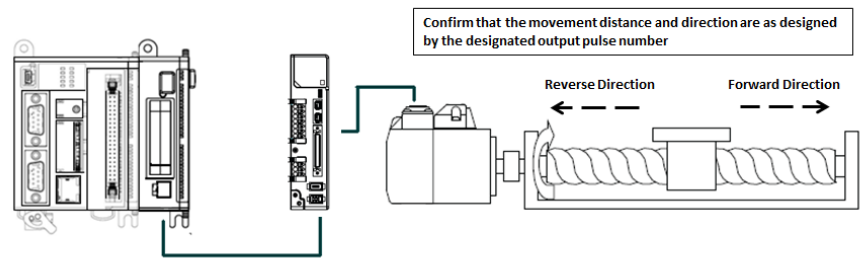
※ For detailed information about the DIP switch setting on the bottom of the unit, refer to the chapter 4.

### Step 2.

Confirm that movement distance goes as designed by designated output pulse number.

#### Check Point

The movement distance is determined by the pitch of the ball screw, the reduction gear ratio, the drive ratio, and the number of programmed pulses..



## ■ Confirm the operation of Near Home-sensor Switch and Home-sensor Switch

### Step 1

Forced operation of home-sensor input and near home-sensor input is performed to check whether the operation display LED of the positioning unit is on.

Also use the programming tool to monitor input contacts R□.6, R□.7 and check them equally

### Step 2

Enter a home return program and make sure that it is actually performed and that the deceleration operation is performed in accordance with the near home-sensor input.

### Check Point

Input valid logic of home-sensor input and near home-sensor input is determined by control code of program.

### Step 3

Repeat JOG operation and home return operation to see if they deviate from the home stop position

### Check Point

Deviation may occur depending on the position of the home-sensor input or the return speed.

### Step 4

If there is a deviation from the home stop position, try to change the near home-sensor input position or reduce the home return speed so that the home position does not deviate.





Caution :

Change of CPU unit from RUN to PROG while operating the positioning unit, it will decelerates to stop.

For detailed information about deceleration stop, refer to the 「chapter 11」.

## Notes on Basic Operation

- When the power is turned off, the table value of output data will be cleared.

Shared memory data on the positioning unit is not backed up during a power failure. Therefore, when the power is turned on again, input the initial operation data to the shared memory, and then turn on each start point.

※ Each setting value of output data will be “0” when the power is turned off. All of control codes are returned to their initial values.

Caution :

If the movable point is turned on without inputting data, a set value error may occur or an operation other than the intended operation may be performed.

Caution :

If returned to the home-sensor while the power is ON, Be sure to input the control code before turning on the home return starting point. If control code is not input, unexpected operation may be performed depending on the direction of home-sensor return, difference of input logic, and so on.

Reference :

To read the elapsed value data before the power is turned off when the power is turned on, write the following program.

< Example >

Always read the elapsed value of W0100 ~ W0101 before turning off the power, and input the contents of W0100 ~ W0101 into the elapsed value area of the unit through W0102 ~ W0103 when the power is ON

■ Operation when CPU module is in RUN-> PROG mode.

If the CPU mode is changed to PROG during E point control, P point control, JOG operation, and home return, the positioning unit stops operation in progress and enters deceleration operation in consideration of safety.

< Example >

When CPU unit is in RUN -> PROG mode during E point control operation

Caution :

Deceleration stop operation starts when the CPU unit mode is switched from RUN to PROG.

The acceleration of deceleration at that time is the deceleration at the acceleration determined by the data registered in the output data table when switching from RUN to PRO.

Do not change the CPU unit mode from RUN to PROG while the positioning operation is being performed in normal use.

Reference :

For detailed information about deceleration operation, refer to the 「chapter 11」.

■ When one of the actions is activated, the other action is not executed.

When one of the 5 basic operations of the positioning unit (E point control, P point control, home-sensor return, JOG operation, and pulse generator input operation) turned ON and start operating, the other operation will not be executed even if the contact of the other operation is ON.

< Example >

Start E point control with turning ON the E point control starting point and during E point control operation, the operation cannot be switched even if the starting point for P point control, home-sensor return, JOG operation, and pulse generator input operation is turned on

### Reference :

If any of the deceleration stop, forced stop, and other contact points is turned on, the 5 basic operations described above will immediately enter the stop operation.

**5. Install and Use of S/W ..... 2**

    Requirement of Installation..... 2

    Software Setup..... 2

    Software Specification..... 2

    X8PM Setting..... 2

        Common Contents ..... 2

        Read Current Status ..... 7

    XGPC Setting..... 15

        Common Contents ..... 15

        Read Current Status ..... 15

# 5. Install and Use of S/W

This chapter describes how to install and use the Position Manager to operate the X8 positioning module.

## Requirement of Installation

Operating System: Windows XP/Windows7/8/10  
RAM: 512MB  
Hard Disk: 512MB

## Software Setup

Download the X8 Position Manager corresponding to the X8 positioning module from our website (<http://www.rsautomation.co.kr>).

### Screen of Dataroom from Website

Following screen will appear when you run the Setup.exe file.  
Click Next to proceed to the next step.

### Setup Screen

Select the folder where you want to install the Position Manager program, and then click the Next button.

### Setup Screen

When the installation is completed, it asks whether to restart the PC as shown below. Click Yes to restart automatically.

## Software Specification

## X8PM Setting

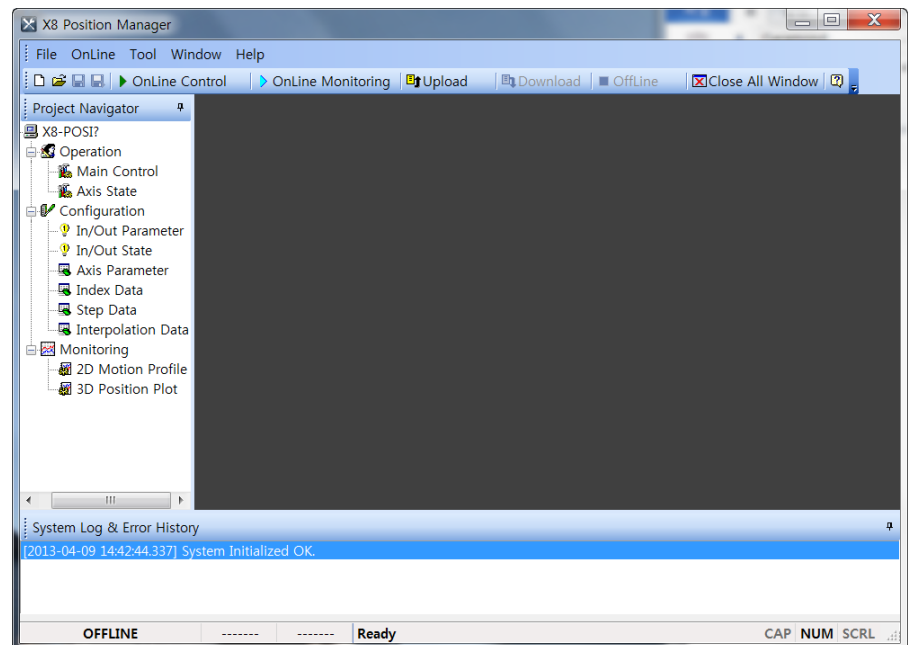
## Common Contents

X8PM Software is a program for Windows that controls the positioning module of RS Automation X8 PLC. It provides functions for the positioning parameter Read/Write, Input/Output Data Monitoring and Data Import/Export of X8 POS1/2/4.

X8 Position Manager provides various operating modes. The position manager which can control various motors such as Jog Mode, MPG Mode, E-Motion, P-Motion, Index Mode, Step Mode,

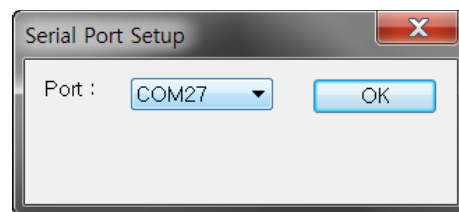
Interpolation Mode, Homing and etc can set each mode individually, so that the user can easily control the motion.

After running the Position Manager, follow screen will appear. Through the Operation menu on this screen, you can actually issue commands and check the operation status of each axis.

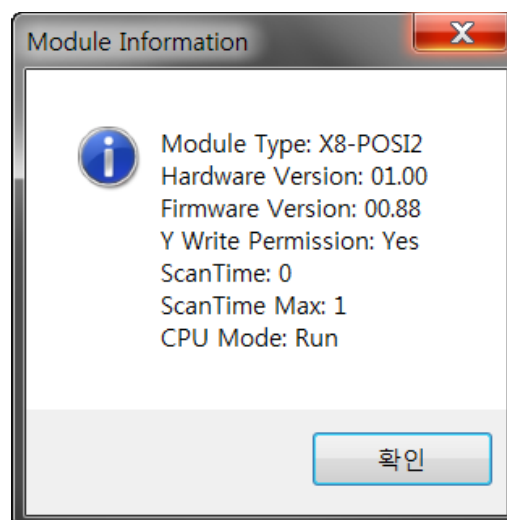


- New  
Create a new project
- Open  
Pre-saved configuration files can be loaded
- Save  
Save the settings of the created program or modified program
- Save As  
Save the configuration file that has already been saved in a different place than the name of the existing file, instead of overwriting it.
- Exit  
Exit of Position Manager
- Connect for Control  
Try to make an online connection with X8 Position Module by X8PM Software.
- Connect for Monitor  
Online connection mode to monitor the operation of X8 position module via Axis State window.

- Go Offline  
Release the connection to offline the X8 position module and X8PM software.
- Download Parameter  
Download the parameter of Index Data, Step Data, Interpolation Data, etc. to Position module.
- Upload Parameter  
Bring the parameter of Index Data, Step Data, Interpolation Data, etc. that saved on current position module.
- Port Setup  
Setting of USB port which connects to the current position module.



- Log Clear  
Initialize the System Log and Error History with Position Module.
- Log Export  
Save the current log history as text file
- Module Information  
Shows the information and status of the currently connected Position Module.



- Float Number View

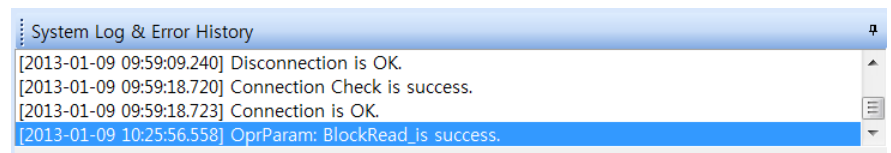
Sets the decimal range indicated by the In/Out parameter. It can be set from the 1<sup>st</sup> decimal place (x.y) to the 5<sup>th</sup> decimal place (x.yyyyy).

- Project Navigation

Check and set Operation Parameter, In/Out State, In/Out Parameter, Operation Data, Index Data etc. related to the currently connected X8-POS module.

- Log Viewer

Record the operation status of the program such as communication status, operation command execution, etc and shows the System Log and Error History.

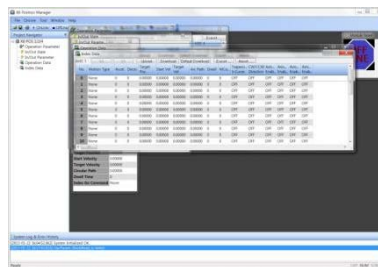


The display format as follows.

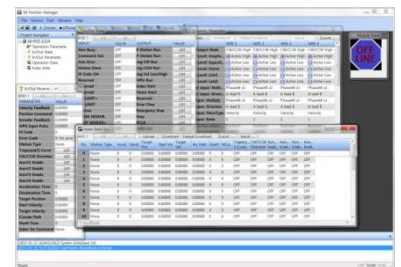
“[year-month-day hour-minute-second.millisecond] log message...”

- Window Position

Axis settings such as In/Out Parameter, In/Out State, Operation Parameter, Index/Operation Data, Module State of X8 Position Manager and the shape of the monitoring window to Cascade type.



<Cascade>



<Tile>



# Table of Contents

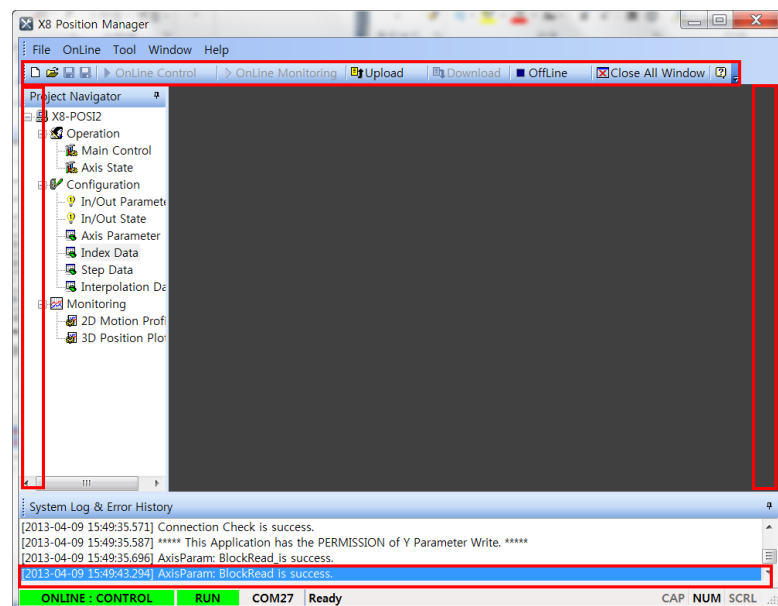
## • TOOLBAR

The toolbar which lists the frequently used functions of the X8PM as icon buttons, makes it possible to use the software quickly.



Icon	Item	Description
1	New	Create a new project
2	Open	Open a program file
3	Save	Save the project file
4	Save As	Save project file as different name
5	Online Control	Control connection to the set port
6	Online Monitoring	Monitoring connection to the set port
7	Upload	Read various parameter in position module
8	Download	Sent to various parameter data position module
9	Close All Window	Close all opened windows

The location of the Toolbar can be changed to the top, bottom, left, right position of the program by dragging the Toolbar with the mouse on the X8PM software.



## • PROJECT TREE

Shows the menu items such as Main Control, Axis State, Operation Parameter, In / Out State, In / Out Parameter, Operation Data, and Index Data that can be set and monitored for each axis of X8-POS module connected to X8PM

## Read Current Status

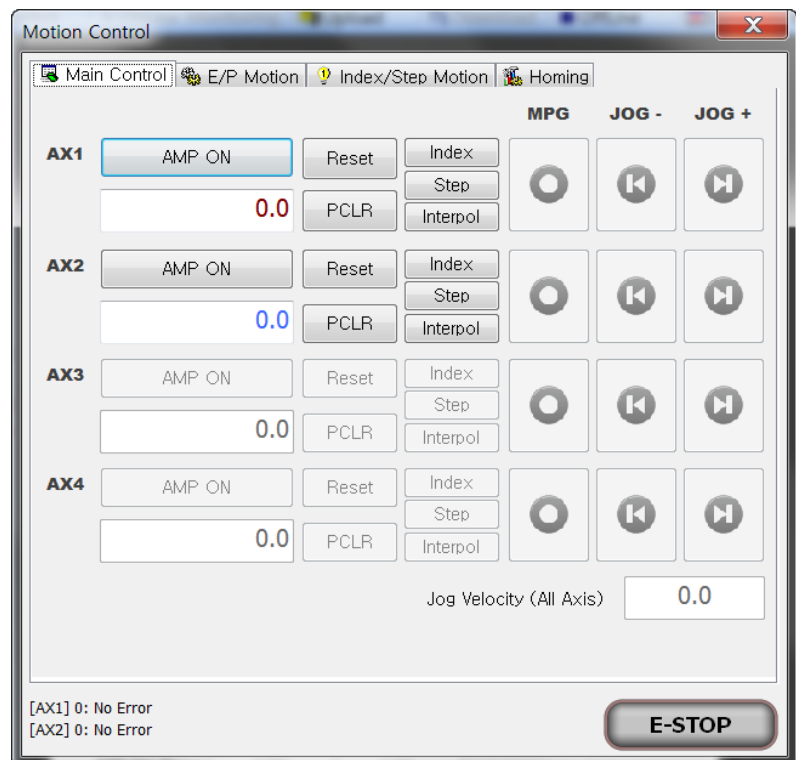
### ■ Operation

In Motion Control, you can set and operate each parameter such as Jog, MPG, E-Motion, P-Motion, Index/Step Motion and Homing, etc. It can be divided into operating modes of axis and parameter and monitoring can be done easily by the user.

When each operating is performed, axis status and error code are displayed at the bottom in real time.

#### • Main Control

In Main control, servo drive control such as Servo On, Error Clear, Position Initialization, etc. can be performed intuitively. In addition, position data such as JOG operation, MPG operation and Index, Step, Interpolation of current servo motor can be conveniently set by teaching function.



Parameter	Function Description
AMP ON	Servo drive ON / OFF output of each connected axis
Reset	Clear when an Axis Error occurs
PCLR	Initialize the current position of axis to 0.0
Index	Index Data to specify current position command and encoder value, 0 ~ 31
Step	Step Data to specify current position command and encoder value, 1 ~ 512

## Table of Contents

Interpol	Interpolation Data to specify current position command and encoder value, 1 ~ 512
MPG	Control the motor by using MPG
JOG -	Move the motor counter-clockwise in JOG mode
JOG +	Move the motor clockwise in JOG mode
Jog velocity	Motor speed in High-speed JOG operation mode
E-STOP	Stopping the motor in operation

### • E/P Motion

The E/P Motion tab allows you to enter motion types, speed and position settings for E-Motion and P-Motion, and control their motion.

Motion Control

☒ Main Control
 ☒ E/P Motion
 ☐ Index/Step Motion
 ☐ Homing

Operation Mode : ☒ E-Motion ☐ P-Motion

	AXIS 1	AXIS 2	AXIS 3	AXIS 4
Motion Type	None	None	None	None
Accel/Decel	100	100	100	100
Position 1	10000.0	10000.0	10000.0	10000.0
Velocity 1	3000.0	3000.0	3000.0	3000.0
Arc Path 1	1000.0	1000.0	1000.0	1000.0
Position 2	20000.0	20000.0	20000.0	20000.0
Velocity 2	4000.0	4000.0	4000.0	4000.0
Arc Path 2	2000.0	2000.0	2000.0	2000.0
Position 3	30000.0	30000.0	30000.0	30000.0
Velocity 3	5000.0	5000.0	5000.0	5000.0
Arc Path 3	3000.0	3000.0	3000.0	3000.0

AX Mapping: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 1 ☐ 2 ☐ 3 ☐ 4

Vel. Profile: ☐ Trap/S-Curve ☐ Trap/S-Curve ☐ Trap/S-Curve ☐ Trap/S-Curve

Direction: ☐ CW/CCW ☐ CW/CCW ☐ CW/CCW ☐ CW/CCW

[AX1] 0: No Error  
 [AX2] 0: No Error

**E-STOP**

Parameter	Function Description
Operation Mode	Select between E-Motion and P-Motion in Operation mode
Motion Type	Set the operation mode of the axis
Accel / Decel	Acceleration/Deceleration time setting of motor operation
Position 1	Set of E/P-Motion target position
Velocity 1	Set of E/P-Motion target speed
Arc Path 1	Parameter in multi axis interpolation operation
Position 2	Set of P-Motion 2 <sup>nd</sup> target position
Velocity 2	Set of P-Motion 2 <sup>nd</sup> target speed
Arc Path 2	Parameter in the 2 <sup>nd</sup> multi-axis interpolation operation of P-Motion
Position 2	Set of P-Motion 3 <sup>rd</sup> target position
Velocity 2	Set of P-Motion 3 <sup>rd</sup> target speed

Arc Path 2	Parameter in the 3 <sup>rd</sup> multi-axis interpolation operation of P-Motion
AX Mapping	Interpolation axis setting in multi-axis interpolation operation
Vel Profile	Specify speed profile to be used for movement (Trapezoid, S-Curve)
Direction	Setting the direction of axis rotation in multi-axis interpolation operation
Run	Mapping axis motion of current axis and multi-axis interpolation motion

- Index/Step Motion

In Index/Step Motion, axis can be operated by selecting Index Mode, Step Run Mode and Step Interpolation Mode.

Parameter	Function Description
Operation Mode	Select a mode between Index, Step and Interpolation mode
Index Go Cmd	In index mode, set of initial index
Step Number	In step mode, set of initial step number
Step End	In step mode, set of last step number
Step Repeat	In step mode, set of repeat count

- Homing

Controls the homing operation to locate the homing sensor position from current position of axis. A total of 20 modes of homing are supported, each of detailed operation is described in the Homing Type Note. Home Type and various parameter settings cannot be

## Table of Contents

set in X8PM Software, and can be set in offline XGPC. However, if Home Type 16 is set, parameter value can be set in X8PM.

The Motion Control window displays homing parameters for four axes. The 'Homing' tab is selected. The parameters are as follows:

	AXIS 1	AXIS 2	AXIS 3	AXIS 4
Homing Type	Type 18	Type 18	Type 0	Type 0
Target Velocity	5000.0	5000.0	0.0	0.0
Start Velocity	500.0	500.0	0.0	0.0
Fine Velocity	500.0	500.0	0.0	0.0
Accel.(=Decel.)	1000	1000	0	0
User Home Type	Type 0	Type 0	Type 0	Type 0
Home Direction	0: CW	0: CW	0: CW	0: CW
Dwell Time	1000	1000	0	0

Homing Type Note:  
 0: Slow Stop after Home Sensor  
 1: Reverse Home Vel after Home Sensor  
 2: Stop at Z Hall after Home Sensor  
 3: Stop at Z Hall with Some Distance after Home Sensor  
 4: Stop at Z Hall with Low Vel after Home Sensor  
 5: Stop at Z Hall with High Vel after Home Sensor  
 6: Slow Stop after Limit Sensor  
 7: Stop at Z Hall with Low Vel after Limit Sensor  
 8: Stop at Z Hall with High Vel after Limit Sensor

Run buttons are provided for each axis. Status at the bottom: [AX1] 0: No Error, [AX2] 0: No Error. An E-STOP button is also present.

- Axis State

In the Axis State window, you can monitor the current operation of the motor and check the status information for each axis.

The Axis State window displays status information for four axes (AX1, AX2, AX3, AX4). The status is 'OFF' for all listed items.

	AX1	AX2	AX3	AX4
Pos Command	0.0	0.0		
Enc Feedback	0.0	0.0		
Vel Feedback	0.0	0.0		
MPG Pulse	0.0	0.0		
M Code	0.0	0.0		
AMP ON	OFF	OFF		
Axis Error	OFF	OFF		
AMP Alarm	OFF	OFF		
HW Limit +	OFF	OFF		
HW Limit -	OFF	OFF		
Home Sensor	OFF	OFF		
SW Limit +	OFF	OFF		
SW Limit -	OFF	OFF		
Z Sensor	OFF	OFF		
Axis Busy	OFF	OFF		
Step Run Busy	OFF	OFF		
Interpol Busy	OFF	OFF		
ABS Hm Done	OFF	OFF		
Home Done	OFF	OFF		
Motion Done	OFF	OFF		
Command Ack	OFF	OFF		

Parameter	Function Description
Pos Command	Position command value of current axis
Enc Feedback	Position feedback value in Servo Motor Encoder
Vel Feedback	Speed feedback value of Servo Motor
MPG Pulse	Operating pulse value by using MPG
M Code	Output value at start-up when output is ON in setting
AMP ON	Servo Drive ON/OFF Status Display
Axis Error	ON when axis motion error occurs
AMP Alarm	ON when Servo self-error occurs
HW Limit +	ON when reaching +Limit sensor of axis
HW Limit -	ON when reaching -Limit sensor of axis
Home Sensor	ON when reaching Home sensor of axis
SW Limit +	ON at the Limit High value position specified by XGPC
SW Limit -	ON at the Limit Low value position specified by XGPC
Z Sensor	ON when Motor 1 rotate Z pulse occurs
Axis Busy	ON when current axis operates
Step Run Busy	On when Run Mode operates
Interpol Busy	On when Interpol Mode operates
ABS Hm Done	On when homing of Absolute Encoder is completed
Home Done	ON when Homing operation is completed
Motion Done	ON at stop after operating each axis
Command Ack	ON when command setting completion check at P point control

#### ■ Configuration

In Configuration, Operation and monitoring of each axis motion is possible. In Operation, setting and operating is possible for each mode but in the configuration, it is possible to control by axis. In addition, Index Data, Step Data and Interpolation Data can be set in Configuration.

#### ● In/Out Parameter

In In/Out Parameter, you can monitor and set parameters such as speed, position and error code for each axis.

## Table of Contents

**In/Out Parameter**

AXIS 1 << >>

PARAMETER	VALUE
Velocity Feedback	0.0
Position Command	0.0
Encoder Feedback	0.0
MPG Input Pulse	0.0
M Code	0
Error Code	0: No Error
Motion Type	None
Trapezoid/S-Curve	OFF
CW/CCW Direction	OFF
Axis#1 Enable	OFF
Axis#2 Enable	OFF
Axis#3 Enable	OFF
Axis#4 Enable	OFF
Acceleration Time	0
Deceleration Time	0
Target Position	0.0
Start Velocity	0.0
Target Velocity	0.0
Arc Path Point	0.0
Dwell Time	0
Step Number	0
Index Go Command	None

- In/Out State

In In/Out State, Output control of module is possible. You can operate the Jog Mode, MPG Mode, E-Motion, P-Motion, Index Mode, Step Mode, and Interpolation Mode each, and set the operation such as ON/OFF and error clear of AMP.

**In/Out State**

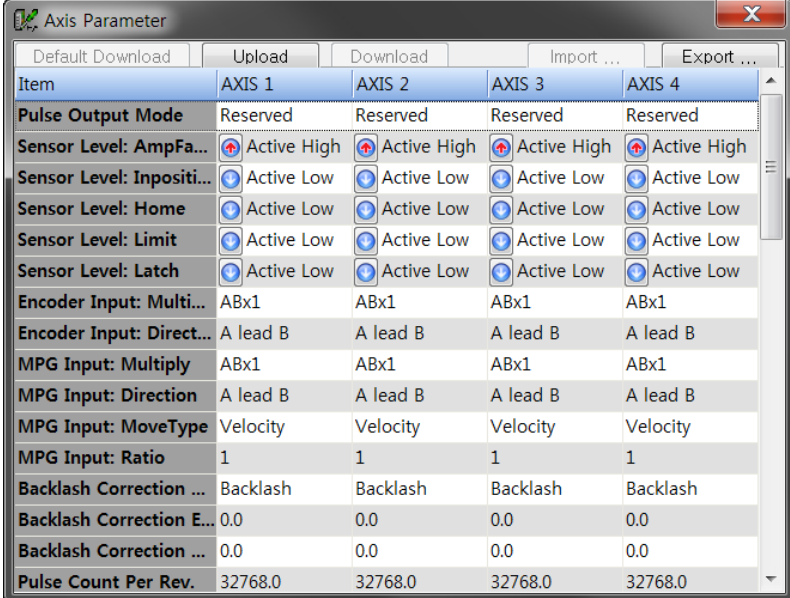
AXIS 1 << >>

INPUT	VALUE	OUTPUT	VALUE
Axis Busy	OFF	E-Motion Run	OFF
Command Ack	OFF	P-Motion Run	OFF
Axis Error	OFF	Jog CW Run	OFF
Motion Done	OFF	Jog CCW Run	OFF
Home Done	OFF	Jog Vel Override	OFF
AMP ON	OFF	MPG Run	OFF
ABS Home Done	OFF	Index Start	OFF
Step Run Busy	OFF	Home Start	OFF
SW LIMIT+	OFF	Step Start	OFF
SW LIMIT-	OFF	Error Clear	OFF
Zsensor	OFF	Emergency Stop	OFF
HOME SENSOR	OFF	Stop	OFF
HW LIMIT+	OFF	PCLR	OFF
HW LIMIT-	OFF	AMP ON	OFF
AMP Alarm	OFF	AMP Error Clear	OFF
Interpolation Busy	OFF	Interpolation Start	OFF

On the left side of the In/Out State Window, you can monitor the operation of axis by Input Parameter and on the right side, axis can be control by Output.

- **Axis Parameter**

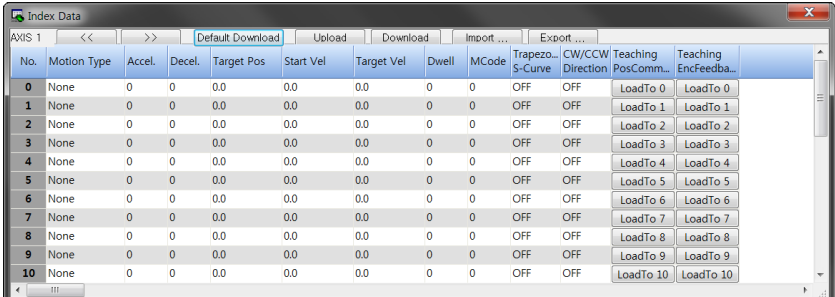
The Axis Parameter shows the motion settings for each axis. Parameter cannot be set on the X8 Position Manager, It can be set when connecting X8 position module with XGPC. You can check parameters such as Sensor Operation, Encoder Type, MPG Operation, Various Stop Action, JOG Speed, Homing mode setting, etc.



Item	AXIS 1	AXIS 2	AXIS 3	AXIS 4
<b>Pulse Output Mode</b>	Reserved	Reserved	Reserved	Reserved
<b>Sensor Level: AmpFa...</b>	<input checked="" type="radio"/> Active High	<input checked="" type="radio"/> Active High	<input checked="" type="radio"/> Active High	<input checked="" type="radio"/> Active High
<b>Sensor Level: Inpositi...</b>	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low
<b>Sensor Level: Home</b>	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low
<b>Sensor Level: Limit</b>	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low
<b>Sensor Level: Latch</b>	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low	<input type="radio"/> Active Low
<b>Encoder Input: Multi...</b>	ABx1	ABx1	ABx1	ABx1
<b>Encoder Input: Direct...</b>	A lead B	A lead B	A lead B	A lead B
<b>MPG Input: Multiply</b>	ABx1	ABx1	ABx1	ABx1
<b>MPG Input: Direction</b>	A lead B	A lead B	A lead B	A lead B
<b>MPG Input: MoveType</b>	Velocity	Velocity	Velocity	Velocity
<b>MPG Input: Ratio</b>	1	1	1	1
<b>Backlash Correction ...</b>	Backlash	Backlash	Backlash	Backlash
<b>Backlash Correction E...</b>	0.0	0.0	0.0	0.0
<b>Backlash Correction ...</b>	0.0	0.0	0.0	0.0
<b>Pulse Count Per Rev.</b>	32768.0	32768.0	32768.0	32768.0

- **Index Data**

Index Mode, you can input the setting parameters while operating. The maximum number of Index contacts is 32 points and can be set up to Input0 - Input31. In Index Mode, Motion Type supports Absolute and Relative movement commands.



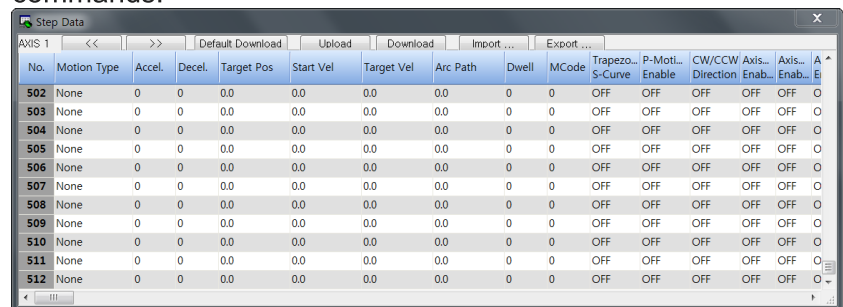
No.	Motion Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Dwell	MCode	Trapezo...	CW/CCW	Teaching	Teaching
0	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 0	LoadTo 0
1	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 1	LoadTo 1
2	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 2	LoadTo 2
3	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 3	LoadTo 3
4	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 4	LoadTo 4
5	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 5	LoadTo 5
6	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 6	LoadTo 6
7	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 7	LoadTo 7
8	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 8	LoadTo 8
9	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 9	LoadTo 9
10	None	0	0	0.0	0.0	0.0	0	0	OFF	OFF	LoadTo 10	LoadTo 10



# Table of Contents

- Step Data

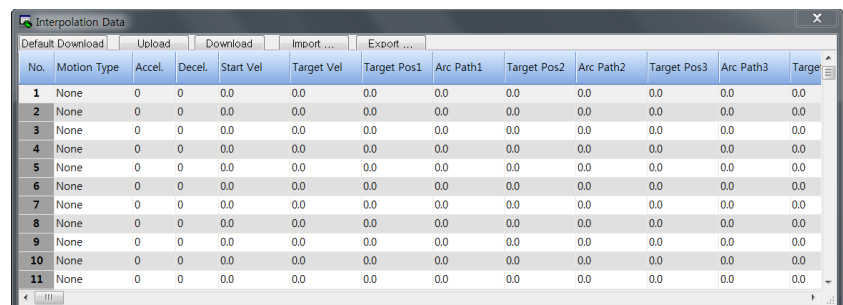
Parameter data used in Step Mode operation. Up to 512 steps can be set. Motion Type supports Absolute and Relative movement commands.



No.	Motion Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Arc Path	Dwell	MCode	Trapezo S-Curve	P-Moti Enable	CW/CCW Direction	Axis Enab.	Axis Enab.
502	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
503	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
504	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
505	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
506	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
507	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
508	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
509	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
510	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
511	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF
512	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF

- Interpolation Data

The axis data can be set during the Interpolation Mode operation. Up to 512 can be set, and the Relative axis/Absolute movement and Multi-axis Relative/Absolute interpolation can be set.



No.	Motion Type	Accel.	Decel.	Start Vel	Target Vel	Target Pos1	Arc Path1	Target Pos2	Arc Path2	Target Pos3	Arc Path3
1	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	None	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

- Monitoring

The X8 Position Manager provides the ability to monitor the detailed behavior of the axis.

- 2D Motion Profile
- 3D Position Plot

- Test Operation

- Homing Control
- E-point Control
- P-point Control
- Parameter and Operation Data setting
- Positioning Operation
- Change Operation setting during operation
- Error Code

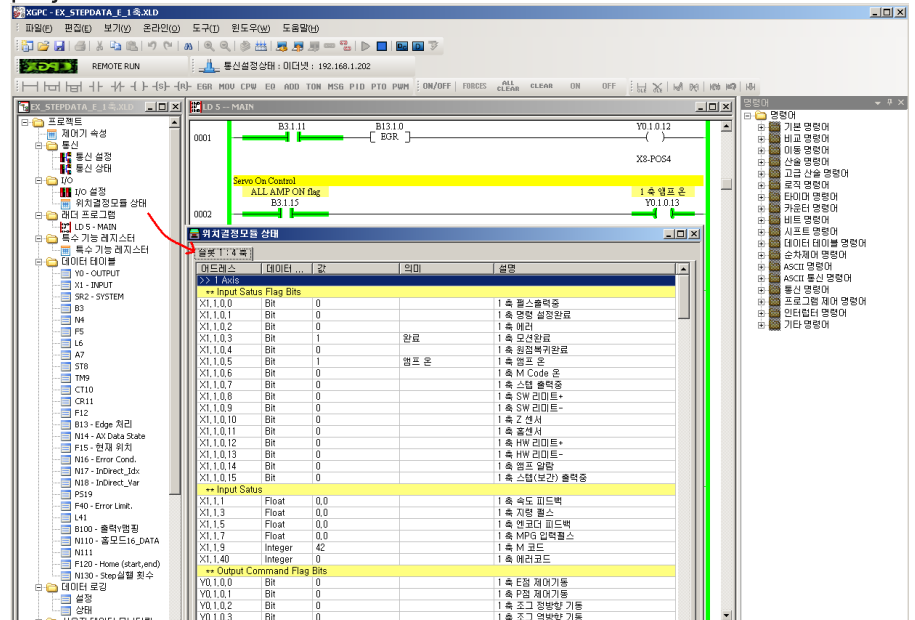
# XGPC Setting

## Common Contents

XGPC is dedicated software for X8 series PLC distributed by RS Automation. To use X8 position module, you need to register the information of hardware in XGPC. Also, various settings required for operation of the position module, pulse output direction, JOG Operation Speed, Homing Mode, Software Limit, etc. can be set.

## Read Current Status

In XGPC, you can click on the Positioning Module Status tab in the project tree to see detailed information..



## ■ Test Operation

For more detailed information, refer to the “Chapter 8. Positioning Control”

- Homing Control
- E-point Control
- P-point Control
- Parameter and Operation Data setting
- Positioning Operation
- Change Operation setting during operation
- Error Code

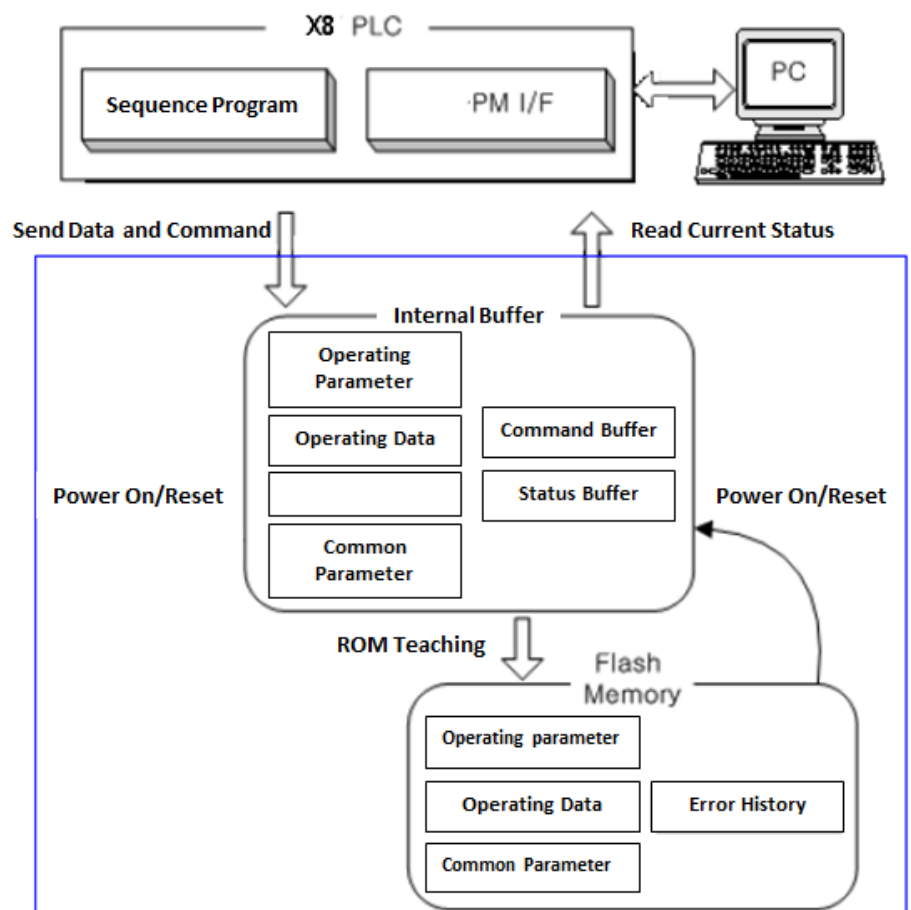
<b>6. Positioning Parameter and Operating Data .....</b>	<b>2</b>
Parameter & Operating Data Processing.....	2
Basic Parameter .....	3
Variables of basic I/O parameters	3
Basic Parameter Setting	4
Expansion Parameter .....	4
Variables in extended parameters	4
Expansion Parameter Setting	5
Manual Operation Parameter.....	6
Variables of manual operation parameter	6
Manual Operation Parameter Setting	7
Homing(Home-return) Parameter .....	7
Variables of homing(Home-return) parameters	7
Home(Home-return) Parameter Setting	8
MPG Input Parameter .....	8
Variables of MPG signal parameters	8
MPG Signal Parameter Setting	9
Sensor Operation Signal Parameter .....	10
Various of Sensor Operation Signal Parameter	10
Sensor Operating Signal Parameter Setting	11
Common Parameter .....	11
Variables of common parameters	11
Common Parameter Setting	12

## 6. Positioning Parameter and Operating Data

This Chapter describes the internal parameter of positioning module and required data for operating. Parameter and starting data must be set for each axis.

### Parameter & Operating Data Processing

The internal flow chart for processing parameters and operation data is as follows.



# Basic Parameter

## Variables of basic I/O parameters

### Pulse Output Mode

Specifies the type of output pulse. It supports 3 types mode such as One Pulse(Pulse/Sign), Two Pulse(CW/CCW) and AB Phase. Depending on the pulse output direction setting, “Forward/Reverse” direction is determined.

Pulse Output Direction : 0 (Forward Direction → Default)

- 0 : Two Pulse - CW/CCW A Low(default)
- 1 : Two Pulse - CW/CCW A High
- 2 : One Pulse - Pulse/Sign - High/High
- 3 : One Pulse - Pulse/Sign - Low/Low
- 4 : AB Phase - B lead A

Pulse Output Direction : 1 (Reverse Direction)

- 0 : Two Pulse - CW/CCW B Low
- 1 : Two Pulse - CW/CCW B High
- 2 : One Pulse - Pulse/Sign - High/Low
- 3 : One Pulse - Pulse/Sign - Low/High
- 4 : AB Phase - B lead A

The following table should be rearranged according to the setting values 0,1,2,3,4.

Setting Value	Logic	Pulse Type	Forward Rotation	Reverse Rotation	Input Multiplication
0	Positive Logic	CW + CCW			-
2		Pulse + Sign			-
4		A + B			1 Multiplication
5					2 Multiplication
6					3 Multiplication
1	Negative Logic	CW + CCW			-
3		Pulse + Sign			-

### Encoder Multiplication Setting

Specifies the count mode of the input encoder pulse.

- 0 : AB x 1 (default) (1 count of AB phase 1 pulse)
- 1 : AB x 2 (1 count of AB phase 2 pulse)
- 2 : AB x 4 (1 count of AB phase 4 pulse)

3 : CW/CCW x 1 (Each pulse counts 1 pulse)

## Encoder Direction

Specifies the count direction of input encoder pulse.

0 : A Lead B (default)

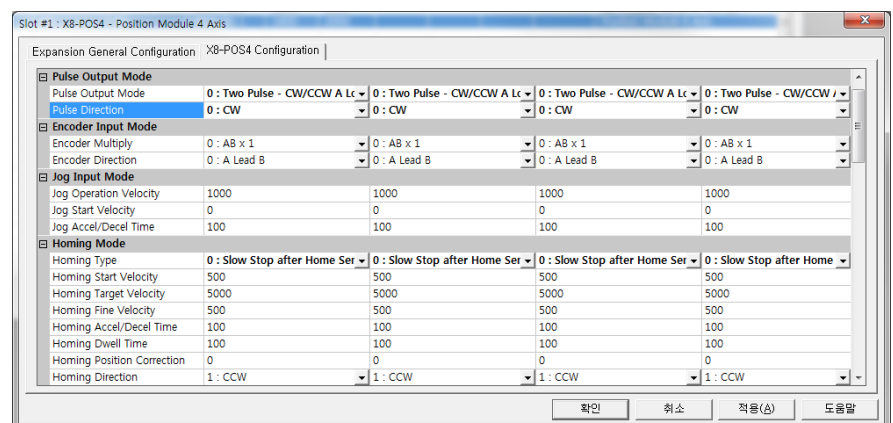
(Forward count when the A phase is ahead of the B phase)

1 : B Lead A

(Forward count when the B phase is ahead of the A phase)

## Basic Parameter Setting

Set related parameters in I/O setting of XGPC.



## Expansion Parameter

### Variables in extended parameters

#### Backlash Correction

When the position is moved, output in advance as much as the amount of correction, and move the next specified position.

#### Backlash Correction Type

0 : Not Used (Do not correct the output pulse)

1 : Backlash (Correct each time that changes direction)

2 : Slip (Correct every time that moves)

### Backlash Correction Error Value

(Corrected by the set value and command pulse output)

### Backlash Correction Speed Value

(Speed at which is correction amount is output)

### Pulse Counter/Resolution

(Number of pulses per motor revolution)

### Electronic Gear Ratio

(Gear Ratio applied to position and speed)

### M Code Output Mode

### Command Initial Value

### Position Initial Value

### Deviation initial value

## Expansion Parameter Setting

Set related parameters in I/O Setting of XGPC.

Slot #1 : X8-POS4 - Position Module 4 Axis

Expansion General Configuration | X8-POS4 Configuration

- ☐ Jog Input Mode
- ☐ Homing Mode
- ☐ MPG Input Mode
- ☐ Backlash Correction
  - Backlash Correction Type: 0 : Not Used
  - Backlash Correction Error: 0
  - Backlash Correction Velocity: 1
- ☐ Sensor Active Level Mode
- ☐ Stop Action Mode
- ☐ Software Limit
- ☐ Compare Output
- ☐ ETC
  - Pulse Count Per Revolution: 32768
  - Distance Per Revolution: 32768
  - M Code Output Mode: 1 : Output in starting
  - Command Initial Value: 0
  - Position Initial Value: 0
  - Error Initial Value: 0

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## Manual Operation Parameter

Variables of manual operation parameter

JOG Operation Setting.

### Jog High

(Target speed when high speed start point is ON)

### Jog Low

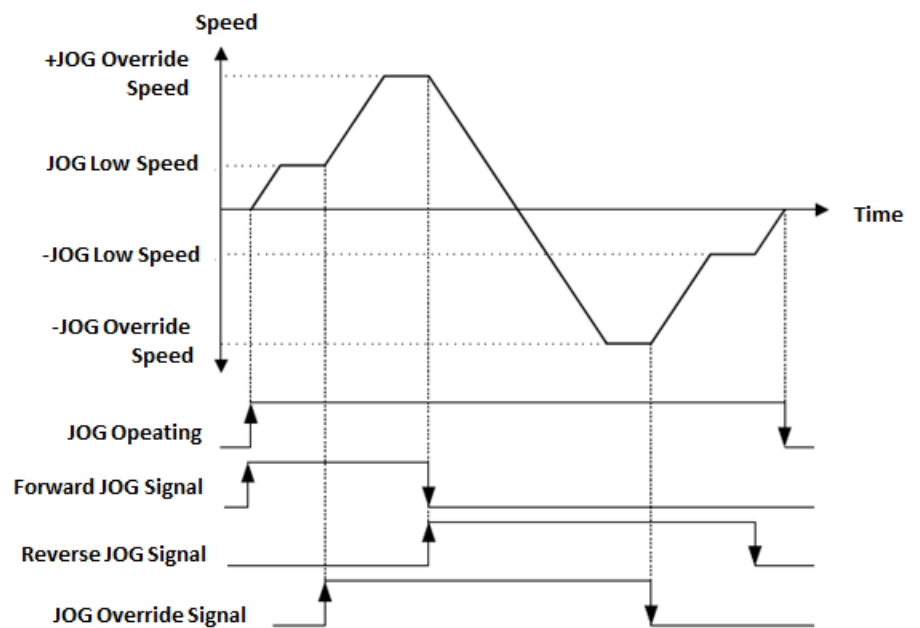
(Target speed when high speed start point is OFF)

### Jog Initial Speed

(Initial Speed of Jog operation)

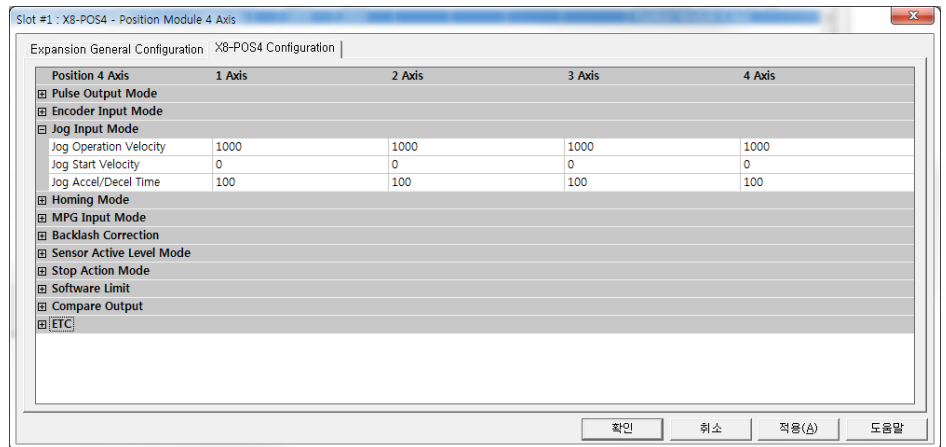
### Jog Acceleration/Deceleration Time

(Accel./Decel. Time(msec) of Jog operation)





## Manual Operation Parameter Setting



## Homing(Home-return) Parameter

### Variables of homing(Home-return) parameters

It is activated when bit 7 of the start command flag is ON. For detailed information, refer to the "chapter 10. Home Return".

#### Type

(Supported No.0~No.17 mode)

#### Initial Speed

(Initial Speed at Home-return operation)

#### Target Speed

(Target Speed at Home-return operation)

#### Home Speed

(Precision Moving Speed at Home-return operation)

#### Acceleration/Deceleration Time

(Acceleration/Deceleration Time (msec) at Home-return operation)

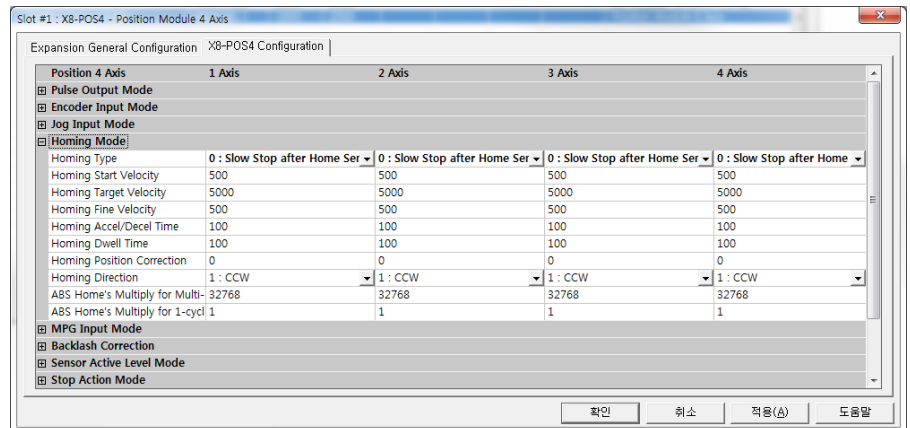
#### Correction Amount

(Distance from Homing sensor on Homing mode No.13)

#### Homing Direction

(If '0', start homing to Forward direction, '1' to Reverse direction)

## Home(Home-return) Parameter Setting



## MPG Input Parameter

### Variables of MPG signal parameters

#### Encoder Multiplication Setting

Specifies the count mode of the input encoder pulse.

- 0 : AB x 1 (default) (1 count of AB phase 1 pulse)
- 1 : AB x 2 (1 count of AB phase 2 pulse)
- 2 : AB x 4 (1 count of AB phase 4 pulse)
- 3 : CW/CCW x 1 (Each pulse counts 1 pulse)

#### Encoder Direction

Specifies the count direction of the input encoder pulse.

- 0 : A Lead B (default)  
(Forward count when the A phase is ahead of the B phase)
- 1 : B Lead A  
(Forward count when the B phase is ahead of the A phase)

#### How to move MPG

- 0 : MPG Speed Movement (default)

(When MPG is start operating, depending on the amount and speed at which the MPG pulses are counted)

1 : MPG Position Movement

(When MPG is start operating, the MPG pulse is reflected only by the amount set in 'MPG Mode - Max. Relative movement')

### Ratio

(The MPG pulse counts at a rate of 1 to 32 times and rotates the motor)

### Maximum Speed

(Limit the speed of actual motor movement relative to the speed of the MPG count)

### Maximum Relative Movement Amount

(Maximum movement amount when using the 'MPG position movement')

## MPG Signal Parameter Setting

Slot #1 : X8-POS4 - Position Module 4 Axis

Expansion General Configuration : X8-POS4 Configuration

	1 Axis	2 Axis	3 Axis	4 Axis
<input checked="" type="checkbox"/> Pulse Output Mode				
<input checked="" type="checkbox"/> Encoder Input Mode				
<input checked="" type="checkbox"/> Jog Input Mode				
<input checked="" type="checkbox"/> Homing Mode				
<input checked="" type="checkbox"/> MPG Input Mode				
Encoder Multiply	0 : AB x 1	0 : AB x 1	0 : AB x 1	0 : AB x 1
Encoder Direction	0 : A Lead B	0 : A Lead B	0 : A Lead B	0 : A Lead B
MPG Operation	0 : MPG Velocity Move	0 : MPG Velocity Move	0 : MPG Velocity Move	0 : MPG Velocity Move
Ratio	1	1	1	1
Max Velocity	5000	5000	5000	5000
Max Relative Move	10000	10000	10000	10000
MPG Initial Value	0	0	0	0
<input checked="" type="checkbox"/> Backlash Correction				
<input checked="" type="checkbox"/> Sensor Active Level Mode				
<input checked="" type="checkbox"/> Stop Action Mode				
<input checked="" type="checkbox"/> Software Limit				
<input checked="" type="checkbox"/> Compare Output				
<input checked="" type="checkbox"/> ETC				

확인 취소 적용(A) 도움말

### **Sensor Operation Signal Parameter**

#### Various of Sensor Operation Signal Parameter

Set for the operational level of each input signal.

##### **Amplifier Fault Level**

0 : Active Low

1 : Active High (default)

##### **In-position Level**

0 : Active Low (default)

1 : Active High

##### **Home Operating Level**

0 : Active Low (default)

1 : Active High

##### **Limit Operating Level**

0 : Active Low (default)

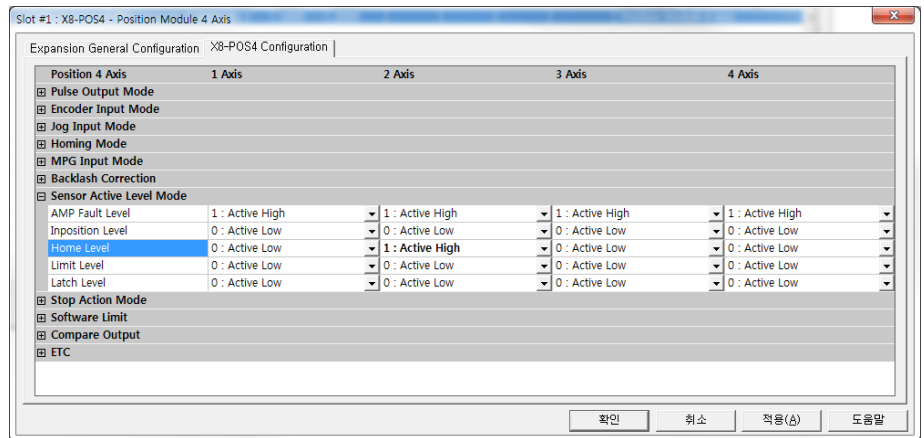
1 : Active High

##### **Latch Operating Level**

0 : Active Low (default)

1 : Active High

## Sensor Operating Signal Parameter Setting



## Common Parameter

### Variables of common parameters

#### Stop Operation Mode

Set the stopping operation of output pulse of motor according to the condition.

#### Limit Operation

1 : Slow Down Stop

(Decelerate to stop when limit sensor is detected)

2 : Emergency Stop (default)

(Immediate stop when limit sensor is detected)

#### Amplifier Fault Level

1 : Slow Down Stop

(Decelerate to stop when servo alarm is detected)

2 : Emergency Stop (default)

(Immediate stop when servo alarm is detected)

#### Soft Limit Positive Operation

0 : No Action (default) (Do not stop)

1 : Slow Down Stop

(Decelerate to stop when software limit value is exceeded)

## 2 : Emergency Stop

(Immediate stop when software limit value is exceeded)

### Soft Limit Negative Operation

0 : No Action (default) (Do not stop)

1 : Slow Down Stop

(Decelerate to stop when software Limit value is exceeded)

2 : Emergency Stop

(Immediate stop when software Limit value is exceeded)

### CPU Run to Stop Action

1 : Slow Down Stop (default)

(Decelerate to stop when CPU Run to Stop)

2 : Emergency Stop

(Immediate to stop when CPU Run to Stop)

### Software Limit

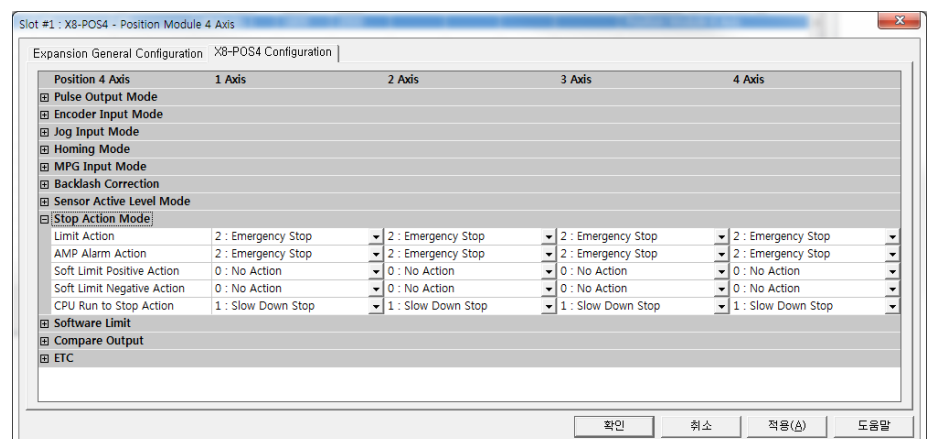
Software Limit High

(Upper limit value to use at Soft Limit Positive Action)

Software Limit Low

(Lower limit value to use at Soft Limit Negative Action)

## Common Parameter Setting



**7. Operating Data..... 2**

    I/O Table Allocation ..... 2

        Variable of I/O data ..... 2

        I/O Data Setting ..... 6

    Internal Memory ..... 7

        Index Run Data ..... 7

        Step Start Data ..... 9

        Teaching Start Data ..... 10

        Interpolation Start Data ..... 10

    Simultaneous Start Interpolation Data ..... 10

## 7. Operating Data

This chapter describes internal memory of positioning module. The internal memory is divided into I/O table allocation required for operation and operating data.

### I/O Table Allocation

Variable of I/O data

#### Input Point Allocation List

1-axis	2-axis	3-axis	4-axis	Name	Description	Type
X0	X10	X20	X30	Status	Status display	Bits
X1	X11	X21	X31	Velocity Feedback	Speed feedback	Float
X2	X12	X22	X32			
X3	X13	X23	X33	Position Command	Command pulse	Float
X4	X14	X24	X34			
X5	X15	X25	X35	Encoder Feedback	Encoder feedback	Float
X6	X16	X26	X36			
X7	X17	X27	X37	MPG Input Pulse	MPG input pulse	Float
X8	X18	X28	X38			
X9	X19	X29	X39	M Code	M code	Integer
X10	-	-	-	Error Code (1-axis module)		Integer
X20	X21	-	-	Error Code (2-axis module)		Integer
X40	X41	X42	X43	Error Code (4-axis module)		Integer

#### Status Display Bit List

1-axis	2-axis	3-axis	4-axis	Name	Description	Type
Bit 0	Bit 0	Bit 0	Bit 0	Axis Busy	During pulse output	Bit
Bit 1	Bit 1	Bit 1	Bit 1	Command Ack	Check flag of setting value change	Bit
Bit 2	Bit 2	Bit 2	Bit 2	Axis Error	Error	Bit
Bit 3	Bit 3	Bit 3	Bit 3	Motion Done	Pulse output Completion	Bit
Bit 4	Bit 4	Bit 4	Bit 4	Reserved	Reserved	Bit
Bit 5	Bit 5	Bit 5	Bit 5	AMP On	Amplifier ON	Bit
Bit 6	Bit 6	Bit 6	Bit 6	ABS Home Done	ABS Homing Completion	Bit



Bit 7	Bit 7	Bit 7	Bit 7	Step Run Busy	During step output	Bit
Bit 8	Bit 8	Bit 8	Bit 8	SW Limit +	SW Limit+	Bit
Bit 9	Bit 9	Bit 9	Bit 9	SW Limit -	SW Limit-	Bit
Bit 10	Bit 10	Bit 10	Bit 10	Z Sensor	Z Sensor	Bit
Bit 11	Bit 11	Bit 11	Bit 11	HOME Sensor	Homing sensor	Bit
Bit 12	Bit 12	Bit 12	Bit 12	HW LIMIT+	HW Limit+	Bit
Bit 13	Bit 13	Bit 13	Bit 13	HW LIMIT-	HW Limit-	Bit
Bit 14	Bit 14	Bit 14	Bit 14	AMP Alarm	Amplifier Alarm	Bit
Bit 15	Bit 15	Bit 15	Bit 15	Reserved	Reserved	Bit

### Output Point Allocation List

1-axis	2-axis	3-axis	4-axis	Name	Description	Type
Y0	Y20	Y40	Y60	Bit Command	Start command flag	Bits
Y1	Y21	Y41	Y61	Motion Type	Control code	Integer
Y2	Y22	Y42	Y62	Motion Type Detailed	Expansion control code	Integer
Y3	Y23	Y43	Y63	Acceleration Time	Acceleration time	Integer
Y4	Y24	Y44	Y64	Deceleration Time	Deceleration time	Integer
Y5	Y25	Y45	Y65	Target Position	Position command value	Float
Y6	Y26	Y46	Y66			
Y7	Y27	Y47	Y67	Start Velocity	Start Speed	Float
Y8	Y28	Y48	Y68			
Y9	Y29	Y49	Y69	Target Velocity	Target speed	Float
Y10	Y30	Y50	Y70			
Y11	Y31	Y51	Y71	Arc Path Point	Arc Path Point	Float
Y12	Y32	Y52	Y72			
Y13	Y33	Y53	Y73	Dwell Time	Dwell time	Integer
Y14	Y34	Y54	Y74	Step Number	Start number of step	Integer
Y15	Y35	Y55	Y75	Index Go Command	Index Start : Index Point Step Start : 15 words - Step End Number 16words - Repeat Number	Long
Y16	Y36	Y56	Y76			
Y17	Y37	Y57	Y77	Reserved	-	
Y18	Y38	Y58	Y78	Reserved	-	
Y19	Y39	Y59	Y79	Reserved	-	

### Start Command Flag List

1-axis	2-axis	3-axis	4-axis	Name	Description	Type
Bit 0	Bit 0	Bit 0	Bit 0	E-Motion Run	E-point control run	Bit
Bit 1	Bit 1	Bit 1	Bit 1	P-Motion Run	P-point control run	Bit
Bit 2	Bit 2	Bit 2	Bit 2	Jog CW Run	JOG forward direction run	Bit
Bit 3	Bit 3	Bit 3	Bit 3	Jog CCW Run	JOG Reverse direction run	Bit
Bit 4	Bit 4	Bit 4	Bit 4	Jog Velocity Override	JOG Velocity Override	Bit
Bit 5	Bit 5	Bit 5	Bit 5	MPG Run	MPG run	Bit
Bit 6	Bit 6	Bit 6	Bit 6	Index Start	Index run	Bit
Bit 7	Bit 7	Bit 7	Bit 7	Home Start	Home start	Bit
Bit 8	Bit 8	Bit 8	Bit 8	Step Start	Step start	Bit
Bit 9	Bit 9	Bit 9	Bit 9	Error Clear	Error clear	Bit
Bit 10	Bit 10	Bit 10	Bit 10	Emergency Stop	Emergency stop	Bit
Bit 11	Bit 11	Bit 11	Bit 11	Stop	Decelerate to stop	Bit
Bit 12	Bit 12	Bit 12	Bit 12	PCLR	Position Counter Error Clear	Bit
Bit 13	Bit 13	Bit 13	Bit 13	AMP On	Amplifier ON	Bit
Bit 14	Bit 14	Bit 14	Bit 14	AMP Error Clear	Amplifier Error Clear	Bit
Bit 15	Bit 15	Bit 15	Bit 15	Reserved	Reserved	Bit

### Control Code List

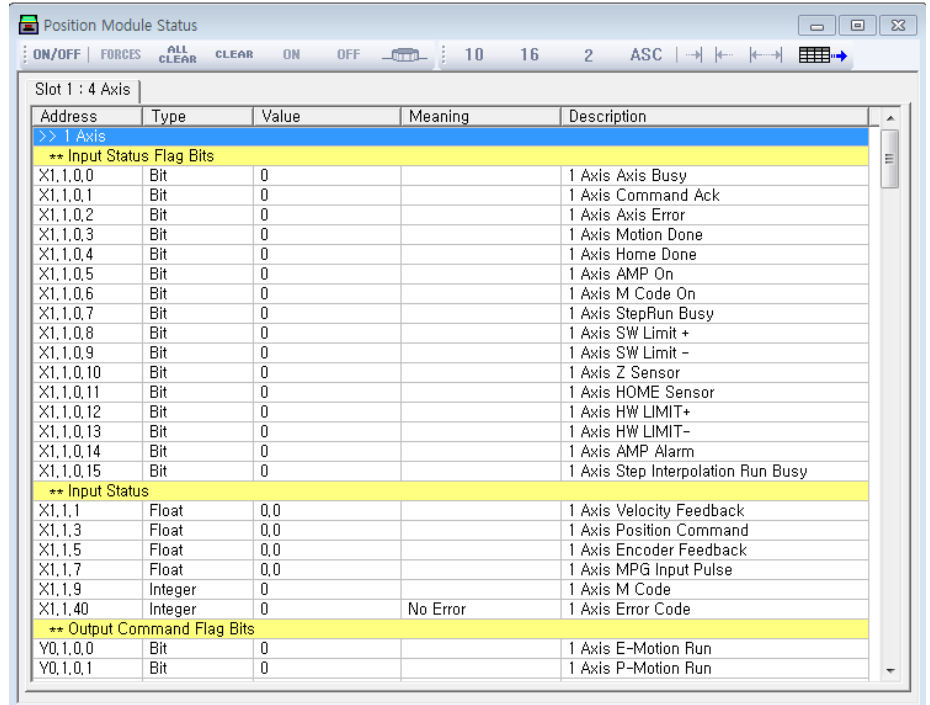
Value	Motion Function	Description	Cycle
0	None	Setting error	
1	RMOVE	Minor axis of relative movement command	
2	AMOVE	Minor axis of absolute movement command	
3	VMOVE	Minor axis of velocity movement command (JOG)	
4	PMOVE	Minor axis of inching movement command	
5	MPG_MOVE	Minor axis of MPG movement command	
6	HOME	Minor axis of home movement command	
7	L_RMOVE	Multiple axis of relative movement command	
8	L_AMOVE	Multiple axis of absolute linear interpolation	
9	C_RMOVE_XY	Multiple axis of relative circle interpolation (pivot interpolation)	For 3-axis interpolation, only 1/2/3 axes can be used. 4-axis cannot be used
10	C_AMOVE_XY	Multiple axis of absolute circle interpolation (pivot interpolation)	
11	C_RMOVE_PATH	Multiple axis of relative circle interpolation (Via point interpolation)	
12	C_AMOVE_PATH	Multiple axis of absolute circle interpolation (Via point interpolation)	
13	C_RMOVE_DEGREE	Multiple axis of relative circle interpolation (Rotation angle interpolation)	
14	C_AMOVE_DEGREE	Multiple axis of absolute circle interpolation (Rotation angle interpolation)	

### Detailed Control Code List

Bit No	Symbol	Description	Remark
Bit 0	Trapezoid/S-Curve	0 : Trapezoid, 1 : S Curve	
Bit 1	List Motion Enable (Deleted)	0 : Disable, 1 : Enable	Continuous control flag at step motion
Bit 2	CW/CCW Direction	0 : CW, 1 : CCW	When interpolating circular arc pivot or home direction
Bit 3	Reserved	0	
Bit 4	Reserved	0	
Bit 5	Reserved	0	
Bit 6	Reserved	0	
Bit 7	Reserved	0	
Bit 8	Axis #1 Enable	Interpolation axis enable at multi-axes interpolation	
Bit 9	Axis #2 Enable	Interpolation axis enable at multi-axes interpolation	
Bit 10	Axis #3 Enable	Interpolation axis enable at multi-axes interpolation	
Bit 11	Axis #4 Enable	Interpolation axis enable at multi-axes interpolation	
Bit 12	Reserved	0	
Bit 13	Reserved	0	
Bit 14	Reserved	0	
Bit 15	Reserved	0	

## I/O Data Setting

In XGPC's project tree, status information can be read or default value can be set by using the status module of position module.



The screenshot shows the 'Position Module Status' window. At the top, there are buttons for 'ON/OFF', 'FORCES', 'ALL CLEAR', 'CLEAR', 'ON', and 'OFF'. Below these are numerical values: 10, 16, 2, and 'ASC'. The main title is 'Slot 1 : 4 Axis'. The table below lists various status bits and their values.

Address	Type	Value	Meaning	Description
<b>&gt;&gt; 1 Axis</b>				
<b>** Input Status Flag Bits</b>				
X1.1.0.0	Bit	0		1 Axis Axis Busy
X1.1.0.1	Bit	0		1 Axis Command Ack
X1.1.0.2	Bit	0		1 Axis Axis Error
X1.1.0.3	Bit	0		1 Axis Motion Done
X1.1.0.4	Bit	0		1 Axis Home Done
X1.1.0.5	Bit	0		1 Axis AMP On
X1.1.0.6	Bit	0		1 Axis M Code On
X1.1.0.7	Bit	0		1 Axis StepRun Busy
X1.1.0.8	Bit	0		1 Axis SW Limit +
X1.1.0.9	Bit	0		1 Axis SW Limit -
X1.1.0.10	Bit	0		1 Axis Z Sensor
X1.1.0.11	Bit	0		1 Axis HOME Sensor
X1.1.0.12	Bit	0		1 Axis HW LIMIT+
X1.1.0.13	Bit	0		1 Axis HW LIMIT-
X1.1.0.14	Bit	0		1 Axis AMP Alarm
X1.1.0.15	Bit	0		1 Axis Step Interpolation Run Busy
<b>** Input Status</b>				
X1.1.1	Float	0.0		1 Axis Velocity Feedback
X1.1.3	Float	0.0		1 Axis Position Command
X1.1.5	Float	0.0		1 Axis Encoder Feedback
X1.1.7	Float	0.0		1 Axis MPG Input Pulse
X1.1.9	Integer	0		1 Axis M Code
X1.1.40	Integer	0	No Error	1 Axis Error Code
<b>** Output Command Flag Bits</b>				
Y0.1.0.0	Bit	0		1 Axis E-Motion Run
Y0.1.0.1	Bit	0		1 Axis P-Motion Run

## Internal Memory

This section explains the internal memory that can be used when applying the positioning module.

### Index Run Data

The point for index run supports 32 points and the address for running is as follows.

Output Address Y0.Δ.15	Name		Output Address Y0.Δ.16	Name	
Bit 0	Index Point 0		Bit 16	Index Point 16	
Bit 1	Index Point 1		Bit 17	Index Point 17	
Bit 2	Index Point 2		Bit 18	Index Point 18	
Bit 3	Index Point 3		Bit 19	Index Point 19	
Bit 4	Index Point 4		Bit 20	Index Point 20	
Bit 5	Index Point 5		Bit 21	Index Point 21	
Bit 6	Index Point 6		Bit 22	Index Point 22	
Bit 7	Index Point 7		Bit 23	Index Point 23	
Bit 8	Index Point 8		Bit 24	Index Point 24	
Bit 9	Index Point 9		Bit 25	Index Point 25	
Bit 10	Index Point 10		Bit 26	Index Point 26	
Bit 11	Index Point 11		Bit 27	Index Point 27	
Bit 12	Index Point 12		Bit 28	Index Point 28	
Bit 13	Index Point 13		Bit 29	Index Point 29	
Bit 14	Index Point 14		Bit 30	Index Point 30	
Bit 15	Index Point 15		Bit 31	Index Point 31	

After index run in program, operation is performed by index point allocation. Index point operates at Rising Edge.

The index run data in the positioning module can be up to 32 points and the contents are as follows.

Index Point Data Structure					Setting Range
Offset	1-axis	2-axis	3-axis	4-axis	Contents
0	0	16	32	48	Control code
1	1	17	33	49	Expansion Control code
2	2	18	34	50	Acceleration Time
3	3	19	35	51	Deceleration Time
4	4	20	36	52	Position command value
5	5	21	37	53	
6	6	22	38	54	Start Velocity
7	7	23	39	55	

# Table of Contents

8	8	24	40	56	Target Velocity
9	9	25	41	57	
10	10	26	42	58	
11	11	27	43	59	Arc Path Point
12	12	28	44	60	
13	13	29	45	61	Dwell Time
14	14	30	46	62	M Code
15	15	31	47	63	

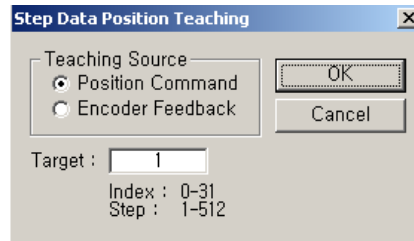
Index start data can be set easily using X8 PM.

Index Data																	
AXIS 1																	
	<<	>>	Upload	Download	Default Download	Export ...	Import ...										
No.	Motion Type	StepRun Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Arc Path	Dwell	MCode	Trapezoid/ S-Curve	CW/CCW Direction	Axis#1 Enable	Axis#2 Enable	Axis#3 Enable	Axis#4 Enable	Teaching
0	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 0
1	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 1
2	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 2
3	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 3
4	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 4
5	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 5
6	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 6
7	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 7
8	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 8
9	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 9
10	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 10
11	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 11
12	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 12
13	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 13
14	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 14
15	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	LoadTo 15



### Teaching Start Data

If the teaching data is set, the encoder value or position command value at the desired position can be copied to the index data or step data area and used as the start data.



### Interpolation Start Data

The address of interpolation data is the same as the step data, but it has additional data area for multi axis setting.

## Simultaneous Start Interpolation Data

The start instruction is executed after the start data is set first when the program is executed simultaneously.

Parameter	Data Table	Initial Setting Value	Contents
Expansion Control Code	Y0.Δ.2	0	Bit 8: 1-axis Enable Bit 9: 2-axis Enable Bit 10: 3-axis Enable Bit 11: 4-axis Enable



**8. Positioning Control..... 2**

    Minor axis of E-point Position Control..... 2

        Flow of E-point control operation ..... 2

        I/O contact point operation before and after E-point control ..... 4

        Example Program ..... 6

    Minor Axis of P-point Position Control..... 15

        Flow of P-point Control Operation ..... 15

        I/O Contract-point Operation before and after the P-point Control ..... 20

        Program Example ..... 22

        Note for P-point Control Program Creation ..... 31

## 8. Positioning Control

This chapter describes the positioning control.

E-point Control

P-point Control

### Minor axis of E-point Position Control

Flow of E-point control operation

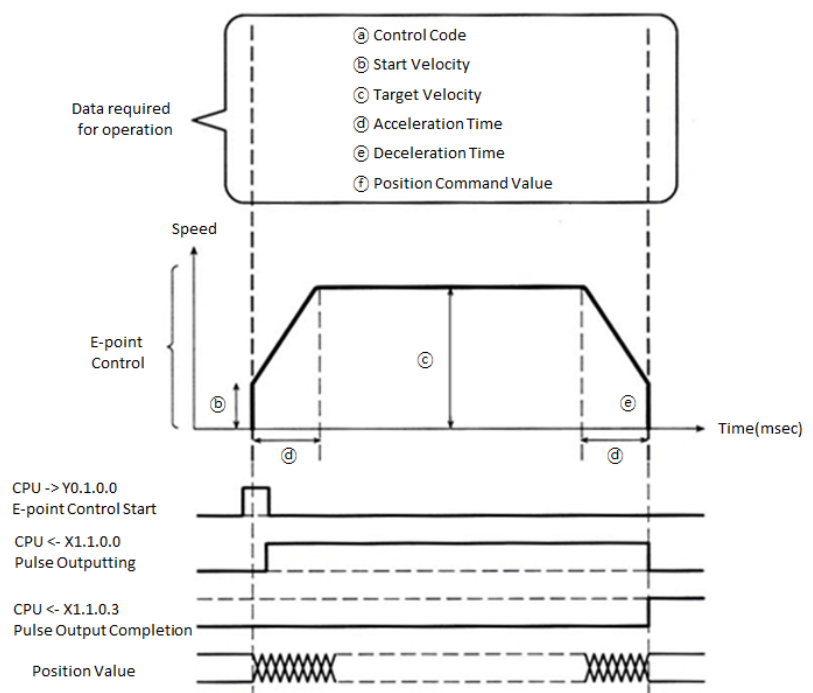
#### ■ E-point Control : Point to Point Control

When the E-point control start is turned ON, acceleration / deceleration control of short axis is automatically performed according to the specified data table. Acceleration/Deceleration can be specified separately, allowing symmetric / asymmetric velocity profiles to be generated. Trapezoid/S-Curve acceleration/deceleration can also be selected.

**When 4-axis type positioning unit is installed in slot 1**

Operation

When the E-point control start is turned ON, it decelerates to stop depending on setting.



※ When Y0.1.0.0 (E point control start contact) is turned ON by a ladder program, the 1-axis motor starts to accelerate.  
Input X1.1.0.0 is a BUSY point indicating that operation is in progress, and X1.1.0.3 is a point indicating completion of operation.  
The operation completion contact remains ON until the next operation request is given.

#### Setting Data

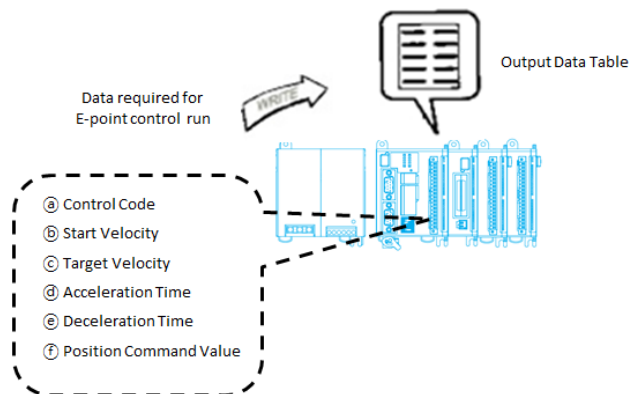
The following data must be entered in the output data table address. If you repeat the same operation, you do not need to reset it. The operation is determined by the following 6 kinds of data.

- Control Code
- Start Velocity
- Target Velocity
- Acceleration Time
- Deceleration Time
- Position Command Value

#### ■ Operation Step

##### Step 1 : Preparations

Send data for the operation in advance to output data table.

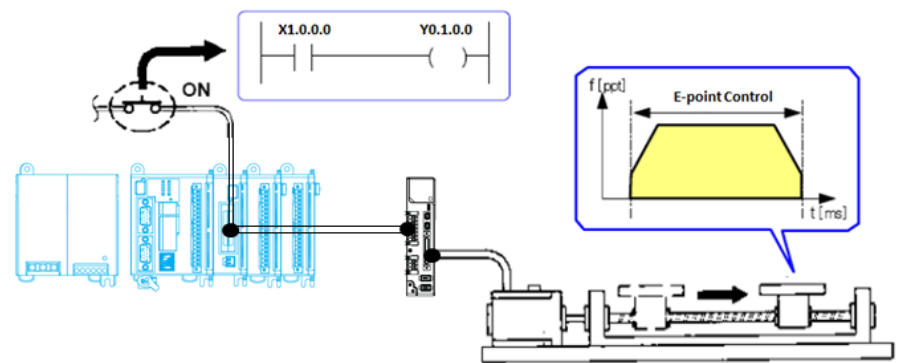


##### Step 2 Execution of Operation

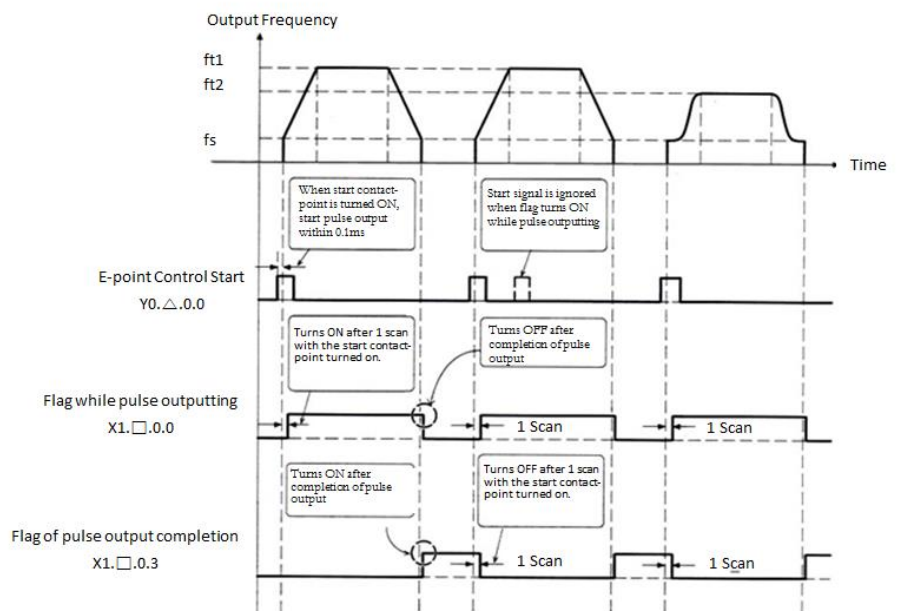
When Y0.1.0.0 (E-point control start contact) is turned ON, the operation starts. It determines whether it is S-curve acceleration/deceleration or linear acceleration/deceleration according to the control code.

It accelerates then decelerates from the start velocity to the target velocity by acceleration/deceleration time, and stops when it reaches the start velocity.

This amount of movement is specified by position command value.



I/O contact point operation before and after E-point control



※ Flag OFF of pulse outputting and Pulse output completion ON can be delayed as much as dwell time(Y0. Δ.13).

## ■ E-point Control Start Point (Y0.Δ.0.0)

- ① Start E-point control based on the parameters that entered in position unit.
- ② Does not start while the pulse outputting flag(X1.□.0.0) is turned ON.
- ③ Reset when power is turned OFF.

## ■ Pulse Outputting Flag (X1.□.0.0)

- ① It turns ON at the next scan after E point control is started, and turns OFF when pulse output is completed.
- ② While this signal is ON, another operation is not performed. (Excluding forced stop and decelerate to stop)
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, and Homing(Home-return) operation. (Excluding the pulse generator input permission)

■ Pulse Output Completion Flag (X1.□.0.3)

① It is turned ON when the pulse output is completed, then remains until the any operation of either E-point control, P-point control, JOG operation, Homing operation and pulse generator input permission is started.

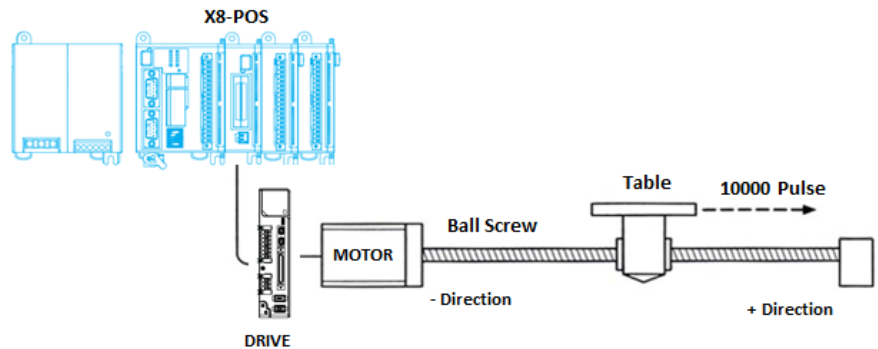
② Reset when power if turned OFF.

※ This flag is common operation to E-point control, P-point control, JOG operation, and pulse generator input permission.

## Example Program

Increment <Relative Value Control > : CW(+) Direction

The target position set in CW (+ direction) is set as relative movement and moved.



Axis no.1 starting parameter installed in slot no.1 (Starting Command : Y0.1.0 = 0x0001, E-point Control Start)

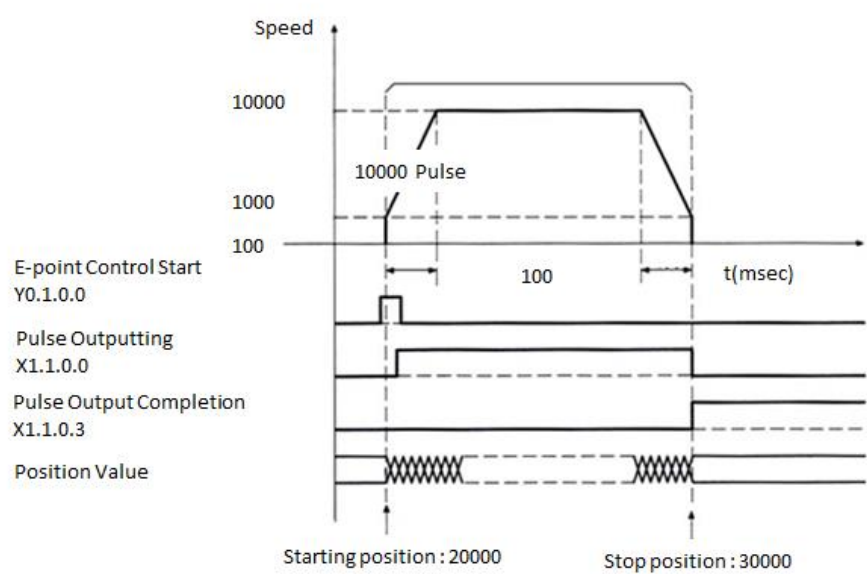
## Output Data Table Setting

Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value
Control Code	Y0.1.1	1
Expansion Control Code	Y0.1.2	0
Acceleration Time[ms]	Y0.1.3	100
Deceleration Time [ms]	Y0.1.4	100
Dwell Time[ms]	Y0.1.13	0
Position Command Value	Y0.1.5	+10000.0
Start Velocity	Y0.1.7	1000
Target Velocity	Y0.1.9	10000.0

## User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	Setting Value
Control Code	N4.0	Increment	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	0 : Trapezoid 1 : S-curve
Acceleration Time[ms]	N4.2	100	32,767
Deceleration Time [ms]	N4.3	0	32,767
Dwell Time[ms]	N4.4	0	Do not use in P-point Control
Position Command Value	F12.0	+10000.0	-2,147,483,648 ~ 2,147,483,647
Start Velocity	F12.0	1000	0~1,000,000
Target Velocity	F12.2	10000.0	1~1,000,000

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)



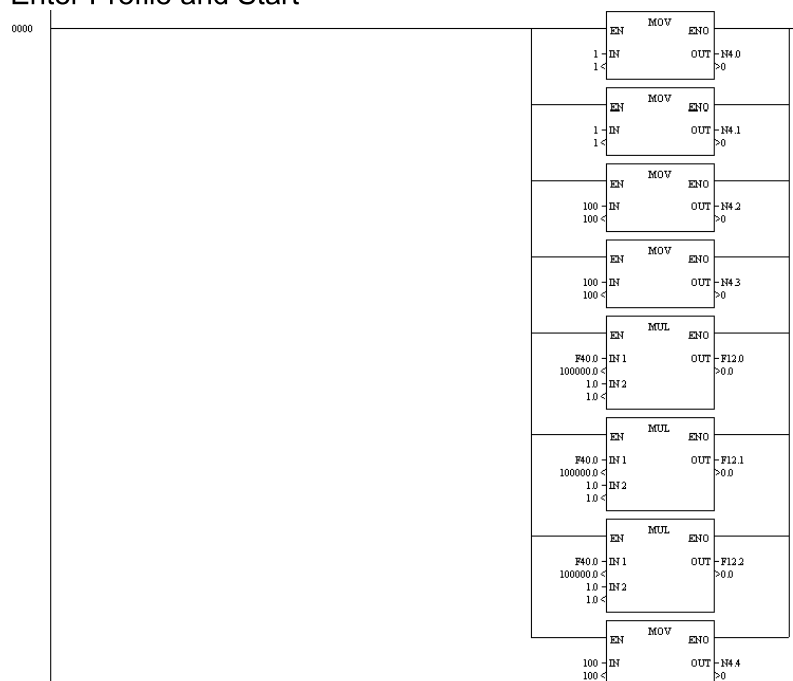
### ■ Each Flag Operation

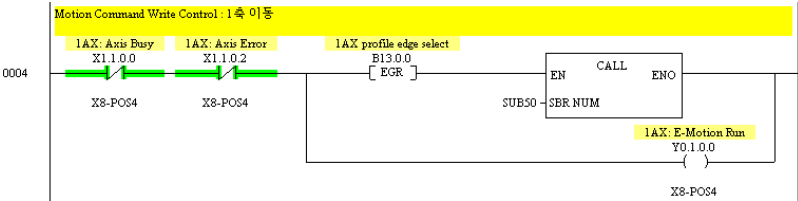
Pulse outputting flag (X1.1.0.0) turns ON at E-point control start and turns OFF when pulse output is completed.

Pulse output completion flag (X1.1.0.3) turns ON when pulse output is completed, then remains ON until the any operation of either E-point control, P-point control, JOG operation, Homing operation and pulse generator input permission is started.

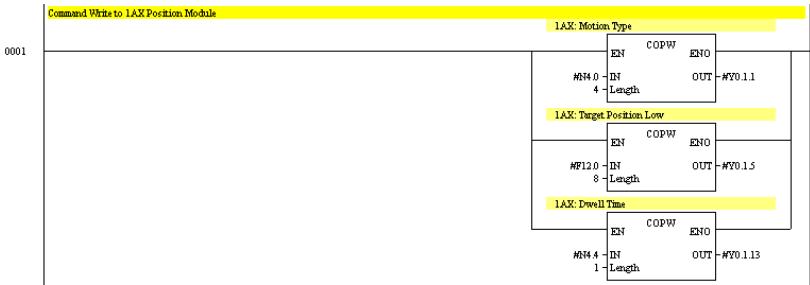
The position value is stored in the positioning unit's internal counter as an absolute value

### ■ Program Example Enter Profile and Start





WRITE Program in Output Data Table



■ Program Notes

The output data table that inputs each control parameter is used in common with other controls such as Acceleration/Deceleration control, JOG operation, Homing operation (Home-return). Do not overwrite with other conditions.

If each value of the start velocity, target velocity, acceleration/deceleration time, and position command value exceeds the settable range, a set value error occurs and it does not start.

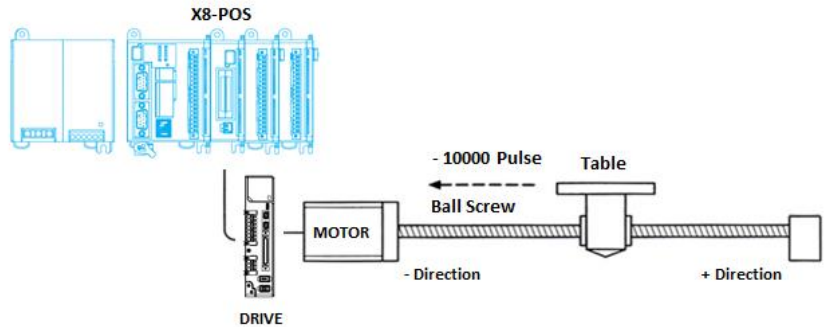
The starting contact number changes depending on the number of axes and the mounting position of the unit.

The slot number to be assigned and the output data table address change depending on the slot position and axis number of the positioning unit.



Increment <Relative Value Control > : CCW(-) Direction

The target position set in CCW (- direction) is set as relative movement and moved.



Axis no.1 starting parameter installed in slot no.1 (Starting Command : Y0.1.0 = 0x0001, E-point Control Start)

#### Output Data Table Setting

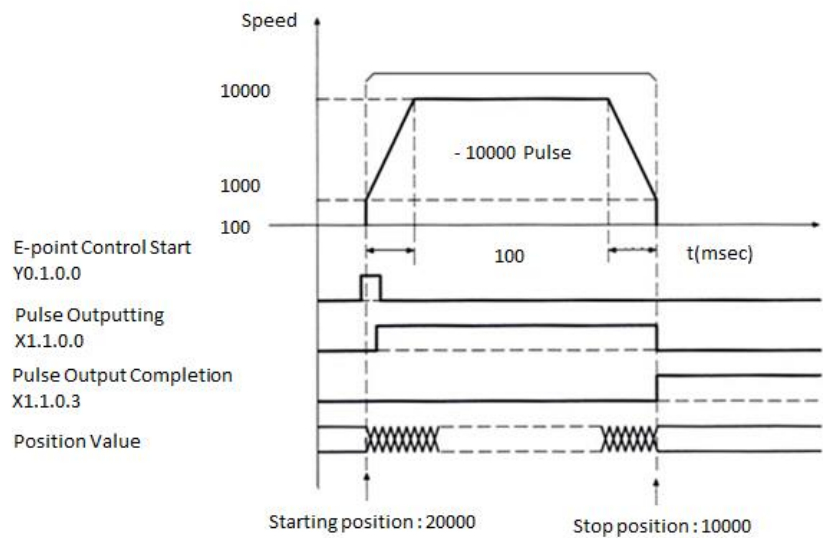
Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value
Control Code	Y0.1.1	1
Expansion Control Code	Y0.1.2	0
Acceleration Time[ms]	Y0.1.3	100
Deceleration Time [ms]	Y0.1.4	100
Dwell Time[ms]	Y0.1.13	0
Position Command Value	Y0.1.5	-10000.0
Start Velocity	Y0.1.7	1000
Target Velocity	Y0.1.9	10000.0

#### User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	Setting Value
Control Code	N4.0	Increment	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	0 : Trapezoid 1 : S-curve
Acceleration Time[ms]	N4.2	100	32,767
Deceleration Time [ms]	N4.3	0	32,767
Dwell Time[ms]	N4.4	0	Do not use in P-point Control
Position Command Value	F12.0	+10000.0	-2,147,483,648 ~ 2,147,483,647
Start Velocity	F12.0	1000	0~1,000,000
Target Velocity	F12.2	10000.0	1~1,000,000

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)

# Table of Contents



- Each Flag Operation

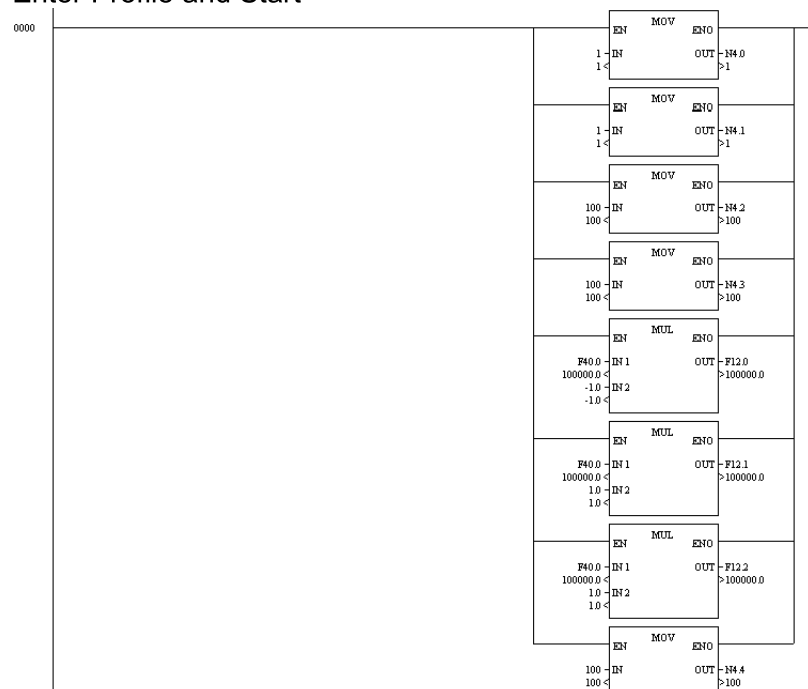
Pulse outputting flag (X1.1.0.0) turns ON at E-point control start and turns OFF when pulse output is completed.

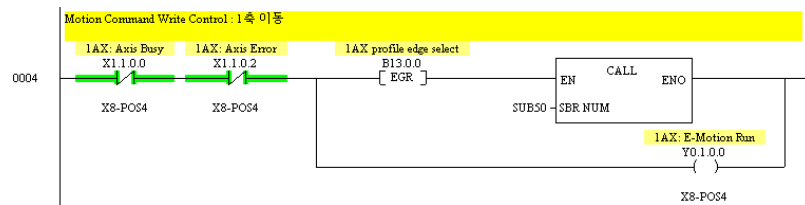
Pulse output completion flag (X1.1.0.3) turns ON when pulse output is completed, then remains ON until the any operation of either E-point control, P-point control, JOG operation, Homing operation and pulse generator input permission is started.

The position value is stored in the positioning unit's internal counter as an absolute value.

## ■ Program Example

Enter Profile and Start





## WRITE Program in Output Data Table

Command Write to 1AX Position Module			
0001	1AX: Motion Type		
	EN	COPW	ENO
	#N4.0 - 4 Length	IN	OUT
			#Y0.1.1
	1AX: Target Position Low		
	EN	COPW	ENO
	#F12.0 - 8 Length	IN	OUT
			#Y0.1.5
	1AX: Dwell Time		
	EN	COPW	ENO
	#N4.4 - 1 Length	IN	OUT
			#Y0.1.13

### Program Notes

The output data table that inputs each control parameter is used in common with other controls such as Acceleration/Deceleration control, JOG operation, Homing operation (Home-return). Do not overwrite with other conditions.

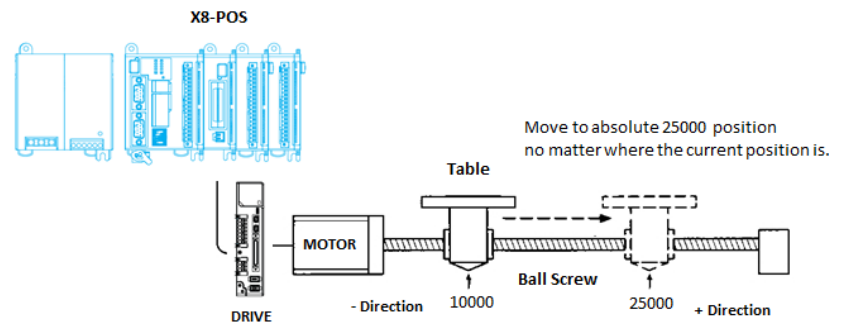
If each value of the start velocity, target velocity, acceleration/deceleration time, and position command value exceeds the settable range, a set value error occurs and it does not start.

The starting contact number changes depending on the number of axes and the mounting position of the unit.

The slot number to be assigned and the output data table address change depending on the slot position and axis number of the positioning unit.

## Absolute <Absolute Control>

Set the movement amount setting type as “Absolute”, and set the direction of rotation of the motor to positive (The elapsed value increases).



Axis no.1 starting parameter installed in slot no.1 (Starting Command : Y0.1.0 = 0x0001, E-point Control Start)

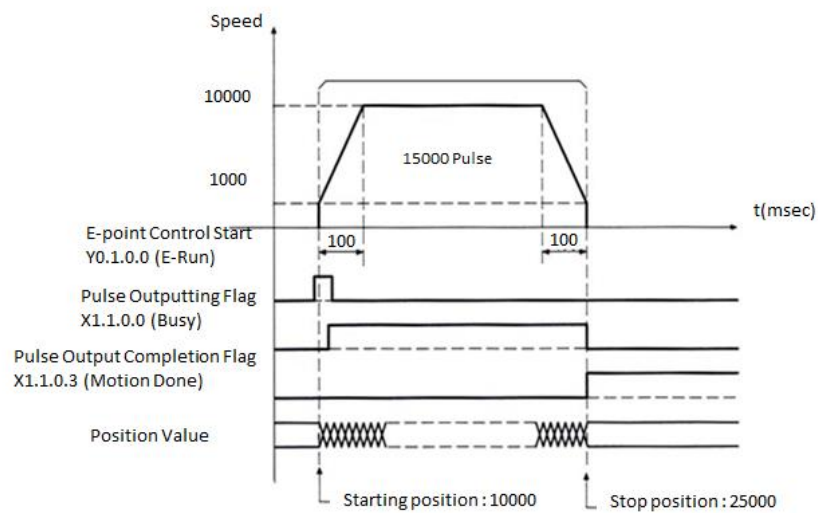
## Output Data Table Setting

Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value
Control Code	Y0.1.1	1
Expansion Control Code	Y0.1.2	0
Acceleration Time[ms]	Y0.1.3	100
Deceleration Time [ms]	Y0.1.4	100
Dwell Time[ms]	Y0.1.13	0
Position Command Value	Y0.1.5	25000.0
Start Velocity	Y0.1.7	1000
Target Velocity	Y0.1.9	10000.0

## User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	Setting Value
Control Code	N4.0	Increment	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	0 : Trapezoid 1 : S-curve
Acceleration Time[ms]	N4.2	100	32,767
Deceleration Time [ms]	N4.3	0	32,767
Dwell Time[ms]	N4.4	0	Do not use in P-point Control
Position Command Value	F12.0	+25000.0	-2,147,483,648 ~ 2,147,483,647
Start Velocity	F12.0	1000	0~1,000,000
Target Velocity	F12.2	10000.0	1~1,000,000

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)



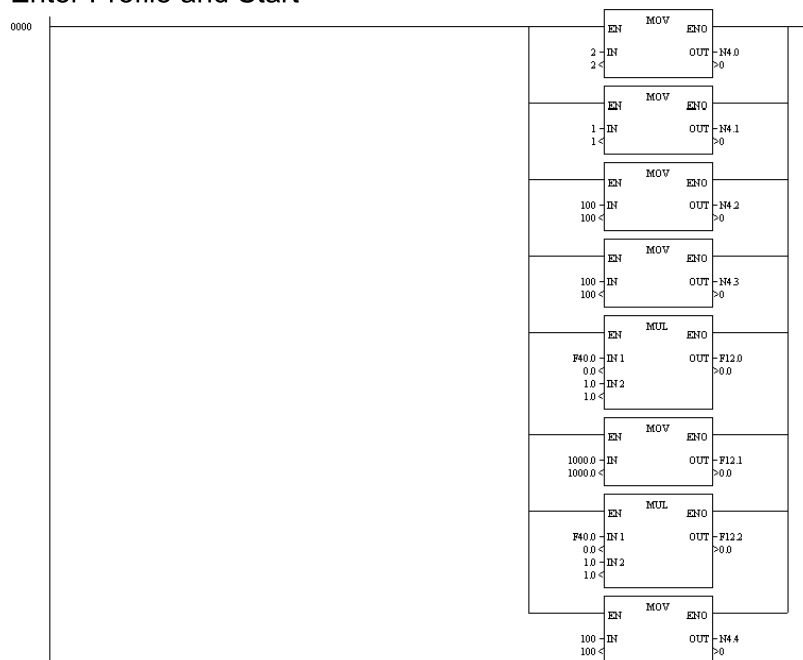
#### ■ Each Flag Operation

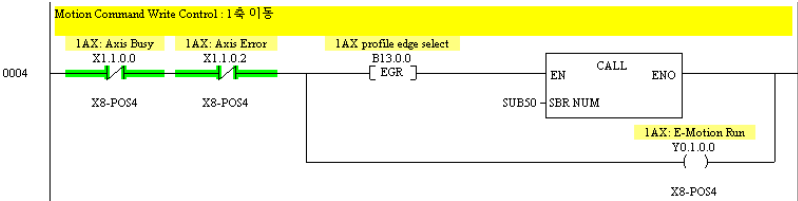
Pulse outputting flag (X1.1.0.0) turns ON at E-point control start and turns OFF when pulse output is completed.

Pulse output completion flag (X1.1.0.3) turns ON when pulse output is completed, then remains until the any operation of either E-point control, P-point control, JOG operation, Homing operation and pulse generator input permission is started.

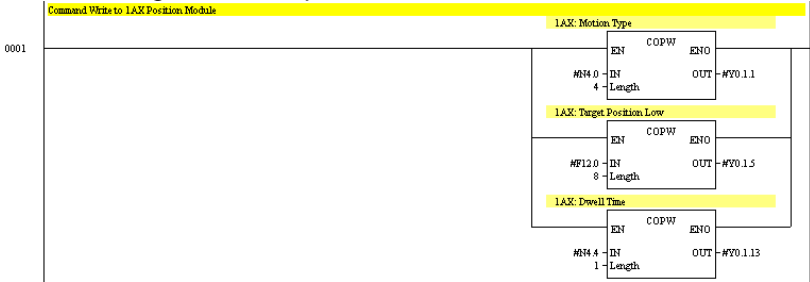
The position value is stored in the positioning unit's internal counter as an absolute value

#### ■ Program Example Enter Profile and Start





WRITE Program in Output Data Table



■ Program Notes

The output data table that inputs each control parameter is used in common with other controls such as Acceleration/Deceleration control, JOG operation, Homing operation (Home-return). Do not overwrite with other conditions.

If each value of the start velocity, target velocity, acceleration/deceleration time, and position command value exceeds the settable range, a set value error occurs and it does not start.

The starting contact number changes depending on the number of axes and the mounting position of the unit.

The slot number to be assigned and the output data table address change depending on the slot position and axis number of the positioning unit.

# Minor Axis of P-point Position Control

## Flow of P-point Control Operation

### ■ P-point Control : Continuous Movement Control

When the contact-point is turned ON for start-up, acceleration/deceleration is repeated and stopped according to the setting of the specified data table.

By confirming the command confirmation contact-point, it is possible to move the continuous movement repeatedly several times.

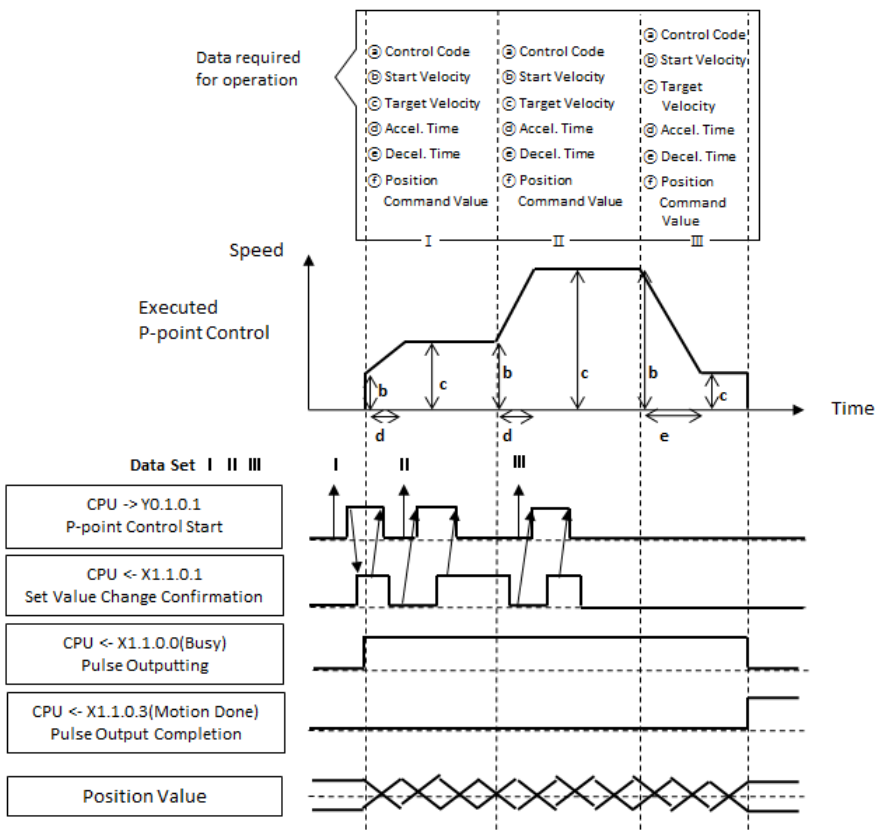
Acceleration/deceleration can be specified, allowing symmetric/asymmetric velocity profiles to be generated.

Trapezoidal/S-curve acceleration/deceleration can also be selected.

### Mounting the 4-axis type positioning unit in slot 1

#### Example Operation

When the contact is turned ON to start the P-point control, acceleration/deceleration is repeatedly moved and stopped according to the setting.



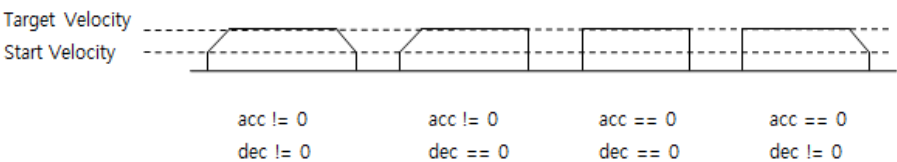
#### TIP

When Y0.1.0.1 is turned ON by the ladder program, the 1st axis motor starts to accelerate.

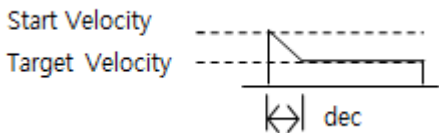
Input X1.1.0.0 is a BUSY contact-point indicating that

	operation is in progress, and X1.1.0.3 is a contact-point indicating completion of operation. After completion of operation, the operation completion contact-point remains ON until a new operation request is given.
--	---

※ Supported Speed Profile



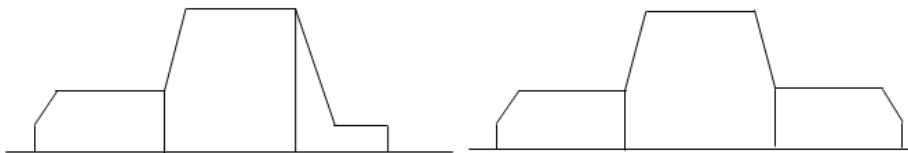
In the third of these profiles, the starting speed will be meaningless. If the acceleration is 0 and the deceleration is present as in the fourth case, the specified target speed is used as the starting speed, and the value entered as the starting speed is used as the lower speed of deceleration.



As shown in the figure above, if the starting velocity is higher than the target velocity, the profile will start to decelerate immediately and the acceleration time will be ignored (Do not care process).

<b>TIP</b>	If the starting velocity is larger than the target velocity as described above, the deceleration starts immediately. Therefore at low speed, it takes a long time to reach the target position. Use the fourth profile if necessary.
------------	--

※ P-point Control Velocity Profile Application Example



Setting Data  
Each step of I, II, and III in the figure on the previous page, it is necessary to input to the address of the output data table in order of the operation to execute the data as shown below. Check the setting value change confirmation flag (X1.1.0.1) and enter it in order.

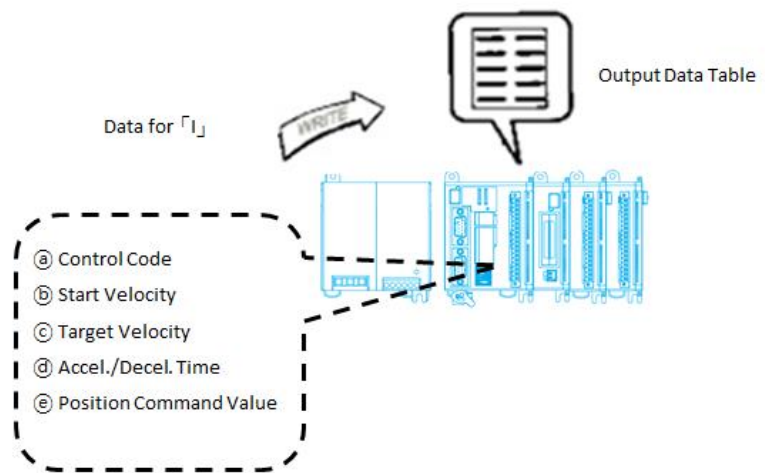


「 I 」	「 II 」,「 III 」
Control Code	Control Code
Start Velocity	Start Velocity
Target Velocity	Target Velocity
Acceleration/Deceleration Time	Acceleration/Deceleration Time
Position Command Value	Position Command Value

## ■ Operation Step

### Step 1 : Preparation

For 「 I 」 operation, send data to output data table in advance.



### Step 2 : 「 I 」 Execution of Operation

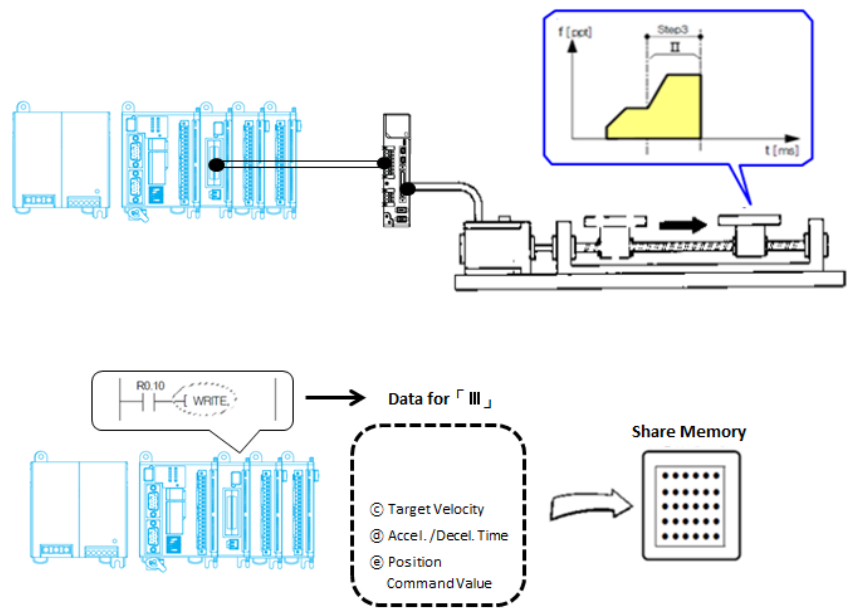
Starts operation when P point control start contact-point Y0.1.0.1 is turned ON.

At this time, the constant value change confirmation flag X1.1.0.1 turns ON, and then the start contact Y0.1.0.1 turns OFF again. When the set value change confirmation flag X1.1.0.1 turns ON, it means that the command has been received. If the start contact Y0.1.0.1 is set to OFF, the set value change confirmation flag X1.1.0.1 turns OFF when the next command is ready to be received again.

### Step 3 : 「 II 」 Operation Execution

After confirming that the value change confirmation flag X1.1.0.1 is OFF, data for 「 II 」 operation is transferred to the output data table.

After the data is transferred, if the P-point control start contact Y0.1.0.1 is turned ON after 1 scan, 「 II 」 operation is prepared. If data is transferred, after turning on the P-point control start contact Y0.1.0.1 after 1 scan, 「 II 」 operation is prepared. Then, when the 「 I 」 operation is completed and the target position of 「 I 」 is reached, the operation starts continuously without stopping.

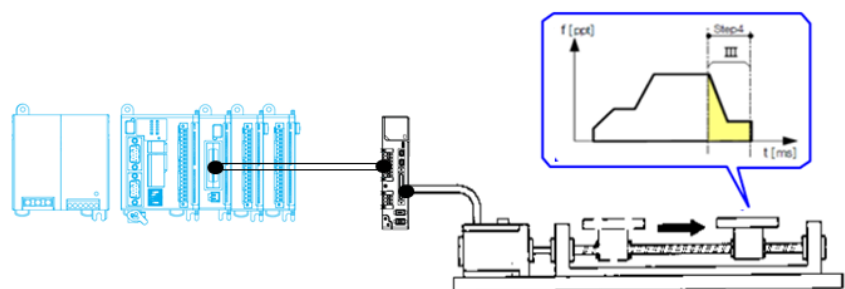


If the set value change confirmation flag X1.1.0.1 turns ON after the P-point control start contact-point Y0.1.0.1 turns ON, the start contact-point Y0.1.0.1 turns OFF again.

When the command confirmation contact X1.1.0.1 turns ON, it means that the command has been received. When the start contact-point Y0.1.0.1 is turned OFF and ready to receive the next command again, the command confirmation contact-point X1.1.0.1 turns OFF.

## Step 4 : 「III」 Operation Execution

After confirming that the set value change confirmation flag X1.1.0.1 is OFF, data for [III] operation is transferred to the output data table. If data 0 is transmitted, after "1" scan, turn on the P-point control start contact-point Y0.1.0.1 and "III" operation is prepared. There after, when the operation of [II] is completed and the target position of [II] is reached, the operation starts continuously without stopping.



If the set value change confirmation flag X1.1.0.1 turns ON after the P-point control start contact-point Y0.1.0.1 turns ON, the start contact-point Y0.1.0.1 turns OFF again.

When the command confirmation contact X1.1.0.1 turns ON, it means that the command has been received.

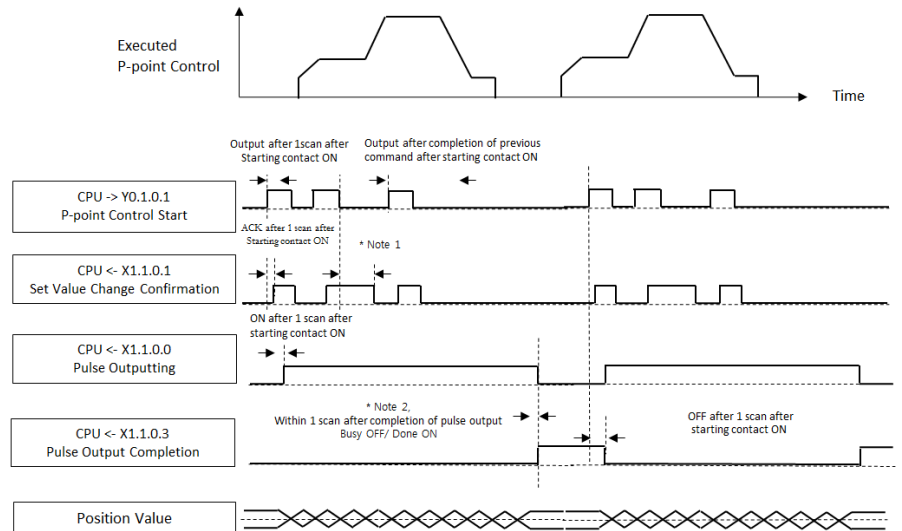
When the start contact-point Y0.1.0.1 is turned OFF and ready to receive the next command again, the command confirmation contact-point X1.1.0.1 turns OFF.

#### Step 5 : 「III」 Operation Completion

Before the 「III」 operation ends, if the following data is not prepared in advance, and if the new P-point control start contact Y0.1.0.1 is not turned on, it will be completed automatically.

When all operations are completed and movement is stopped, the move completion contact X1.1.0.3 turns ON.

## I/O Contract-point Operation before and after the P-point Control



### TIP

#### \*Note 1

Command Ack contact OFF point is within 1 scan after the start contact OFF, but if there are more than 3 consecutive commands that have already been entered but have not yet started to move, at least one command may be delayed until the movement is completed

#### \*Note 2

Pulse outputting OFF and the pulse output completion ON can be delayed as much as Dwell time(Y0.1.1.3).

### ■ P-point Control Start Contact-point (Output Y0.Δ.0.1)

- ① Starts P-point control based on the parameters entered in position unit. When the set value change confirmation flag (X1. □ .0.1) turns on, the P-point control start contact (Y0.Δ.0.1) must be turned off
- ② If the command confirmation contact (X1. □ .0.1) is OFF even while the pulse outputting flag (X1. □ .0.0) is ON, a new target position is set and the P-point control start contact-point is turned ON again. Therefore you can prepare the next command to be moved
- ③ Reset when power is turned OFF

■ Set Value Change Confirmation Flag (Input X1.□.0.1)

- ① P point control starts and turns ON after 1 scan.
- ② This is a flag that indicates that the command has been delivered when the command is sent to the P point control start contact (Y0.△.0.1).

The point at which the set value change confirmation flag turns OFF is the point at which the continuous move command in the internal wait is processed and a new continuous move command can be received.

- ③ Reset when power is turned OFF.

■ Pulse Outputting Flag (Input X1.□.0.0)

- ① It turns ON at the next scan after P point control is started, and turns OFF when pulse output is completed.
- ② It remains ON until the pulse output is completely stopped. It is turned OFF when the pulse output stops even if the movement operation is completed and stopped or forced stop or deceleration stop on the way.
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

■ Pulse Completion Flag (Input X1.□.0.3)

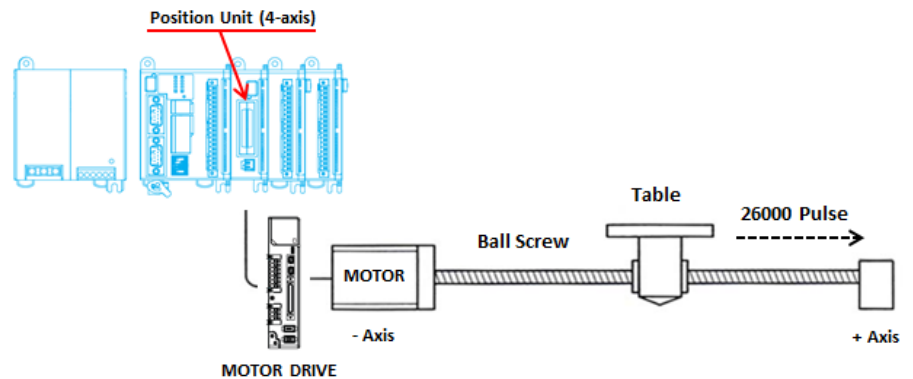
- ① It is turned ON when pulse output is completed, and then remains until E point control, P point control, JOG operation, MPG operation, and Homing(Home-return) operation are started.
- ② Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

## Program Example

Increment <Relative Value Control > : CW(+) Direction

Set the movement amount setting type as “Increment”, and set the direction of rotation of the motor to positive (The elapsed value increases). Moves continuously by setting the set target position as the relative movement amount.



Example of the 1<sup>st</sup> axis starting parameter installed in slot 1 (Start Command : Y0.1.0 = 0x0002, P-point Control Start)

### Output Data Table Setting

Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value
Control Code	Y0.1.1	1	1	1
Expansion Control Code	Y0.1.2	0	0	0
Acceleration Time[ms]	Y0.1.3	100	100	500
Deceleration Time [ms]	Y0.1.4	100	100	500
Dwell Time[ms]	Y0.1.13	0	0	0
Position Command Value	Y0.1.5	5000	15000	6000
Start Velocity	Y0.1.7	500		
Target Velocity	Y0.1.9	5000	20000	500

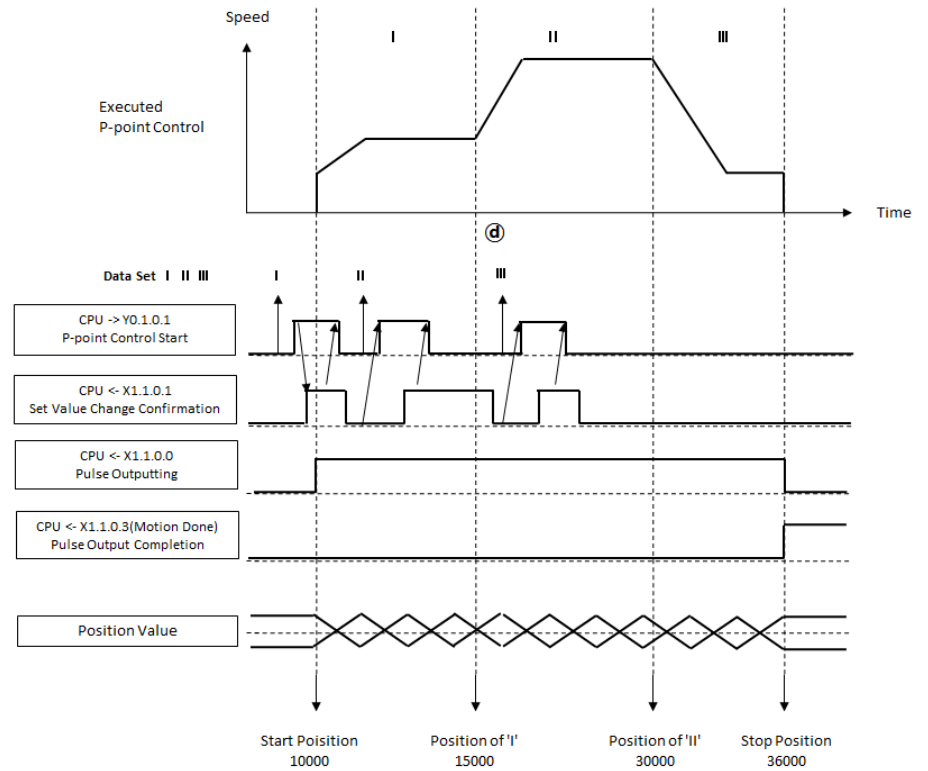
Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)

### User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value	Setting Range
Control Code	N4.0	Increment	Increment	Increment	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	Trapezoid	Trapezoid	0 : Trapezoid 1 : S-Curve
Acceleration Time[ms]	N4.2	100	100	0	32,767
Deceleration Time [ms]	N4.3	0	0	500	32,767
Dwell Time[ms]	N4.4	0	0	0	Do not use in P-point control
Position	F12.0	5000	15000	6000	-2,147,483,648 ~

Command Value					2,147,483.647
Start Velocity	F12.0	500			0~1,000,000
Target Velocity	F12.2	5000	20000	500	1~1,000,000

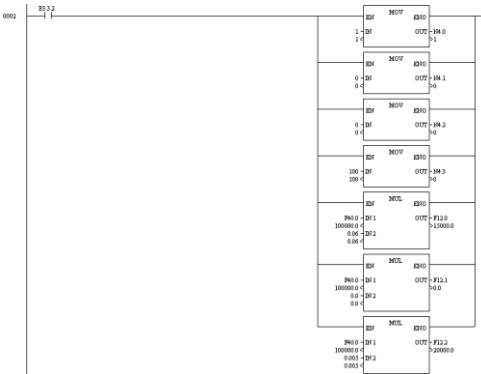
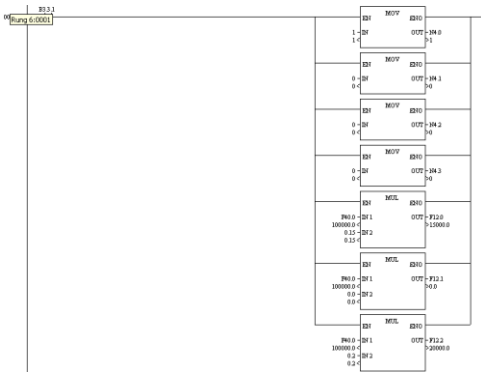
Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)



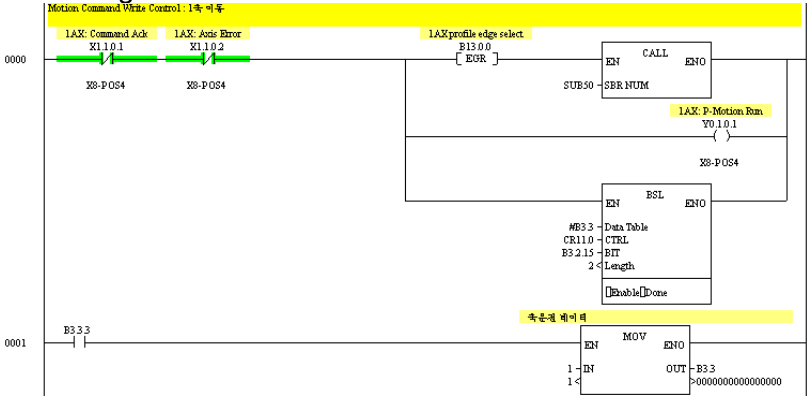
## ■ Program Example Enter Profile

Data Set I II III			
0000	1	0	0
0001	1	0	0
0002	1	0	0
0003	1	0	0
0004	1	0	0
0005	1	0	0
0006	1	0	0
0007	1	0	0
0008	1	0	0
0009	1	0	0
0010	1	0	0
0011	1	0	0
0012	1	0	0
0013	1	0	0
0014	1	0	0
0015	1	0	0
0016	1	0	0
0017	1	0	0
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0021	1	0	0
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0030	1	0	0
0031	1	0	0
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0040	1	0	0
0041	1	0	0
0042	1	0	0
0043	1	0	0
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0060	1	0	0
0061	1	0	0
0062	1	0	0
0063	1	0	0
0064	1	0	0
0065	1	0	0
0066	1	0	0
0067	1	0	0
0068	1	0	0
0069	1	0	0
0070	1	0	0
0071	1	0	0
0072	1	0	0
0073	1	0	0
0074	1	0	0
0075	1	0	0
0076	1	0	0
0077	1	0	0
0078	1	0	0
0079	1	0	0
0080	1	0	0
0081	1	0	0
0082	1	0	0
0083	1	0	0
0084	1	0	0
0085	1	0	0
0086	1	0	0
0087	1	0	0
0088	1	0	0
0089	1	0	0
0090	1	0	0
0091	1	0	0
0092	1	0	0
0093	1	0	0
0094	1	0	0
0095	1	0	0
0096	1	0	0
0097	1	0	0
0098	1	0	0
0099	1	0	0

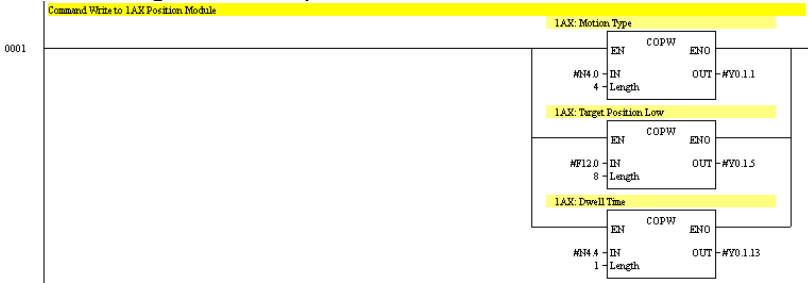
# Table of Contents



## Start Program



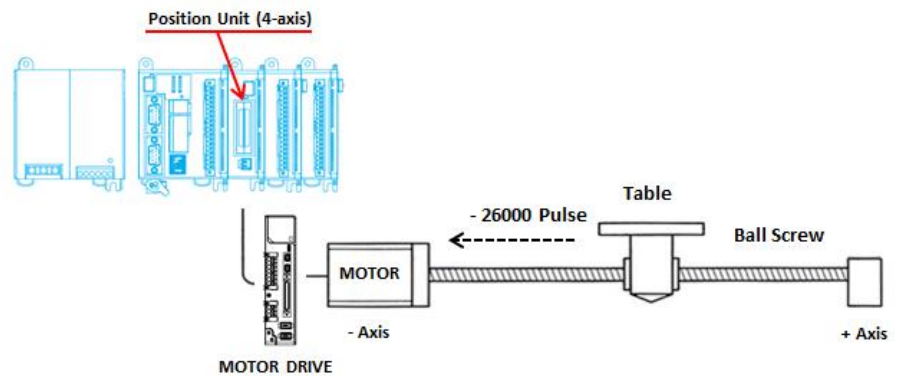
## WRITE Program in Output Data Table





Increment <Relative Value Control> : CCW(-) Direction

Set the movement amount setting type as “Increment”, and set the direction of rotation of the motor to positive (The elapsed value increases). Moves continuously by setting the set target position as the relative movement amount.



Example of the 1<sup>st</sup> axis starting parameter installed in slot 1 (Start Command : Y0.1.0 = 0x0002, P-point Control Start)

#### Output Data Table Setting

Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value
Control Code	Y0.1.1	1	1	1
Expansion Control Code	Y0.1.2	0	0	0
Acceleration Time[ms]	Y0.1.3	100	100	500
Deceleration Time [ms]	Y0.1.4	100	100	500
Dwell Time[ms]	Y0.1.13	0	0	0
Position Command Value	Y0.1.5	-5000	-15000	-6000
Start Velocity	Y0.1.7	500		
Target Velocity	Y0.1.9	5000	20000	500

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)

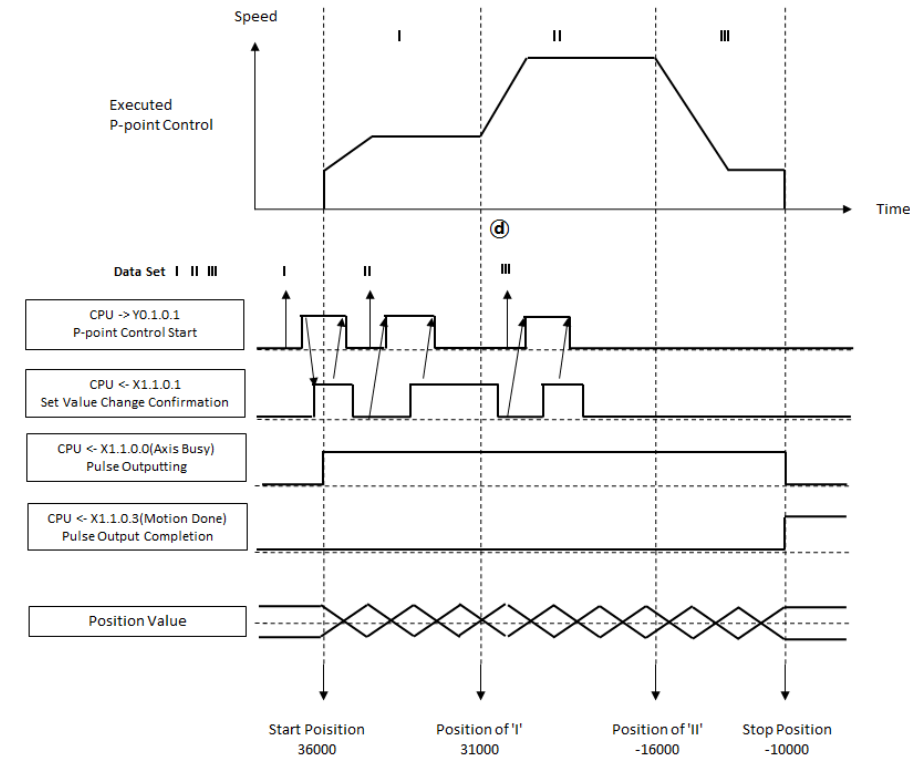
#### User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value	Setting Range
Control Code	N4.0	Increment	Increment	Increment	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	Trapezoid	Trapezoid	0 : Trapezoid 1 : S-curve
Acceleration Time[ms]	N4.2	100	100	0	32,767
Deceleration Time [ms]	N4.3	0	0	500	32,767
Dwell Time[ms]	N4.4	0	0	0	Do not use in P-point control
Position Command Value	F12.0	-5000	-15000	-6000	-2,147,483,648 ~ 2,147,483,647

# Table of Contents

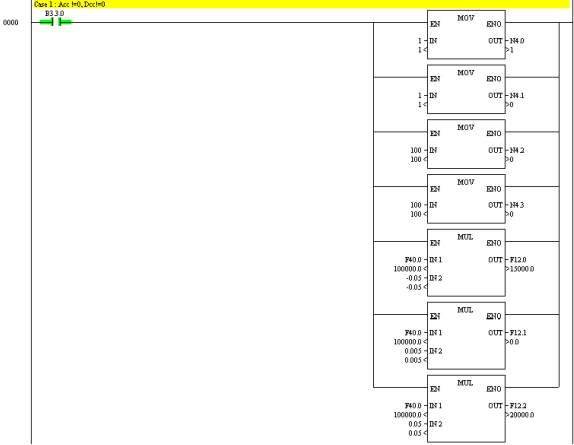
Start Velocity	F12.0	500			0~1,000,000
Target Velocity	F12.2	5000	20000	500	1~1,000,000

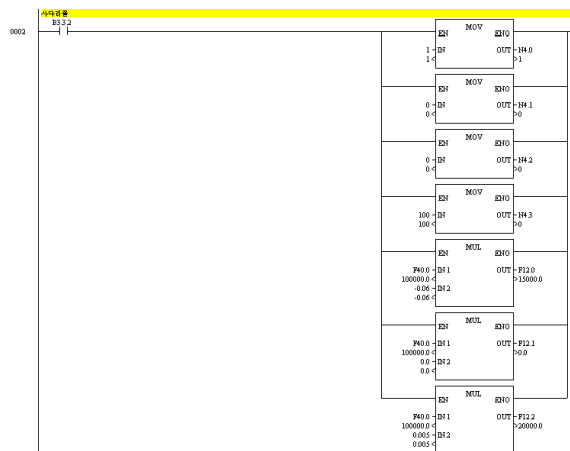
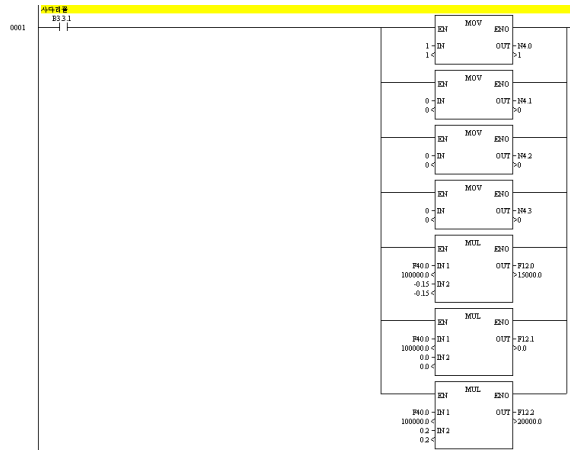
Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)



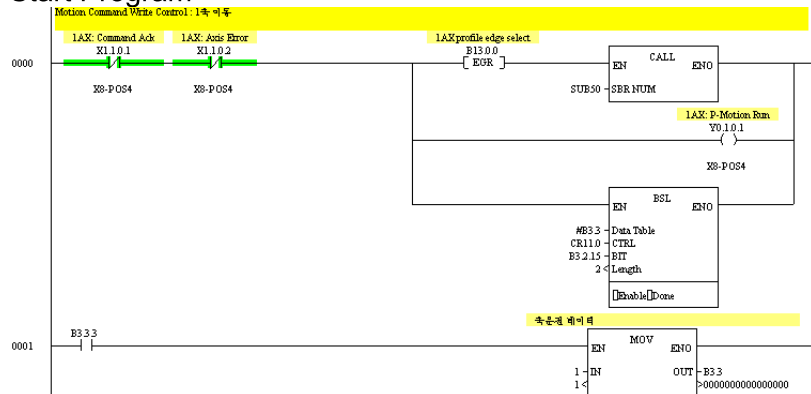
## Program Example

### Enter Profile

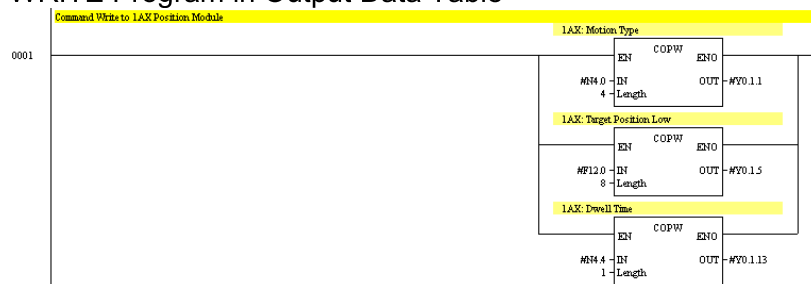




## Start Program



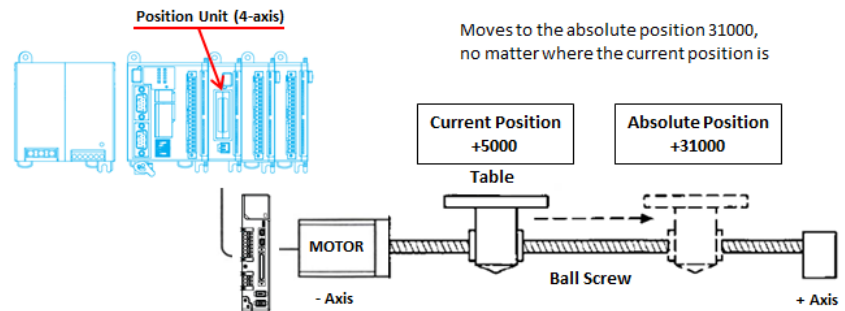
## WRITE Program in Output Data Table



# Table of Contents

## Absolute <Relative Value Control> : CW(+) Direction

Automatically determines the direction to move based on the current absolute position, and moves the set target position to the absolute position to be moved.



Example of the 1<sup>st</sup> axis starting parameter installed in slot 1 (Start Command : Y0.1.0 = 0x0002, P-point Control Start)

### Output Data Table Setting

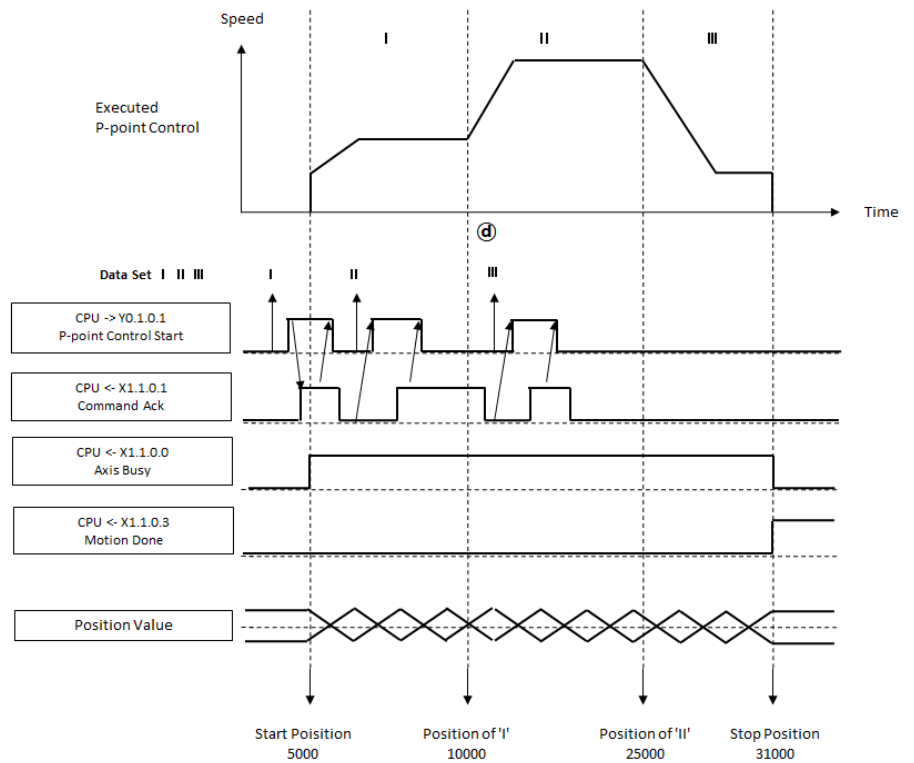
Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value
Control Code	Y0.1.1	1	1	1
Expansion Control Code	Y0.1.2	0	0	0
Acceleration Time[ms]	Y0.1.3	100	100	500
Deceleration Time [ms]	Y0.1.4	100	100	500
Dwell Time[ms]	Y0.1.13	0	0	0
Position Command Value	Y0.1.5	10000	25000	31000
Start Velocity	Y0.1.7	500		
Target Velocity	Y0.1.9	5000	20000	500

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)

### User Data Table Setting

Parameter	Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value	Setting Range
Control Code	N4.0	Absolute	Absolute	Absolute	1 : Increment 2 : Absolute
Expansion Control Code	N4.1	Trapezoid	Trapezoid	Trapezoid	0 : Trapezoid 1 : S-curve
Acceleration Time[ms]	N4.2	100	100	0	32,767
Deceleration Time [ms]	N4.3	0	0	500	32,767
Dwell Time[ms]	N4.4	0	0	0	Do not use in P-point control
Position Command Value	F12.0	10000	25000	31000	-2,147,483,648 ~ 2,147,483,647
Start Velocity	F12.0	500			0~1,000,000
Target Velocity	F12.2	5000	20000	500	1~1,000,000

Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)



## Program Example

### Enter Profile

Data Set I II III			
0000	IN	MOV	OUT
2-2	IN	OUT	IN 0
2-2	IN	OUT	IN 0
1-1	IN	OUT	IN 1
1-1	IN	OUT	IN 1
100-100	IN	OUT	IN 2
100-100	IN	OUT	IN 2
100-100	IN	OUT	IN 3
100-100	IN	OUT	IN 3
100000.0-0.1	IN	OUT	IN 0
0.1-0.1	IN	OUT	IN 0
100000.0-0.005	IN	OUT	IN 1
0.005-0.005	IN	OUT	IN 1
100000.0-0.05	IN	OUT	IN 2
0.05-0.05	IN	OUT	IN 2



Position Command Value and Encoder Feedback Monitoring  
 F15.0 : Target Velocity  
 F15.1 : Position Command Value  
 F15.2 : Encoder Feedback



### Note for P-point Control Program Creation

Caution for setting value change confirmation flag X1.□.0.1

Setting value change confirmation flag turns On/OFF at the timing as shown below, do not overwrite on output data table at the same time.

- OFF → ON condition

- ※ Turns ON when the set value is changed when P-point control start command is applied.

- ※ It is turned ON while the start command is held when P point control pulse output is completed.

- ON → OFF condition

- ※ When the P-point control start command is turned OFF after the P-point control start-up is applied and the set value is changed, it is OFF when ready to accept the next setting.

### IMPORTANT

It is OFF when the new setting value is written to the output data table and the internal memory for receiving the next setting value exists in the positioning module. Check the setting value change flag X1.□.0.1 in different conditions Insert an interlock into each circuit so that it does not change. Given information is important information that can help to understand and utilizing the product

### Example Ladder Program

**9. JOG Operation ..... 2**

    Flow of JOG Operation ..... 2

    Speed Change during JOG Operation..... 5

    I/O Contact Operation of Before and After Operation ..... 7

    Precautions for Speed Change during Operation ..... 8

    Program Example..... 8



# 9. JOG Operation

This chapter describes the JOG operation of position module.

## Flow of JOG Operation

### ■ JOG Operation

When the jog start contact-point is turned ON, the axis moves at a constant speed after accelerating using the preset parameters. When the stop contact-point is turned ON continuously, it stops at the moment.

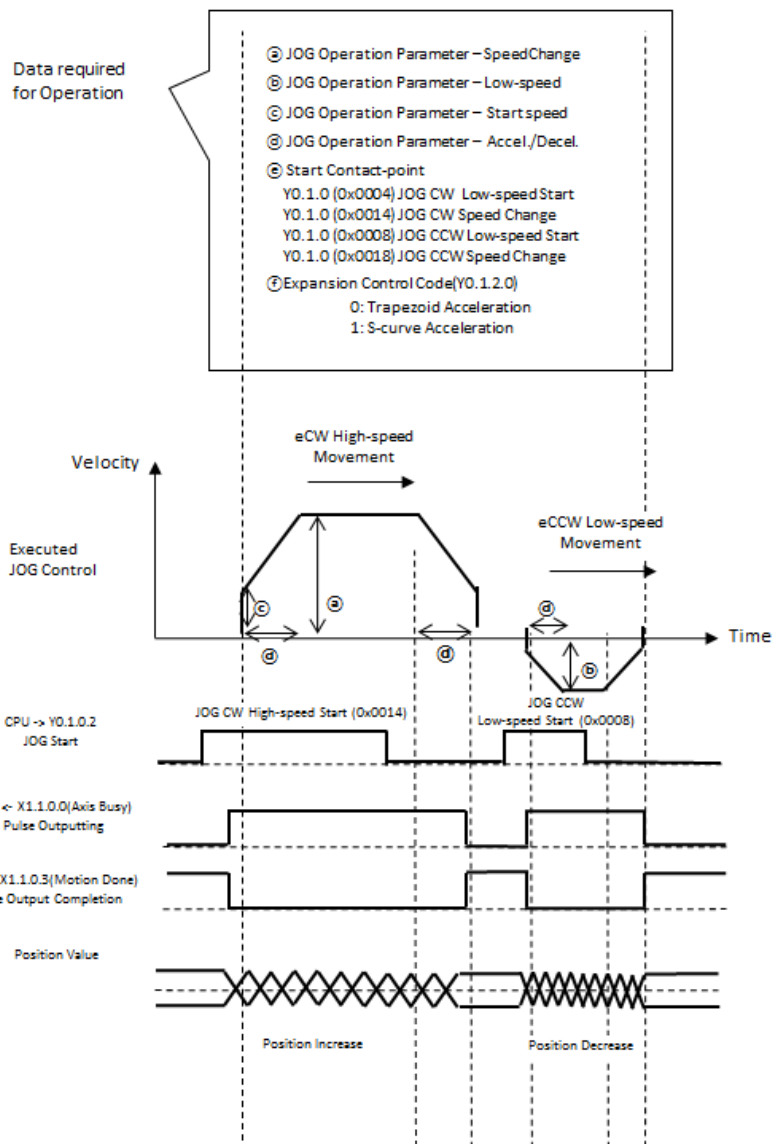
Output data table contact-point for JOG start is as follows.

Parameter	Output Data Table	Initial Value	Contents
1st Velocity	Y0.Δ.0.2	0	JOG forward direction start
Setting	Y0.Δ.0.3	0	JOG reverse direction start
Value	Y0.Δ.0.4	0	JOG speed change

### When 4-axis type positioning unit is installed in slot 1

#### Operation

If the JOG start contact-point is ON, it moves after acceleration. If the deceleration stop contact-point is ON during movement, it decelerates for the time applied during acceleration and then stops. If the rapid stop contact turns ON while moving, it will stop immediately without deceleration.



※ If JOG operation contact-point is ON by ladder program, it accelerates at the pre-entered start speed and accelerates to the target speed of high/low-speed and starts to move. When start contact-point is turned OFF, it will decelerate and stop.

Input X1.1.0.0 is a BUSY point indicating that operation is in progress, and X1.1.0.3 is a point indicating completion of operation. The operation completion contact remains ON until the next operation request is given.

### Data for Setting

The following parameter must be entered in the setting data.

- a JOG Operation Parameter – Speed Change Select
- b JOG Operation Parameter – Low-speed
- c JOG Operation Parameter – Start Speed
- d JOG Operation Parameter – Accel./Deceleration

<b>TIP</b>	<p>When the jog speed change is selected, the start speed and the target speed are connected to the control variables assigned to the output data table.</p> <p>Y0.Δ.3 : Acceleration/Deceleration Time Y0.Δ.7 : Start Speed Y0.Δ.9 : Target Speed</p>
------------	--

### ■ Operation Step

#### Step 1 : Preparation

For JOG operation, enter the JOG parameter in advance.

#### Step 2 : Execution of Operation

Turn ON the JOG start contact-point to move. Y0.1.0.2 is CW start, Y0.1.0.3 is JOG CCW start contact-point. When Y0.1.0.4 is OFF, it becomes JOG low-speed movement and if it's ON, Low/High-speed movement is performed in JOG speed change mode.

#### Step 3 : Operation Stop

Turns OFF the JOG start contact-point to stop. When it's OFF, it starts to decelerate to stop.

#### Step 4 : Operation Completion

When the deceleration is completed and stopped, the BUSY contact-point turns OFF and moving completion contact-point turns ON.

## Speed Change during JOG Operation

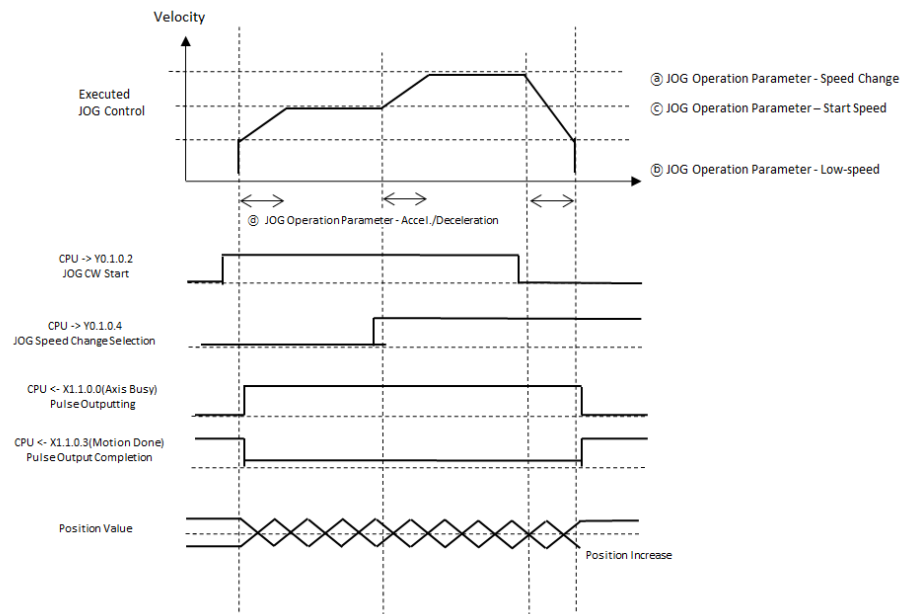
- When the jog speed change selection contact-point (Y0.Δ.4.4) is turned ON during jog start contact ON, the speed change mode is activated. If it's OFF, the speed change mode is released and the speed is changed at low speed.

Data Structure at JOG Speed Change Mode					Setting Range
Offset	1-axis	2-axis	3-axis	4-axis	Contents
0	Y0	Y20	Y40	Y60	
1	Y1	Y21	Y41	Y61	
2	Y2	Y22	Y42	Y62	
3	Y3	Y23	Y43	Y63	Accel./Decel. Time
4	Y4	Y24	Y44	Y64	
5	Y5	Y25	Y45	Y65	
6	Y6	Y26	Y46	Y66	
7	Y7	Y27	Y47	Y67	Start Speed
8	Y8	Y28	Y48	Y68	
9	Y9	Y29	Y49	Y69	Target Speed
10	Y10	Y30	Y50	Y70	
11	Y11	Y31	Y51	Y71	
12	Y12	Y32	Y52	Y72	
13	Y13	Y33	Y53	Y73	
14	Y14	Y34	Y54	Y74	
15	Y15	Y35	Y55	Y75	
16	Y16	Y36	Y56	Y76	
17	Y17	Y37	Y57	Y77	
18	Y18	Y38	Y58	Y78	
19	Y19	Y39	Y59	Y79	

## When 4-axis type positioning unit is installed in slot 1

Operation :

JOG Low-speed → Speed Change Mode Selection (High-speed Movement)



## Teaching after JOG Operation

### ■ Example of Teaching after JOG Operation

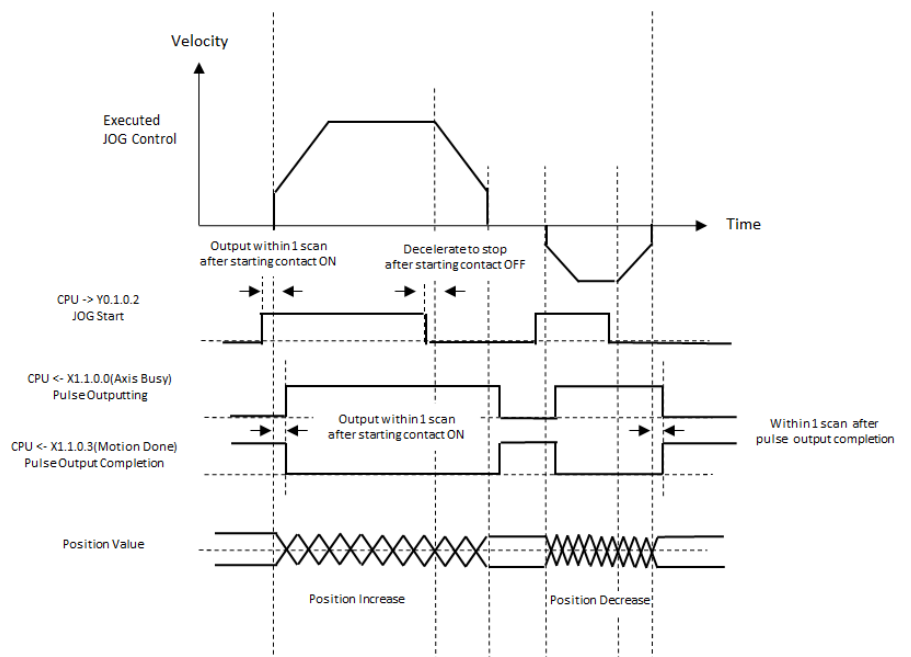
When move completion contact-point is ON after JOG.

If the movement complete contact-point is turned ON after stopping JOG movement, the read position value is the current absolute position. For the 1st axis, [X1.1.3 ~ 4] is the command pulse position value and [X1.1.5 ~ 6] is the encoder feedback position value  
The position value is Float type data(2 word size)

<<<< Ladder Block Diagram >>>>

After confirming movement completion, read current position and save.

## I/O Contact Operation of Before and After Operation



### ■ JOG CW Control Start Contact-point (Output Y0.Δ.0.2)

- ① Starts JOG CW(Forward direction) control based on the parameters on position module.
- ② While the start contact is ON, it continues to move in the CW direction. When it's OFF, it decelerates to stop.
- ③ Reset when power is turned OFF.

### ■ JOG CCW Control Start Contact-point (Output Y0.Δ.0.3)

- ① Starts JOG CCW(Reverse direction) control based on the parameters on position module.
- ② While the start contact is ON, it continues to move in the CCW direction. When it's OFF, it decelerates to stop..
- ③ Reset when power is turned OFF.

### ■ JOG Speed Change Selection Control Contact-point (Output Y0.Δ.0.4)

- ① The target speed is applied at high-speed based on the parameters input to the positioning unit.
- ② If it is set to high-speed (ON) or low-speed (OFF) during JOG movement, the speed is changed and JOG moves
- ③ Reset when power is turned OFF.

### ■ Pulse Outputting Flag (Input X1.□.0.0)

- ① It turns ON at the next scan after JOG control is started, and turns OFF when pulse output is completed.
- ② It remains ON until the pulse output is completely stopped. It is turned OFF when the pulse output stops even if the movement operation is completed and stopped, or forced stop or deceleration stop on the way.
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

### ■ Pulse Output Completion Flag (Input X1.□.0.3)

- ① It is turned ON when pulse output is completed, and then remains until E-point control, P-point control, JOG operation, MPG operation, and Homing(Home-return) operation are started
- ② Reset when power is turned OFF.

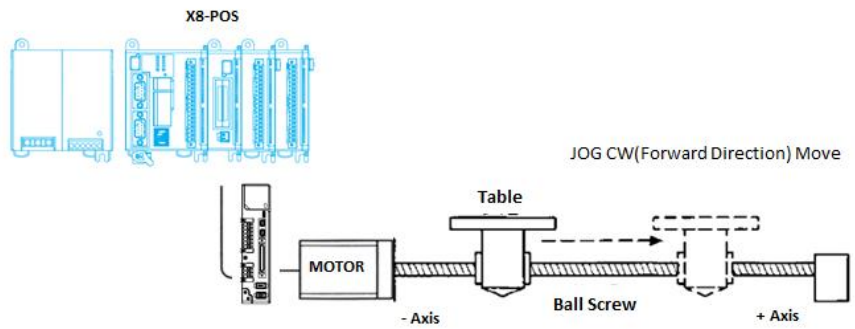
※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

## Precautions for Speed Change during Operation

When moving to CCW (Reverse direction) while moving to CW (Forward direction) by JOG movement, CCW (Reverse) movement must be started after CW (Forward) movement stops after confirming the movement completed contact-point.

## Program Example

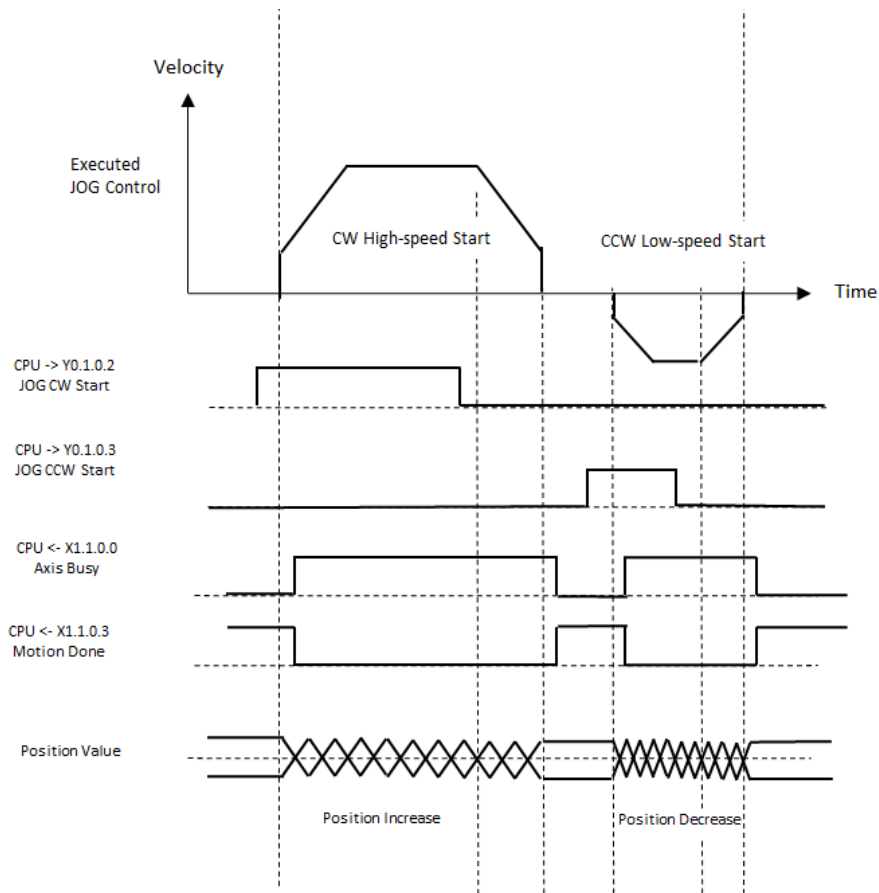
When the JOG CW start contact (Y0.1.0.2) is ON, it moves in the forward direction. When the JOG CCW start contact (Y0.1.0.3) is in the ON state, it moves in the reverse direction.



Example of the 1<sup>st</sup> axis starting parameter installed in slot 1 (Start Command : Y0.1.0.2 JOG CW Start)

Data	Setting Value
JOG Operation Parameter – Speed Change Selection	1
JOG Operation Parameter – Low-speed	100000
JOG Operation Parameter – Start Speed	0
JOG Operation Parameter – Accel./Decel.(msec)	100
Detailed Motion Setting Y0.1.2.0	0 (Trapezoid Accel./Decel.)





<<<< Ladder Block Diagram >>>>

**10. Input Operation by Manual Pulse Generator (MPG)..... 2**

    Flow of Input Operation by Pulse Generator..... 2

    I/O Contact-point Operation at Input Operation by Pulse Generator  
    ..... 4

    Manual Pulse Generator (MPG) Type..... 5

    Program Example..... 5

# 10. Input Operation by Manual Pulse Generator (MPG)

This Chapter describes the input operation by Manual Pulse Generator (MPG).

## Flow of Input Operation by Pulse Generator

### ■ Pulse Generator Input Operation

You can manually control the motor by connecting a pulse generator (Manual Pulse Generator).

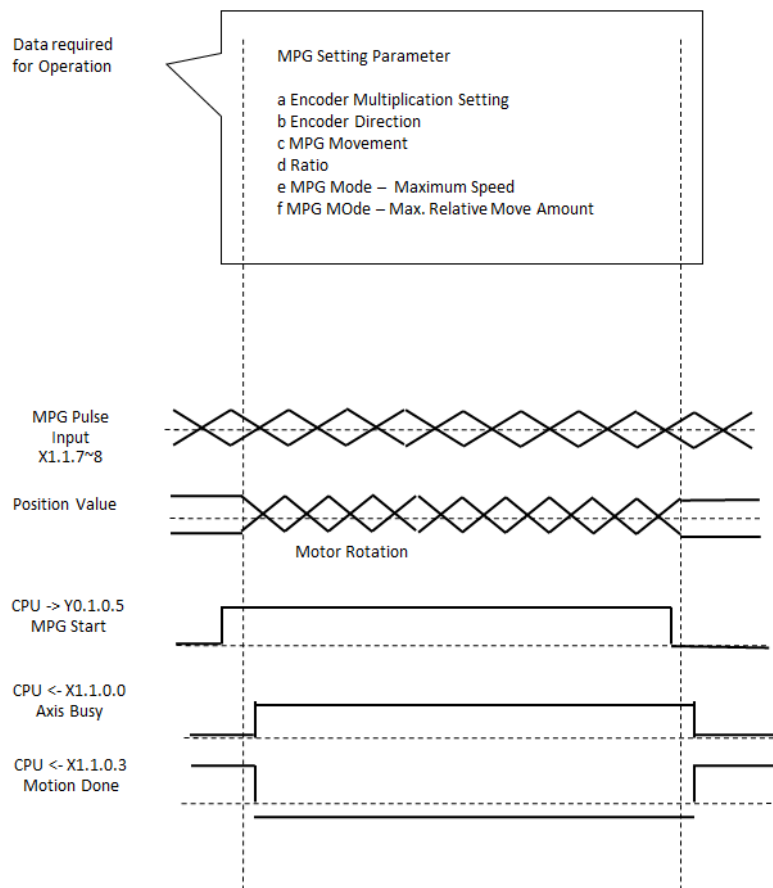
While the pulse generator start contact (Y0.1.0.5) is turned ON, MPG start control is performed by the pulse input to the pulse generator

You can select the number of pulses sent to the motor drive per pulse of the pulse generator signal (Depends on the parameters entered in the setup data).

### When 4-axis type positioning unit is installed in slot 1

#### Operation

When the pulse generator start contact (Y0.1.0.5) is turned ON, the motor rotates forward and backward according to the operation of the pulse generator.



※ When the MPG start contact (Y0.1.0.5) is turned ON by a ladder program, the 1<sup>st</sup> axis motor moves by the number of pulses input to the pulse generator. When it is OFF, even if a pulse is input to the pulse generator, it is ignored. Only when the number of pulses input is ON, the amount of increase in the number of pulses is effectively reflected in the MPG control movement distance.

※ The amount of movement of the motor is determined by the amount by which the MPG pulses are counted, and the direction of movement is determined by the sign of the value being counted. The MPG pulse count value can be checked at X1.1.7 ~ 8. (Float type data, 2 word size)

※ The speed at which the motor moves depends on the speed at which the MG pulse is counted, but the maximum speed is limited by the “MPG mode-Maximum speed” of the setting parameter.

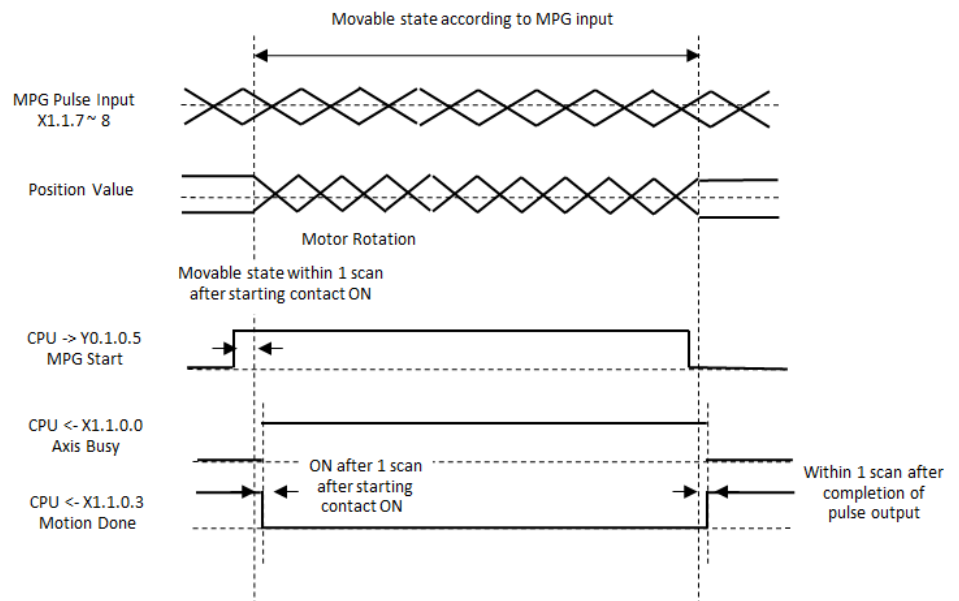
※ When the MPG movement setting is MPG position movement, BUSY contact is automatically turned OFF and movement completed contact is ON when MPG counter is increased by the set MPG mode - maximum relative movement amount.

※ If 2 pulses of pulse generator input to the MPG terminal, are counted as shown below

Forward Rotation (CW)		Phase A		Multiplication Setting : AB x 1 Counter Value : + (2 * Ratio)
		Phase B		Multiplication Setting : AB x 2 Counter Value : + (4 * Ratio)
		CW		Multiplication Setting : AB x 4 Counter Value : + (8 * Ratio)
		CCW		Multiplication Setting : CW/CCW x 1 Counter Value : + (2 * Ratio)
Reverse Rotation (CCW)		Phase A		Multiplication Setting : AB x 1 Counter Value : - (2 * Ratio)
		Phase B		Multiplication Setting : AB x 2 Counter Value : - (4 * Ratio)
		CW		Multiplication Setting : AB x 4 Counter Value : - (8 * Ratio)
		CCW		Multiplication Setting : CW/CCW x 1 Counter Value : - (2 * Ratio)

※ The ratio of MPG related setting parameters can be set from 1 to 32, and it becomes the magnification of MPG counter.

## I/O Contact-point Operation at Input Operation by Pulse Generator



### ■ MPG Control Start Contact-point (Output Y0.Δ.0.5)

- ① Start MPG control based on the parameters entered in position unit.
- ② While the start contact-point is ON, output the pulse as much as MPG pulse counter value to the motor and move.
- ③ Reset when power is turned OFF.

### ■ Pulse Outputting Flag (Input X1.□.0.0)

① It turns ON at the next scan after MPG control is started, and outputting pulse turns OFF when contact-point is OFF.

② It remains ON until the pulse output is completely stopped. It is turned OFF when the pulse output stops even if the movement operation is completed and stopped or forced stop or deceleration stop on the way.

If the MPG movement method is position movement, the BUSY contact is automatically turned off when the MPG counter is increased by the set movement amount.

③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

#### ■ Pulse Output Completion Flag (Input X1.□.0.3)

① It is turned ON when pulse output is completed, and then remains ON until E-point control, P-point control, JOG operation, MPG operation, and Homing(Home-return) operation are started.

If the MPG movement method is position movement, the completion flag is automatically ON when the MPG counter is increased by the set movement amount.

② Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

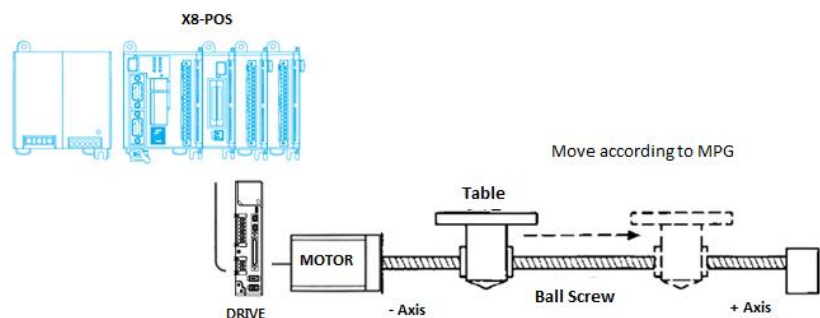
## Manual Pulse Generator (MPG) Type

■ An open collector type of 24V manual pulse generator (MPG) or rotary encoder is available.

Pulse output type supports phase A/B or CW/CCW type.

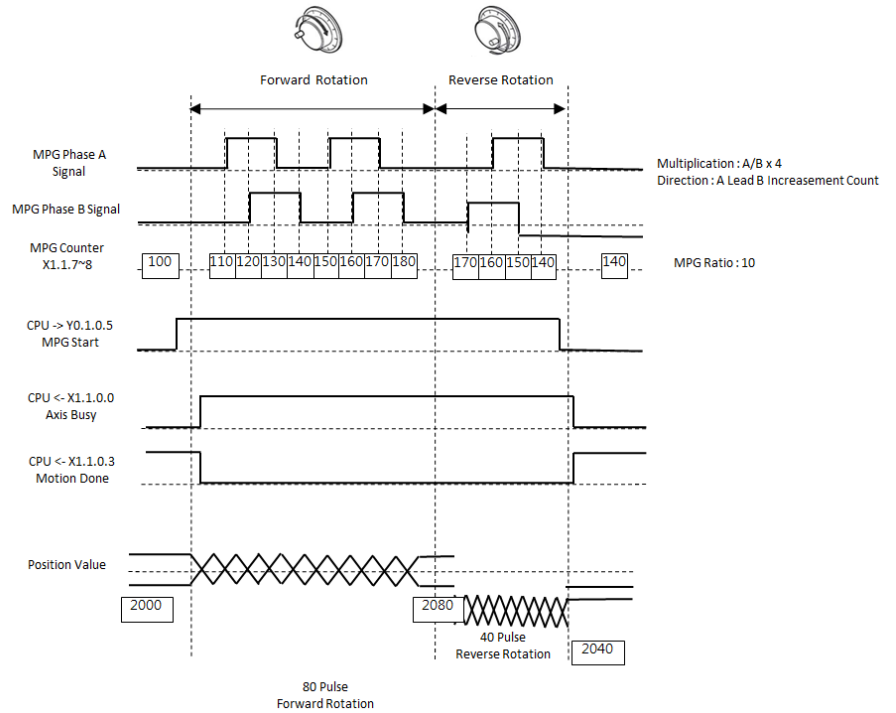
## Program Example

When MPG Start Contact (Y0.1.0.5) is ON, it moves in forward or reverse direction according to the increment of the MPG counter.



Example of the 1<sup>st</sup> axis starting parameter installed in slot 1 (Start Command : Y0.1.0.5 MPG Start)

Data ( MPG Setting Parameter)	Setting Value
Encoder Multiplication Setting	A/B x 4
Encoder Direction	A Lead B
MPG Movement	Speed Movement
Ratio	10
MPG Mode – Maximum Speed	5000
MPG Mode – Max. Relative Move Amount	10000



**11. Index Point Operation..... 2**

    Flow of Index Input Operation ..... 2

    I/O Contact-point Operation at Index Input Operation ..... 5

    Program Example..... 6



# **11. Index Point Operation**

This chapter describes the index point setting and operation.

## **Flow of Index Input Operation**

Index point start must be set in the index data area before execution.

### **■ Index Start Control : Index Pointer Control**

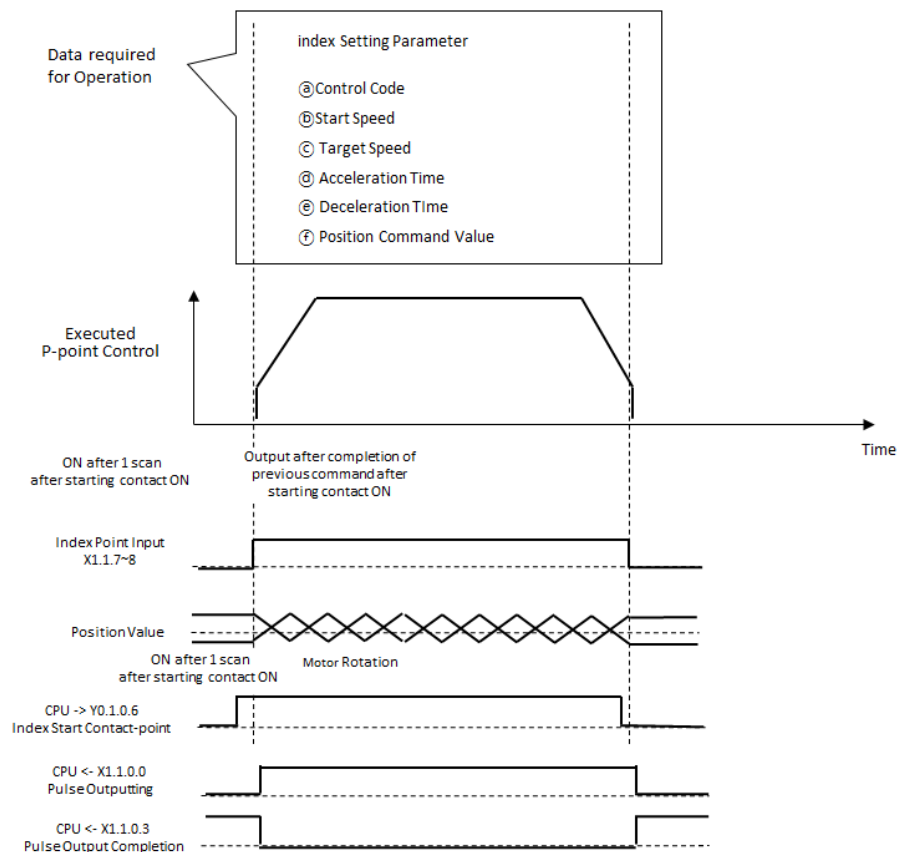
When the index start contact is turned ON, acceleration / deceleration control of short axis is automatically performed according to the specified index table

Acceleration/deceleration can be specified separately, allowing symmetric/asymmetric velocity profiles to be generated. You can also select Trapezoid, S-shaped acceleration/deceleration.

### **When 4-axis type positioning unit is installed in slot 1**

#### **Operation**

When contact-point is turned ON for index control, it accelerates/decelerates, move and stop according to the setting.



※ When Y0.1.0.0 (E point control start contact) is turned ON by a ladder program, the 1-axis motor starts to accelerate. Input X1.1.0.0 is a BUSY point indicating that operation is in progress, and X1.1.0.3 is a point indicating completion of operation. The operation completion contact remains ON until the next operation request is given.

#### Setting Data

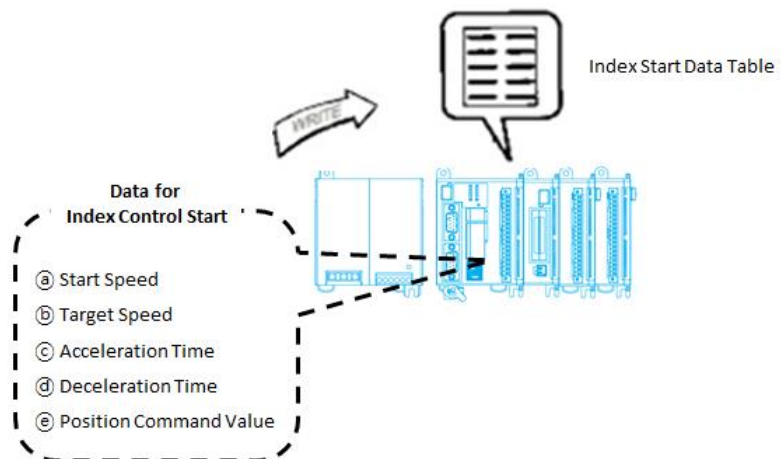
The following data must be entered in the output data table address. If you repeat the same operation, you do not need to reset it. The operation is determined by the following 6 kinds of data.

- Control Code
- Start Velocity
- Target Velocity
- Acceleration Time
- Deceleration Time
- Position Command Value

#### ■ Operation Step

##### Step 1 : Preparation

Send data for the operation in advance to output data table.

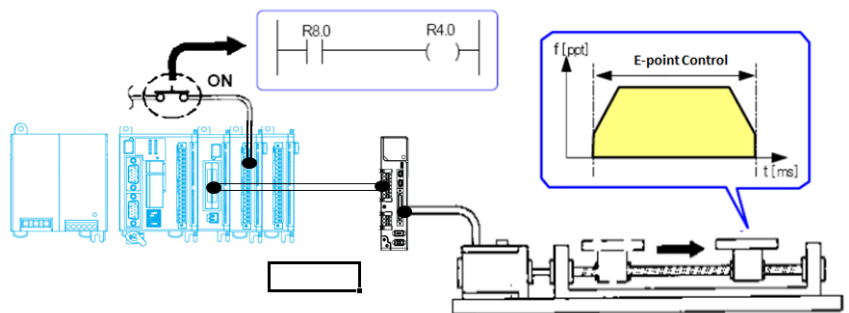


## Step 2 Execution of Operation

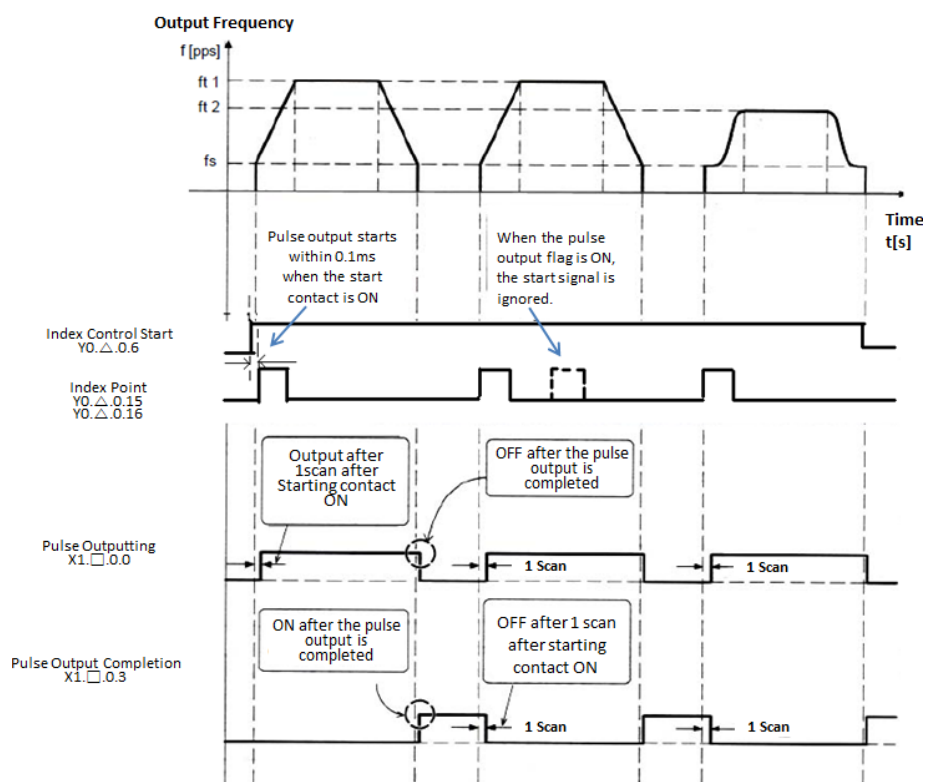
When Y0.1.0.6(Index Control Start Contact) is turned ON, the operation starts. It determines whether it is S-curve acceleration/deceleration or linear acceleration/deceleration according to the control code.

It accelerates then decelerates from the start velocity to the target velocity by acceleration/deceleration time, and stops when it reaches the start velocity.

This amount of movement is specified by position command value.



## I/O Contact-point Operation at Index Input Operation



※ Flag OFF of pulse outputting and Pulse output completion ON can be delayed as much as dwell time(Y0. Δ.13).

## ■ Index Control Start Contact-point (Y0.Δ.0.6)

- ① Start Index Control based on the index setting data that entered in position unit..
- ② Does not start while the pulse outputting flag(X1.□.0.0) is turned ON.
- ③ Reset when power if turned OFF

## ■ Pulse Outputting Flag (X1.□.0.0)

- ① It turns ON at the next scan after index control is started, and turns OFF when pulse output is completed.
  - ② While this signal is ON, another operation is not performed. (Excluding Forced stop and decelerate to stop).
  - ③ Reset when power if turned OFF
- ※ This flag is common to each operation of E-point control, P-point control, JOG operation, and Homing(Home-return) operation. (Excluding the pulse generator input permission).

## ■ Pulse Output Completion Flag (X1.□.0.3)

- ① It is turned ON when pulse output is completed, and then remains until one of E point control, P point control, JOG operation, Homing(Home-return) operation and pulse generator input permission is started.
  - ② Reset when power if turned OFF
- ※ This flag is common to each operation of E-point control, P-point control, JOG operation and pulse generator input permission.

## Program Example

Index Data															
Axis 1															
No.	Motion Type	StepRun Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Arc Path	Dwell	MCODE	Trapezoid/ S-Curve	CW/CCW Direction	Axis#1 Enable	Axis#2 Enable	Teaching
0	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 0
1	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 1
2	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 2
3	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 3
4	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 4
5	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 5
6	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 6
7	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 7
8	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 8
9	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 9
10	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 10
11	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 11
12	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 12
13	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 13
14	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 14
15	None	Single_End	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF	OFF	LoadTo 15

**12. Step Operation ..... 2**

    Flow of Step Operation ..... 2

    Step Operation for E-point Control..... 5

    Step Operation for P-point Control..... 5

    Step Operation for Teaching ..... 7

    I/O Contact Operation of Before and After Operation ..... 8

    Precautions for Step Operation..... 9

    Program Example..... 10

# 12. Step Operation

This chapter describes step operation of position module.

## Flow of Step Operation

### ■ Step Operation

When the step operation contact-point is turned ON, the axis moves at a constant speed after accelerating using the preset step operation data. When the stop contact-point is turned ON continuously, it stops at the moment.

Output data table contact-point for step operation is as follows.

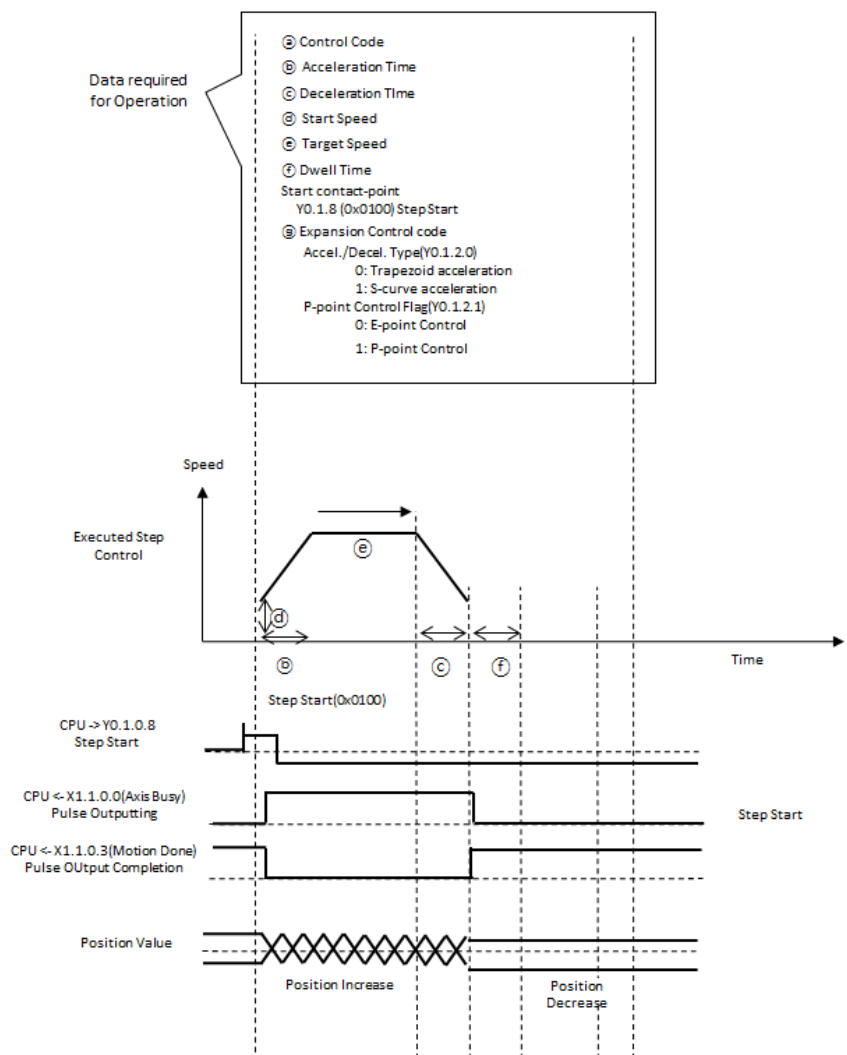
Parameter	Output Data Table	Initial Value	Contents
1st Velocity	Y0.Δ.0.8	0	Step start flag
Setting	Y0.Δ.14	0	Step start number
Value	Y0.Δ.15	0	Step end number
	Y0.Δ.16	0	Step repeat number

The operation data can be stored in the positioning module. Refer to Chapter 7 “Operation Data” for the setting method.

### When 4-axis type positioning unit is installed in slot 1

Operation :

If the step start contact-point is ON, it moves after acceleration. If the deceleration stop contact-point is ON during movement, it decelerates for the time applied during acceleration and then stops. If the rapid stop contact turns ON while moving, it will stop immediately without deceleration.



※ If Step contact-point is ON by ladder program, it accelerates at the pre-entered start speed and accelerates to the target speed of high/low-speed and starts to move. When start contact-point is turned OFF, it will decelerate and stop.

Input X1.1.0.0 is a BUSY point indicating that operation is in progress, and X1.1.0.3 is a point indicating completion of operation.

The operation completion contact remains ON until the next operation request is given.

#### Data for Setting

The following parameter must be entered in the setting data.

- a Control Code, Expansion Code
- b Acceleration/Deceleration Time
- c Target Position, Start Speed, Target Speed
- d Dwell Time, Accel./Decel. Type, Control Type

#### TIP

During step operation, X1.1.0.0 during pulse output and X1.1.0.7 during step pulse output operate.



### ■ Operation Step

#### Step 1 : Preparation

For step operation, enter the step parameter in advance.

#### Step 2 : Execution of Step

Turn ON the step start contact-point to move.

Y0.1.0.8 is step start contact-point. This is the step start contact.

When Y0.1.0.8 is OFF, step start is stopped.

#### Step 3 : Operation Stop

Turns OFF the step start contact-point to stop. When it's OFF, it starts to decelerate to stop.

#### Step 4 : Operation Completion

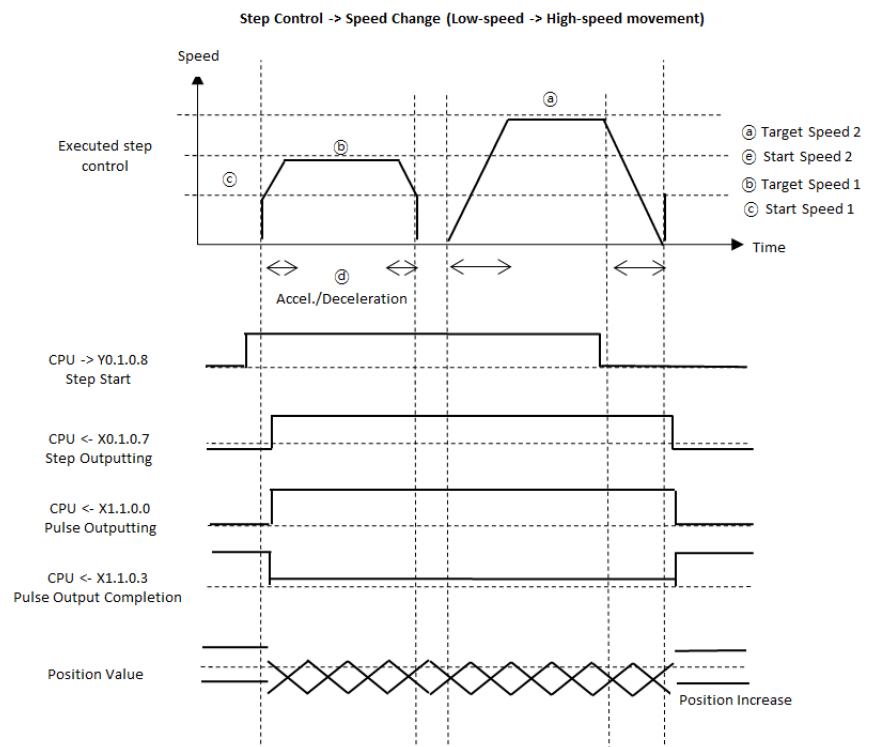
When the deceleration is completed and stopped, the BUSY contact-point turns OFF and moving completion contact-point turns ON.

## Step Operation for E-point Control

■ When the contact-point is turned ON for the step start, acceleration/deceleration is repeated and stopped according to the internal step operation data setting.

Each time the operation data is input, it is possible to repeat the continuous movement several times by confirming the contact-point during pulse output.

Acceleration/deceleration can be specified, allowing symmetric/asymmetric velocity profiles to be generated. You can also select Trapezoid, S-shape acceleration/deceleration.



## Step Operation for P-point Control

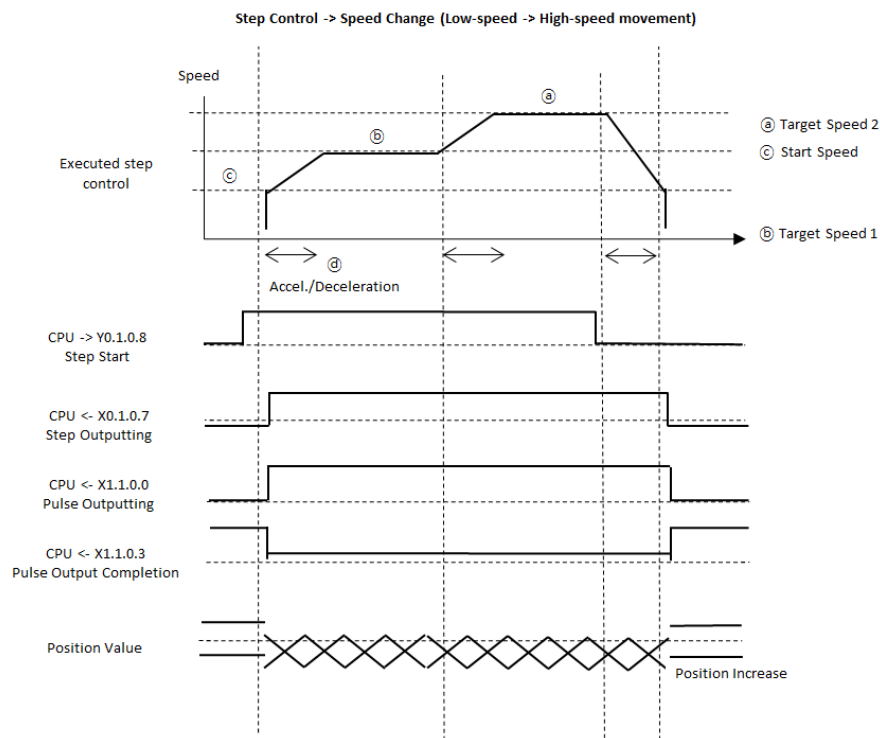
■ When the contact is turned ON for the step start, acceleration/deceleration is repeated and stopped according to the internal step operation data setting.

Each time the operation data is input, it is possible to repeat the continuous movement several times by confirming the contact-point during pulse output.

Acceleration/deceleration can be specified, allowing symmetric/asymmetric velocity profiles to be generated. You can also select Trapezoid, S-shape acceleration/deceleration..

When 4-axis type positioning unit is installed in slot 1

Operation :



TIP

To use the speed override during the step start, the target speed of the 1<sup>st</sup> profile and the start speed of the 2<sup>nd</sup> profile should be set to the same value.  
To end the section repeat operation, the P-motion enable (Bit 1 of the extended control code) flag of the step data must be turned OFF (Disable).

## Step Operation for Teaching

### ■ Example of How to Put Teaching Data in Step Data.

Position value which manually stopped the movement and position feedback can be entered in the step data. The read position value is the current absolute position.

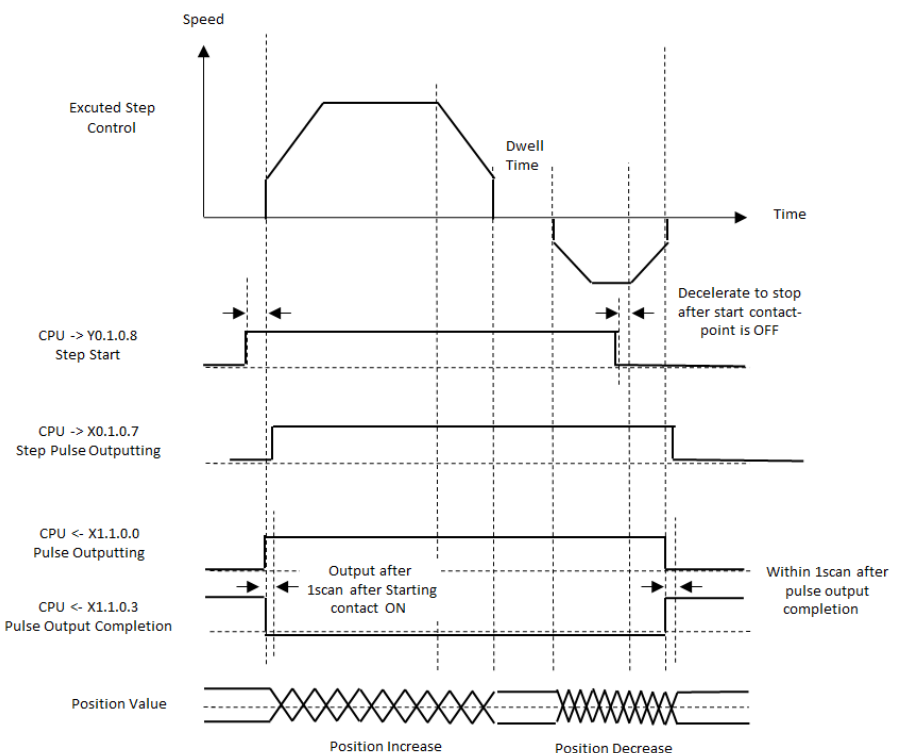
For the 1st axis, [X1.1.3 ~ 4] is the command pulse position value and [X1.1.5 ~ 6] is the encoder feedback position value

The position value is Float type data(2 word size)

<<<< Ladder Block Diagram >>>>

After confirming movement completion, read current position and save.

## I/O Contact Operation of Before and After Operation



### ■ Step Control Start Contact-point (Output Y0.Δ.0.8)

- ① Start step control based on the operation data on position module.
- ② While the start contact is ON, it continues to move. When it's OFF, it decelerates to stop.
- ③ Reset when power is turned OFF.

### ■ Step Execute Area Selection Contacts (Output Y0.Δ.14, Y0.Δ.15, Y0.Δ.16)

- ① start after the start speed and target speed are applied based on operation data on the position module.
- ② The contents of the output are as follows.  
 Y0.Δ.14 : Step Start Number  
 Y0.Δ.15 : Step End Number  
 Y0.Δ.16 : Step Repeat Number
- ③ Reset when power is turned OFF.

### ■ Step Outputting Flag (Input X1.□.0.7)

- ① It turns ON at the next scan after step control is started, and turns OFF when pulse output is completed.
  - ② It remains ON until the pulse output is completely stopped. It is turned OFF when the pulse output stops even if the movement operation is completed and stopped, or forced stop or deceleration stop on the way.
  - ③ Reset when power is turned OFF.
- ※ This flag is common to E-point control, P-point control operation at step start.

■ Pulse Outputting Flag (Input X1.□.0.0)

- ① It turns ON at the next scan after step control is started, and turns OFF when pulse output is completed.
- ② It remains ON until the pulse output is completely stopped. It is turned OFF when the pulse output stops even if the movement operation is completed and stopped, or forced stop or deceleration stop on the way.
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

■ Pulse Output Completion Flag (Input X1.□.0.3)

- ① It is turned ON when pulse output is completed, and then remains until E-point control, P-point control, JOG operation, MPG operation, and Homing(Home-return) operation are started
- ② Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, MPG operation and Homing(Home-return) operation.

## Precautions for Step Operation

- Operation pattern at step start only supports relative movement and absolute movement.
- Supports profile creation and operation for each minor-axis. Use interpolation table when performing interpolation control for multi-axis operation.

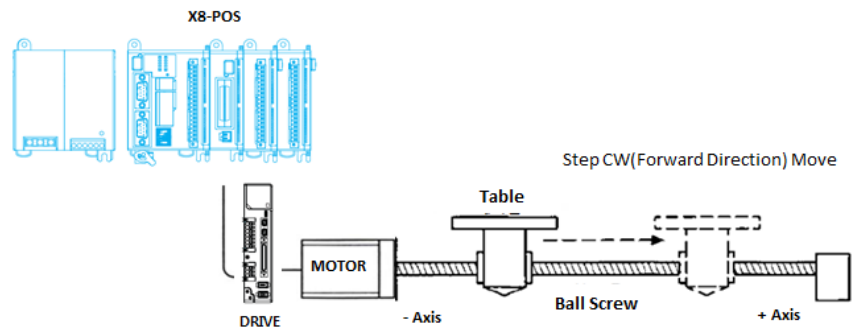
## Program Example

### ■ Program Example by Using Step Operation Data.

For the 4 axis module, the contents of the output data table are as follows.

Data Structure at Step Operation					Setting Range
Offset	1-axis	2-axis	3-axis	4-axis	Contents
0	Y0	Y20	Y40	Y60	Step Start Flag
1	Y1	Y21	Y41	Y61	
2	Y2	Y22	Y42	Y62	
3	Y3	Y23	Y43	Y63	
4	Y4	Y24	Y44	Y64	
5	Y5	Y25	Y45	Y65	
6	Y6	Y26	Y46	Y66	
7	Y7	Y27	Y47	Y67	
8	Y8	Y28	Y48	Y68	
9	Y9	Y29	Y49	Y69	
10	Y10	Y30	Y50	Y70	
11	Y11	Y31	Y51	Y71	
12	Y12	Y32	Y52	Y72	
13	Y13	Y33	Y53	Y73	
14	Y14	Y34	Y54	Y74	Step Start Number
15	Y15	Y35	Y55	Y75	Step End Number
16	Y16	Y36	Y56	Y76	Step Repeat Number
17	Y17	Y37	Y57	Y77	
18	Y18	Y38	Y58	Y78	
19	Y19	Y39	Y59	Y79	

When the step start contact-point (Y0.1.0.8) is ON, it moves based on operation data.



Axis no.1 starting parameter installed in slot no.1 (Starting Command : Y0.1.0.8 Step start)

### Output Data Table Setting

Parameter	Output Data Table	1 <sup>st</sup> Velocity Setting Value	2 <sup>nd</sup> Velocity Setting Value	3 <sup>rd</sup> Velocity Setting Value
Control Code	Y0.1.1	1	1	1
Expansion Control Code	Y0.1.2	0	0	0
Acceleration Time[ms]	Y0.1.3	100	100	0
Deceleration Time [ms]	Y0.1.4	0	0	100
Dwell Time[ms]	Y0.1.13	0	0	0
Position Command Value	Y0.1.5	5000	15000	-20000
Start Velocity	Y0.1.7	500	5000	15000
Target Velocity	Y0.1.9	5000	15000	20000

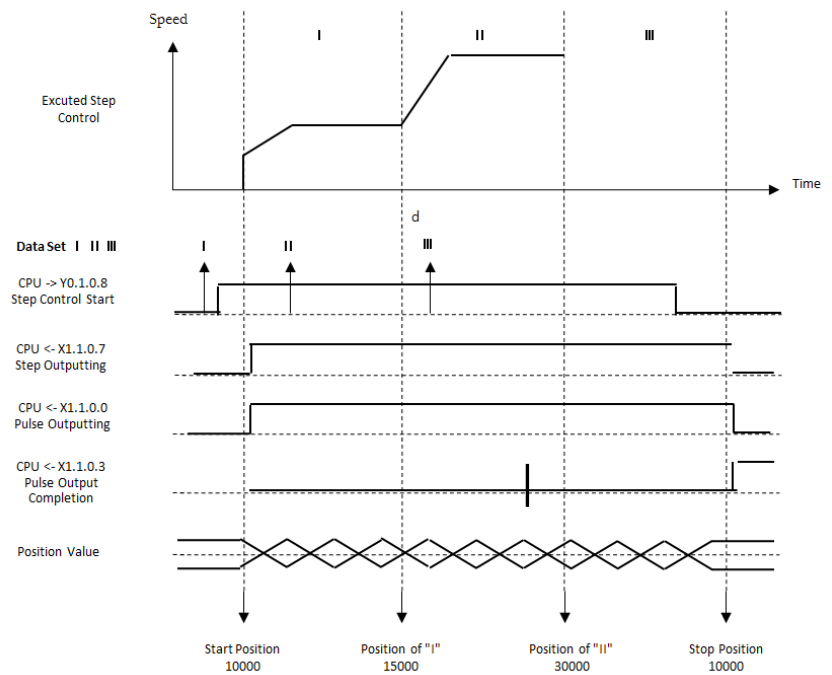
Caution : Target position, Starting Velocity, Maximum Velocity are Float type data. (2 word size)

### Setting for Internal Operation Data of Position Module

Step Data												
AXIS 1												
Default Download   Upload   Download   Import ...   Export ...												
No.	Motion Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Arc Path	Dwell	MCode	Trapezoid/ S-Curve	P-Motion Enable	CW/CCW Direction
36	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
37	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
38	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
39	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
40	RMOVE	100	0	5000.0	10.0	5000.0	0.0	0	40	OFF	ON	OFF
41	RMOVE	100	0	15000.0	5000.0	15000.0	0.0	0	41	OFF	ON	OFF
42	RMOVE	0	100	-20000.0	10000.0	20000.0	0.0	0	42	OFF	OFF	OFF
43	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
44	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
45	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
46	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF
47	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF	OFF

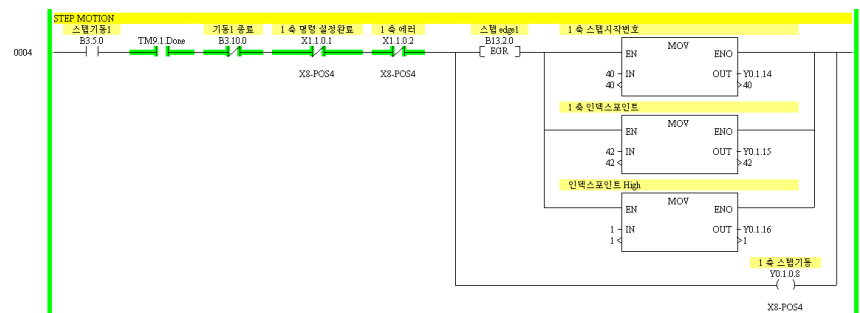


# Table of Contents



## ■ Program Example

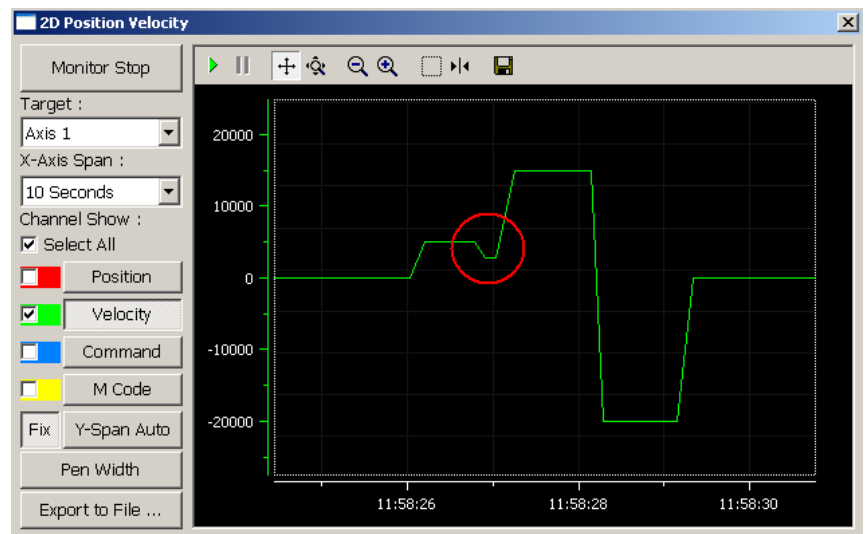
Enter Profile and Start : Set step interval and repeat count.



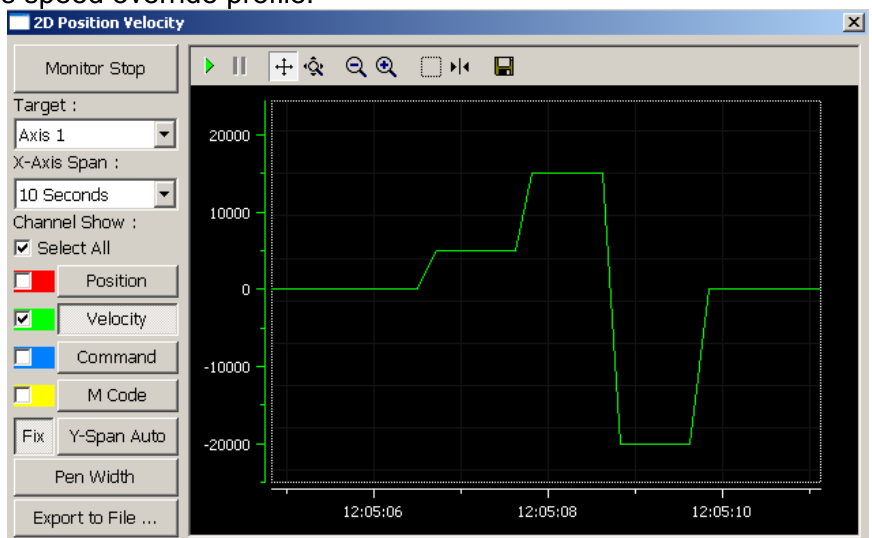
## ■ Operation of E-point control type.

When the start-up speed and the target speed do not match : The deceleration time of the 1<sup>st</sup> profile and the acceleration time of the 2<sup>nd</sup> profile are calculated and operate as a slower profile.

Step Data											
No.	Motion Type	Accel.	Decel.	Target Pos	Start Vel	Target Vel	Arc Path	Dwell	MCode	Trapezoid/S-Curve	P-Motion Enable
32	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
33	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
34	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
35	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
36	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
37	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
38	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
39	None	0	0	0.0	0.0	0.0	0.0	0	0	OFF	OFF
40	RMOVE	100	100	5000.0	100.0	5000.0	0.0	0	40	OFF	OFF
41	RMOVE	100	100	15000.0	100.0	15000.0	0.0	0	41	OFF	OFF
42	RMOVE	100	100	-20000.0	5000.0	20000.0	0.0	2000	42	OFF	OFF
43	None	100	100	0.0	0.0	0.0	0.0	0	0	OFF	OFF

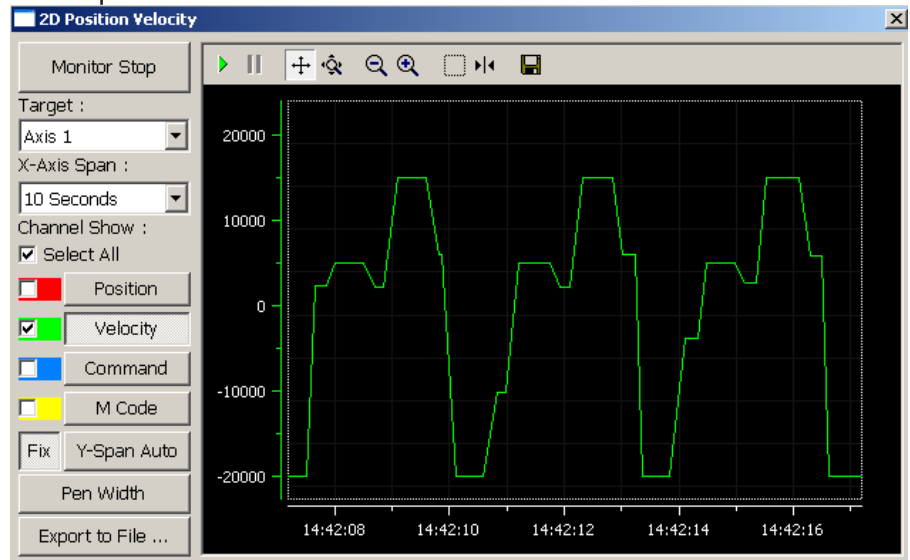


When the start-up speed and the target speed do match : start-up speed of 2<sup>nd</sup> profile become the target speed of 1<sup>st</sup> profile and operate as speed override profile.

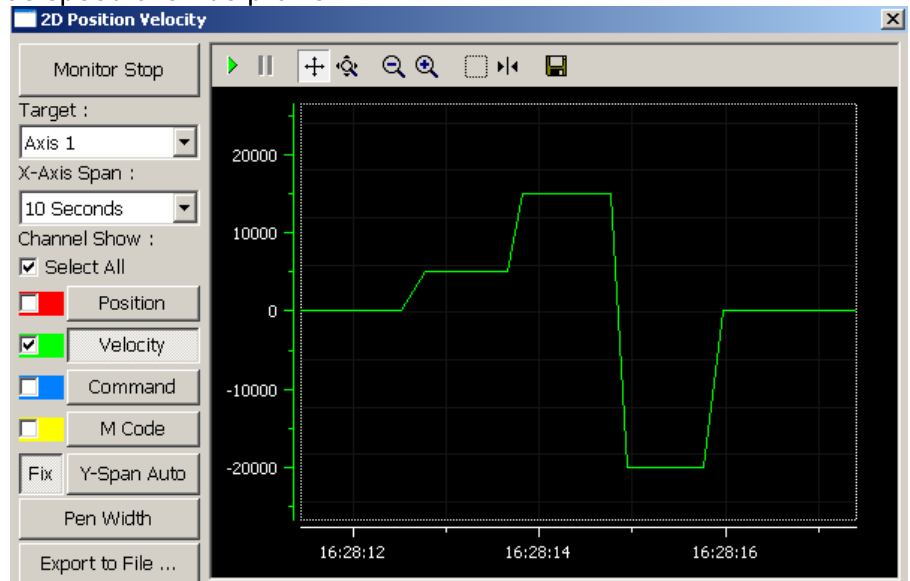


### ■ Operation of P-point control type.

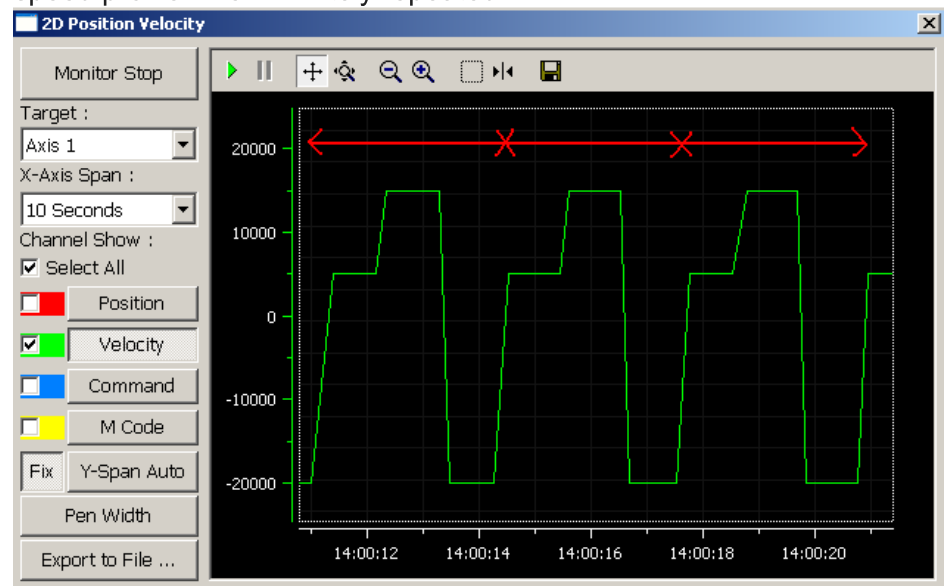
When the start-up speed and the target speed do not match : As same as E-point control, the deceleration time of the 1<sup>st</sup> profile and the acceleration time of the 2<sup>nd</sup> profile are calculated and operate as a slower profile.



When the start-up speed and the target speed do match : Start-up speed of 2<sup>nd</sup> profile become the target speed of 1<sup>st</sup> profile and operate as speed override profile.



Dwell time is not applied for P-point control. Below figure shows the speed profile when infinitely repeated.



■ Program Example by Using Internal Data Table of PLC.

<b>13. Homing(Home-return) Operation.....</b>	<b>2</b>
Homing Mode.....	2
Parameter for Homing mode.....	2
Flow of Homing Operation .....	3
Operation of I/O contact before and after homing operation .....	6
Home Return Type .....	8
Homing Sensor Detection Type (0 Mode)	10
Re-detection after Homing Sensor Detection (Mode 1)	11
Z-phase pulse detection after deceleration and home sensor detection (Mode 2)	12
Z-phase pulse detection after homing sensor detection (Mode 3)	13
Z-phase pulse low-speed detection in reverse direction after homing sensor detection (Mode 4)	14
Stops at Z-phase pulse with high velocity after home sensor detection (Mode 5)	14
Limit Sensor Detection Type (Mode 6)	16
Z-phase pulse low-speed detection in reverse direction after limit sensor detection (Mode 7)	17
Z-phase pulse high-speed detection in reverse direction after limit sensor detection (Mode 8)	18
Home sensor detection type and further movement (Mode 9)	19
Z-phase pulse detection type after home sensor detection and further movement (Mode 10)	20
Z-phase pulse high-speed detection in reverse direction after limit sensor detection and further movement (Mode 11)	21
Z-phase pulse high-speed detection in reverse direction after limit sensor detection and further movement (Mode 12)	22
Combination type of home sensor and limit sensor detection (Mode 13)	23
Home-return type after escaping from the home sensor (Mode 14)	24
Z-phase home-return type (Mode 15)	25
User home defined type (Mode 16)	26
Absolute Encoder Type (Mode 17)	27
Combination Type 2 (Mode 19)	30
Program Example.....	32

## 13. Homing(Home-return) Operation

This chapter describes the Homing(Home-return) Operation of position module.

### Homing Mode

Homing mode supports 20 modes according to whether Home sensor, Limit sensor, Z phase pulse is used or no. You can select the homing mode or use it in combination as required.. Refer to the Homing(Home-return) method for a detailed description of the operating method according to the Homing(Home-return) mode.

### Parameter for Homing mode

<div> <div></div> <div>Homing Mode</div> </div>	
Homing Type	0 : Slow Stop after Home Sensor ▾
Homing Start Velocity	500
Homing Target Velocity	5000
Homing Fine Velocity	500
Homing Accel/Decel Time	100
Homing Dwell Time	100
Homing Position Correction	0
Homing Direction	1 : CCW ▾
ABS Home's Multiply for Multi-cycle	32768
ABS Home's Multiply for 1-cycle	1

#### Homing Type

Indicates and sets the homing mode.

#### Homing Start Velocity

Start speed of Homing operation

#### Homing Target Velocity

Maximum speed of Homing Operation

#### Homing Fine Velocity (Escape Distance from Home)

Speed to detect sensor or Z phase pulse more precisely in homing mode 1, 4, 6, 7, etc.

In home return mode 13, used as home escape distance amount.

#### Homing Accel/Decel Time

Indicates the acceleration/deceleration time of Homing operation.

#### Homing Position Correction

Sets the Homing correction amount Homing Direction

#### Absolute Home's Multiple for Multi-cycle

Sets the multiplication value of the absolute encoder.

Absolute Home's Multiple for 1-cycle

Sets the 1 rotation multiplication value of absolute encoder.

## Flow of Homing Operation

### ■ Homing(Home-return)

As executing the homing operation automatically and move to the mechanical homing contact-point and initialize the position.

Home sensor, limit sensor or Z-phase pulse (index pulse) is used according to the specified method, and homing operation is performed by repeating movement in forward or reverse direction according to the setting.

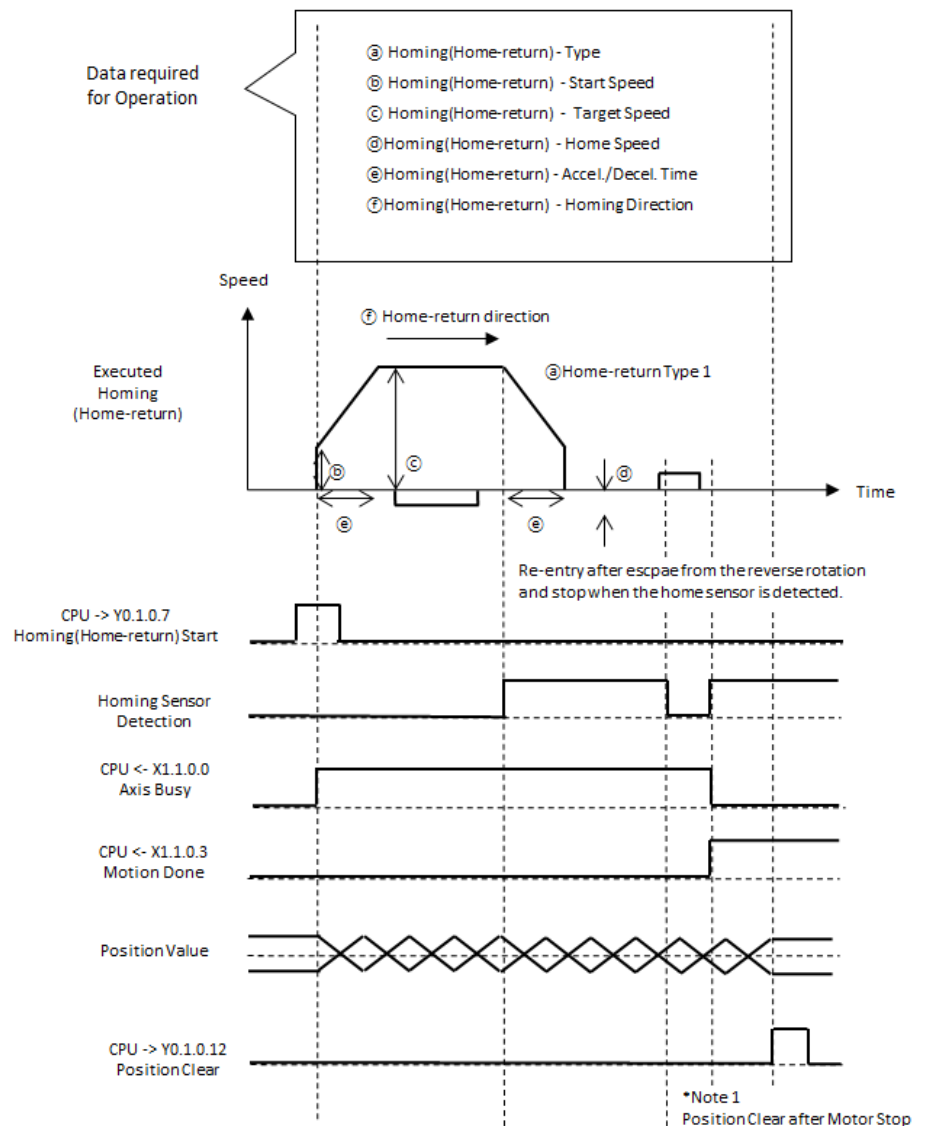
### When 4-axis type positioning unit is installed in slot 1

Operation :

When the homing contact-point is turned ON, accelerate to move until the target speed according to the setting.

Stops when Z-phase pulse or sensor is detected while movement. At this time, after stopping, take the mechanical stability time into account and stop the position clear contact (Y0.1.0.12).

# Table of Contents



\* Note 1. When the position clear contact-point (Y0.1.0.12) is ON, each position data is set as the initial value of command/encoder/deviation/MPG counter pre-entered in I/O setting data.

Refer to the step of operation(step4) below for turning ON the position clear contact-point.

※ If Y0.1.0.7 is turned ON by the ladder program, 1-axis motor will start to move to the pre-set direction. Stops when it reaches the condition of homing mode while movement.

Above figure shows the example of homing mode 1, when home sensor is detected, it will escape by reverse rotation. After that, it rotates in the set direction again and stops when it is detected again.

## Setting Data

The following data must be entered in the position module at I/O setting data.



- Ⓐ Homing(Home-return) - Type
- Ⓑ Homing(Home-return) - Start Speed
- Ⓒ Homing(Home-return) - Target Speed
- Ⓓ Homing(Home-return) - Home Speed
- Ⓔ Homing(Home-return) - Accel./Decel. Time
- Ⓕ Homing(Home-return) - Homing Direction

#### ■ Operation Step

##### Step 1 : Preparations

Send data for the operation in advance to I/O setting data.

##### Step 2 : Execution of Operation (Refer to the chapter 10.5 Homing(Home-return) Type)

Turn ON the Homing(home-return) start contact-point Y0.1.0.7.

When Homing start contact point is turned ON, It accelerates from the starting speed to the target speed by the acceleration/deceleration time and moves it repeatedly until it reaches the condition of home-return mode.

##### Step 3 : Homing Sensor Input

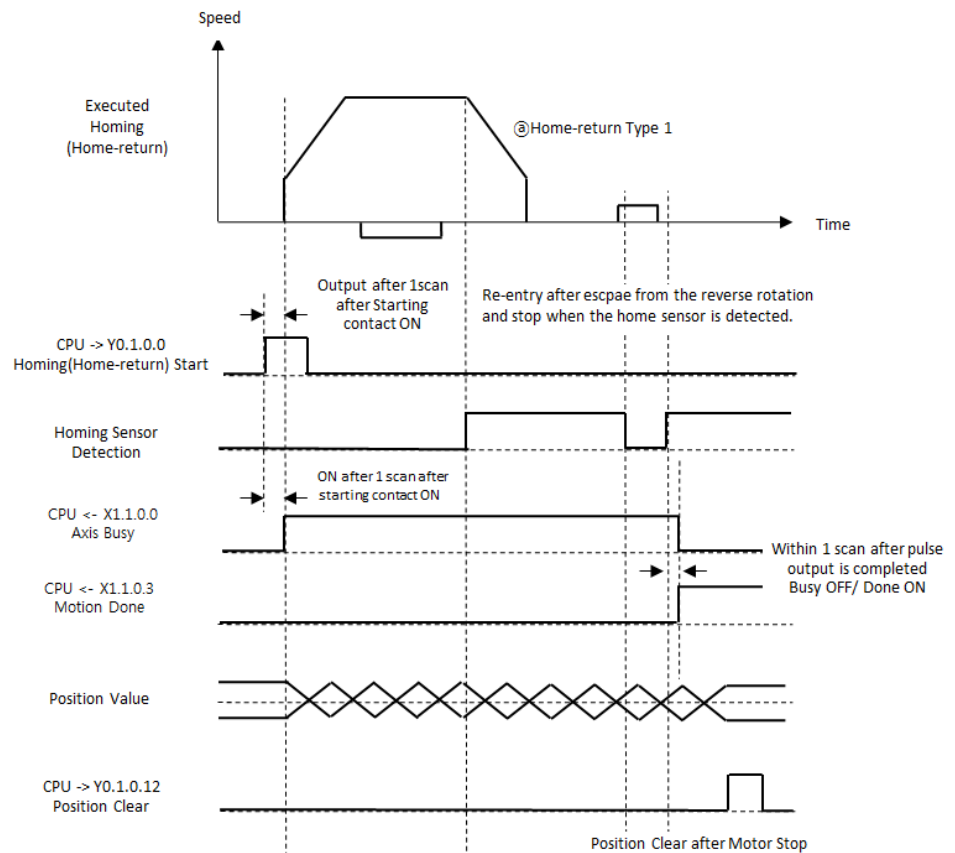
Homing sensor input is detected, and stops when the condition is reached.

##### Step 4 : Home Position Setting

When the pulse output completion contact (X1.1.0.3) is turned ON, wait for a while after considering the mechanical stability time, and turn on the position clear contact (Y0.1.0.12), the command/encoder/deviation/MPG position becomes IO setting data Is set to the initial value position.

※ Pulse output completion contact (X1.1.0.3) is a signal that is turned ON when the output pulse is stopped and the in-position signal of the servo drive is entered. Even if the pulse output completion contact (X1.1.0.3) is turned on, the motor may be moving more or less depending on the in-position range set in the servo drive and the degree of inertia of the mechanical load. After the pulse output completion contact (X1.1.0.3) is turned on, turn on the position clear contact after a certain period of time, or set the Dwell Time (Y0.1.13). It is recommended to clear the position by setting the pulse output completion contact (X1.1.0.3) to turn on after a certain time.

## Operation of I/O contact before and after homing operation



※ Busy OFF and Done ON can be delayed as much as dwell Time (Y0.1.13).

### ■ Homing(Home-return) Start Contact-point (Y0.△.0.7)

- ① Starts the home return based on the data entered in the positioning unit.
- ② It does not start while the pulse output flag (X1.□.0.0) is ON.
- ③ Reset when power is turned OFF.

### ■ Homing(Home-return) Sensor Input (X1.□.0.11)

- ① When input of home sensor connected to positioning unit is detected, home return operation is performed automatically.
- ② The home return operation is based on the home return type which previously set.

### ■ Pulse Outputting Flag (X1.□.0.0)

- ① It turns ON at the next scan after homing(Home-return) is started, and turns OFF when pulse output is completed after all operations are done.
- ② While this signal is ON, another operation is not performed. (Excluding forced stop and decelerate to stop)
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG Operation, Homing(Home-return) Operation.

■ Pulse Output Completion Flag (X1.□.0.3)

① When home-return is completed, the pulse output completion flag turns ON.

② Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG Operation, and pulse generator input permission.

■ Position Clear Output (Y0.Δ.0.12)

① When position clear output is turned ON, the command / encoder / deviation / MPG position counter is initialized to the value entered in the IO setting data.

## Home Return Type

The simple operation according to home return mode is as follows.

Classification by Homing Type		Remarks
Mode	Operation Flow	Contents
0	1. Check the first 'OFF->ON' edge and stop	
1	1. Check the first 'OFF->ON' edge and stop 2. Stop in ON state of sensor -> Move to reverse direction 'ON->OFF' -> Stop in forward direction 'OFF->ON' : OK	
2	1. After check the first 'OFF->ON' edge, (start decelerating) stop when Z-phase is detected.	
3	1. After check the first 'OFF->ON' edge, (constant velocity) stop when Z-phase is detected.	
4	1. Check the first 'OFF->ON' edge and stop 2. Check 'ON->OFF' edge while reverse rotation. 3. Stop when Z-phase is detected.	
5	1. Check the first 'OFF->ON' edge and stop 2. Check 'ON->OFF' edge while reverse rotation. 3. Stop when Z-phase is detected.	
6	1. Detect of the first limit 'OFF->ON' 2. Stop in On state of sensor → Stop when reverse direction 'ON-OFF' is detected : OK	
7	1. Detect of the first limit 'OFF->ON' 2. Stop when Z-phase is detected at Limit OFF level while reverse rotation.	
8	1. Detect of the first limit 'OFF->ON' 2. Stop when Z-phase is detected at Limit OFF level while reverse rotation.	
9~12	Same as 0,3,5,8	
13	<p>1. Stop when the first home-sensor 'OFF-&gt;ON' is detected. 1. Move and escape in reverse direction when the first home sensor starts from ON level. Move in forward direction when On-&gt;OFF is detected. Stop when OFF -&gt; ON is detected. 1. Move in reverse direction when the first limit sensor 'OFF-&gt;ON' is detected. ( Also move in reverse direction when the first limit sensor starts at ON level) Constantly stop and move to escape in reverse direction after home sensor is detected. Move in forward direction when 'ON-&gt;OFF' is detected. Stop and completed when 'OFF-&gt;ON' is detected.</p> <p>The distance to escape from the bottom of home sensor in reverse direction is given by the specified value at home vel. Even if the specified value is small, the relative movement is repeatedly moved until it escapes.</p> <p>Mode 13 is the mode that always stops in the same direction of the home sensor.</p>	
14	1. Check the first 'ON->OFF' edge and stop 2. Stop at OFF level after deceleration. (if it is detected again during the deceleration, it moves to the start speed continuously)	
15	-	
16	-	
17	-	
18	-	
19	-	

Caution:

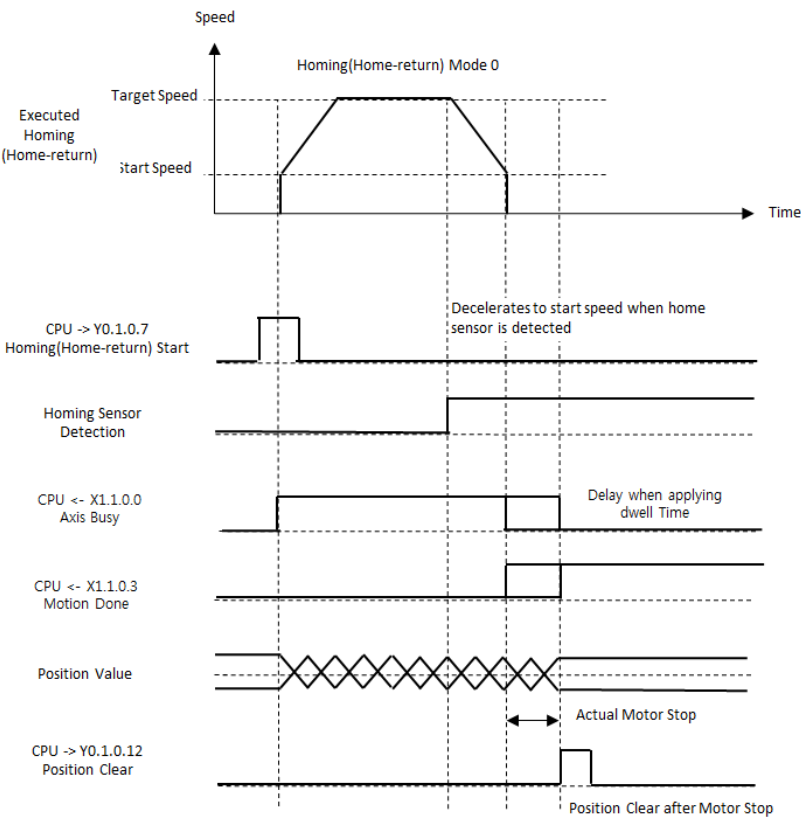
Forward direction: The 1<sup>st</sup> home-return move direction

Since the 1<sup>st</sup> 'OFF-> ON' edge is checked, home-return should not be started in the detection state. (Except of mode 13).

The stop location should not stop over the sensor while detection.

Homing Sensor Detection Type (0 Mode)

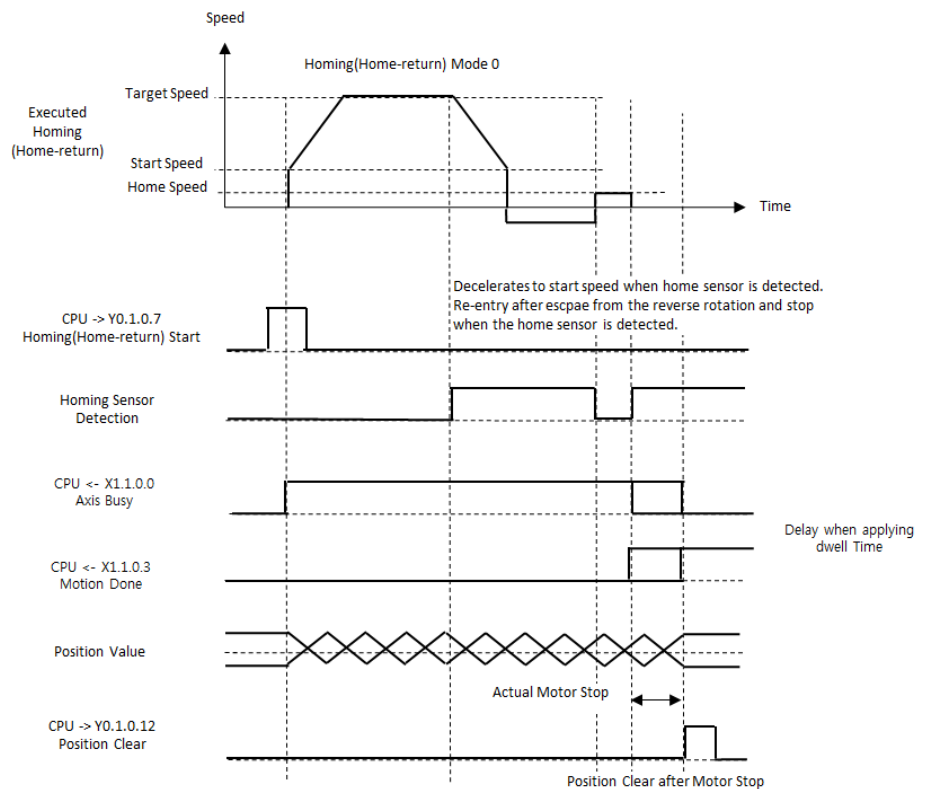
It is the mode that decelerates and stops when homing sensor is detected.



## Re-detection after Homing Sensor Detection (Mode 1)

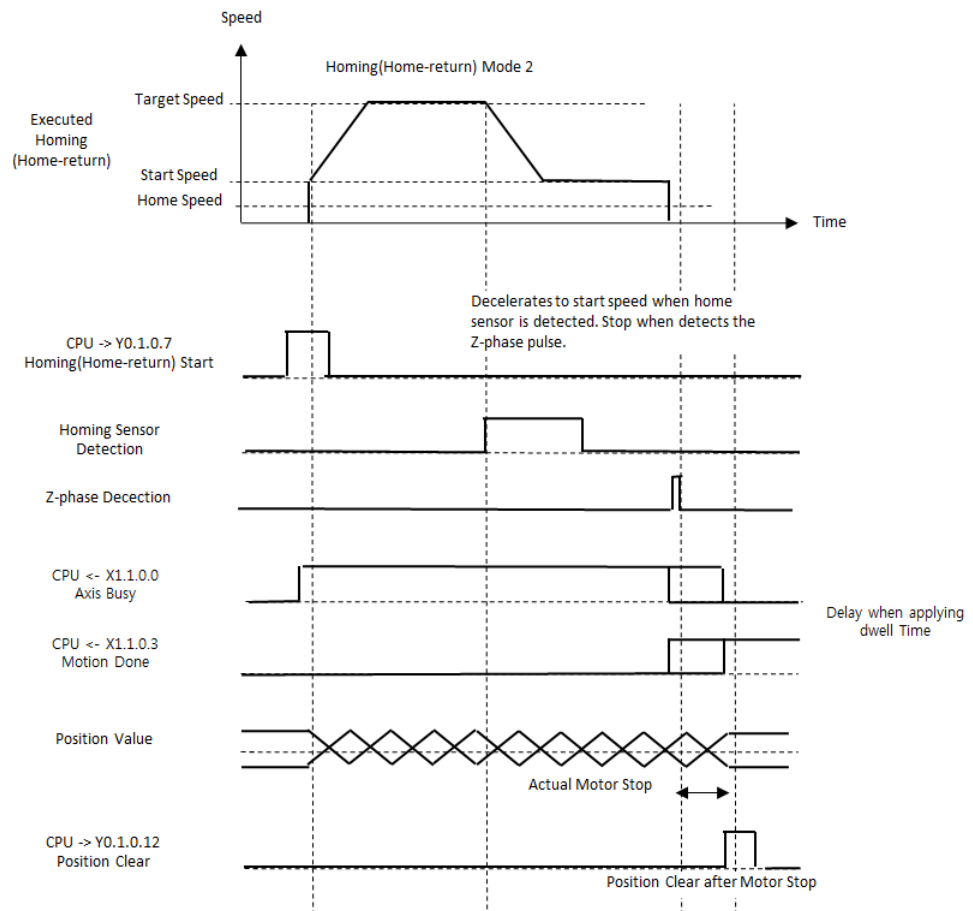
If the homing sensor is detected, it decelerates to stop then moves in the reverse direction at low speed. It is a mode to escape from home sensor and stop by detecting home sensor again at low speed.

It is general type for home-return, home location will be accurate when the direction for detecting the sensor has to be always the same while repeating of home-return. It will be more accurate with low-speed.



## Z-phase pulse detection after deceleration and home sensor detection (Mode 2)

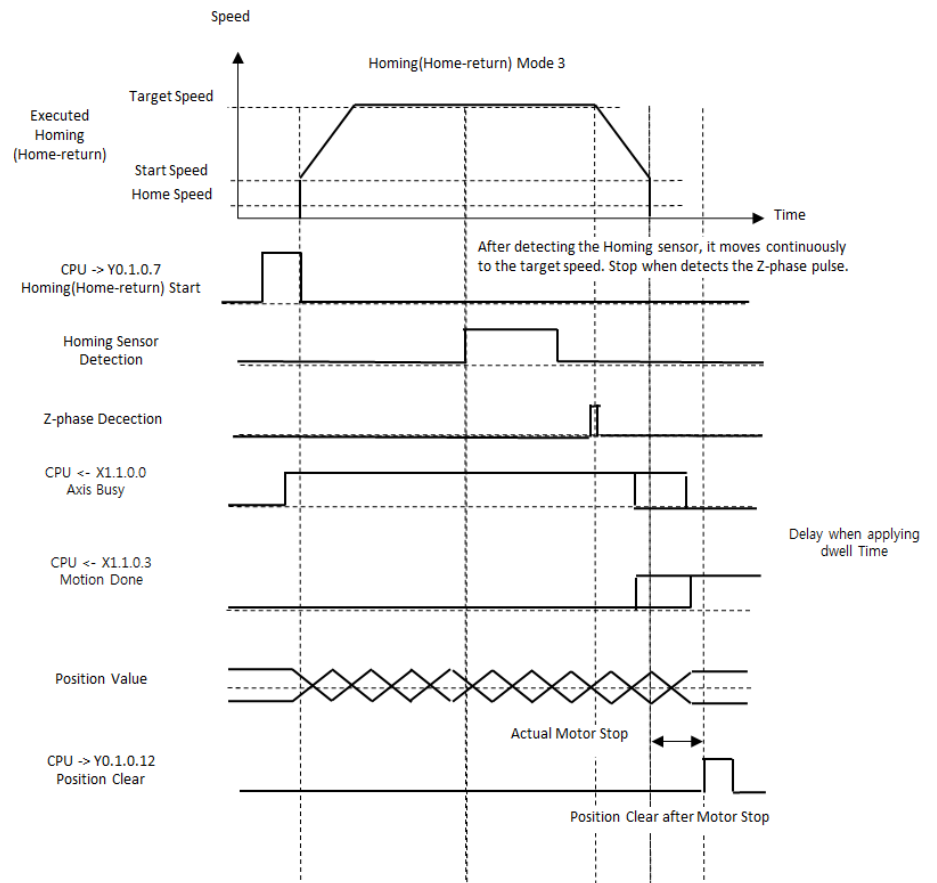
It is the mode that starts decelerate to the direction when home sensor is detected and stops when Z-phase pulse is detected. If Z-phase is not detected until deceleration is completed, it continuously moves to the start velocity until Z-phase is detected. Therefore, be cautious that start velocity should not be near '0'.





## Z-phase pulse detection after homing sensor detection (Mode 3)

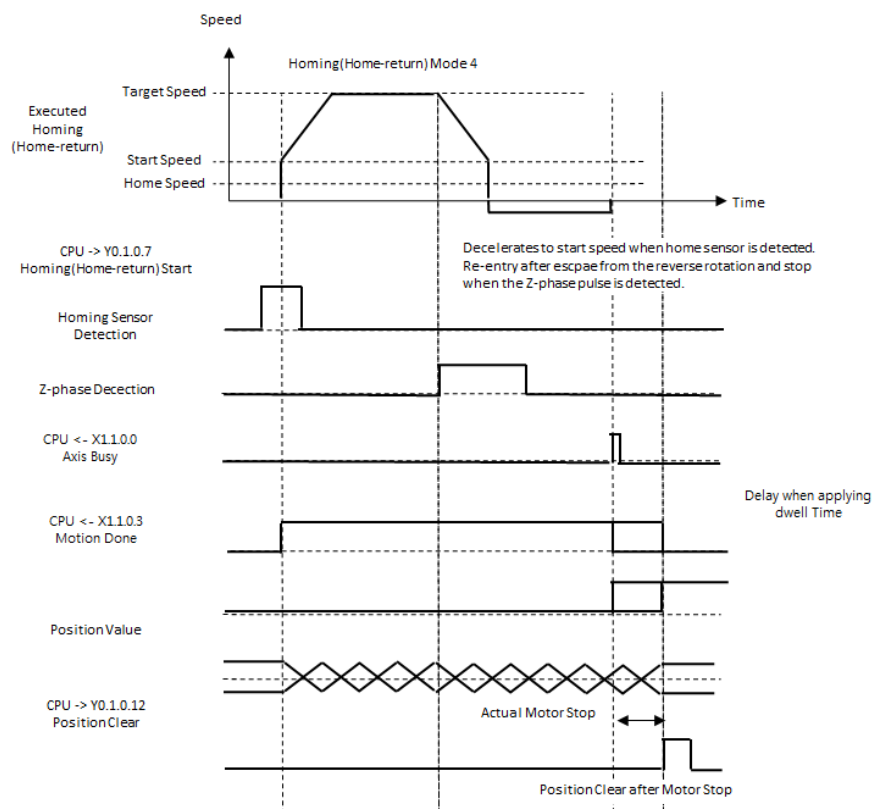
It is the mode that starts decelerate to the direction when home sensor is detected and decelerate to stops when Z-phase pulse is detected.



## Z-phase pulse low-speed detection in reverse direction after homing sensor detection (Mode 4)

When home sensor is detected, it decelerates to stop, then rotates in the reverse direction at low speed to escape the home sensor. Then, stops when z-phase is detected.

Z-phase detection operation performs after when home sensor is detected at 'ON → OFF' state while rotation in reverse direction.

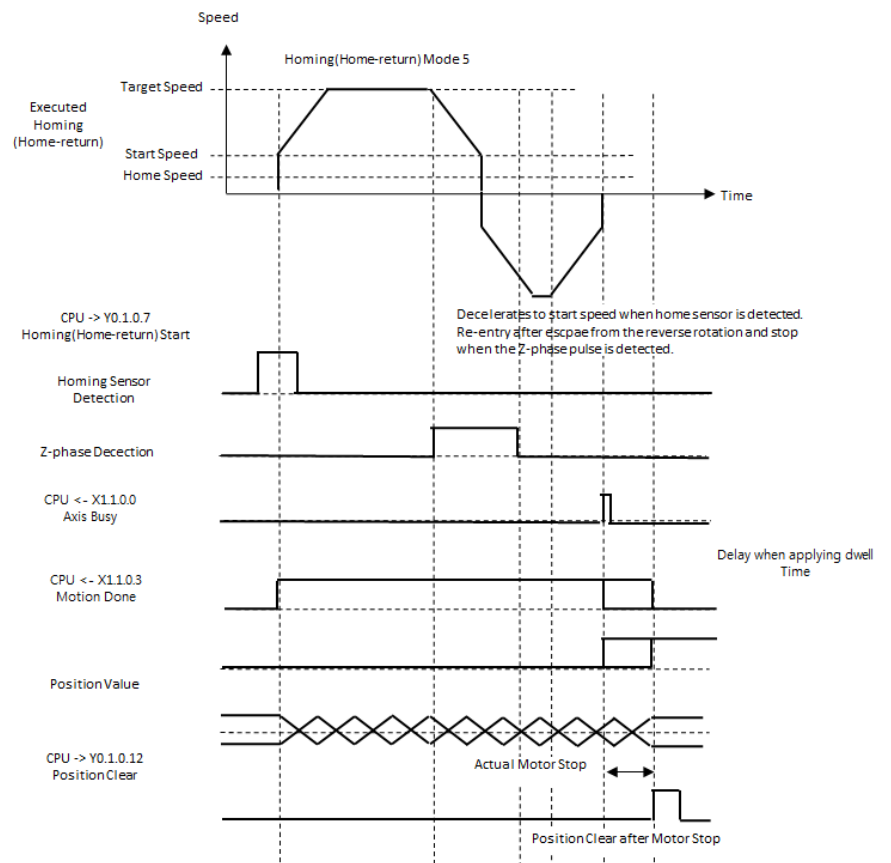


## Stops at Z-phase pulse with high velocity after home sensor detection (Mode 5)

When home sensor is detected, it decelerates to stop, then rotates in the reverse direction at high speed to escape the home sensor. Then, stops when Z-phase is detected.

Z-phase detection operation performs after when home sensor is detected at 'ON → OFF' state while rotation in reverse direction.

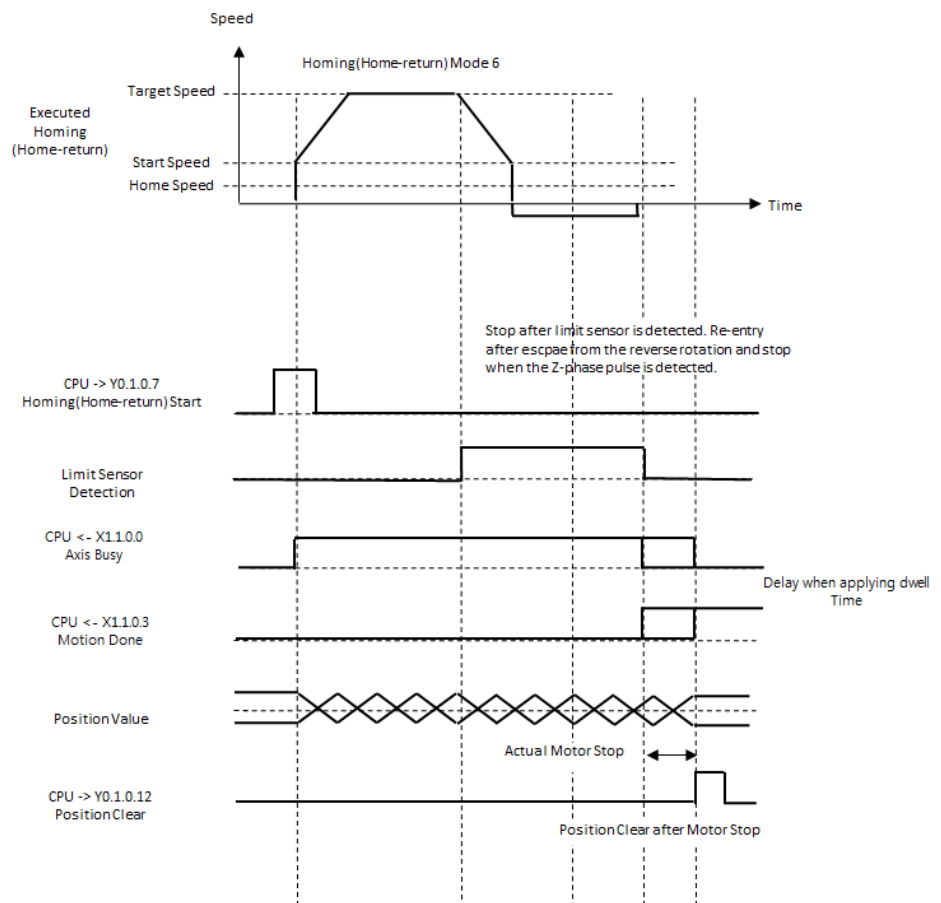
Also reverse rotation should start at home sensor detection state.



## Limit Sensor Detection Type (Mode 6)

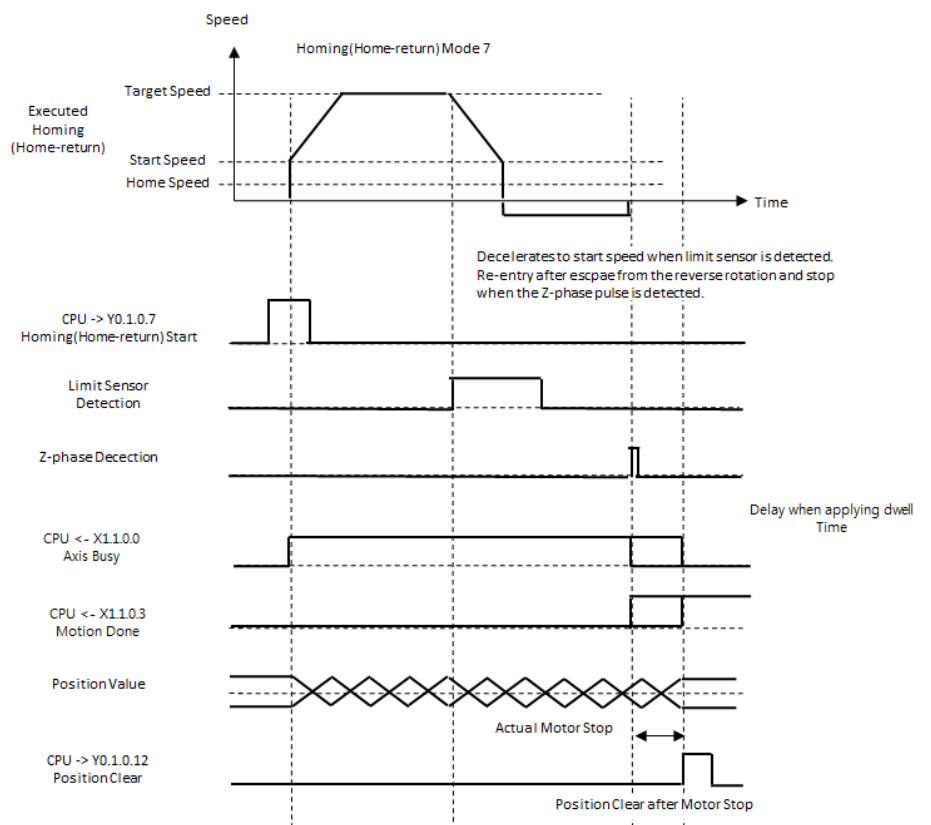
It stops when limit sensor is detected, then rotates in the reverse direction at low speed to escape the home sensor and stops. The stop when the limit sensor is detected for the first time, is decelerated to stop according to the setting of Stop Action Mode (Limit Action) in the setting data, or stops immediately.

If the limit sensor has already passed in the direction when limit sensor is detected and stopped at first, home operation will be finished at that location. When decelerating stop is used in the Stop Action, the Acceleration / Deceleration of Home-return should be set to a sufficiently small value so that there is no possibility of passing the limit sensor.



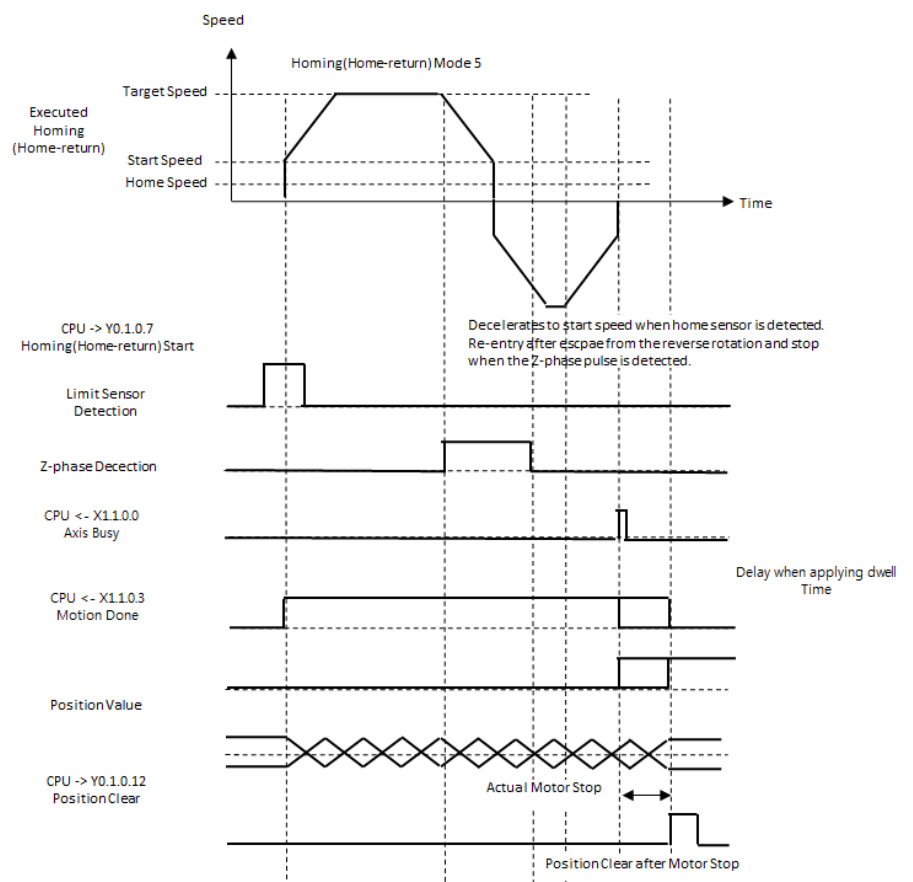
## Z-phase pulse low-speed detection in reverse direction after limit sensor detection (Mode 7)

It stops when limit sensor is detected, then rotates in the reverse direction at low speed. It stops again when Z-phase is detected. The stop when the limit sensor is detected for the first time, is decelerated to stop according to the setting of Stop Action Mode (Limit Action) in the setting data, or stops immediately.



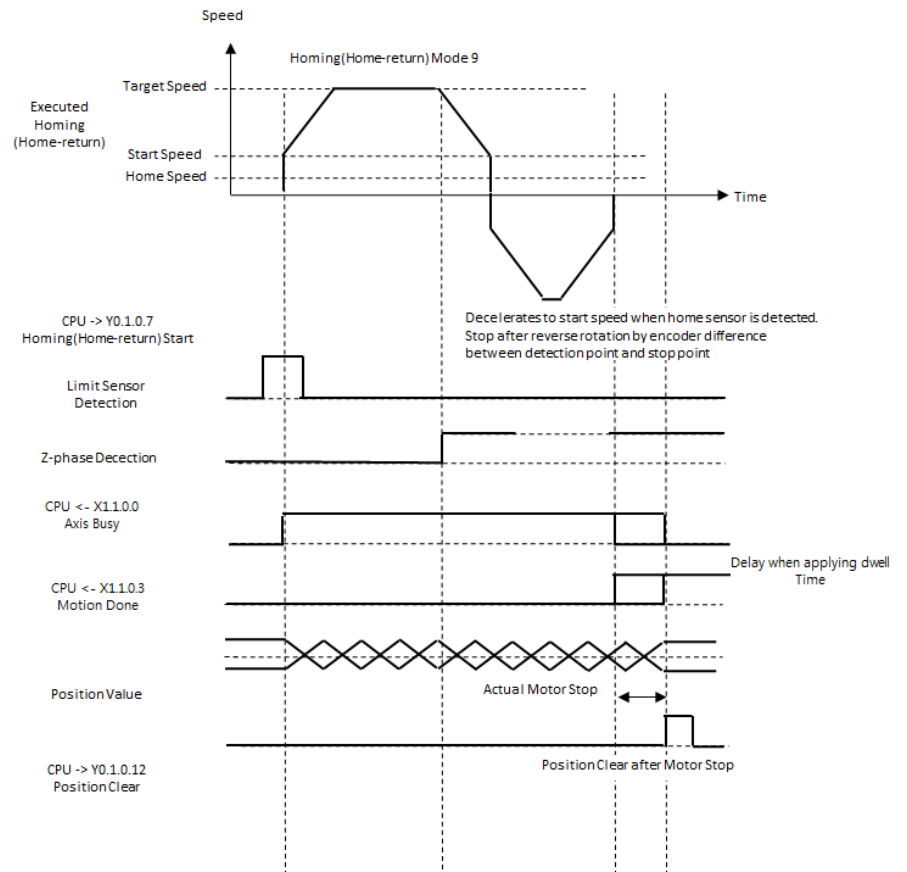
## Z-phase pulse high-speed detection in reverse direction after limit sensor detection (Mode 8)

It stops when limit sensor is detected, then rotates in the reverse direction at high speed. It stops again when Z-phase is detected. The stop when the limit sensor is detected for the first time, is decelerated to stop according to the setting of Stop Action Mode (Limit Action) in the setting data, or stops immediately.



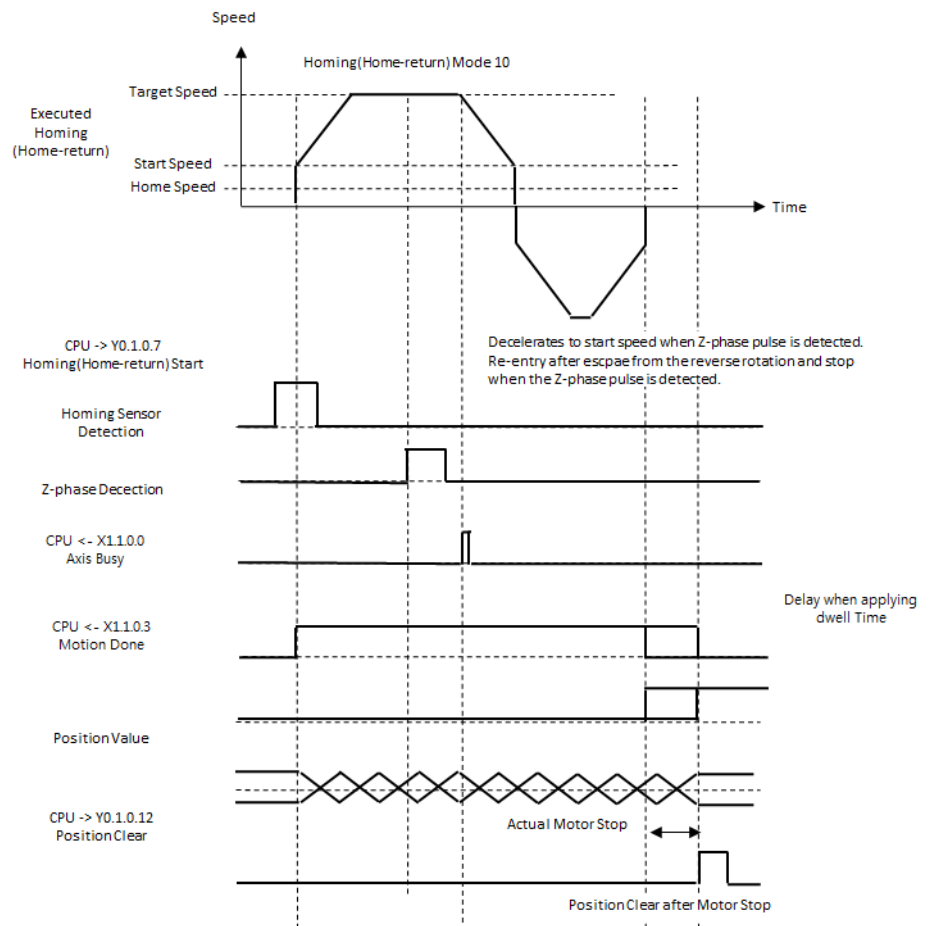
## Home sensor detection type and further movement (Mode 9)

When the home sensor is detected, it operates in mode 0 which decelerates to stop. Then it returns by the amount of encoder movement in deceleration section.



## Z-phase pulse detection type after home sensor detection and further movement (Mode 10)

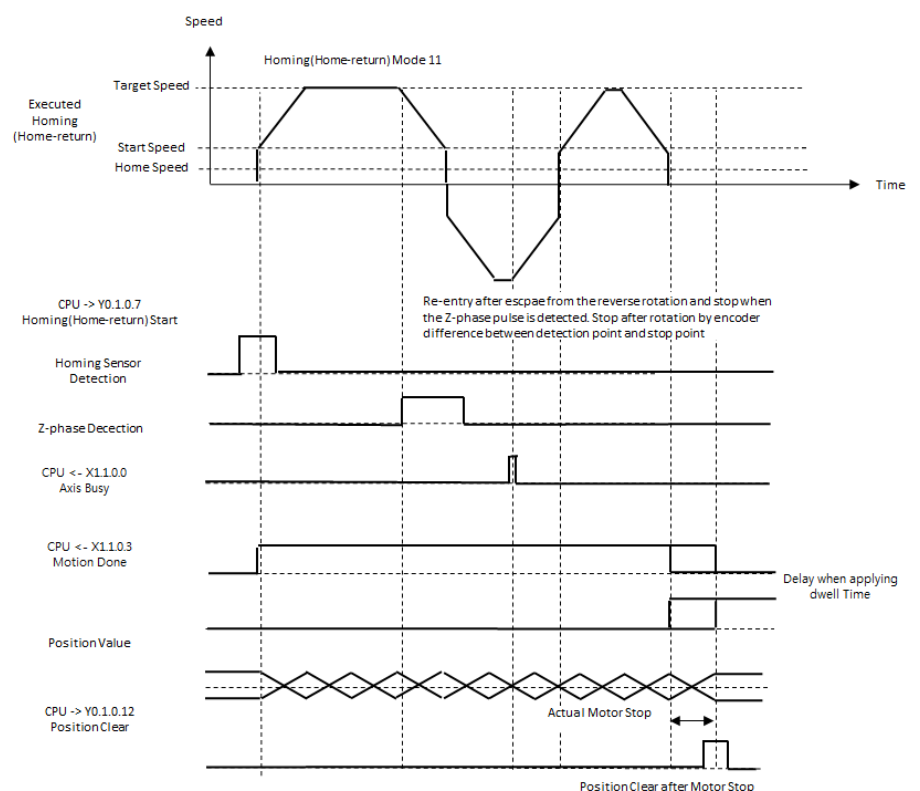
When the home sensor is detected, it operates in mode 3 which decelerates to stop after Z-phase pulse is detected. Then it returns by the amount of encoder movement in deceleration section.





## Z-phase pulse high-speed detection in reverse direction after limit sensor detection and further movement (Mode 11)

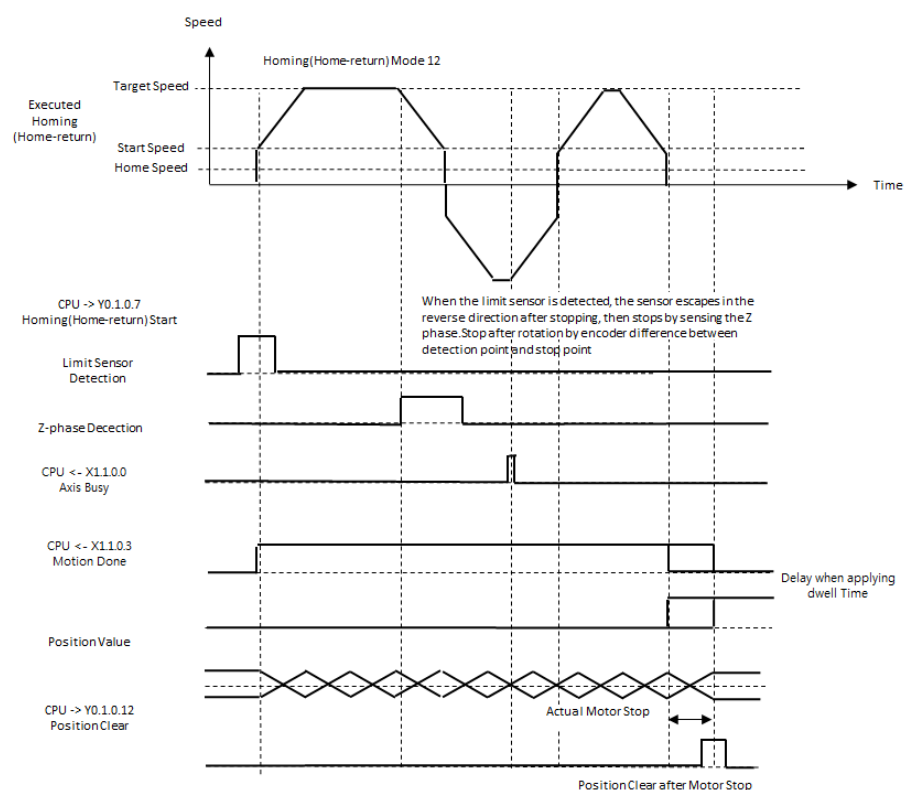
When the home sensor is detected, it operates in mode 5 which rotates in the reverse direction at high speed to escape from home sensor and stops after Z-phase pulse is detected. Then it returns by the amount of encoder movement in deceleration section. At rotation of reverse direction, Z-phase pulse detection operation performs after the change of 'ON -> OFF' state of home sensor is detected. In addition, reverse rotation must be started from home sensor detection state.



## Z-phase pulse high-speed detection in reverse direction after limit sensor detection and further movement (Mode 12)

When the limit sensor is detected, it operates in mode 8 which decelerates to stop after rotation in the reverse direction at high speed when Z-phase pulse is detected. Then it returns by the amount of encoder movement in deceleration section.

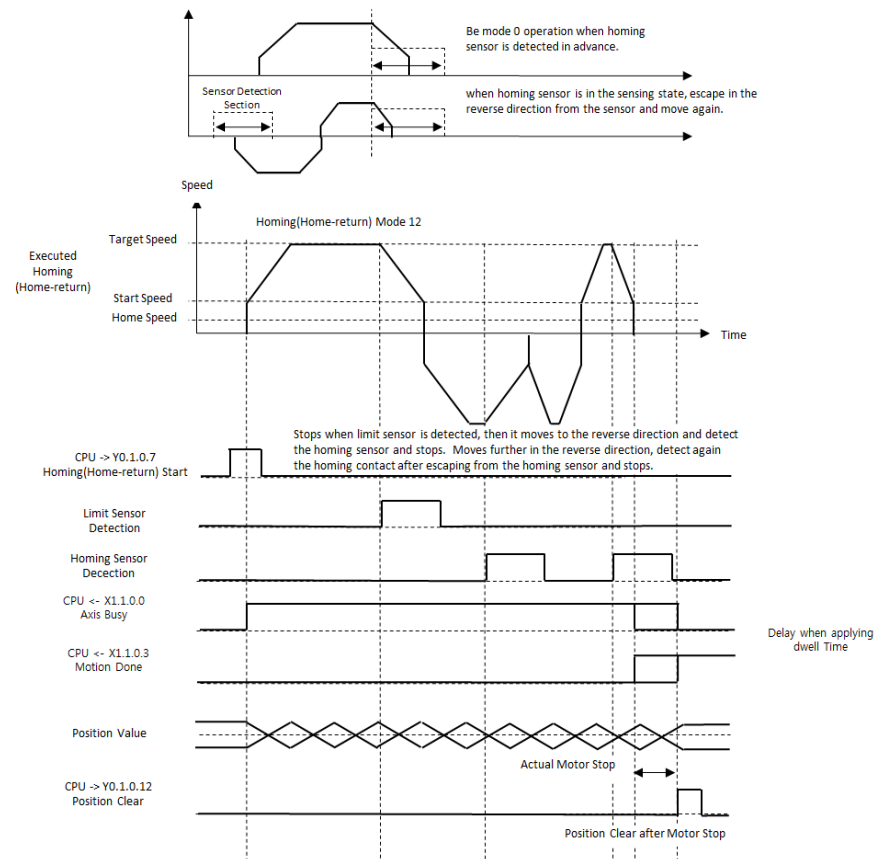
The stop when the limit sensor is detected for the first time, is decelerated to stop according to the setting of Stop Action Mode (Limit Action) in the setting data, or stops immediately



## Combination type of home sensor and limit sensor detection

### (Mode 13)

It is the mode either stops after detection of home sensor or detect limit sensor first then rotate in reverse direction to detect the home sensor and stops, then re-detect to stop the home sensor after escape from home sensor.

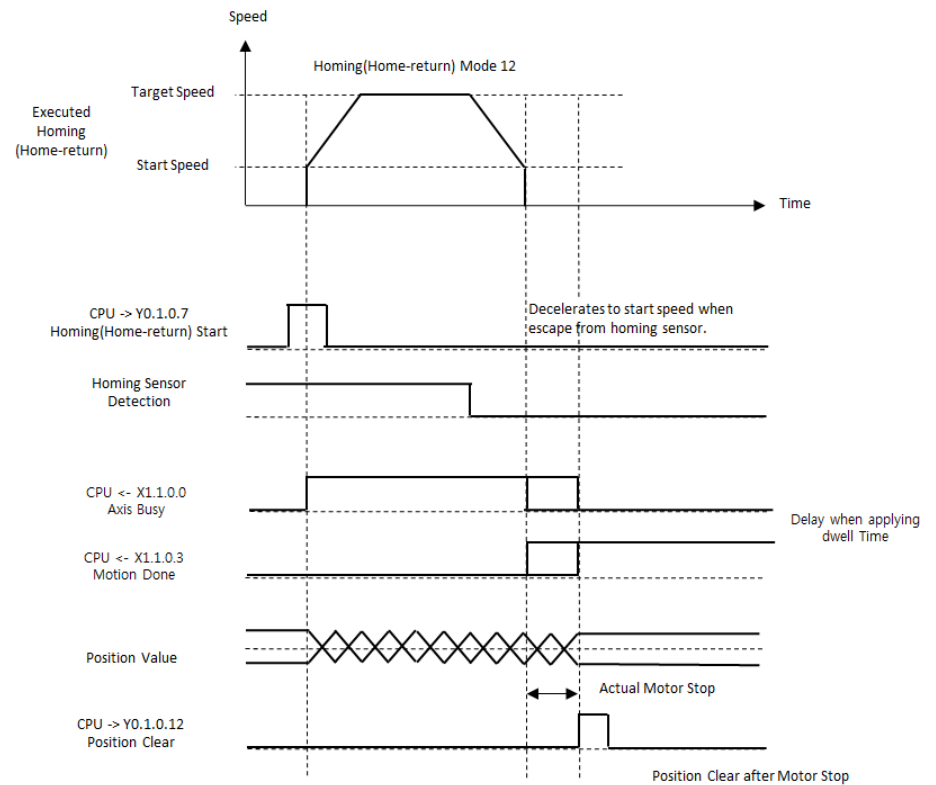


The stop when the limit sensor is detected for the first time, is decelerated to stop according to the setting of Stop Action Mode (Limit Action) in the setting data, or stops immediately

The amount of movement that escape from home sensor is applied the Home velocity (Escape distance) value.

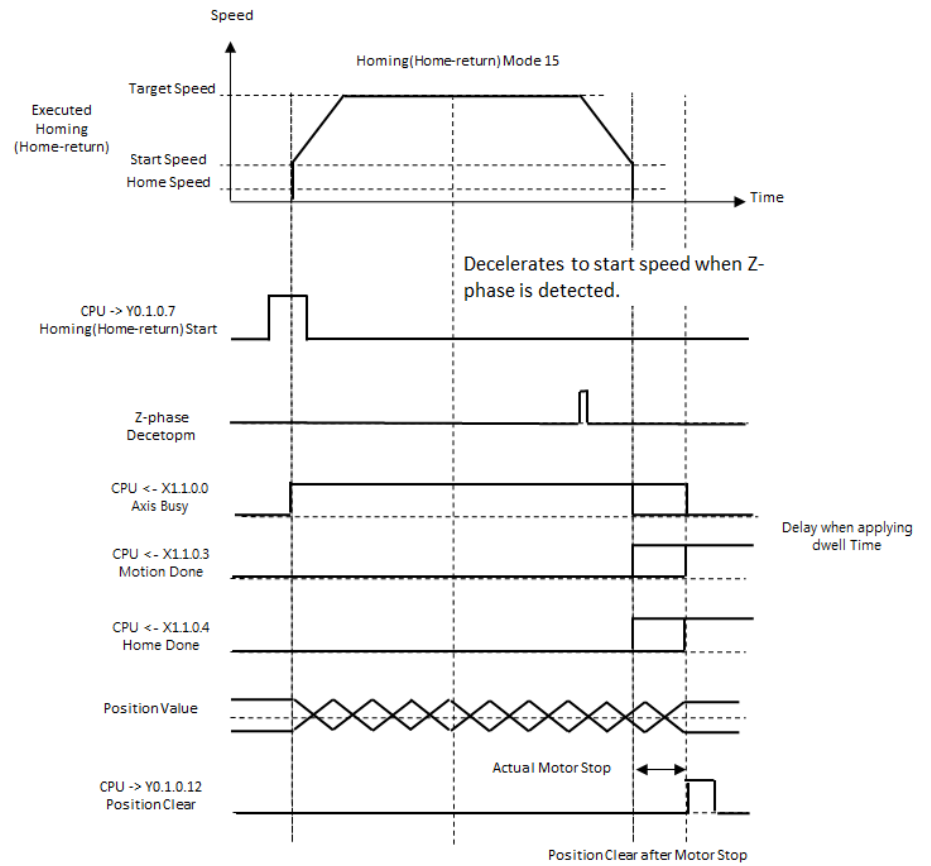
## Home-return type after escaping from the home sensor (Mode 14)

It is the deceleration and stopping mode when the home sensor escapes from the detection state.



## Z-phase home-return type (Mode 15)

It is the mode that stops when Z-phase pulse is detected.



## User home defined type (Mode 16)

It is the home-return mode that used by setting data which user defined on output data table without using setting value in expansion parameter.

When set to user home defined type mode 16, the related parameter will be applied based on value from output data table.

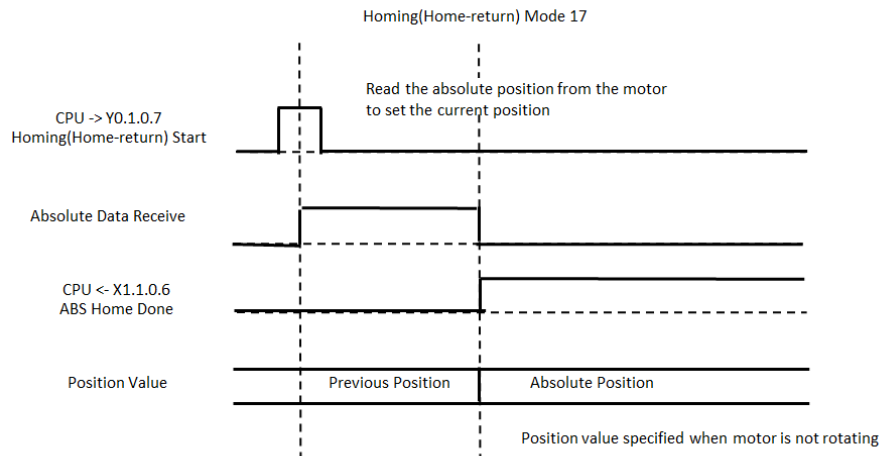
Data Structure at Homing Mode by User Defined Type					Setting Range
Offset	Contents	2-axis	3-axis	4-axis	Contents
0	Y0	Y20	Y40	Y60	Homing Start(Y0.Δ.1.7)
1	Y1	Y21	Y41	Y61	Home Mode(0~14)
2	Y2	Y22	Y42	Y62	Home Direction(CW/CCW)
3	Y3	Y23	Y43	Y63	Accel./Decel. Time
4	Y4	Y24	Y44	Y64	
5	Y5	Y25	Y45	Y65	
6	Y6	Y26	Y46	Y66	
7	Y7	Y27	Y47	Y67	Start Speed
8	Y8	Y28	Y48	Y68	
9	Y9	Y29	Y49	Y69	Target Speed
10	Y10	Y30	Y50	Y70	
11	Y11	Y31	Y51	Y71	Home Speed
12	Y12	Y32	Y52	Y72	
13	Y13	Y33	Y53	Y73	Dwell Time
14	Y14	Y34	Y54	Y74	
15	Y15	Y35	Y55	Y75	
16	Y16	Y36	Y56	Y76	
17	Y17	Y37	Y57	Y77	
18	Y18	Y38	Y58	Y78	
19	Y19	Y39	Y59	Y79	

Caution : Starting velocity, Target velocity, Home velocity are Float type data. (2 word size)

<b>TIP</b>	<p>User home defined type(Mode 16) follows the home-return mode which specified in Y0.Δ.1, and each operations are performed as described in previous chapter.</p> <p>Operations that can be performed as the user defined home-return type can be specified any actions from home type 0 to 14</p>
------------	---

## Absolute Encoder Type (Mode 17)

This is the mode to set the current position using the absolute value data coming from the motor when the absolute value motor is used. When using an absolute motor, the sensor is detected and the current position is immediately read and the position value is set without movement.



Position of Absolute Value = ABS Multiple-rotation Data x Start Parameter (Absolute Value Home Multiple-rotation Multiplication Value) + ABS 1-rotation Data x Start Parameter (Absolute Value Home 1-rotation Multiplication Value)

The value of the start parameter must be set in advance according to the servo drive (motor) that is used.

Example)

ABS Multiple-rotation Data : 3

ABS 1-rotation Data : 100

Absolute Value Home Multiple-rotation Multiplication Value : 32768  
(When the motor rotates once per 32768 pulses)

Absolute Value Home 1-rotation Multiplication Value : 0.25 (When  
ABS 1 rotation data is received in 4 multiplication)

Position of Absolute Value =  $3 \times 32768 + 100 \times 0.25$   
 $= 98304 + 25 = 98329$  (In some cases, the scale value of the  
operation parameter may be set to a minus (-) sign)

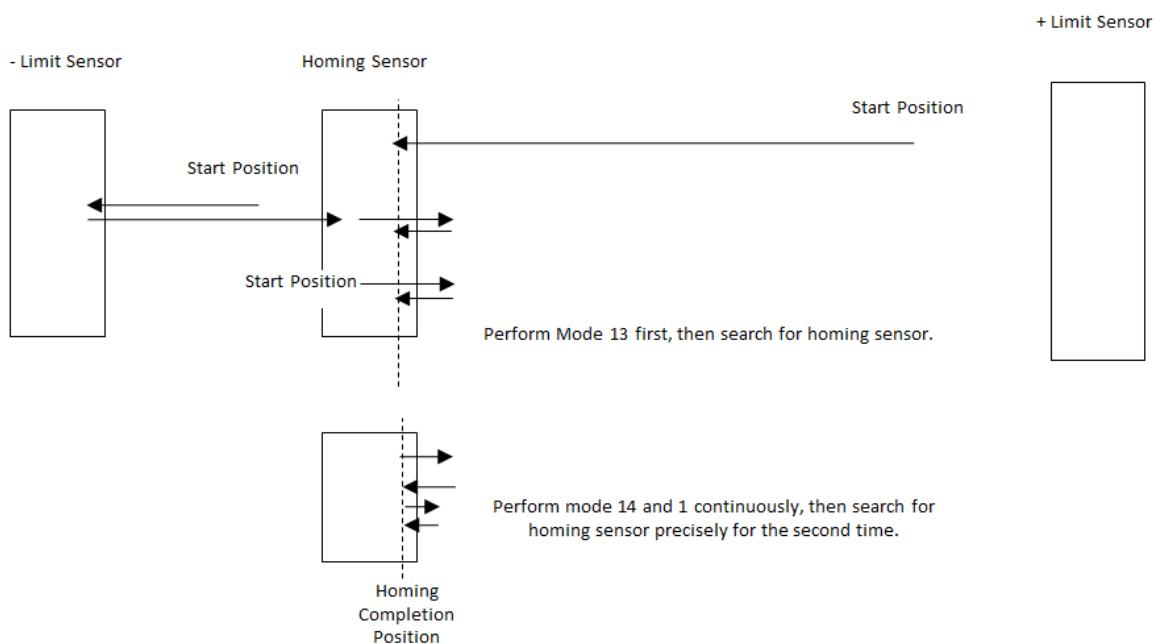
## Combination Type 1 (Mode 18)

It is a mode to perform home-return automatically by continuous operation of Home-return Mode 13(Combination of Home sensor & Limit sensor), Mode 14(Escape Home sensor), Mode 1(Re-detection of Home sensor). After looking for the home sensor with high-speed, search the home sensor precisely again.

Operation of each mode in continuous operation is the same as operation description of each mode.

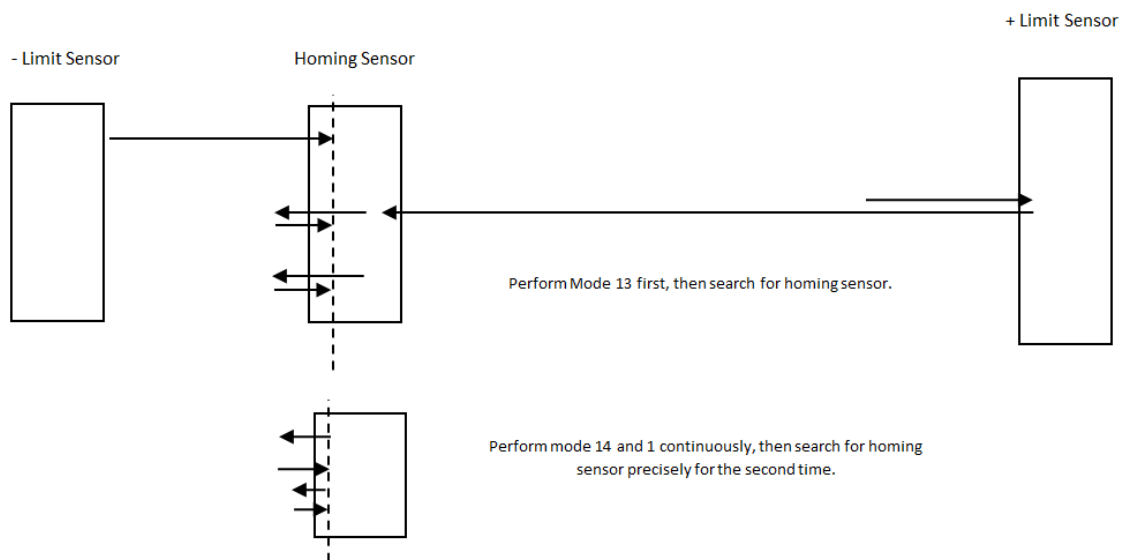
## Homing(Home-return) mode 18

Homing(Home-return) start in reverse direction





## Homing(Home-return) start in forward direction



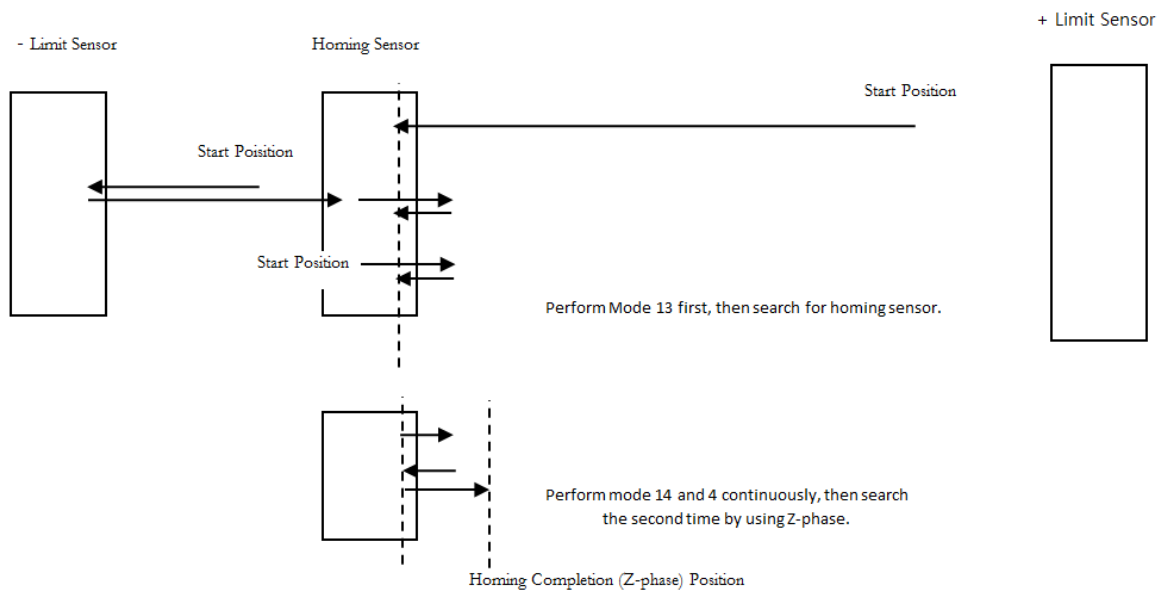
### Combination Type 2 (Mode 19)

It is a mode to perform home-return automatically by continuous operation of Home-return Mode 13(Combination of Home sensor & Limit sensor), Mode 14(Escape Home sensor), Mode 4(Detection of Z-phase after home sensor). After looking for the home sensor with high-speed, search the Z-phase pulse precisely again.

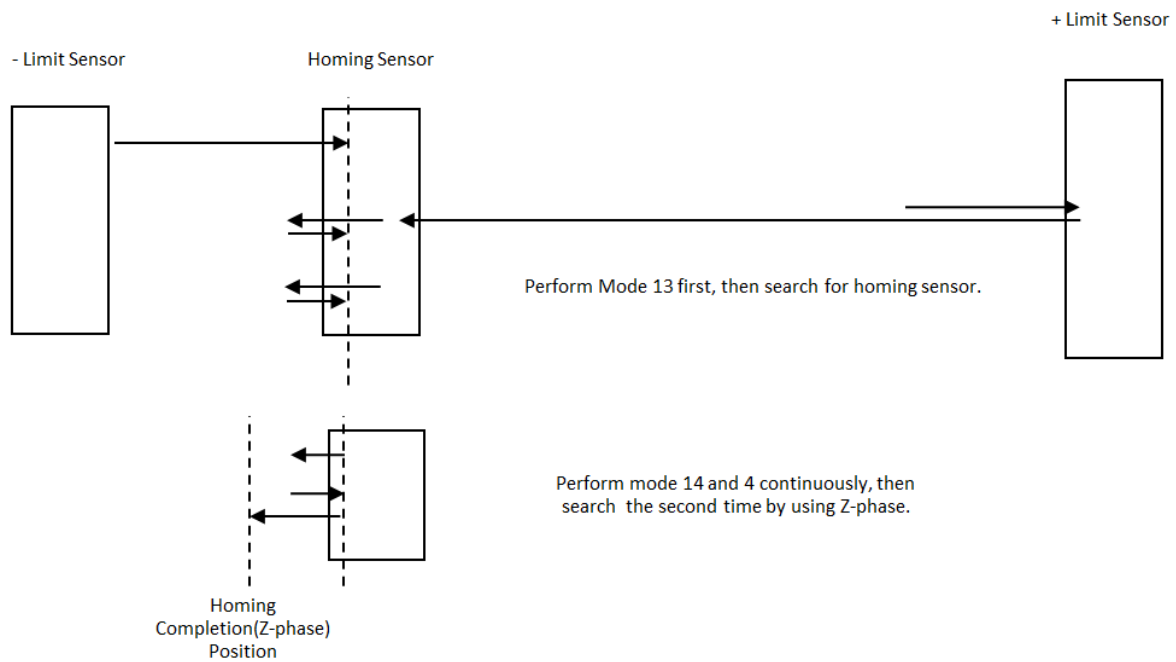
Operation of each mode in continuous operation is the same as operation description of each mode.

## Homing(Home-return) Mode 19

Homing(Home-return) start in reverse direction

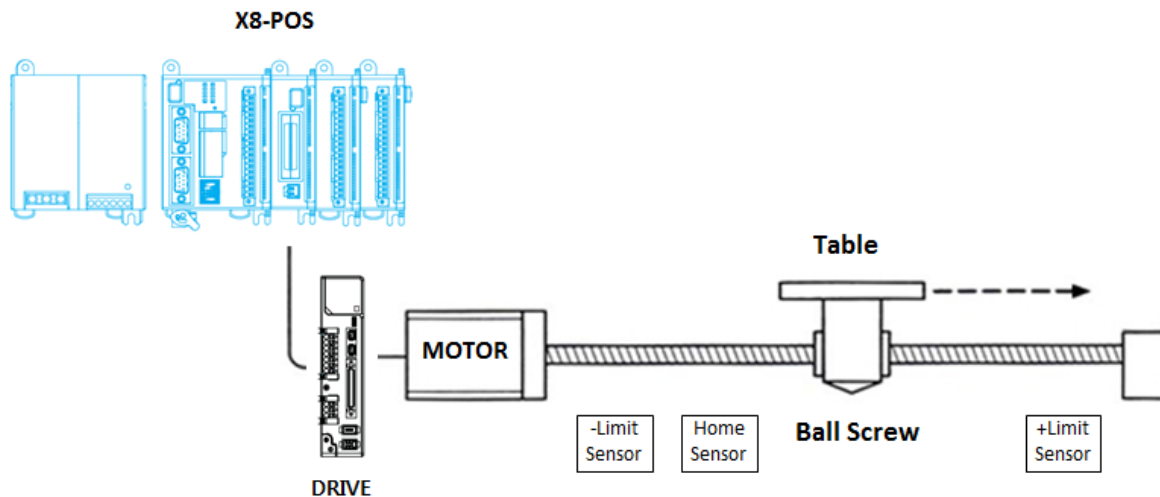


Homing(Home-return) start in forward direction.



## Program Example

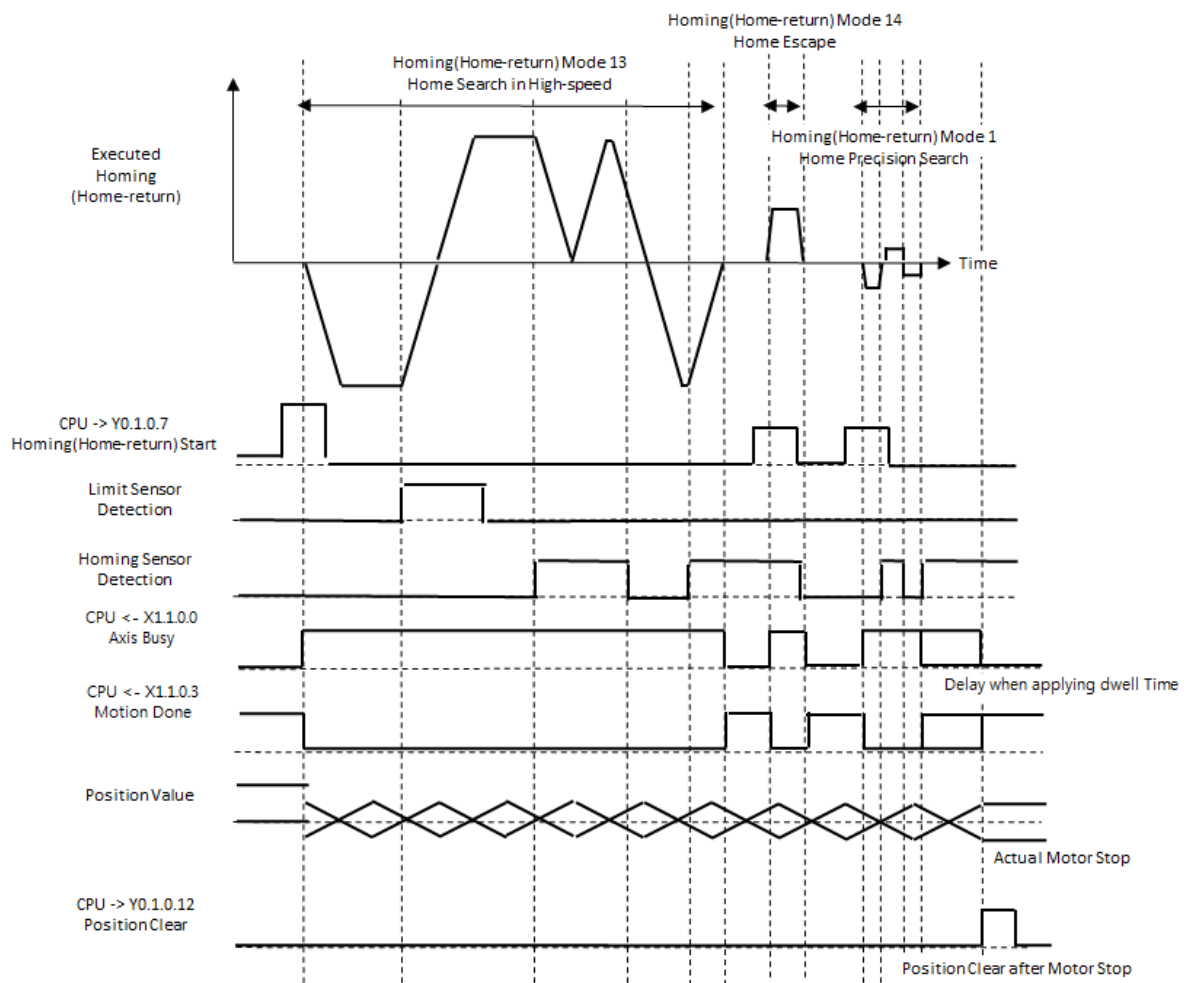
In the general case, Homing Mode 13 is executed and Mode 1 (or Mode 4) is performed once more to achieve more accurate home-return.



Example of 1 axis start parameter that mounted on Slot 1. (Start Command : Y0.1.0 = x00080, Start of Home-control)

Start Data		Quick Return		Escape from Home		Precision Return	
Output Data Table	Parameter	Setting Value	Contents	Setting Value	Contents	Setting Value	Contents
Y0.1.1	Control Code	13	1 <sup>st</sup> Home Return	14	Escape from Home	1	2 <sup>nd</sup> Precision Detection
Y0.1.2	Expansion Control Code	0x0004	CCW Direction	0x0000	CW Direction	0x0004	CCW Direction
Y0.1.3	Accel./Decel. Time	50	msec	30	msec	10	msec
Y0.1.7~8	Start Speed	0.0	Initial Speed	0.0	Initial Speed	0.0	Initial Speed
Y0.1.9~10	Target Speed	10000.0	Maximum Speed	1000.0	Maximum Speed	1000.0	Maximum Speed
Y0.1.11~12	Home Speed /Escape Distance	300.0	Escape Distance(Mode 13)	-	N/A(Mode 14)	100.0	Low-speed Movement(Mode 1)
Y0.1.13	Dwell Time	0	msec	0	msec	0	msec

Caution : Starting Velocity, Maximum Velocity and Home Velocity are Float type data. (2 word size)

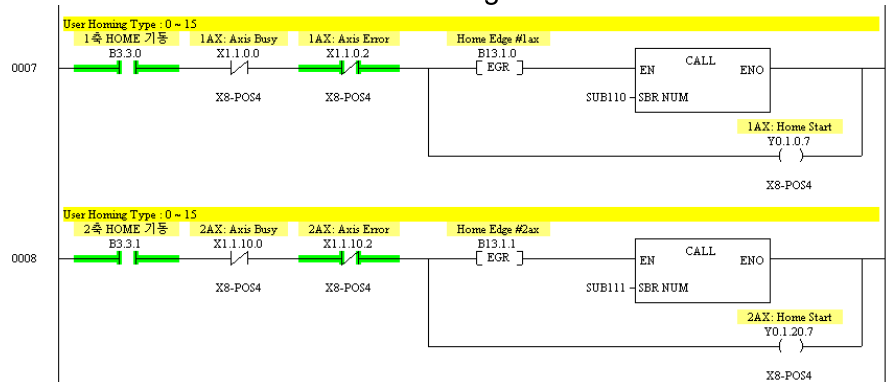


## ■ Program Example Enter Profile

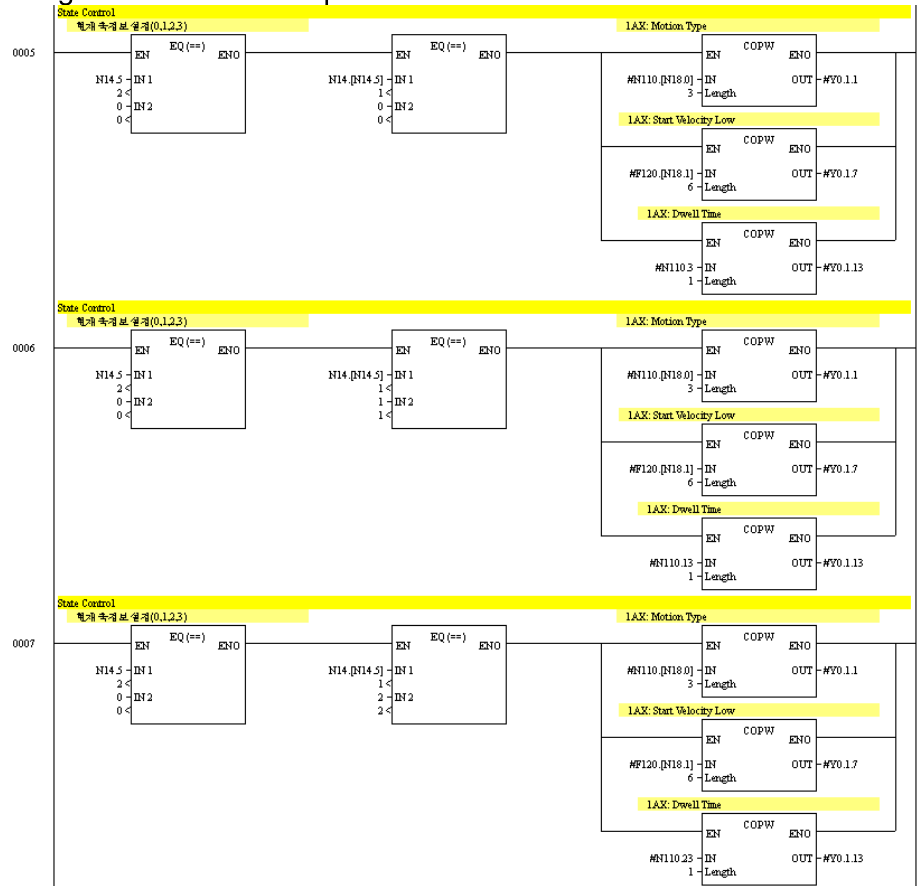
Data Table : N110 -- 홈모드16_DATA				
어드레스	데이터 타입	값	의미	설명
N110.0	Integer	13		HOME MODE 13
N110.1	Integer	1		HOME Dir, 1:역방향
N110.2	Integer	50		Accel/Decel
N110.3	Integer	0		Dwell Time
N110.4	Integer	0		
N110.5	Integer	0		
N110.6	Integer	0		
N110.7	Integer	0		
N110.8	Integer	0		
N110.9	Integer	0		
N110.10	Integer	14		Home Mode 14
N110.11	Integer	0		HOME Dir, 1:역방향
N110.12	Integer	30		Accel/Decel
N110.13	Integer	0		Dwell Time
N110.14	Integer	0		N110.12, Integer
N110.15	Integer	0		Accel/Decel
N110.16	Integer	0		
N110.17	Integer	0		
N110.18	Integer	0		
N110.19	Integer	0		
N110.20	Integer	1		Home Mode 1
N110.21	Integer	1		HOME Dir, 1:역방향
N110.22	Integer	10		Accel/Decel
N110.23	Integer	0		Dwell Time
N110.24	Integer	0		
N110.25	Integer	0		
N110.26	Integer	0		
N110.27	Integer	0		
N110.28	Integer	0		
N110.29	Integer	0		

Data Table : F120 -- Home (start,end)				
어드레스	데이터 타입	값	의미	설명
F120.0	Float	0.0		Home Start Vel
F120.1	Float	10000.0		Home End Vel
F120.2	Float	300.0		Home Vel
F120.3	Float	0.0		Home Start Vel
F120.4	Float	1000.0		Home End Vel
F120.5	Float	0.0		Home Vel
F120.6	Float	0.0		Home Start Vel
F120.7	Float	1000.0		Home End Vel
F120.8	Float	100.0		Home Vel

## 2-axis Simultaneous Home Start Program



## Program to write on Output Data Table



### WARNING



Caution 1. Accurate home-return can be done by stopping in the lower section of the sensor with appropriate set of acceleration/Deceleration (Recommendation : 20msec ~ 100msec)

Caution 2. Once the homing operation starts, the current position value will be changed. Therefore, it will be a reliable position value only after home-return operation normally completes.

**14. Deceleration Stop and Forced Stop ..... 2**

    Operation of Deceleration Stop..... 2

    Operation of Forced Stop..... 3

    I/O Contact-point Operation of Before and After Stop Operation ..... 4

    Precaution for Stop operation ..... 5

        State of pulse output completion flag after being stopped ..... 5

        Re-after after the stop ..... 5

        Elapsed value data at forced stop ..... 6

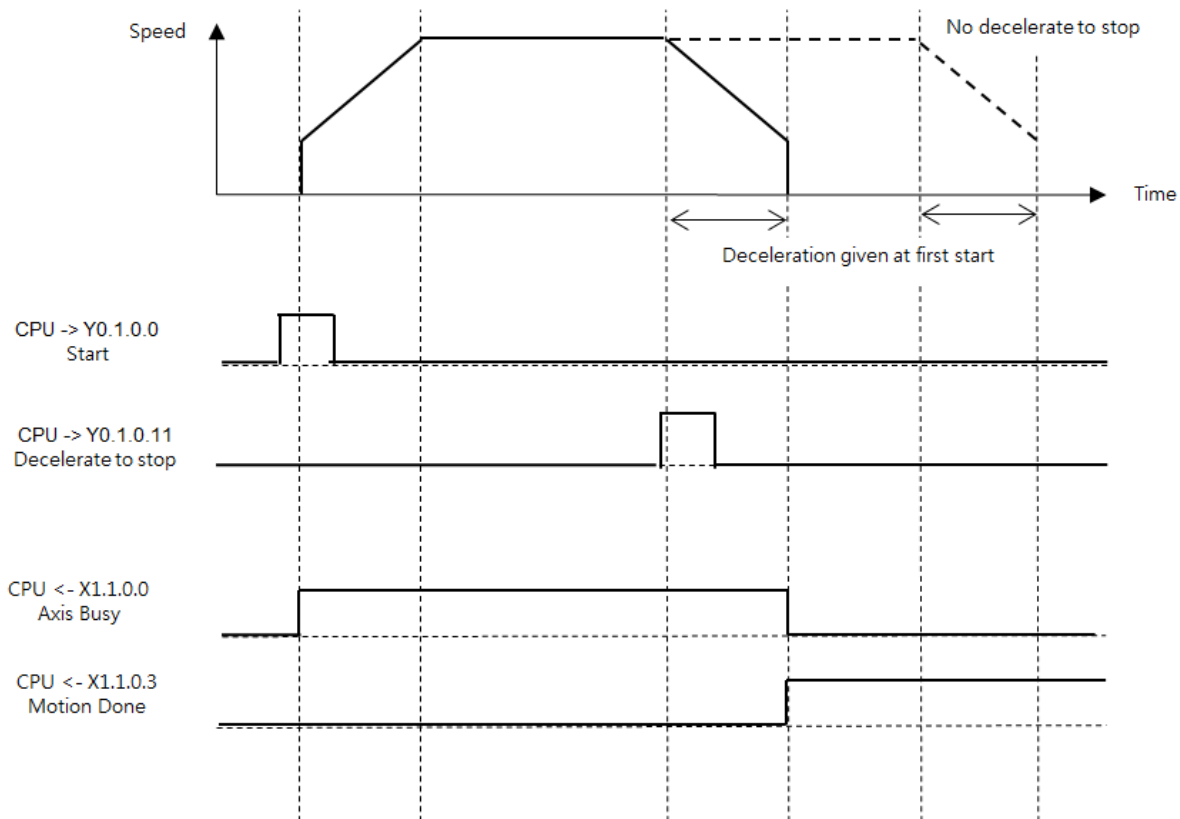


# 14. Deceleration Stop and Forced Stop

This chapter describes the deceleration stop and forced stop functions for position module. This function stops the control axis that is currently moving, before reaching target position. The same applies to all start command.

## Operation of Deceleration Stop

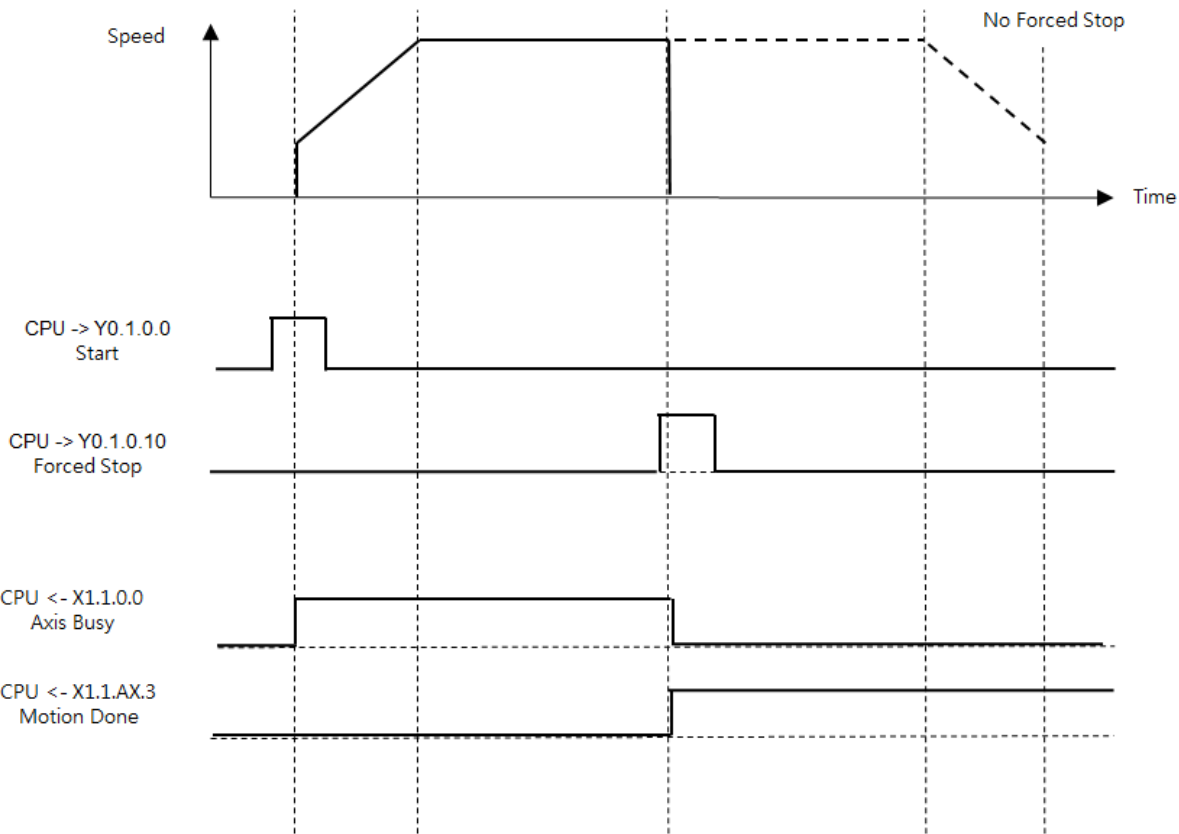
The moving control axis by E-point control, P-point control, Interpolation control will decelerate and stop according to the deceleration value set at start. (JOG operation is applied as deceleration to the acceleration value set at the first start)



After the deceleration is completed and the operation is completely stopped, the pulse output completion flag turns ON.

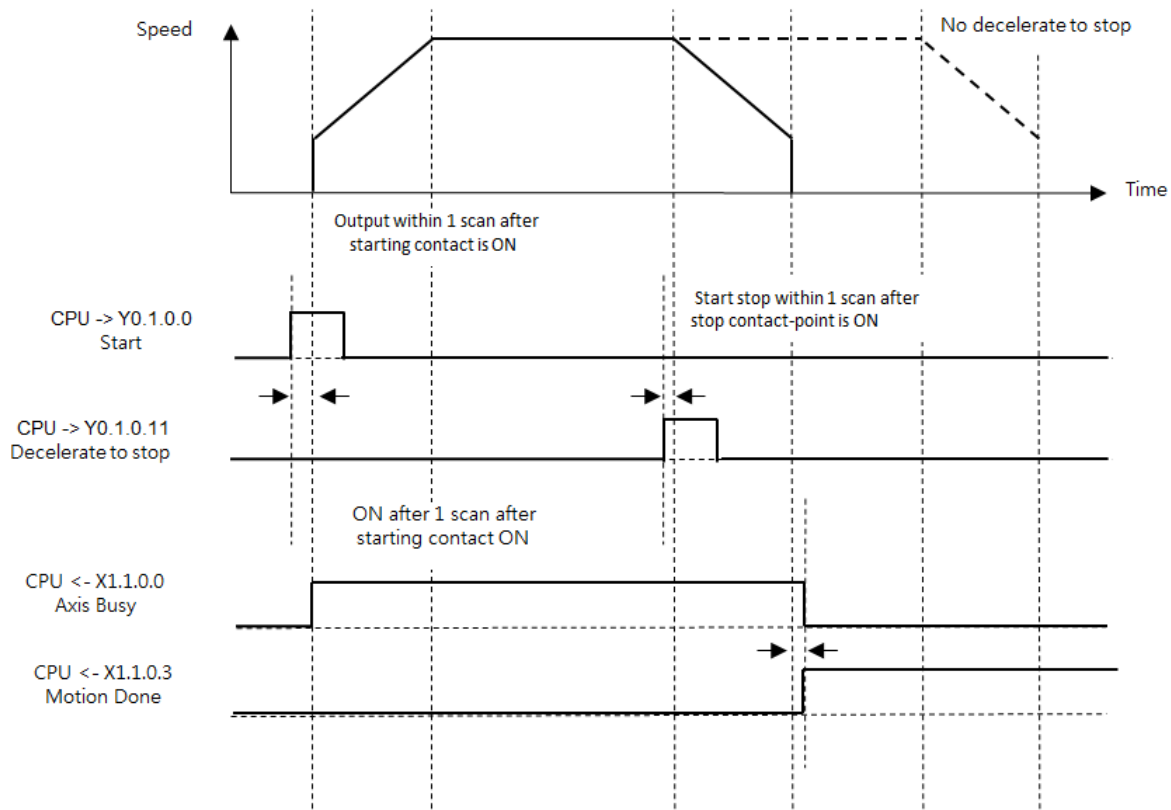
# Operation of Forced Stop

The control axis that is being moved to all start commands will stop immediately without deceleration.



After the deceleration is completed and the operation is completely stopped, the pulse output completion flag turns ON.

## I/O Contact-point Operation of Before and After Stop Operation



### ■ Deceleration Stop Contact-point (Y0.Δ.0.11) and Forced Stop Contact-point (Y0.Δ.0.10)

- ① Current operation will be stopped
- ② Ignored when it is stopped.
- ③ Will reset when power is off.

### ■ Flag while pulse output (X1.□.0.0)

- ① It turns ON at the next scan after E point control is started, and turns OFF when pulse output is completed.
- ② While this signal is ON, another operation is not performed. (Excluding forced stop and decelerate to stop)
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, and Homing(Home-return) operation. (Excluding the pulse generator input permission)

#### ■ Pulse Output Completion Flag (X1.□.0.3)

① It is turned ON when the pulse output is completed, then remains until the any operation of either E-point control, P-point control, JOG operation, Homing operation and pulse generator input permission is started

② Reset when power if turned OFF.

※ This flag is common operation to E-point control, P-point control, JOG operation, and pulse generator input permission.

## Precaution for Stop operation

Motor being completely stopped after the stop command, has to be decided after seen the pulse output completion flag.

It will not reach the original target position, since it was stopped randomly during the movement.

It is recommended to use in urgent needs, since forced stop may cause the mechanical shock due to stop without deceleration.

When stopping during interpolation control, stop command must be issued to all axes.

### State of pulse output completion flag after being stopped

In call cases of deceleration stop and forced stop, the pulse output completion flag is turned ON after stopping.

If the pulse output completion flag is used as the trigger signal for operation after completion of positioning, write a program so that it does not move to the next operation at deceleration stop or forced stop.

### Re-after after the stop

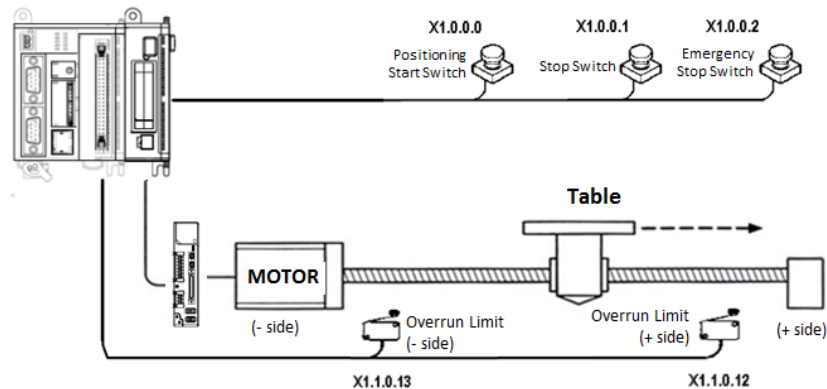
When the deceleration stop or forced stop operation is executed, re-start cannot be executed unless the start contact-point of each operation is turned OFF.

This flag is common operation to E-point control, P-point control, Homing(Home-return), JOG operation, and pulse generator input permission.

## Elapsed value data at forced stop

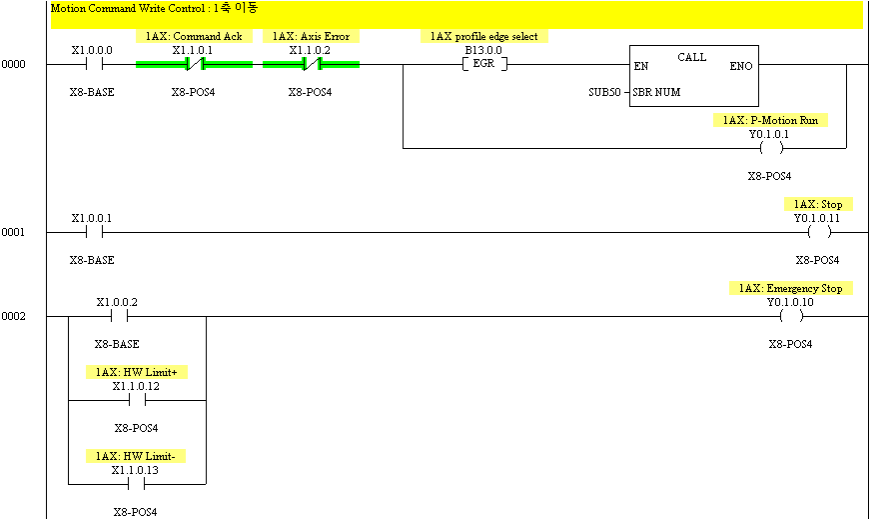
Position elapsed value data is retained even after forced stop. However, it is recommended that to start positioning control again after returning to the home position because it may cause a mechanical displacement in general.

Example Program



This is an example of stop operation during P-point control. Stop operation does not need parameter setting and it will stop when the stop contact-point is turned ON at current axis.

Program



■ Program Note

The number of stop input contact-point changes depends on the number of axes of module and mounting position.  
When the deceleration stop or forced stop operation is executed, re-start cannot be executed unless the start contact-point of each operation is turned OFF.  
This flag is common operation to E-point control, P-point control, Homing(Home-return), JOG operation, and pulse generator input permission.

**15. Multi-axis Linear Control ..... 2**

    Operation Data required for Multi-axis Linear Movement ..... 2

    Operation Flow-chart of Multi-axis Linear Movement..... 2

    Operation of I/O Contact-point before and after Multi-axis Linear Movement..... 6

    2-axis Linear Interpolation Control ..... 7

    3-axis Linear Interpolation Control ..... 8

    4-axis Linear Interpolation Control ..... 9

    Program Example ..... 10

# 15. Multi-axis Linear Control

This chapter describes the multi-axis linear interpolation of positioning module. Linear control operates the specified axis 2,3,4 of linear interpolation. This function takes the specified velocity into consideration as the vector direction of the space, and the velocity of each axis is adjusted automatically. So that start is started simultaneously and stops at the same time.

## Operation Data required for Multi-axis Linear Movement

After setting the data required for multi-axis linear movement operation to I/O parameters in advance, specify the start command. Set the following parameters in the main axis, and the target position values in the other axis.

Example of linear interpolation of the main axis where axis 1 of the module installed in slot 1

Output	Contents
Y0.1.0.0	E-point Start
Y0.1.1	Control Code 7: Multi-axis Relative Linear Interpolation 8: Multi-axis Absolute Linear Interpolation
Y0.1.2	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Enable
Y0.1.3	Acceleration Time(msec)
Y0.1.4	Deceleration Time (msec)
Y0.1.5~6	Target position of axis 1
Y0.1.25~26	Target position of axis 2
Y0.1.45~46	Target position of axis 3
Y0.1.65~66	Target position of axis 4
Y0.1.7~8	Start Velocity
Y0.1.9~10	Target Velocity

Caution : Target position, Start velocity, Target velocity are Float type data (2 word size)

## Operation Flow-chart of Multi-axis Linear Movement

### ■ Linear Interpolation Motion Control

When the E point control start contact is turned ON, acceleration/ deceleration movement control of 2 to 3 axes is automatically performed according to the previously specified data.



Acceleration/deceleration can be specified separately, allowing symmetric/asymmetric velocity profiles to be generated. You can also select Trapezoidal/S-shaped acceleration/deceleration.

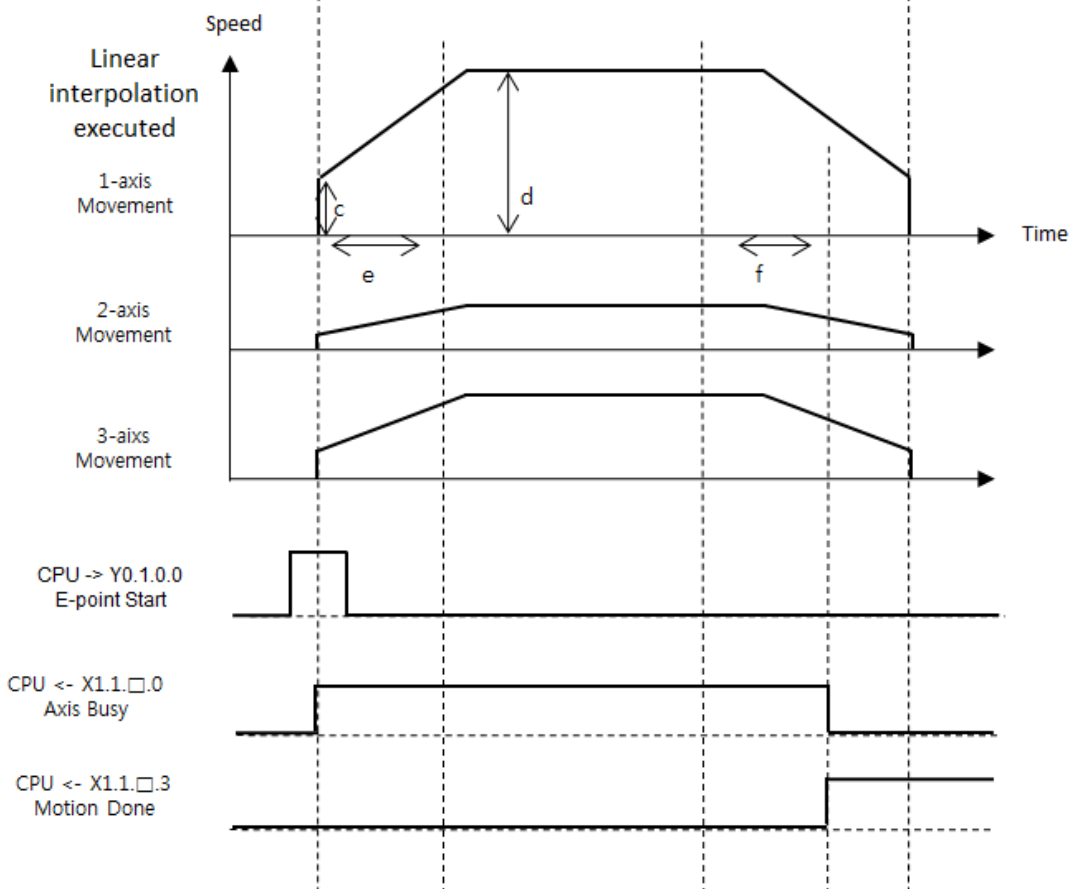
#### **When mounting the 4-axis type positioning unit in slot 1**

##### **Operation :**

When the contact-point is turned ON for E point control, the selected 3 axes are accelerated/decelerated, moved and stopped at the same time. The speed of each axis is automatically adjusted according to the given target position value, so that it starts and stops at the same time.

Multi-axes Linear Interpolation Data

- Ⓐ Control Code  
: Multi-axis Absolute/Relative Movement
- Ⓑ Expansion Control Code  
: Velocity Profile, The Axis
- Ⓒ Start Speed
- Ⓓ Target Speed
- Ⓔ Acceleration Time
- Ⓕ Deceleration Time
- Ⓖ Target Position



※ The BUSY contact-point and the Motion Done contact-point operate on both of these movement axes.

### Setting Data

The following data must be entered in the position module at I/O parameter.

Enter all at main-axis parameter, and target position to each axis.

- Ⓐ Control Code : Multi-axis Absolute/Relative Movement
- Ⓑ Expansion Control Code : Velocity Profile, The Axis.
- Ⓒ Start Velocity
- Ⓓ Target Velocity
- Ⓔ Acceleration Time
- Ⓕ Deceleration Time
- Ⓖ Target Location

### ■ Operation Step

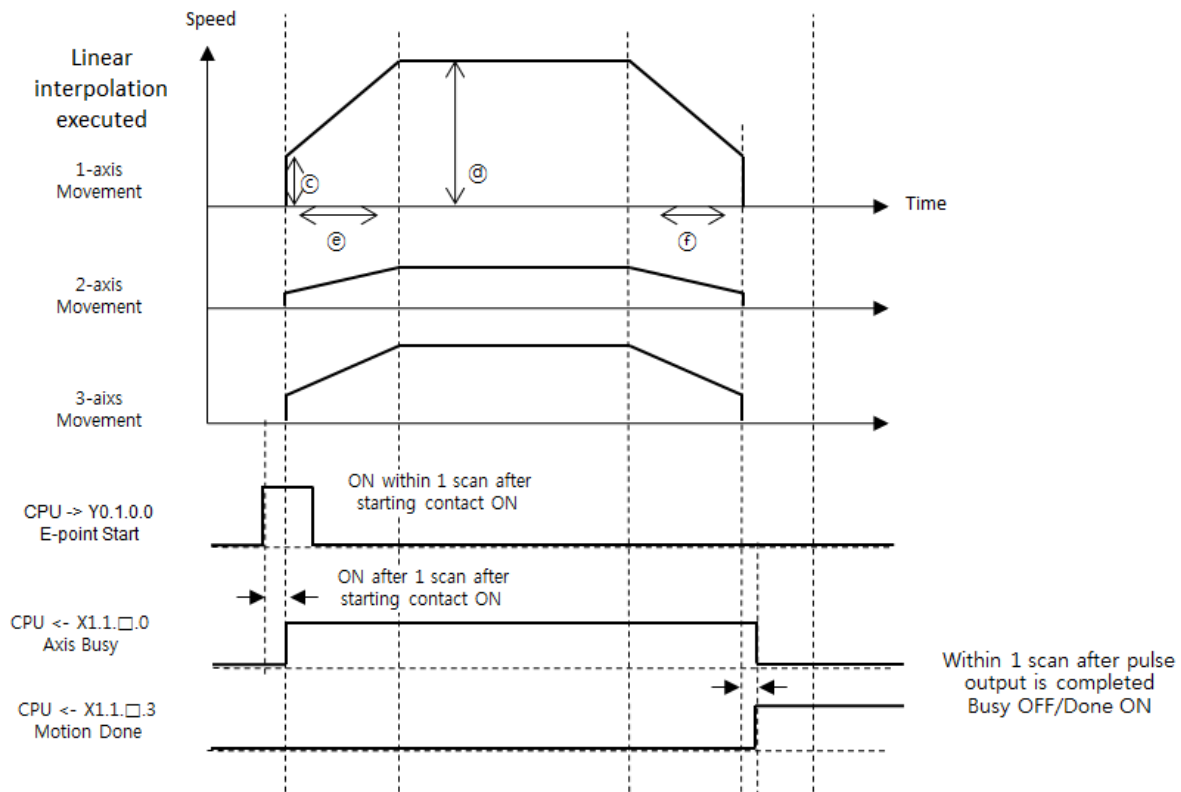
#### Step 1 : Preparations

Send data for the operation in advance to I/O parameter.

#### Step 2 : Execution of Operation

Turn ON the E-point start contact-point (Y0.1.0.0) of the main-axis.  
When the starting contact-point is turned ON, each axis accelerates from the Starting Velocity to the Target Velocity at the same time.  
When it reaches the Target Position, it decelerates and stops.

## Operation of I/O Contact-point before and after Multi-axis Linear Movement



※ Busy OFF and Done ON can be delayed as much as Dwell Time (Y0.1.13).

### ■ E-point Control Start Contact-point (Y0.△.0.0)

- ① Start E-point control based on the parameter which entered in positioning unit.
- ② Does not start while pulse outputting flag (X1.□.0.0) is turned ON.
- ③ Reset when power is turned OFF.

### ■ Pulse Outputting Flag (X1.□.0.0)

- ① It turns ON at the next scan after E-point control is started, and turns OFF when pulse output is completed.
- ② While this signal is ON, another operation is not performed. (Excluding forced stop and decelerate to stop)
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG Operation, Homing(Home-return) Operation. (Excluding the pulse generator input permission)

■ Pulse Output Completion Flag (X1.□.0.3)

① It is turned ON when the pulse output is completed, and then remains until one of E-point control, P-point control, JOG operation, Home return, or Pulse generator input operation is started.

② Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG operation, Pulse generator input permission.

## 2-axis Linear Interpolation Control

■ Example of Setting

Parameters of linear interpolation to select axis 1 and 2 of module installed in slot 1

Output	Contents
Y0.1.0.0	E-point Start
Y0.1.1	Control Code 7: Multi-axis Relative Linear Interpolation 8: Multi-axis Absolute Linear Interpolation
Y0.1.2	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 11~8: 0011b Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Disable Bit 11: Axis #4 Disable
Y0.1.3	Acceleration Time (msec)
Y0.1.4	Deceleration Time (msec)
Y0.1.5~6	Target position of axis 1
Y0.1.25~26	Target position of axis 2
Y0.1.7~8	Start Velocity
Y0.1.9~10	Target Velocity

Caution : Target position, Start velocity, Target velocity are Float type data (2 word

size)

■ Velocity of each axis

Velocity of axis 1  $V_x = V * P_x / \sqrt{P_x^2 + P_y^2}$

Velocity of axis 2  $V_y = V * P_y / \sqrt{P_x^2 + P_y^2}$

V : Velocity set in the main axis parameter ( Vector velocity X-Y)

Px : Movement of main axis

Py : Movement of 2nd axis

## 3-axis Linear Interpolation Control

### ■ Example of Setting

Parameters of linear interpolation to select axis 1, 2 and 3 of module installed in slot 1

Output	Contents
Y0.1.0.0	E-point Start
Y0.1.1	Control Code 7: Multi-axis Relative Linear Interpolation 8: Multi-axis Absolute Linear Interpolation
Y0.1.2	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 11~8: 0111b Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Disable
Y0.1.3	Acceleration Time (msec)
Y0.1.4	Deceleration Time (msec)
Y0.1.5~6	Target position of axis 1
Y0.1.25~26	Target position of axis 2
Y0.1.45~46	Target position of axis 3
Y0.1.7~8	Start Velocity
Y0.1.9~10	Target Velocity

Caution : Target position, Start velocity, Target velocity are Float type data (2 word

size)

### ■ Velocity of each axis

Velocity of axis 1  $V_x = V * P_x / \sqrt{P_x^2 + P_y^2 + P_z^2}$

Velocity of axis 2  $V_y = V * P_y / \sqrt{P_x^2 + P_y^2 + P_z^2}$

Velocity of axis 3  $V_z = V * P_z / \sqrt{P_x^2 + P_y^2 + P_z^2}$

V : Velocity set in the main axis parameter ( Vector velocity X-Y-Z)

Px : Movement of main axis

Py : Movement of 2nd axis

Pz : Movement of 3rd axis

## 4-axis Linear Interpolation Control

### ■ Example of Setting

Parameters of linear interpolation to select axis 1, 2, 3 and 4 of module installed in slot 1

Output	Contents
Y0.1.0.0	E-point Start
Y0.1.1	Control Code 7: Multi-axis Relative Linear Interpolation 8: Multi-axis Absolute Linear Interpolation
Y0.1.2	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 11~8: 1111b Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Enable
Y0.1.3	Acceleration Time (msec)
Y0.1.4	Deceleration Time (msec)
Y0.1.5~6	Target position of axis 1
Y0.1.25~26	Target position of axis 2
Y0.1.45~46	Target position of axis 3
Y0.1.65~66	Target position of axis 4
Y0.1.7~8	Start Velocity
Y0.1.9~10	Target Velocity

Caution : Target position, Start velocity, Target velocity are Float type data (2 word

size)

### ■ Velocity of each axis

If the movement of fourth axis is not the longest, velocity of axis 1-3 will have the same velocity in X-Y-Z as 3-axis linear interpolation. And the speed of the fourth axis is adjusted accordingly.

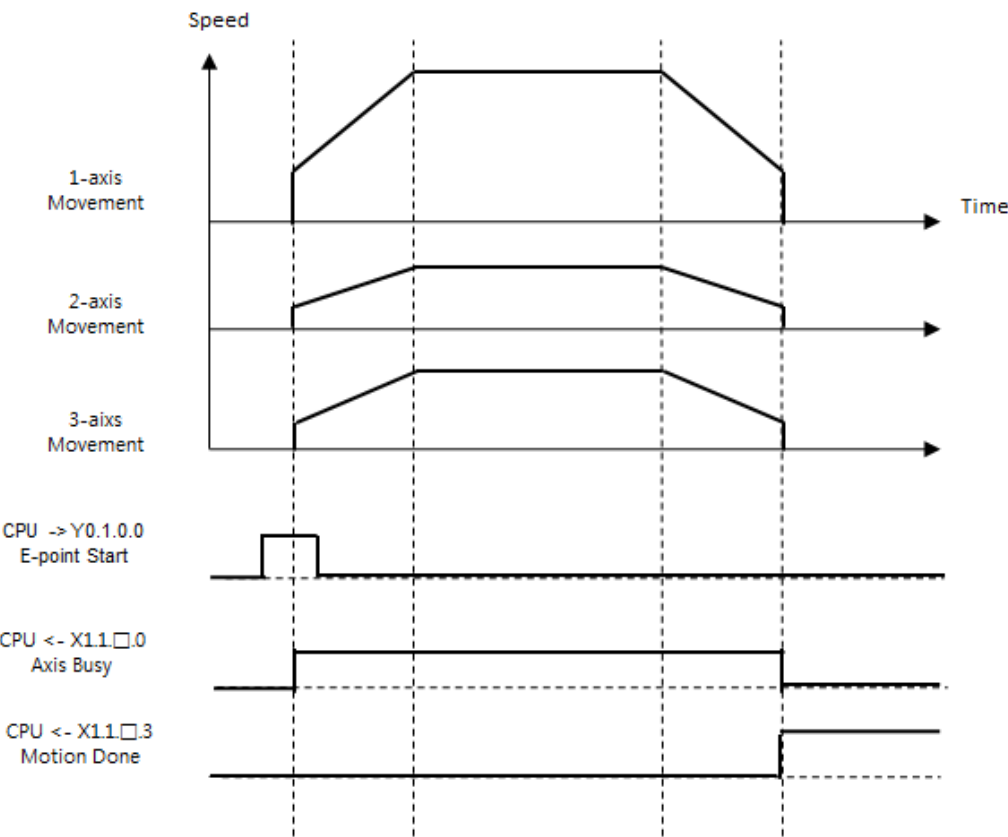
In case of movement of fourth axis is the longest, the velocity set on the main axis is the moving velocity of the fourth axis, and the velocity of the other axes are adjusted accordingly.

Program Example

Example of Linear Interpolation Selected by Axis 1, 2, and 3 of Module Installed in Slot 1.

Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	7 (Multi-axis Relative Linear Interpolation)
Y0.1.2	Bit 0: 0 Trapezoid Bit 11~8: 0111 (Choose of 3-axis)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	200000
Y0.1.25~26	50000
Y0.1.45~46	100000
Y0.1.7~8	20000
Y0.1.9~10	100000

size) Caution : Target position, Start velocity, Target velocity are Float type data (2 word





## WARNING

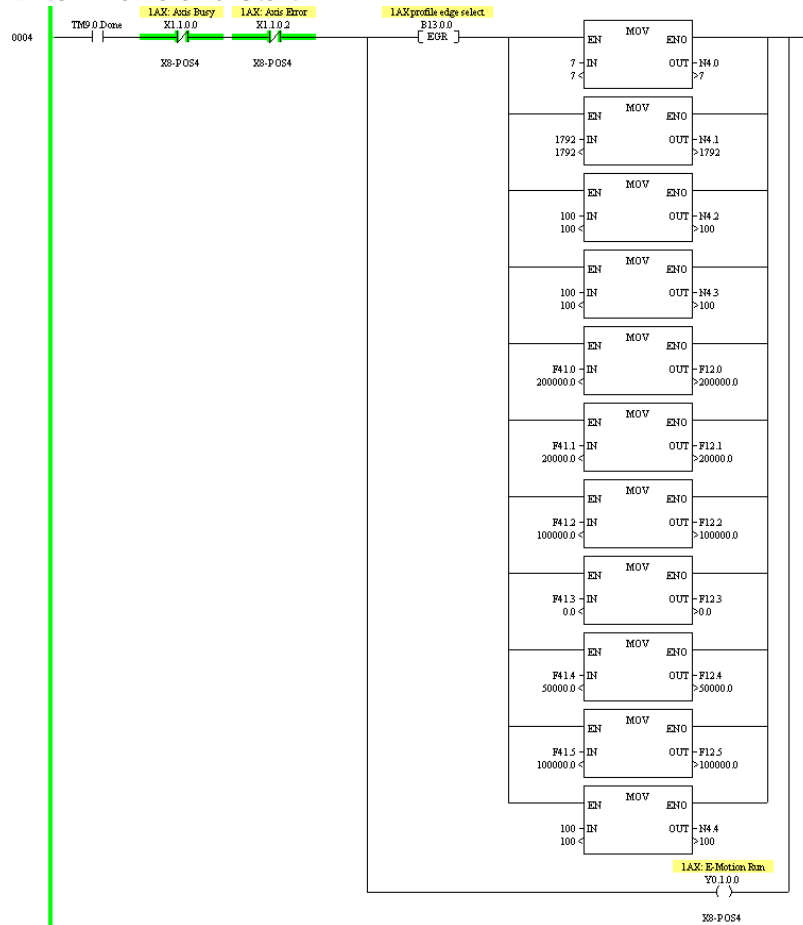


1. You cannot perform two different pairs of interpolation commands at the same time because you can only perform one interpolation operation in one positioning module.

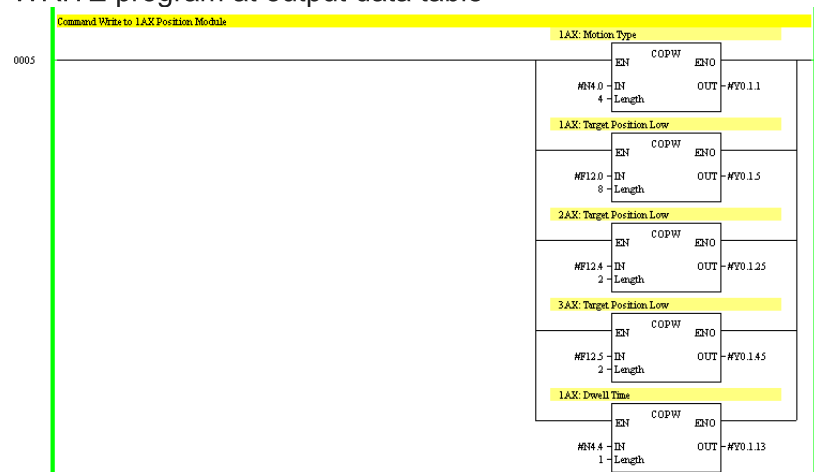
2. When circular interpolation is used for 3 axes, the motion axes must be 1, 2, and 3. Axis 4 cannot be used, because it is used as synchronous output.

## Program Example

### Enter Profile and Start



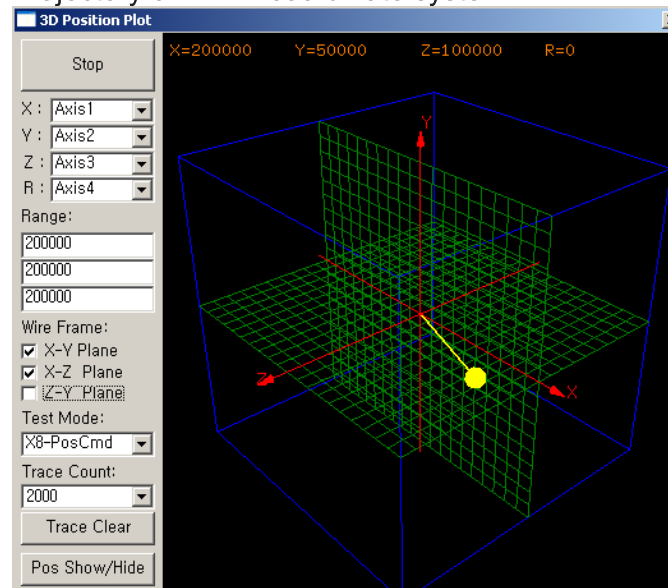
## WRITE program at output data table



## Velocity Profile



## Trajectory of X-Y-Z coordinate system



## **16. Multi-axis Circular Interpolation Control..... 2**

Operation Data required for Multi-axis Circular Movement ..... 2

Operation Flow-chart of Multi-axis Circular Movement..... 4

■ Circular Interpolation Motion Control ..... 4

■ Operation Step ..... 6

Operation of I/O Contact-point before and after Multi-axis Circular Movement ..... 7

Circular Interpolation Control with Specified Way-point ..... 8

Circular Interpolation Control with Specified Center-point..... 9

Interpolation Control with Specified Rotation Angle..... 10

Helical Interpolation Control ..... 12

Program Example..... 13

■ Specified Center-point Circular Interpolation Control 2-axis ..... 13

■ Specified Way-point Circular Interpolation Control 2-axis ..... 16

■ Specified Rotation Angle Circular interpolation control 2 axes ..... 20

■ Specified Center-point Helical Control 3 axes ..... 23

■ Specified Way-point Helical Control 3 axes ..... 26

■ Specified Rotation Angle Helical Control 3 axes ..... 29

# 16. Multi-axis Circular Interpolation Control

This chapter describes the multi-axis circular interpolation of positioning module. Circular interpolation performs circular interpolation operation for specified 2 axes. When 3 axes are specified, 2-axis circular interpolation and 1-axis linear interpolation are performed simultaneously, and cylindrical helical interpolation is performed.

## Operation Data required for Multi-axis Circular Movement

After setting the data required for multi-axis circular movement operation to I/O parameters in advance, specify the start command. Set the following parameters in the main axis, and the center-point position values and way-point position values in the other axis.

Example of circular interpolation of the main axis where axis 1 of the module installed in slot 1

Output	Center-point Circular Interpolation	Way-point Circular Interpolation	Rotation Angle Circular Interpolation
Y0.1.0.0	E-point Start	E-point Start	E-point Start
Y0.1.1	Control Code 9: Multi-axis Relative Linear Interpolation 10: Multi-axis Absolute Linear Interpolation	Control Code 11: Multi-axis Relative Linear Interpolation 12: Multi-axis Absolute Linear Interpolation	Control Code 13: Multi-axis Relative Linear Interpolation 14: Multi-axis Absolute Linear Interpolation
Y0.1.2	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 2: 0 : CW, 1: CCW Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Enable	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 2: n/a Automatically designate direction to the way point Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Enable	Expansion Control Code Bit 0: 0 :Trapezoid, 1: S-Curve Bit 2: n/a Designate direction to the rotation angle Bit 8: Axis #1 Enable Bit 9: Axis #2 Enable Bit 10: Axis #3 Enable Bit 11: Axis #4 Enable
Y0.1.3	Acceleration Time (msec)	Acceleration Time (msec)	Acceleration Time (msec)
Y0.1.4	Deceleration Time (msec)	Deceleration Time (msec)	Deceleration Time (msec)
Y0.1.5~6	Target position of axis 1	Target position of axis 1	Rotation angle (Axis 1 as main axis)
Y0.1.25~26	Target position of axis 2	Target position of axis 2	Rotation angle (Axis 2 as main axis)
Y0.1.45~46	Target position of axis 3	Target position of axis 3	Rotation angle (Axis 3 as main axis)
Y0.1.65~66	Target position of axis 4	Target position of axis 4	Rotation angle (Axis 4 as main axis)
Y0.1.7~8	Start Velocity	Start Velocity	Start Velocity
Y0.1.9~10	Target Velocity	Target Velocity	Target Velocity
Y0.1.11~12	Center point X	Way point X	Center point X
Y0.1.31~32	Center point Y	Way point Y	Center point Y

Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data(2 word size)

■ Center-point interpolation : Draw a circle by specifying the center point of the circle and the end point of the circle with the current position as the start position.

- If the end-point is set to the same value as the starting position, it will be a circle that rotates 360 degrees.
- Rotation Direction should be specified separately. ( Rotation Direction 0: CW , Rotation Direction 1: CCW )
- If the specified end-point is +/- 20% out of the radius of rotation to the given center-point, the error is processed.

■ Way-point interpolation : Draw a circle by specifying the movement path and end-point of the circle movement with the current position as the start position.

- End-point cannot be at the same location as start position, different 3 points must be given.
- The direction of rotation is automatically specified in the direction through which the way-point can be passed.

■ Rotation angle interpolation : Draw a circle by specifying the center point of the circle and rotation angle with the current position as the start position.

- Rotation angle is the relative angle to be rotated at the current position. If the value is plus (+), the rotation is CCW, and if the value is minus (-), the rotation is CW.

2-axes circular interpolation : By enabling arbitrary 2 axes in motion detail setting (Y0.1.2), the selected 2 axes will interpolate to draw a circle on the X-Y plane.

3-axes circular interpolation : By enabling axis 1, 2, 3 in extended control code setting(Y0.1.2), selected axis 1-2 are move to circle, and axis 3 is moved linearly to perform helical interpolation movement. At this time, target position (Y0.1.45~46) of 3-axis should be specified, axis 4 should not be used because it is used as start output axis.

## Operation Flow-chart of Multi-axis Circular Movement

### ■ Circular Interpolation Motion Control

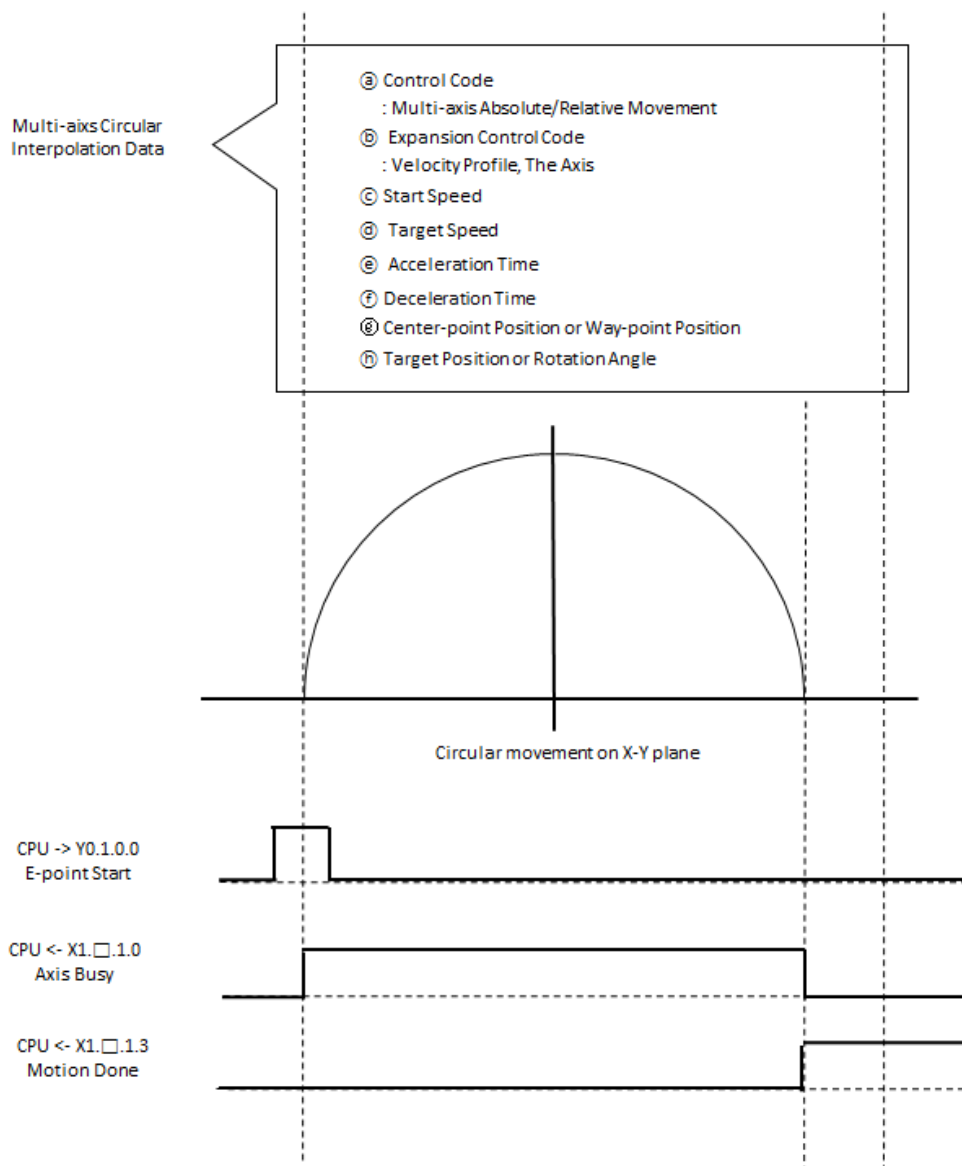
When the E point control start contact is turned ON, acceleration/deceleration movement control of 2 to 3 axes is automatically performed according to the previously specified data.

Acceleration/deceleration can be specified separately, allowing symmetric/asymmetric velocity profiles to be generated. You can also select Trapezoidal/S-shaped acceleration/deceleration.

#### **When mounting the 4-axis type positioning unit in slot 1**

Operation :

When the contact-point is turned ON for E point control, the selected 3 axes are accelerated/decelerated, moved and stopped at the same time. The speed of each axis is automatically adjusted according to the given target position value, so that it starts and stops at the same time.



※ The BUSY contact-point and the Motion Done contact-point operate on both of these movement axes.

### Setting Data

The following data must be entered in the position module at I/O parameter.

Enter all at the main-axis parameter. Enter each of the target position (or rotation angle) and the center position of the circle (or via position) on the corresponding axis

- a Control Code : Multi-axis Absolute/Relative Movement
- b Expansion Control Code : Velocity Profile, The Axis. Rotation Direction(Center point circular interpolation)
- c Start Velocity
- d Target Velocity
- e Acceleration Time
- f Deceleration Time
- g Center-point Position or Way-point Position
- h Target Position or Rotation Angle

### ■ Operation Step

#### Step 1 : Preparations

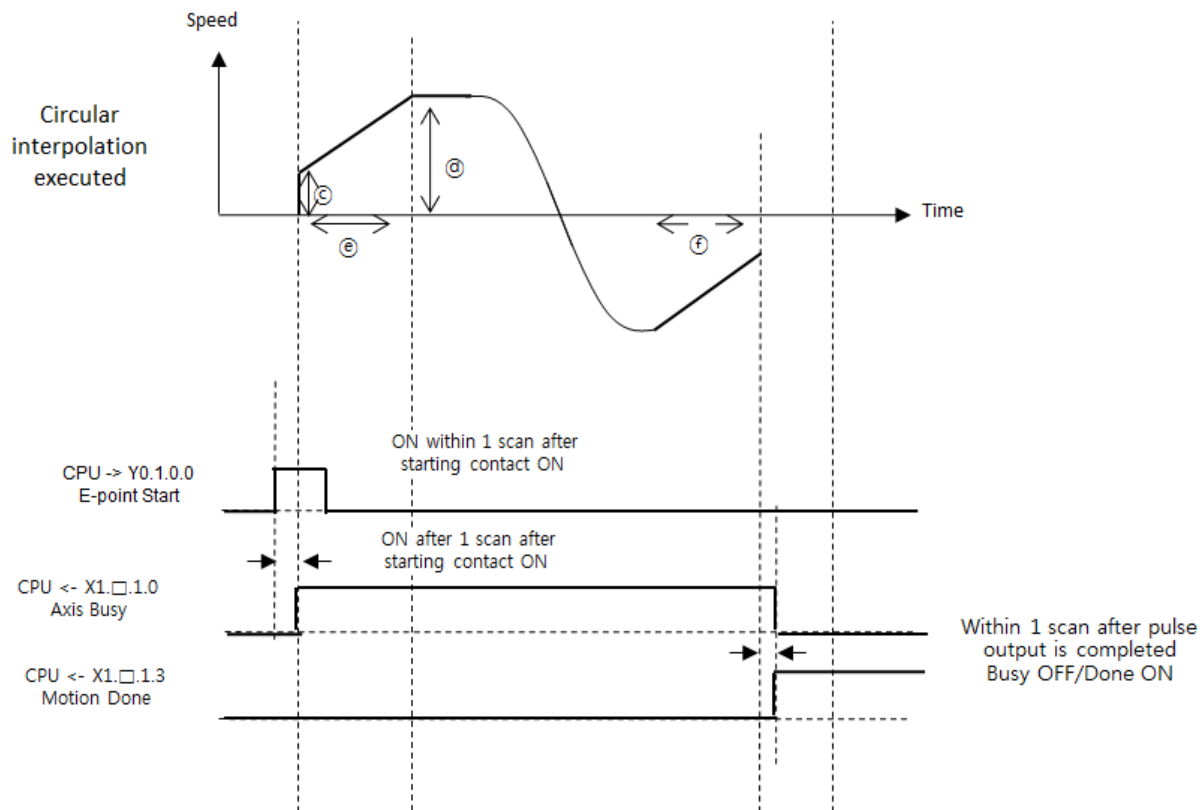
Send data for the operation in advance to I/O parameter.

#### Step 2 : Execution of Operation

Turn ON the E-point start contact-point (Y0.1.0.0) of the main-axis. When the starting contact-point is turned ON, each axis accelerates from the Starting Velocity to the Target Velocity at the same time. When it reaches the Target Position, it decelerates and stops.



## Operation of I/O Contact-point before and after Multi-axis Circular Movement



※ Busy OFF and Done ON can be delayed as much as Dwell Time (Y0.1.13).

### ■ E-point Control Start Contact-point (Y0.Δ.0.0)

- ① Start E-point control based on the parameter which entered in positioning unit.
- ② Does not start while pulse outputting flag (X1.□.0.0) is turned ON.
- ③ Reset when power is turned OFF.

### ■ Pulse Outputting Flag (X1.□.0.0)

- ① It turns ON at the next scan after E-point control is started, and turns OFF when pulse output is completed
- ② While this signal is ON, another operation is not performed. (Excluding forced stop and decelerate to stop)
- ③ Reset when power is turned OFF.

※ This flag is common to E-point control, P-point control, JOG Operation, Homing(Home-return) Operation. (Excluding the pulse generator input permission)

■ Pulse Output Completion Flag (X1.□.0.3)

① It is turned ON when the pulse output is completed, and then remains until one of E-point control, P-point control, JOG operation, Home return, or Pulse generator input operation is started.

② Reset when power is turned OFF.

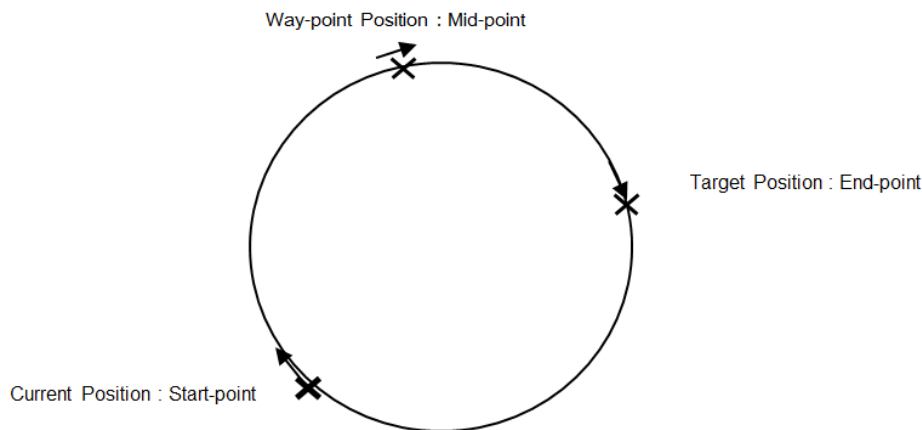
※ This flag is common to E-point control, P-point control, JOG operation, Pulse generator input permission.

## Circular Interpolation Control with Specified Way-point

Draw a circle by specifying the movement path and end-point of the circle movement with the current position as the start position.

- End-point cannot be at the same location as start position, different 3 points must be given.

- The direction of rotation is automatically specified in the direction through which the way-point can be passed.



Way-point position and target positions are specified as a relative position in the current position reference when multi-axis relative circular interpolation, and specified the absolute position from the origin point when multi-axis absolute circular interpolation.

The parameter is set on X-axis(main axis), and way-point position and target position are set the position value on each of X, Y-axes.

**WARNING**

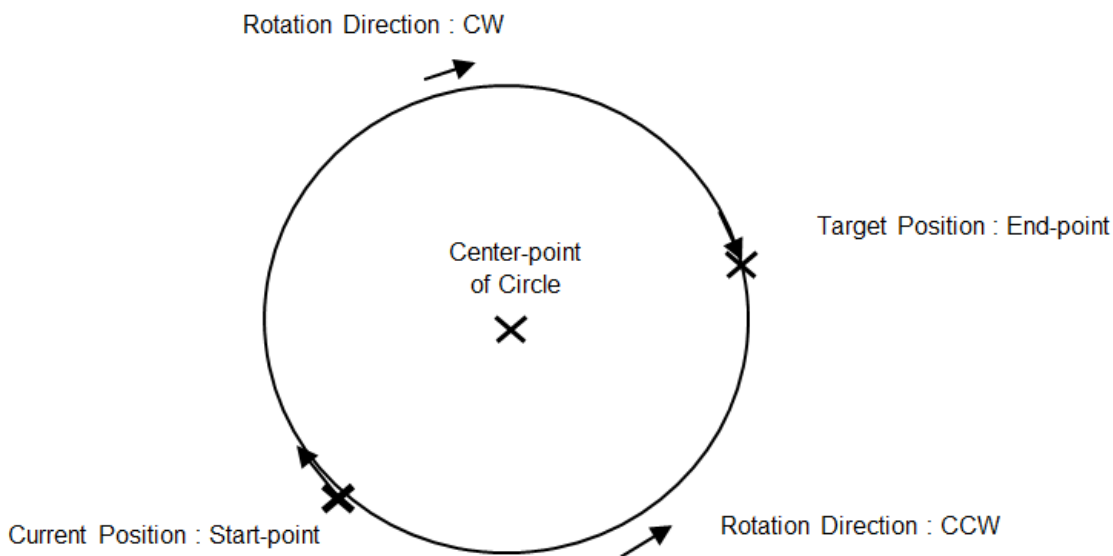


If circular interpolation of 3 axes is set on the main axis, the target position is also set on the Z axis. (in case of 3 axes circular interpolation, X-Y-Z must be axis 1, 2, 3 and axis 4 cannot be used externally).

Only one interpolation operation can perform at once in a position module, so it should not execute 2 different pairs of interpolation commands.

Circular Interpolation Control with Specified Center-point

- Draw a circle by specifying the center point of the circle and the end point of the circle with the current position as the start position.
- If the end-point is set to the same value as the starting position, it will be a circle that rotates 360 degrees.
  - Rotation Direction should be specified separately. (Rotation Direction 0: CW , Rotation Direction 1: CCW )
  - If the specified end-point is +/- 20% out of the radius of rotation to the given center-point, the error is processed.



- Center-point position and target positions are specified as a relative position value in the current position reference when multi-axis relative circular interpolation, and specified the absolute position from the origin point when multi-axis absolute circular interpolation.

The parameter is set on X-axis(main axis), and center-point position and target position are set the position value on each of X, Y-axes. Rotation direction should be set on motion detailed setting parameter of main axis.

If axis 3 circular interpolation is set on main axis, target position should be set at Z axis also.  
(In case of 3 axes circular interpolation, X-Y-Z must be axis 1, 2, 3 and axis 4 cannot be used externally).

	In case of start point (0,0) and center point (50000,50000) In principle, you should give one point below the solid line. If you cannot set the
--	---

**WARNING**

exact position, you must give one of the dotted lines.

Given radius :  $R = \sqrt{50000^2 + 50000^2} = 70710.678$  ( 0.0 ~ 50000,0000)

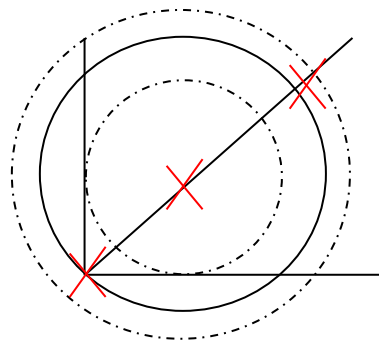
When the arbitrary target point is set to (110000, 110000), the radius due to the target point

$R_t = \sqrt{60000^2 + 60000^2}$

$= 84852.813$  ( 50000,50000 ~ 100000.100000)

$R_t > R * 1.2$  ( $84852 > 70710 * 1.2 (=84852)$ ) :  
Critical region

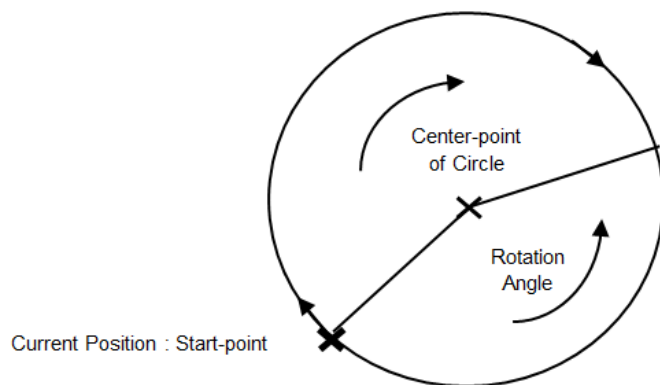
If it is out of the 20% error range of the specified radius, it is treated as an error. It should be within the range of 1.2 times the radius, not 20% for the X and Y axes



## Interpolation Control with Specified Rotation Angle

Draw a circle by specifying the center point of the circle and rotation angle with the current position as the start position.

- Rotation angle is the relative angle to be rotated at the current position. If the value is plus (+), the rotation is CCW, and if the value is minus (-), the rotation is CW.



- Center-point position is specified as a relative position value in the current position reference when multi-axis relative circular interpolation, and specified the absolute position from the origin point when multi-axis absolute circular interpolation

The parameter is set on X-axis(main axis), and set the angle to rotate at the target position. Rotation angle can be set from -360.0 ~ +360.0 and direction of rotation sets according to the sign.

#### WARNING



If circular interpolation of 3 axes is set on the main axis, the target position is also set on the Z axis. (in case of 3 axes circular interpolation, X-Y-Z must be axis 1, 2, 3 and axis 4 cannot be used externally).

Only one interpolation operation can perform at once in a position module, so it should not execute 2 different pairs of interpolation commands.

## Helical Interpolation Control

If 3 axes are selected to operate 3 axes circular interpolation in multi-axis circular interpolation control (Way-point circular interpolation, Center-point circular interpolation, Rotation angle circular interpolation), the helical interpolation is as shown below.

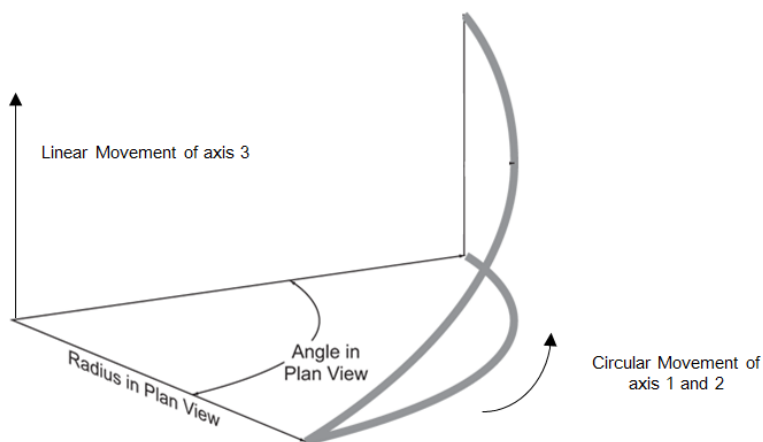
Helical interpolation is a function that performs circular operation on the X-Y axes and simultaneously starts and stops the linear axis interpolation on the Z-axis automatically.

### WARNING



If circular interpolation of 3 axes is set on the main axis, the target position is also set on the Z axis. (in case of 3 axes circular interpolation, X-Y-Z must be axis 1, 2, 3 and axis 4 cannot be used externally).

Only one interpolation operation can perform at once in a position module, so it should not execute 2 different pairs of interpolation commands.



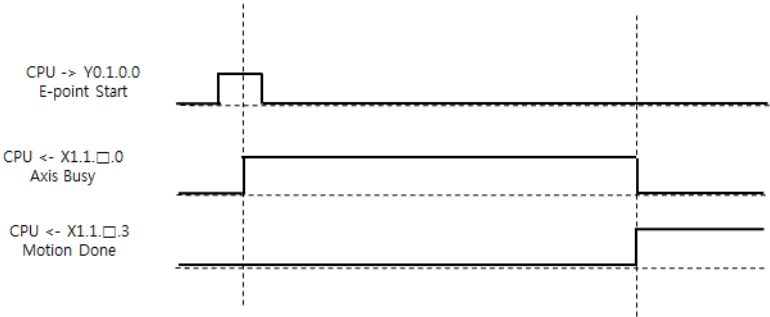
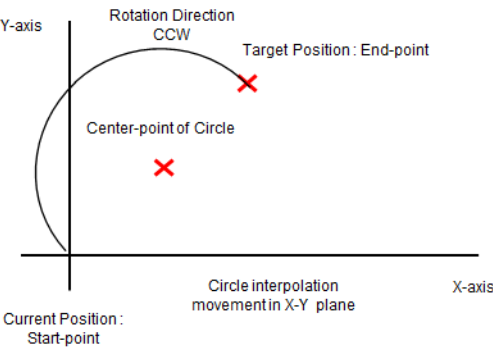
# Program Example

## ■ Specified Center-point Circular Interpolation Control 2-axis

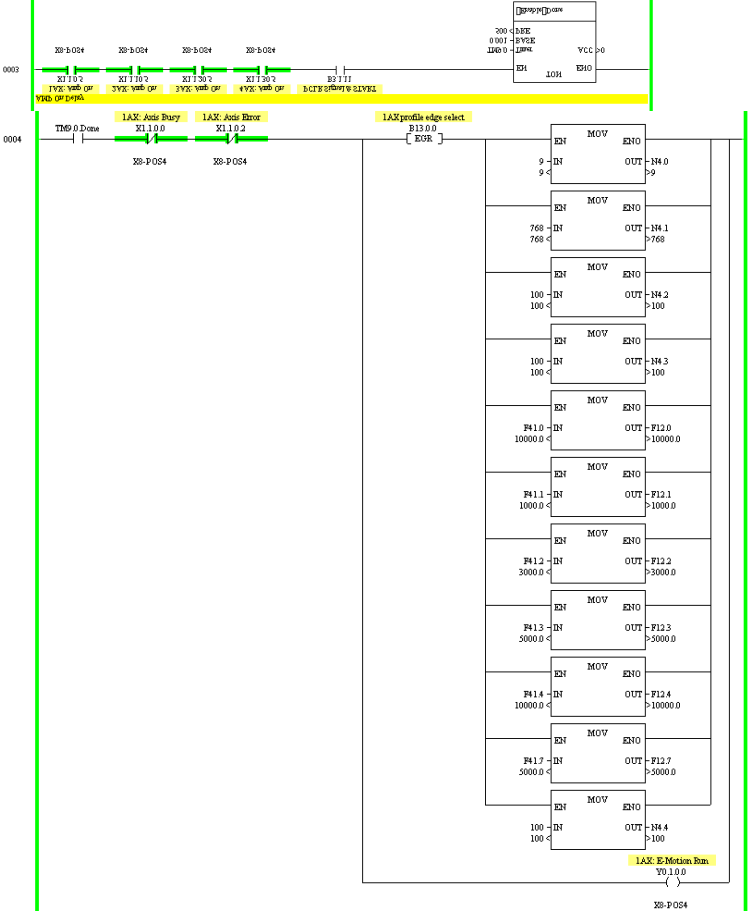
Example of circular interpolation of center-point of 2 axes which main axis 1 of the module installed in slot 1.

Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Center-point Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : CW Bit 11~8: 0011 (Choose of 2-axis)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	10000 (Target Position – End Point X)
Y0.1.25~26	10000 (Target Position – End Point Y)
Y0.1.45~46	-
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	5000 (Center-point of Circle X)
Y0.1.31~32	5000 (Center-point of Circle Y)

Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)



■ Program Example  
Enter Profile and Start  
While the contact B3.1.11 is ON, it moves to E-point continuous start.



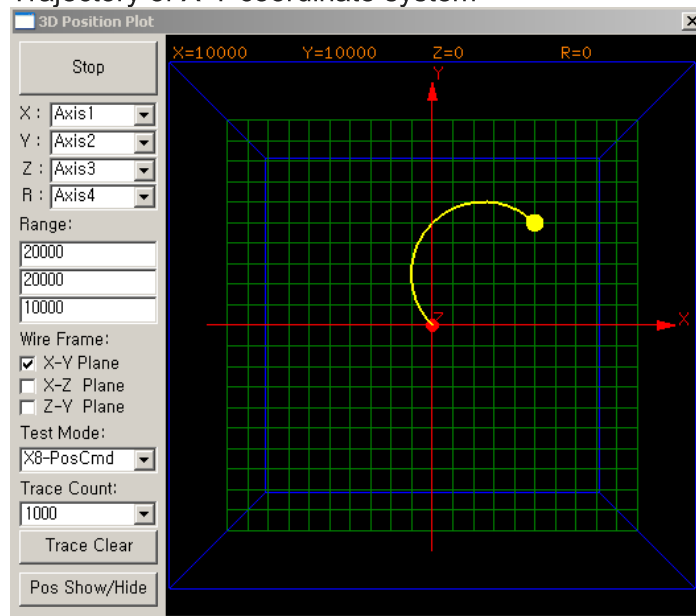
WRITE program at output data table

0005

1AX: Motion Type	
EN	COPW
ENO	
M04.0 - IN	OUT - MY0.1.1
4 - Length	
1AX: Target Position Low	
EN	COPW
ENO	
M012.0 - IN	OUT - MY0.1.5
8 - Length	
2AX: Target Position Low	
EN	COPW
ENO	
M012.4 - IN	OUT - MY0.1.25
8 - Length	
3AX: Target Position Low	
EN	COPW
ENO	
M012.8 - IN	OUT - MY0.1.45
8 - Length	
4AX: Target Position Low	
EN	COPW
ENO	
M012.12 - IN	OUT - MY0.1.65
8 - Length	
1AX: Dwell Time	
EN	COPW
ENO	
M04.4 - IN	OUT - MY0.1.13
1 - Length	



## Trajectory of X-Y coordinate system

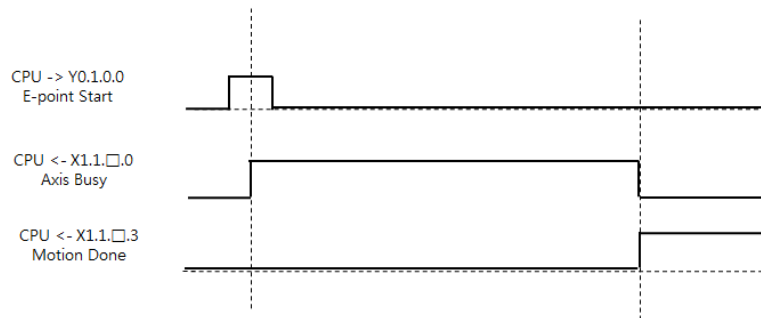
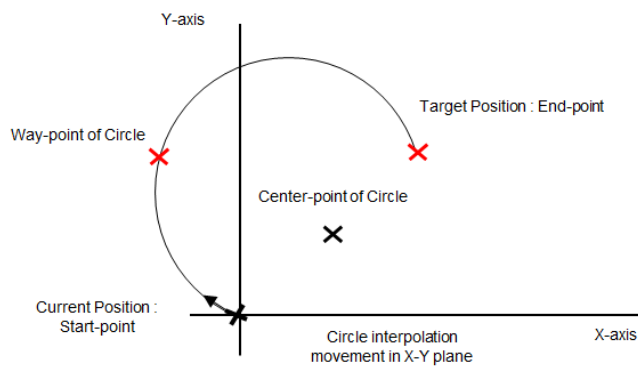


## ■ Specified Way-point Circular Interpolation Control 2-axis

Example of circular interpolation of center-point of 2 axes which main axis 1 of the module installed in slot 1.

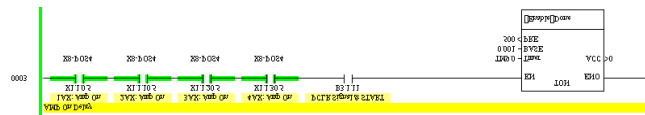
Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Center-point Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : n/a Bit 11~8: 0011 (Choose of 2-axis)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	10000 (Target Position – End Point X)
Y0.1.25~26	10000 (Target Position – End Point Y)
Y0.1.45~46	-
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	-5000 (Center-point of Circle X)
Y0.1.31~32	10000 (Center-point of Circle Y)

Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)



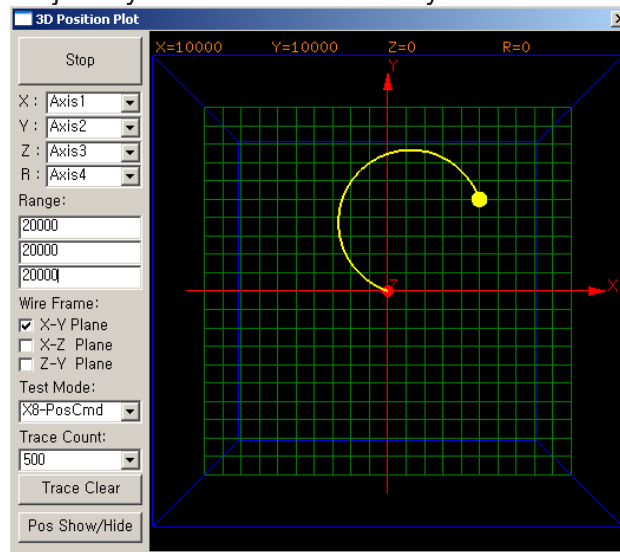
### ■ Program Example Enter Profile and Start

While the contact B3.1.11 is ON, it moves to E-point continuous start.





## Trajectory of X-Y-Z coordinate system

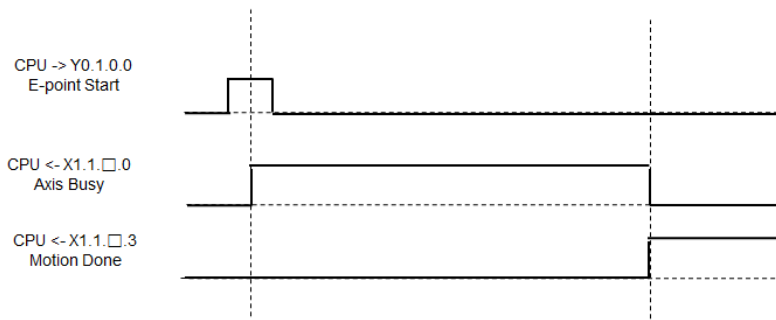
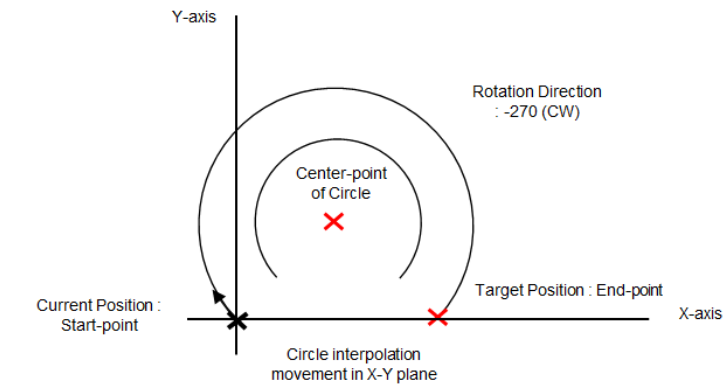


## ■ Specified Rotation Angle Circular interpolation control 2 axes

Example of circular interpolation of center-point of 2 axes which main axis 1 of the module installed in slot 1.

Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Rotation Angle Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : n/a Bit 11~8: 0011 (Choose of 2-axis)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	-270 (Target Position-Rotation Angle X)
Y0.1.25~26	0 (Target Position-Rotation Angle Y)
Y0.1.45~46	-
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	5000 (Center-point of Circle X)
Y0.1.31~32	5000 (Center-point of Circle Y)

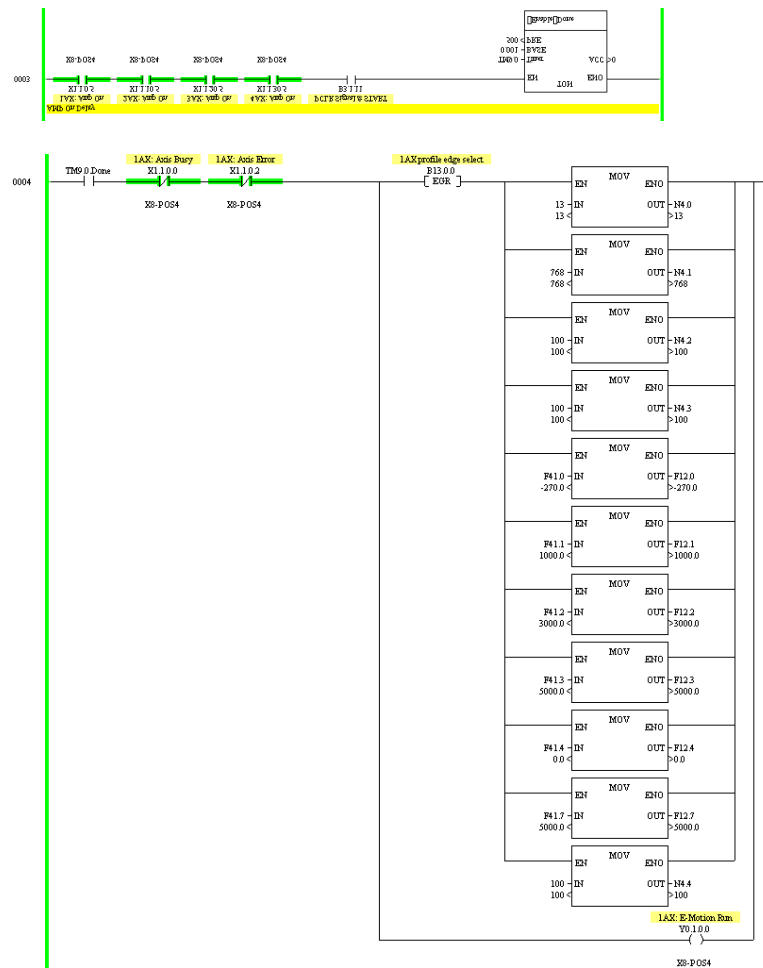
Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)



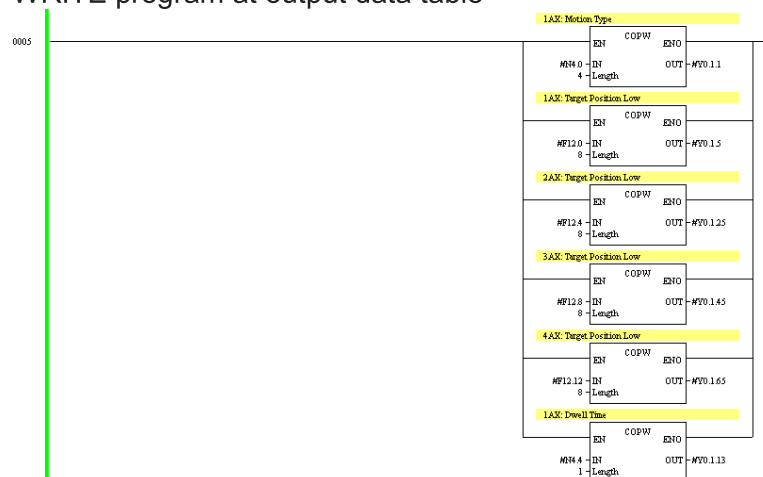
## Program Example

### Enter Profile and Start

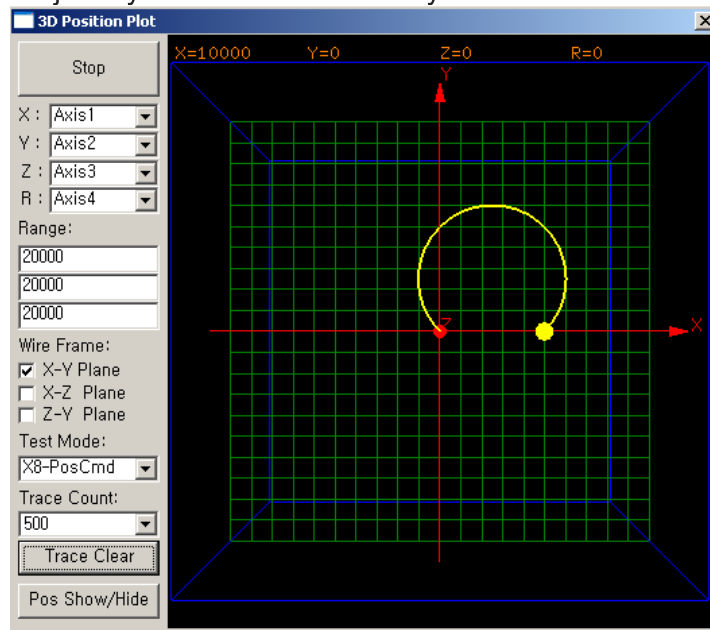
While the contact B3.1.11 is ON, it moves to E-point continuous start.



## WRITE program at output data table



## Trajectory of X-Y-Z coordinate system



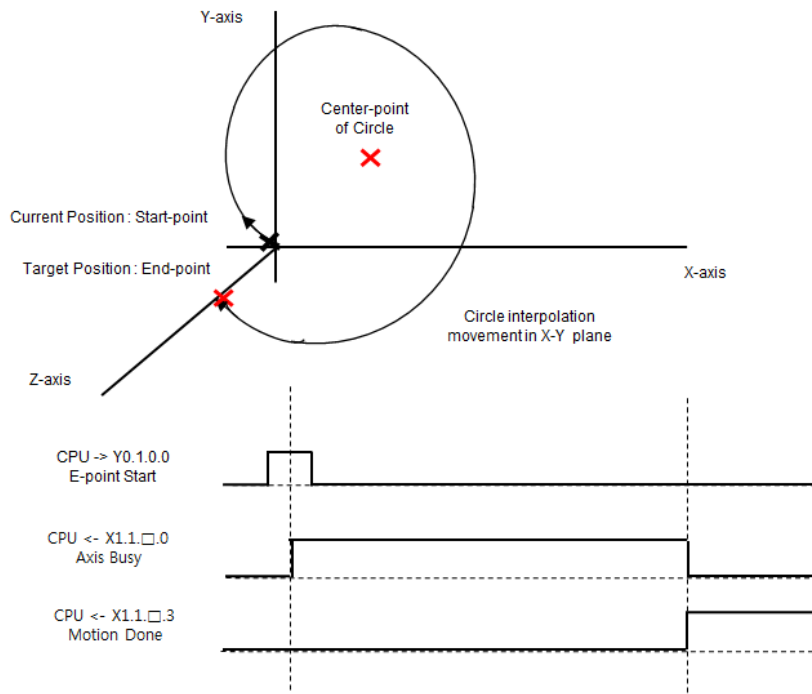


## ■ Specified Center-point Helical Control 3 axes

Example of rotation angle circular interpolation of center-point of 3 axes which main axis 1 of the module installed in slot 1.

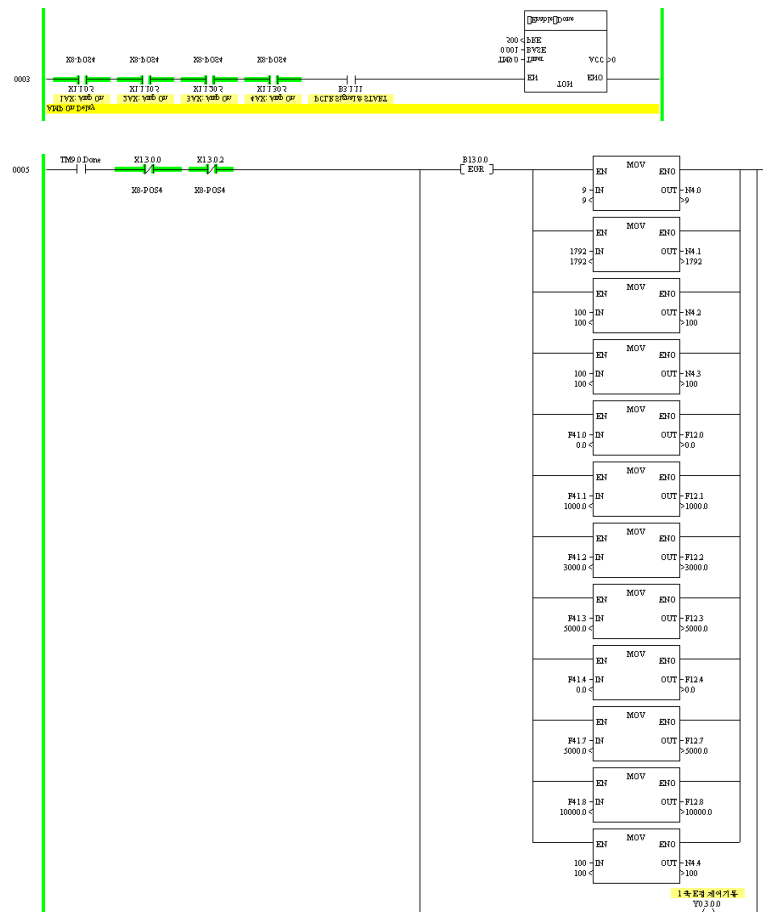
Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Rotation Angle Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : n/a Bit 11~8: 0111 (Choose of 3-axis)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	0 (Target Position-Rotation Angle X)
Y0.1.25~26	0 (Target Position-Rotation Angle Y)
Y0.1.45~46	1000
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	5000 (Center-point of Circle X)
Y0.1.31~32	5000 (Center-point of Circle Y)
Y0.1.45~46	10000 (Linear interpolation distance of Z axis)

Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)

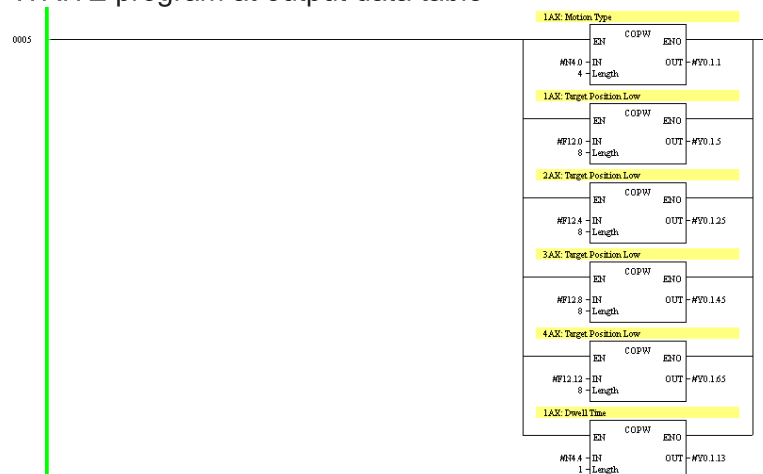


## ■ Program Example Enter Profile and Start

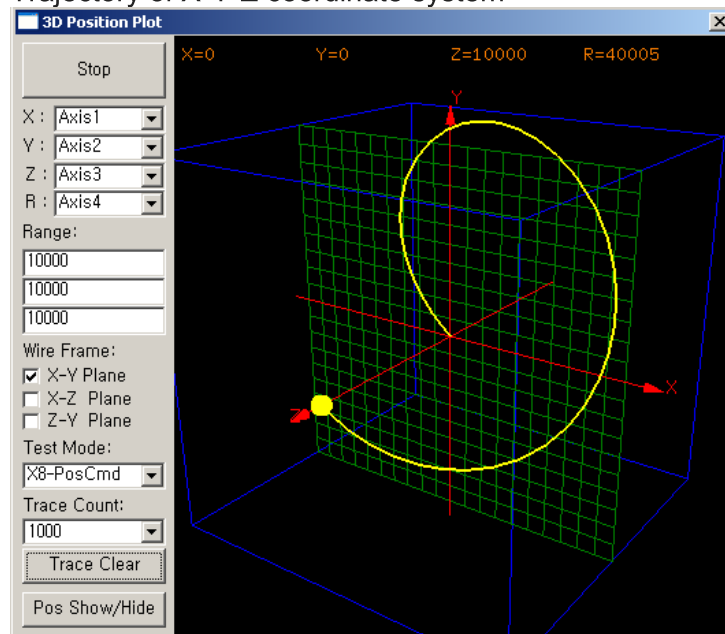
While the contact B3.1.11 is ON, it moves to E-point continuous start.



## WRITE program at output data table



## Trajectory of X-Y-Z coordinate system

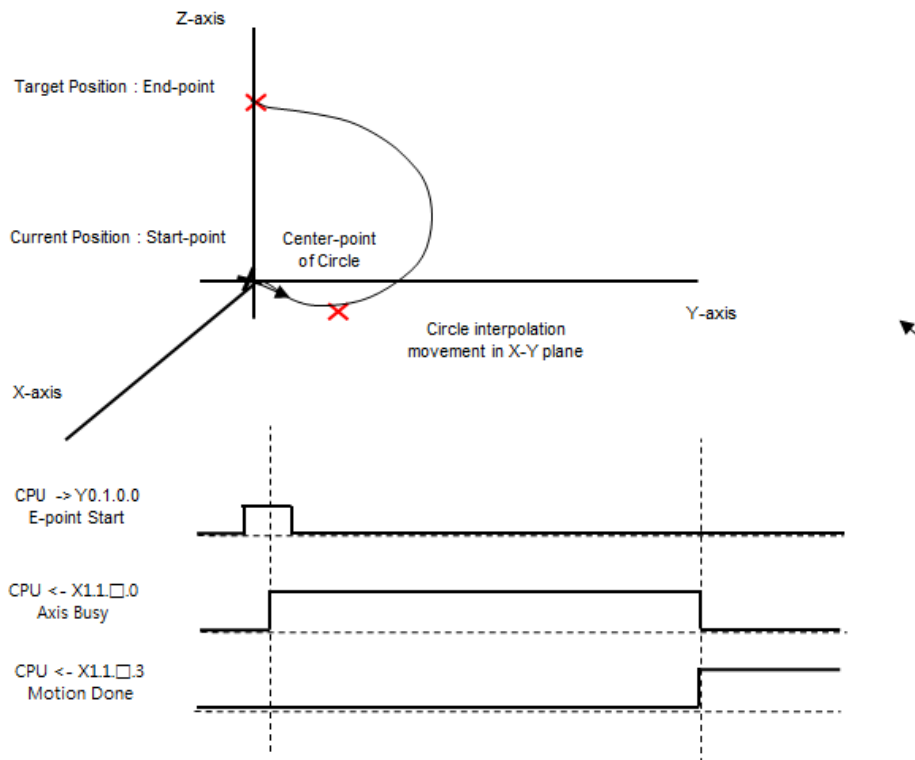


## ■ Specified Way-point Helical Control 3 axes

Example of rotation angle circular interpolation of center-point of 3 axes which main axis 1 of the module installed in slot 1.

Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Way-point Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : n/a Bit 11~8: 0111 (3 축 선택)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	0 (Target Position-X)
Y0.1.25~26	10000 (Target Position-Y)
Y0.1.45~46	1000
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	5000 (Way-point of Circle X)
Y0.1.31~32	5000 (Way-point of Circle Y)
Y0.1.45~46	10000 (Linear interpolation distance of Z axis)

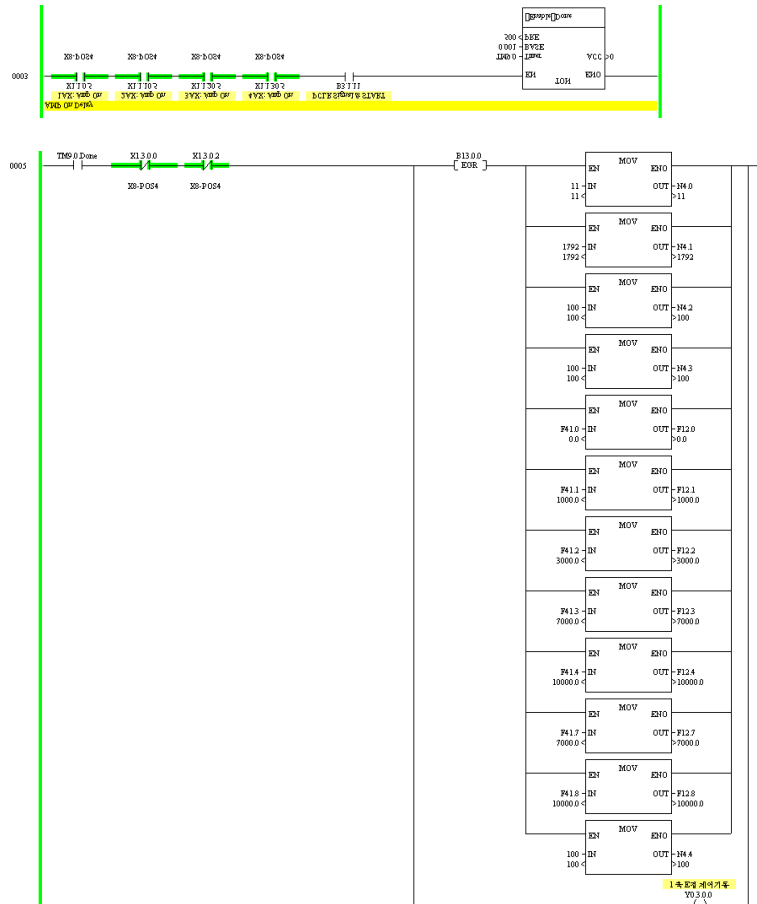
Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)



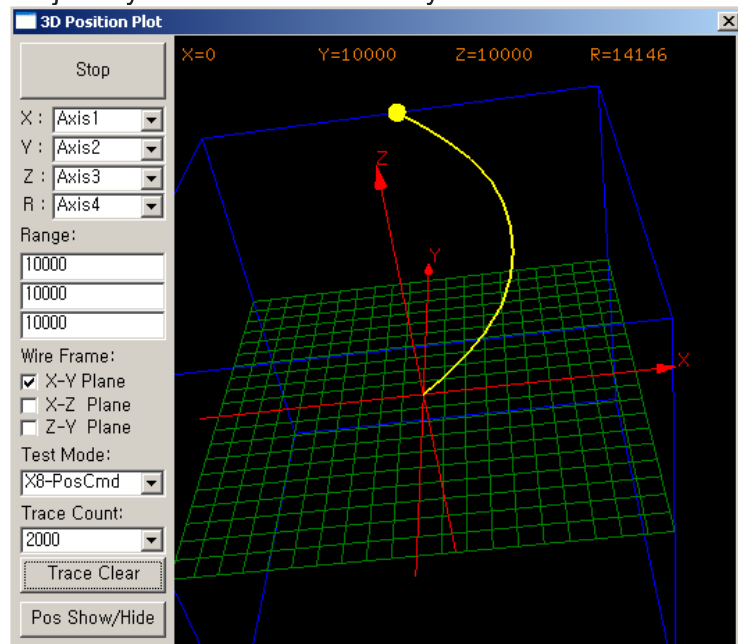
## ■ Program Example

Enter Profile and Start

While the contact B3.1.11 is ON, it moves to E-point continuous start.



## Trajectory of X-Y-Z coordinate system

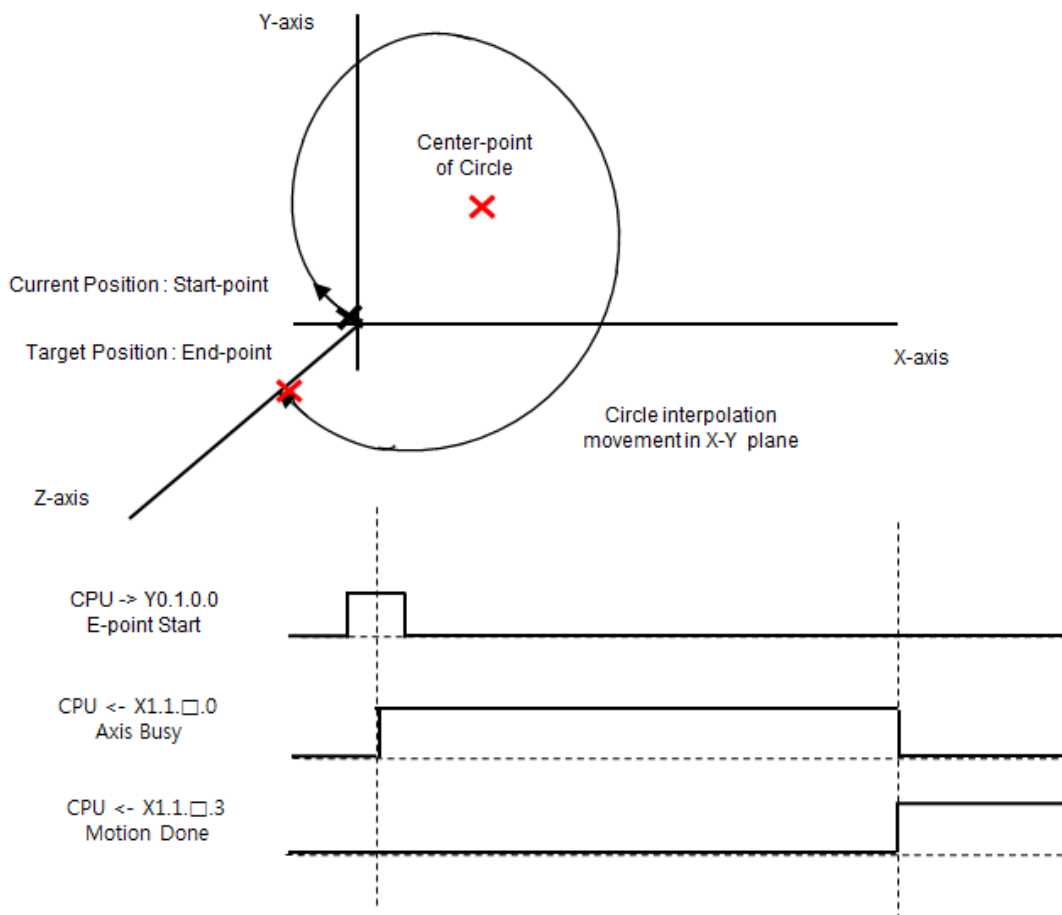


## ■ Specified Rotation Angle Helical Control 3 axes

Example of rotation angle circular interpolation of center-point of 3 axes which main axis 1 of the module installed in slot 1.

Parameter	Set Value
Y0.1.0.0	E-point Start
Y0.1.1	9: Multi-axis Relative Way-point Circular Interpolation
Y0.1.2	Bit 0: 0 :Trapezoid Bit 2: 0 : n/a Bit 11~8: 0111 (3 축 선택)
Y0.1.3	100 (Acceleration Time msec)
Y0.1.4	100 (Deceleration Time msec)
Y0.1.5~6	-360 (Target Position-Rotation Angle X)
Y0.1.25~26	0 (Target Position-Rotation Angle Y)
Y0.1.45~46	1000
Y0.1.7~8	3000
Y0.1.9~10	5000
Y0.1.11~12	5000 (Center-point of Circle X)
Y0.1.31~32	5000 (Center-point of Circle Y)

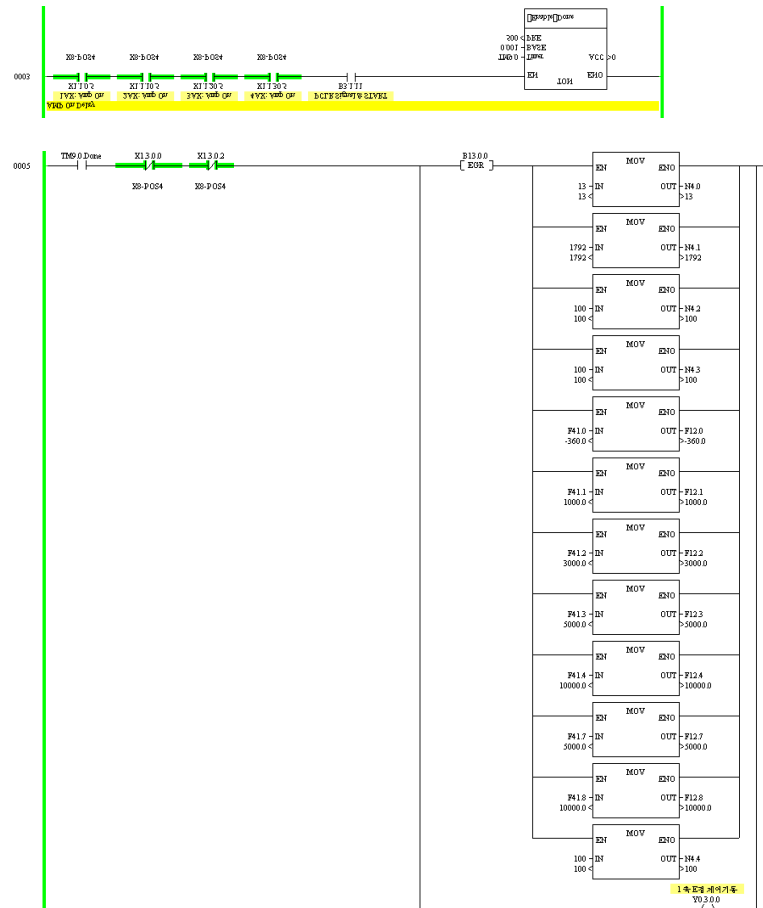
Caution : Target position, Start velocity, Target velocity, Center-point, Way-point are Float type data (2 word size)



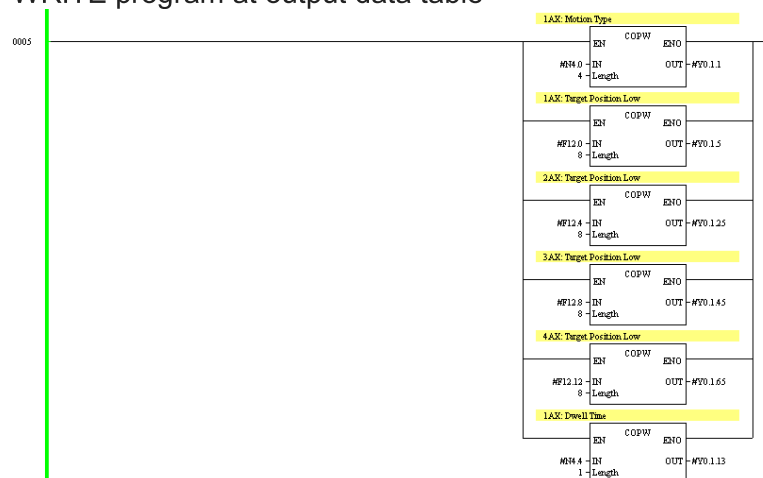
## Program Example

### Enter Profile and Start

While the contact B3.1.11 is ON, it moves to E-point continuous start.

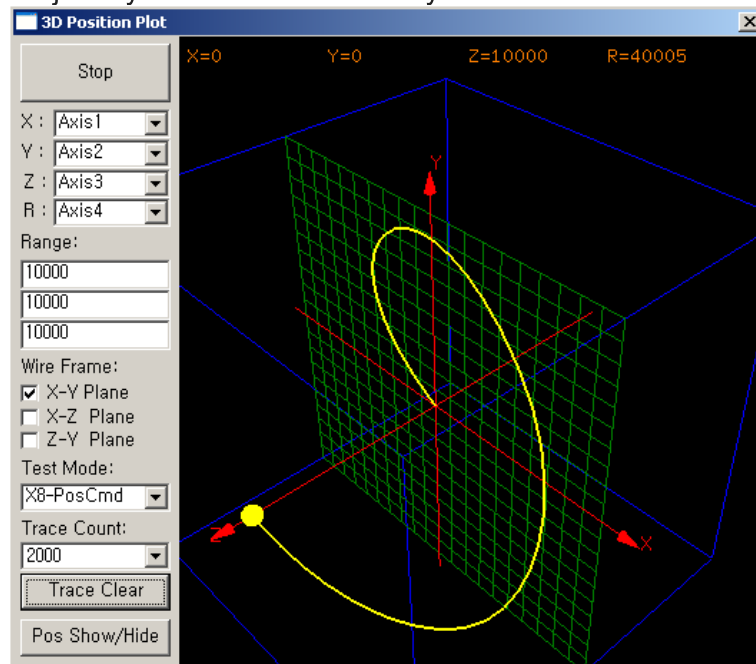


## WRITE program at output data table

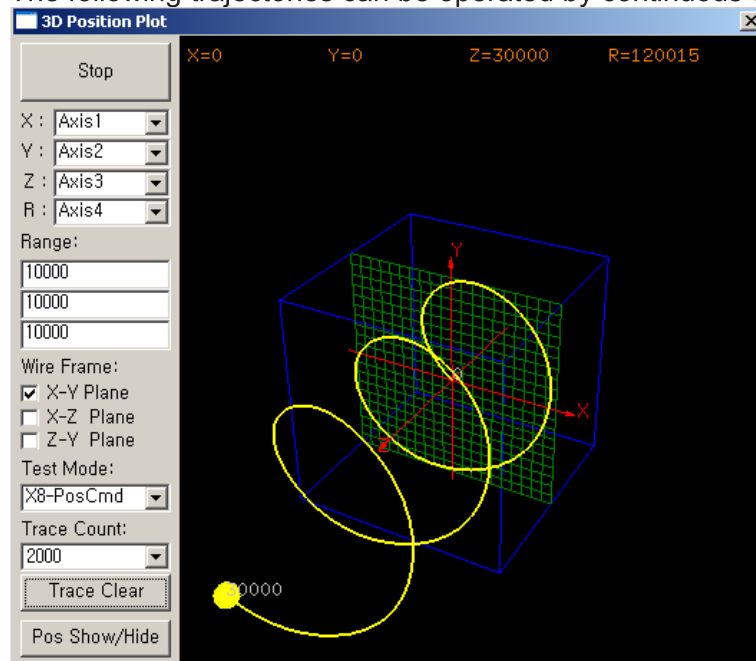




## Trajectory of X-Y-Z coordinate system



The following trajectories can be operated by continuous control.



## **17. Control Assistant Function..... 2**

### **Control Change Function ..... 2**

Upper/Lower Limit	2
M Code	2
Floating home-point setting	2
Continuous Operation	2
Skip Operation	2
Position Override	2
Velocity Override	2
Positioning Velocity Override	2
Current Position Preset	2
Encoder Preset	2
Change Start Step Number	2
Change Repeat Operation Step Number	2
PCLR Setting, Use and Operation	3
PULSE Capture Setting, Use and Operation	4
Compare output Setting, Use and Operation	5
Program Example	6

### **Data Change Function ..... 6**

Multiple Teaching	6
Operation Parameter Change in Program	6
Start Data Change in Program	6
Read/Write of Variable Data	6

# 17. Control Assistant Function

This chapter describes the assistant functions for controlling the position module.

## Control Change Function

Upper/Lower Limit

M Code

Floating Home-point Setting

Continuous Operation

Skip Operation

Position Override

Velocity Override

Positioning Velocity Override

Current Position Preset

Encoder Preset

Change Start Step Number

Change Repeat Operation Step Number

## PCLR Setting, Use and Operation

Reset function of the position value when PCLR contact-point (Y0.Δ.0.12) is turned ON.

Users must be careful because the position of the mechanism where homing is performed will be different, in case of PCLR is operated at an arbitrary position. Also, PCLR must be operated on stopped state because the position of axis will change while controlling.

In PCLR operation, parameter used to initialize the position value and external output signal are specified as below.

PCLR Parameter	Description
PCLR Y Output Setting (Axis Parameter)	If PCLR contact-point is turned ON, select of the parameter to be used for position initial value. 0 : The initial setting is based on the axis parameter 1 : The initial setting is based on the output parameter
PCLR Output Setting (Axis Parameter)	If PCLR contact-point is turned ON, specify the external signal which output to the servo drive. 0 : None (Not used) 1 : PCLR signal is wired as an absolute value data request signal 2 : PCLR signal is wired to the 5V PCLR signal of servo drive 3 : Compare 2 Output signal is wired to the 24V PCLR signal of servo drive

In PCLR contact-point is turned ON, position value is initialized to the following value.

Initial position value	Use of the axis parameter	Use of the output parameter			
		AXIS 1	AXIS 2	AXIS 3	AXIS 4
Initial command value	Initial command value	Y0.Δ.5~6	Y0.Δ.25~26	Y0.Δ.45~46	Y0.Δ.65~66
Initial position value	Initial position value	Y0.Δ.7~8	Y0.Δ.27~28	Y0.Δ.47~48	Y0.Δ.67~68
Initial deviation value	Initial deviation value	Y0.Δ.9~10	Y0.Δ.29~30	Y0.Δ.49~50	Y0.Δ.69~70
Initial MPG value	Initial MPG value	Y0.Δ.11~12	Y0.Δ.31~32	Y0.Δ.51~52	Y0.Δ.71~72

Caution : Position value is float type (2 word size).

In case of PCLR is performed used by output parameter, turn on the each bit of output parameter below to select the position value and initialize.

Axis	Output parameter	Selecting the reset position value
AXIS 1	Y0.Δ.1	Bit 0: Command Initialization Bit 1: Position Initialization Bit 2: Deviation Initialization Bit 3: MPG Initialization
AXIS 2	Y0.Δ.21	
AXIS 3	Y0.Δ.41	
AXIS 4	Y0.Δ.61	

## PULSE Capture Setting, Use and Operation

This function memorizes the encoder position at the moment of capture input.

### ■ Contact-point

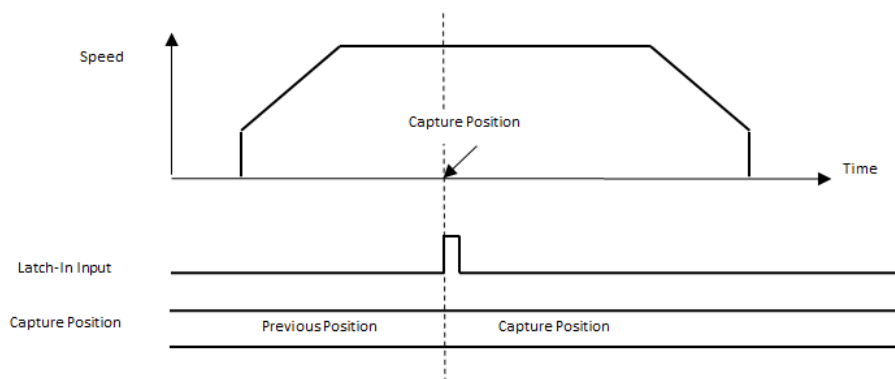
One point (Latch-In) input is available for each axis.

Axis	Latch-In Input (AX1/2 Connector)
AXIS 1	No. 21
AXIS 2	No. 22
AXIS 3	No. 39
AXIS 4	No. 40

### ■ Parameter Setting

Capture Parameter	Description
Capture Enable (Axis Parameter)	ON : Enable OFF : Disable
Capture Position (Input Parameter)	AXIS 1 : X1.□.7~8 AXIS 2 : X1.□.17~18 AXIS 3 : X1.□.27~28 AXIS 4 : X1.□.37~38  ※ Capture function and MPG function cannot be used at the same time, since the MPG input counter is using the same area.

### ■ Example of Capture Operation



## Compare Output Setting, Use and Operation

This function outputs when the control axis passes a specific position while moving.

### ■ Output Contact-point

Two points (Compare 1, Compare 2) output are available for each axis.

Axis	Compare 1 Output (AX3/4 Connector)	Compare 2 Output (AX3/4 Connector)
AXIS 1	No. 21	No. 22
AXIS 2	No. 39	No. 40
AXIS 3	No. 41	No. 42
AXIS 4	No. 55	No. 56

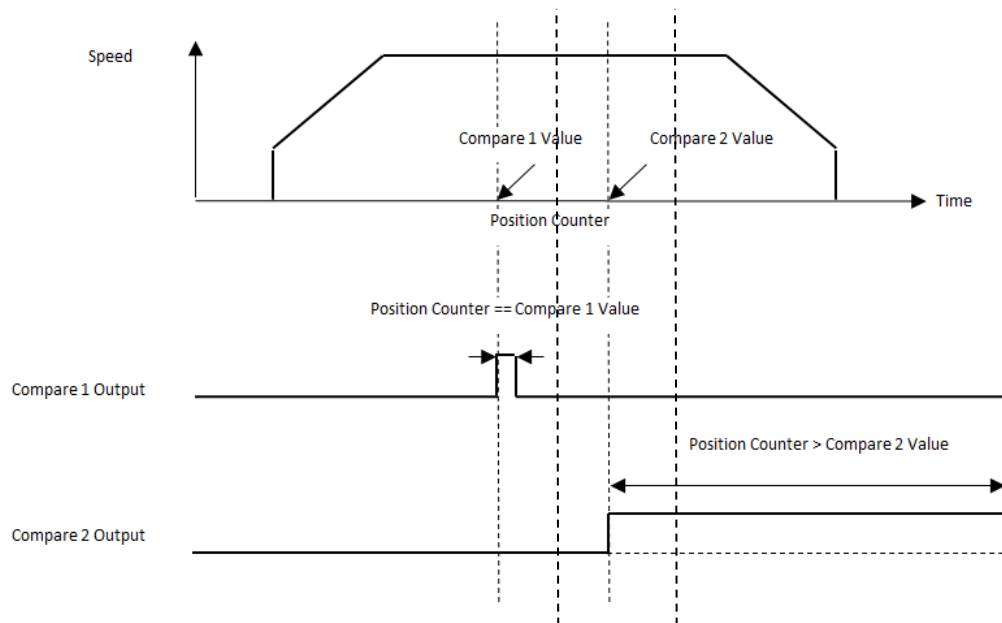
### Parameter Setting

The following related values must be set in the axis parameter in advance.

Compare Parameter	Description
Compare 1 Enable	ON : Enable OFF : Disable
Compare 1 Type	Command Pulse : Compare the position with Command Pulse Counter Encoder Pulse : Compare the position with Feedback Pulse Counter
Compare 1 Mode	0 : None 1 : Counter == Compare 1 Value (In case of moving in both +/- direction) 2 : Counter == Compare 1 Value (In case of moving in + direction only) 3 : Counter == Compare 1 Value (In case of moving in – direction only) 4 : Counter < Compare 1 Value (Smaller than comparable position) 5 : Counter > Compare 1 Value (Bigger than comparable position)
Compare 1 Value	Position value for comparison
Compare 2 Enable	ON : Enable OFF : Disable ※ No operation will performed, in case of setting the 'Compare 2' to Output from the PCLR.
Compare 2 Type	Command Pulse : Compare the position with Command Pulse Counter Encoder Pulse : Compare the position with Feedback Pulse Counter
Compare 2 Mode	0 : None 1 : Counter == Compare 2 Value (In case of moving in both +/- direction) 2 : Counter == Compare 2 Value (In case of moving in + direction only ) 3 : Counter == Compare 2 Value (In case of moving in – direction only) 4 : Counter < Compare 2 Value (Smaller than comparable position) 5 : Counter > Compare 2 Value (Bigger than comparable position)
Compare 2 Value	Position value for comparison

### ■ Example of Compare Operation

In case of setting the operation of Compare 1 as current position value to be same as Compare 1 value, and operation of Compare 2 as to be greater than Compare 2 value, it will be operating as below.



### Program Example

## Data Change Function

Multiple Teaching

Operation Parameter Change in Program

Start Data Change in Program

Read/Write of Variable Data

## **18. How to respond when an error occurs ..... 2**

### Operation In Case of Error Occurs ..... 2

- When Error LED of positioning module is turned ON ..... 2
- When Error LED of CPU module is turned ON ..... 3

### Errors that occur in position module itself..... 3

### How to deal with an error ..... 4

- When ER LED of positioning module is turned ON ..... 4
- When the Motor does not operate. .... 6
- When the direction of rotation is opposite. .... 6
- When stop position does not coincide with homing ..... 8
- When does not decelerate while homing ..... 9
- When does not stop at homing (after deceleration termination) ..... 10
- Error Code ..... 11

### Error Code ..... 11



## 18. How to respond when an error occurs

This chapter describes how to take corrective action when an error occurs in the position module.

### Operation In Case of Error Occurs

- When Error LED of positioning module is turned ON



- Start (Stop)

If a set value error occurs at start (stop), each operation will not start performing.

E-point control, P-point control, Home-return, JOG operation, Pulse generator operation will not start either.

- P-point control operation or JOG operation

If a set value error occurs at 「P-point Control」 or 「JOG Operation」, positioning unit must stop the operation in progress and start deceleration stop.

Reference :

If a set value error occurs, it is impossible to restart until the error reset contact is cleared as “OFF → ON → OFF”. Other axes without a set value error, will operate continuously.

(Reference : “Chapter 11. Deceleration Stop”)

- When Error LED of CPU module is turned ON



Positioning unit stops the operation in progress, and start to do the operation of 「Deceleration Stop」

Reference :

But, if the operation at the time of occurrence of various errors is set to "operation" in the system register setting, the operation is continued. (Reference : "Chapter 11. Deceleration Stop")

## Errors that occur in position module itself

The positioning unit itself has a function to notify an error when the setting contents of 「Start speed」, 「Target speed」, 「Acceleration / deceleration time」 are not appropriate. Errors are displayed for each axis.

When an error occurs and contents							
		Start Setting			Edit while Operation		
		-(Minus)	0	Out of Range	-(Minus)	0	Out of Range
E-point Control	Start Velocity	Error		Error	N/A		
	Target Velocity	Error	Error	Error			
	Acceleration	Error		Error			
	/Deceleration Velocity	Error		Error			
P-point Control	Start Velocity	Error		Error			
	Target Velocity	Error		Error	Error	Error	Error
	Acceleration	Error		Error	Error		Error
	/Deceleration Velocity	Error		Error	Error		Error
Return to Home-point	Start Velocity	Error	Error	Error	N/A		
	Target Velocity	Error	Error	Error			
	Acceleration	Error		Error			
	/Deceleration Velocity	Error		Error			
JOG Operation	Start Velocity	Error		Error			
	Target Velocity	Error	Error	Error	Error	Error	Error
	Acceleration	Error		Error			
	/Deceleration Velocity	Error		Error			
Pulse Generator Input	Start Velocity				N/A		
	Target Velocity	Error	Error	Error			
	Acceleration						
	/Deceleration Velocity						
If the above error occurs		Operation does not start			Decelerate to stop		

- ① The position command value and control code are not subject to the increment or absolute value setting error.

- ② Data of in this area is not an error target.
- ③ An error occurs when the start speed  $\geq$  target speed is set at the start of each mode (except the pulse generator input).
- ④ It is only possible to rewrite during operation in JOG operation when linear acceleration / deceleration is selected.

## How to deal with an error

When ER LED of positioning module is turned ON

- Situation

Setting error of position data has occurred.

- Process 1

Check if the data register value which use for data table of position parameter is within the settable range using by programming tool(XGPC S/W).

Settable range for setting by positioning data

Specify the setting range of parameter type on program

Start Velocity[pps] 0 ~ 1,000,000[pps] 0 ~ 1000000

Target Velocity[pps] +1 ~ +1,000,000[pps] 1 ~ 1000000

Acceleration/Deceleration Time[ms] 0 ~ +32,767[ms] 0 ~ 32767

Check Point :

- ① Is the start velocity set as bigger than target velocity? Error occurs even when it is the same.

Set the value bigger than start velocity in case of E-point control, 1<sup>st</sup> velocity of P-point control, JOG operation, Home-return.

- ② Is the target velocity set to "0"?
- ③ Is the data register set to "-(minus)" value?
- ④ If the parameter is set externally or if it is calculated in the PLC, make sure that the value is as designed.

- Process 2

Edit the value which is out of the setting range on program.

- Process 3

Reset the setting value error as shown below.

- ① Set the ECLR(Error clear contact-point) from OFF → ON → OFF in the program.

- ② Set the ECLR(Error clear contact-point) from OFF → ON → OFF as forced output of programming tool(XGPC S/W).
- ③ First, turn off the power in the order of Drive → PLC, then turn on the power in the order of PLC → Drive

Caution :

When ECLR(Error clear signal) is turned ON, each operation of positioning is not started.

Restart each operation after error clear.

Reference :

The start contact point of each operation is valid after the error is cleared.

When the error clear signal is cleared in the program, error clear can be performed even if the other axis is in operation.

#### ■ Clear by Error Clear Signal ① [By program]

Method to clear the error in the program with the switch connected in advance.

With an arbitrary input, turn ON the error clear signal corresponding to each axis.

Caution :

The Relay number used depends on the allocation position. (Refer to Chapter 1 and 4)

#### ■ Clear by Error Clear Signal ② [By forced output]

Process :

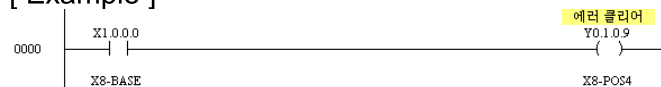
1. Select <Forced In/Output> from Programming Tool(XGPC S/W) Menu
2. Specify Y0.Δ.0.9 Relay that forced output
3. Turn OFF the contact point after turning it ON in advance.
4. Release force state.

Caution :

Be sure to perform “Force Release” operation after forced output. Relay number changes according to the positioning unit type, assigned position and axis number. (Refer to the Chapter 1 and 4)

X1.0.0.0 Y0.1.0.9

[ Example ]



Clear the positioning unit setting error by Input X1.0.0.0

Position unit operation when the error occurs.

When the Motor does not operate.

(When the display LED of pulse output A· B is flickering or lighted)

- Corrective Action 1 : For Servo Motor  
Check if Servo ON Input is turned ON.
- Corrective Action 2 :  
Check if the Drive power is turned ON.
- Corrective Action 3  
Check if the Wiring between the Positioning unit and the Drive is properly connected.
- Corrective Action 4  
Check if the setting of the pulse output setting (CW / CCW or Pulse / Sign) matches the Drive.  
Refer to the Chapter 4 for Mode Switch Setting

(When the display LEDs of pulse output A and B are turned OFF)

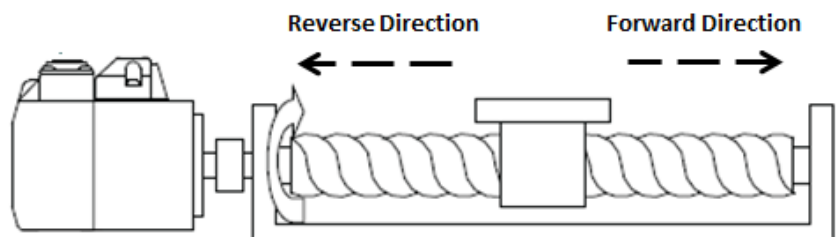
- Corrective Action  
Edit the program.

Check Point

- ① Check if the number of I/O is correct.
- ② Check if the starting contact point has not been modified in the program.

When the direction of rotation is opposite.

[Example of Reverse Direction]



- Corrective Action 1  
Check if the Wiring between the Positioning unit and the Drive is properly connected.

Check Point

Check if the CW / CCW output or Pulse / Sign output is connected to the corresponding input on the drive side, respectively..  
(Refer to the Chapter 3 for Pulse Output Signal Connection)

- Corrective Action 2

Check if the setting of the control code and the position command value are correctly specified in the program.

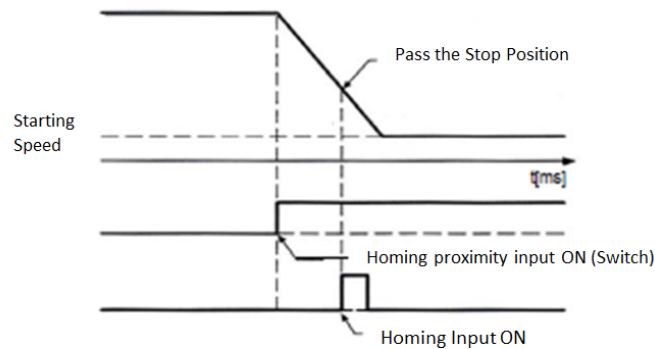
Check Point

Increment < Relative Value Control > and Absolute < Absolute Value Control> are specified by control codes in the program.  
(Refer to the Chapter 4 for Increment and Absolute)

- Corrective Action 3

If the positioning data is specified in the reverse direction of + and – direction, change the direction of rotation by setting.

## When stop position does not coincide with homing

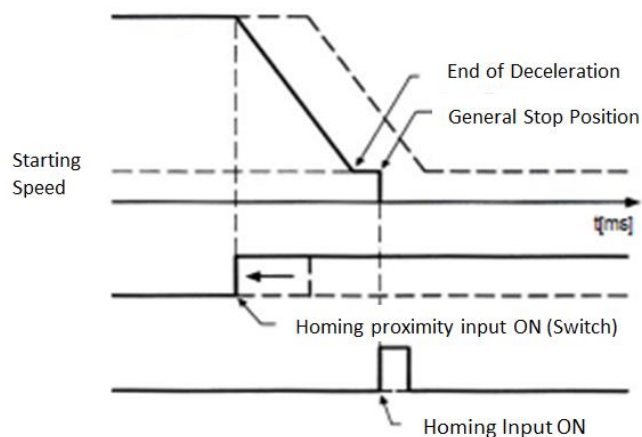


### • Situation

Deceleration may not be sufficient when returning to the home position. If it is impossible to decelerate to the starting speed, it will not stop even if the home input is correct.

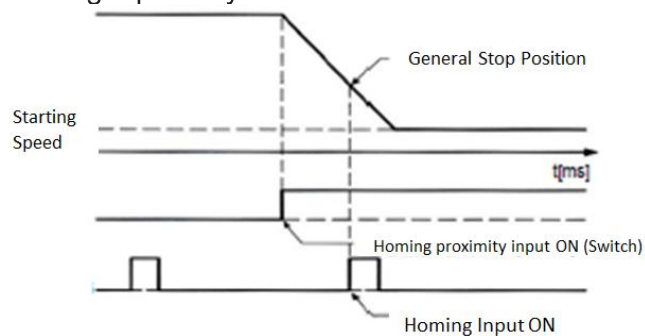
### • Corrective Action 1

Change the position of Homing Proximity Input Switch to Reverse direction of Homing direction.



### Check Point

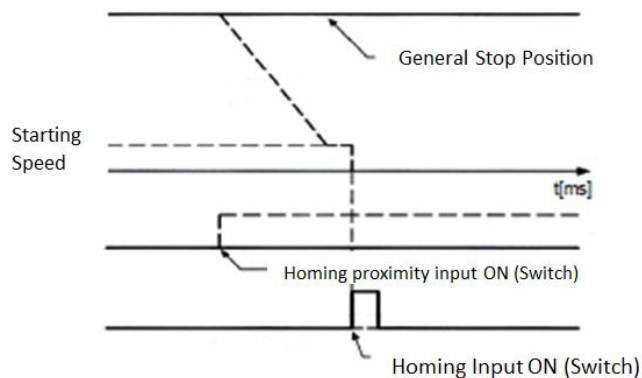
When the Home Position Input is connected to Z phase of the Servo Motor Drive, the position of the Homing Proximity Input and the Homing Input may be close to each other.



### • Corrective Action 2

Modify the program and decelerate the Homing Return Speed.

## When does not decelerate while homing



- Situation

Possible that Homing Proximity Input may not be accepted correctly.

- Corrective Action 1

Forcibly turn ON / OFF the home proximity input switch externally and confirm that the "D" of the home proximity input display LED of the positioning unit lights up.

- Corrective Action 2

Check whether the input logic of the Homing Proximity Input Switch is normally ON or OFF.

- Corrective Action 3

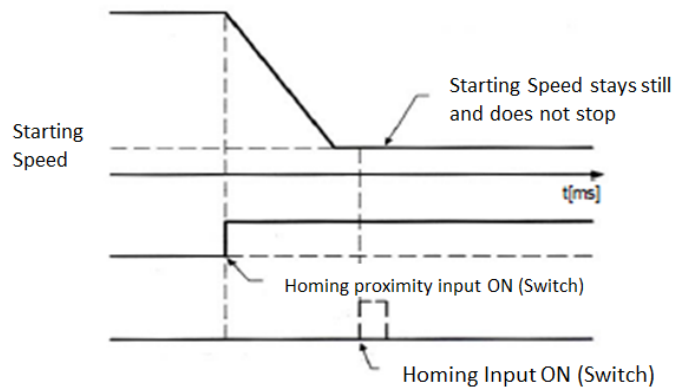
Check the control code of the Homing Return Program.  
The control code specified differs according to the input logic confirmed in <Corrective Action 2>  
(Refer to the Chapter 4 for Control Code)  
(Refer to the Chapter 9 for Input Logic)

### Check Point

If Homing Proximity Input is not connected, it is recognized as OFF.



When does not stop at homing (after deceleration termination)



- Situation

Possible that Homing Input may not be accepted correctly

Check Point

Homing Return Point is effective when the homing position input after deceleration is valid. If the homing position signal is input during deceleration, the input is ignored.

- Corrective Action 1

Forcibly turn ON / OFF the homing input switch externally and confirm that the "Z" of the homing input display LED of the positioning unit lights up.

- Corrective Action 2

Check whether the input logic of the Homing Input Switch is normally ON or OFF.

- Corrective Action 3

Check the control code of the Homing Return Program.

The control code specified differs according to the input logic confirmed in <Corrective Action 2>

(Refer to the Chapter 4 for Control Code)

(Refer to the Chapter 9 for Input Logic)

Check Point

If Homing Proximity Input is not connected, it is recognized as OFF.

## Error Code

This chapter describes the error code of the position module.

## Error Code

Error occurs when the positioning module cannot continuously control the motion. The related code is shown below.

Index	Error Code	In English	Description
0	0x00	No Error	
1	0x01	Not Founded	Module not detected
2	0x02	Driver Open Error	Drive open error
3	0x03	File Open Read/Write Error	File open Read/Write error
4	0x04	ABS Serial Comm Time Out	Absolute value communication timeout
5	0x05	Mutex Open Error	Mutex open error
6	0x06	Mutex Time Out	Mutex timeout
7	0x07	Invalid Axis Number	Error of axis number
8	0x08	Invalid Parameter	Error of parameter
9	0x09	Not Initialized	Error of initialization
10	0x0A	Invalid Speed	Velocity error
11	0x0B	Invalid Axes for Multi Axes	Multi-axes error
12	0x0C	Amp Off Status	Amplifier off state
13	0x0D	Invalid Acc/Dec	Specified error of acceleration/deceleration
14	0x0E	Continuous Move Not Ready	Not ready for continuous control
15	0x0F	Invalid Port Number	Port error
16	0x10	ABS Serial Data Error	Data error of absolute value
20	0x14	Config Parameter Error	Parameter error of setting value
21	0x15	None Recovery Error	Recovery error
22	0x16	Amp Not Enabled	No amplifier enabled
23	0x17	Axis Invalid	Error of specifying the axis
24	0x18	Invalid Function Code	Function code error
25	0x19	Invalid Position Number	Position number error
26	0x1A	Unexpected Prog Error	Abnormal program error
27	0x1B	CMOV Too Many Axes	Multi-axes circular interpolation error
28	0x1C	CMOV Invalid Axes	Specified error of circular interpolation
29	0x1D	Motor ABS Encoder Busy	Conflict of absolute encoder read
30	0x1E	Motor Encoder Read Error	Error of absolute encoder read
31	0x1F	Motor Index Command Error	Index command error
32	0x20	AMP Fault	Amplifier alarm
33	0x21	P Motion Not Enabled	Not prepared for

			P-point control
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<b>TIP</b>	<p>Error code of POS1 module is X1.□.0.10 in the Input Data Table.</p> <p>Error codes of POS2 module are X1.□.0.20, X1.□.0.21 in the Input Data Table.</p> <p>Error codes of POS4 module are X1.□.0.40, X1.□.0.41, X1.□.0.42, X1.□.0.43 in the Input Data Table.</p>
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