



# MapleLogic Positioning User Manual

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Your Industrial Control Solutions Source

For use with the following:

- PLC-ES1616P
- PLC-ES0808P
- PLC-FB1616P0202
- PLC-FB0808P

*1010 -1166 REV 1.0*

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## 1. Positioning

### 1.1 General

The built-in positioning function of CPU is NPN OPEN Collector type which outputs pulse train. By using the positioning module, positioning control is executed by stepping motor or servo motor.

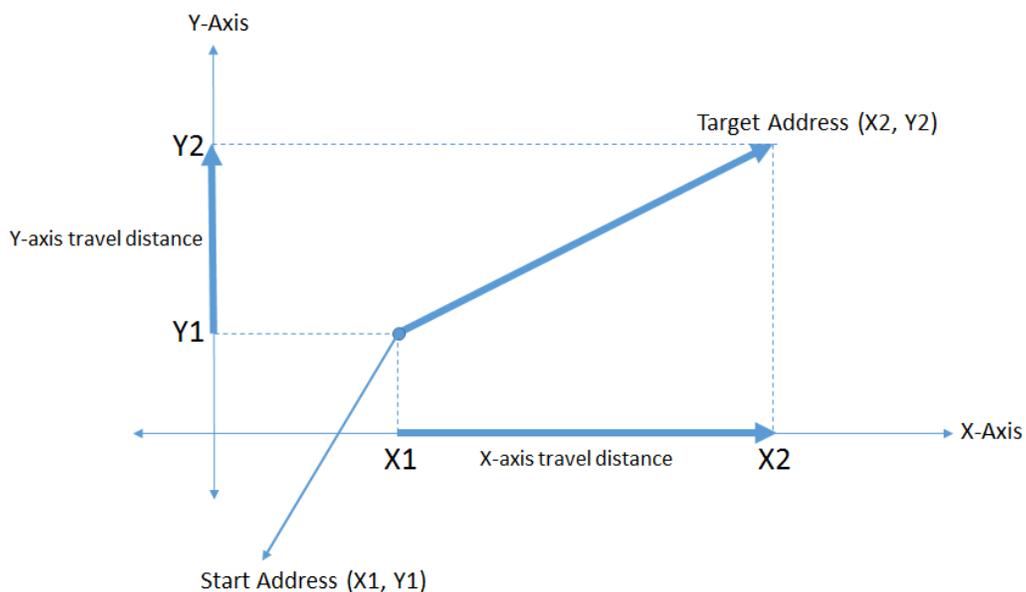
- The Number of Control Axis

The number of control axes for positioning function is equal to the number of motors to be controlled. PLC executes the two-axis positioning control and supports linear interpolation.

#### ① 1-Axis Linear Control (X axis or Y axis)



#### ② 2-Axis Linear Interpolation Control



- Positioning Instruction

PLC is equipped with dedicated commands for positioning and thus enables easy control.

- Manual Operation

Manual operation is made possible by JOG operation, Inching operation and general purpose Manual Pulse Generator (MPG).

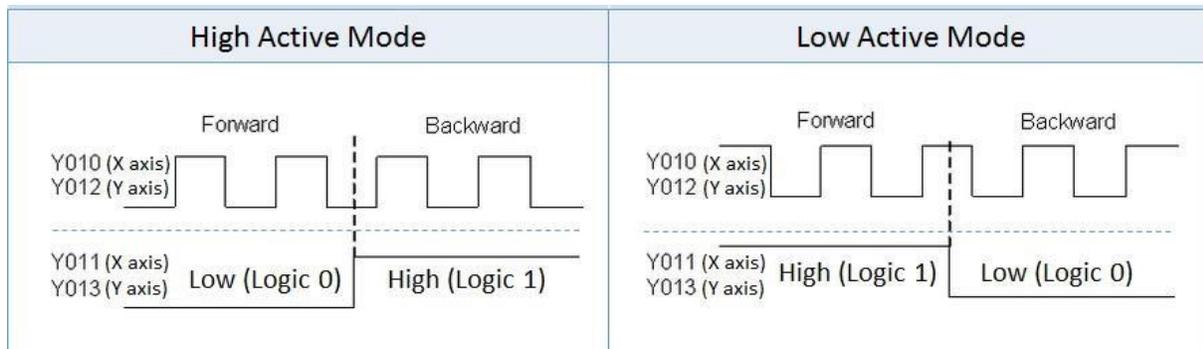
- OPR Control

PLC provides three OPR control methods: DOG/Zero OFF, DOG/Zero ON, and near-point DOG.

*Note: OPR Control is only supported on the PLC-ES1616P and the PLC-FB1616P0202*

## 1.2 Output Pulse Level

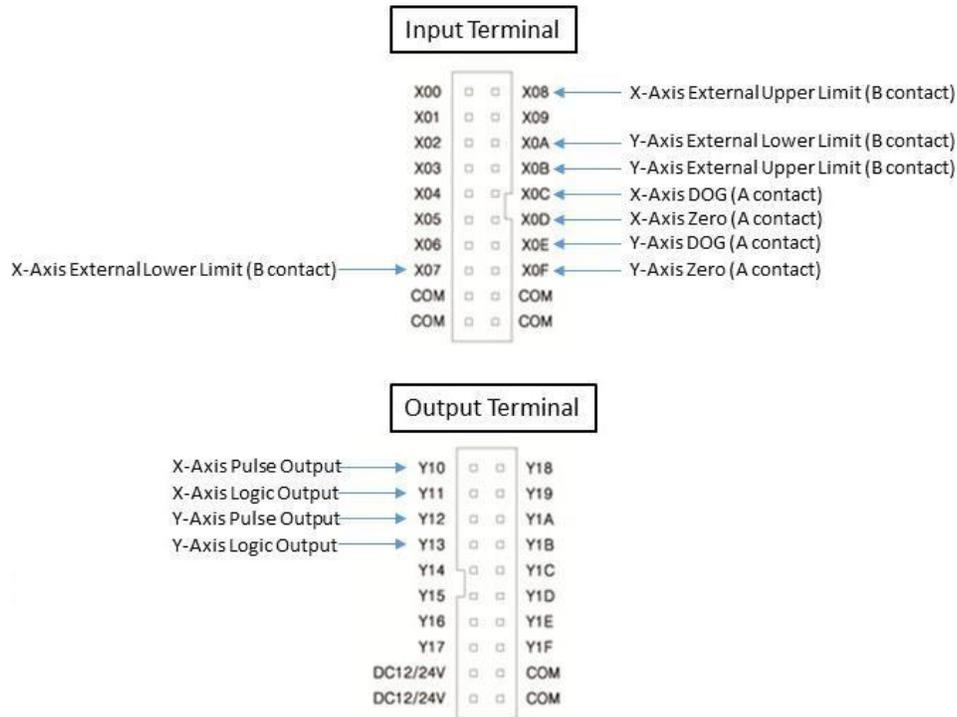
The direction of position control is determined by configuring the 'High Active' or 'Low Active' mode in a scan program or special program.



## 1.3 External Signal Wiring

### 1.3.1 PLC CPU I/O Pin

Input and output connectors of PLC CPU are structured as follows.

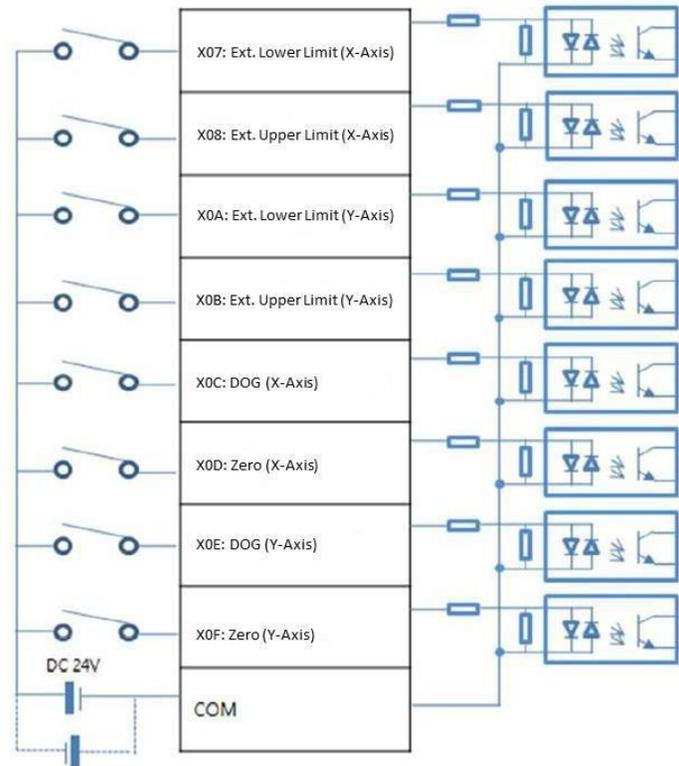


### 1.3.2 PLC CPU Positioning I/O Pin

Input signals and internal circuit of PLC CPU positioning pin are as follows.

Pin	Input Signals	
	X Axis	Y Axis
X07	Ext. Lower Limit (B contact)	
X08	Ext. Upper Limit (B contact)	
X09	N/A	
X0A		Ext. Lower Limit (B contact)
X0B		Ext. Upper Limit (B contact)
X0C	DOG (A contact)	
X0D	Zero (A contact)	
X0E		DOG (A contact)
X0F		Zero (A contact)
COM	Input Common	Input Common

### a) Wiring and Internal Circuit of Input Signal

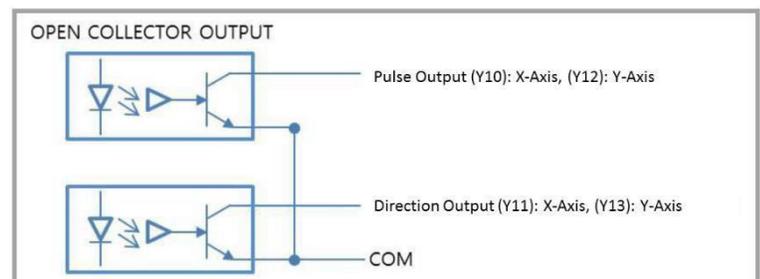


In case of using 'X Axis' only, **X0A, X0B, X0E, X0F** can be used as digital input and output pins.

In case of using 'Y Axis' only, **X07, X08, X0C, X0D** can be used as digital input and output pins.

Output signals and internal circuit of PLC CPU positioning pin are as follows.

Pin	Output Signal	
	X Axis	Y Axis
Y010	Pulse Output	
Y011	Direction Output	
Y012		Pulse Output
Y013		Direction Output
DC24V	Output Common (+)	
COM	Output Common (-)	



### b) Internal Circuit of Output Signal

When controlling only the X-Axis, **Y012** and **Y013** can be used as digital input and output pins.

When controlling only the Y-Axis, **Y010** and **Y011** can be used as digital input and output pins.

## 1.4 Specifications

### 1.4.1 Performance Specifications

The following describes the performance specifications of PLC built-in Positioning function.

Item	Specification
Number of Control Axis	2 Axes
Interpolation	2 Axes Linear Interpolation (Less than 5kpps)
Pulse Output Signal	Open Collector Type (DC24V)
Pulse Output Type	Pulse + Direction Output
Control Type	Position control, Speed control, Speed/Position switching, Position/Speed switching
Control Unit	Pulse
Position Data	30 Position Data Per Axis (Operation step number : 1 .. 30)
How to Configure Position Data	MapleLogic Special Program (Permanent auto preservation)
Positioning Monitor	Dedicated monitoring window provided by MapleLogic
Back-Up	Parameter, operation data → Saved in Flash memory
Positioning Method	Absolute / Incremental
Position Address Range	-2,147,483,648 ~ 2,147,483,647 (Pulse)
Speed Range	1 ~ 100,000 pps (1 pps unit)
Acceleration/Deceleration Type	Trapezoid-shaped
Acceleration/Deceleration Time	0 ~ 100,000 mSec. (Selectable from 4 types of acceleration/deceleration patterns)
Maximum Output Pulse (X-Axis)	Position Control / Speed Control: 100kpps
Maximum Output Pulse (Y-Axis)	Position Control: 5kpps, Speed Control: 100kpps
Maximum Connection Distance	2m

### 1.4.2 Input and Output Signal Specifications

Item	Specification
Rated Input Voltage	24V DC (20.4V ~ 28.8V)
Rated Input Current	About 7 mA / 24V
Insulation type	Photo-coupler insulated
Input Impedance	About 3.3kΩ
On Voltage (Min.)	20.4V or above
Off Voltage (Max.)	6V or less
Response time	0.5mSec or less (Used for positioning)
Min. Input Width	100 μs or above
Ext. Upper Limit Input	X07 (X axis) / X0A (Y axis), B contact
Ext. Lower Limit Input	X08 (X axis) / X0B (Y axis), B contact
DOG Input	X0C (X axis) / X0E (Y axis), A contact
Zero Input	X0D (X axis) / X0F (Y axis), A contact

Item	Specification
Rated Load Voltage	DC5 / 24V (DC4.75 ~ 26.4V)
Max. Load Current	0.1A / 1 point or below
Insulation	Photo-coupler
Inrush current	1A / 10ms or below
On Voltage Drop	DC 0.3V or below
OFF Leakage Current	0.1mA or below
Response time	0.1ms or below (rated load, resistor load)

## 1.5 Positioning Parameter

The following positioning parameters can be configured by using “Positioning for PLC” Special Program in MapleLogic. The configured parameters are saved in the same area (flash memory) as that of sequence program and therefore will be preserved even after power is lost.

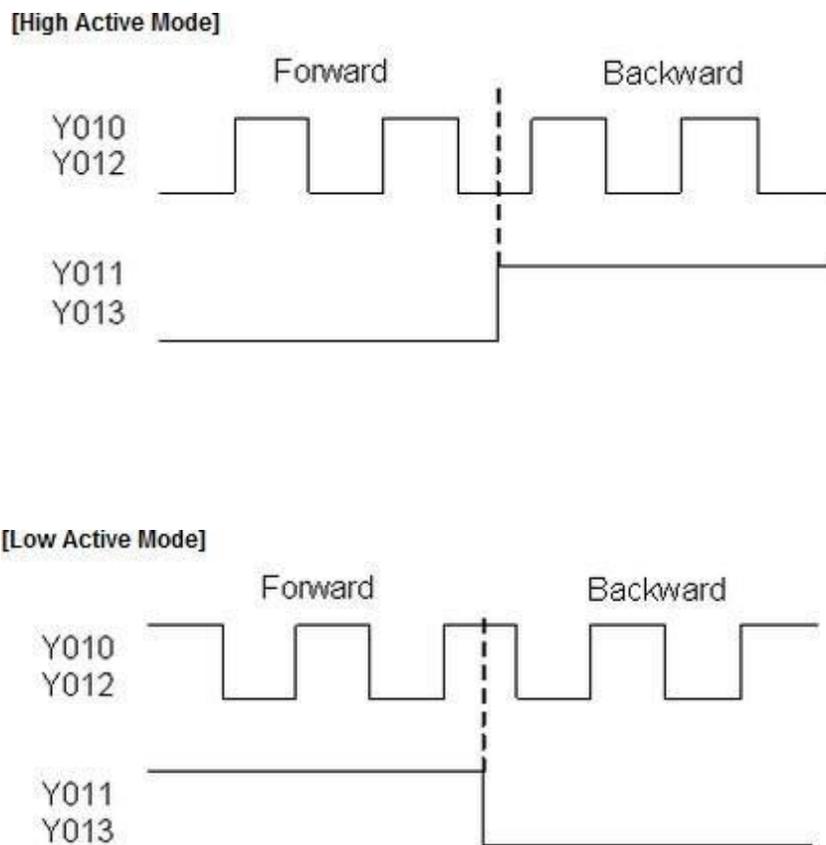
Offset	Item	Configuration Details		R/W	Remark
		Default	Function		
0	Select Pulse Output	0	0=Not Used 1=High Active 2=Low Active	W	
1	Bias Speed	1	1 ~ 100,000 PPS	DW	Low
2					High
3	Speed Limit	50,000			Low
4					High
5	Acceleration/Dec Time 1	1,000	1 ~ 65,535 mSec	W	
6	Acceleration/Dec Time 2				
7	Acceleration/Dec Time 3				
8	Acceleration/Dec Time 4				
9	S/W Upper Limit	2,147,483,647	-2,147,483,648 ~ 2,147,483,647	DW	Low
10					High
11	S/W Lower Limit	-2,147,483,648			Low
12					High
13	Position address under speed control	0	0=Do not update 1=Update 2=Clear and update	W	
14	Backlash Compensation	0	0 ~ 65,535 Pulse	W	
15	Ext. Upper/Lower Limit Signal	0	0=Not Used, 1=Wired (Used)	W	
16	Jog Speed Limit	20,000	1 ~ 100,000 PPS (Bias Speed<Jog Speed<Speed Limit)	DW	Low
17					High
18	Jog Acceleration/Dec Time	0	Number of Acc/Dec Time (0~3)	W	
19	Inching Speed	100	0 ~ 65,535 PPS	W	
20	Complete Output Signal Duration	1000	0 ~ 65,535 mSec	W	
21	OPR Method	0	0=DOG / Zero OFF 1=DOG / Zero ON 2=DOG	W	
22	OPR Direction	0	0=Forward, 1=Backward	W	
23	Origin Address	0	-2,147,483,648 ~ 2,147,483,647	DW	Low
24					High
25	OPR High Speed	50,000	1 ~ 100,000 PPS	DW	Low
26					High
27	OPR Low Speed	1,000	1 ~ 100,000 PPS	DW	Low
28					High
29	OPR Acceleration/Dec Time	0	Number of Acc/Dec Time (0~3)	W	
30	DWELL Time	0	0 ~ 50,000 mSec.	W	

## 1.5.1 Select Pulse Output (Address "0")

This parameter allows a user to configure and select which pulse output (High Active or Low Active) modes to be used according to pulse input type of a servo or stepping motor driver connected with the positioning module. It is also possible to configure and adjust the settings on the other side devices.

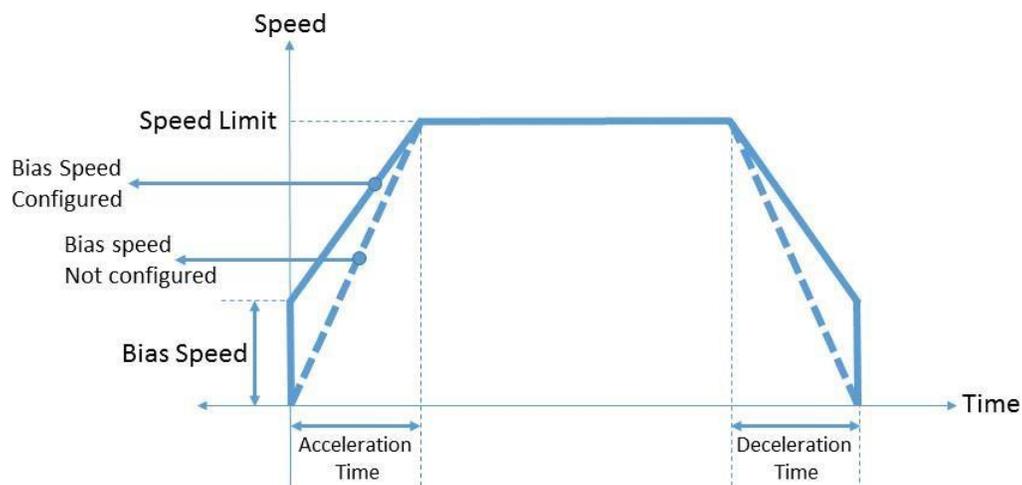
If a non-zero value is assigned for this parameter, pulse signal output is enabled and the signal type (High Active or Low Active) can be selected.

If a zero (0) value is assigned, pulse signal output is disabled for the specific axis.



## 1.5.2 Bias Speed (Address “1-2”)

- Bias speed refers to the initial speed of the positioning operation.
- Considering that torque of a stepping motor is unstable when its initial speed is almost at 0, the initial speed (bias speed) has to be set during early operation in order to facilitate motor’s rotation and to save positioning time.
- Bias speed should not be entered over the selected speed limit value.



## 1.5.3 Speed Limit (Address “3-4”)

- Speed Limit means the allowable maximum speed that can be set in the positioning operation.
- Positioning operation speed cannot be configured greater than the value set as the Speed Limit.

## 1.5.4 Acceleration / Deceleration Time (Address “5-8”)

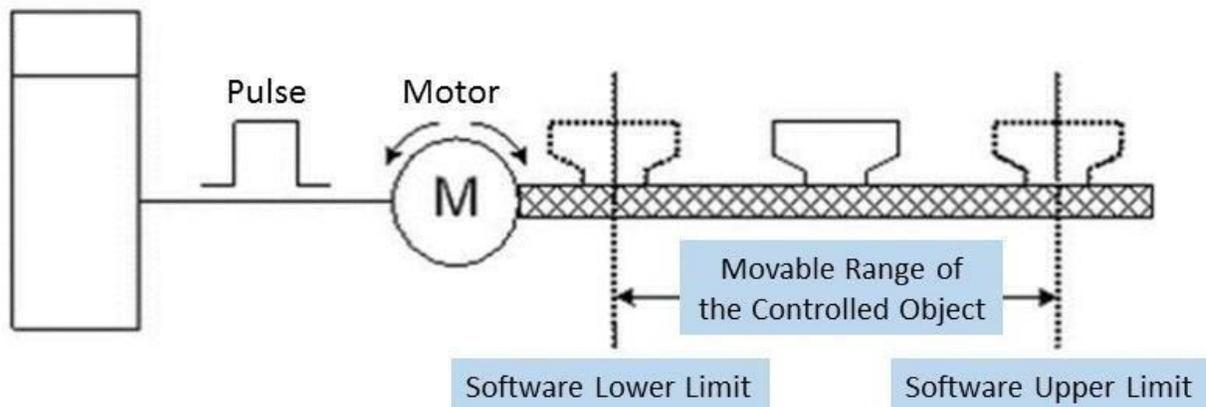
- Acceleration Time: a duration required to reach from “0 (Stop)” speed to the max. Speed Limit.
- Using bias would be a time consumed to reach from Bias Speed to the Speed Limit.
- Deceleration Time: a duration required to reach from the Speed Limit down to “0 (Stop)” speed.
- Using bias would be a time consumed to reach to Bias Speed configured in parameter.
- The actual Acceleration / Deceleration Time can be calculated by the formula shown below.

$$T = V \times Ta / (Vmax - Vbias)$$

(V = Target speed change, Ta = Acc/Dec time, Vmax = Speed Limit, Vbias = Bias Speed)

## 1.5.5 Software Upper/Lower Limit (ADDRESS "9-10" Upper/ "11-12" for Lower)

- Movable range of a machine in operation is called 'stroke limit,' and it sets the upper and lower limits of stroke into the software upper limit and software lower limit. The Software Upper and Lower Limit does not execute positioning if it operates out of the ranges configured in the parameters.
- Range of software upper limit and lower limit is checked before starting positioning and also during the operation.
- Pulse output stops when an error (codes 154, 155) is detected.
- Checking for software limit function is disabled when identical values are assigned for both Upper and Lower Limits.



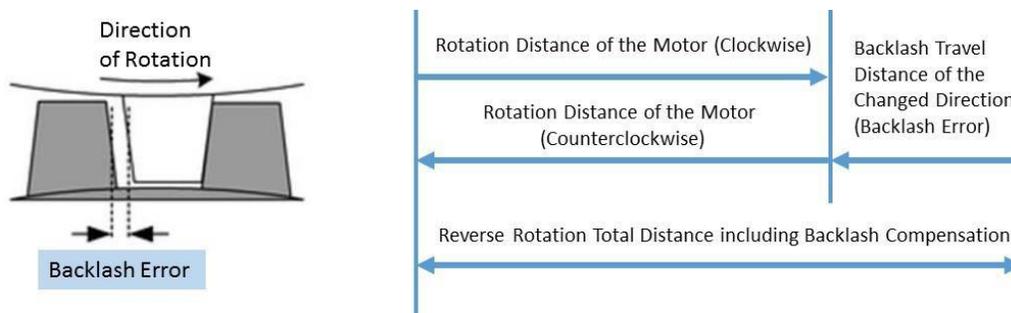
## 1.5.6 Position Indication of the Speed Control (ADDRESS “13”)

- This parameter allows a user to enable or disable the update of current position address while operations are performed under the speed control.
- The speed control command outputs pulses according to the specified speed and direction until the axis stop signal is entered.
- When the speed control command is executed, how the value of the current coordinates is updated differs depending on the configurations of the “Position Indication of the Speed Control.”

Set Value	Position Address Operation	Function Description
0	Do not update	<ul style="list-style-type: none"> <li>• While controlling speed, it maintains the value without changing the current coordinates.</li> </ul>
1	Update (Software Upper/Lower Limit Detection)	<ul style="list-style-type: none"> <li>• Displays current coordinate by accelerating or decelerating through the speed control in the last positioning coordinates.</li> <li>• Since the current coordinate changes, it is possible to detect the Software Upper and Lower Limits.</li> </ul>
2	Clear and Update (Software Upper/Lower Limit Detection)	<ul style="list-style-type: none"> <li>• After configuring the current coordinate as 0, this function displays current coordinates as much as the amount of movement.</li> </ul>

## 1.5.7 Backlash Compensation (ADDRESS “14”)

- A loose connection is made on the gear and screws of the motor shaft for the purpose of preventing abrasion. Due to this, an error named “Backlash” occurs during shifting a direction.
- The error that occurs due to backlash when moving the machine via gears can be compensated.
- When the Backlash Compensation amount is configured, the pulse equivalent to the compensation amount will be outputted each time the direction changes during positioning.



## **1.5.8 Use External Upper/Lower Limit Input (ADDRESS “15”)**

- To use external upper limit (X08, X0B) and external lower limit (X07, X0A) input signals during operation, the [Use External Upper/Lower Limit Input] parameter must be set as 1.
- Otherwise, it does not detect upper and lower limits and the 4 terminals (X07, X08, X0A, X0B) will operate as general input contacts.
- The External Upper and Lower Limit input signals operate by B contact. In other words, these external input signals are detected when switching from ON to OFF. And the axis operation stops immediately.
- Be cautious when using a stepping motor because the motor may operate out of phase.

## **1.5.9 Jog Speed Limit (ADDRESS “16-17”)**

- Jog operation, a type of manual operation, is driven by a pattern characterized by acceleration – constant speed – deceleration. The [Jog Speed Limit] parameter configures speed for the constant speed phase.

## **1.5.10 Jog Acceleration/Deceleration Time (ADDRESS “18”)**

- This parameter configures the period of time for the acceleration and deceleration of Jog operation. The time is assigned by selecting one of the pre-configured values from the [Acceleration and Deceleration Time, Address 5-8].
- Specifies the value from the range of 0 to 3.

## **1.5.11 Inching Speed (ADDRESS “19”)**

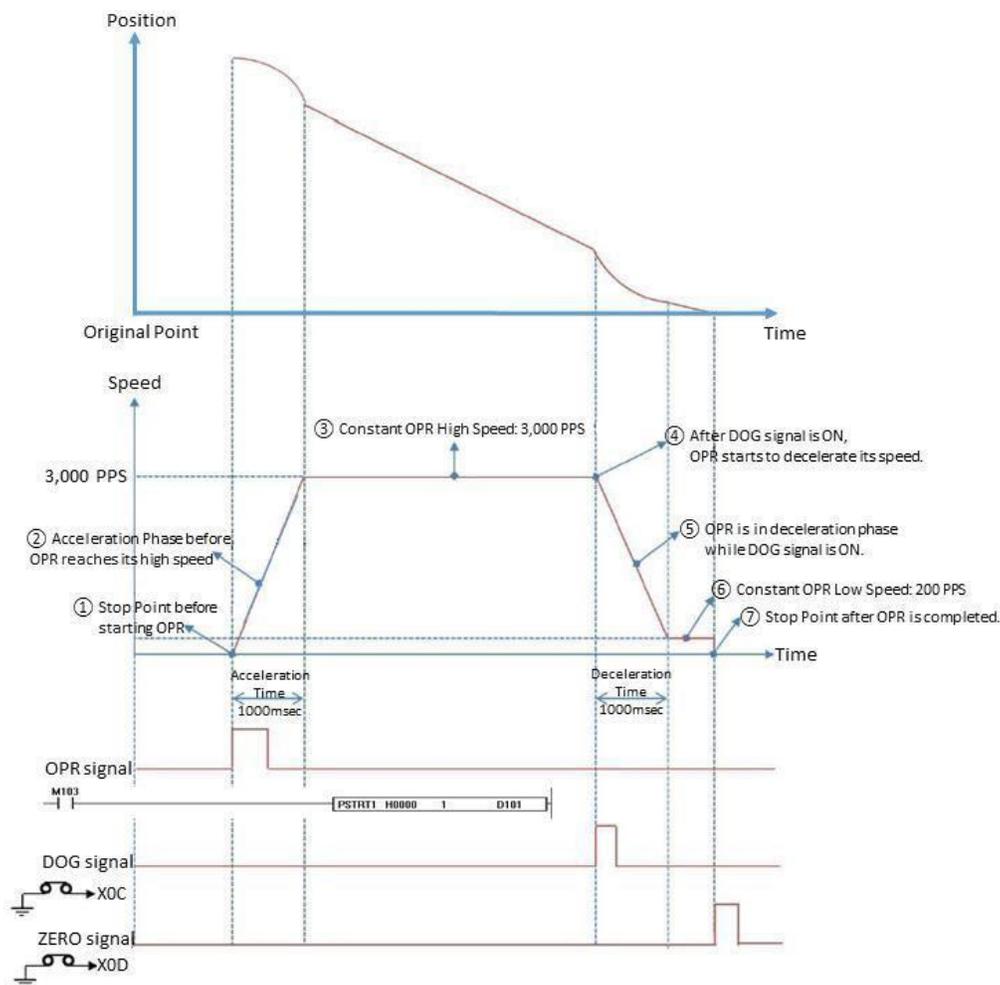
- Inching operation, a type of manual operation, outputs the specified amount of pulses at the speed configured in this [Inching Speed] parameter.
- Unlike the Jog operation which makes it difficult to move to the correct destination because it is driven by ON/OFF signals of the start contact, the Inching operation allows a user to reach the target point by easily setting the desired amount of movement in the Inching command.
- Therefore, use the Jog command to move quickly to the vicinity of the work place and then use the [POSCTRL-Inching command] for fine movement. Or after writing the desired amount of Inching movement at the Offset 8 of the operation memory area, a user can turn on the Jog and Inching signal to move to the correct location of the work place.

## 1.5.12 Origin Point Return Method (ADDRESS "21")

- Origin Point Return (OPR) is executed after power is supplied to confirm the position of the origin (a reference position when executing the positioning control). Applicable PLCs provide 3 different OPR methods.

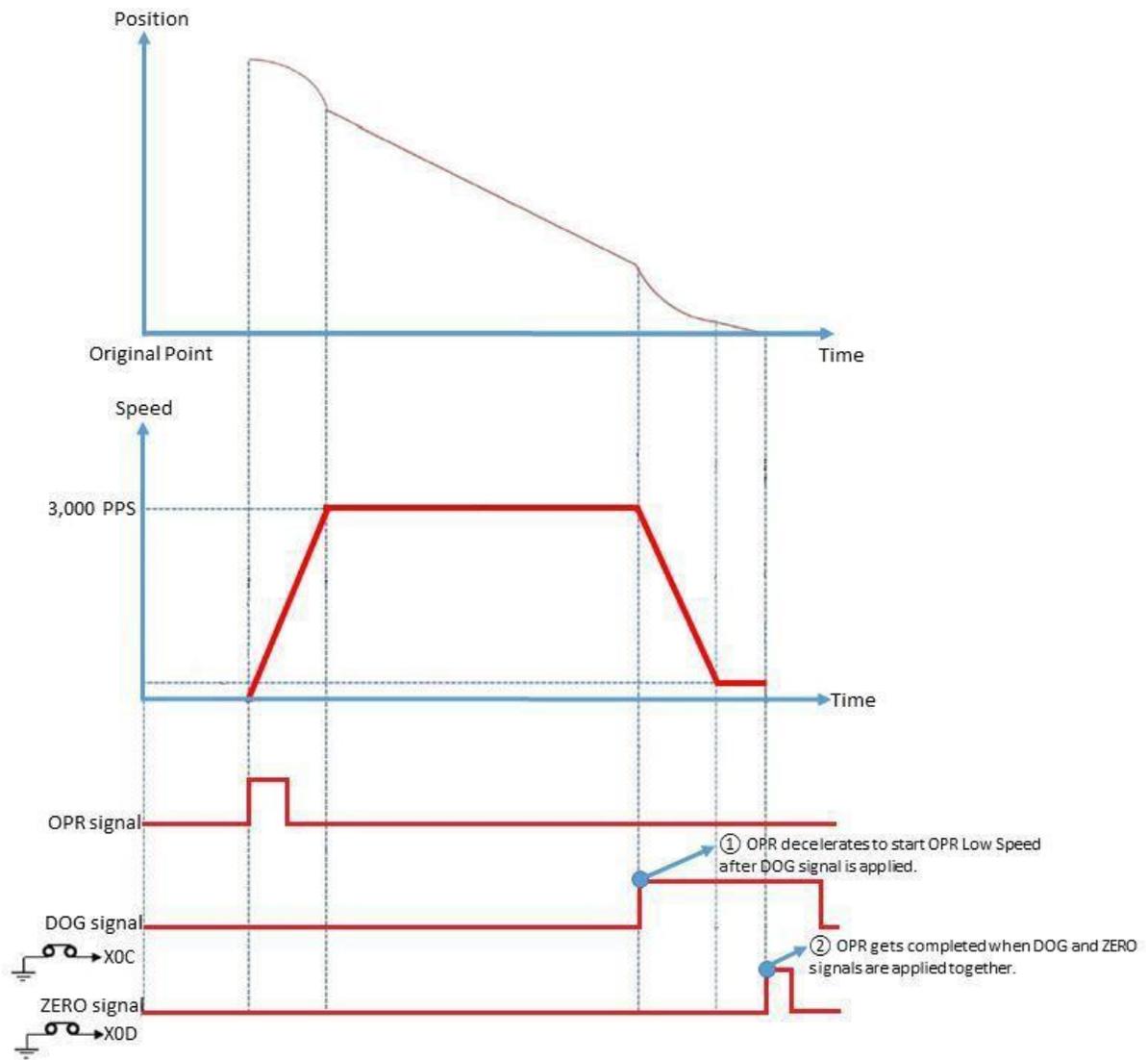
### a) Origin Point (ZERO) Detection after turning DOG OFF

OPR begins with OPR High Speed in the OPR Direction configured at OPR parameters until DOG signal is turned ON to cause OPR to decelerate with OPR Low Speed. When the DOG signal is OFF, the first ZERO signal is detected as well as the OPR ends at the same time. DOG and ZERO signals can only be entered at external signals. They cannot be entered in internal scan program. Therefore, use the external buttons to enter DOG and ZERO signals.



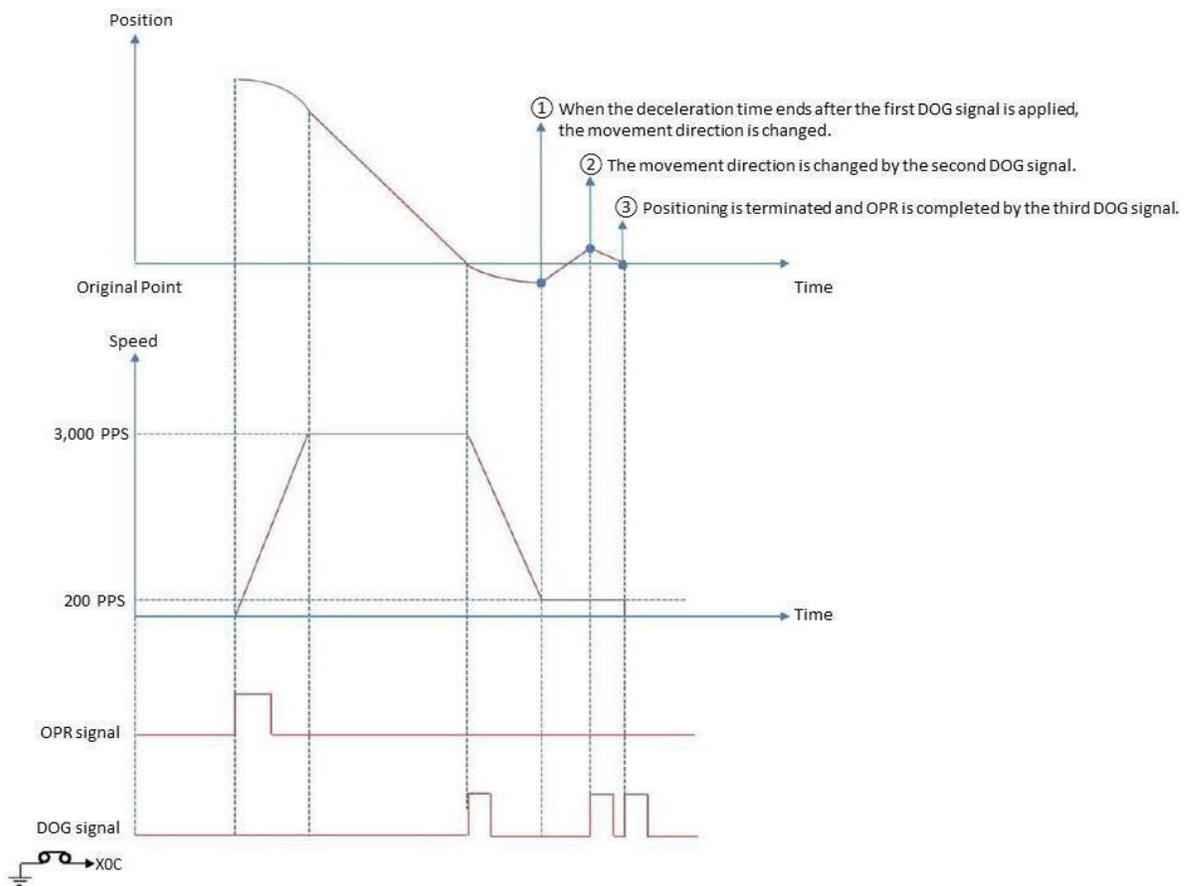
## b) Origin Point (ZERO) Detection after decelerating when DOG signal is ON

OPR begins with OPR High Speed in the OPR Direction configured at OPR parameters until DOG signal is turned ON to cause OPR to decelerate with OPR Low Speed. After the deceleration, the first ZERO signal is detected as well as the OPR ends at the same time.



### c) DOG Signal Detection

- OPR begins with OPR High Speed in the OPR Direction configured at OPR parameters until DOG signal is detected (ON) to cause OPR to decelerate, stop and drive in the reverse direction with OPR Low Speed.
- When the DOG signal is turned OFF, OPR decelerates to a stop and then drives in the reverse direction with OPR Low Speed. When the DOG signal is detected again, the pulse output stops, and OPR gets completed.



### **1.5.13 Origin Point Return Direction (ADDRESS “22”)**

This parameter configures the direction to go to the origin when OPR command is executed.

### **1.5.14 Origin Address (ADDRESS “23-24”)**

This parameter sets the address used as a reference point for positioning control (ABS system). When OPR is completed, the stop position address is changed to this address. At the same time, ‘Origin Address’ is stored in “Current Positioning Address.”

### **1.5.15 Origin Point Return High Speed (ADDRESS “25-26”)**

This parameter configures the speed for the high speed part of the OPR operation. The allowable input range goes: Bias Speed  $\leq$  OPR Low Speed  $\leq$  **OPR High Speed**  $\leq$  Speed Limit.

### **1.5.16 Origin Point Return Low Speed (ADDRESS “27-28”)**

This parameter configures the speed for the low speed part of the OPR operation. The allowable input range goes:  $0 <$  **OPR Low Speed**  $\leq$  OPR High Speed  $\leq$  Speed Limit. It is recommended to set the speed as low as possible.

### **1.5.17 Origin Point Return Acceleration/Deceleration Time (ADDRESS “29”)**

This parameter specifies the number out of the [Acceleration/Deceleration Time 1-4] for the acceleration and deceleration time during the OPR operation.

### **1.5.18 DWELL Time (ADDRESS “30”)**

This parameter sets the time that machine dwells after the positioning stops (pulse output stop) to the output of the positioning complete signal.

## 1.6 Operation Data

Offset	Axis	Item	Description		Remarks
			Bit	Function	
0		Control Flag	0	Enable Axis (1) / Disable Axis (0)	
			1	Decelerate Stop Request (activated on rising edge, and auto reset)	
			2	Emergency Stop Request (activated on rising edge)	
			3	Forward JOG/Inching ON(1) / OFF(0)	
			4	Backward JOG/Inching ON(1) / OFF(0)	
			5	reserved	
			6		
			7		
			8		
			9		
			A		
			B		
			C		
			D		
			E		
			F	Error Clear Request (activated on rising edge, and auto reset)	
1	X Axis	Status Flag	0	Run (0=Stop, 1=Running)	
			1	Under position control	
			2	Under speed control	
			3	Under linear interpolation	
			4	Under OPR	
			5	Reserved (0)	
			6	Reserved (0)	
			7	Under acceleration	
			8	Under constant speed	
			9	Under deceleration	
			A	Under dwell	
			B	Positioning Completed	
			C	OPR Completed	
			D	Direction: Forward(0) / Backward(1)	
			E	Disable Pulse Output	
			F	Error occurs	
2	Current Pos. Address	L	-2,147,483,648 ~ 2,147,483,647	Pulse	
3		H			
4	Current Speed	L	1 ~ 100,000	PPS	
5		H			
6	Current Step		Current position program step number (1 ~ 30)		
7	Next Step		Next position program step number (1 ~ 30)		
8	Inching Movement		Inching distance (0 – 65535)	Pulse	
9	Error Code		[Refer to the error code table]		

10	Control Flag	0	Enable Axis (1) / Disable Axis (0)	
		1	Decelerate Stop Request (activated on rising edge, and auto reset)	
		2	Emergency Stop Request (activated on rising edge)	
		3	Forward JOG/Inching ON(1) / OFF(0)	
		4	Backward JOG/Inching ON(1) / OFF(0)	
		5		
		6		
		7		
		8		
		9		
		A		
		B		
		C		
		D		
		E		
		F	Error Clear Request (activated on rising edge, and auto reset)	
11	Status Flag	0	Run (0=Stop, 1=Running)	
		1	Under position control	
		2	Under speed control	
		3	Under linear interpolation	
		4	Under OPR	
		5	Reserved (0)	
		6	Reserved (0)	
		7	Under acceleration	
		8	Under constant speed	
		9	Under deceleration	
		A	Under dwell	
		B	Positioning Completed	
		C	OPR Completed	
		D	Direction : Forward(0) / Backward(1)	
		E	Disable Pulse Output	
		F	Error occurs	
12	Current Position Address	L	-2,147,483,648 ~ 2,147,483,647	Pulse
13		H		
14	Current Speed	L	1 ~ 100,000	PPS
15		H		
16	Current Step		Current position program step number (1 ~ 30)	
17	Next Step		Next position program step number (1 ~ 30)	
18	Inching Movement		Inching distance (0 - 65535)	Pulse
19	Error Code		[refer to the error code table]	

## 1.6.1 Enable / Disable Axis

- Read: Reading this flag allows a user to recognize the currently active axis.
- Write: When the bit is set (1), all the positioning functions get enabled. When the bit is reset (0), all the positioning functions get disabled.

## 1.6.2 Decelerate Stop Request

When this flag is set, the axis in motion decelerates to a full stop. Various stop factors, causes and reactions are listed in the table below.

Stop Cause		Positioning	OPR	JOG	Error Code
Software	Upper Limit	Immediate Stop	Ignore	Immediate Stop	154
	Lower Limit	Immediate Stop	Ignore	Immediate Stop	155
Sequence	Deceleration Stop	Deceleration Stop	Deceleration Stop	Ignore (Error Code 553)	
MapleLogic	Emergency Stop	Immediate Stop	Immediate Stop	Immediate Stop	102
External Limit Signal	Upper Limit	Immediate Stop	Immediate Stop	Immediate Stop	104
	Lower Limit	Immediate Stop	Immediate Stop	Immediate Stop	105

## 1.6.3 Emergency Stop Request

The Emergency Stop Request flag immediately stops the axis in motion without deceleration process.

The other occasions where the axis is stopped immediately rather than by this flag are as follows.

- Detection of the Upper limit signal
- Setting of the Software Upper/Lower limit signal

## 1.6.4 Forward/Backward JOG and Inching ON/OFF

JOG Operation: If 'Inching Movement' was set as 0, then 'JOG/Inching ON' activates JOG operation without instructions. 'JOG Speed Upper Limit' and 'JOG Accelerate/Decelerate Time' set in parameter are used in JOG operation. JOG operation can be executed even when Original Point is not determined.

Inching Operation: If 'Inching Movement' was set as non-zero value, then 'JOG/Inching ON' activates Inching operation. It outputs predefined number of pulses ("Inching Movement") to the drive unit from PLC when the signal is changed from OFF to ON. "Inching Speed" set in parameter is applied here.

## 1.6.5 Positioning Completed Flag

Positioning Completed Flag turns ON when a positioning operation is completed. Duration can be configured by setting “Complete Output Signal Duration” in parameter.

## 1.6.6 OPR Completed Flag

OPR Completed Flag turns ON at the end of dwell time after OPR. Reset (OFF) condition is listed here.

- When CPU changes to STOP mode.
- When a new OPR operation begins.
- When the axis gets disabled.

## 1.6.7 Direction Flag

Direction Flag indicates the rotation direction of the axis. (0 = Forward, 1 = Backward)

## 1.6.8 Disable Pulse Output

When an error occurs during the positioning operation, error code gets written in the memory offset 19. At the same time, ‘Error’ and ‘Disable Pulse Output’ flags are set automatically. Pulse does not output while the ‘Disable Pulse Output’ flag is set. To enable the pulse output, the source of the error should be removed and the error code has to be cleared by setting the ‘Error Clear Request’ in the control flag.

## 1.6.9 Error Flag

If an error occurs during the operation of the corresponding axis, this ‘Error’ flag is set. The detailed information on the error is found in the ‘Error Code.’ After removing the source of the error, this flag can be cleared by using the POSCTRL instruction.

## 1.7 Position Data

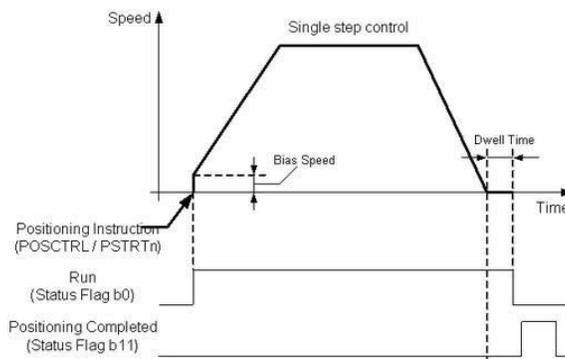
- The basic controls such as position control and speed control are executed by setting the required items in this 'Position Data.'
- The special program named "Positioning Program for PLC" provides a tool for 'Position Data.'
- Maximum of 30 'position data' can be configured for each axis.
- A 'position data' occupies 8 word-sized memory.
- The same structure of 8 word memory is applied to 'POSCTRL' instruction.
- Control Code must be '0' at the end of 'position data' list.
- While in operation, if the control code is zero (0), PLC terminates the series of positioning control and does not go onto the next item on the list.
- When a set value is written on the device used as indirect data in the sequence program, the set value of the 'position data' gets modified.

Offset	Item	Bit	Description	Unit
0	Control Pattern	0	00 = Single step control	
		1	01 = Continuous control	
	Interpolation	2	00 = Non-Interpolation	
		3	01 = Main Axis : Y (Linear Interpolation)	
			10 = Main Axis : X (Linear Interpolation)	
	Accelerate Time	4	Acc/Dec No. (0 ~ 3)	
		5		
	Decelerate Time	6	Acc/Dec No. (0 ~ 3)	
7				
	Control Code	8..F	See 'Control Code' table	
1				
2	Dwell Time		0 ~ 65,535 or indirect data (device memory)	mSec
3				
4	Operation Speed	L	1 ~ 100,000	PPS
5		H	or indirect data (device memory)	
6	Target Position Address	L	-2,147,483,648 ~ 2,147,483,647	Pulse
7		H	or indirect data (device memory)	

## 1.7.1 Control Pattern

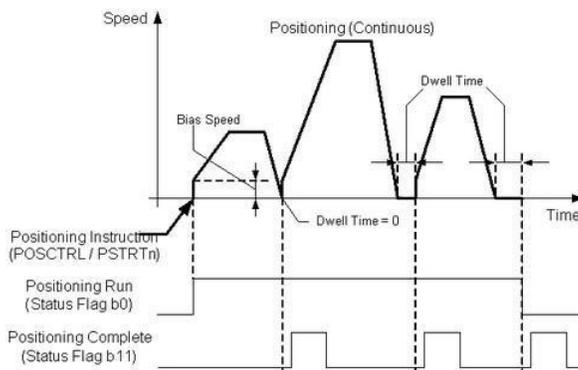
### a) Single Step Control (Terminate after control)

The Single Step Control executes only one position data. If Dwell Time is configured, the control is terminated after the Dwell Time has expired.



### b) Continuous Control

The Continuous Control is used when several position data need to be executed continuously. PLC automatically decelerates each time the positioning is completed. Acceleration is then carried out after the positioning speed reaches 0 to carry out the next position data operation. If Dwell Time is designated, the acceleration is carried out after the designated time elapses. In operation by continuous positioning control, the next positioning No. is automatically executed. Always set operation pattern as “Single Step” in the last positioning data to terminate the continuous positioning. If the operation pattern is set to “Continuous,” the operation will continue until operation pattern “Single Step” is found. If the operation pattern “Single Step” cannot be found, the operation may carry out until the position data reaches No. 30 and it terminates the positioning operation automatically.



## 1.7.2 Interpolation

Set the main axis and sub axis for interpolation control.

- **Non-Interpolation**

Used for normal single axis positioning control and does not require any further configurations.

- **Main Axis Y (Sub Axis X)**

This configuration specifies the corresponding position data as interpolation and designates Y as the Main Axis and X as the Sub Axis for the interpolation operation.

- **Main Axis X (Sub Axis Y)**

This configuration specifies the corresponding position data as interpolation and designates X as the Main Axis and Y as the Sub Axis for the interpolation operation.

- 1) If the main axis settings between X and Y position data do not match, the system will select main axis automatically. It is based on the moving distance. The axis which has longer moving distance becomes the main.
- 2) In continuous control, an interpolation axis waits until the other (partner) axis proceeds to the interpolation step. In this case, there is no limit on the waiting time. To escape from the waiting status, use the “Emergency Stop Request” control flag.
- 3) In interpolation operation, set values such as speed, dwell time and Acc/Dec time are taken from the main axis position data set. Only the target position address is effective set in position data of sub axis.
- 4) Speed control command is not applicable in interpolation operation. Commands for interpolation are restricted to ABS and INC.

## 1.7.3 Accelerate Time / Decelerate Time Number

The acceleration and deceleration time to apply for positioning operation is configured by selecting one of the 4 Accelerate Time / Decelerate Time values configured in the parameter.

## 1.7.4 Control Code

The Control Code for the position data of X Axis is listed in the table below.

Instruction	Code		Symbol	Function	Remark
	Hex	Dec			
END	00H	0	-	End of position data	Terminates continuous control
Operation Command	01H	1	ABS	Absolute position control	
	05H	5	INC	Incremental position control	
	09H	9	FEED	Incremental position control after resetting address	
	13H	19	FSC	Speed control (Forward)	
	17H	23	RSC	Speed control (Backward)	
	80H	128	NOP	No operation	
Program Control Command	81H	129	JUMP	Force to change next step No.	Next step set value is stored in 'target position address'
	82H	130	LOOP	The first step of loop	Loop count is stored in 'target position address'
	83H	131	LEND	The last step of loop	
	84H	132	POS	Force to change the current position address	New address is stored in 'target position address'

### a) ABS (Absolute Coordinate)

- 1) Position control by absolute coordinate is performed based on the address designated in the origin point address. Object moves from start address to target address.
- 2) Direction of movement is determined by the sign (+, -) and pulse output method of the movement amount.
  - Pulse Output Method: High Active Mode
    - When the movement direction is plus (+): Forward Positioning
    - When the movement direction is minus (-): Backward Positioning
  - Pulse Output Method: Low Active Mode
    - When the movement direction is plus (+): Backward Positioning
    - When the movement direction is minus (-): Forward Positioning

\*For instance,

If the start address is '1000' and the target address is '5000,' the PLC moves forward and stops at '5000.' The overall movement amount is '5000 – 1000 = 4,000.'

### 3) Positioning Special Module (PLC) Configuration

#### A) How to configure X Axis Parameter

The default setting for the X Axis is as follows.

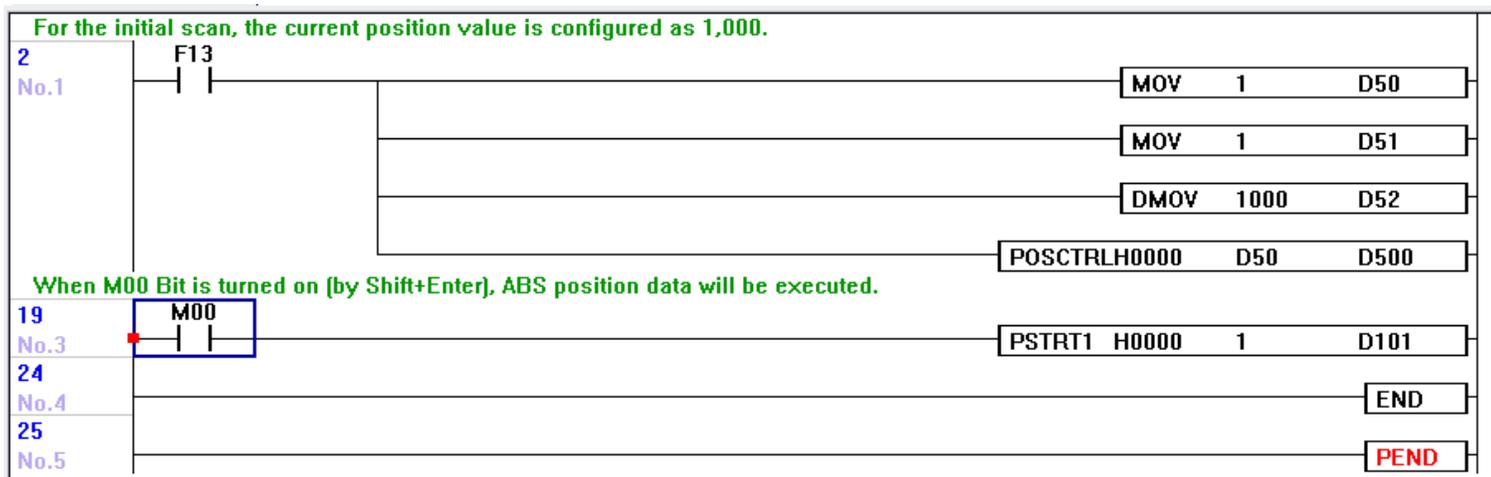
Item	Setting Value	Description
Pulse Output Method	High Active	Select a desired pulse output type
Bias Speed(PPS)	100	Initial speed for the positioning
Speed Limit(PPS)	1,000	Maximum speed for the positioning
Acc/Dec Time 1	1,000	The time taken for the speed to increase or decrease from 0 to the speed limit
Acc/Dec Time 2	1,000	
Acc/Dec Time 3	1,000	
Acc/Dec Time 4	1,000	

#### B) How to configure X Axis Position Data

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	ABS	0	1,000	5,000

#### C) How to write a Scan Program

- 1) For the initial run, the current position value is configured as 1,000.
  - POSCTRL command is used.
- 2) When M00 Bit is turned on (by Shift + Enter), ABS position data will be executed.



**b) INC (Relative Coordinate)**

- 1) Object moves from the start address according to the target amount of movement (as long as the target address is configured in operation data).
- 2) This INC command is using relative coordinate which means the target address number is counted from the start address (present position before operating this command).
- 3) Direction of movement is determined by the sign (+, -) and pulse output method of the movement amount.
  - Pulse Output Method: High Active Mode
    - When the movement direction is plus (+): Forward Positioning
    - When the movement direction is minus (-): Backward Positioning
  - Pulse Output Method: Low Active Mode
    - When the movement direction is plus (+): Backward Positioning
    - When the movement direction is minus (-): Forward Positioning

\*For instance,

If the start address is '1000' and the target address is '5000,' the PLC moves forward and stops at '6000' (as opposed to ABS which stops at '5000'). The overall movement amount is '6000-1000=5,000.'

- 4) Positioning Special Module (PLC) Configuration
  - A) The X Axis parameter setting is the same as the ABS configuration.
  - B) How to configure X Axis Position Data

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	INC	0	1,000	5,000

- C) The Scan Program setting is the same as the ABS configuration.

**c) FEED**

- 1) Before executing the FEED command, the current coordinate is cleared to zero (0) and then the object moves (positioning control) by the specified movement amount.
- 2) Direction of movement is determined by the sign (+, -) and pulse output method of the movement amount.
  - Pulse Output Method: High Active Mode
    - When the movement direction is plus (+): Forward Positioning
    - When the movement direction is minus (-): Backward Positioning
  - Pulse Output Method: Low Active Mode
    - When the movement direction is plus (+): Backward Positioning
    - When the movement direction is minus (-): Forward Positioning

\*For instance,

If the start address is '1000' and the target address is '5000,' the current coordinate (1,000) is cleared to zero (0) and then PLC moves forward and stops at '5,000' according to the target address (as opposed to ABS which stops at '5000' and INC which stops at '6000').

- 3) Positioning Special Module (PLC) Configuration
  - A) The X Axis parameter setting is the same as the ABS configuration.
  - B) How to configure X Axis Position Data

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	FEED	0	1,000	5,000

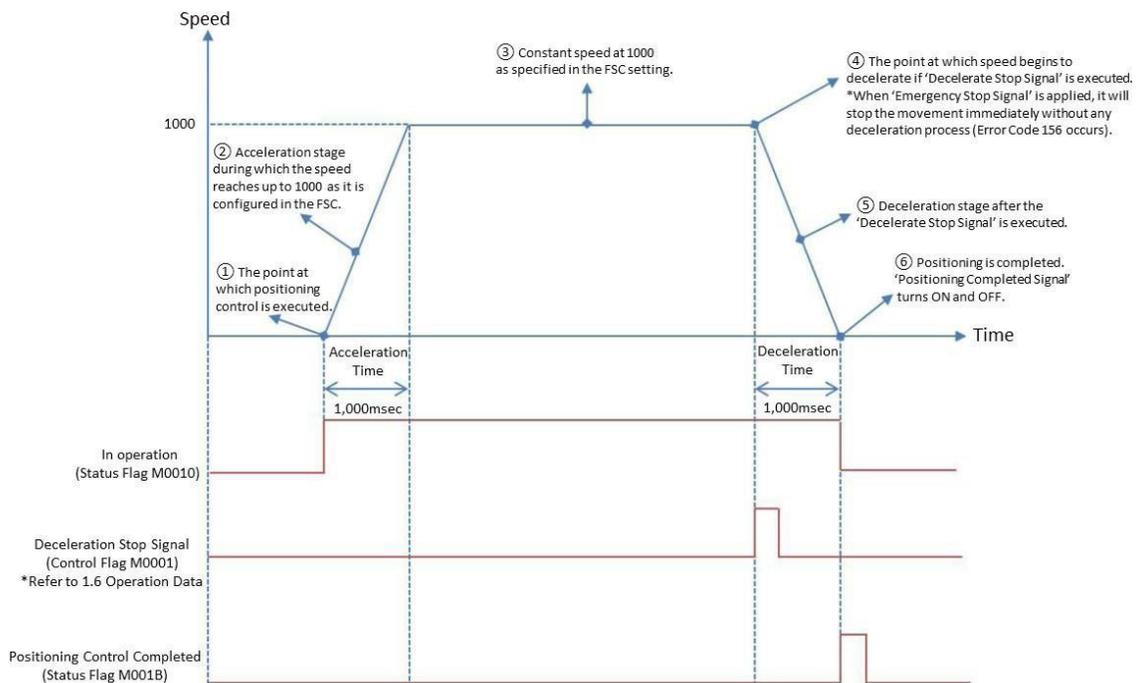
- C) The Scan Program setting is the same as the ABS configuration.

## d) FSC (Forward Speed Control) / RSC (Backward Speed Control)

- 1) This command performs speed control.
- 2) Speed control outputs designated speed of pulse until the deceleration stop request is entered (bit 1, control flag).
- 3) According to the 'position address under speed control' set in parameter, current position address is cleared / updated or fixed during speed control.
- 4) Speed control has forward and backward maneuvers.
  - Forward: When the FSC code is configured in the positioning control data.
  - Backward: When the RSC code is configured in the positioning control data.

\*For instance,

After the control code is configured as FSC in the X Axis position data and the operation speed is configured as 1000, the speed control is executed.



## 5) Positioning Special Module (PLC) Configuration

- A) The X Axis parameter setting is the same as the ABS configuration.

B) How to configure X Axis Position Data

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	FSC	0	1,000	0

C) The Scan Program setting is the same as the ABS configuration.

e) **NOP**

No operation is performed.

## f) LOOP / LEND

The LOOP command is used for loop control by the repetition of LOOP to LEND.

It is repeated for a specified number of times from the position data number assigned to LOOP to the position data number assigned to LEND.

Nesting loop is allowed and LOOP / LEND have to be set as 'continuous control' type.

The table below illustrates an example of how the positioning commands in between LOOP and LEND are repeated for the number of times specified in the 'target address' of LOOP.

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Continuous	Non-Interpolation	No. 1	No. 1	LOOP	0	0	3
2	Continuous	Non-Interpolation	No. 1	No. 1	ABS	0	1000	- 1000
3	Continuous	Non-Interpolation	No. 1	No. 1	INC	0	1500	2000
4	Continuous	Non-Interpolation	No. 1	No. 1	ABS	0	2000	- 2000
5	Continuous	Non-Interpolation	No. 1	No. 1	LEND	0	0	0

Since the 'Target Address' of the LOOP is 3, the Position Data No. 2, No. 3 and No. 4 commands are repeated for three times.

## g) POS

Forced to change the current position address to a new address. The new address has to be designated in the 'target address' field.

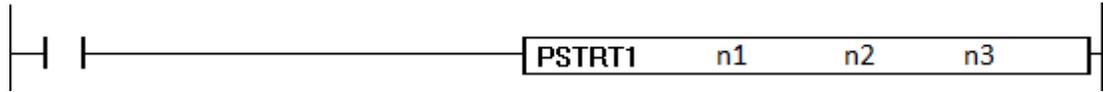
For instance,

Configure the control code as 'POS' and specify the target address as '4000.' When this command is executed, the current coordinate will be set as '4000.'

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	POS	0	1,000	4,000

## 1.8 Positioning Instruction

### 1.8.1 PSTRn (n = 1~2)



This command executes the positioning data assigned as 'n2' of the positioning module assigned as 'n1.'

**a) n1 (Positioning Module Slot number)**

Must be zero (0) for PLC since the CPU module is in the 0th slot.

**b) n2 (Positioning Data number)**

Type in the desired positioning data number to be executed.

1~30: Positioning data number

9001: OPR

9002: High speed OPR

**c) n3 (Result flag)**

Device memory in which an error code (if it exists) and result flag are to be written.

It must be a word device. (For example, M0100).

Upper Byte: Error code

Lower Byte: Command processing status

Bit 0: Processing the command

Bit 1: The command is processed completely

Bit 2: Command processing error

Bit 3~7: Reserved

\*Refer to the section 1.11.1 'Positioning Example Using Scan Program.'

## 1.8.2 POSCTRL

Device area is used to conduct the positioning control instead of using the position data.

### a) n1 (Positioning Module Slot number)

Must be zero (0) for PLC since the CPU module is in the 0th slot.

### b) n2 (Control Parameter)

Device memory in which parameters such as axis, command and control parameter are stored.

When the 'Command Code' is 1, 2, 3, and 6

(n2)	Axis (1..2)
(n2+1)	Command Code (1, 2, 3, 6)
(n2+2)	Control Data (Lower word)
(n2+3)	Control Data (Upper word)

When the 'Command Code' is 7

(n2)	Axis (1..2)
(n2+1)	Command Code (7)
(n2+2)	Parameter Offset
(n2+3)	Setting Data (Word)

When the 'Command Code' is 8

(n2)	Axis (1..2)
(n2+1)	Command Code (8)
(n2+2)	Parameter Offset
(n2+3)	Setting Data (Lower word)
(n2+4)	Setting Data (Upper word)

When the 'Command Code' is 10

(n2)	Axis (1..2)
(n2+1)	Command Code (10)
(n2+2)	Control Data (Lower)
(n2+9)	Position Data (8 Word)

n2: Axis to be controlled (1..2)

n2+1: Command Code

n2+2 ~ n2+9: Data necessary for positioning control

The following table describes in detail with respect to the operation according to the Command Code.

Command Code	Operation	Description
1	Change current position address	Enter a new position address (DWORD) in the parameter. OPR completed flag will be set after this command.
2	Change speed	Write a new speed value in the parameter.
3	Inching operation	Record an inching movement amount (distance) in the parameter, if a negative value is entered, the axis moves backward.
6	Change target address	Enter a new target address in the parameter.
7	Change parameter (WORD)	This function changes the position control parameter in the sequence program. Parameter changed by this function does not carry out the validity check such as setting range. Therefore, pay an attention not to write an incorrect value. All the parameter changes will be lost when switching to STOP mode.
8	Change parameter (DWORD)	
10	Indirect position data	Position data block of 8 word size must be written in the parameter in place of the control data.

### c) n3 (Result flag)

Device memory in which an error code (if it exists) and result flag are to be written.

It must be a word device. (For example, M0100).

Upper Byte: Error Code

Lower Byte: displays command processing status

n Bit 0: Processing the command

n Bit 1: The command is processed completely

n Bit 2: Command processing error (gets set concurrently with Bit 1 completion flag)

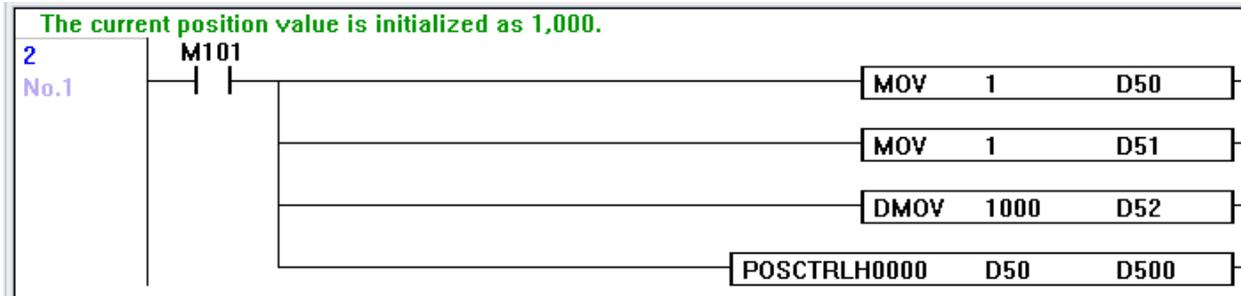
n Bit 3~7: Reserved

\*Refer to the section 1.11.2 'Positioning Example Using Positioning Data.'

(Example)

- a) Change the current coordinates

When the M101 Bit is turned ON, the current coordinates will be set as 1000 and the OPR is completed.

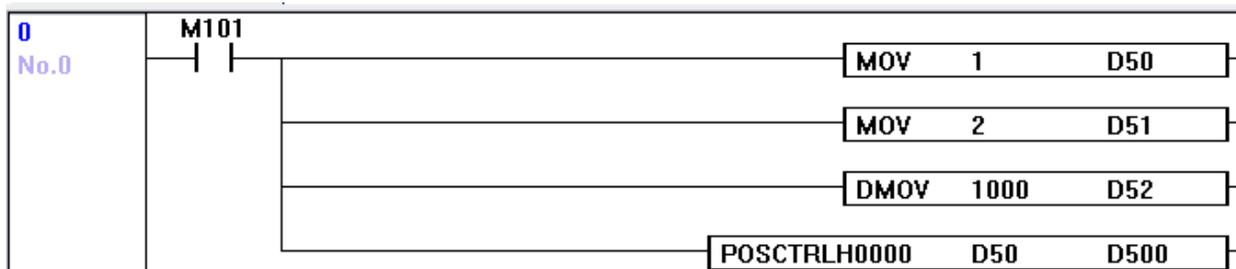


- b) Change the operation speed

When the M101 Bit is turned ON while the speed control is at 500 PPS using FSC or RSC commands, the current speed is changed to 1,000 PPS.

\*Error Code occurs when executing a command to change operation speed during the JOG operation

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	FSC or RSC	0	500	0



MOV 1 (Change current coordinates)

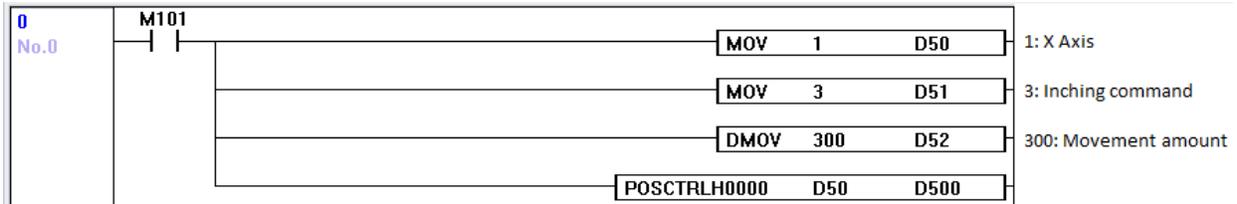
MOV 2 (Change operation speed)

MOV 3 (Inching operation)

MOV 6 (Change target address)

### c) Inching Operation

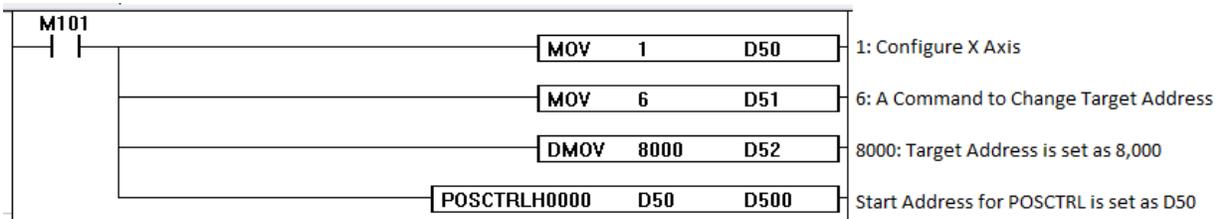
The example below describes an inching operation that moves the distance of 300 PPS after configuring the inching speed as 100 PPS. In the X-Axis parameter setting, the inching speed is configured as 100 PPS and the amount of movement is configured as 300 PPS.



### d) Change Target Address

When executing the position control to the target address (5,000) configured by ABS, INC and FEED position data, it changes the target address (8,000) configured in the POSCTRL.

Position Data No.	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address
1	Single Step	Non-Interpolation	No. 1	No. 1	ABS, INC, FEED	0	500	5000

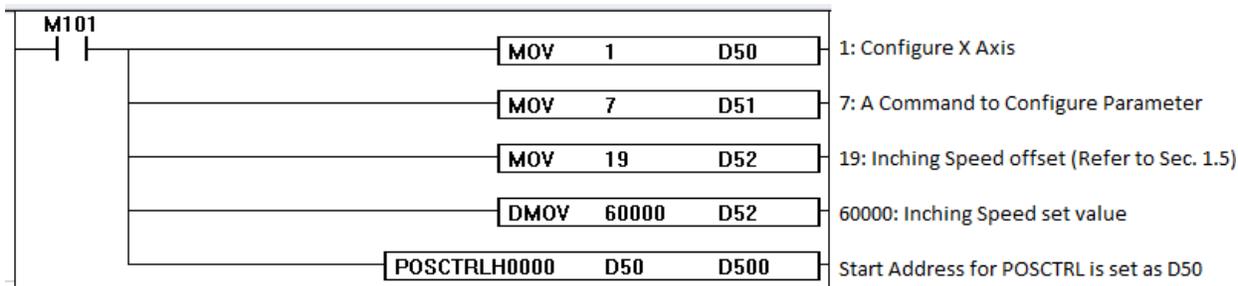


e) Change parameter for WORD or DWORD

It changes the WORD or DWORD configurations of the positioning parameter stated in Section 1.5.

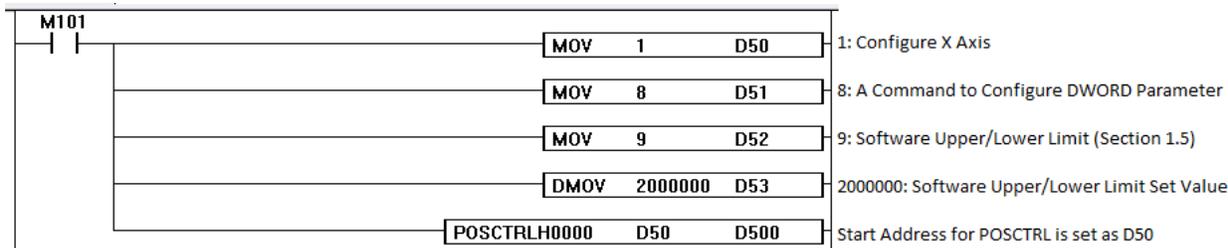
1) When changing the WORD

When changing the Inching Speed



2) When changing the DWORD

When changing the Software Upper/Lower Limit (DWORD)

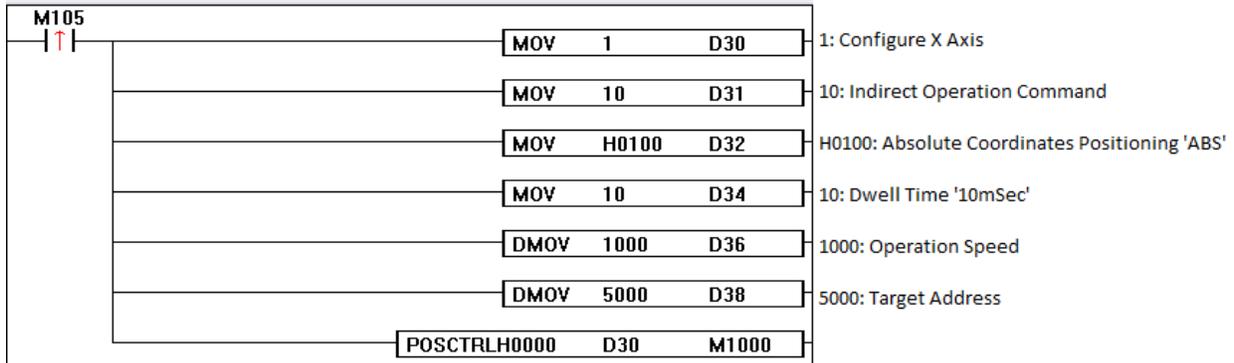


f) Indirect Operation

The position data such as the table below can be configured by indirect operation (ABS) via scan program.

Offset	0				2	4	5	6
Item	Control Pattern	Interpolation	Acceleration Time	Deceleration Time	Control Code	Dwell Time	Operation Speed	Target Address

The scan program shown below represents the position data specified in the table below.



Offset	Item	Bit	Description	Unit
0	Control Pattern	0	00 = Single step control	
		1		
	Interpolation	2	00 = Non-Interpolation	
		3		
	Accelerate Time	4	Acc/Dec Number 1	
		5		
Decelerate Time	6	Acc/Dec Number 1		
	7			
	Control Code	8..F	ABS	
1				
2	Dwell Time		10	mSec
3				
4	Operation Speed	L	1,000	PPS
5		H		
6	Target Address	L	5,000	Pulse

The analysis of [MOV H0100 D32] is shown in the table below.

Offset 0 (1 word)	Control Code								Decelerate Time		Accelerate Time		Interpolation		Control Pattern	
	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	ABS (Absolute Coordinates Positioning Control)								No. 1		No. 1		Non-Interpolation		Single Step	

### 1.8.3 TEACHn (n = 1~2)

This instruction changes a parameter of position data that have already been configured and defined.



**a) n1 (Positioning Module Slot number)**

Must be zero (0) for PLC since the CPU module is in the 0th slot.

**b) n2 (Device Memory Block)**

This flag configures the start address that stores the parameters in the format as shown below.

+ 0	Setting Item & Position Data Number
+ 1	Setting Data (DWORD)
+ 2	

The detailed format of the setting item and position data numbers are as follows.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Setting Item				Position Data Number: 1 ... 30 (H001 ... H01E)											

- 0 : Target Address
- 1 : Speed
- 3 : Dwell Time

Example) H1014: Operation Speed of Position Data No. 20

Type	Setting Item				Position Data Number											
WORD	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Value	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
Hex Value	1				0				1				4			
Contents	Operation Speed				12 bit data represents the position data. H014 is converted to 20 in decimal.											

\* PLC can use a maximum of 30 position data numbers.



## 1.9 Error Code

Category	Code	Error Name	Description
-	0	No error	Normal operation status
Common	101	Disable Y-axis	When using the built-in High Speed Counter function of PLC, Y-axis is disabled to use the pulse output.
	102	Emergency Stop	Stop by the emergency stop command.
	104	H/W upper limit	Exceeds position limit (H/W upper limit signal detected)
	105	H/W lower limit	Exceeds position limit (H/W lower limit signal detected)
	106	Operation speed error	Operational speed exceeds the speed limit.
	154	S/W upper limit	Exceeds S/W position upper limit.
	155	S/W lower limit	Exceeds S/W position lower limit.
	156	Emergency Stop Input	Positioning control is denied. (Emergency stop signal is ON).
OPR	202	OPR required	Home position (OPR) is not decided yet. Cannot execute positioning control.
	203	No DOG signal	Exceeds DOG signal input time limit (30 seconds) during OPR operation.
Manual	300	JOG/Inching error	JOG/Inching command/input is executed while other positioning control is in operation.
Positioning	503	Operation speed error	This error occurs when the operation speed for positioning control is not entered.
	519	Interpolation axis in operation	This error occurs when the specified interpolation axis is controlling another positioning.
	521	Wrong interpolation axis	This error occurs when the unsupported axis is executed for the interpolation operation.
	543	Positioning number error	When a wrong number other than 1~30 and 9001~9004 is entered for the positioning start number.
	545	Loop repetition count error	When the input range for the repetition count of the loop is exceeded.
	547	Loop number setting error	This error occurs if the maximum number of loops that can be run within the loop has exceeded the limit.
	548	Loop command error	When the loop data buffer is lost due to internal operation error of positioning.
	549	Unsupported control command	When an unsupported command code is entered for the positioning control command.
	550	Position address change error	A command to forcefully change current position address is issued while the axis is in operation.
	551	Speed change error	A command to change current speed is issued while the axis stops or dwells. (A command to change current speed is possible during a phase of acceleration, deceleration or constant speed).

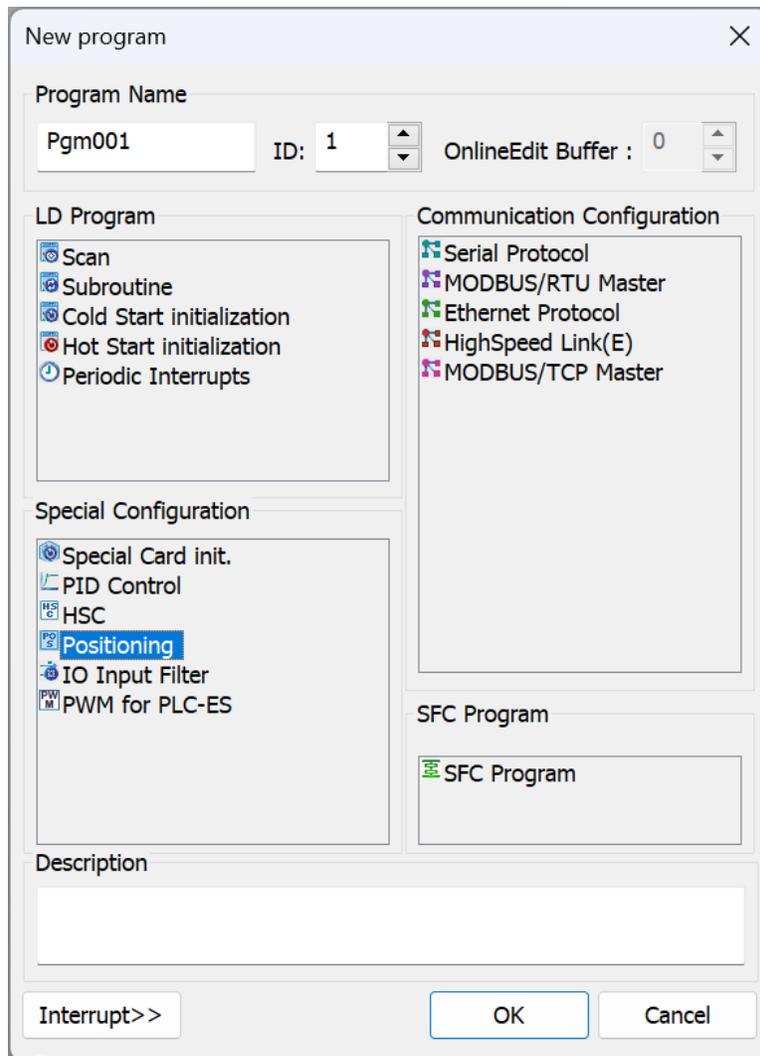
	552	Target address change error	A command to change target address is issued while the axis stops or dwells. (A command to change target address is possible during a phase of acceleration, deceleration or constant speed).
	553	Duplicated position control	Another position control command is issued while the axis is in operation.
	554	Online edit error	Online program edit/modify is performed while the axis is in operation.
Parameter	904	Pulse output mode setting error	An unsupported value other than 0 or 1 is entered for the pulse output mode of the parameters.
	906	Bias speed setting error	When the bias speed is out of the setting range.
	910	Speed limit setting error	When the speed is out of the setting range.
	911	Acceleration and Deceleration time No. 0	When it is beyond the setting range (0~65535 ms) of the Acceleration and Deceleration time No. 0.
	912	Acceleration and Deceleration time No. 1	When it is beyond the setting range (0~65535 ms) of the Acceleration and Deceleration time No. 1.
	913	Acceleration and Deceleration time No. 2	When it is beyond the setting range (0~65535 ms) of the Acceleration and Deceleration time No. 2.
	914	Acceleration and Deceleration time No. 3	When it is beyond the setting range (0~65535 ms) of the Acceleration and Deceleration time No. 3.
	920	Backlash setting error	When the backlash compensation value is beyond the setting range (0~65535).
	921	Software upper limit setting error	When the software upper limit value is out of the setting range (-2,137, 483, 648~2,147,483,647).
	922	Software lower limit setting error	When the software lower limit value is out of the setting range (-2,137, 483, 648~2,147,483,647).
	956	Jog speed limit setting error	When the jog operation speed is configured higher than the jog speed limit of the extended parameters.
	980	OPR method setting error	When a wrong configuration value other than 0~3 is entered for the OPR method setting.
981	OPR direction setting error	When a wrong configuration value other than 0 or 1 is entered for the OPR direction setting.	

## 1.10 MapleLogic Configuration and Use

### 1.10.1 Register the PLC Positioning Special Program

Go to 'File' → 'New Program' → Select [Positioning for PLC].

**\*Only one [Positioning for PLC] special program can be configured for a MapleLogic project.**

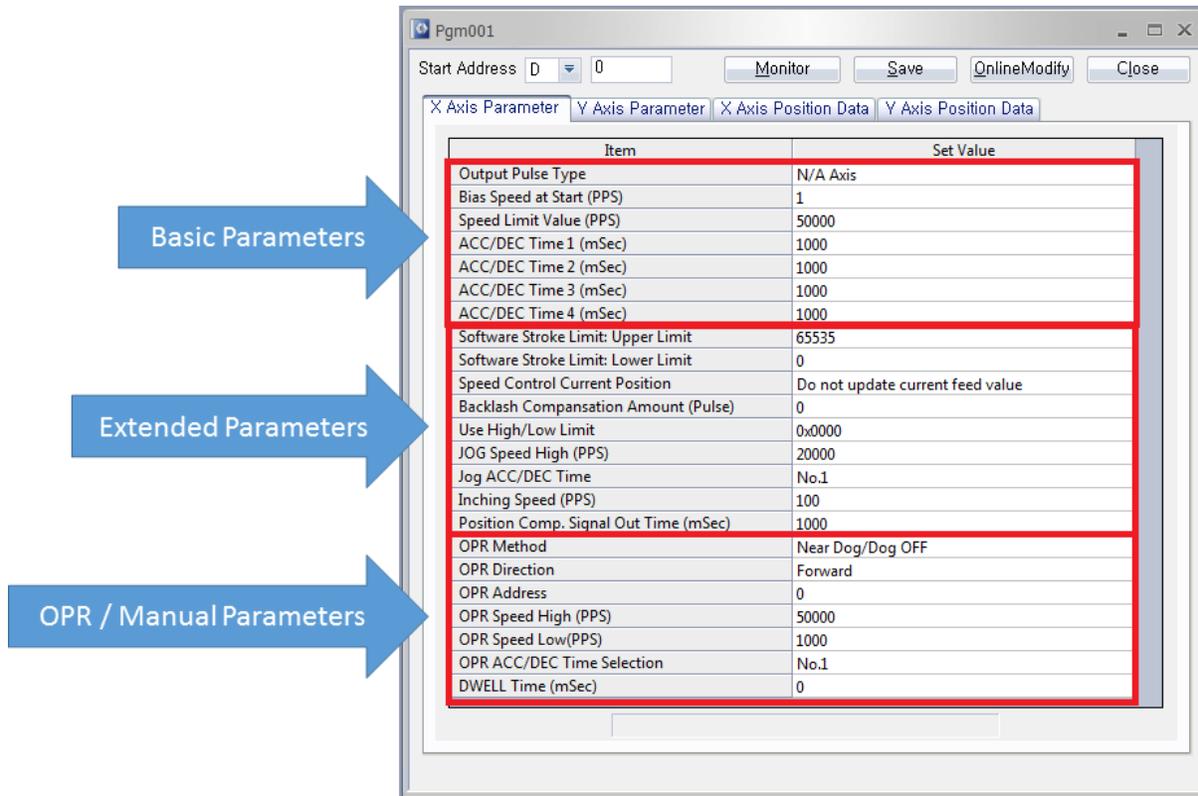


Enter the Program Name, Program ID and Program Free Space (Online Edit Buffer).

Click the [OK] button.

## 1.10.2 Configure the PLC Positioning Special Program

The PLC Positioning Special Program Configuration Window is shown below.



### a) Start Address

You can select M, L, K, D devices for storing the positioning parameters.

While in Monitor Mode or the monitor screen is displayed, you cannot select the Start Address.

Close the Monitor screen and then select the Start Address.



## b) X / Y Axis Parameter

You can configure the parameters below using the PLC Positioning Special Program. Because the setting parameters are stored in the same memory area (flash memory) in which a sequence program is stored, the settings are preserved even after the power is removed.

## c) X / Y Axis Position Data

You can create and configure 30 position data per axis. Each position data occupies the memory size of 8 Word in the following order as shown below. This structure is used in the same manner for POSCTRL, a positioning-dedicated command.

POS Data No.	Operation Pattern	Axis to be Interpolated	ACC TimeNo.	DEC TimeNo.	Control System	Dwell Time	Opr. Speed	Position Address
1	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
2	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
3	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
4	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
5	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
6	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
7	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
8	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
9	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
10	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
11	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
12	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
13	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
14	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
15	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
16	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
17	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
18	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
19	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
20	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
21	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
22	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0

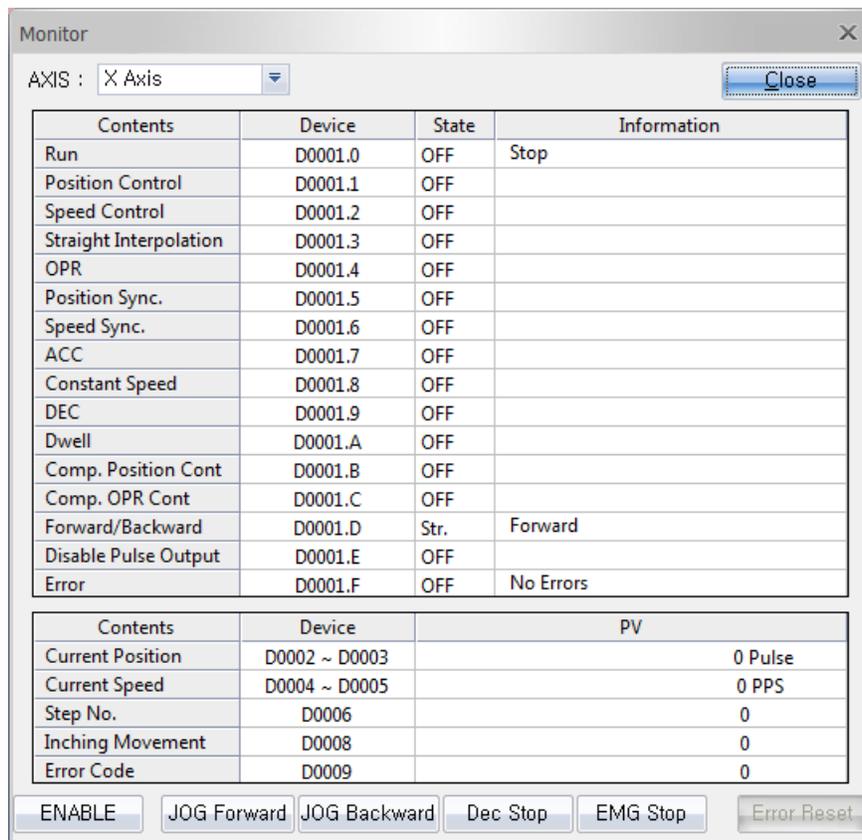
\*Dwell Time / Operation Speed / Position Address can be configured using constant values and devices.

## d) Monitor

Monitor mode is executed.



The Monitor mode displays the operation information based on the Start Address.



\*Inching Movement has been added.

- **AXIS:** Select X Axis or Y Axis. When the axis changes, so does the device. It displays the current value of the device in the information field.
- **ENABLE / DISABLE:**  
 Read: It determines the current activation status of the axis.  
 Write: When this flag is set, the axis function is switched to active status.  
 When this flag is reset, the axis is switched to inactive status.
- **Forward / Backward JOG**

JOG operation initiates the 'Forward / Backward JOG' signal without an instruction.

JOG operation is executed according to the set values of 'JOG Speed Limit' and JOG Acc/Dec Time.'

JOG operation can be activated without having no origin point determined.

\*You cannot click 'Forward' or 'Backward' buttons during the forward/backward operation.

\*Operating status is retained when you close Monitor window during Forward/Backward JOG operation.

- Decelerate Stop: The axis in operation begins to decelerate until it comes to a full stop.
- Emergency Stop: The axis in operation immediately stops without any deceleration process. These are occasions at which the axis immediately stops not by this command.
  - 1) Detection of the Upper and Lower Limit Signals
  - 2) Setting of the Software Upper/Lower Limit Signal

- Error Reset

If an error occurs during the operation of the corresponding axis, the Error Reset button gets activated. The error is displayed on Error Code. Please refer to the error code table for details. Error Reset stops the Monitor Mode if it was in Monitor Mode.

**e) Save**

It saves the PLC Positioning Special Program. When the program is saved successfully, a confirmation message will appear in the Message Window as shown below.

! 2024.06.20 11:... Backupfile [PGM001.1718906872S.SPC] is successfully created.

**f) Online Modify**

! 2024.06.20 11:... Backupfile [PGM001.1718906872S.SPC] is successfully created.

It downloads the PLC Positioning Special Program during the positioning operation.

'Online Modify' saves the program, and the same confirmation message will appear.

\*You cannot 'Online Modify' while positioning is operating. Please stop the operation first.

**g) Close**

It closes the PLC Positioning Special Program.

## h) Control Code Table

Code		Symbol	Function	Remark
Hex	Decimal			
01H	1	ABS	Absolute position control	
05H	5	INC	Incremental position control	
09H	9	FEED	Incremental position control after resetting current address	
13H	19	FSC	Speed control (Forward)	
17H	23	RSC	Speed control (Backward)	
80H	128	NOP	No operation	
81H	129	JUMP	Forced to change next step No.	Next step set value is stored in 'target position address'
82H	130	LOOP	The first step of loop	Loop count is stored in 'target position address'
83H	131	LEND	The last step of loop	
84H	132	POS	Forced to change the current position address	New address is stored in 'target position address'

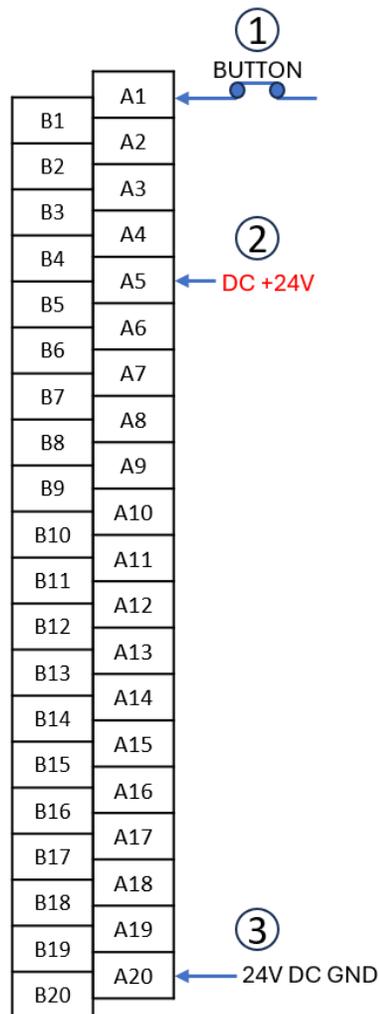
## 1.11 Positioning Control Usage Examples

### 1.11.1 Positioning Example Using Scan Program

This is a positioning example using a scan program.

When you press the button on X00, it is going to perform positioning to +2500 and then to -2500.

#### a) Circuit Wiring



ACC-TB32M	PLC-ES1616P
A1	X00
B1	X01
A2	X02
B2	X03
A3	X04
B3	X05
A4	X06
B4	X07
A5	COM 1
B5	COM 1
A6	X08
B6	X09
A7	X0A
B7	X0B
A8	X0C
B8	X0D
A9	X0E
B9	X0F
A10	COM 2
B10	COM 2
A11	Y10
B11	Y11
A12	Y12
B12	Y13
A13	Y14
B13	Y15
A14	Y16
B14	Y17
A15	DC12/24V
B15	DC12/24V
A16	Y18
B16	Y19
A17	Y1A
B17	Y1B
A18	Y1C
B18	Y1D
A19	Y1E
B19	Y1F
A20	DC GND COM
B20	DC GND COM

- ① This is a button to start the positioning operation.
- ② Connect the DC +24V to A5.
- ③ Connect the +24V GND to A20.

## b) PLC Positioning Special Program

Configure the PLC Positioning Special Program as follows.

①

Start Address D 0 Monitor Save OnlineModify Close

X Axis Parameter Y Axis Parameter X Axis Position Data Y Axis Position Data

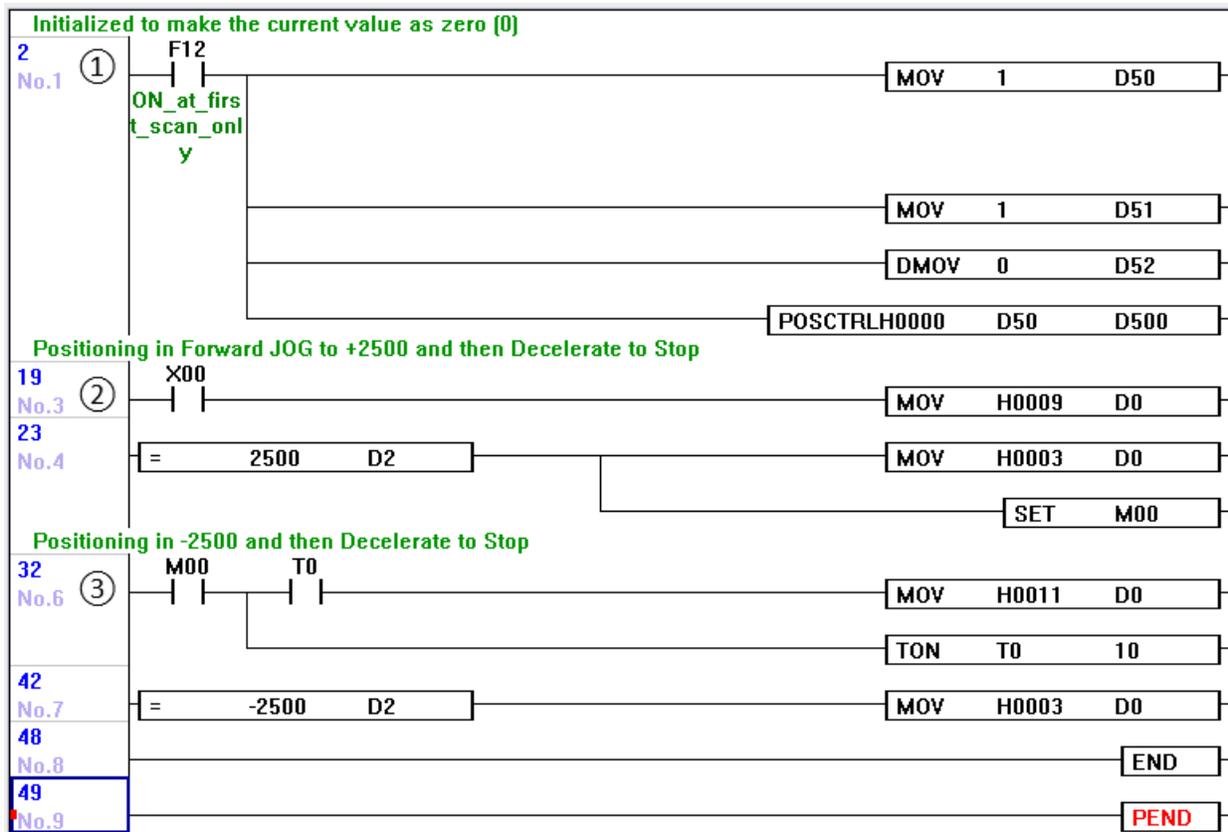
Item	Set Value
Output Pulse Type	② Low Active
Bias Speed at Start (PPS)	③ 500
Speed Limit Value (PPS)	1000
ACC/DEC Time 1 (mSec)	④ 500
ACC/DEC Time 2 (mSec)	1000
ACC/DEC Time 3 (mSec)	1000
ACC/DEC Time 4 (mSec)	1000
Software Stroke Limit: Upper Limit	0
Software Stroke Limit: Lower Limit	0
<b>Speed Control Current Position</b>	Do not update current feed value
Backlash Compansation Amount (Pulse)	0
Use High/Low Limit	0x0000
JOG Speed High (PPS)	⑤ 1000
Jog ACC/DEC Time	No.1
Inching Speed (PPS)	100
Position Comp. Signal Out Time (mSec)	1000
OPR Method	Near Dog/Dog OFF
OPR Direction	Forward
OPR Address	0
OPR Speed High (PPS)	50000
OPR Speed Low(PPS)	1000
OPR ACC/DEC Time Selection	No.1
DWELL Time (mSec)	0

1 - 100,000

- ① Configure the Start Address as 'D0.'
- ② Configure the Pulse Output Type as 'Low Active.'
- ③ Configure the Bias Speed at Start (PPS) as '500.'
- ④ Configure the ACC/DEC Time 1 (mSec) as '500.'
- ⑤ Configure the JOG Speed High Limit (PPS) as '1000.'

### c) Write a Scan Program

Write a scan program as follows.



- ① Initialize to make the current position value as zero (0).  
Please refer to Section 1.8.2 'POSCTRL.'
- ② Positioning in Forward JOG to +2500 and then decelerate to stop.  
D0 is a control flag and is composed of 16Bit.  
MOV H0009 D0: Enable operation, Forward JOG control.  
D2 displays current position. If the value of D2 is 2500, it decelerates to stop and set M00.
- ③ It takes 1000 msec to decelerate to stop.  
After a delay of 1 second, Backward JOG control operates.  
If the value of D2 is -2500, it will decelerate to stop.

## d) Monitor the Operation

① After running the program, it is in initial stage. The current position is initialized to zero (0).

Monitor window showing initial state. The 'AXIS' is set to 'X Axis'. The 'Run' status is OFF. The 'Current Position' is 0 Pulse.

Contents	Device	State	Information
Run	D0001.0	OFF	Stop
Position Control	D0001.1	OFF	
Speed Control	D0001.2	OFF	
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	OFF	
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	OFF	
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	ON	
Forward/Backward	D0001.D	Str.	Forward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	0 Pulse
Current Speed	D0004 ~ D0005	0 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

Buttons: ENABLE, JOG Forward, JOG Backward, Dec Stop, EMG Stop, Error Reset

② Turn on X00 to 'Enable' the operation and the Monitor displays the below information.

Monitor window showing operation state. The 'Run' status is ON. The 'Current Position' is 1697 Pulse.

Contents	Device	State	Information
Run	D0001.0	ON	Running
Position Control	D0001.1	OFF	
Speed Control	D0001.2	ON	Speed Controlling
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	OFF	
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	ON	Constant Speed
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	ON	Complete OPR Control
Forward/Backward	D0001.D	Str.	Forward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	1697 Pulse
Current Speed	D0004 ~ D0005	1000 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

Buttons: DISABLE, Stop Forward, JOG Backward, Dec Stop, EMG Stop, Error Reset

- ③ After positioning to +2500, Backward JOG operation moves to -2500 and then it decelerates.

Monitor X

AXIS : X Axis Close

Contents	Device	State	Information
Run	D0001.0	ON	Running
Position Control	D0001.1	OFF	
Speed Control	D0001.2	ON	Speed Controlling
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	OFF	
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	ON	Constant Speed
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	ON	
Forward/Backward	D0001.D	Rev.	Backward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	-2147 Pulse
Current Speed	D0004 ~ D0005	1000 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

DISABLE JOG Forward Stop Backward Dec Stop EMG Stop Error Reset

## 1.11.2 Positioning Example Using Positioning Data

The 1.11.1 Example is controlled by a scan program and therefore is rather complex. However, using positioning data and scan program together makes this program simpler and easier to implement.

### a) Circuit Wiring

The wiring connection is identical to that of the 1.11.1 Example.

### b) PLC Positioning Special Program

Configure the X Axis Parameter of PLC Positioning Special Program as follows.

Item	Set Value
Output Pulse Type	Low Active
Bias Speed at Start (PPS)	1000
Speed Limit Value (PPS)	10
<b>ACC/DEC Time 1 (mSec)</b>	<b>1000</b>
ACC/DEC Time 2 (mSec)	1000
ACC/DEC Time 3 (mSec)	1000
ACC/DEC Time 4 (mSec)	1000
Software Stroke Limit: Upper Limit	0
Software Stroke Limit: Lower Limit	0
Speed Control Current Position	Do not update current feed value
Backlash Compensation Amount (Pulse)	0
Use High/Low Limit	0x0000
JOG Speed High (PPS)	1000
Jog ACC/DEC Time	No.1
Inching Speed (PPS)	100
Position Comp. Signal Out Time (mSec)	1000
OPR Method	Near Dog/Dog OFF
OPR Direction	Forward
OPR Address	0
OPR Speed High (PPS)	50000
OPR Speed Low(PPS)	1000
OPR ACC/DEC Time Selection	No.1
DWELL Time (mSec)	0

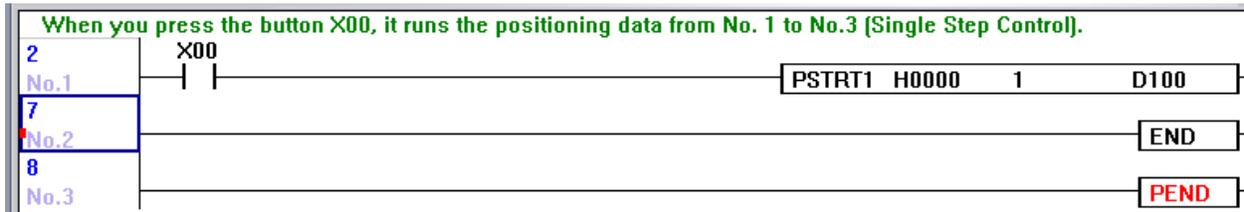
- ① Configure the Pulse Output Type as 'Low Active.'
- ② Configure the Bias Speed at Start (PPS) as '1000.'
- ③ Configure the ACC/DEC Time 1 (mSec) as '1000.'
- ④ Configure the Software Upper Limit, Software Lower Limit as '1000.'

Configure the X Axis Position Data as follows.

POS Data No.	Operation Pattern	Axis to be Interpolated	ACC TimeNo.	DEC TimeNo.	Control System	Dwell Time	Opr. Speed	Position Address
1	Continuous Control	No Interpolation	No.1	No.1	POS	0	1	0
2	Continuous Control	No Interpolation	No.1	No.1	INC	0	1000	2500
3	Single Step Control	No Interpolation	No.1	No.1	ABS	0	1000	-2500
4	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
5	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
6	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
7	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
8	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
9	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
10	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
11	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0
12	Single Step Control	No Interpolation	No.1	No.1	NOP	0	1	0

When you want to control the positioning sequentially, configure the Operation Pattern as ‘Continuous Control’ and set the last one as ‘Single Step Control.’ Please refer to 1.7.4 Control Code.

### c) Write a Scan Program



When you turn on X00, it is going to perform positioning control from No. 1 and No. 2 (Continuous Control) to No. 3 (Single Step Control) configured in the X Axis Position Data.

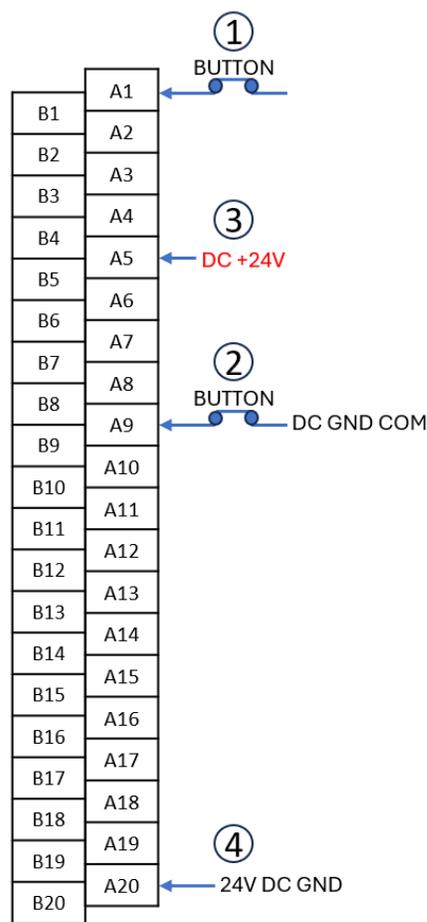
### d) Monitor the Operation

How to monitor the operation is identical to that of the ‘1.11.1 Positioning Example Using Scan Program.’

### 1.11.3 Positioning Example Using OPR

- Starting from its current location 2500, this example turns on X01 to execute OPR and presses the button X0E (DOG signal) three times in order to return to the origin point.
- The X0E button is used for testing purposes in this example. In the industry fields, the X0E button is replaced by sensors.

#### a) Circuit Wiring



ACC-TB32M	PLC-ES1616P
A1	X00
B1	X01
A2	X02
B2	X03
A3	X04
B3	X05
A4	X06
B4	X07
A5	COM 1
B5	COM 1
A6	X08
B6	X09
A7	X0A
B7	X0B
A8	X0C
B8	X0D
A9	X0E
B9	X0F
A10	COM 2
B10	COM 2
A11	Y10
B11	Y11
A12	Y12
B12	Y13
A13	Y14
B13	Y15
A14	Y16
B14	Y17
A15	DC12/24V
B15	DC12/24V
A16	Y18
B16	Y19
A17	Y1A
B17	Y1B
A18	Y1C
B18	Y1D
A19	Y1E
B19	Y1F
A20	DC GND COM
B20	DC GND COM

- ① Connect the OPR button to A1 (X00).
- ② Connect the DOG1 button to A9 (X0E).
- ③ Connect the DC +24V power supply.
- ④ Connect the GND.

## b) PLC Positioning Special Program

Configure the X Axis Parameter of PLC Positioning Special Program as follows.

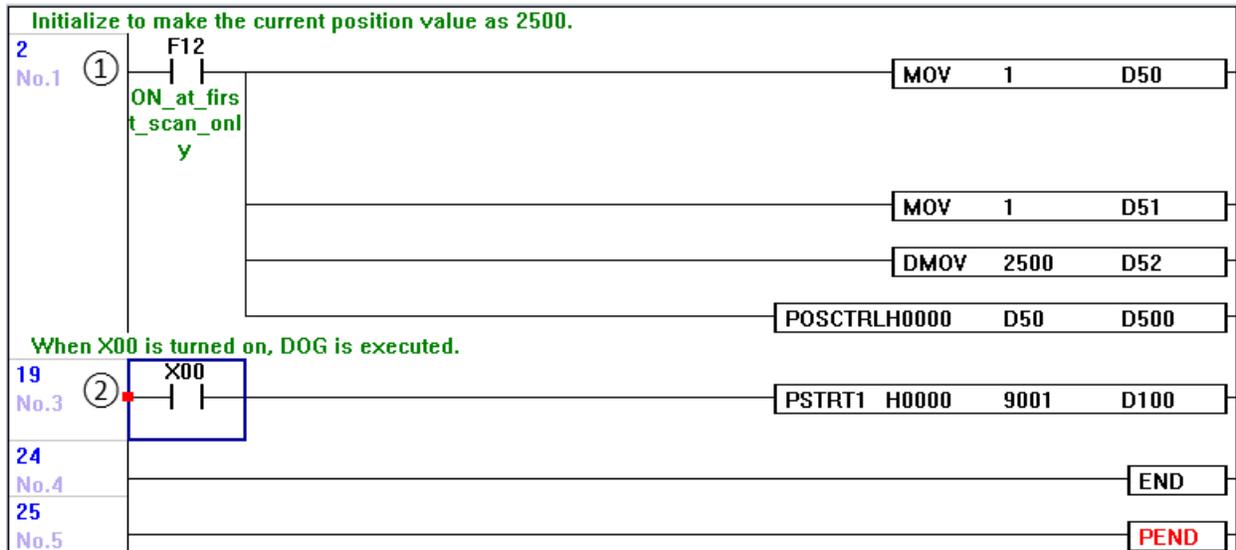
①

Item	Set Value
Output Pulse Type	Low Active
Bias Speed at Start (PPS)	1000
Speed Limit Value (PPS)	1000
ACC/DEC Time 1 (mSec)	1000
ACC/DEC Time 2 (mSec)	1000
ACC/DEC Time 3 (mSec)	1000
ACC/DEC Time 4 (mSec)	1000
Software Stroke Limit: Upper Limit	0
Software Stroke Limit: Lower Limit	0
Speed Control Current Position	Do not update current feed value
Backlash Compansation Amount (Pulse)	0
Use High/Low Limit	0x0000
JOG Speed High (PPS)	1000
Jog ACC/DEC Time	No.1
Inching Speed (PPS)	1000
Position Comp. Signal Out Time (mSec)	1000
OPR Method	Near Dog
OPR Direction	Backward
OPR Address	0
OPR Speed High (PPS)	1000
OPR Speed Low(PPS)	500
OPR ACC/DEC Time Selection	No.1
<b>DWELL Time (mSec)</b>	0

- ① Configure the Start Address as 'D0.'
- ② Configure the ACC/DEC Time1 (mSec) as '1000.'
- ③ Configure the OPR setting as follows.
  - OPR Method: Near Dog
  - OPR Direction: Backward
  - OPR High Speed(PPS): 1000
  - OPR Low Speed(PPS): 500
  - OPR ACC/DEC Time Selection: No.1

### c) Write a Scan Program

Write a Scan Program as follows.



- ① The value of the current position will be set to 2500 when the device operates.
- ② When X00 is turned on, OPR (Origin Position Return) will be executed.  
If you press the DOG button connected to A9 (AOE) three times, the current position will be 0.

### d) Monitor the Operation

An example of the OPR operation using DOG is as follows.

- ① In the initial stage, the current position is initialized to 2500 Pulse.

Contents	Device	PV
Current Position	D0002 ~ D0003	2500 Pulse
Current Speed	D0004 ~ D0005	0 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

DISABLE
JOG Forward
JOG Backward
Dec Stop
EMG Stop
Error Reset

② When X00 is turned on

Contents	Device	State	Information
Run	D0001.0	ON	Running
Position Control	D0001.1	OFF	
Speed Control	D0001.2	ON	Speed Controlling
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	ON	OPR Controlling
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	ON	Constant Speed
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	OFF	
Forward/Backward	D0001.D	Rev.	Backward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	2500 Pulse
Current Speed	D0004 ~ D0005	1000 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

- As OPR is turned on, the Monitor displays it is controlling OPR.
- As it is configured in the Positioning Special Program, the direction of OPR is Backward.

③ When X0E is turned on once

Contents	Device	State	Information
Run	D0001.0	ON	Running
Position Control	D0001.1	OFF	
Speed Control	D0001.2	ON	Speed Controlling
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	ON	OPR Controlling
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	ON	Constant Speed
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	OFF	
Forward/Backward	D0001.D	For.	Forward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	2500 Pulse
Current Speed	D0004 ~ D0005	500 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

- The direction of OPR is modified from 'Backward' to 'Forward.'
- The Current Speed is '500 PPS' according to the set value of 'OPR Low Speed' in the program.

④ When XOE is turned on twice

Contents	Device	State	Information
Run	D0001.0	ON	Running
Position Control	D0001.1	OFF	
Speed Control	D0001.2	ON	Speed Controlling
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	ON	OPR Controlling
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	ON	Constant Speed
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	OFF	
Forward/Backward	D0001.D	Rev.	Backward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	2500 Pulse
Current Speed	D0004 ~ D0005	500 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

- The direction of OPR is modified from 'Forward' to 'Backward.'

⑤ When XOE is turned on three times

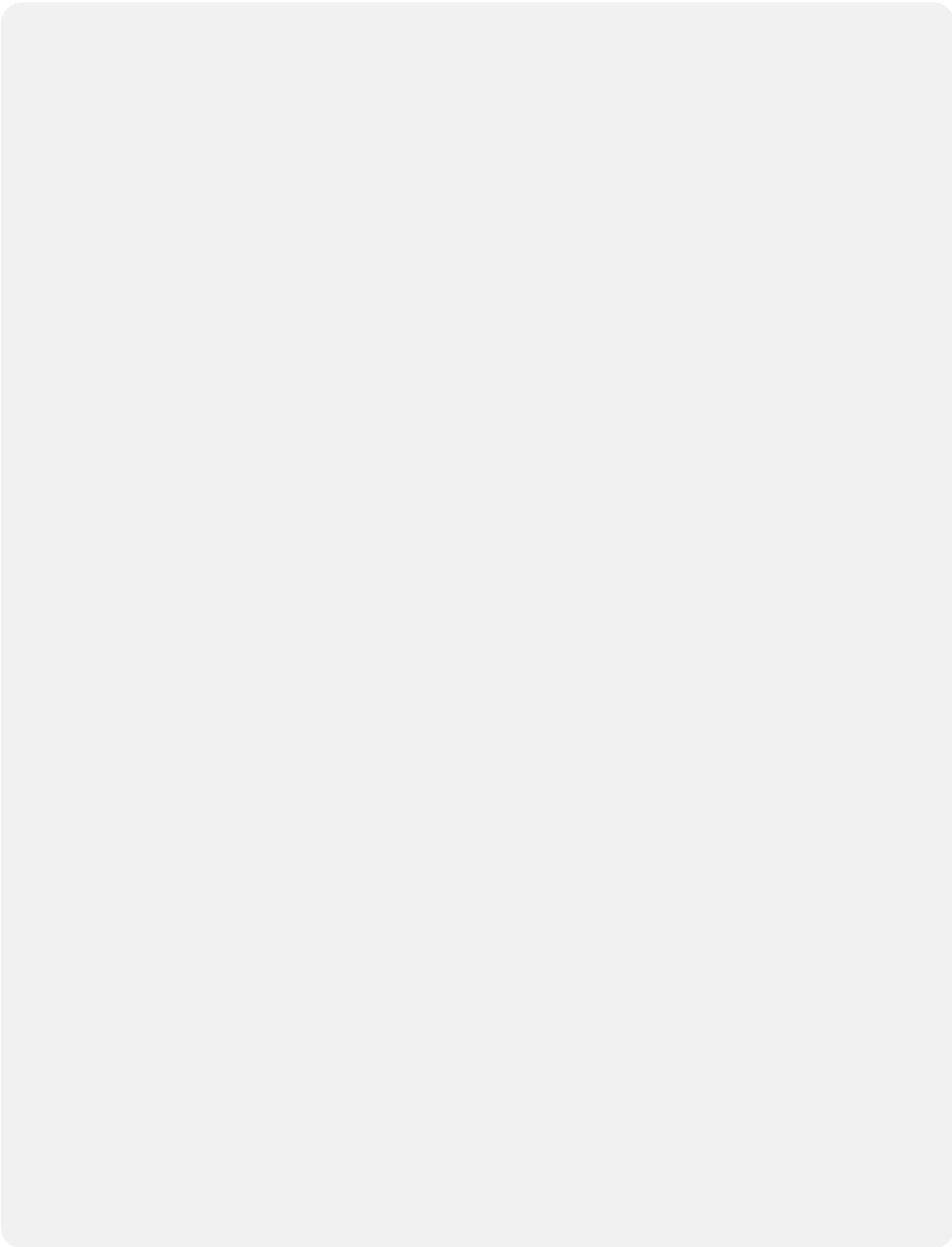
Contents	Device	State	Information
Run	D0001.0	OFF	Stop
Position Control	D0001.1	OFF	
Speed Control	D0001.2	OFF	
Straight Interpolation	D0001.3	OFF	
OPR	D0001.4	OFF	
Position Sync.	D0001.5	OFF	
Speed Sync.	D0001.6	OFF	
ACC	D0001.7	OFF	
Constant Speed	D0001.8	OFF	
DEC	D0001.9	OFF	
Dwell	D0001.A	OFF	
Comp. Position Cont	D0001.B	OFF	
Comp. OPR Cont	D0001.C	ON	Complete OPR Control
Forward/Backward	D0001.D	Rev.	Backward
Disable Pulse Output	D0001.E	OFF	
Error	D0001.F	OFF	No Errors

Contents	Device	PV
Current Position	D0002 ~ D0003	0 Pulse
Current Speed	D0004 ~ D0005	0 PPS
Step No.	D0006	0
Inching Movement	D0008	0
Error Code	D0009	0

- 'Complete OPR Control' is ON and the current position becomes 0 Pulse according to the set value of 'Origin Position' in the Positioning Special Program.

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