Ezi-SERVO®Ⅱ Plus-E

Closed Loop Stepping System

User Manual

Position Table Function

（ **Rev.04** ）

FASTECH

Table of Contents

※ Before Getting Started

· Presented 「 Ezi-SERVOⅡ Plus-E User Manual "Position Table Function"」 explains position table functions of Ezi-SERVOⅡ Plus-E. Here are 「User Manual_Text」, 「User Manual Communication Function」 in this manual. Please utilize our product afterward understanding about proper usage method with reading these contents carefully.
The word as 'Position Table' can be presented as PT (Position Table) from the following text.
· In particular, Please don't forget to memorize whole matters that requires attention about safety in 「User Manual_Text」 and should try to understand properly. Besides please be safe to do not use the products improperly in any case. At worst, serious damage can be occurred as like death.
We provide this instruction manual and other instruction manual as well. Please keep these manuals in appropriate place whenever you need to find and read comfortably.

1 . Windows of Position Table(PT)

1 - 1 . Loading Position Table data

When click the 'Pos Table' button on main menu of User Program(GUI), then the system displays the following message box and loads data saved in RAM area of drive.
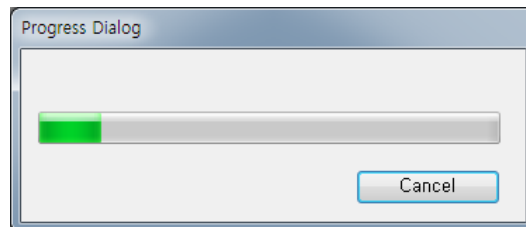
Functions of Position Table allows to process motions in the orders that were predefined by user. In the case of this Ezi-SERVOⅡ Plus-E drive, up to 256 steps can be saved.
Major functions for saving items are shown as following:
(1) Editing function of Motion step (Input/Edit/Delete/Copy).
(2) Start and Stop function of Motion order at User Program(GUI).
(3) Start and Stop Motion function by signal input from outside drive.
(4) Teaching function.
(5) Functions to save Motion steps as file and to load them from file.
(6) View function of current Position Table order under execution status.
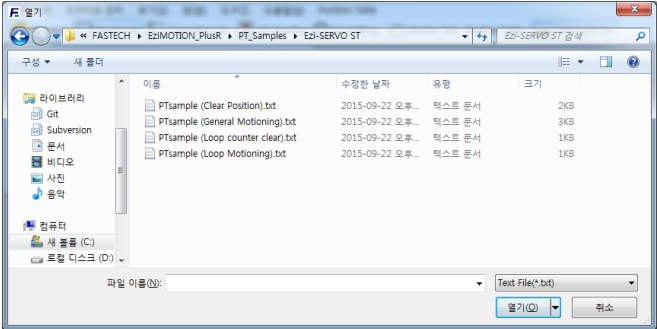
When electric power is supplied to drive, the Position Table data saved in ROM area of drive is copied to RAM area and once click the 'Pos Table' button, then the system loads the data saved in RAM area of drive.

1 - 2 . Main Window of Position Table

The following window describes windows and buttons which execute the position table function.
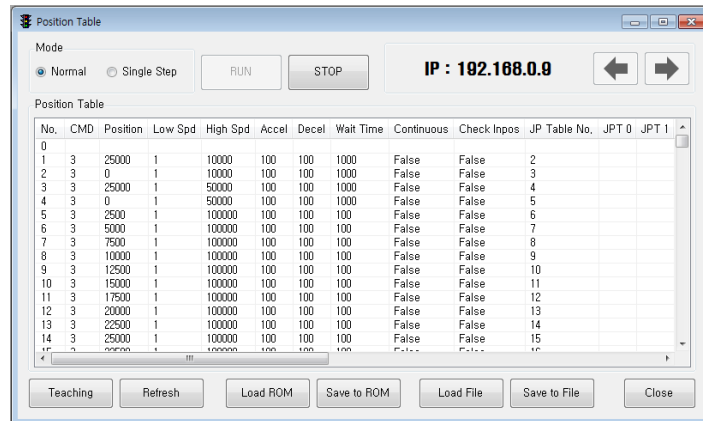
| Button Name	Description
Normal/Single Step	The user can select modes to execute the position table. Normal: All position commands are in order executed according to conditions saved in the position table. Single Step: Only single position command is executed.
Run/Stop/Next	To run/stop items at the defined position table
Teaching	Teaching is executed by either using external input signal or user program. By clicking this button, the user can easily use teaching function at the user program window. For more information, refer to P11. 3-4「Teaching Function」.
Refresh	To display the position value measured by the teaching function. For more information, refer to P11. 3-4「Teaching Function」.
Save to ROM	To save current position table data in ROM drive
Load from ROM	To open position table data saved in ROM drive
Save to File	To save current position table data to an external file (It is saved to a folder defined by the user with a file name defined by the user. The extensions are *.txt and *xlsx.)
Load File	To read position table data saved in external file

* **Up to 256** position table commands can be input and saved.

* By using each position table command, the user can edit the file such as edit, copy, paste, and delete.
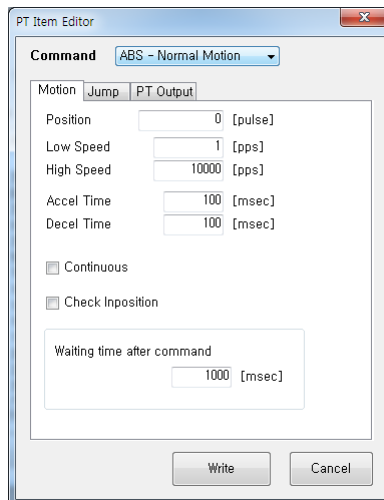
1－3．Position Table Editor

When click right mouse button on a selected Position Table data line, then the following popup menu is activated.
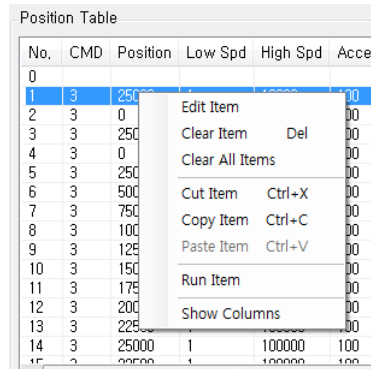
(1) Edit Item: You can edit data on the following dialog box shown as below.

(2) Clear Item: All the items of selected PT are cleared.

(3) Clear All Items: While above function "Clear Item" clears data for one selected order, this function clears data for all the orders of 256 Position Table.

(4) Cut Item: Used to 'Cut & Paste' selected item data of PT.

(5) Copy Item: Used to 'Copy & Paste' selected item data of PT.

(6) Paste Item: Paste the copied data to clipboar by "Cut" or "Copy" to other selected position.

(7) Run Selected Item: Execute motion order from the selected No. of Position Table.

Double click on selected line of Position Table data or click the "Edit Item" from popup menu button shown above figure, then the dialog box shown below is activated.
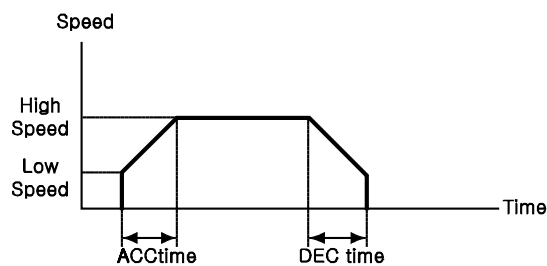

Enter each value on [Motion], [Jump], [PT Output] tab.

After complete editing of all data completely, click 'Write' to save data to RAM. In order to save data to ROM area, click 'Save to ROM' on main screen of Position Table.
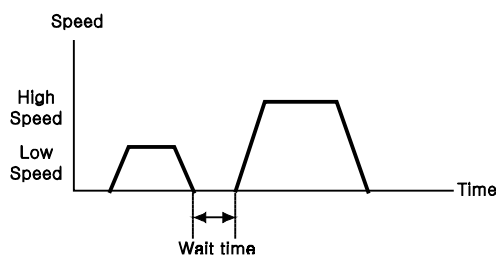
2 . Position Table Item(PT)

2 - 1 . Explanation of Position Table Item

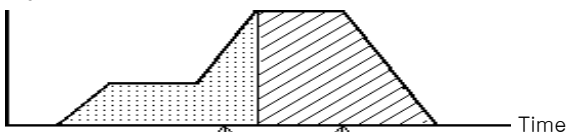| Designated Item	Description	Unit	Lower limit	Upper limit
Command	Specifies type of motion. For more details, refer to 「2.2 Command」.	-	0	10
Position	Specifies position/movement scale by number of pulse.	pulse	-134,217,728	+134,217,727
Low Speed	Specifies low speed by number of pulse in accordance with type of motion. For more details, refer to 「2.2 Command」.	pps	1	500,000
High Speed	Specifies high speed by number of pulse in accordance with type of motion. For more details, refer to 「2.2 Command」.	pps	1	2,500,000
ACC time	Specified acceleration time by msec when starting motion.	ms	1	9,999
DEC time	Specified deceleration time by msec when stopping motion.	ms	1	9,999
Wait time	When the PT No. item to jump is set, the waiting time until the next position operation is started is set in ms. This item is ignored if JP Table No is set to "blank" and Continuous Action is "checked."	ms	0	60,000
Note) Even if Wait Time is specified as 0[ms], the system waits for the completion signal of position setting (INP signal) or motor stop signal before starting next Position Table.				

Continuous action	If this item is set as 'check (1)', the system continues action of current position and next position.	-	0	1

Condition 1) For this function the 'Command' item value must be '0~7'.

This function has to be used in sequentially increased goal position or sequentially decreased goal position.

Condition 2) In order to use this function continuously, all PT steps must be set to 'Continuous action'.

Ex) If position 0 and 1 are set as below and position 0 is designated as continuous operation, acceleration and deceleration of position 1 are ignored and acceleration / deceleration of position 0 is operated.

PT No.	Cont Act	JPT No.
Position 0	1	1
Position 1	0	-

Speed

Position 0 : Movement   Position 1 : Movement

Time

JP Table No.	When this item specified, the system jumps to JP Table No and execute it after completing action of current position. If Position No is specified as 10XXX, system jumps to Position No XXX as soon as 'JPT Start 'begins, one of the input digital signal from controller to outside, becomes ON. For program exit, specify as blank. For more details, refer to 「3.4 Input Condition - Jump」.	-	0	255
			10,000	10,255
JPT 0	If this item is set, it jumps to a position other than the 「jump position number」j (input jump position number) when there are JPT input0, JPT input1, and JPT input2 inputs. For more information, refer to 「3.4 Input Condition Jump」.	-	0	255
			10,000	10,255
JPT 1		-	0	255
			10,000	10,255
JPT 2		-	0	255
			10,000	10,255

Input signal	Corresponding Input Jump Position
JPT input0	Input Jump Position No 0
JPT input1	Input Jump Position No 1
JPT input2	Input Jump Position No 2

Loop Count	If these items are specified, system repeats action of the position under specified	-	0	100

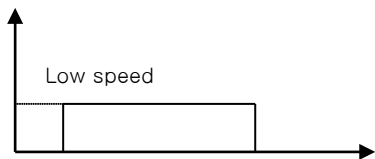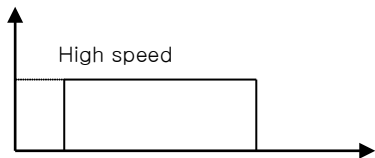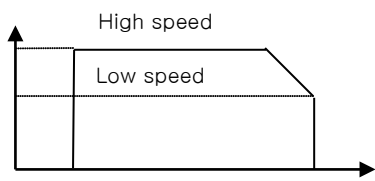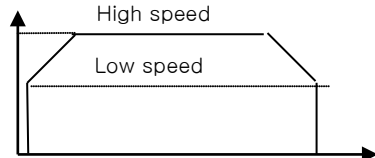|				
Loop Jump Table No.	times (Loop Count) and after then jumps to corresponding position to Loop Jump Table No regardless of specified 「Jump Table No」. For more details, refer to 「3.5.1 Loop Setting」.	-	0 10,000	255 10,255
PT set	Specifies output signals such as PT Output0, PT Output1, PT Output2 in order to confirm the start, pass or end of motor operation for each position. 0,8,16 : Not use output signal 1~7 : Specifies output function when starting operation 9~15 : Specifies output function when completing operation 17~23 : Specifies output function when the position reach to 'Trigger Position' For more details, refer to 「3.7 Start/Pass/End Signal Function」.		0	23
Loop Counter Clear	If this item is checked, Loop Count of specified no of PT is to be cleared. For more details, refer to 「3.5.1 Loop Setting」.	-	0	255
Check Inpos	If this item is checked, stop condition is recognized as In-position finishes.	-	0	1
Trigger Pos	In case of setting 'PT set' as 17 ~ 23 among setting items, set the arbitrary position value to send output signal to PT Output0, PT Output1, PT Output2. For more details, refer to 「3.7 Start/Pass/End Signal Function」.	pulse	-134,217,728	+134,217,727
Trigger Time	In case of setting 'PT set' value from 17 to 23, set the pulse width of the signal when sending the output signal to PT Output0, PT Output1, PT Output2. For more details, refer to 「3.7 Start/Pass/End Signal Function」.	ms	0	65,535
Push Ratio	Specifies motor torque ratio for push Motioning. For more details, refer to 「3.8 Push Motion Function」.	%	20	90

Push Speed	Specifies motion speed of push motioning. (Max 200[rpm])	pps	1	33,333
Push Position	Specifies absolute target position of push motioning.	pulse	-134,217,728	+134,217,727
Push Mode (Pulse Count)	Specifies the push mode : Stop mode(0) or Non-stop mode(1~10,000). For more details, refer to 「3.8 Push Motion Function」.		0	10,000

2－2．Type of Command

Item "Command" specifies type of action pattern to be executed for each position and the followings in the table are list of commands.

Command Name	Specified Value	Description
Abs Move low speed	0	The value in the item "Position" is value for absolute position. 'Teaching' function can be used. 'Continuous Action' function can be used.
Abs Move high speed	1	
Abs Move high speed with deceleration	2	
Abs Move with acceleration and deceleration	3	
Inc Move low speed	4	The value in the item "Position" is value for relative position. 'Teaching' function is not supported. 'Continuous Action' is not supported.
Inc Move high speed	5	
Inc Move high speed with deceleration	6	
Inc Move with acceleration and deceleration	7	
Move to Origin	8	Execute the command to move to origin based on the specified current parameters specified.
Clear Position	9	Reset 'command position' value and 'actual position' value based on current position and clears the values as 0.
Push Abs Move	10	Execute the command to push motion.
Stop	11	To stop the motioning of Push motion Non-stop mode command. For more details, refer to 「3.8 Push Motion Function」.

The following table shows speed patterns for each action of command.

Command Name	Specified Value	Motion Pattern
Abs Move low speed	0	Low speed
Inc Move low speed	4	
Abs Move high speed	1	High speed
Inc Move high speed	5	
Abs Move high speed with deceleration	2	High speed / Low speed
Inc Move high speed with deceleration	6	
Abs Move with acceleration and deceleration	3	High speed / Low speed
Inc Move with acceleration and deceleration	7	

3 . Excution of Position Table

3 - 1 . Explanation of Position Table Item

Position Table operation is executed by input signal or communication command. The followings are example of Position Table operation by input signal to be explained step by step.

In the case of Position Table operation by communication command, the system is executed by sending the communication commands corresponding to the control input signal.

1) Specify Position Table No (0~255) operated by PT A0~PT A7.

2) If the motor is Servo OFF, click Servo ON.

3) Signal ON of PTStart input to start operation.

3 - 2 . Example for general operation

Specify PT No through input data for PT A0 ~ PTA7 and then input 'PT Start' signal to start speed control operation.

【Specifying Position Table】

| PT No.	Command type	Position	Low Speed	High Speed	Accel. time	Decel. time	Wait time	Continuous Action	JP Table No.
0	3	10,000	1	2,500	50	300	0	1	1
1	3	1,000	1	500	-	-	0	1	2
2	3	5,000	1	1,500	50	300	300	0	3
3	3	-2,500	1	1,000	300	300	0	0	-
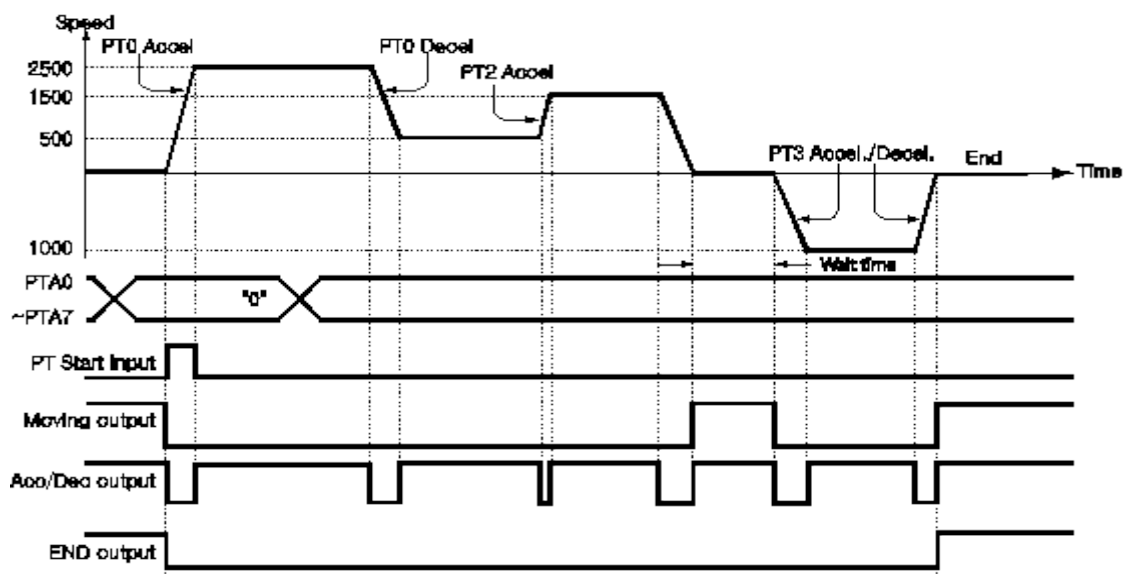
* Refer to the sample file for testing Position Table, 'PT sample (General Motioning).txt'.

3 - 3 . Operation Mode

Position Table commands can be executed by two modes as follows.

3 - 3 - 1 . Normal

Select 'Normal' at the main window of position table, and all commands will be executed in order by conditions already loaded in PT data.
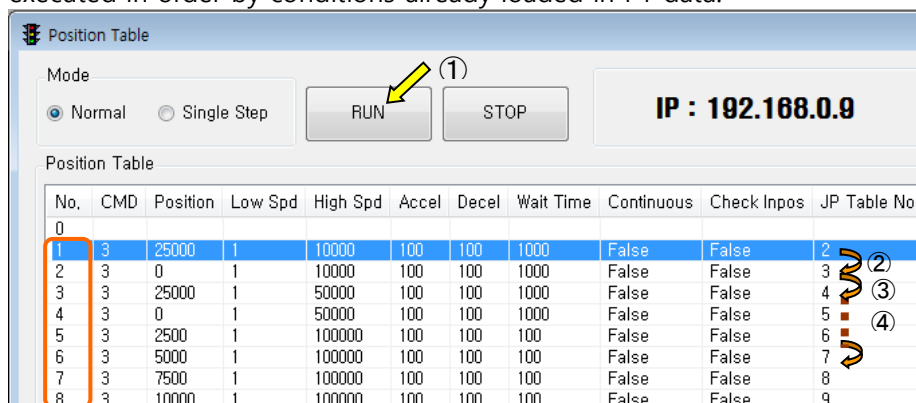
1) While Normal mode is selected, the user sets PT number to 0 and click 'Run' and then PT 0 is executed.

2) PT 1 is executed by PT data jump conditions.

3) PT 2 is executed by PT data jump conditions.

4) As mentioned above, next PT number is automatically executed by position data jump conditions.

5) Click 'Stop' to stop operating.

3 - 3 - 2 . Single Step

Select 'Single Step' at the main window of position table, and only corresponding PT command will be executed and next PT commands will be on stand-by. This mode can be easily used when the user executes testing for each position command. And it is available for User Program (GUI) only.
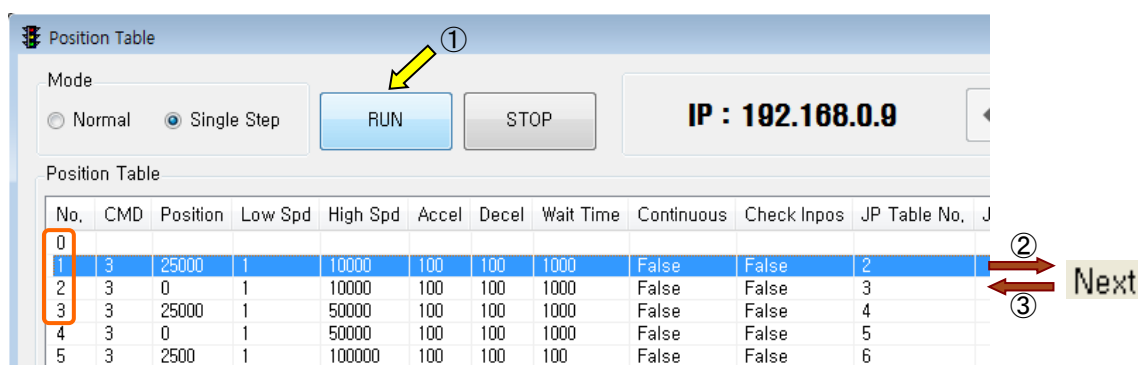
1) With Single Step Mode selected, set PT number to start operation as 0 and click 'Run', PT number 0 is executed.

2) After execution is stopped, 'Run' icon is changed into ' Next ' and next command is on stand-by.

3) Click Next button, and PT 1 will be executed.

4) When pressing each Next button, one PT command is executed.

5) Click 'Stop' to stop operation. After operation is stopped, the user can set new PT number and click 'Run' button to start the program again.

3 - 4 . Teaching Function

Teaching signal functionalizes that the position value[pulse] being working can be automatically inputted into a 「position」 value of a specific position table.

It is the easy method to measuring the position value when it is difficult to calculate the real movement distance (position value). The type of commands which is using teaching function are in the below table.

Command Name	Value	To be used or not
Abs Move low speed.	0	'Teaching' can be used.
Abs Move high speed	1	
Abs Move high speed with deceleration.	2	
Abs Move with acceleration and deceleration.	3	
Inc Move low speed.	4	'Teaching' cannot be used.
Inc Move high speed	5	
Inc Move high speed with deceleration.	6	
Inc Move with acceleration and deceleration.	7	
Move to Origin	8	
Clear Position, Push Abs Move, Stop	9,10,11	

3 - 4 - 1 . Teaching by user program

When click 'Teaching' button on Position Table screen, the following dialog box is activated.
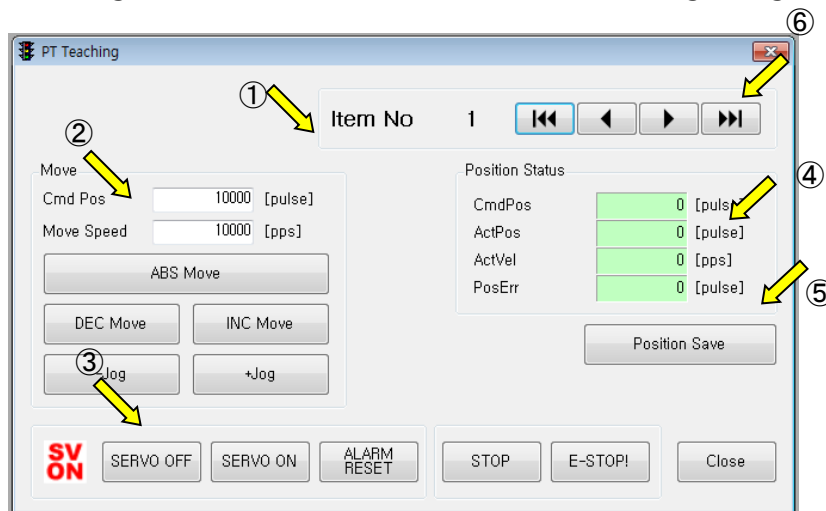
① Select No.1 among 256 Position Table.

② Move the motor to the position that want.
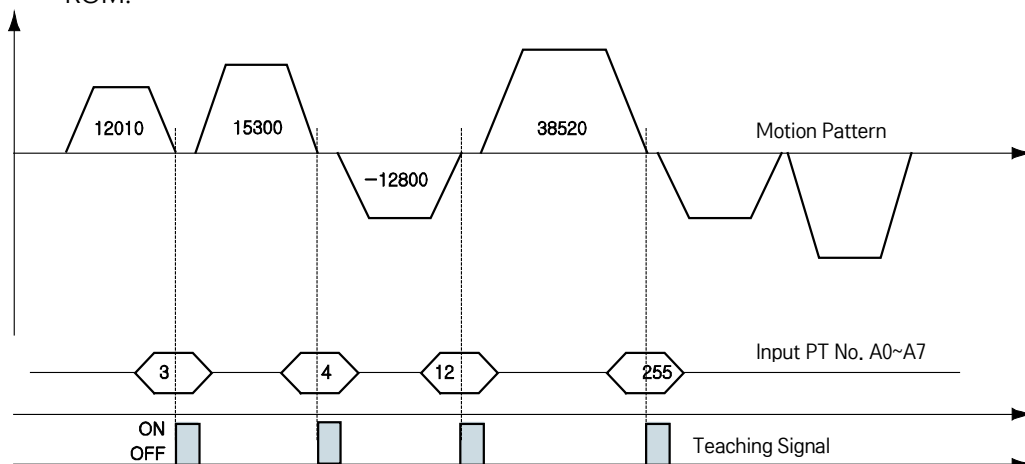
③ It is available to Servo ON or OFF during teaching.

④ Display current position information and the value displayed in 'Actual Position' is to be teaching value.

⑤ Current 'Actual Pos' value is an absolute position value. It is saved on the 'Position' of selected PT. It is saved on RAM, so click 'Save to ROM' button' to save on ROM.

⑥ In order to move to the next position, select PT No. by using arrow keys.

3－4－2 . Teaching by Input signal

You can save current position information to the Position Table data by Turning ON teaching control input signal. Also, when executes teaching, position value (no. of pulse) is specified as absolute position value.

Teaching is executing by following orders:

1) Select PT No. to save data and specify items like「Command」, etc.
   (except item「Position」only)

2) Move the motor to the position where you want to save data of it.

3) Specify PT No's that teaching is executing by 'PT A0~PT A7'.

4) Turn ON teaching signal to save current position value into item「Position」of Position Table data.

5) If you want to apply the saved value, you need to 'Refresh' PT data in order to verify the value on the User Program(GUI) screen.

6) The values are to be saved on RAM and click 'Save to ROM' button in order to save on ROM.

| 12010 | 15300 | | 38520 | Motion Pattern |
| −12800 | | | | |

Input PT No. A0~A7

| 3 | 4 | 12 | 255 |

ON / OFF   Teaching Signal

PT No. (CMD)	Position Value for each PT [pulse] (Position)
Position 3	12,010
Position 4	15,300
Position 12	-12,800
Position 255	38,520

3 - 5 . Input Condition Jump

Among the setting items, "JP Table No.", "JPT 0", "JPT 1"and "JPT 2" are used to specify next PT no. to be executed. Specified next PT no. to be executed, there are two different methods depending on the control input signal as following.
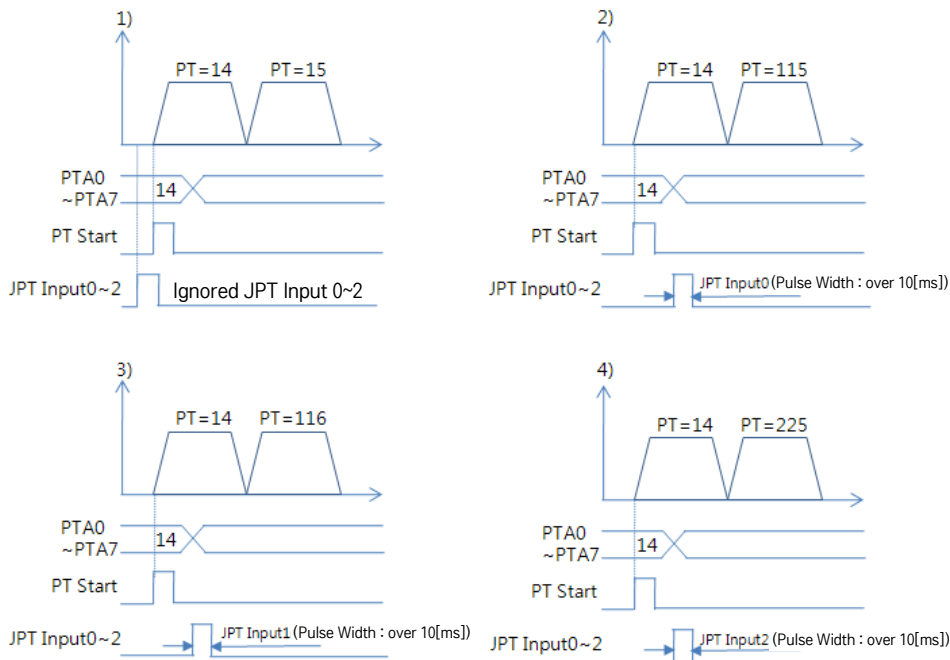
3 - 5 - 1 . Automatic Jump

This is the method to specify next action pattern (PT no.) by input condition.
System jumps to next PT no. to be executed automatically according to procedure.

For example as shown in the following figure, when PT no.14 is executing, if there is no input signal, next action pattern is to be executed by PT no.15 as shown in figure 1). However, if any of input signal is [ON] such as JPT Input0, JPT Input1 or JPT Input2 during the operation of PT no.14, then system jumps to JPT 0, JPT 1 or JPT2 accordingly and execute it that is specified in the Position Table data as shown in the figure 2) ~ 4).

Data for PT No.14

PT No (CMD)	Position Table No to jump (JP Table No.)	Input Jump Position No 0 (JPT 0)	Input Jump Position No 1 (JPT 1)	Input Jump Position No 2 (JPT 2)
14	15	115	116	225

* Refer to the sample file for testing Position Table, 'PT sample (Loop Motioning).txt'.

3 - 5 - 2 . Jump by External Signal

This is the method to specify next action pattern (PT no.) by input condition.

It is executed by an external signal instead of automatically jumping to the next PT to be executed according to the procedure.

'Difference from the function in 'section 4.5.1' :

1) Jump Position No. to jump need to have the format of 10XXX.

2) 'JPT Start' needs to be [ON] in order to execute the next action.

  If specified "Wait Time" of PT data is more than 0, then the next action is to be executed after the specified time.

Data for PT No.14

PT No (CMD)	Wait Time (Wait Time)	Position Table No to jump (JP Table No.)	Input Jump Position No 0 (JPT 0)	Input Jump Position No 1 (JPT 1)	Input Jump Position No 2 (JPT 2)
14	0	10,015	10,115	10,116	10,255
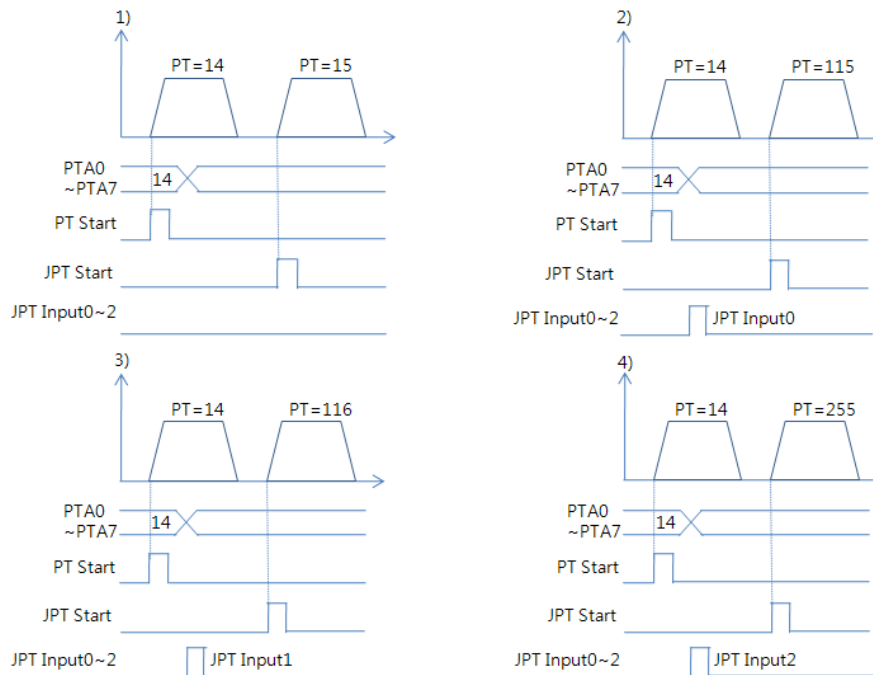
* If more than 2 signals become [ON] of 3 'Input Jump Position No.(JPT0~2)', the lower number (JPT0 > JPT1 > JPT2) has the high-priority and will be executed.

3 - 6 . Loop condition Jump

3 - 6 - 1 . Specifying Loop

If 「Loop Count」 and 「Loop Jump Table No.」are specified, system repeats the action of position specified times (Loop Count) and then jumps to corresponding position to 「Loop Jump Table No.」. That is, 「Jump Position No.」 is ignored.
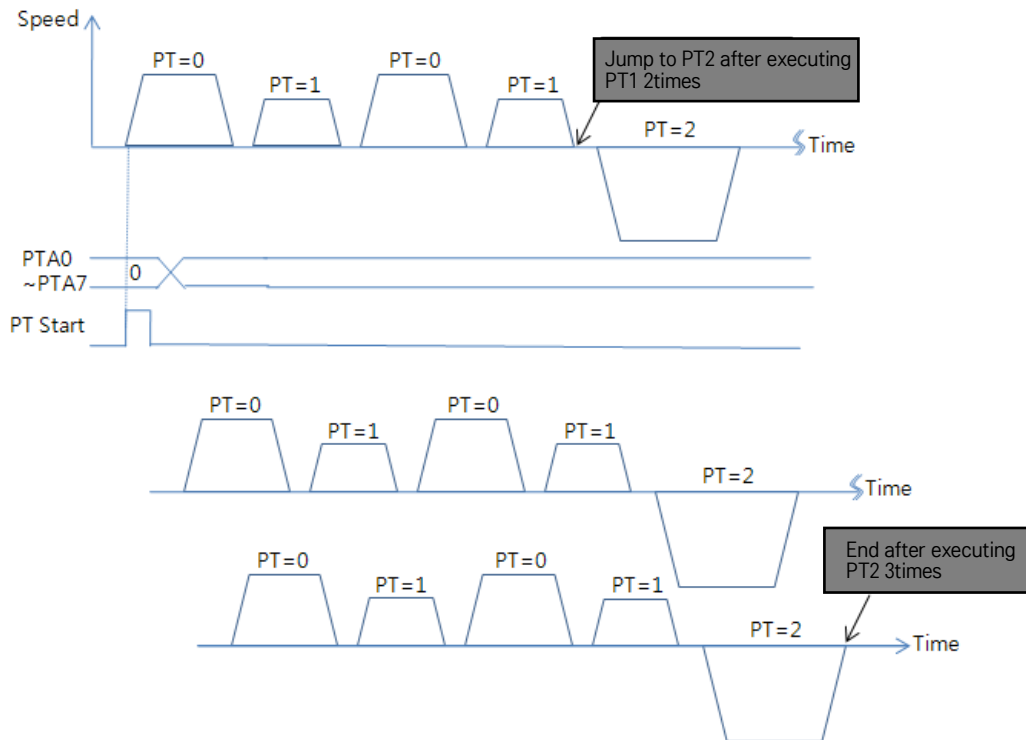
There are rules in specifying loop as following.

1) If 「Loop Count」 is set to 0, the loop setting function is canceled.

2) If the 「Loop Count」 is not reached during operation, jumps to 「Jump Position No.」. (When 「Loop Count」 is reached, 「Jump Position No.」 is ignored and jumps to 「Loop Jump Table No.」.)

3) If user set 「Loop Jump Table No.」 to 'blank', it ends after the corresponding PT motion is executed.

4) If 「Loop Jump Table No.」 is set to 10XXX, it is executed by 'JPT Start' input signal.
Following Table is one of example for specifying loop.

Specifying Position Table

PT No (CMD)	Movement Scale (Position)	Position Table No to jump (JP Table No.)	Loop Count	Position Table No. to jump after completing loop (Loop Jump Table No.)	Loop Counter Clear
0	8000	1	0	0	-
1	4000	0	2	2	-
2	0	0	3	-	1

* Refer to the sample file for testing Position Table, 'PT sample (Loop Motioning).txt'.

3 - 6 - 2 . Loop counter Clear

The 'Loop Counter' is a counter inside the drive to compare with the value of the 'Loop Count' of the PT item.

After the PT motion is executed, the loop counter value of 'Position Table' specified in this item is cleared to '0'. If you set 「Loop Clear」 to 'blank', this function will be released.

Following table shows an example of specifying Loop Counter Clear.

Specifying Position Table

PT No (CMD)	Movement Scale (Position)	Position Table No to jump (JP Table No.)	Loop Count	Position Table No to jump after completing loop (Loop Jump Table No)	Loop Counter Clear
0	8000	1	0	0	-
1	4000	0	2	2	-
2	0	0	0	0	1

1) Specify 'Loop Counter Clear' of PT No.2 as PT No.1.

2) Start operation from PT No.0.
   When starts operation, system reset all 'Loop Count' values as 0.

3) After repeats the loop block PT No.0 ~ PT No.1 two times, the 'Loop Counter' becomes 2 same as specified 'Loop Count' so system completes looping and jumps to PT No.2.

4) After executing PT No.2, system jumps to PT No.0.

Before jumping to PT No.0, system clears 'Loop Counter'- the internal counter as 0.

5) Then paragraph 3) and 4) are repeated infinitely.

6) If this 'Loop Clear' value is not specified, 'Loop Counter' value of internal drive increase continuously. It jumps to PT No.2 one time, after that, repeat block 'PT No.0 ~ PT No.1' block infinitely.
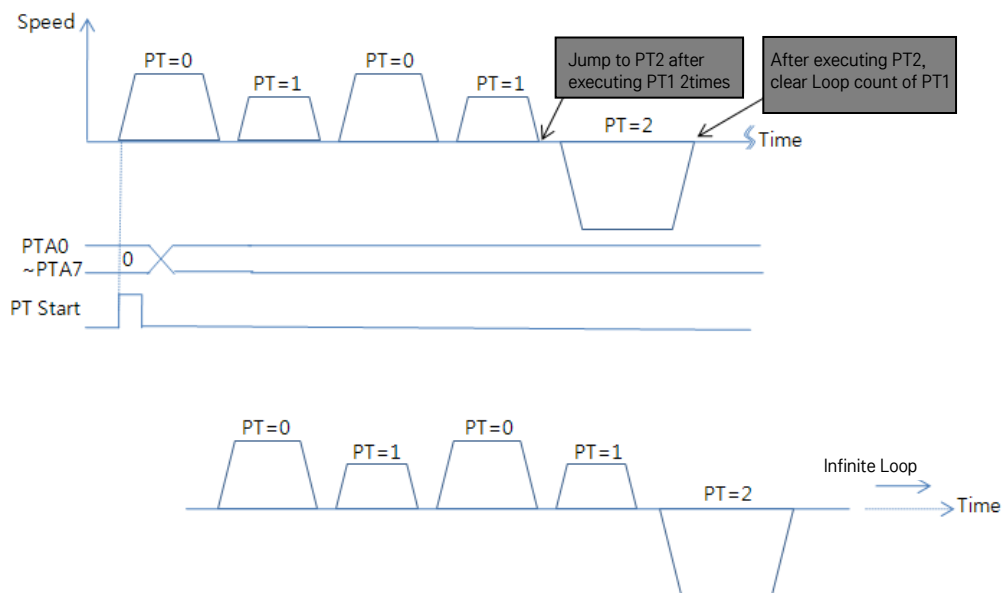
* Refer to the sample file for testing Position Table, 'PT sample (Loop counter clear).txt'.

3－7．Start/Pass/End signal function

By specifying the item「Start/Pass/End Signal Function」, user can recognize the status of
Position Table whether operation started, is under pass operation, or completed operation
through control signal output.

If you do not want to use 「Start/Pass/End Signal Function」, specify this item as 0,8 or 16.
If other value is specified, the position performs following actions depending on specified
value.

This function is work on both absolute positioning and relative position motion.

3－7－1．Start/End Sign

- If the value between 1 to 7(Start Sign) is specified for PT Set, PT Output HEX value is output
  through output of 'PT Output 0 ~ PT Output 2'at the time of starting operation.
- If the value between 9 to 15(End Sign) is specified for PT Set, PT Output HEX value is output
  through output of 'PT Output 0 ~ PT Output 2'after completion of operation.

PT Set value	PT Output 2 signal	PT Output 1 signal	PT Output 0 signal	PT Output HEX value	Function
0	OFF	OFF	OFF	0	Not use output function of PT Output 0~2.
1	OFF	OFF	ON	1	PT Output 0~2 signals turn to [ON] **at the time of starting** operation of the corresponding PT.
2	OFF	ON	OFF	2	
3	OFF	ON	ON	3	
4	ON	OFF	OFF	4	
5	ON	OFF	ON	5	
6	ON	ON	OFF	6	
7	ON	ON	ON	7	
8	OFF	OFF	OFF	0	Not use output function of PT Output 0~2.
9	OFF	OFF	ON	1	PT Output 0~2 signals turn to [ON] **after end of operation** of the corresponding PT.
10	OFF	ON	OFF	2	
11	OFF	ON	ON	3	
12	ON	OFF	OFF	4	
13	ON	OFF	ON	5	
14	ON	ON	OFF	6	
15	ON	ON	ON	7	

* If you set the PT Set value to 9 ~ 15 and use the jump function at the same time and set the
'Wait Time' to 0, the PT Output will not be output.

3 - 7 - 2 . Pass Sign

· If the value between 17 to 23(Pass Sign) is specified for PT Set, PT Output HEX value is output through output of 'PT Output 0~PT Output 2' when the position starts.

PT Set Value	PT Output 2 Signal	PT Output 1 Signal	PT Output 0 Signal	PT Output HEX Value	Function
16	OFF	OFF	OFF	0	Not use output function of PT Output 0~2.
17	OFF	OFF	ON	1	PT Output 0~2 signals become [ON] when the motion of PT of the corresponding number reaches **Trigger Position**.
18	OFF	ON	OFF	2	
19	OFF	ON	ON	3	
20	ON	OFF	OFF	4	
21	ON	OFF	ON	5	
22	ON	ON	OFF	6	
23	ON	ON	ON	7	
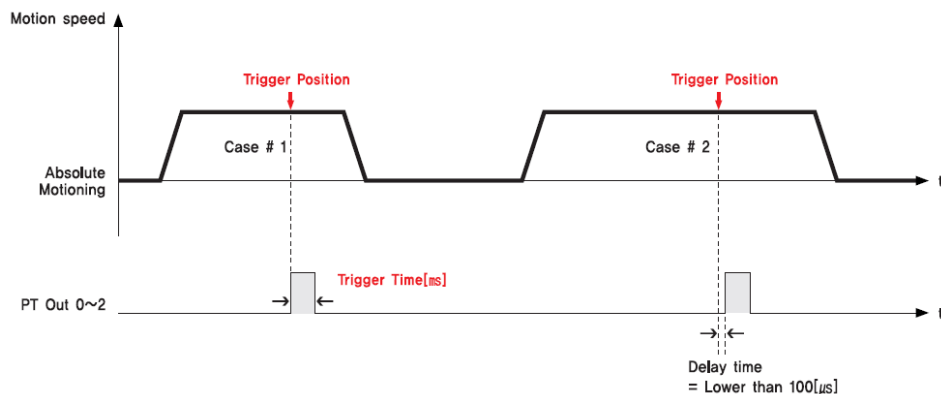
* The signal pulse width of PT Output is set by 'Trigger Time' value.

* The 'Trigger Position' is not the absolute position value, but the relative position value from the start position of that PT command.

3 - 8 . Push Motion Function

It is a function to move while maintaining a fixed force from a certain position during movement by position command, to stop movement in stop mode when it comes into contact with work during movement, and to keep the force in None-Stop mode.
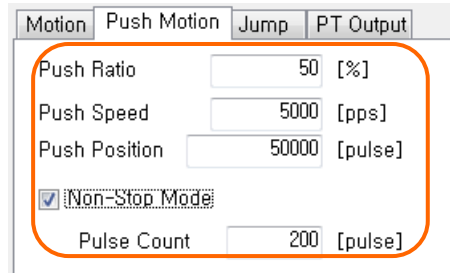
3 - 8 - 1 . Setting method

1) Select the command type to 'Push ABS Motion'.
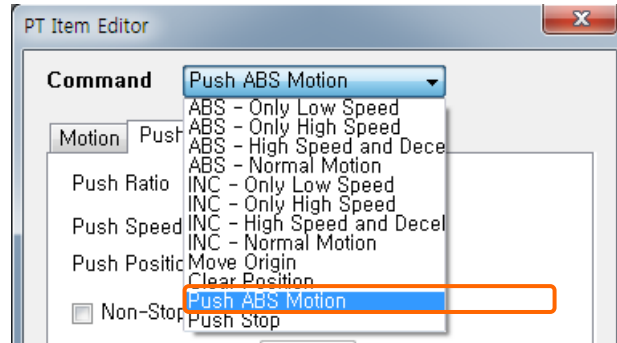
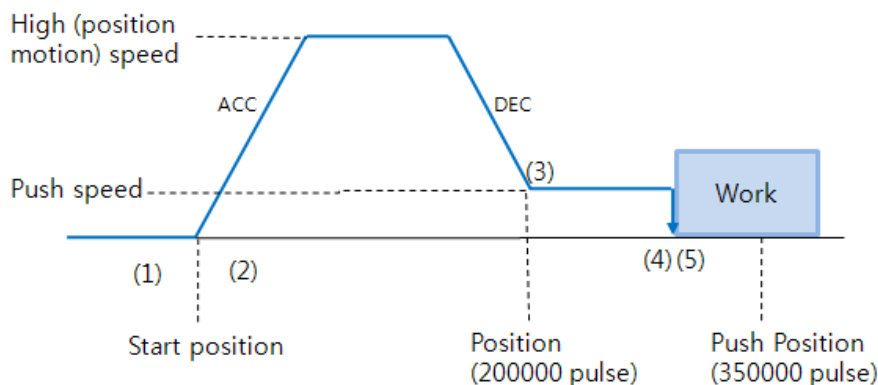2) Specifies the normal position motion command settings.
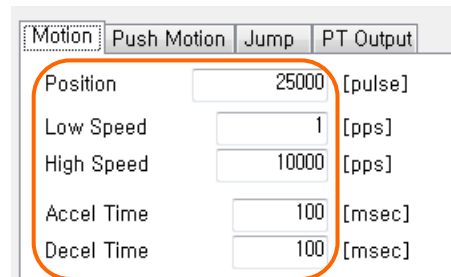
3) Specifies the Push motion command settings.

This is for Non-stop mode and set backward position value to 200[pulse] after stop procedure.

3 - 8 - 2 . Push motion function

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(1) Start Push Motion command.

(2) Normal position motion command is executed. (status : position mode)

(3) Decelerate the speed from position motion to push motion.
    (Push motion speed must be lower than 200[rpm].)

(4) Push motioning until the work detected with specified motor torque.
    (status : push mode)

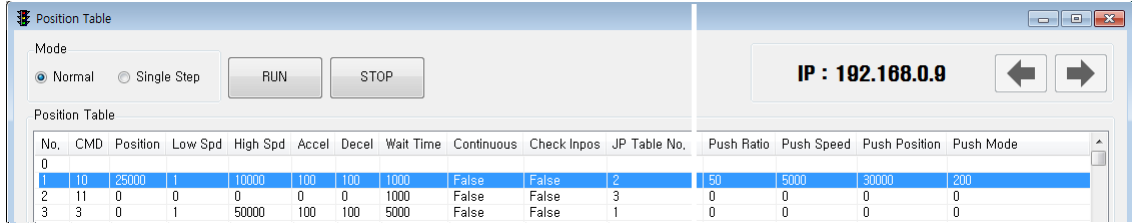(5) There are two method according to mode

    When Push mode is **'Stop mode'**

After the work detected, the motor will stop but the motor torque will be maintained.

At that time, the end signal of 'Inposition'/'PT Stopped'/'END' signal is effective.

The maintained motor torque will be return to normal Servo ON status (release 'push mode' and change to 'position mode') by 'stop' command or normal 'position motion' command.

The next is an example of PT data for a simple 'Stop mode' Push function test.

When Push mode is **'Non-stop mode'**:

After the work detected, the motor will not stop and the motor torque will be maintained.

At that time, the end signal of 'Inposition'/'PT Stopped/'END' is effective. The 'Stop' command must be executed before the next motion command. (But in Stop mode, if there are not a shock in a mechanism, do not need to 'Stop'.)

At this time, it moves in the opposite direction by the value of 'Push mode setting' among the control condition parameters to mitigate the impact on the equipment. Therefore, if user do not use the stop command, no backward motion will be executed. At this time, the speed of backward motion is fixed at 5,000 [pps].

For more information about current Push motion, refer to 「User Manual-Text 8-6. Push Motion Function」.

The next is an example of PT data for a simple 'Non-Stop mode' Push function test.

As above example
1) If execute PT No.1, **Push motioning during 5,000[msec]** after work detect.
2) And then execute PT No.2 (Stop function)
3) Move to start position and repeat push motioning again by executing PT No.3

⚠ Caution	In the case of Non-stop mode, must execute the 'Stop' command before the next motion command in the work detect the situation.

⚠ Caution	If there is a shock in the mechanism, the time delay is needed for returning the original state after 'Stop' operation.

For more information about current Push motion, refer to 「User Manual-Text 8-6. Push Motion Function」.