

MECQ1 series

User Manual

Text

(Rev.02)



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1 . Safety Pre-cautions

※ Before operation

- Thank you for your purchasing the MINDMAN's MECQ1 product.
- MECQ1 is an unit type of Full digital position control drive of stepping motor which is adopted 32bit high performance ARM chip.
- This manual describes handling, maintenance, repairing, diagnosis and troubleshooting of MECQ1.
- Before operating MECQ1, thoroughly read this manual for safety.
- After reading this manual, please keep this manual near MECQ1 so that any user can read the manual whenever needed.

1 - 1 . Precautions

◆ General Precautions

- Contents of this manual are subjected to change without prior notice for functional improvement, change of specifications or user's better understanding. Thoroughly read the manual provided with the purchased MECQ1.
- When the manual is damaged or lost, please contact with MINDMAN's agents or download from the website.
- Our company is not responsible for a product breakdown due to user's dismantling for the product, and such a breakdown is not guaranteed by the warranty.

◆ Put the Safety First

- Before installation, operation and repairing the MECQ1, thoroughly read the manual and fully understand the contents, Before operating the MECQ1 please fully understand the mechanical characteristics of the product, related safety information and precautions.
- This manual divides safety precautions into **Attention** and **Warning**.

 Attention	If user does not properly handle the product, the user may seriously or slightly injured and damages may occur in the machine.
 Warning	If user does not properly handle the product, a dangerous situation (Such as an electric shock) may occur resulting in death or serious injuries.

- Although precaution is only a **Attention**, a serious result could be caused depending on the situation. Please follow safety precautions.

◆ Check the Product

 Attention	<p>Check the Product is damaged or parts are missing.</p> <p>Otherwise, the machine may get damaged or the user may get injured.</p>
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◆ Installation

 Attention	<p>Please carry the MECQ1 carefully.</p> <p>Otherwise, the product may get damaged or user's foot may get injured by dropping the product.</p> <p>Use non-flammable materials such as metal in the place where the MECQ1 is to be installed.</p> <p>Otherwise, a fire may occur.</p> <p>When installing several MECQ1 in a sealed place, install a cooling fan to keep the ambient temperature of the product as 50°C or lower.</p> <p>Otherwise, a fire or other kinds of accidents may occur due to overheating.</p>
 Warning	<p>The process of installation, Connection, Operation, Checking and Repairing should be done by qualified person.</p> <p>Otherwise, a fire or other kinds of accidents may occur.</p>

◆ Connect Cables

 Attention	<p>Keep the rated range of input Voltage for MECQ1 drive.</p> <p>Otherwise, a fire or other kinds of accidents may occur.</p> <p>Cable connection should be following the wiring diagram.</p> <p>Otherwise, a fire or malfunction of machine may occur.</p>
 Warning	<p>Before connecting cables, check if input power is off.</p> <p>Otherwise, an electric shock or a fire may occur.</p> <p>The case of this MECQ1 is installed from the ground of the internal circuit by the condenser, Please Ground the MECQ1.</p> <p>Otherwise, an electric shock or a fire may occur and a cause of malfunction of machine.</p>

◆ Operation & Setting change

 Attention	<p>If a protection function (Alarm) occurs, firstly remove its cause and then release (Alarm reset) the protection function.</p> <p>If you operate continuously without removing its cause, the machine may get damaged or the user may get injured.</p> <p>Make all input signals to OFF before supply input voltage to MECQ1 drive.</p> <p>The machine may get damaged or the user may get injured by motor operation.</p> <p>All parameter values are set by default factory setting value. Change this value after reading this manual thoroughly.</p> <p>Otherwise, the machine may get damaged or other kinds of accidents may occur.</p>
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◆ Check and Repair

 Warning	<p>Stop to supply power to the main circuit and wait sufficient time before checking or repairing this MECQ1.</p> <p>Electricity remaining in the condenser may cause of electric shock.</p> <p>Do not change cabling while power is being supplied.</p> <p>Otherwise, the user may get injured or the product and machine may get damaged.</p> <p>Do not reconstruct the MECQ1.</p> <p>Otherwise, an electric shock may occur or the product and machine get damaged. And the reconstructed product cannot get after service.</p>
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1 - 2 . Notes on Installation

- 1) This product has been designed for indoor uses. The ambient temperature of the room should be 0°~ 55°C .
- 2) If the temperature of the case is 50°C or higher, radiate heat outside for cooling down.
- 3) Do not install this product under direct rays or near magnetic or radioactive objects.
- 4) If more than 2 drives are installed in a line, keep the interval of 20mm or more vertically and 50mm or more horizontally at least.

2 . Specifications of the Drive

2 - 1 . Characteristic Table

Type of Drive	MECQ1 series
Input Voltage	24VDC ± 10%
Control Method	Closed loop control with ARM-based 32-bit MCU
Multi Axes Drive	Maximum 16 axes drive through Daisy-Chain
Position Table	256 of Motion command steps (Speed, External start, Jump, Loop, Wait and PT finish etc.)
Current Consumption	Max. 500mA (Except motor current)
Operating condition	Ambient Temperature In Use : 0~50°C In Storage: -20~70°C
	Humidity In use : 35~85%RH (Non- condensing) In Storage : 10~90%RH (Non-condensing)
	Viv. Resist 0.5G
Function	Rotation Speed 0~3,000rpm*1
	Resolution [P/R]*2 500 1,000 1,600 2,000 3,200 3,600 4,000 5,000 6,400 8,000 10,000 20,000 25,000 36,000 40,000 50,000 (Select by Parameter)
	Protection Function Over current, over speed, position tracking error, over load, over temperature, over regenerated voltage, motor connect error, encoder connect error, in-position error, ROM error, position overflow error
	LED Display Power status, In-Position status, Enable status, Alarm status
	In-position selection 0~63 (Selectable by parameter)
	Position Gain selection 0~63 (Selectable by parameter)
	Rotational Direction CW/CCW (Selectable by parameter)
	RUN Current 50%~150% (Selectable by parameter) RUN current is flowing current value in the motor when motor is operating (rotating), It is set based on constant current of motor * Default factory setting value : 100%
I/O Signal	STOP Current 20%~100% (Selectable by parameter) It is set as setting value of STOP current 0.1 sec after motor stop. STOP current value is at a ratio against RUN current value of motor * Default factory setting value is : 50%
	Input signal 3 dedicated input (LIMIT+, LIMIT-, ORIGIN), 9 programmable input (Photo coupler)
Communication interface	Output signal 1 dedicated output (Compare Out), 9 programmable output (Photo coupler), Brake signal
	RS-485 serial communication , Transmission speed : 9,600~921,600bps
Position Control	Incremental mode / Absolute mode Data range : -134,217,728 to +134,217,727 pulse, Operating : Max. 3,000rpm
	Return to Origin Origin Sensor, Z phase, ±Limit sensor, Torque
GUI	User interface Program for Windows
	Motion Library (DLL) for Windows 2000/XP/Vista/7/8

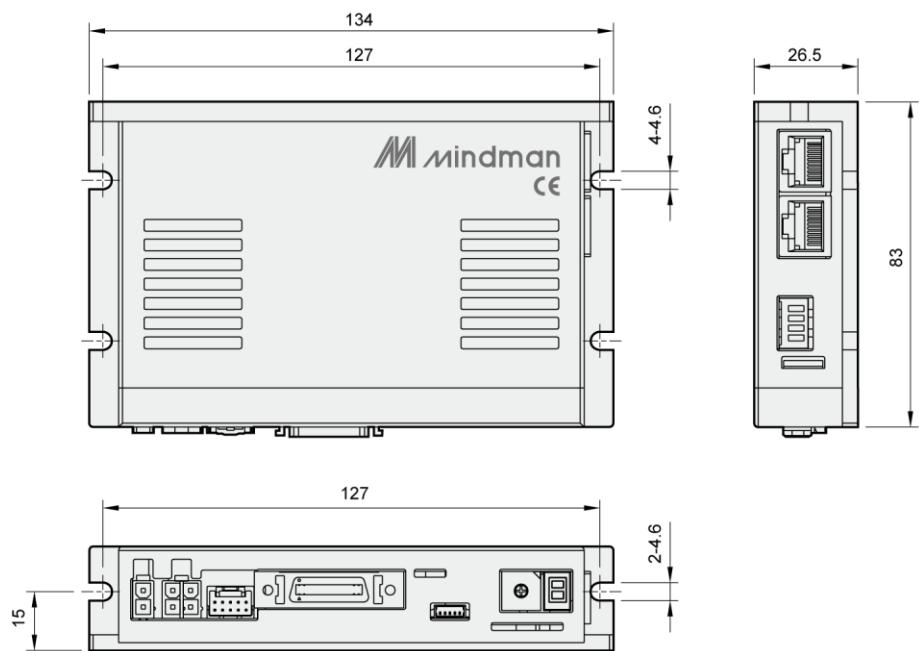
*1 Maximum Rotation speed can be changed by Resolution. Up to Resolution 4,000. Max rotation speed is 3,000 rpm. For 20L motor, the maximum rotation would be 1,600 rpm.

More than 4,000, Max rotation speed will be decreased

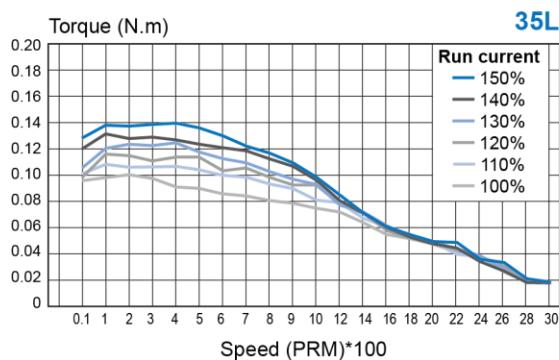
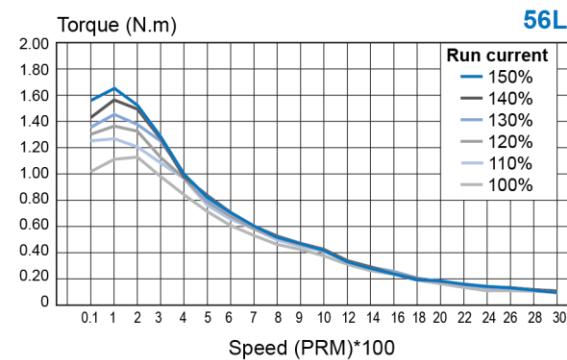
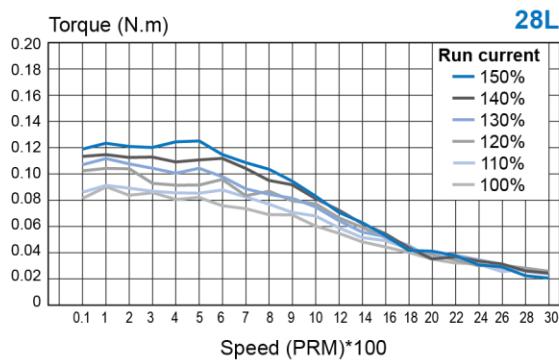
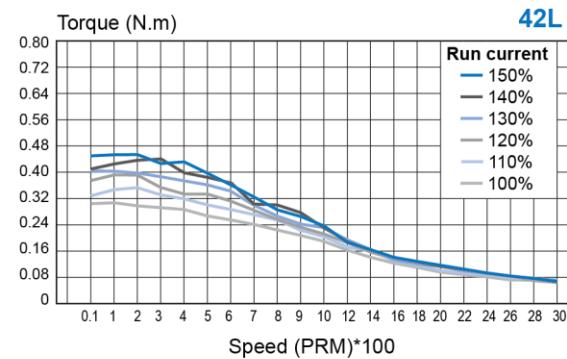
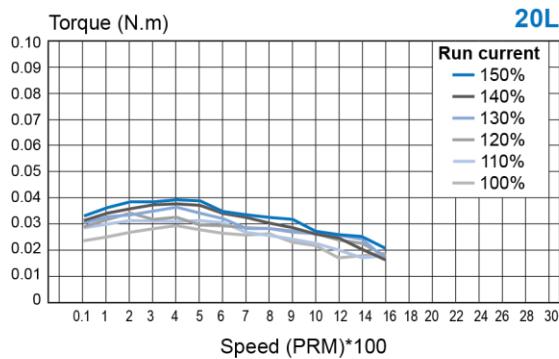
*2 Maximum Resolution of encoder which is adopted to MECQ1 is 4,000[P/R]

So that setting resolution is more than 4,000[P/R], It will be operating as micro step between the encoder pulse

2 - 2 . Dimensions

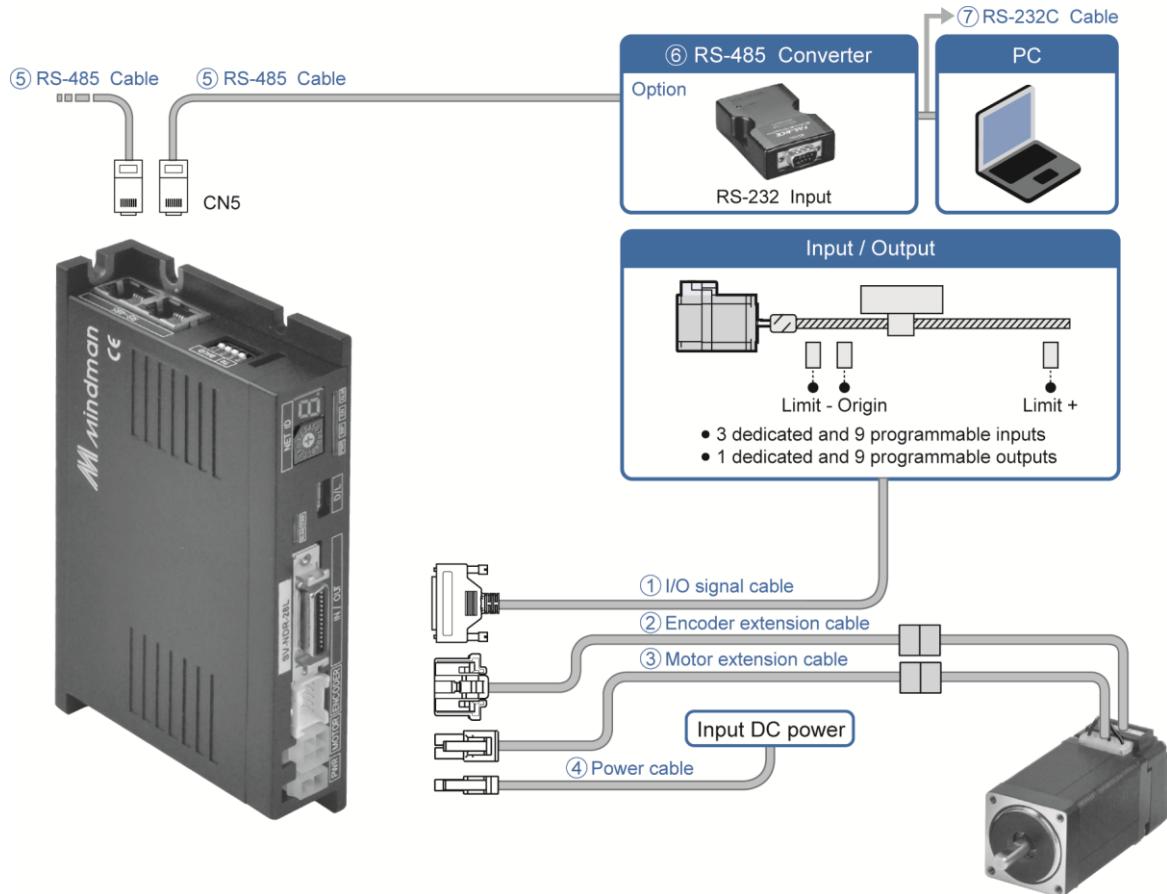


3 . Characteristics of Motor Torque



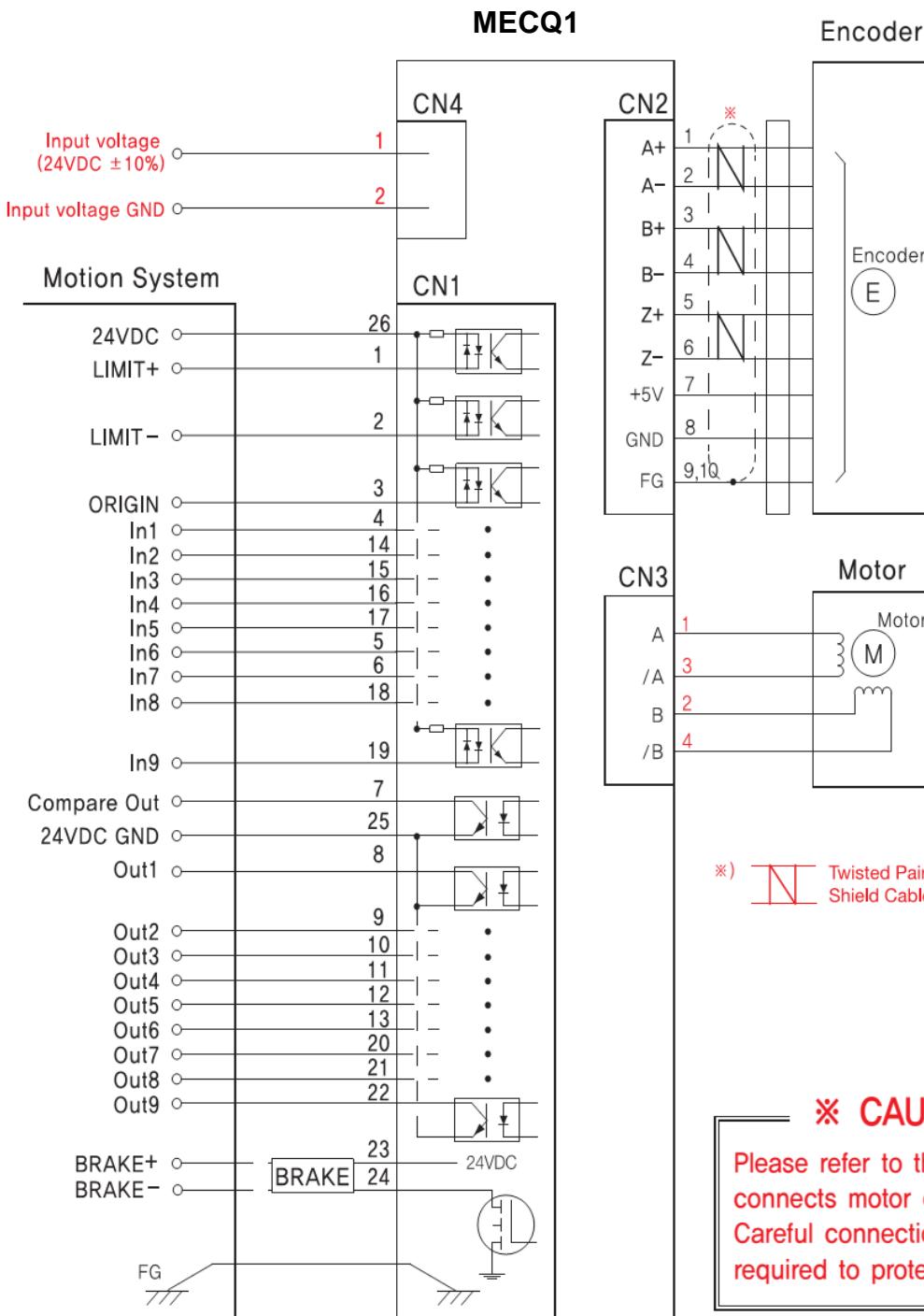
4 . Controller configuration

4 - 1 . Configuration of MECQ1



Purpose	Item		Max. length (m)	Note	Exterior
I/o connections	Connector	10126-3000PE	3	Isolation cable	
	Shell	10326-52FO-008			
Encoder connection	Drive side	Housing	5	Isolation + Flexible cable	
	Encoder side	Terminal			
Motor connection	Drive side	Housing	5	Flexible cable	
	Encoder side	Terminal			
Power connection	Housing	5557-02R	-	Housing and terminal only	
	Terminal	5556T			

4 - 2 . External Wiring Diagram

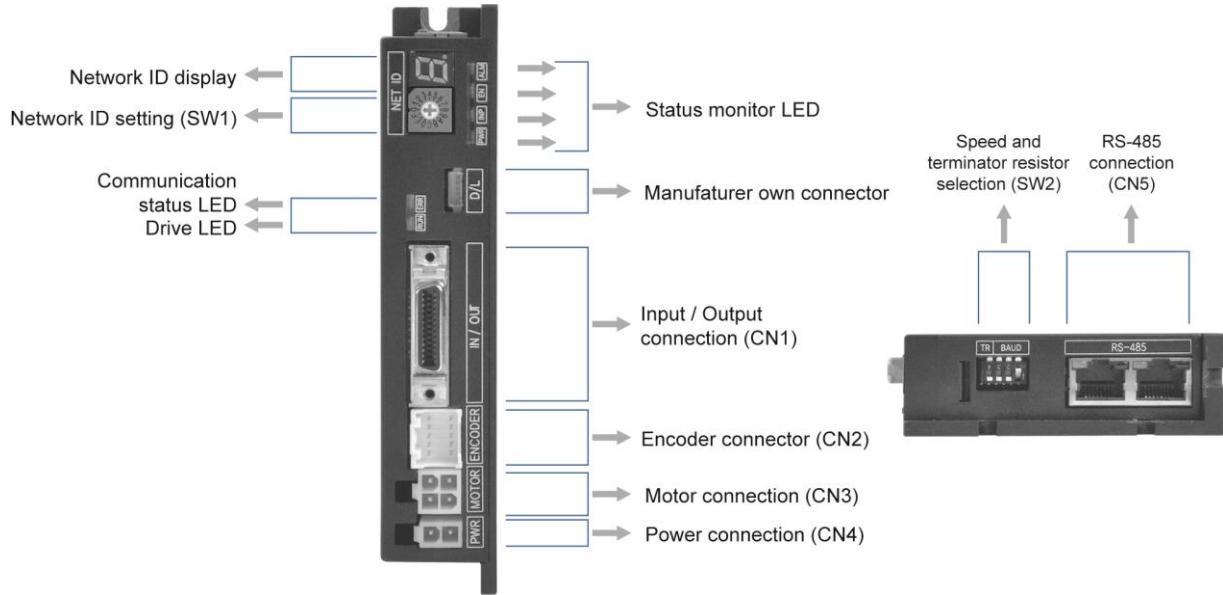


※ CAUTION ※

Please refer to the Manual when connects motor extension cable. Careful connection will be required to protect any damages.

5 . External Name and Function Setting of MECQ1

5 - 1 . Appearance and Part Name

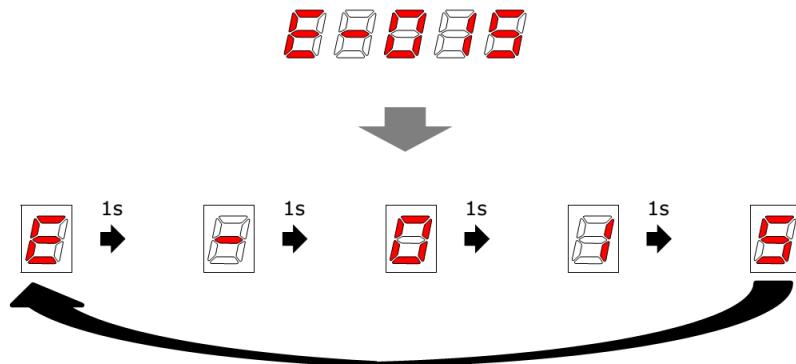


5 - 2 . Status Display LED

Display	Color	Function	On / Off Condition
PWR	Green	Power Input Indication	Light on when power is applied.
INP	Yellow	Complete Positioning motion	Light on when position command pulse input and then position deviation is within the parameter setting value
EN	Orange	Motor enable status indication	Enable : Light On, Disable: Light Off
ALM	Red	Alarm indication	Flash repeat when protection function is activated. (if count LED flash time, it is possible to check which protection function is activating)

5 - 3 . Indication of Network ID

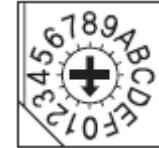
- 1) It displays the setting ID of SW1 (Drive ID Selection Switch)
- 2) When Alarm generating from drive, Alarm value is displayed on 7-Segment, not ID value.
Alarm value is displayed on 7-Segment as 'E-000' type with one each dial.
This dial is changing every one second. (ex. Display of Alarm No. 15)



5 - 4 . Drive ID Selection Switch (SW1)

- 1) When several modules are connected to one daisy chain network, this switch is to set intrinsic ID of each modules
- 2) The switch can set intrinsic ID of each module up to 16 numbers from 0 to F (15)..

Position	ID Number	Position	ID Number
0	0	8	8
1	1	9	9
2	2	A	10
3	3	B	11
4	4	C	12
5	5	D	13
6	6	E	14
7	7	F	15



5 - 5 . Communication Speed and Terminal Resistance Select Switch (SW2)

SW2 is to set the communication speed between central controller (PC) and Drive.

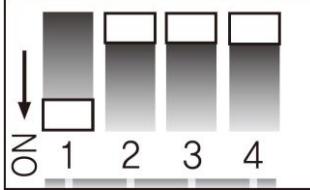
If corresponding drive module is connected to the end of one network segment, SW2 sets whether terminal resistance is used.

SW2.1 is to set the use of terminal resistance and SW2.2 ~SW2.4 is to set the communication speed as follows.

For high-speed communication, common PCI Bus type RS-485 communication board can be used.

SW2.1	SW2.2	SW2.3	SW2.4	Speed baud[bps]
OFF	OFF	OFF	-	9600
OFF	OFF	ON	-	19200
OFF	ON	OFF	-	38400
OFF	ON	ON	-	57600
ON	OFF	OFF	-	115200 *1
ON	OFF	ON	-	230400
ON	ON	OFF	-	460800
ON	ON	ON	-	921600

*1 : default setting value.



SW2.4 is OFF : Terminal resistance is OFF
SW2.4 is ON : Terminal resistance is ON

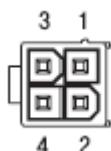
 Caution	The communication speed of drive modules connected to one segment must be set with same value.
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 Caution	Support maximum 115200 [bps] when using RS-232 to RS-485 converter
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5 - 6 . Motor Connection (CN3)

(Connector Type : Molex 5569-04A2)

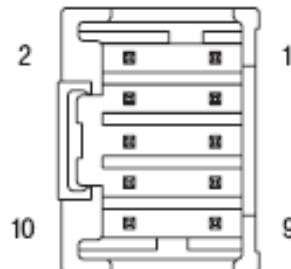
No	Function
1	A
2	B
3	/A
4	/B



5 - 7 . Encoder Connection (CN2)

(Connector Type : Molex 55959-1030)

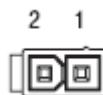
No	Function
1	A+
2	A-
3	B+
4	B-
5	Z+
6	Z-
7	5VDC
8	5VDC GND
9	Frame GND
10	Frame GND



5 - 8 . Power Connection (CN4)

(Connector Type : Molex 5569-02A2)

No	Function
1	Power input : 24VDC \pm 10%
2	Power input : GND

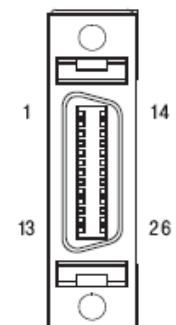


5 - 9 . I/O Signal Connection (CN1)

(Connector Type : 3M 10226-5A2JL)

No	Color	Function	No	Color	Function
1	Brown	LIMIT+ (Dedicated input)	14	Gray	Digital In2 (Programmable input)
2	Brown/Black	LIMIT- (Dedicated input)	15	Gray/Black	Digital In3 (Programmable input)
3	Red	Origin (Dedicated input)	16	White	Digital In4 (Programmable input)
4	Red/Black	Digital In1 (Programmable input)	17	White/Black	Digital In5 (Programmable input)
5	Orange	Digital In6 (Programmable input)	18	L. Blue	Digital In8 (Programmable input)
6	Orange/Black	Digital In7 (Programmable input)	19	L. Blue/Black	Digital In9 (Programmable input)
7	Yellow	Compare Out (Dedicated output)	20	L. Green	Digital Out7 (Programmable output)
8	Yellow/Black	Digital Out1 (Programmable output)	21	L. Green/Black	Digital Out8 (Programmable output)
9	Green	Digital Out2 (Programmable output)	22	Pink	Digital Out9 (Programmable output)
10	Green/Black	Digital Out3 (Programmable output)	23	Pink/Black	Brake +24V (Output)
11	Blue	Digital Out4 (Programmable output)	24	White/Red	Control signal for Brake (Output)
12	Blue/Black	Digital Out5 (Programmable output)	25	Black	GND external (Input)
13	Purple	Digital Out6 (Programmable output)	26	Purple/Black	+24V external (Input)

* This connector fixing pin is connected to frame GND through a mount hall



The programmable input/output pin is set by using the user program (GUI) or DLL library.



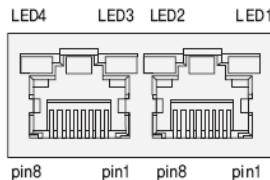
Caution

Connect the Brake (current consumption is under 200[mA]) for pin 24.
Refer to [6.4 Output signal for the Brake that is over 200\[mA\]](#).

5 - 1 0 . Communication connection (CN5)

Connector type : RJ45

Pin No.	Function
1,2,4,5,7,8	GND
3	Data+
6	Data-
case	Frame GND



6 . Control I/O Signal

6 - 1 . Signal Cabling

All control I/O signals use connector CN1 as specified below.

1) Input : 「Limit+」, 「Limit-」, 「Origin」 signals are fixed to CN1 No. 1,2,3.

Other signals as like 'Clear Pos' are assigned to IN1~IN9 terminal blocks.

3 dedicated input + 9 programmable input = total 12 input pins

CN1 No.	Signal Name	Function
1	Limit+	Positive Limit sensor signal
2	Limit-	Negative Limit sensor signal
3	Origin	Origin sensor signal
4	IN1	Clear Pos
14	IN2	Position Table A0 ~ Position Table A7 (PT A0~PT A7)
15	IN3	Position Table start execution (PT Start)
16	IN4	Soft Stop(Stop)
17	IN5	Jog+, Jog-
5	IN6	Alarm Reset, Servo ON
18	IN7	Pause, Origin Search, Teaching
6	IN8	Emergency Stop(E-Stop)
19	IN9	Jump Position Table input 0 ~ Jump Position Table input 2 (JPT IN 0~ JPT IN 2)
		Jump Position Table start (JPT Start)
		User input 0 ~ User input 8 (User IN 0 ~ User IN 8)

2) Output : 「COMP」 signal is dedicated to CN1 No.7. Other signals like

In-position are assigned to OUT1~OUT9 terminal blocks.

1 dedicated Out + 9 programmable Out = 10 Outputs

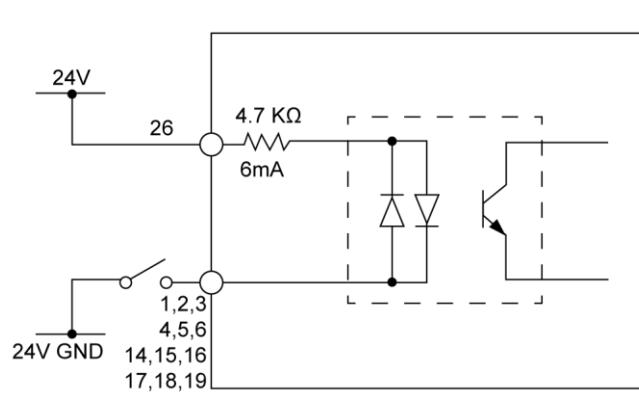
CN1 No.	Signal Name	Function
7	COMP	Specific output signal (Compare Out)
8	OUT1	
9	OUT2	In-Position, Alarm, Moving
10	OUT3	Acc/Dec
11	OUT4	ACK, END
12	OUT5	AlarmBlnk, OriginSearchOK
13	OUT6	ServoReady
20	OUT7	Brake
21	OUT8	Position Table output 0 ~ Position Table output 2 (PT OUT 0 ~ PT OUT 2)
22	OUT9	User Output 0 ~ User Output 8

6 - 2 . Connection Circuit

All drive I/O signals are insulated by a photo coupler. The signals display the internal photo coupler status - [ON: Conduction] and [OFF: Non- Conduction], not the signal voltage level.

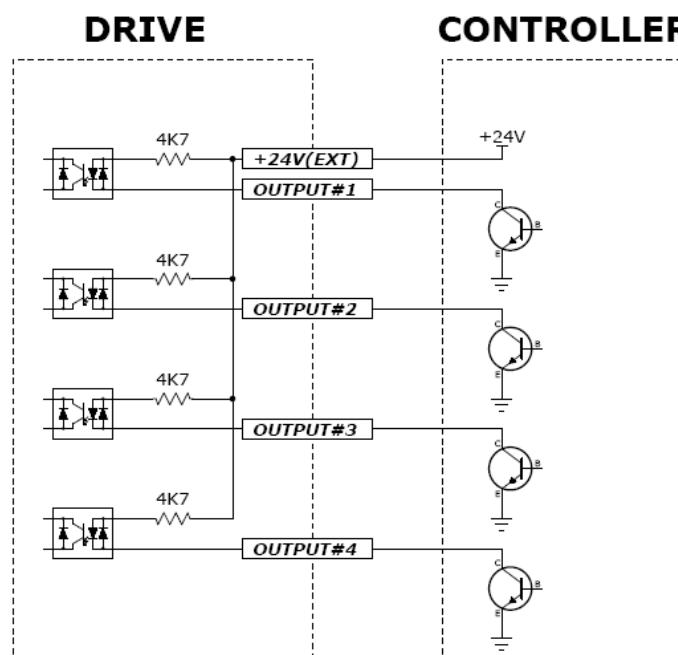
1) Input Circuit

Input circuit power of DC24V \pm 10% (consumed current : about 5mA/circuit) should be separately prepared.



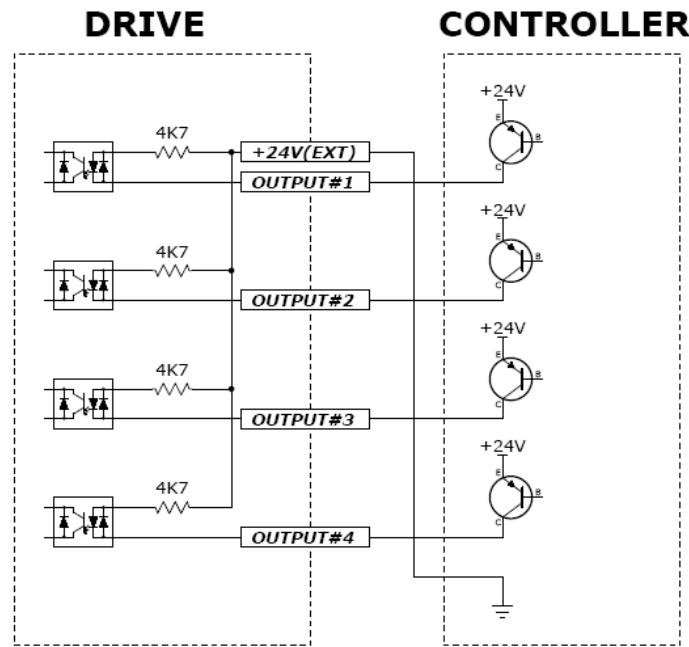
● Connect NPN type Input signal

Connect the '+24V external' signal of drive to '+24V' of Controller.



● Connect PNP type Input signal

Connect the '+24V external' signal of drive to 'GND' of Controller.



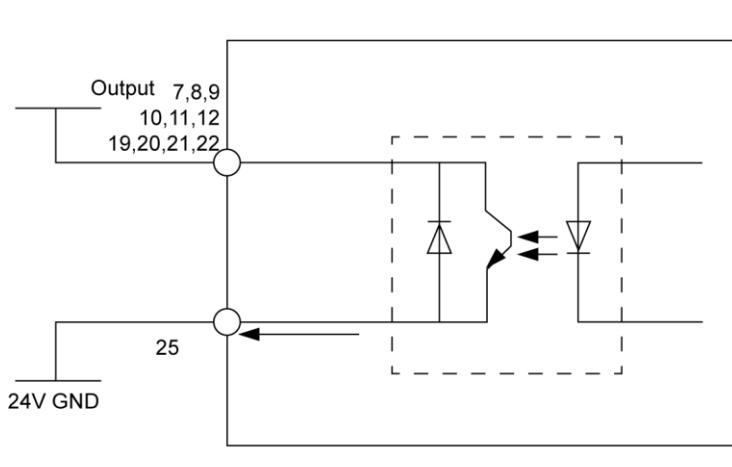
2) Output Circuit

Output circuit power should be separately prepared. This may share input circuit power. In this case, working power capacity should add output power capacity to input power capacity.

Applied voltage and power capacity in the control output port are as follows.

- Applied voltage \leq 30V
- Electrified current \leq 15mA

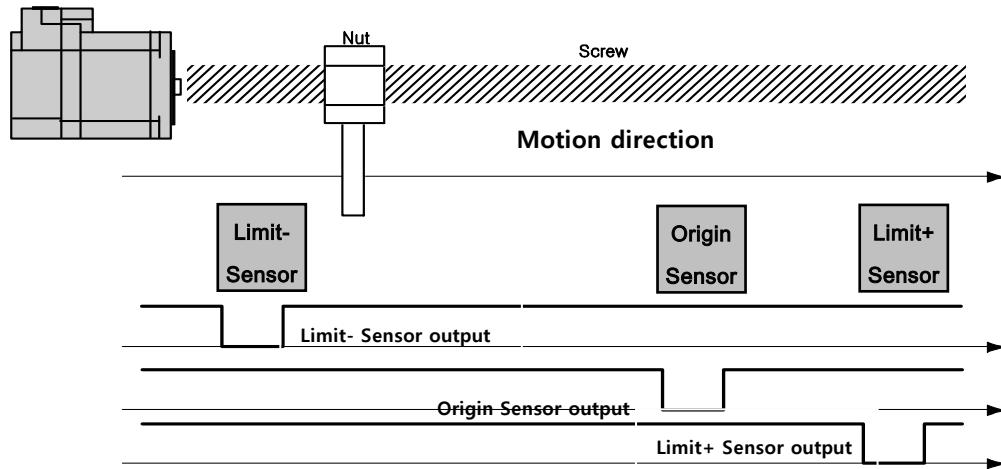
Output



6 - 3 . Input Signal

1) Limit Sensor and Origin Sensor

Limit sensor and origin sensor are assigned to LIMIT+, LIMIT-, and ORIGIN pin in the CN1 connector respectively. LIMIT+ and LIMIT- sensors are used to limit the motion of each axis to prevent mechanical collision. Origin sensor is to set the origin of equipment



2) Clear Pos

This input signal sets the command position and the actual position to 0 in relation to motion position control. The reset signal pulse scale is 10ms or more.



Position value is to be "0" from the rising/falling edge of this signal

3) Position Table A0 – A7 (PT A0~A7)'Input

The position table supports the machine so that its motion can be controlled by I/O signals of central controller. It can directly transmit commands such as position table number, start/stop and origin return to the machine through the PLC. Also, the user can check output signals such as in-position, completion of origin return and Servo ready through the PLC.

「Position Table A0~A7」 Inputs are total 8 bits of input signal. It is used to set 256 position table numbers. There are two application methods as follows

- 1) To set position table number (0~255) to be set by 'PT start' input signal.
- 2) To set position table number (0~255) to save current position values by 'Teaching' input signal.

By using PT A0~A7 signals, the position table address can be set from 0 to 255 with a binary number. A0 is least significant bit and A7 is most significant bit. The following table shows how to assign position table number.

*1. Save signal cabling : If 'PT A0~A7' signal is not connected when motioning by 'PT Start' signal, the position table number will be '0'.

A7	A6	A5 ~ A3	A2	A1	A0	PT No
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
0	0	0	1	0	0	4
...						
1	1	1	1	1	0	254
1	1	1	1	1	1	255

*2. 'PT A5/UserIN 6' 'PT A6/UserIN 7' 'PT A7/UserIN 8'signal setting :

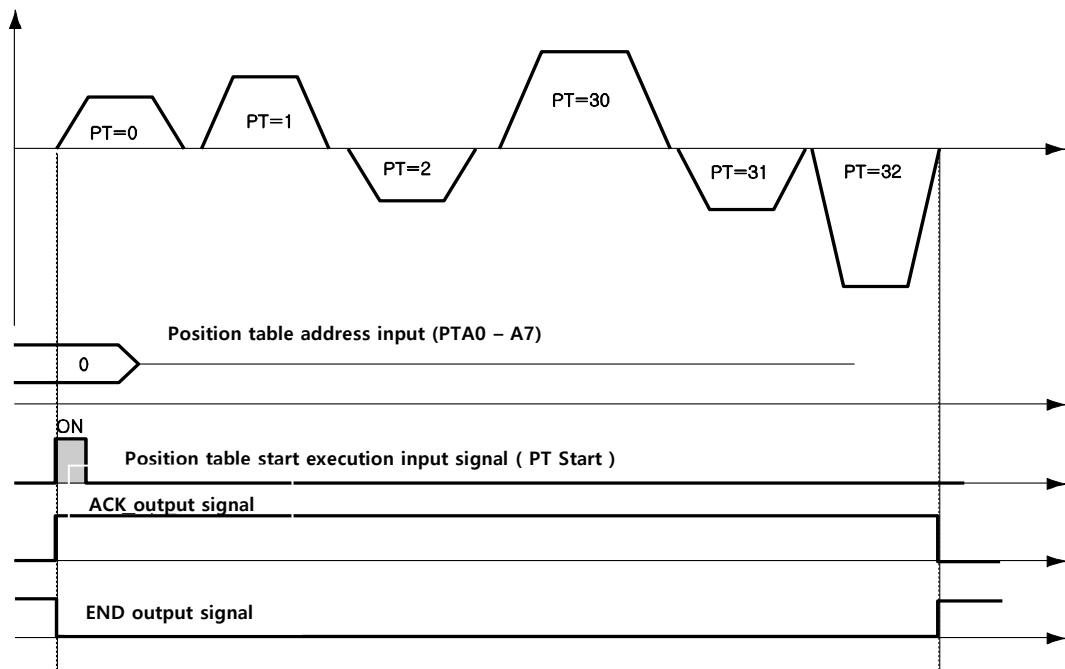
This signal can be used as 'PT A5~A7', and also can be used as 'User IN6~IN8'signal when the input signal 'User IN0~IN5' is not enough.

4) 'Position Table Start (PT Start)' Input

By using PT A0~A7 signals, set and input the running PT start number. Then the motion pattern corresponds to the PT No. will be executed.

Following example shows that total 6 motion patterns are in order to execute from No.0 to No.32 and then stopped.

- 1) All of PT A0~A7 is set to '0' and PT number is set to '0'.
- 2) Set PT Start signal to [ON], and PT No.0 motion pattern will be executed.
- 3) When the motion pattern is started by PT, ACK signal and END signal are displayed to [ON] at CN1 output port as illustrated below. The signal is kept until one motion pattern loop is stopped. After all motions are stopped, the output signal level is set to [OFF].
- 4) PT Start signal is **edge trigger** type and pulse scale is 10ms or more.

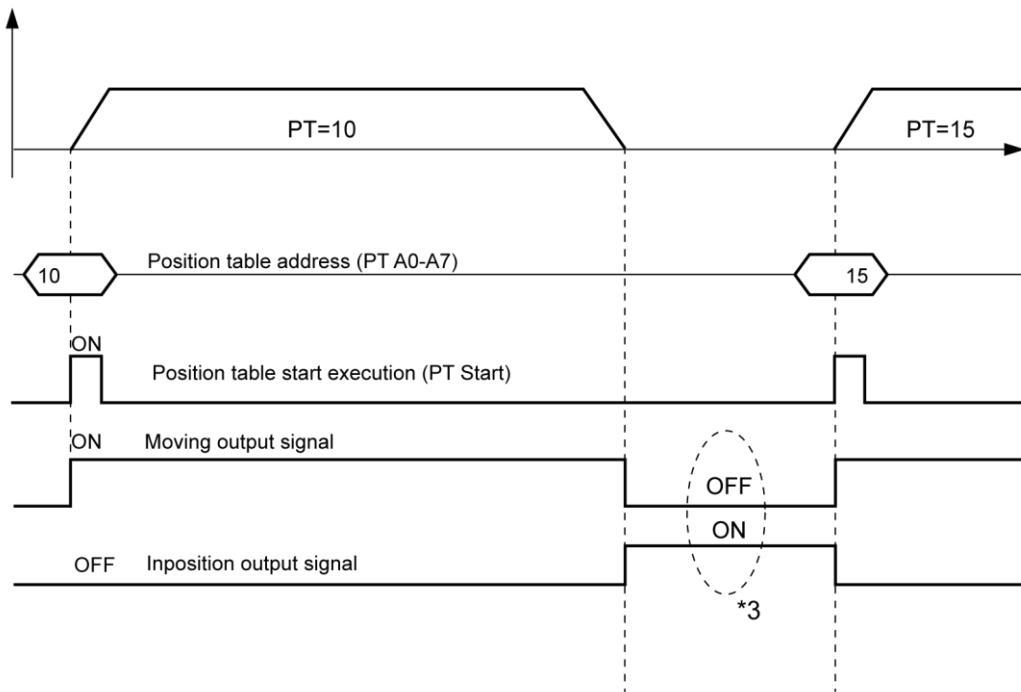


*1. Timing of signals : PT A0~A7 signals must be set before(50msec) PT Start signal set to [ON].

*2. If the PT A0~A7 signals are not used and the PT Start signal set to [ON] the PT No. 0 will be executed..

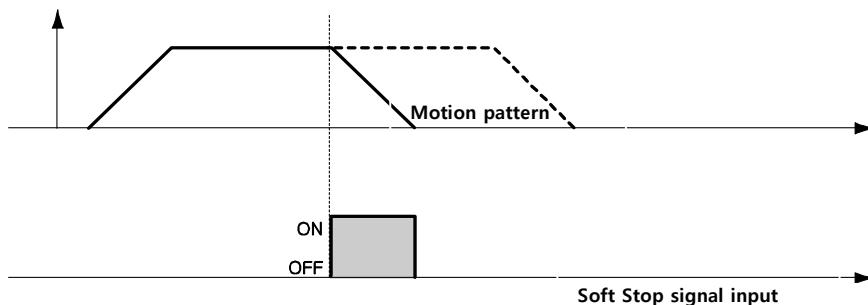
*3. Checking the 'Moving' and 'In-position' signals:

Between sequential 'PT Start' motion command signal, the checking step for motion status(Moving, In-position) is needed before next motion command.



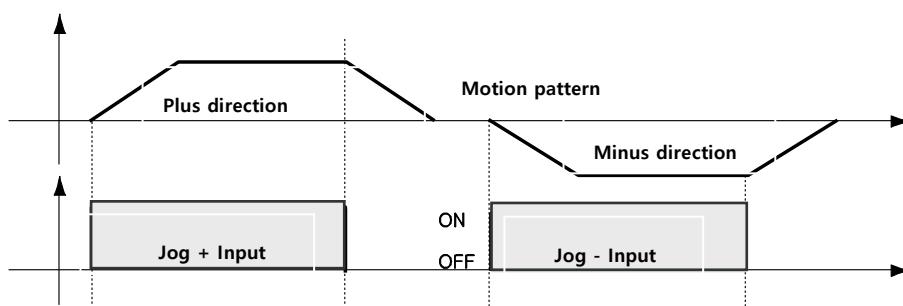
5) Stop input

Soft stop input signal is to stop motion patterns under operation. The deceleration condition until they stop complies with the deceleration time value and the start speed value set previously. The soft stop signal is active in ON level and pulse scale is 10ms or more.



6) Jog+ and Jog- input

When Jog+ or Jog- signal is ON, the motor rotates clockwise or counterclockwise until it reaches the hardware limit or the software limit. Jog motion pattern is subject to jog related parameters (No.7: start speed, No.6: speed, No.8: Acc Dec time).



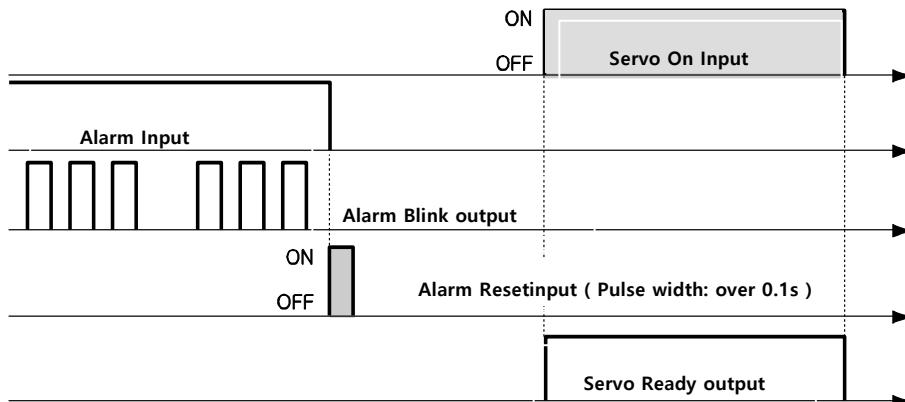
7) Servo ON and Alarm Reset Input

When the protective function of drive executes, alarm output is released. When AlarmReset input is set to ON, alarm output and alarm blink output are released. Before releasing alarm output, the user must remove any cause of alarm operating.

When Servo ON/OFF signal is set to OFF, the drive stops supplying the current to the motor and so the user can directly adjust the output position. When Servo ON/OFF signal is set to ON, the drive restarts to supply the current to the motor and its torque is recovered. Before operating the motor, the user must set it to ON.

When the drive is set to Servo ON, CN1 connector's <ServoReady> output signal is set to ON. Servo ON signal is **edge trigger** type and pulse scale is 10ms or more.

 Caution	If the 'Servo ON' signal is assigned to input pin, Servo ON command from GUI or DLL library will not executed.
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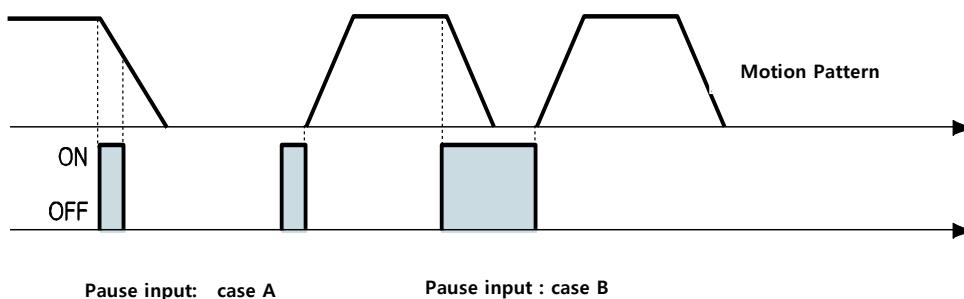
- *1. If 'No.0: Pulse per Revolution' in the parameter list is changed, the motor is set to Servo OFF.
- *2. After 'ServoON' signal is assigned to input pin, it is impossible to use 'SERVO ON' button in User Program(GUI).
- *3. After 'ServoON' is executed, the 'Command Position' value will be changed as same as 'Actual Position' value to remove 'Position Error'.

8) Pause Input

When Pause signal is set to ON, the motion in service is stopped. There are two pause signal operation modes as follows.

- ① Case A : When Pause signal is set to ON, the motor starts to decelerate. Pause signal becomes OFF before the motor is completely stopped. To start motion, Pause signal should be set to ON.
- ② Case B : When Pause signal is set to ON, the motor starts to decelerate. The signal is continuously maintained since the motor is completely stopped. To start motion, Pause signal should be set to OFF.

Pause signal pulse scale is 10ms or more.

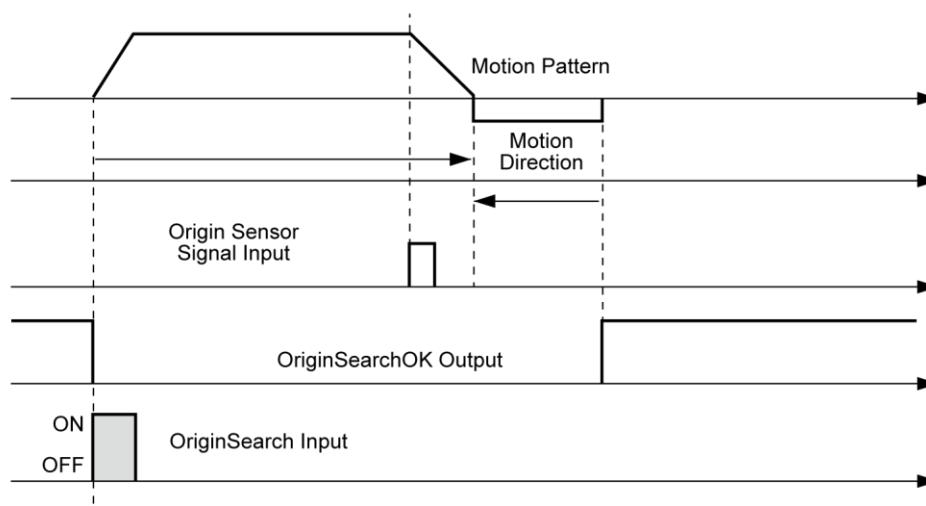


*1. This function is not applied while 'Repeat Test' of the User Program (GUI) is executing.

*2. This function is not applied while 'Push Motion' positioning.

9) Origin Search Input

When 'Origin Search' signal is set to ON (10ms or more), it starts to search the origin position according to selected conditions. The conditions are subject to parameters such as No.20:Org Method, No.17:Org Speed, No.18:Org Search Speed, No.19:Org AccDec Time, No.21:Org Dir. (For more information, refer to '[10 Parameter](#)'). When the origin search command is completed, 'Origin Search OK' signal is set to ON to CN1 connector's output port.

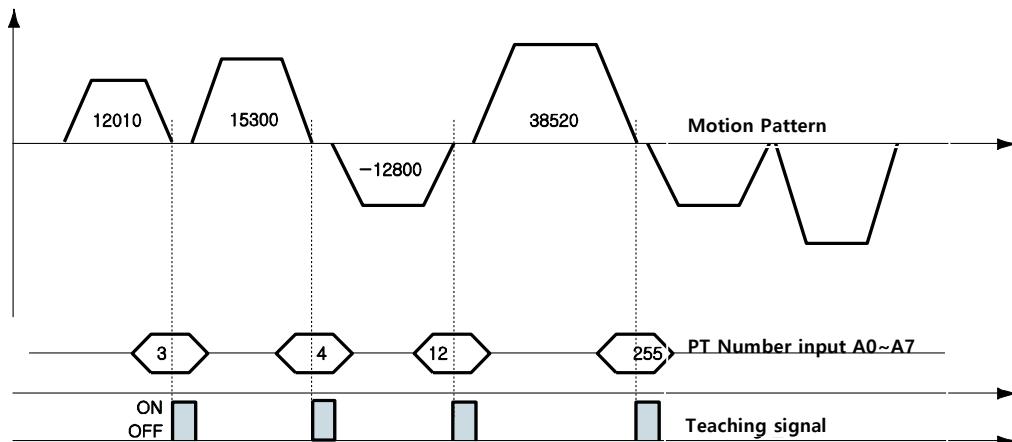


10) Teaching Input

[Teaching] signal functions that the position value [pulse] being working can be automatically inputted into a 'position' value of a specific position table. If it is hard to calculate the exact moving distance (position value) of specific motion mechanically, the user can measure and set the distance (position value) easily by using this signal.

- 1) By using User Program (GUI), set a command type of corresponding PT number among 4 kinds of **absolute moving commands (Absolute Move)**.
- 2) By using input signal (PT A0~A7), select corresponding PT number.
- 3) When Teaching signal is set to ON, the position value [pulse] is saved to the position value of corresponding PT. At this time, it becomes the absolute position value.
- 4) Teaching signal pulse scale is 10ms or more.

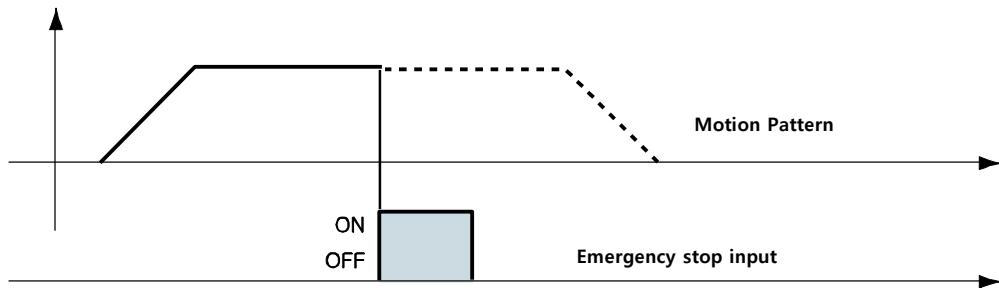
* After executing Teaching, click 'Refresh' icon, and the position value will be displayed to the position table.
 * Click 'Save to ROM' icon, and the position value will be saved to the ROM area.
 * Teaching signal can be used by two methods; the user assigns actual signal to the motor, or he clicks 'Teaching' icon at the 'I/O Monitoring' window of User Program(GUI).



PT No.	Position Value [pulse] of Corresponding PT
3	12010
4	15300
12	-12800
255	38520

11) E-Stop Input

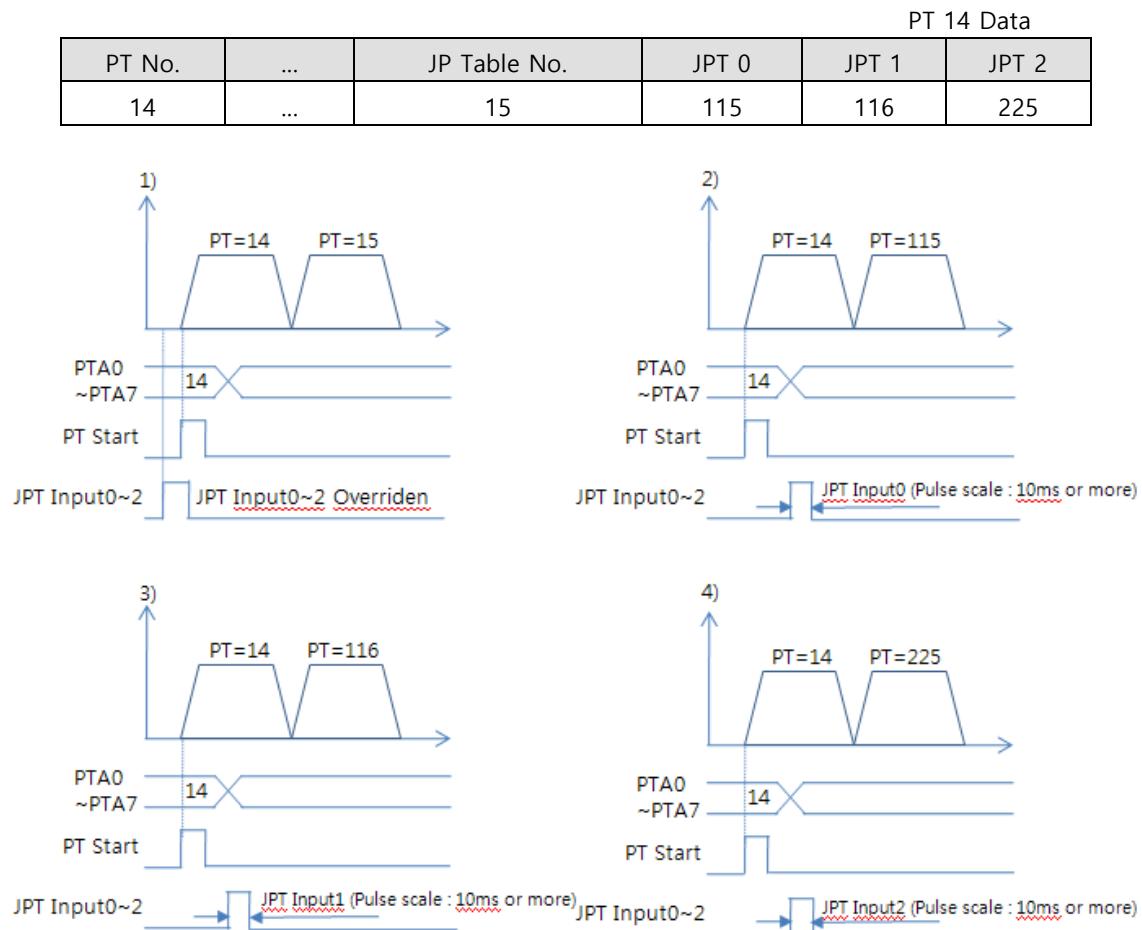
When [Emergency stop] signal is set to [ON] the current motion is stopped immediately without deceleration. E-Stop signal is active in ON level and pulse scale is 10ms or more.



12) JPT Input0~Input2 (Jump Position Table Input) Input

Select motion pattern (position table number) to be subsequently executed according to input signal conditions.

【Example】 If PT 14 motion operates, when there is no other input signal, next motion becomes PT 15 as shown in Figure 1). However, if 'JPT Input0~Input2' input signal is set to ON while PT 14 is executing, each corresponding position number is executed as shown in Figure 2)~4).

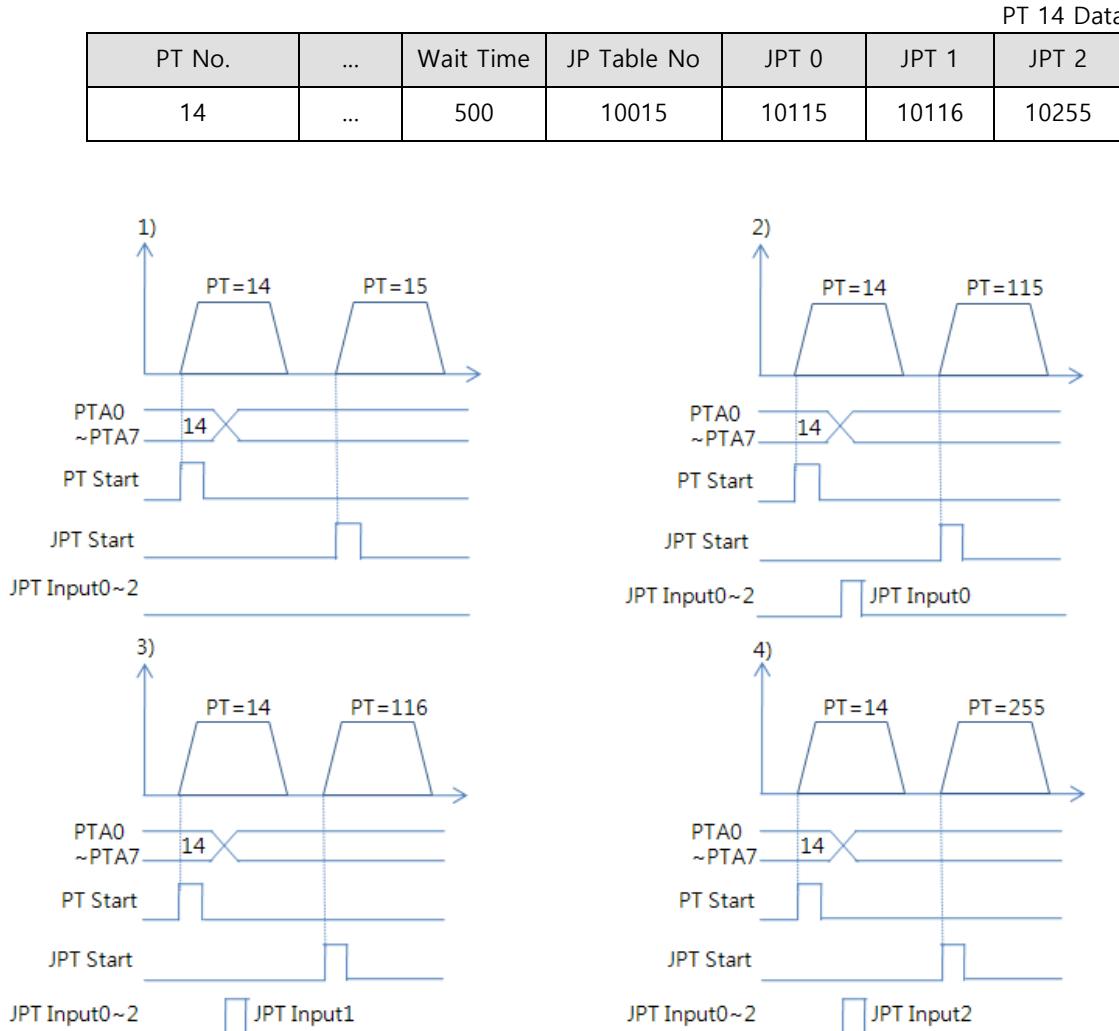


13) JPT(Jump Position Table) Start Input

To select motion pattern (position table number) to be subsequently executed according to input signal conditions. The difference from Paragraph 「12) JPT Input0~Input2 Input」 is:

- 1) PT number to be jumped must be composed to 10XXX;
- 2) Next motion is not executed until 'JPT Start' is set to ON. If 'Wait Time' value of PT data is more than '0', the time lapses additionally and then next motion is executed.

【Example】



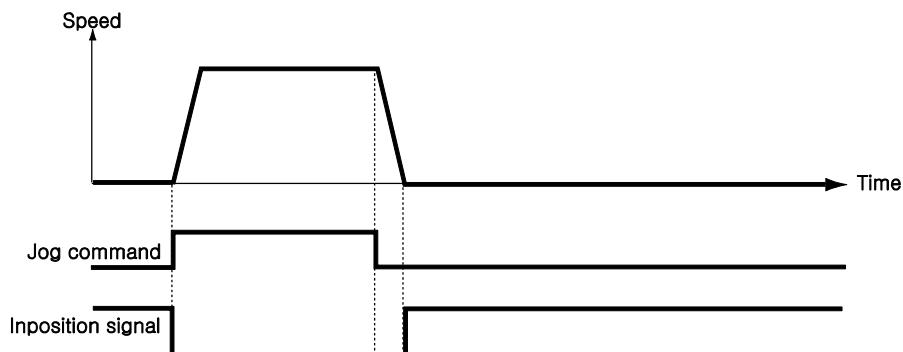
6 - 4 . Output Signal

1) 'Compare Out' / 'Trigger Pulse Output' Output

'Trigger Pulse Output' signal is displayed when specific conditions are performed. It is fixed to CN1 connector's COMP (Compare Out) pin. And it is available when the motor needs to be synchronously controlled by an external controller. Refer to [「8.5 Trigger Pulse Output」](#).

2) In-position Output

After the motor stop in target position exactly on Servo ON status, the signal becomes [ON]. The condition of this signal depends on parameter 'Position Loop Gain' and 'Inpos Value'.



* Time delay of Output signal depends on the parameter 'Inpos' Value':

Value	Mode	Description
0~63	Fast mode	Output the signal in 1[msec] after the motor stop in target position.
64~127	Accurate mode	Output the signal in maximum 100[msec] after the motor stop in target position. (Time is needed to check find exact positioning)

3) Alarm and Alarm Blink Output

When the motor operates normally, alarm output becomes OFF. When the protective function operates, alarm output becomes ON. The upper controller being used by the user detects this alarm and then stops motor operation command. If overload or overcurrent occurs while the motor is operating, the drive detects it and cuts off the motor's current. And alarm output is set to ON and also 'AlarmBlink' flash so that the user can check abnormality type.

The following table shows alarm type according to LED flash count.

Flash Count	Alarm Name	Description
1	Overcurrent	The current through power devices in inverter exceeds the limit value
2	Overspeed	Command speed for motor exceeds 3300[rpm].
3	Position Tracking	Position error value is higher than specified value ^{*1} in position command status. ^{*1}
4	Overload	The motor is continuously operated more than 5 second under a load exceeding the max. torque.
5	Overheat	The internal temperature of the drive exceeds 55°C.
6	Over regenerative voltage	Back-EMF more than limit value. ^{*2}
7	Motor connection	The connection of drive and motor is defective.
8	Encoder connection	The connection of drive and encoder is defective.
10	In-position error	After operation is finished, a position error occurs.
12	ROM error	Read/Write error on ROM device in drive system.
15	Pos. Error Overflow	Position error value is higher than specified value ^{*1} in motor stop status. ^{*3}

^{*1} Values[pulse] of parameter 'Pos Tracking Limit[No.24]

^{*2} Upper limit value : 70[V]

^{*3} Values[pulse] of parameter 'Pos. Error Overflow Limit[No.28]

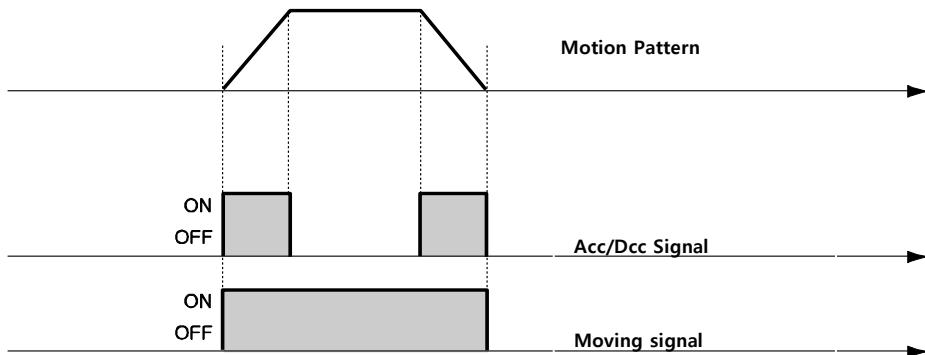
4) PT ACK and PT End Output

'PT ACK' and 'PT End' signals are available only when the motion is executed by position table. When PT ACK signal is set to ON and PT End signal is set to OFF, all motion loops are finished. Then PT ACK signal becomes OFF and PT End signal becomes ON. If the 'Wait time' value in PT item is not 0, the defined time is needed to PT End signal becomes ON.

Refer to [「MECQ1 User Manual – 'Position Table Function」](#).

5) Moving and Acc/Dec Output

As shown below, the position starts to move by motion command, and Moving signal becomes ON and Acc/Dec signal becomes ON in the acceleration and deceleration section only.



* Moving signal is not related to actual position. The signal becomes to [OFF]
Just after the 'position command 'is finished.

6) Org Search OK Output

When the origin return motion is executed by origin search command, 'Origin Search OK' signal is set to OFF. When the origin return motion is normally finished by the origin sensor, 'Origin Search OK' is set to ON. Refer to [「6.3 Input Signal - 8\) Origin Search Input」](#).

7) Servo Ready Output

When the drive supplies power to the motor by **Servo ON** signal or command and is ready to perform motion command, '**ServoReady**' signal displays ON signal. Refer to [「6.3 Input Signal - 7\) Servo On and Alarm Reset Input」](#).

8) PT(Position Table) Output 0~2 Output

Control output used for 'Start/Stop Message Function'. When these items are set, this signal enables the user to check if corresponding PT motion starts or stops through control output signal. If 'Start/Stop Message Function' is not used, this signal should be set to 0 or 8. At the position set with other values, the motion operates as follows.

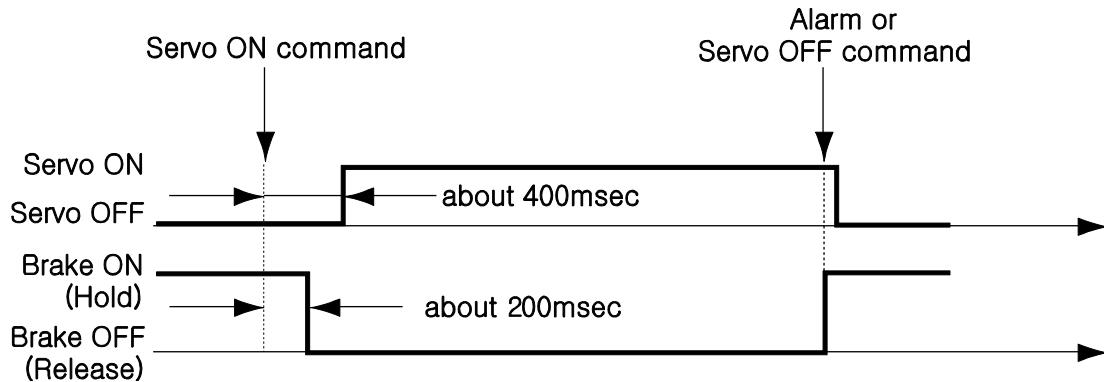
- If PT set items are set to '1~7', when the position starts to move, PT Output HEX value is displayed to 'PT Output 0 ~ PT Output 2'.
- If PT set items are set to '9~15', the position motion is finished and then PT Output HEX value is displayed to 'PT Output 0 ~ PT Output 2'.

For more information, refer to [「MECQ1 User Manual – Position Table Function」](#).

9) BRAKE+ and BRAKE-

This function is used to protect motor rotation in Servo ON status by pin23 And pin24 of CN1 connector. DC +24V is connect to 'BRAKE+' for brake logic and brake control signal is connect to 'BRAKE-'.

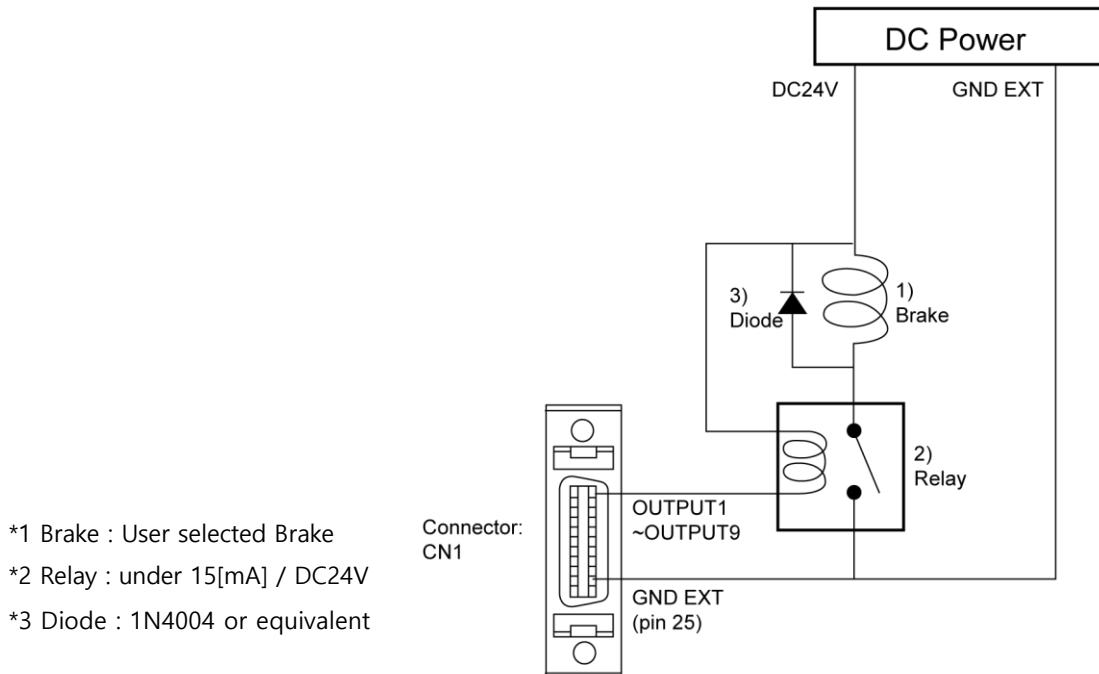
This output function must be used to the Brake that is under 200[mA]/DC24V of current consumption.



10) Brake for High current

This function can be used when the Brake signal is assigned to one of OUTPUT1~OUTPUT9 of CN1 connector. This is used for protect motor rotation in Servo ON status. The signal timing diagram between Servo ON command and Brake signal is same as 9) 'BRAKE+' and 'BRAKE-' Output.

This signal used for the Brake that is over 200[mA]/DC24V of current consumption. Brake, Relay and diode is needed for this function and the signal connection diagram is as follows.



7 . Operation

7 - 1 . Power Supply Timing

MECQ1 is supplied power through drive module to motor. Therefore, connect the drive and the motor with a cable and then supply power to the drive module. After power is supplied, the motor is basically set to Servo OFF.

7 - 2 . Servo ON Operation

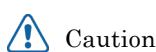
After power is supplied, set the drive module to Servo ON as follows.

- ① Click 'Servo OFF' button at the User Program (GUI).
- ② Give the drive a command through DLL library.
- ③ Assign 'Servo ON' to a control input pin, and supply the drive with the signal through the pin.

After **Servo ON** command is given, In-position is finished to the time as shown below.



T1 can be different subject to the rising time of supplying power and the motor status.



If the 'Servo ON' signal is assigned to input pin, **Servo ON command from GUI or DLL library will not executed.**

7 - 3 . Operation Mode

This controller can do three control operations such as I/O command, communication command (DLL program), and User Program (GUI)

(1) I/O Command Mode

This controller can execute control operation like in-position by I/O command transmitted from the upper controller. The in-position control operation is executed by operating position table with I/O command.

(2) Communication Command Mode

This controller can execute control operation like in-position by command transmitted from the upper controller. The in-position control operation is executed by operating position table with I/O command

Position Table Operation Sequence

It is can executed continuous operation by position table at the I/O command mode.

- ① By using PT A0 ~ PT A7 input signal or DLL program, set PT number to be operated.
- ② In case of Servo OFF, set the controller to Servo ON by communication program or Servo ON

control input.

- ③ Start to operate by rising edge of PT Start input signal or communication program.

Stopping Continuous Operation of Position Table

When the motor is executing continuous operation of position table with MECQ1, stop executing position table by following methods.

- ① To use DLL program or control input signal corresponding to 'Stop' and 'E-Stop'. In this case, operation is completely finished and is not connected to next operation.
- ② The user can click 「Pause」 at User Program(GUI) to temporarily stop operating. In this case, click 「Pause」 again, and remaining operation will be executed again.

Position control Operation

To operate the motor by parameters set by User Program (GUI) or DLL program. (This is not connected with PT operation.)

Once position control operation is started, PT operation command is overridden. Likewise, while PT operation is executing, position control operation command is overridden.

The followings show parameters applied to position control operation. All position table item values are overridden.

Parameter Name	Setting Content	Range
Axis Max Speed	Operation speed after acceleration is finished	1~2,500,000[pps]
Axis Start Speed	Operation start speed before acceleration starts	1~35,000[pps]
Axis Acc Time	Required time until the motor reaches the axis max speed from stop status	1~9,999[ms]
Axis Dec Time	Required time until the motor reaches from the axis max speed to the stop status	1~9,999[ms]
Motion Dir	To select motion direction (CW or CCW)	0~1
Pulse per Revolution	Number of pulses per revolution. The range of 'Axis Max Speed' parameter depends on this value.	0~9

Teaching Function

Teaching can be executed only by User Program(GUI). For more information, refer to [「User Manual – Position Table Function」](#).

8 . Other Operation functions

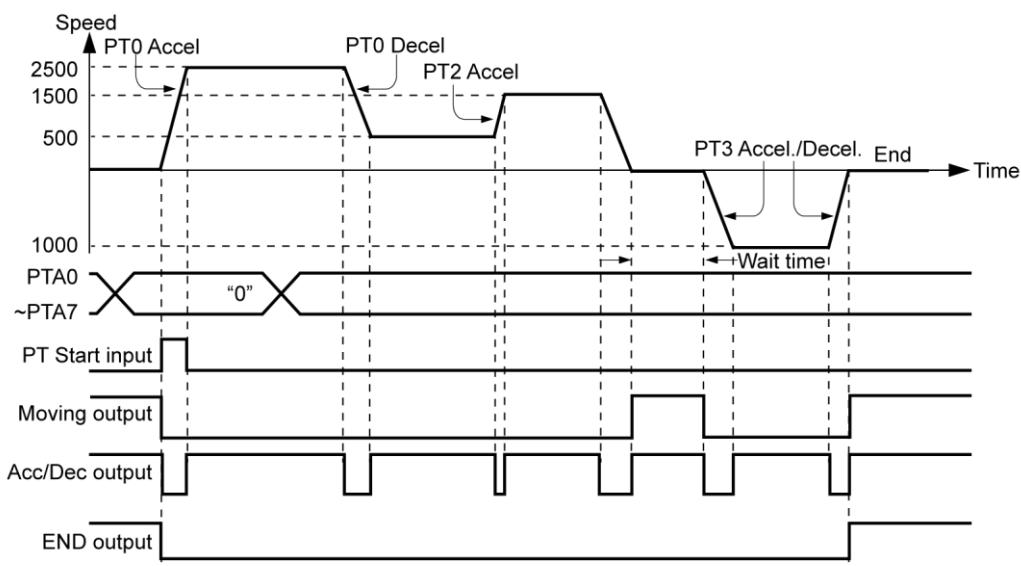
8 - 1 . Position Table(PT) Operation Example

Input 'PT A0~ PT A7' signals to set PT number.

Input 'PT Start' number to execute speed control operation. For more information, refer to [「User Manual – Position Table Function」](#).

【Position Table Setting】

PT No	Command type	Position	Low Speed	High Speed	Accel. time	Decel. time	Wait time	Continuous Action	JP Table No.
0	3	10000	1	2500	50	300	0	1	1
1	3	1000	1	500	-	-	0	1	2
2	3	5000	1	1500	50	300	300	0	3
3	3	-2500	1	1000	300	300	0	0	-

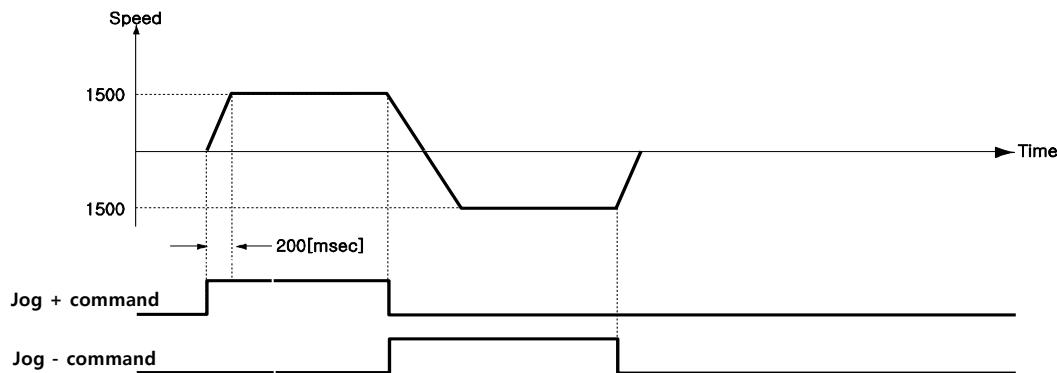


8 - 2 . Jog Operation Example

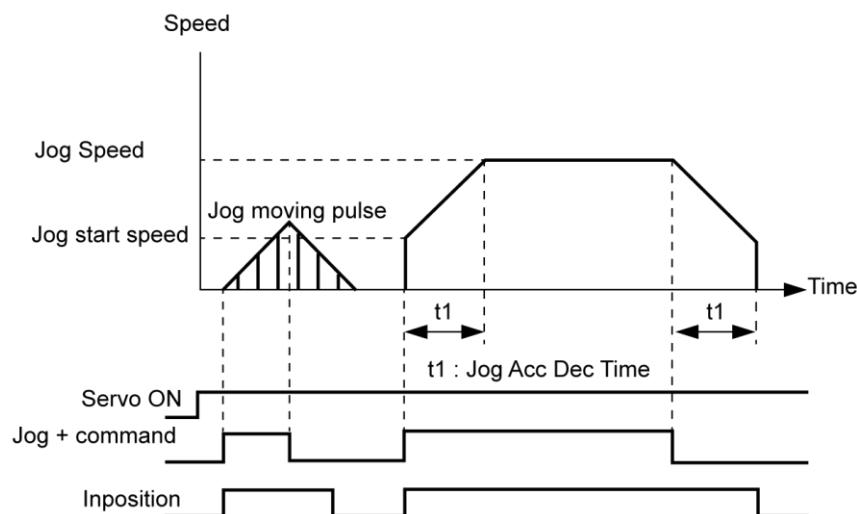
The machine executes speed control operation at the speed set by parameters according to inputting 'Jog+' and 'Jog-' signals.

[Parameter Setting]

No.	Parameter Name	Setting Value	Unit
6	Jog Speed	1500	[pps]
7	Jog Start Speed	100	[pps]
8	Jog Acc Dec Time	200	[msec]



Also, when any value except 0 is set to the 'Jog Start Speed' parameter, the relation between jog command and in-position is indicating as below diagram.



8 - 3 . Origin return

If the machine is operated by I/O signals, the motor can execute origin return by inputting 'Origin Search' signal. Also, the motor can execute origin return with User Program (GUI) and DLL program. The following table shows parameter types related to origin return.

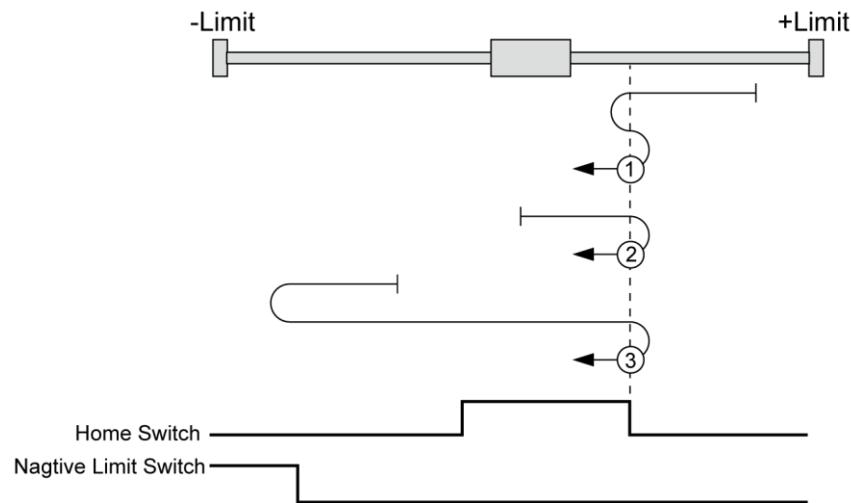
Parameter Name	Description	Range
Org Speed	Operation speed when origin return starts	1~500,000[pps]
Org Search Speed	Low-speed operation speed after origin sensor is sensed and operation start speed when origin starts.	1~50,000[pps]
Org Acc Dec Time	The time assigned to the acceleration/deceleration section when origin return starts and stops.	1~9,999[ms]
Org Method	To select how to return the origin	0~5
Org Dir	To select operation direction(CW or CCW)	0~1
Org Offset	After origin return is finished, the motor moves additionally as this setting value and then stops.	-134,217,727 ~ 134,217,727
Org Position Set	After origin return is finished, 'Command Pos' value is set to this setting value.	-134,217,727 ~ 134,217,727
Org Sensor Logic	To set the origin sensor signal level.	0~1
Org Torque Ratio	To set the torque ratio during Torque origin method	10~100[%]

(1) Origin Return method setting

To execute origin return, 'Org Method' parameter should be set as follows.

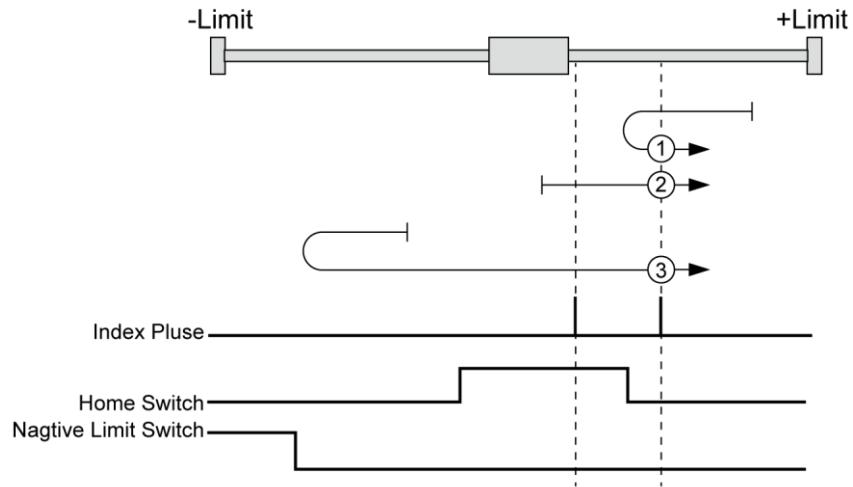
- Arrow mark is for moving direction in below picture.
- ○ is origin end position in below pic..
(Numbers in ○ mark is indication the sensor Dog position or following example of origin direction.)
- Index Pulse is Z Phase
- In the case of origin return by a Z-pulse , after the completion of low speed origin return in 'Org Search Speed' value, Z-pulse origin return (fixed rate) is done twice to complete the return to origin with 10[pps] speed. (Fixed speed)
(It is method for precise return to Z-pulse origin.)

1) Origin (In case of Org Method = 0)



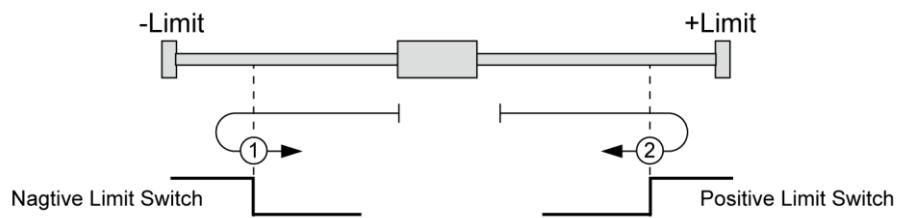
- ① : In case of position of sensor Dog is between the origin and +Limit Sensor
- ② : In case of position of sensor Dog is in the origin sensor
- ③ : In case of position of sensor Dog is between origin and -Limit Sensor

2) Z Origin (In case of Org Method = 1)



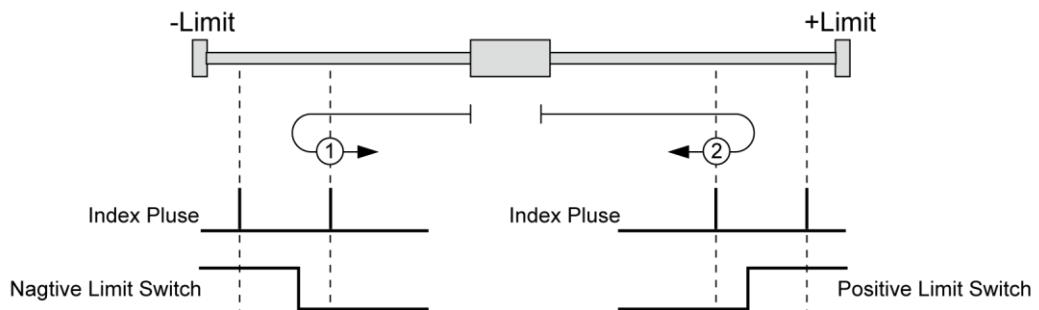
- ① : In case of position of sensor Dog is between the origin and +Limit Sensor
- ② : In case of position of sensor Dog is in the origin sensor
- ③ : In case of position of sensor Dog is between origin and -Limit Sensor

3) Limit Origin (In case of Org Method = 2)



- ① : In case of Org Dir is 1 (CCW)
- ② : In case of Org Dir is 0 (CW)

4) Z Limit Origin (In case of Org Method = 3)

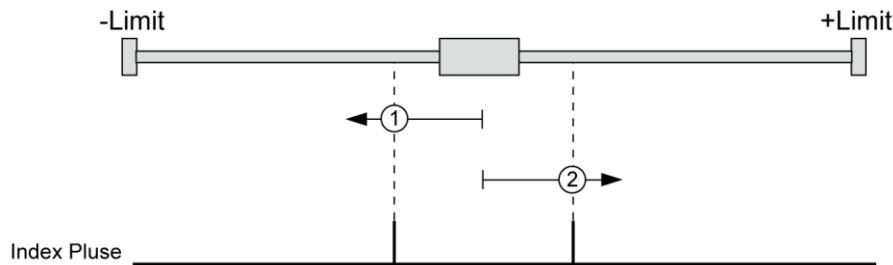


- ① : In case of Org Dir is 1 (CCW)
- ② : In case of Org Dir is 0 (CW)

5) Set Origin (In case of Org Method = 4)

It designates current mechanics position as origin irrespective sensor.

6) Z Phase (In case of Org Method = 5)



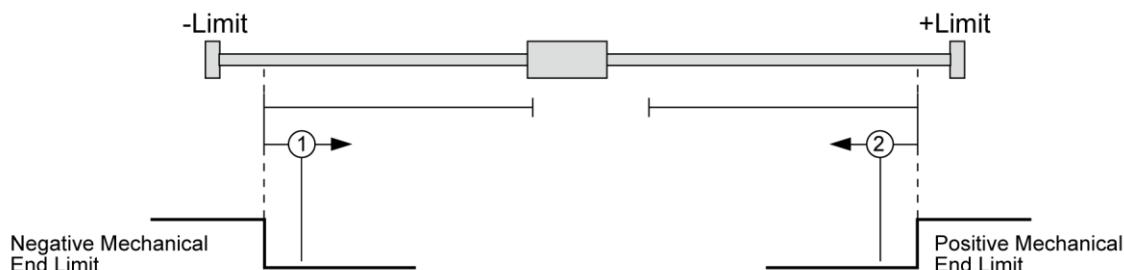
① : In case of Org Dir is 1 (CCW)

② : In case of Org Dir is 0 (CW)

7) Torque Origin (In case of Org Method=6)

During In movement motion by 'Org Speed' value , motion stop when detecting the force as much as 'Org Torque Ratio' by contact with particular object, and finished origin return after moving to opposite origin return direction of certain position.

This method can be used in system of origin sensor or no Limit sensor supporting.



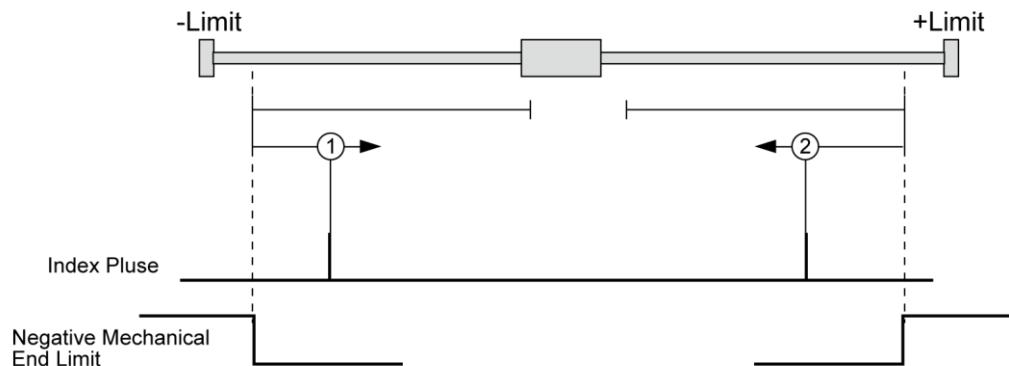
① : In case of Org Dir is 1 (CCW)

② : In case of Org Dir is 0 (CW)

8) Torque Origin (In case of Org Method=7)

'During In movement motion by 'Org Speed' value , motion stop when detecting the force as much as 'Org Torque Ratio' by contact with particular object, finished origin return when detecting the Z phase during the moving to opposite origin return direction.

This method can be used in system of origin sensor or no Limit sensor supporting.



① : In case of Org Dir is 1 (CCW)

② : In case of Org Dir is 0 (CW)

(2) Origin Return Procedure

Origin return is executed according to the following procedure.

- ① Set parameters required to origin return.
- ② If the Servo is OFF, (reset an alarm when it occurs) input a control input Servo ON command or send a communication program so that the Servo can be ON.
- ③ Start origin return operation to the rising edge of control input origin search or the communication program.

(3) Interruption of Origin Return

When the machine is under origin return, click 'Stop' or 'E-Stop' to stop the machine. In this case, the machine's origin is not edited and origin return is not completed either.

(4) Output of Origin Return Finish

The completion of origin return operation can be decided with related bit values of either 'Origin Search OK' of control output or 'Axis Status' of communication program.

8 - 4 . Stop Operation

By using two methods of control input and communication program command, the user can input stop and emergency stop commands. Even though the emergency stop command is inputted, the Servo will be not OFF. In case emergency stop, the machine stops immediately without deceleration. So, a special caution for mechanical impact is required.

8 - 5 . Trigger Pulse Output

This function is used when the output signal becomes ON periodically in specific condition.

(1) Control Method

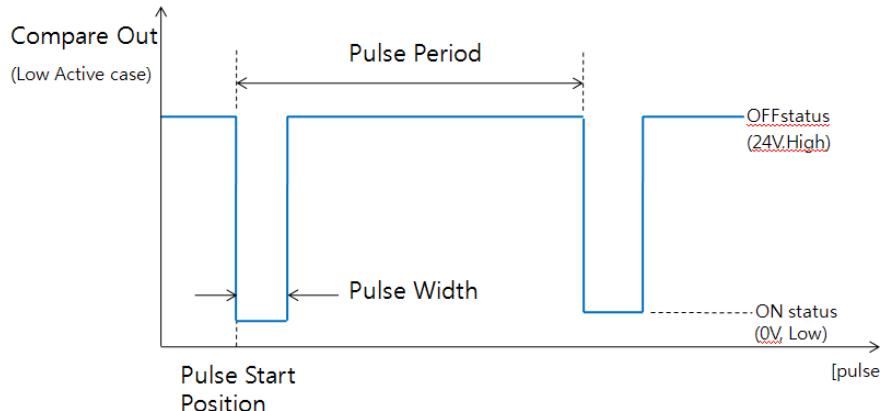
This function is working with RS-485 communication (DLL library) method only.

This command can be executed during the positioning command or before the positioning command also. The following table shows the setting conditions and refers to
「User Manual – Communication Function」.

Setting Item	Description	Range
Start/Stop	Setting start/stop of pulse output.	0~1
Pulse Start Position	Setting the start position of first pulse output.	-134,217,727 ~ 134,217,727
Pulse Period	Setting the pulse period. (0 : pulse output only 1 time in Pulse start position. 1~ : pulse output repeatedly depends on setting.)	0~134,217,727 [pulse]
Pulse Width	Setting the pulse width.	1~1000[ms]

(2) Output signal

This output pin of CN1 connector for Trigger Pulse is fixed to 「Compare Out」 and the signal diagram is as follows.



Caution

The pulse is output only in bigger position area than 'pulse starts position' and is output in both motion directions.

(3) Status Check

By using DLL program, the user can check the trigger pulse output status.

Refer to 「User Manual – Communication Function」.

8 - 6 . Push Motion Function

This function is used when the specified motor torque is needed during motioning and Stop (only in Stop-mode) status..

(1) Function

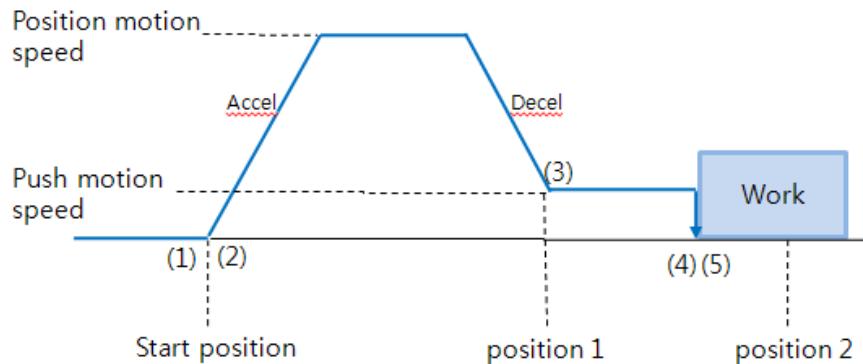
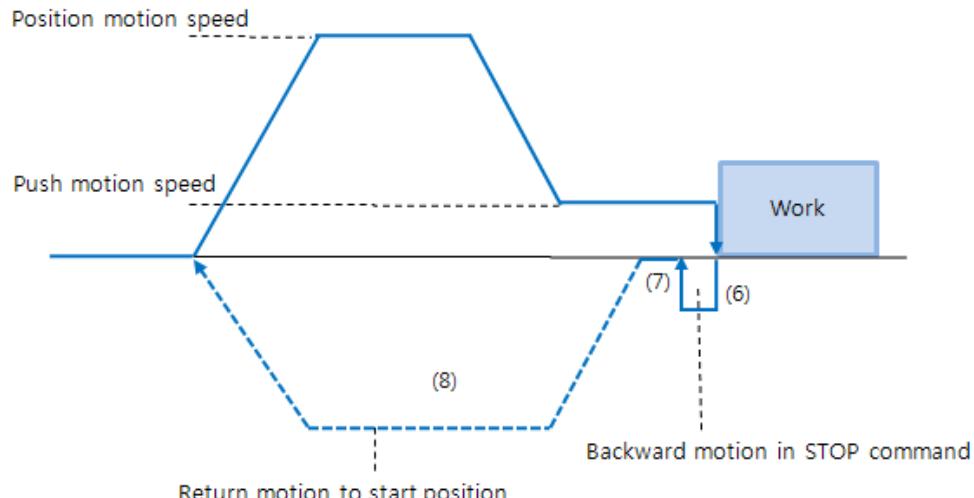


Fig 10.6.1

- 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)
The motioning will stop just after the work detected.
- ⑤ When Push mode is 'Stop':
After the work detected, the motor will stop but the motor torque will be maintained and the 'inposition' / 'PT Stopped' / 'END' signal is effective.
The maintained motor torque will be return to normal (Servo ON) status by 'stop' command.
(status : release push mode and return to position mode)
- When Push mode is 'Non-stop':
After the work detected, the motor will not stop and the motor torque will be maintained and the 'inposition' and other signal is effective.
- ⑥ Additional next step is needed as below diagram (Figure 10.6.2).



Pig 10.6.2

The 'Stop' command must be executed before next motion command. (In Stop mode it does not need to 'stop' when there is no shock in mechanism) At this 'stop' procedure, the motor move to backward as much as the 'Push mode' parameter values. This motion will be reduce the shock in mechanism. So if the Stop command is not used, 'Backward motion' is also not executed. 'Backward motion' speed is set to 5000[pps] at this moment.

- ⑦ Time delay can be needed before returning to start position depends on mechanical conditions.
- ⑧ Return to start position.

 Caution	Non-stop mode : must be execute the 'Stop' command before next motion command in the work detect situation.
---	--

 Caution	If there is shock in mechanism, the time delay is needed after 'Stop' operation.
---	---

(3) Setting Method

This function is working only in absolute position value. The position error can be happened due to the work status in push mode. Push motion command can be executed by 2 methods. One is RS-485 communication (DLL library) method and the other is external digital signal(PT Start command) method.

① DLL library method

The following table shows the setting conditions and refer to [「User Manual – Communication Function」](#).

There is another library for status checking of push motioning.

The position values of using for Push Motion are all absolute coordinate values

Setting Item	Description	Range *1
Position command Start speed	Start speed value of position motion	1~35000[pps]
Position command Moving speed	Moving speed of position motion	1~500000[pps]
Position command Target position	Absolute target position value of position command ('position 1' of Figure 10.6.1)	134,217,727 ~ 134,217,727
Accel time	Accel time of position motion	1~9,999[ms]
Deceleration time	Decelerate time of position motion	1~9,999[ms]
Push ratio	Motor torque value in push mode	20~90[%]
Push command Moving speed	Moving speed of Push motion (max 200[rpm])	1~33333[pps]
Push command Target position	Absolute target position value of push command ('position 2' of Figure 10.6.1) *Non-stop mode : the value must be set more than 'Position command Target Position' value.	134,217,727 ~ 134,217,727

Push mode	Set Stop mode(0) or Non-stop mode(1~10000) after the work detect. In case of Non-stop mode, the motor move backward as much as this value[pulse] distances.	0~10,000
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*1 : The unit of [pps] in this item is referenced to 10,000[ppr] encoder.

② Input signal (PT Start) Method

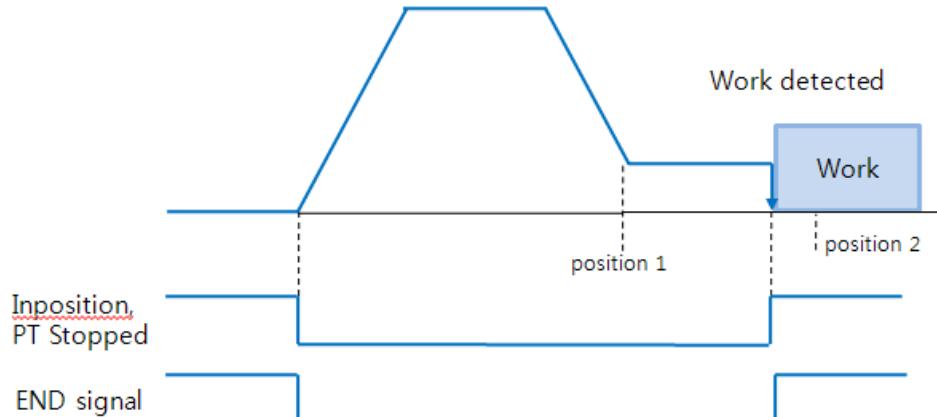
Firstly the position table data must be entered before the push motioning and refer to [「User Manual – Position Table Function」](#).

(4) Status check

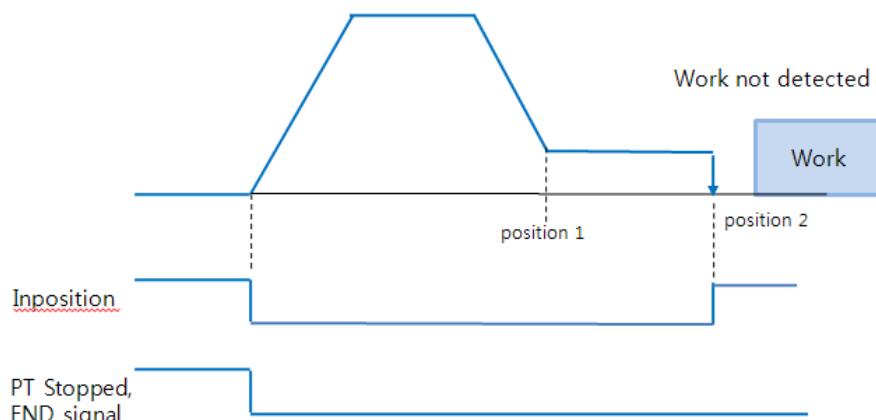
Basically the current push motion status can be checked by DLL library and

Additionally can be checked by Flag (Inposition & PT Stopped signal) and Output (END signal) as follows.

① Work detected



② Work not detected (Stop mode)



The 'Inposition' signal is still OFF when the work is not detected in **Non-stop mode**. The push command is stopped at 'position 2' (absolute position value in push command).

9 . Communication Function

In case of RS-485, up to 16 axes can be controlled by the multi-drop link(daisy chain).



If Windows goes to the stand-by mode, serial communication is basically disconnected. So, after recovering from the stand-by mode, the user should connect communication again. This content is equally applied to the library provided with the product.

9 - 1 . Connection with the PC

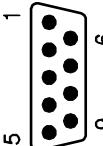
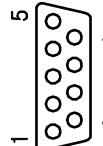
There are one method of connecting between the drive and the PC by RS-485(serial communication). PC's RS-232C port can be used. By using following communication converters according to each communication type, the user can connect the PC and the drive module. The maximum communication speed is 115200[bps] with RS-232 to RS-485 converter



For connection with the PC, refer to [「4. Controller Configuration」](#).

1) Cable of Connecting RS232 Port (to PC) and Converter (RS232 ↔ RS-485)

Normally Power does not need to be supplied to the converter module. But when the communication have problems without power, DC 5~24V external power can be connected. The signal is wired as follows

PC Connector (DB-9 female)		Cable Connection	Convertor Connector (DB-9 male)	
Pin Layout	Pin No		Pin No	Pin Layout
	1	1	1	
2	2	2	2	9
3	3	3	3	8
4	4	4	4	7
5	5	5	5	6
6	6	6	6	5
7	7	7	7	4
9	9	9	9	3
Frame GND	Frame GND	Frame GND	Frame GND	Frame GND

2) Cable of connecting RS-485 Converter and Drive Module(CN5 : MECQ1 only)

Connector Type : RJ45

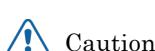
Cable Type : LAN cable, CAT5 or better (UTP or STP)

Signal Wiring : Standard Straight Wiring

(1<->1, 2<->2, 3<->3, ..., 8<->8)

If multi-axis connection is required at one segment, up to 16 drive modules can be connected by the daisy-chain method. The pin signal content is as follows.

RJ45 Pin No.	UTP CAT5E cable	Function
1	White/Orange	GND
2	Orange	GND
3	White/Green	Data+
4	Blue	GND
5	White/Blue	GND
6	Green	Data-
7	White/Brown	GND
8	Brown	GND
case		Frame GND



Caution "The fixing pin of connector is connected with the Frame GND through a mount hall of the PCB. In this case, use the STP CAT5E cable

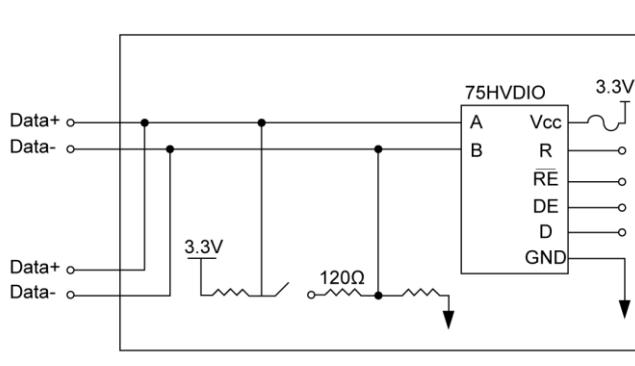


Caution The cable length of RS-485 Converter<->Drive or Drive<->Drive must be longer than 60 cm.



Caution Signal cable 'Data+' and 'Data-' are differential type signals. These two signal cables must be **twisted**.

9 - 2 . Communication Interface Circuit



The above figure shows an I/O circuit of RS-485 communication interface signal. When communication is connected, MECQ1 maintains to receive stand-by status. It performs sending only when it receives the signal from upper communication and then replies. For more information about communication function, refer to [「User Manual – Communication Function」](#) in a separate volume.

10 . Parameter

10 - 1 . Parameter list

No.	Name	Unit	Lower Limit	Upper Limit	Default
0	Pulse Per Revolution		0	15	6
1	Axis Max Speed	[pps]	1	2,500,000	500,000
2	Axis Start Speed	[pps]	1	35,000	1
3	Axis Acc Time	[msec]	1	9,999	100
4	Axis Dec Time	[msec]	1	9,999	100
5	Speed Override	[%]	1	500	100
6	Jog Speed	[pps]	1	2,500,000	5,000
7	Jog Start Speed	[pps]	1	35,000	1
8	Jog Acc Dec Time	[msec]	1	9,999	100
9	S/W Limit Plus Value	[pulse]	-134,217,728	134,217,727	134,217,727
10	S/W Limit Minus Value	[pulse]	-134,217,728	134,217,727	-134,217,728
11	S/W Limit Stop Method		0	2	2
12	H/W Limit Stop Method		0	1	0
13	Limit Sensor Logic		0	1	0
14	Org Speed	[pps]	1	500,000	5,000
15	Org Search Speed	[pps]	1	50,000	1,000
16	Org Acc Dec Time	[msec]	1	9,999	50
17	Org Method		0	7	0
18	Org Dir		0	1	1
19	Org OffSet	[pulse]	-134,217,728	134,217,727	0
20	Org Position Set	[pulse]	-134,217,728	134,217,727	0
21	Org Sensor Logic		0	1	0
22	Position Loop Gain		0	63	4
23	Inpos Value		0	63	0
24	Pos Tracking Limit	[pulse]	1	134,217,727	1,000
25	Motion Dir		0	1	0
26	Limit Sensor Dir		0	1	0
27	Org Torque Ratio	[%]	20	90	50
28	Pos. Error Overflow Limit	[pulse]	1	134,217,727	1,000
29	Brake Delay Time	[msec]	10	5,000	200
30	Run Current	*10[%]	5	15	10
31	Boost Current	*50[%]	0	7	0
32	Stop Current	*10[%]	2	10	5

10 - 2 . Parameter Description

No.	Description	Unit	Lower Limit	Upper Limit	Default																																				
0	<p>Pulse per Revolution : Number of pulses per revolution. If this value is changed, the motor is set to Servo OFF..</p> <table border="1"> <thead> <tr> <th>Value</th><th>Pulse/Revolution</th><th>Value</th><th>Pulse/Revolution</th></tr> </thead> <tbody> <tr><td>0</td><td>500</td><td>8</td><td>6400</td></tr> <tr><td>1</td><td>2,000</td><td>9</td><td>8000</td></tr> <tr><td>2</td><td>1,600</td><td>10</td><td>10000</td></tr> <tr><td>3</td><td>2,000</td><td>11</td><td>20000</td></tr> <tr><td>4</td><td>3,200</td><td>12</td><td>25000</td></tr> <tr><td>5</td><td>3,600</td><td>13</td><td>36000</td></tr> <tr><td>6</td><td>4,000</td><td>14</td><td>40000</td></tr> <tr><td>7</td><td>5,000</td><td>15</td><td>50000</td></tr> </tbody> </table>	Value	Pulse/Revolution	Value	Pulse/Revolution	0	500	8	6400	1	2,000	9	8000	2	1,600	10	10000	3	2,000	11	20000	4	3,200	12	25000	5	3,600	13	36000	6	4,000	14	40000	7	5,000	15	50000		0	15	6
Value	Pulse/Revolution	Value	Pulse/Revolution																																						
0	500	8	6400																																						
1	2,000	9	8000																																						
2	1,600	10	10000																																						
3	2,000	11	20000																																						
4	3,200	12	25000																																						
5	3,600	13	36000																																						
6	4,000	14	40000																																						
7	5,000	15	50000																																						
1	<p>Axis Max Speed : When position moving commands (absolute move, incremental move) are given, this mode sets the maximum speed which the motor can operate. So, the motor cannot be operated faster than this value in any case. This value is set to [pps] unit. Upper Limit value has limited by Pulse per resolution value *In case of 10000 : 500,000 In case of 20000 : 1,000,000</p>	pps	1	2,500,000	500,000																																				
2	<p>Axis Start Speed : When position moving commands (absolute move, incremental move) are given, this mode sets the operation start speed to [pps] unit.</p>	pps	1	35,000	1																																				
3	<p>Axis Acc Time : When position moving commands (absolute move, incremental move) are given, this mode sets the acceleration section of operation start segment to [msec] unit. Possible range is different from Axis Speed. (Ex.1) Axis Start Speed=1, Move Speed=400000 : 1~1430 [msec] (Ex.2) Axis Start Speed=1, Move Speed=10000 : 1~350 [msec]</p>	msec	1	9,999	100																																				
4	<p>Axis Dec Time : When position moving commands (absolute move, incremental move) are given, this mode sets the deceleration section of operation stop segment to [msec] unit. Possible range is different from Axis Speed same as 'Axis Acc Time' parameter</p>	msec	1	9,999	100																																				
5	<p>Speed Override : When position moving commands (absolute move, incremental move) are given, the operation speed is subject to the ratio set to 'Move Speed'. (Ex) If current move speed is 10,000 and speed override is 200, actual motion speed is set to 20,000.</p>	%	1	500	100																																				

6	Jog Speed : When jog position moving command is given, this mode sets the motor revolution value to [pps] unit.	pps	1	2,500,000	5,000
7	Jog Start Speed : When jog position moving command is given, this mode sets the operation start speed to [pps] unit.	pps	1	35,000	1
8	Jog Acc Dec Time : In case of jog operation, this mode sets the time of acceleration and deceleration sections to [msec] unit.	msec	1	9,999	100
9	S/W Limit Plus Value : When position moving commands (absolute move, incremental move, jog) are given, this move set the maximum input limit that the motor can move to the plus (+) direction with 28 bits.	pulse	-134,217, 728	+134,217, 727	+134,217, 727
10	S/W Limit Minus Value : When position moving commands (absolute move, incremental move, jog) are given, this move set the minimum input limit that the motor can move to the minus (-) direction with 28 bits.	pulse	-134,217, 728	+134,217, 727	-134,217, 728
11	S/W Limit Stop Method : Sets how to stop the motor by SW Limit Plus/Minus Value', not stop motion by the limit sensor. ◆ 0 : stops the motor immediately by emergency stop mode. ◆ 1 : stops the motor gradually by soft stop mode. ◆ 2 : Do not use S/W Limit.		0	2	0
12	H/W Limit Stop Method: In case of stop motion by the limit sensor, this mode sets how to stop the motor. ◆ 0 : stops the motor immediately by emergency stop mode. ◆ 1 : stops the motor gradually by soft stop mode.		0	1	0
13	Limit Sensor Logic : Sets the signal level so that the motor can recognize limit sensor's input to ON. ◆ 0 : 0 V (Active low level) ◆ 1 : 24V(Active high level)		0	1	0
14	Org Speed : In case of origin return command, this modes sets the operation speed until the motor senses the origin sensor to [pps] unit	pps	1	500,000	5,000
15	Org Search Speed : In case of origin return command, The low operation speed for precise origin return after the motor senses the origin sensor is set to [pps] unit by this mode	pps	1	500,000	1,000

16	Org Acc Dec Time : In case of origin return command, the acceleration/deceleration section time of the operation start/stop segment is set to [msec] unit by this mode	msec	1	9,999	50
17	Org Method : The user can select origin return command types. <ul style="list-style-type: none"> ◆ 0 : The motor moves up to the origin sensor spot by 'Org Speed' and then executes precise origin return at the low value of 'Org Search Speed'. ◆ 1 : The motor moves up to the origin sensor spot by 'Org Speed' and then executes Z-pulse origin return at the low value of 'Org Search Speed'. ◆ 2 : The motor moves up to the limit sensor spot by 'Org Speed' and then immediately stops. ◆ 3 : The motor moves up to the limit sensor spot by 'Org Speed' and then executes Z-pulse origin return at the low value of 'Org Search Speed'. ◆ 4 : To set origin in current mechanical position. ◆ 5 : To execute the Z-pulse origin return at the low value of 'Org Search Speed'. ◆ 6 : The motor moves up to the wall by 'Org Torque Ratio' and then immediately stops. ◆ 7 : The motor moves up to the wall by 'Org Torque Ratio' and then executes Z-pulse origin return at the low value of 'Org Search Speed'. <p>For more information, refer to '8.3 Origin Return'.</p> <p>※ In the case of origin return by a Z-pulse , after the completion of low speed origin return in 'Org Search Speed' value, Z-pulse origin return (fixed rate) is done twice to complete the return to origin with 10[pps] speed. (Fixed speed) (It is method for precise return to Z-pulse origin.)</p>		0	7	0
18	Org Dir : In case of origin return, this mode sets the revolution direction of the motor. <ul style="list-style-type: none"> ◆ 0 : moves the motor clockwise. ◆ 1 : moves the motor counterclockwise. 		0	1	0
19	Org Offset : After origin return is completed, the motor moves additionally as this setting value and then stops. 'Command Pos/Actual Pos' is set to '0'.	pulse	-134,217, 727	+134,217, 727	0
20	Org Position Set : After origin return is completed, 'Command Pos/Actual Pos' value is set to this setting value.	pulse	-134,217, 727	+134,217, 727	0

21	<p>Org Sensor Logic : Sets the origin sensor signal level so that the motor can recognize origin sensor's input to ON.</p> <ul style="list-style-type: none"> ◆ 0 : 0 V (low level) ◆ 1 : 24V(high level) 	0	1	0																																																																																																																																																																																																						
22	<p>Position Loop Gain : After the motor stops, this mode controls the motor's response by a load attached to the motor. This value is a relative value, not a real value In use of internal drive. For example, if this value is changed 3 to 6, not increased the response time two times.</p> <p>If this parameter value is small, motor stop motion become sensitive, motor stop time is getting shorter, and , if value is big stop motion becomes insensitive , motor stop time is getting longer relatively.</p> <p>Set this mode as follows.</p> <ol style="list-style-type: none"> 1) Set the value to '0' 2) Increase the value until the motor's response is stabilized. 3) Previously adjust the setting status by increasing/decreasing one or two steps of the current setting value. <table border="1"> <thead> <tr> <th>Va lu e</th><th>Integral Part's Time Constant*</th><th>Proportion al Gain*</th><th>Va lu e</th><th>Integral Part's Time Constant*</th><th>Proportio nal Gain*</th></tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>1</td><td>32</td><td>5</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>2</td><td>33</td><td>5</td><td>2</td></tr> <tr><td>2</td><td>1</td><td>3</td><td>34</td><td>5</td><td>3</td></tr> <tr><td>3</td><td>1</td><td>4</td><td>35</td><td>5</td><td>4</td></tr> <tr><td>4</td><td>1</td><td>5</td><td>36</td><td>5</td><td>5</td></tr> <tr><td>5</td><td>1</td><td>6</td><td>37</td><td>5</td><td>6</td></tr> <tr><td>6</td><td>1</td><td>7</td><td>38</td><td>5</td><td>7</td></tr> <tr><td>7</td><td>1</td><td>2</td><td>39</td><td>5</td><td>2</td></tr> <tr><td>8</td><td>2</td><td>1</td><td>40</td><td>6</td><td>1</td></tr> <tr><td>9</td><td>2</td><td>2</td><td>41</td><td>6</td><td>2</td></tr> <tr><td>10</td><td>2</td><td>3</td><td>42</td><td>6</td><td>3</td></tr> <tr><td>11</td><td>2</td><td>4</td><td>43</td><td>6</td><td>4</td></tr> <tr><td>12</td><td>2</td><td>5</td><td>44</td><td>6</td><td>5</td></tr> <tr><td>13</td><td>2</td><td>6</td><td>45</td><td>6</td><td>6</td></tr> <tr><td>14</td><td>2</td><td>7</td><td>46</td><td>6</td><td>7</td></tr> <tr><td>15</td><td>2</td><td>8</td><td>47</td><td>6</td><td>8</td></tr> <tr><td>16</td><td>3</td><td>1</td><td>48</td><td>7</td><td>1</td></tr> <tr><td>17</td><td>3</td><td>2</td><td>49</td><td>7</td><td>2</td></tr> <tr><td>18</td><td>3</td><td>3</td><td>50</td><td>7</td><td>3</td></tr> <tr><td>19</td><td>3</td><td>4</td><td>51</td><td>7</td><td>4</td></tr> <tr><td>20</td><td>3</td><td>5</td><td>52</td><td>7</td><td>5</td></tr> <tr><td>21</td><td>3</td><td>6</td><td>53</td><td>7</td><td>6</td></tr> <tr><td>22</td><td>3</td><td>7</td><td>54</td><td>7</td><td>7</td></tr> <tr><td>23</td><td>3</td><td>2</td><td>55</td><td>7</td><td>2</td></tr> <tr><td>24</td><td>4</td><td>1</td><td>56</td><td>8</td><td>1</td></tr> <tr><td>25</td><td>4</td><td>2</td><td>57</td><td>8</td><td>2</td></tr> <tr><td>26</td><td>4</td><td>3</td><td>58</td><td>8</td><td>3</td></tr> <tr><td>27</td><td>4</td><td>4</td><td>59</td><td>8</td><td>4</td></tr> <tr><td>28</td><td>4</td><td>5</td><td>60</td><td>8</td><td>5</td></tr> <tr><td>29</td><td>4</td><td>6</td><td>61</td><td>8</td><td>6</td></tr> <tr><td>30</td><td>4</td><td>7</td><td>62</td><td>8</td><td>7</td></tr> <tr><td>31</td><td>4</td><td>8</td><td>63</td><td>8</td><td>8</td></tr> </tbody> </table>	Va lu e	Integral Part's Time Constant*	Proportion al Gain*	Va lu e	Integral Part's Time Constant*	Proportio nal Gain*	0	1	1	32	5	1	1	1	2	33	5	2	2	1	3	34	5	3	3	1	4	35	5	4	4	1	5	36	5	5	5	1	6	37	5	6	6	1	7	38	5	7	7	1	2	39	5	2	8	2	1	40	6	1	9	2	2	41	6	2	10	2	3	42	6	3	11	2	4	43	6	4	12	2	5	44	6	5	13	2	6	45	6	6	14	2	7	46	6	7	15	2	8	47	6	8	16	3	1	48	7	1	17	3	2	49	7	2	18	3	3	50	7	3	19	3	4	51	7	4	20	3	5	52	7	5	21	3	6	53	7	6	22	3	7	54	7	7	23	3	2	55	7	2	24	4	1	56	8	1	25	4	2	57	8	2	26	4	3	58	8	3	27	4	4	59	8	4	28	4	5	60	8	5	29	4	6	61	8	6	30	4	7	62	8	7	31	4	8	63	8	8	0	63	4
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21	3	6	53	7	6																																																																																																																																																																																																					
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26	4	3	58	8	3																																																																																																																																																																																																					
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29	4	6	61	8	6																																																																																																																																																																																																					
30	4	7	62	8	7																																																																																																																																																																																																					
31	4	8	63	8	8																																																																																																																																																																																																					

	Inpos Value : Sets the output condition of the in-position finish signal. After position command pulse is finished, when the position deviation from target position is within 'Inpos Value', this mode displays in-position finish signal The position deviation to output the In-position is 0~63.. According to control mode set value is as follows: 1) Fast Response Mode : 0~63 2) Accurate Response Mode : 64~127 According to each mode, the position deviation range is 0~63. Fast Response and Accurate Response control method is as below pig.		0	127	3
23					
24	Pos Tracking Limit : Acts to protect the motor and the drive. While the motor is run, when 'Position Error' is greater than this setting value, this mode generates an alarm to stop a flow of electricity to the motor and then set it to Servo OFF.	pulse	1	+134,217,727	1,000
25	Motion Dir : When the motor operates by position command, this mode sets the revolution direction of the motor. ◆ 0 : moves the motor clockwise. ◆ 1 : moves the motor counterclockwise.		0	1	0
26	Limit Sensor Dir : Sets the limit sensor direction to stop the motor to the limit spot under operation. ◆ 0 : When operation direction is 'CW', input the sensor signal to the Limit+ direction, and the motor will stop. ◆ 1 : When operation direction is 'CW', input the sensor signal to the Limit- direction, and the motor will stop.		0	1	0
27	Org Torque Ratio : In case of 'Origin Method' parameter is set to '5' or '6' to set the maximum torque value to stop the motor.	%	10	100	50

28	<p>Pos. Error Overflow Limit : Acts to protect the motor and the drive. While the motor stops and is set to Servo ON, when 'Position Error' is greater than this setting value, this mode generates an alarm to stop a flow of electricity to the motor and then set it to Servo OFF.</p>	pulse	1	+134,217,727	1,000
29	<p>Brake Delay Time : According to the SERVO ON command, It can be set the brake operation time.</p>	msec	10	5000	200
30	<p>Run Current: Run Current is value of running current during the operating of motor, it is set based on rated current of motor. This value is related with torque in operating of motor, if this value is big, motor torque getting high in operation. So, in case of lack of torque, it can be raising the torque by increasing the run current value.</p> <p>Precaution)</p> <ol style="list-style-type: none"> 1) To be notified If Run Current value is high, heat temperature can be increasing. 2) Maximum set value of Run Current (150%) is limited by 4[A]. So, in case of motor (56,60mm) of rated current value is exceed 2.7[A], set value is not increased as much as set-up, even increasing the set value. 3) Run Current is automatically controlled according to load, so please use in case of lacking torque in operation. 	*10[%]	5	15	10
31	<p>Boost Current : It is the parameter of supplied current to motor to improve for character of acceleration in case of cannot set the acceleration time sufficiently. . (it is applied to acceleration .) Example of use)</p> <ul style="list-style-type: none"> ※ SM-42XL (Current : 1.2[A]) ※ Run Current : 10(100[%]) ※ Boost Current : 1(50[%]) ※ Control current in case of acceleration : $1.2[A] + 1.2[A]*50\% = 1.8[A]$ ※ The control current is limited by 4[A] same as Run Current case. ※ In case of motor (56,60mm) of rated current value is exceed 2.7[A], set value is not increased as much as set-up, even increasing the set value. 	*50[%]	0	7	0
32	<p>Stop Current: Stop Current is meaning of motor current which is automatically set after 0.1 second since motor stop. This parameter is using to decrease the temperature when motor stopped long- time. It also can be increased the motor temperature in case set-up more than 60%.</p>	*10[%]	10	10	5

1 1 . Protective Function

1 1 - 1 . Type of Alarm

When an alarm occurs while the controller is operating, a red LED among status display LEDs flash and the following protective function will be displayed according to the number of LED flash counting

Flash Count	Alarm Name	Description
1	Overcurrent	The current through power devices in inverter exceeds the limit value ^{*1}
2	Overspeed	Command speed for motor exceeds 3300[rpm].
3	Position Tracking	Position error value is higher than specified value ^{*1} in-position command status. ^{*2}
4	Overload	The motor is continuously operated more than 5 second under a load exceeding the max. torque.
5	Overheat	The internal temperature of the drive exceeds 55°C.
6	Over regenerative voltage	Back-EMF more than limit value. ^{*3}
7	Motor connection	The connection of drive and motor is defective.
8	Encoder connection	The connection of drive and encoder is defective.
10	In-position error	After operation is finished, a position error occurs.
12	ROM error	Read/Write error on ROM device in drive system.
15	Pos. Error Overflow	Position error value is higher than specified value ^{*1} in motor stop status. ^{*4}

^{*1} Detection current: 4.5A

^{*2} Set value [pulse] in 'Pos Tracking Limit[No.24]' parameter

^{*3} Limiting value: 70V

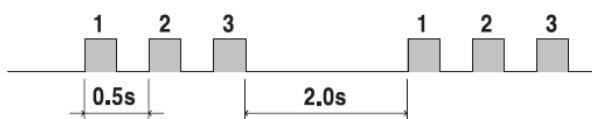
^{*4} Set value [pulse] in 'Pos Error Overflow Limit[No.28]' parameter

1 1 - 2 . Acquiring the alarm information

When an alarm occurs, the motor become Servo OFF and then stops by free run and at the same time displays alarm message. It is display the alarm number on 7-Segment for alarm ID display purpose.

Also, 'AlarmBlink' signal repeats On/Off according to the timing as illustrated below. The red LED flash every 0.5 second in accordance with alarm number and wait for 2 seconds. And then red LED flash repeatedly until inputting 'AlarmReset' signal.

(Example) Alarm 3 : 'AlarmBlink' display signal occurred when the step-out is occurred



1 1 - 3 . Alarm check and Release

If an alarm occurs, remove its cause and then release it. The alarm can be released as follows. In case of alarms of which 'Reset 'column is indicated to 'Invalid', power must get down prior to releasing the alarms

Flash Count	Alarm Name	Description	Reset
1	Overcurrent	1)Check the motor's short-circuit (A, /A, B, /B) 2)Check the mechanical status such as parameter setting.	Valid
2	Overspeed	1)Check parameter setting, and abnormal operation of the motor. 2)Check the speed command of upper controller(ex:PLC).	Valid
3	Position Tracking	1)Get down the load or increase the acceleration or deceleration speed. 2)Check assemble status of mechanism. 3)Check the brake signal cable. 4)Check the motor's short-circuit (A, /A, B, /B) 5)Check the encoder cable connection status. 6)Check the parameter setting value.	Valid
4	Overload	1)Compare the motor's rating with load scale. 2)Check assemble status of mechanism. 3)Check 'SW limit' value of parameter. 4)Check the status of sensors. 5)Check the motorDB for driver and motor. 6)Check the motor's short-circuit (A, /A, B, /B)	Valid
5	Overheat	1)Get down the ambient temperature or install a cooling fan. 2)Check the distance is over 50mm between drivers.	Valid
6	Over regeneratively voltage	1)In case of high-speed operation, check if the acceleration or deceleration speed is low.	Valid
7	Motor connection	1)Check the connection status of drive and motor.	Invalid
8	Encoder connection	1)Check the connection status of drive and encoder. 2)Check the screw condition, cabling short-circuit of encoder.	Invalid
10	Inposition error	1)Check if parameters are set correctly or the machine is over-loaded. 2)Check the vibration of mechanism and belt tension. 3)Check the cabling status of motor and	Valid

		encoder.	
12	ROM error	1)Contact to distributor.	Invalid
14	Drive voltage error	1)Check if power is supplied to the drive.	Invalid
15	Pos. Error Overflow	1)Get down the load or increase the acceleration or deceleration speed. 2)Check the brake and encoder is working correctly or not.	Valid

11 - 4 . Alarm Log Function

If an alarm occurs, its log information are saved in ROM area in the drive.

- ① The maximum number of alarm logs are 30.
- ② The inquiry of alarm log is possible only on Servo OFF status.
- ③ To remove alarm log, use the 'Reset Alarm Logs' menu.

