mindman

DRIVER



CK10 series

User Manual

VER. 202410

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1. Safety Pre-caution and Note on Installation

※ Before Operation

◆ Thank you for purchasing our CK10 series.
◆ CK10 series are a high-performance 32bit ARM chip embedded Full Digital position control stepping driving unit.
◆ This manual describe the handling, maintenance, repair, diagnosis and troubleshooting of CK10 series.
◆ Before start operation of CK10, thoroughly read this manual.
◆ After reading this manual, keep the manual near CK10, so that any user can read this manual whenever needed.

1-1. Precautions

◆ General Precautions

1. Contents of this manual are subject to change without prior notice for functional improvements, change of specifications or user's better understanding. In case of manual is damaged or lost, please contact with MINDMAN's agent or our company at the address on the last page of this manual.
2. MINDMAN 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.

◆ Safety Precaution

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

 **Attention**	If user does not properly handle the products, the user may seriously or slightly injured damages may occur in the machine.
 **Attention**	If user does not properly handle the products, a dangerous situation (such as an electric shock) may occur resulting in deaths or serious injuries.

- Although precaution is only a **Attention**, a serious result could be caused depending on t he situation. Follow safety precaution.

◆ Check the Product

 **Attention**	Check the Product is damaged or parts are missing. Otherwise, the machine may get damaged or the user may get injured.

◆ **Setting**

 **Attention**	Please carry the CK10 carefully. Otherwise, the product may get damaged or user's foot may get injured by dropping the product. Use non-flammable materials such as metal in the place where the CK10 is to be installed. Otherwise, a fire may occur. When installing several CK10 in to be sealed place, install a cooling fan to keep the ambient temperature of the product as 50℃ or lower. Otherwise, a fire or other kinds of accidents may occur due to overheating.
 **Attention**	The process of installation, Connection, Operation, Checking and Repairing should be done by qualified person. Otherwise, a fire or other kinds of accidents may occur.

◆ **Connect Cables**

 **Attention**	Keep the rated range of input Voltage for drive. Otherwise, a fire or other kinds of accidents may occur. Cable connection should be following the wiring diagram. Otherwise, a fire or malfunction of machine may occur.
 **Warning**	Before connecting cables, check if input power is off.. Otherwise, an electric shock or a fire may occur. The case of this CK10 is installed from the ground of the internal circuit by the condenser, Please Ground the CK10. Otherwise, an electric shock or a file may occur and a cause of malfunction of machine.

◆ **Operation & Setting change**

 **Attention**	If a protection function (Alarm) occurs, firstly remove its cause and then release (Alarm reset) the protection function. If you operate continuously without removing its cause, the machine may get damaged or the user may get injured. Make all input signals to OFF before supply input voltage to drive. The machine may get damaged or the user may get injured by motor operation. All parameter values of CK10 are set by default factory setting value. Change this value after reading this manual thoroughly. Otherwise, the machine may get damaged or other kinds of accidents may occur.

◆ **Check and Repair**

 **Warning**	Stop to supply power to the main circuit and wait sufficient time before checking or repairing this CK10. Electricity remaining in the condenser may cause of electric shock. Do not change cabling while power is being supplied. Otherwise, the user may get injured or the product and machine may get damaged. Do not reconstruct the CK10. Otherwise, an electric shock may occur or the product and machine get damaged. And the reconstructed product cannot get after service.

1-2. Note on Installation

(1) This product has been designed for indoor uses. The ambient temperature of the room should be 0°~ 50°C .
(2) If the temperature of drive case is 50°C or higher, heat dissipation must be done to the outside.
(3) Do not install this product under direct sunlight or near magnetic or radioactive objects.

2. Specifications of the Drive

2-1 Specifications

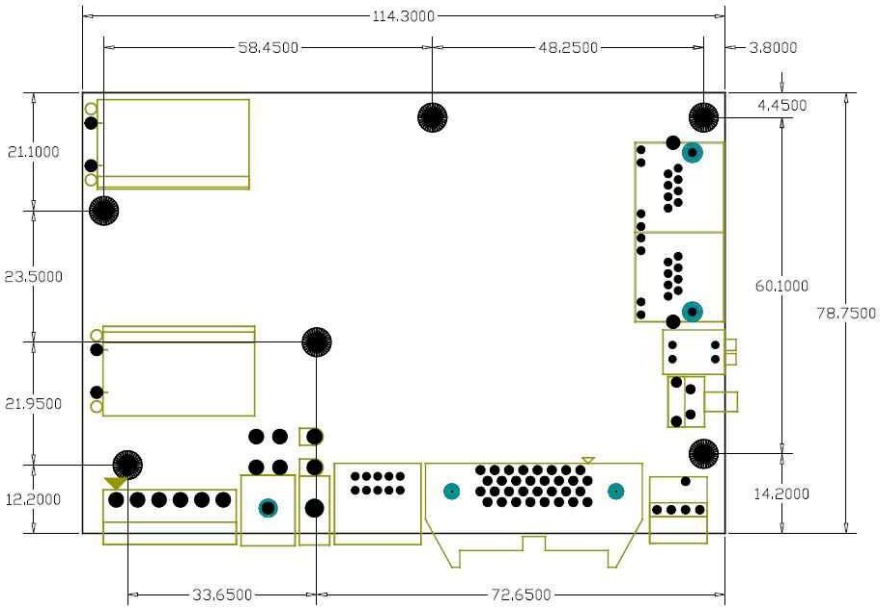
Type of Drive		CK10 Series
Input Power(Control)		24VDC ± 10%
Input Power(Motor Drive)		22VDC ~ 50VDC
Control Method		Closed loop control with ARM-based 32-bit MCU
Multi Axes Drive		Maximum 16 axes through Daisy-Chain
Position Table		128 motion command steps (Move, Wait, Loop, Jump, External control. etc)
Current Consumption		Max. 500mA (Except motor current)
Operating condition	Ambient Temperature	Operating : 0~50℃ Storage : -20~70℃
	Humidity	In use : 35~85%RH (No condensation) In Storage : 10~90%RH (No condensation)
	Vib. Resist.	0.5G
Function	Rotation Speed	0~3,000 [rpm]
	Resolution [P/R]	500 1,000 1,600 2,000 3,200 3,600 4,000 4,800 5,000 6,400 8,000 9,600 10,000 16,000 20,000 (Available to set by the paramter) *
	Protection Function	Over Current Error, Over Speed Error, Position Tracking Error, Over Load Error, Over Temperature Error, Over Regenerated Voltage Error, 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%
	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%
I/O	Input Signals	12 programmable inputs (Photocoupler)
	Output Signals	10 programmable outputs (Photocoupler, Max. 30V 10mA)
Drive Interface		The RS-485 serial communication (Plus-R) - Communication speed: 9600, 19200, 38400, 57600, 115,200 [bps] Pulse I/F (Dir/Pulse, CW/CCW, A/B)
Position Control		Incremental mode / Absolute mode Data Range: -2,147,483,648 to +2,147,483,647 [pulse] Operating speed: Max. 3,000 [rpm]
Return to Origin		Origin Sensor, Z phase, ±Limit sensor, Torque
GUI		User Interface Program within Windows (Plus-R mode)
Software		Motion Library (DLL) for Windows XP/7/8/10 (Plus-R mode)

* Up to the resolution of 16,000[ppr] the maximum speed can be reached by 3,000[rpm]. And if the resolution is over 16,000[ppr], the maximum speed will decrease accordingly.

Specifications of the Motor

Model		□20	□28	□35	□42	□56
Drive Method	-	Bi-Polar				
Number of Phases	-	2	2	2	2	2
Current per Phase	A	0.6	0.67	1	1.68	2.8
Holding Torque	N.m	0.037	0.118	0.137	0.431	1.72
Rotor Inertia	$g{\cdot}cm^2$	3.3	18	14	68	480
Weights	g	105	227	210	416	1075
Insulation Resistance	Mohm	100 MIN.(at 500VDC)				
Insulation Class	-	Class B (130℃)				
Operating Temperature	℃	0~55				
Encoder	-	Incremental Optical Encoder				

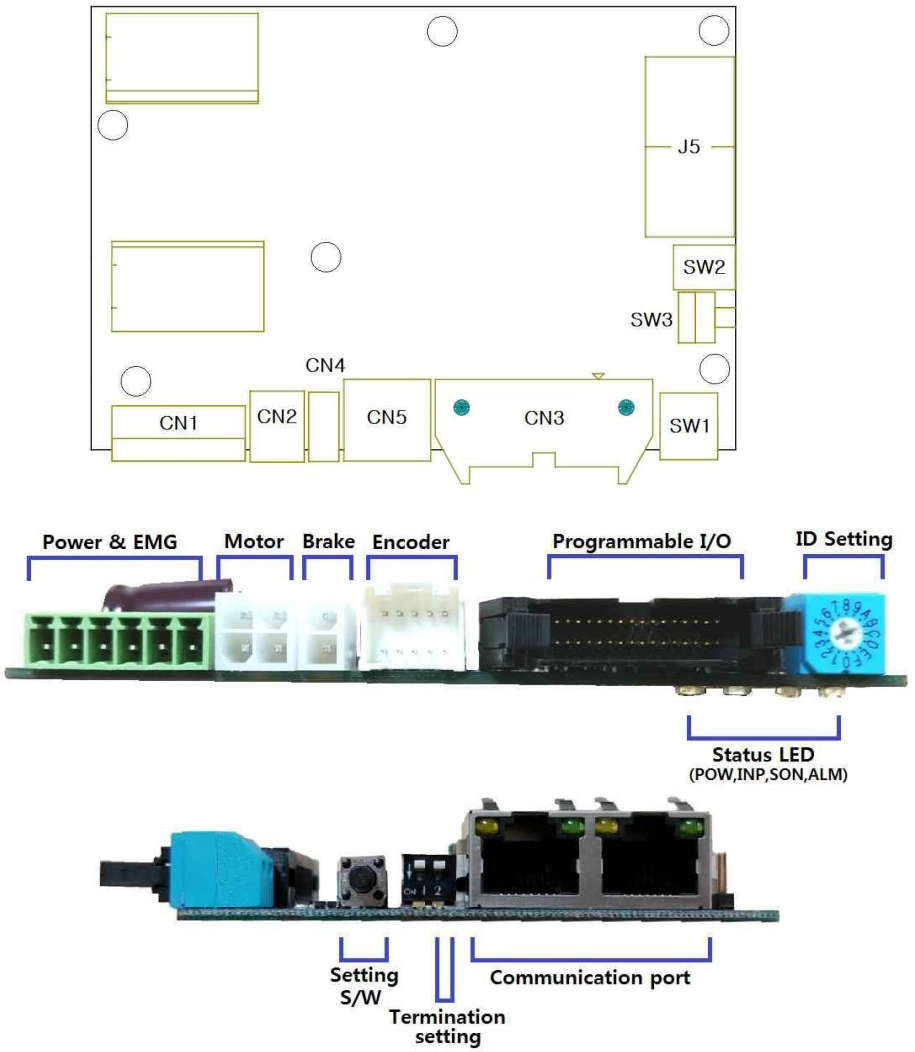
2-2. Dimensions



3. Configuration

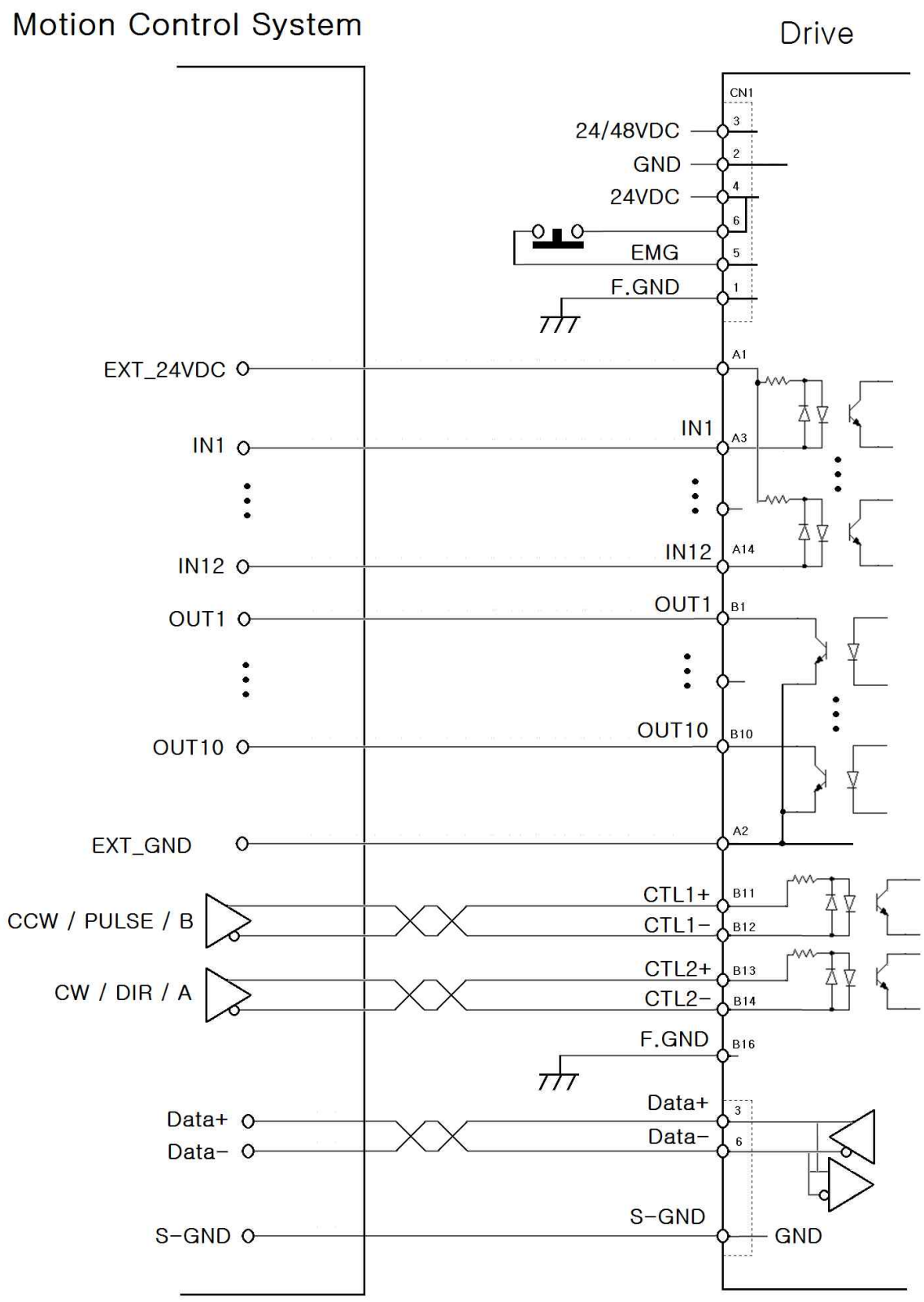
3-1. Controller configuration

(1) CK10 Connectors & Switches



No	Function	No	Function
CN1	Power & EMG input	SW1	ID Setting
CN2	Motor	SW2	RS-485 Termination
CN4	Brake	SW3	Setting S/W
CN5	Encoder	J5	Communication port
CN3	Programmable I/O & input		

3-2. External Wiring Diagram



* Note : S-GND is connected to GND in the drive.

3-3. Drive status monitor LED

In case of CK10 series, status of LED can be checked by turning on / off the status LED and flashing.

Name	Color	Function	ON / OFF Condition
PWR	Green	Power input indication	Lights On when power is applied.
INP	Yellow	Complete Positioning	When position command pulse input and then the position deviation is within the value set by the parameter, this lights On.
SON	Orange	Servo On/Off indication	Servo On : light On Servo Off : light Off
ALM	Red	Alarm indication	Flash when protective function is activated. (If you count LED flash time, you can check what protective function is run.)

The following table shows the alarms according to the number of red LED flashes when an alarm occurs during operation.

Times	Alarm name	Condition
1	Over Current Error	The current through power devices in drive exceeds 4.8A
2	Over Speed Error	Motor speed exceeds 3,000 [rpm]
3	Position Tracking Error	Position error value is higher than 90˚in motor run state *1
4	Over Load Error	The motor is continuously operated more than 5 seconds under a load exceeding the max. torque
5	Over Temperature Error	Inside temperature of drive exceeds 85℃
6	Over Regenerativted Voltage Error	Back-EMF is higher than 70V
7	Motor Connect Error	The power is ON without connection of the motor cable to drive
8	Encoder Connect Error	Cable connection error in Encoder connection of drive
10	In-Position Error	After operation is finished, a position error occurs
12	ROM Error	Error occurs in parameter storage device(ROM)
15	Position Overflow Error	Position error value is higher than 90˚ in motor stop state *2

*1. The setting value [pulse] in ‘Pos Tracking Limit[No.24]’parameter

*2. The setting value[pulse] in ‘Pos Error Overflow Limit[No28]’ parameter

3-4. Network ID setting (SW1)

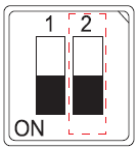
When several modules are connected to one daisy chain network, this switch is to set intrinsic ID to each module.

Position	ID(PR)	ID(Modbus)	Position	ID(PR)	ID(Modbus)
0	0	1	8	8	9
1	1	2	9	9	10
2	2	3	A	10	11
3	3	4	B	11	12
4	4	5	C	12	13
5	5	6	D	13	14
6	6	7	E	14	15
7	7	8	F	15	16

* The ID in MODBUS mode is the set value plus 1.

3-5. Termination setting (SW2.2)

Termination resistor is connected internally by setting on SW2.2.
When connecting to the end of the communication network, please set the termination.



3-6. Setting switch (SW3)

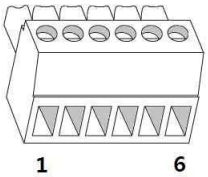
When this switch is kept pressed and the drive is powered on the drive operates in the Plus-R mode at 115,200bps.
The switch's function after power-on can be programmable. Please refer to the parameters settings.



3-7. Power & EMG input (CN1)

Motor power and control power are supplied separately and the rated current of driving motor is 4A.
Please be careful not to supply only motor power, And use appropriate power supply and cables.
EMG input can force the drive to stop at emergency.
Please refer to the parameter settings.
(Connector Type : DINKLE / 15EDGRC-3.81-6P)

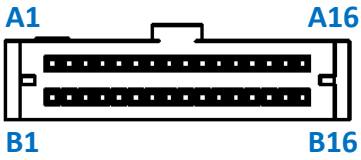


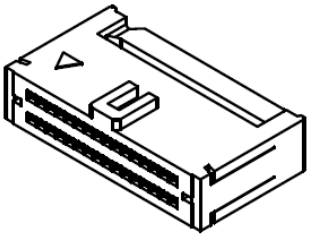


No	Name	Description
1	F.G	Frame Ground
2	GND	
3	DRV-PWR	24/48VDC
4	CTL-PWR	24VDC
5	EMG+	Emergency Stop control (Use B-contact)
6	EMG-	"EMG-" is the internal power source.

3-8. I/O connector (CN3) (Version V2)

CK10 Series support versatile I/O functions.
You can select the functions with the setting program(GUI) provided.
(Connector Type : HIROSE/ HIF6-032PA-1.27DS)

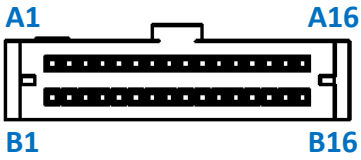


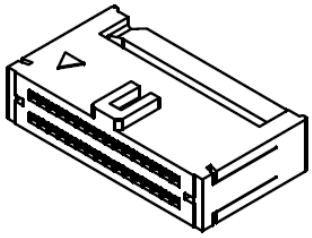


NO.	Color	Name	Function
A1	Brown / Black	EXT_24VDC	IO Power (+24V)
A2	Red / Black	EXT_GND	IO Power Ground
A3	Orange / Black	INPUT 1	Programmable input -User Input 0~8 -Limit+, Limit- -Org Sensor -Org Search -Jog+, Jog-, Stop -Alarm Reset -Servo-On, E-Stop -PT A0~A7, PT Start -JPT IN0~2
A4	Yellow / Black	INPUT 2	
A5	Green / Black	INPUT 3	
A6	Blue / Black	INPUT 4	
A7	Purple / Black	INPUT 5	
A8	Gray / Black	INPUT 6	
A9	White / Black	INPUT 7	
A10	White / Red	INPUT 8	
A11	**Pink**	INPUT 9	
A12	**Pink / Black**	INPUT 10	
A13	**Brown / White**	INPUT 11	
A14	Yellow / Red	INPUT 12	
A15	Gray / Red	Reserved	Do not connect
A16	Blue / White	Reserved	Do not connect
B1	Brown	OUTPUT 1	Programmable output -User Output 0~8 -Inposition -Moving, Acc/Dec -Servo Ready -Alarm -Compare Out -Brake Signal -PT Out0~2 -ACK, END
B2	Red	OUTPUT 2	
B3	Orange	OUTPUT 3	
B4	Yellow	OUTPUT 4	
B5	Green	OUTPUT 5	
B6	Blue	OUTPUT 6	
B7	Purple	OUTPUT 7	
B8	Gray	OUTPUT 8	
B9	White	OUTPUT 9	
B10	Black	OUTPUT 10	
B11	L. Blue	CTL1+	CCW / Pulse / B-Phase Input
B12	**L. Blue / Black**	CTL1-	
B13	**L. Green**	CTL2+	CW / DIR / A-Phase Input
B14	**L. Green / Black**	CTL2-	
B15	Orange / White	Reserved	Do not connect
B16	Pink / Red	F.G	Frame Ground (Shield)

3-9. I/O connector (CN3) (Version OLD)

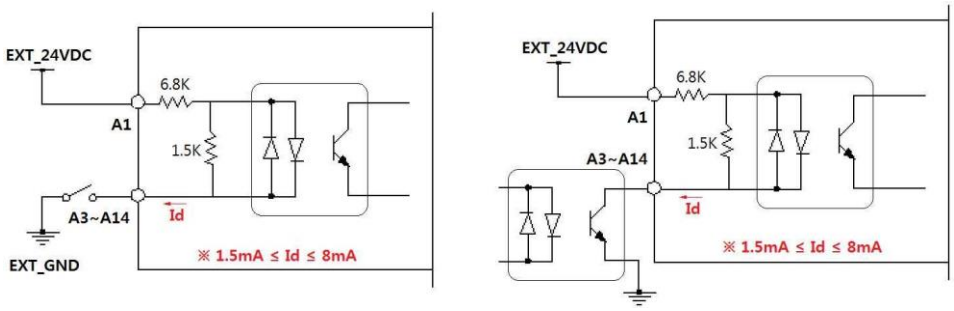
CK10 Series support versatile I/O functions.
You can select the functions with the setting program(GUI) provided.
(Connector Type : HIROSE/ HIF6-032PA-1.27DS)



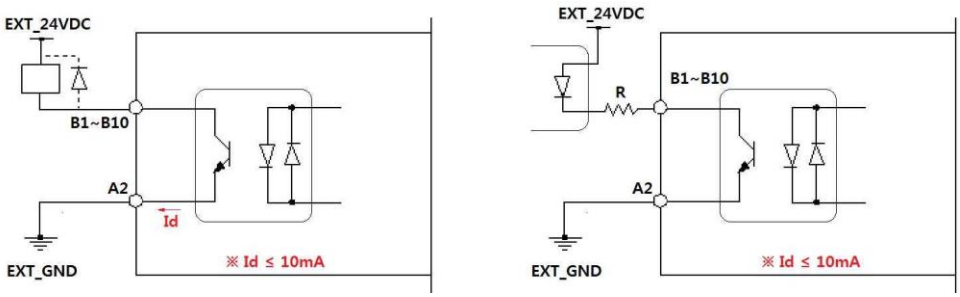


NO.	Color	Name	Function
A1	Brown / Black	EXT_24VDC	IO Power (+24V)
A2	Red / Black	EXT_GND	IO Power Ground
A3	Orange / Black	INPUT 1	Programmable input -User Input 0~8 -Limit+, Limit- -Org Sensor -Org Search -Jog+, Jog-, Stop -Alarm Reset -Servo-On, E-Stop -PT A0~A7, PT Start -JPT IN0~2
A4	Yellow / Black	INPUT 2	
A5	Green / Black	INPUT 3	
A6	Blue / Black	INPUT 4	
A7	Purple / Black	INPUT 5	
A8	Gray / Black	INPUT 6	
A9	White / Black	INPUT 7	
A10	White / Red	INPUT 8	
A11	L. Blue / Black	INPUT 9	
A12	L. Green / Black	INPUT 10	
A13	Pink / Black	INPUT 11	
A14	Yellow / Red	INPUT 12	
A15	Gray / Red	Reserved	Do not connect
A16	Blue / White	Reserved	Do not connect
B1	Brown	OUTPUT 1	Programmable output -User Output 0~8 -Inposition -Moving, Acc/Dec -Servo Ready -Alarm -Compare Out -Brake Signal -PT Out0~2 -ACK, END
B2	Red	OUTPUT 2	
B3	Orange	OUTPUT 3	
B4	Yellow	OUTPUT 4	
B5	Green	OUTPUT 5	
B6	Blue	OUTPUT 6	
B7	Purple	OUTPUT 7	
B8	Gray	OUTPUT 8	
B9	White	OUTPUT 9	
B10	Black	OUTPUT 10	
B11	L. Blue	CTL1+	CCW / Pulse / B-Phase Input
B12	L. Green	CTL1-	
B13	Pink	CTL2+	CW / DIR / A-Phase Input
B14	Brown / White	CTL2-	
B15	Orange / White	Reserved	Do not connect
B16	Pink / Red	F.G	Frame Ground (Shield)

(1) Wiring input

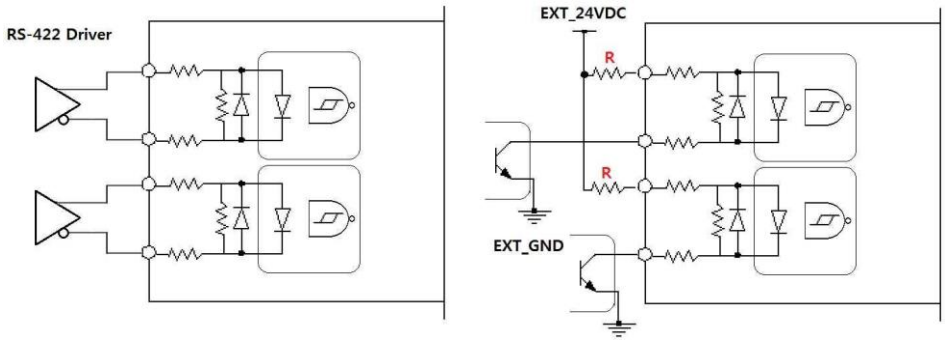


(2) Wiring output



* If the output is connected to inductive loads, Use free-wheel diodes.
* Select appropriate value of resistor(R) or load to meet specifications.

(3) Wiring CTL1,2 input



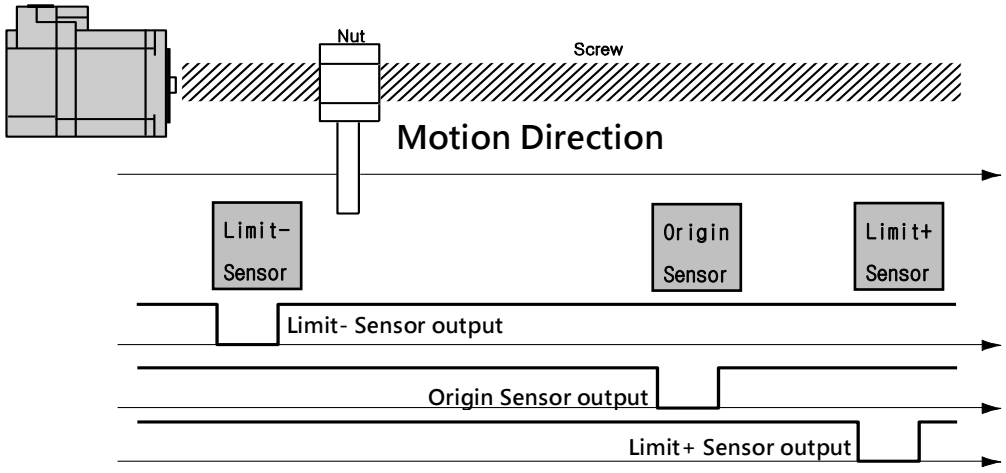
* When driving with the Open-Collector circuit, add external resistors so that the appropriate current flows.
(Ex : 2.2K ~ 4.7K in case of 24V)

4. Control I/O signal

4-1. Input Signal

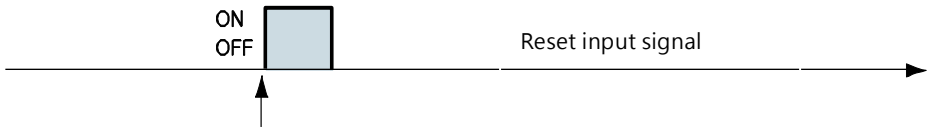
(1) Limit sensor and Origin sensor

Limit sensor and origin sensor are assigned to LIMIT+, LIMIT- , and ORIGIN pin in the CN3 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) User Input Signal

The user input is connected to the IN pins of the I/O connector and the input s tatus can be checked by the master controller. Input signals can be assigned to " User input 0" through "User input 8".

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

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~A6 」 inputs are total 7 bits of input signal. It is used to set 128 position table numbers.

By using PT A0~A6 signals, the position table address can be set from 0 to 127 with a binary number. A0 is least significant bit and A6 is most significant bit. The following table shows how to assign position table number.

* If 'PT A0~A6' signal is not connected when motioning by 'PT Start' signal, the position table number will be '0'

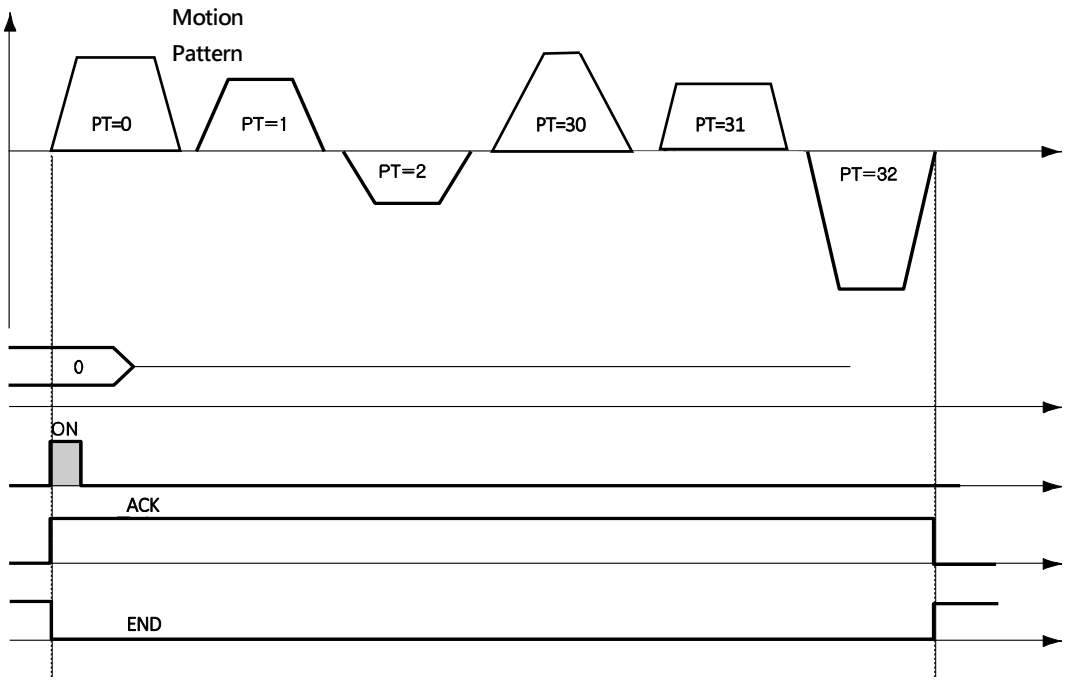
A7	A6	A5 ~ A3	A2	A1	A0	PT NO.
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
0	0	0	1	0	0	4
0	1	1	1	1	0	126
0	1	1	1	1	1	127

* PT-A7 must be set to '0'

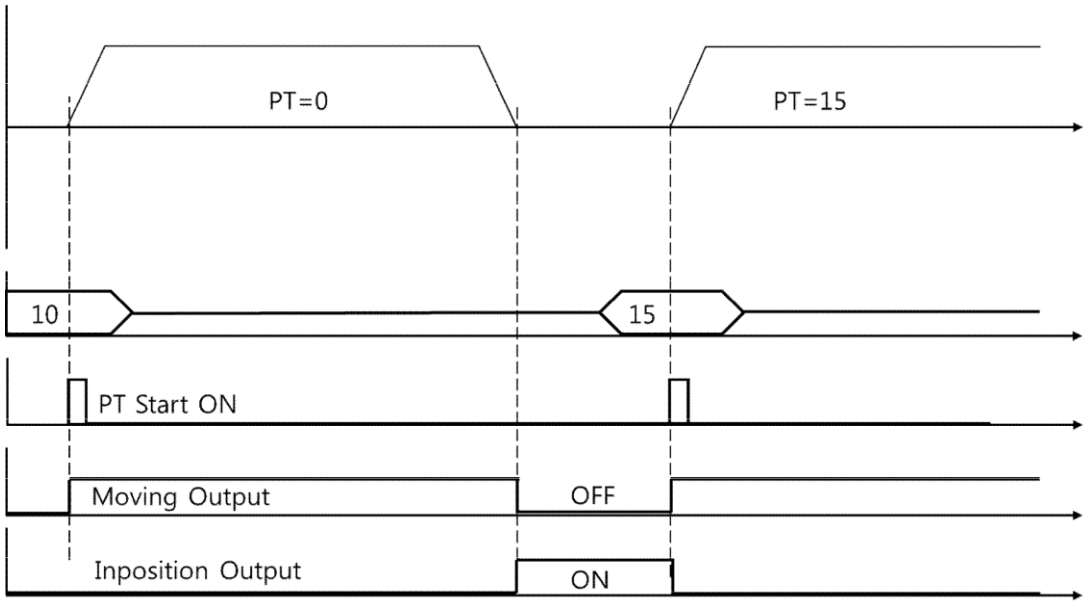
(5) 'Position Table Start (PT Start)'Input

By using PT A0~A6 signals, it can be set the PT start number to be executed.
Following example shows that total 6 motion patterns are executed sequentially starting from No.0 and motion is terminated after execution of No.32.

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 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 is edge triggered input and pulse duration must be is 10ms or more.



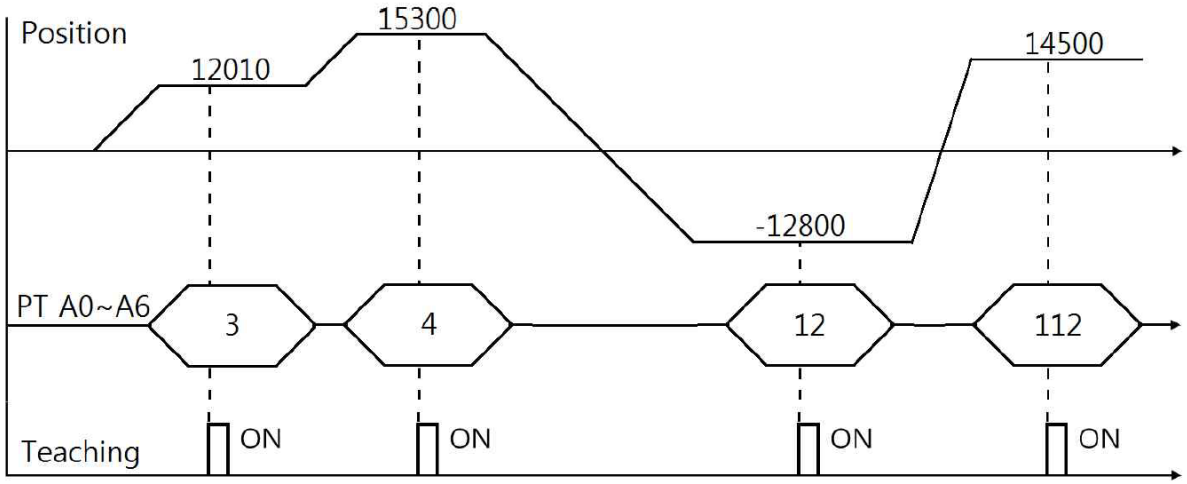
*1. PT A0~A6 signals must be set 50ms before PT Start signal is asserted.
*2. If the PT Start signal asserted when the PT A0~A6 signals are not assigned, the PT No. 0 will be executed.
*3. Checking the 'Moving' and 'Inposition' signals:
Between sequential 'PT Start' command signal, the checking step for motion status(Moving, Inposition) is needed before next motion command.



(6) 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.

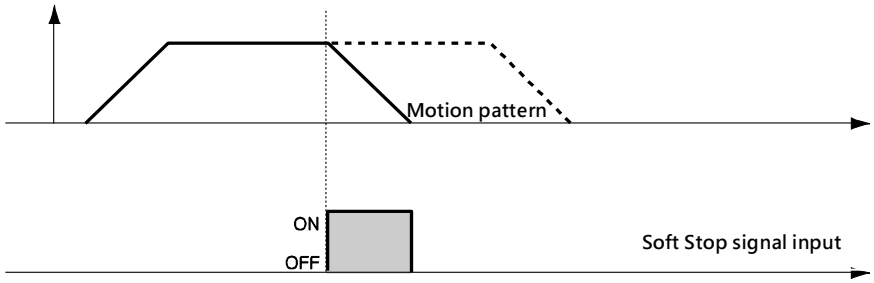


PT No.	Position Value [pulse] of Corresponding PT
3	12010
4	15300
12	-12800
112	14500

* 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).

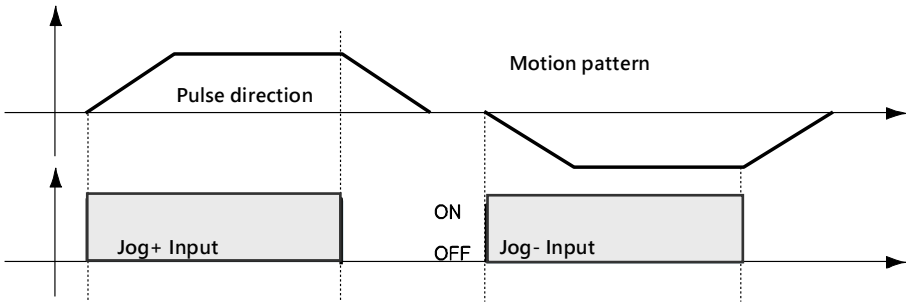
(7) Stop Input

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.



(8) 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).



(9) Servo ON and Alarm Reset input

When the protective function of drive executes, alarm output is activated. 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.

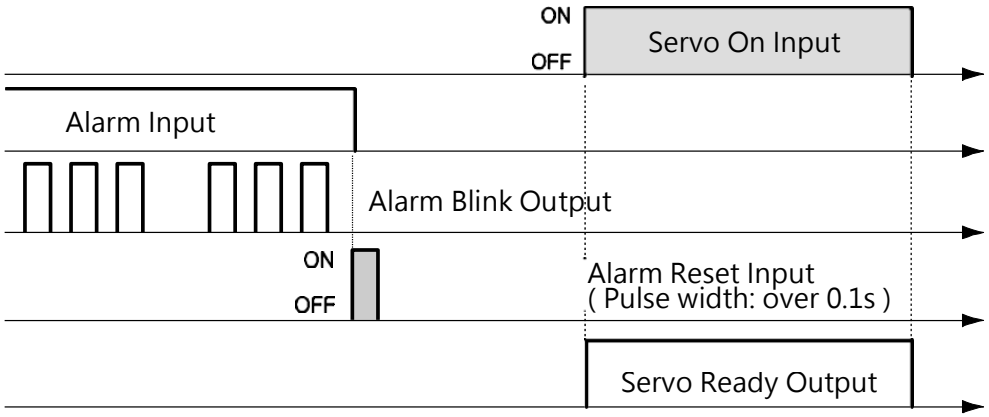
When Servo ON/OFF signal is set to OFF, the drive stops supplying the current to the motor and so the user can directly adjust the output position. When Servo ON/OFF signal is set to ON, the drive restarts to supply the current to the motor and its torque is recovered. Before operating the motor, the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

When the drive is set to Servo ON, < ServoReady > signal is set to ON. Servo ON signal is edge trigger type and pulse duration is 10ms or more.

* Note:

(1) If 'No.0: Pulse per Revolution' in the parameter list is changed while servo-on, the drive will be servo-off followed by servo-on to update the resolution.

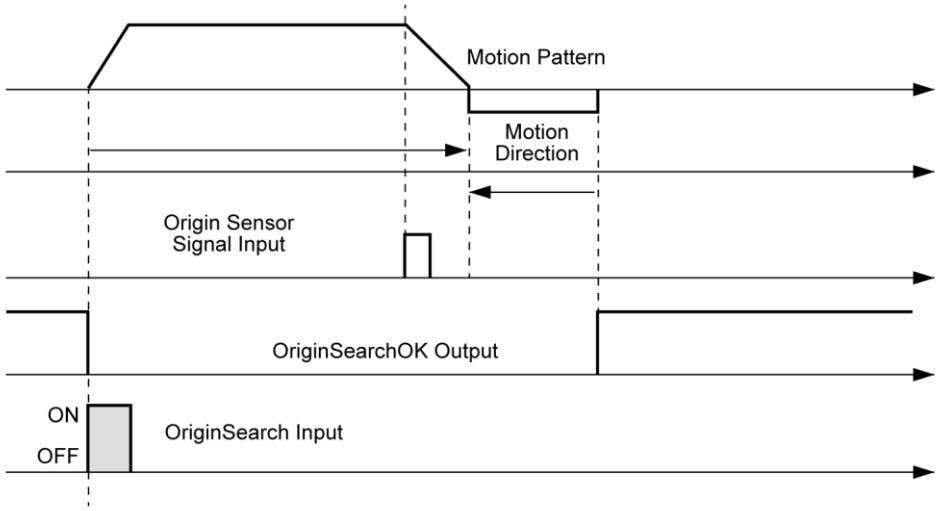
(2) During the 'ServoON' process, the 'Command Position' value will be changed to 'Actual Position' value to remove 'Position Error'.



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

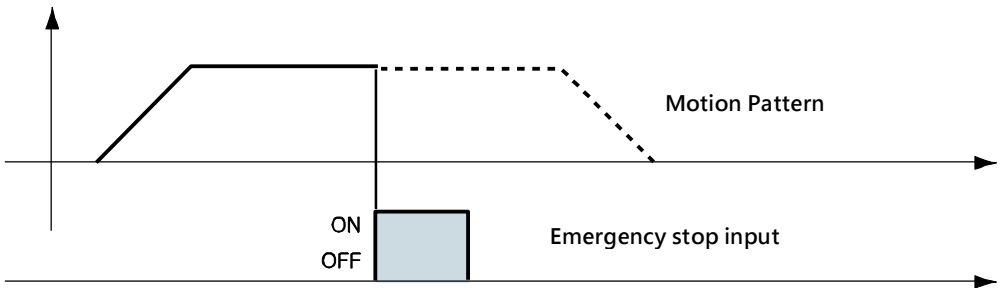
(10) Origin Search Input

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 '1.2 Parameter'.) When the origin search command is completed, 'Origin Search OK' signal is set to ON.



(11) E-Stop Input

When [Emergency stop] signal is set to [ON] the current motion is stopped immediately without deceleration. The duration of this signal must be longer than 10ms. When this signal is activated, the servo-on procedure can't be executed. And unlike the EMG function, the E-STOP function can not be programmed.



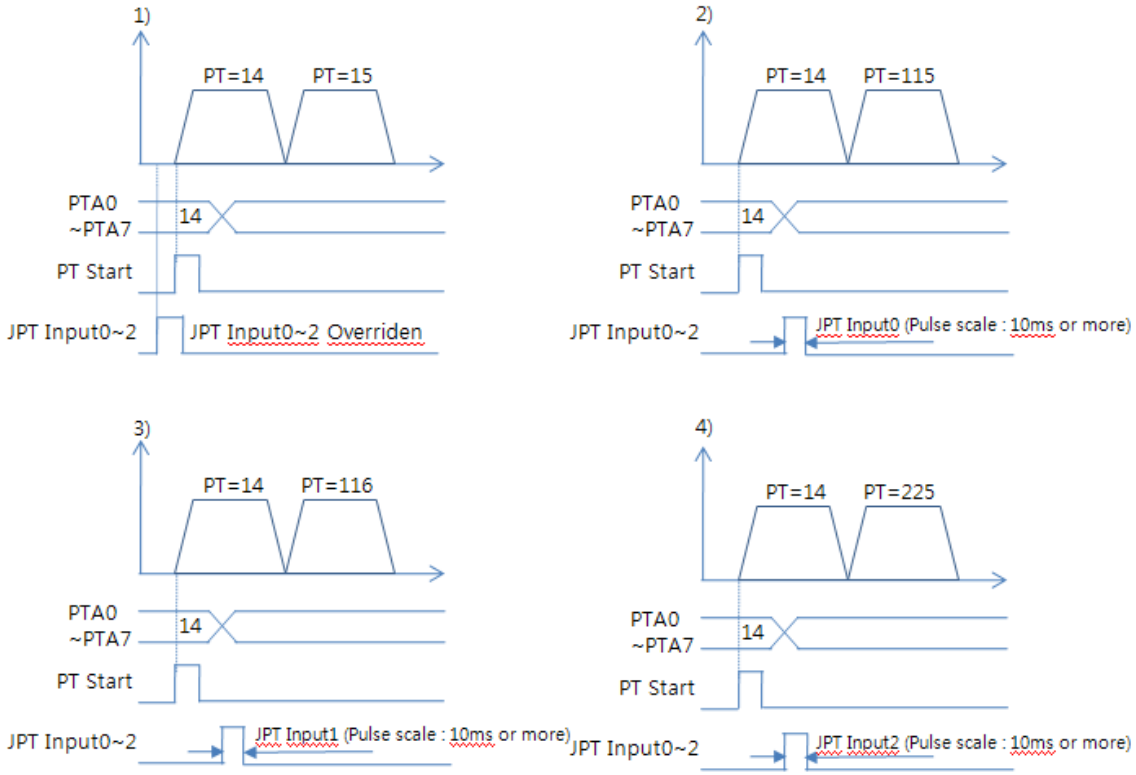
(12) JPT Input0~Input2 (Jump Position Table Input) Input

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 m otion 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).

PT 14 Data

PT No.	…	JP Table No.	JPT 0	JPT 1	JPT 2
14	…	15	115	116	225



(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:

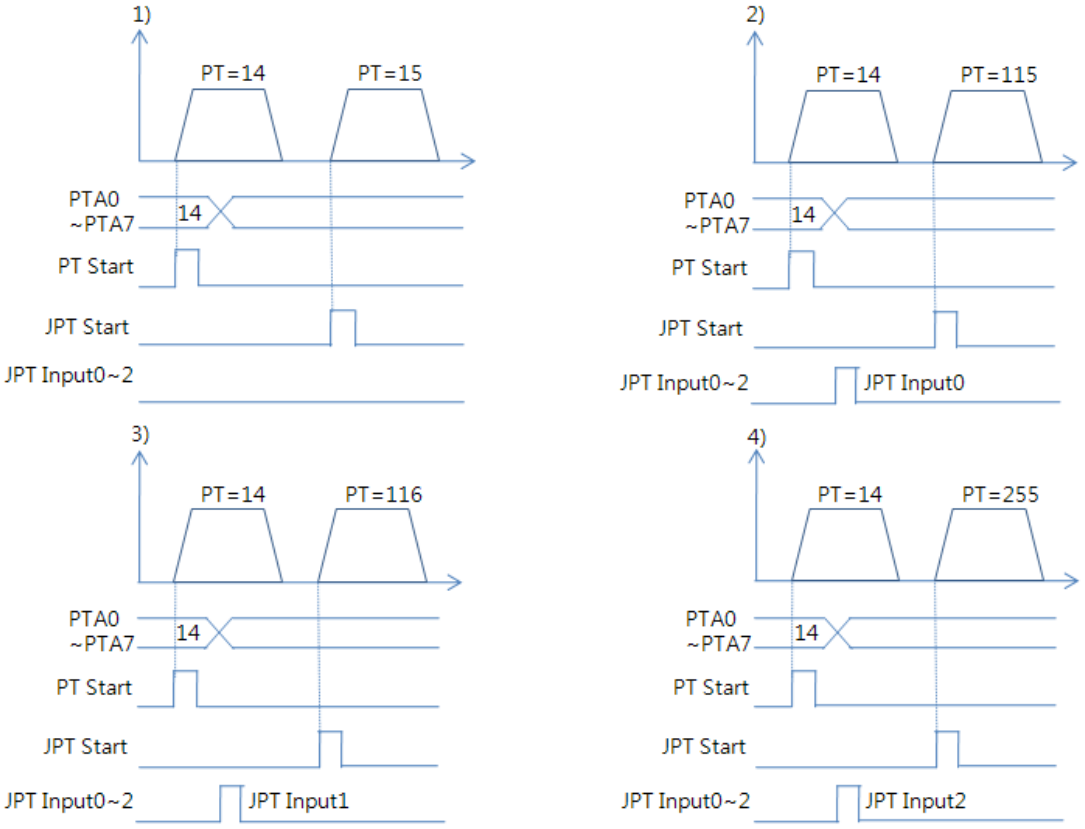
1) PT number to be jumped must be composed to 10XXX;

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】

PT 14 Data

PT No.	…	Wait Time	JP Table No.	JPT 0	JPT 1	JPT 2
14	…	500	10015	10115	10116	10255



(14) EMG Inputs

Opening EMG inputs can force the drive to stop at emergency. Once entering the emergency state, it can be cleared by commands to clear alarm or power off/on procedure.

There are several mode of EMG, quick stop mode, quick stop & servo-off mode, deceleration stop mode, deceleration stop & servo-off mode and servo-off mode. It can be program by parameter. Also setting parameter can define the operation of the brake in emergency state. Please refer to the 8-2 parameter descriptions.

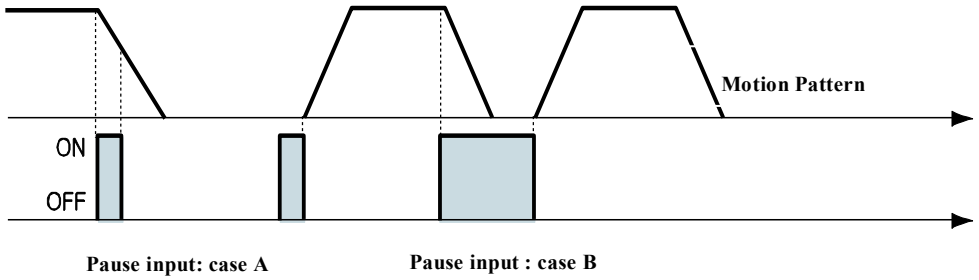
(15) Pause Input

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.

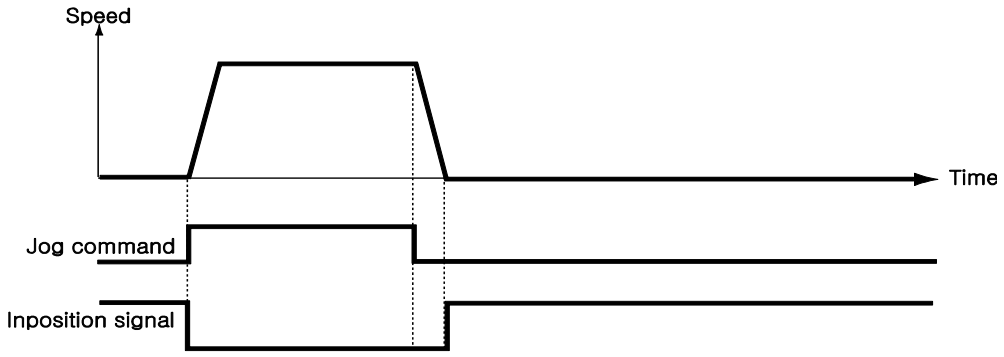
4-2. Output Signal

(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 'CK10_UserManual_Communication Function_MODBUS'and 'CK10_User Manual_Position Table'.

(2) 'Inposition' 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' 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.

(4) 'PT ACK' and 'PT End' Output

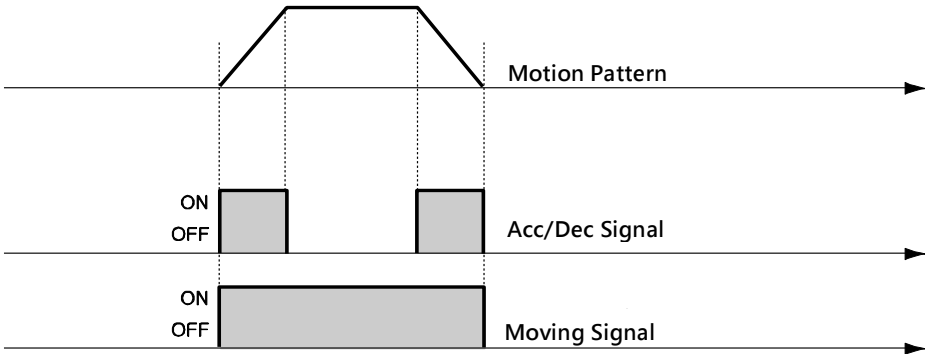
'PT ACK' and 'PT End' signals are available only when the motion is executed by position table. When PT ACK signal is set to ON and PT End signal is set to OFF, all motion loops are finished. Then PT ACK signal becomes OFF and PT End signal becomes ON. If the 'Wait time' value in PT item is not 0, the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

Refer to 'CK10_UserManual_Position Table'.

(Supporting Ver 06.01.3105 or later)

(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.

(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 '4-1. Input Signal (9) Servo On and Alarm Reset Input'.

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

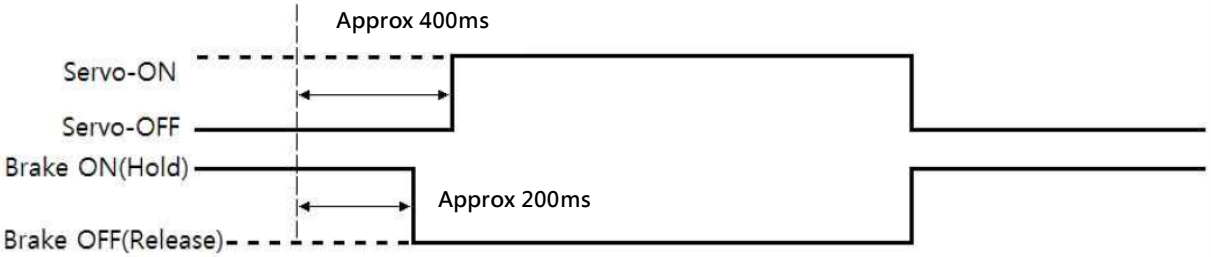
Control output used for 'Start/Stop Message Function'. When these items are set, this signal enables the user to check if corresponding PT motion starts or stops through control output signal. If 'Start/Stop Message Function' is not used, this signal should be set to 0 or 8. At the position set with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

① If PT set items are set to '1~7', when the position starts to move, PT Output HEX value is displayed to 'PT Output O ~ PT Output 2'.
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 O ~ PT Output 2'.

For more information, refer to 'CK10_UserManual_Position Table'.

(9) 'BRAKE+', 'BRAKE-' Output(CN4) and 'Brake' Output(CN3)

The brake function is used to lock the motor during the servo-off state.
CN4 is for brake connection. Also control output port of CN3 can output brake signal. This port needs addtional circuit to drive brake.



* The function of setting the brake delay time will be supported in future releases.

5. Operation

5-1. Servo ON Operation

The default setting after power-on is Servo OFF.
The methods of “Servo ON” are as follows.

① Click ‘Servo ON’ button at the User Program (GUI).
② Send a command to drive through DLL library.
③ Assigned the "Servo ON" among the control input terminals and a signal is supplied to the pin.

After Servo ON command is sent, In-position is activated as shown below.



*T1 is subject to the supplying power, motor type and parameters of drive.

5-2. Operation Mode

This controller can be controlled in two ways such as I/O command, communication command (DLL program or User Program (GUI))

(1) Pulse Input Mode

This controller can do motions by pulse input from the upper controller

① 1 Pulse Mode : Pulse/Dir inputs
② 2 Pulse Mode : CCW/CW pulse inputs
③ Quadrature mode : A/B pulse input

The control signals such as Servo On, Alarm Reset, Servo Ready, Inposition and Alarm signals can be set and used in pulse input mode. These control signals can be set by Plus-R protocol without changing the operating mode.

Please do not set any other functions to I/O. Setting other functions might cause unexpected results.

⚠ Caution	**Do not set any other functions to I/O except Servo-On, Alarm Reset, Servo Ready, Inposition and Alarm in pulse input mode.**

(2) Communication & I/O Command Mode

This controller can execute control operation by communication and I/O command transmitted from the upper controller.

① Plus-R Mode：Support Plus-R network, I/O command, Position table functions

② MODBUS-RTU：Support MODBUS-RTU network, I/O command, Position table functions

③ MODBUS-ASC：Support MODBUS-ASC network, I/O command, Position table functions

Position Table Operation Sequence

The system can execute sequential operation by position table at the I/O command mode.

① By using PT A0 ~ PT A6 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 Operation of Position Table

When the motor is executing continuous operation of position table with CK10, stop executing position table by following methods.

To use DLL program or control input signal corresponding to ‘Stop’ and ‘E-Stop’.

Position Control Operation

You can configure the operation by setting the following parameters with the user GUI program or DLL program.

Parameter Name	Setting contents	Range
Axis Max Speed	Maximum allowable speed	1~2,500,000[pps]
Axis Start Speed	Start speed when acceleration starts	1~35,000[pps]
Axis Acc Time	Required time until the motor reaches the target speed from stop status	1~9,999[ms]
Axis Dec Time	Required time until the motor reaches from the constant 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 is depend on this value.	0~15

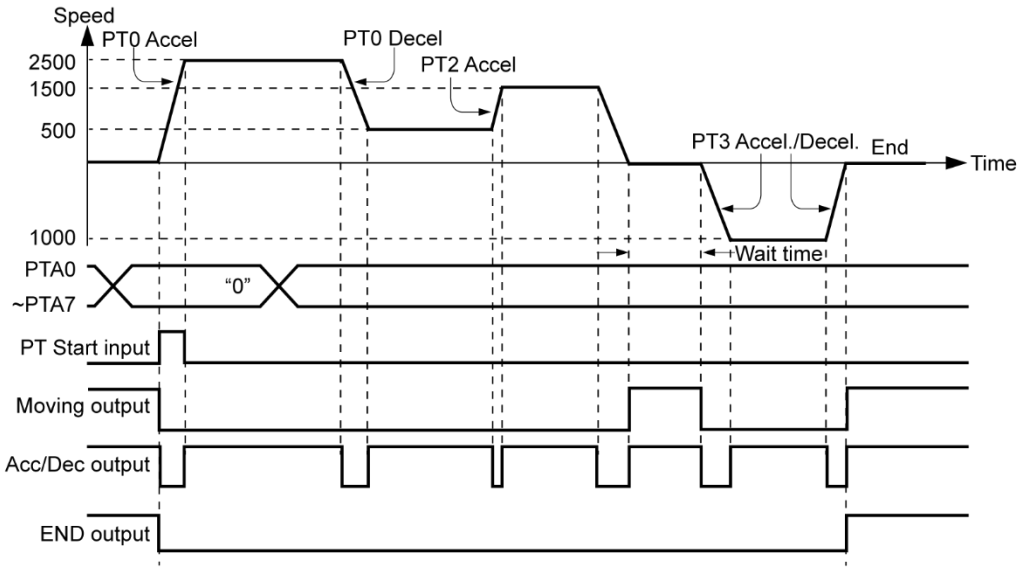
6. Other Operation Function

6-1. Position Table(PT) Operation Example

Input ‘PT A0~ PT A6’ 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	JP Table No.
0	3	10000	1	2500	50	300	0	1
1	3	1000	1	500	-	-	0	2
2	3	5000	1	1500	50	300	300	3
3	3	-2500	1	1000	300	300	0	-

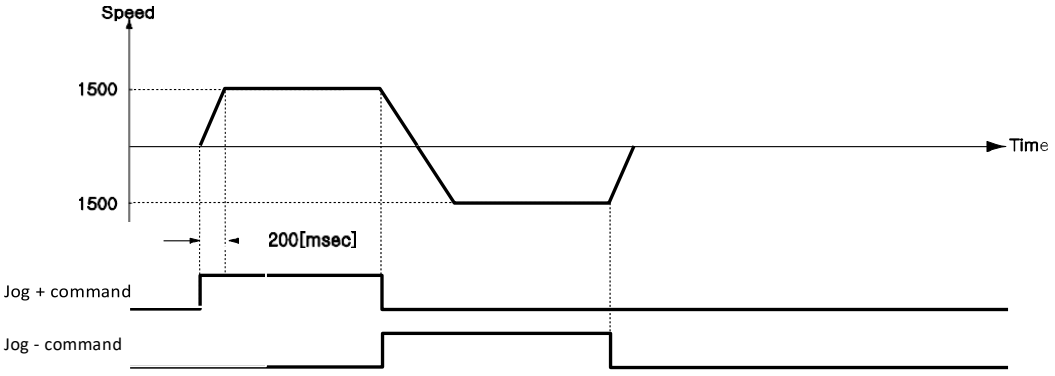


6-2. Jog Operation Example

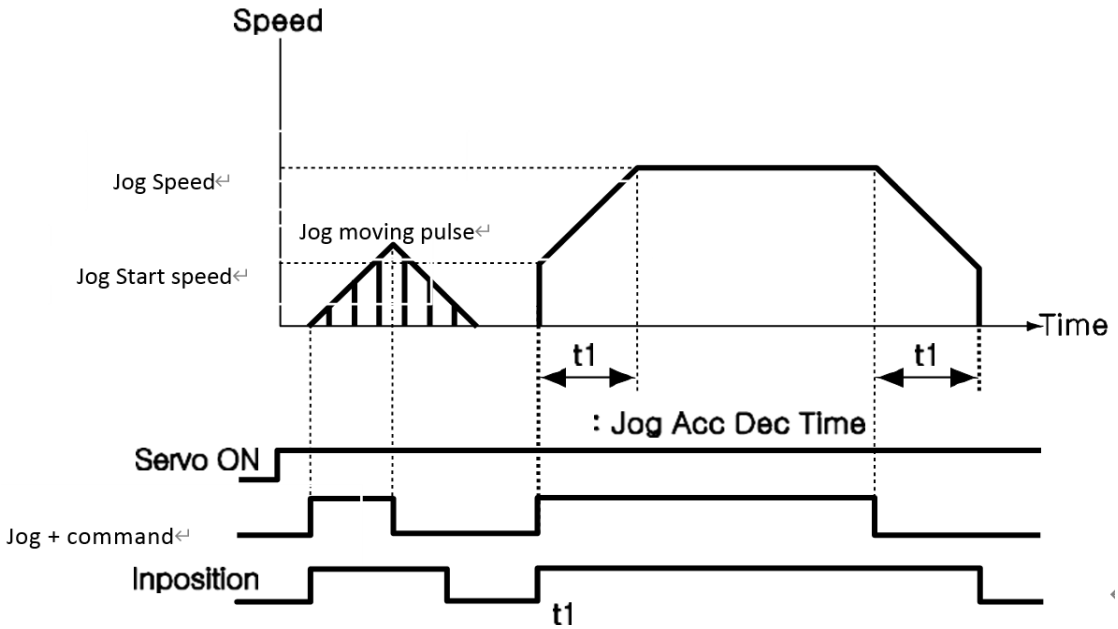
This product executes speed control operation at the speed set by parameters according to inputting ‘Jog+’ and ‘Jog-‘ signals.

【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.



6-3. 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 parameters 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	0~7
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.	-2,147,483,648 ~ +2,147,483,647
Org Position Set	After origin return is finished, 'Command Pos' value is set to this setting value.	-2,147,483,648 ~ +2,147,483,647
Org Sensor Logic	To set the origin sensor signal level.	0~1
Org Torque Ratio	To set the torque ratio during Torque origin method	20~90[%]

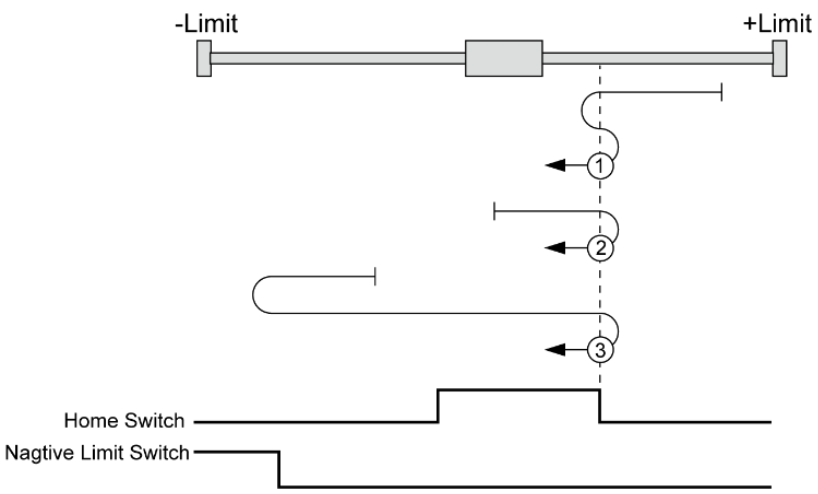
*The Org Torque Ratio value is determined by the load condition and is influenced by motor product variation, power fluctuation, and wiring conditions. Also, if the load fluctuation is expected, please set a sufficiently large value.

(1) Origin Return method setting

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

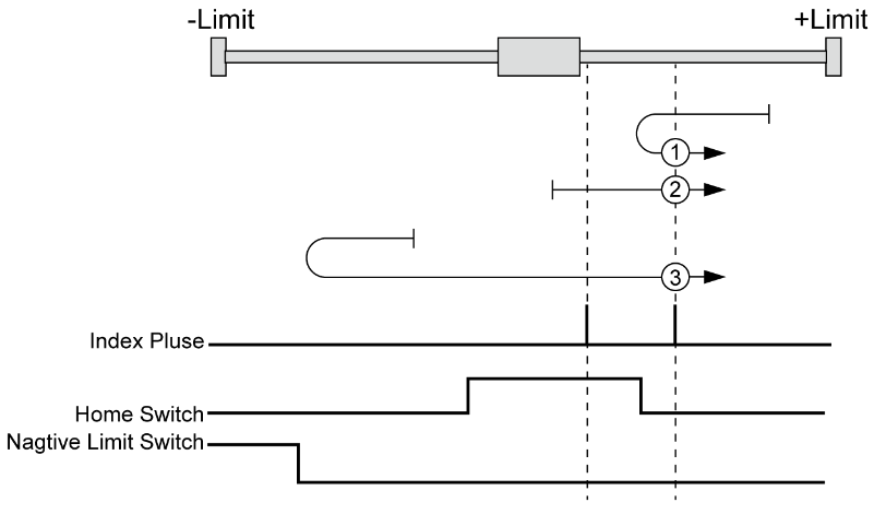
- The arrows in the picture below depict moving directions.
- ○ in the picture below are origin end positions.
- Index Pulse is Z Phase pulse.
- In case of origin return by a Z-pulse, Slow origin return is performed as the speed of 'Org Search Speed' value.

(1) Origin (Org Method = 0)



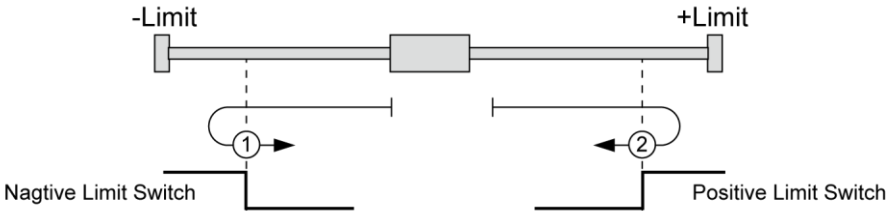
① In case of position of sensor Dog is between the origin and +Limit Sensor
② In case of position of sensor Dog is in the origin sensor
③ In case of position of sensor Dog is between origin and -Limit Sensor

(2) Z Origin (Org Method = 1)



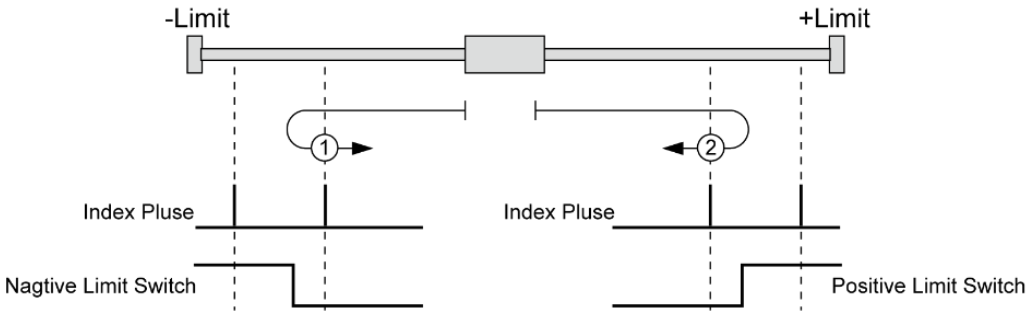
① In case of position of sensor Dog is between the origin and +Limit Sensor
② In case of position of sensor Dog is in the origin sensor
③ In case of position of sensor Dog is between origin and -Limit Sensor

(3) Limit Origin (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 (Org Method = 3)



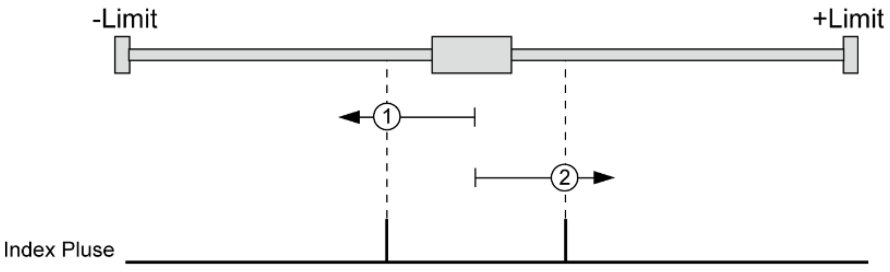
① In case of Org Dir is 1 (CCW)
② case of Org Dir is 0 (CW)

*注意：如果指令解析度與編碼器不同，尋找索引脈衝時可能會出現問題。

(5) Set Origin (Org Method = 4)

It designates the current mechanical position as a origin irrespective of sensor.

(6) Z Phase (Org Method = 5)

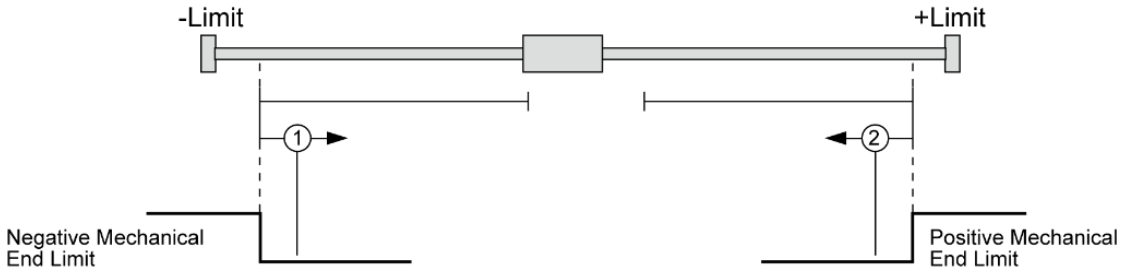


① In case of Org Dir is 1 (CCW)
② In case of Org Dir is 0 (CW)

*注意：如果指令解析度與編碼器不同，尋找索引脈衝時可能會出現問題

(7) Torque Origin (Org Method = 6)

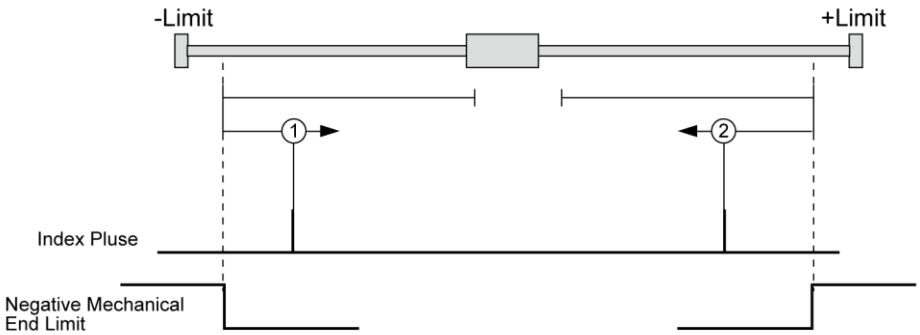
During the motion by 'Org Speed' value ,It will stop motion when detects the force as much as 'Org Torque Ratio' by contacting with a particular object, and finish the origin movement after moving a specified distance with opposite direction.
This method can be used in the system without origin sensor or limit sensor.



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

(8) Z Torque Origin (Org Method = 7)

'During the motion by 'Org Speed' value , It will stop motion when detects a force as much as 'Org Torque Ratio' by contacting with a particular object, And move to opposite direction until detecting the Z phase.
This method can be used in system without origin sensor or limit sensor.



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

*Caution : If the command resolution is different from the encoder resolution, problems may occur when finding the index pulse.

(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 completion

Completion of Origin return can be judged by the value of Origin Search OK (corresponding to Ver06.01.30.05 or later) or the corresponding bit (Origin Search OK) of Axis status of communication program.

6-4. Stop Operation

By using of control input or communication program command, the user can do stop and emergency
stop. 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.

6-5. Compare Out

This function generates periodic pulses in specified condition. This function can be used in absolute coordinate system.

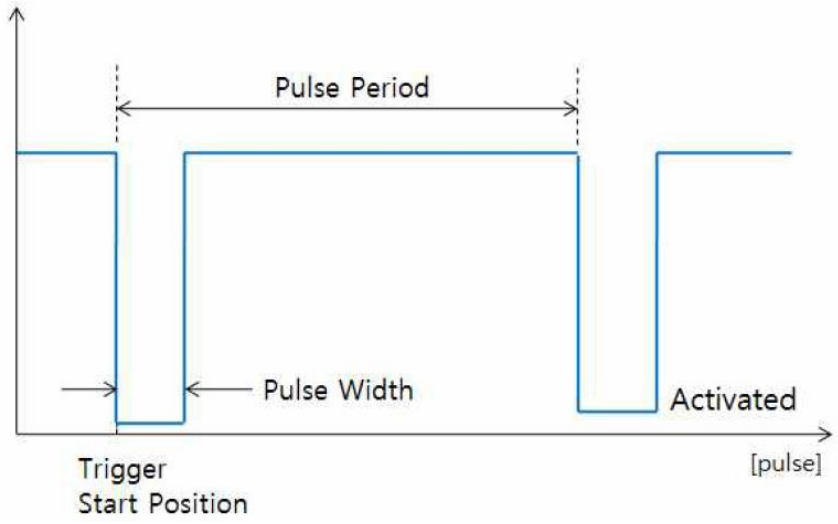
(1) Settings

This function is working with RS-485 communication method only.
This command can be executed during the positioning command or before the positioning command also. The following table shows the setting conditions.

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.	-2,147,483,648 ~ +2,147,483,647
Pulse Period	Setting the pulse period. (0 : pulse output only 1 time in Pulse start position. 1~ : pulse output repeatedly depends on setting.)	1~2,147,483,647 [pulse]
Pulse Width	Setting the pulse width.	1~1000[ms]

(2) Signal Output

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 start position’and is output in incremental motion direction.

⚠ **Caution**	The sign of current position value and the sign of ‘pulse start position’ must be same to pulse output.

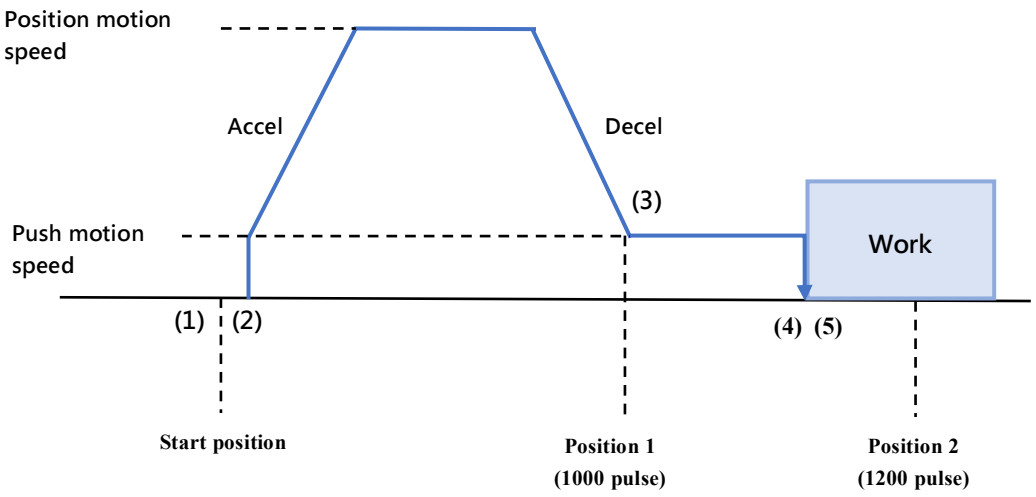
(3) Status Check

By using DLL program, the user can check the trigger pulse output status.
Refer to ‘CK10_UserManual_Communication Function_MODBUS’.

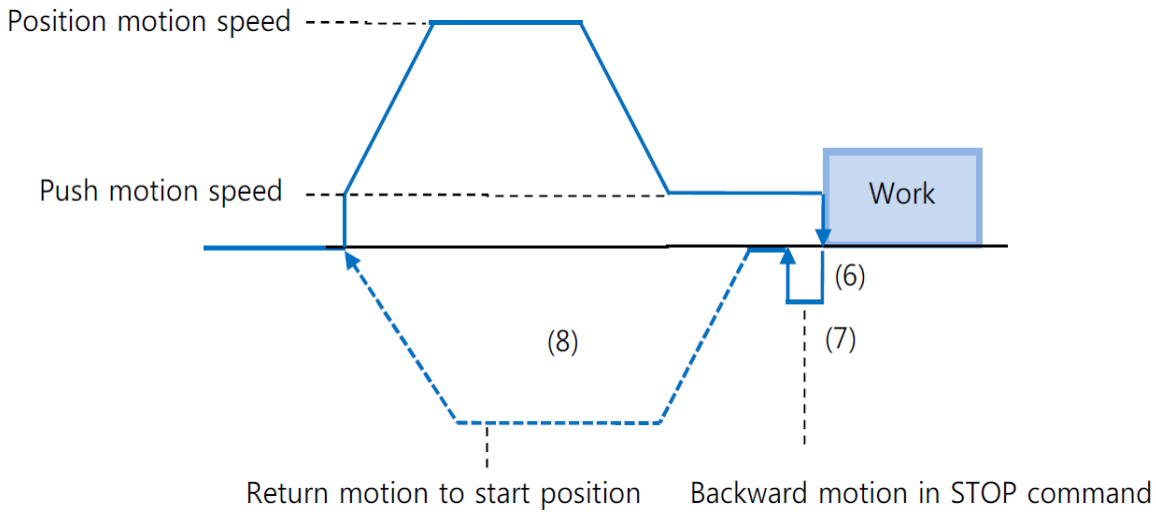
6-6. Push Motion

This function limits the torque of the motor and detects load status. If the load exceed the specified torque ratio in the stop mode, the motor will stop.

(1) Function



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 Stoped' / '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 the next step is needed as below diagram.
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.

⚠ **Caution**	Extends the distance of Position motion command when Push motion is not excuted.

⚠ **Caution**	If the work can not be detect during Push Position, the push mo de is Automatically finished.

⚠ **Caution**	The repeatability of the torque is about 10. And it can be increa sed or decreased depending on the environments.

(2) Setting Method

This function is working only in absolute position value. The position error can happen 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 'CK10_UserManual_Communication Function_MODBUS'.

Setting Item	Description	Range *1
Position motion/ Start speed	Start speed value of position motion	1~35000[pps]
Position motion/ Moving speed	Moving speed of position motion	1~500000[pps]
Position mode/ Target Position	Absolute target position of position command	-2,147,483,648 ~ 2,147,483,647
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 motion/ Moving speed	Moving speed of Push motion (max 400[rpm])	1~66000[pps]
Push motion/ Target position	Absolute target position of push command *Non-stop mode : the value must be set more than ' Position command Target Position' value. *The motor will stop if the position is exceed this value even if the work is not detected.	-2,147,483,648 ~ 2,147,483,647
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].	0~10,000

*1 : The unit of [pps] in this item is referenced to 10,000[ppr] encoder.

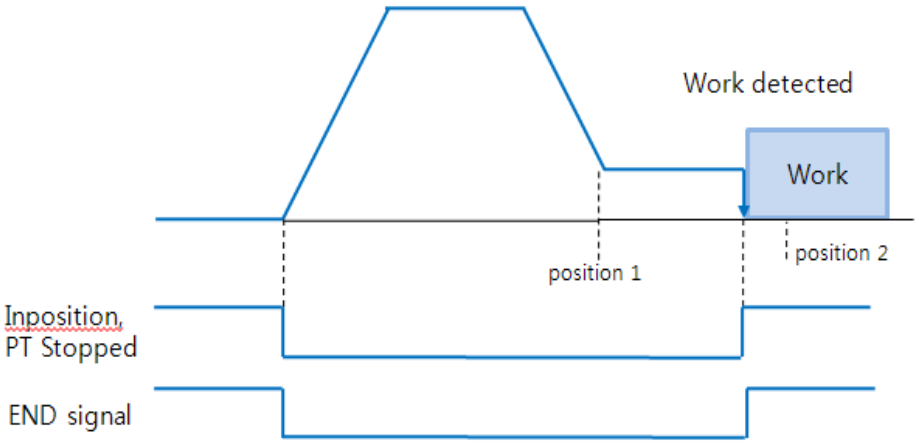
② Input signal(PT Start) Method

Firstly the position table data must be entered before the push motioning and refer to 'CK10_UserManual_Position Table' .

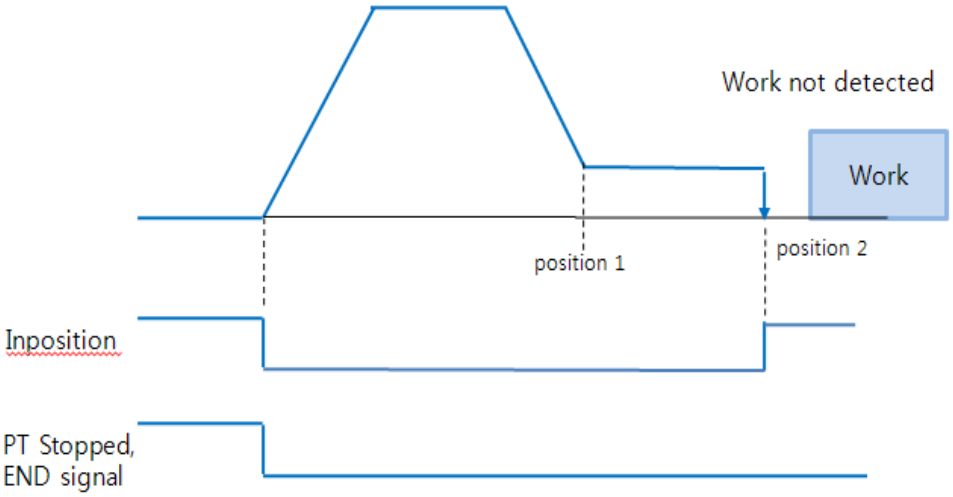
(3) Status Check

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



① Work not detected (Stop mode)



The 'Inposition' signal is still OFF when the work is not detected in Non-stop mode. If the work is overdue after work detect('Inposition' signal is ON), the 'Inposition' signal change to OFF status. But the 'PT Stopped/END' signal is still ON after the first work detect. The push command is stopped at 'position 2'(absolute position value in push command).

(4) Alarm

Basically the alarm (#3 and #4) function is not working during push motion moving. This is because of the position error and overload alarm can be happen in push mode. If the alarm happens during return to start position after finishing push motioning, increase the parameter '27. Position Tracking Limit value.

7. Communication Function

Up to 16 axes can be controlled by Daisy chain of RS-485 communication method.

Caution	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.

7-1. 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

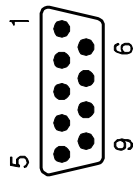
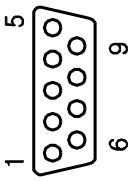


RS-485 Converter (to RS-232)

For connection with the PC, refer to '3-1 Controller Configuration' .

(1) Cable of Connecting RS-232 Port (to PC) and Converter (RS-232 ↔ 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	Converten Connector (DB-9 male)	
Pin Layot	Pin No		Pin No	Pin Layot
	1 2 3 4 5 6 7 9 Frame GND		1 2 3 4 5 6 7 9 Frame GND	

(2) Cable of connecting RS-485 Converter and Drive Module

Connector Type : RJ45
Cable Type : LANcable, 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.

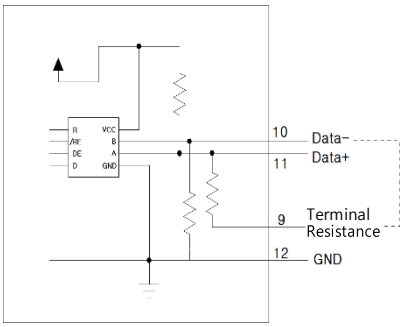
RJ45 Pin No.	UTP CAT5 cable	Function
1	White/Orange	GND
2	Orange	GND
3	White/Green	Data+
4	Blue	GND
5	White/Blue	GND
6	Green	Data-
7	White/Brown	GND
8	Brown	GND
case		Frame GND

Caution	"The chassis 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.

7-2. Communication Interface Circuit



It shows the input / output circuit of RS-485 communication interface signal. When the product is installed at the end of the network configuration, connect the terminating resistor to the data pin as shown in the figure. MECQ2 keeps receiving mode usually and transmits only while responding to the receiving command.
For more information of communication function, refer to
「CK10_UserManual_Communication Function_MODBUS」 in a separate volume.

8. Parameter

8-1. Parameter List

No.	Name	Unit	Lower Limit	Upper Limit	Default
0	Pulse Per Revolution	0	50,000	0	0
1	Axis Max Speed	[pps]	1	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	Reserved	[%]	100	100	100
6	Jog Speed	[pps]	1	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]	-2,147,483,648	2,147,483,647	2,147,483,647
10	S/W Limit Minus Value	[pulse]	-2,147,483,648	2,147,483,647	-2,147,483,648
11	S/W Limit Stop Method		0	2	2
12	H/W Limit Stop Method		0	0	0
13	Reserved		-	-	-
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	[puls]	-2,147,483,648	2,147,483,647	0
20	Org Position set	[puls]	-2,147,483,648	2,147,483,647	0
21	Reserved		-	-	-
22	Position Loop Gain		0	63	4
23	Inpos Value		0	127	0
24	Pos Tracking Limit	[pulse]	1	134,217,727	2,500
25	Motion Dir		0	1	0
26	Reserved		0	1	0
27	Org Torque Ratio	[%]	20	90	50
28	Pos. Error Overflow Limit	[pulse]	1	134,217,727	2,500
29	Reserved	-	-	-	-
30	Run Current	*10[%]	5	15	10
31	Boost Current	*50[%]	0	7	0
32	Stop Current	*10[%]	2	10	5
33	EMG Mode		0	4	0
34	Brake Mode in EMG		0	1	0
35	Operating Mode		0	5	3
36	Tact Switch Function		0	1	0
37	Baudrate		0	4	4
38	Restore ActPos/PT-No		0	1	1
39	Motor No Display		0	1	0

8-2. Parameter Description

<table>
<tr><th>No.</th><th>Description</th><th>Unit</th><th>Lower Limit</th><th>Upper Limit</th><th>Default</th></tr>
<tr><td>0</td><td>Pulse per Revolution :
Number of pulses per revolution.
If this value is changed, the motor is set to Servo OFF.
<table>
<tr><th>Value</th><th>Pulse/Revolution</th><th>Value</th><th>Pulse/Revolution</th></tr>
<tr><td>0</td><td>Set by MDB</td><td>8</td><td>4,800</td></tr>
<tr><td>1</td><td>500</td><td>9</td><td>5,000</td></tr>
<tr><td>2</td><td>1,000</td><td>10</td><td>6,400</td></tr>
<tr><td>3</td><td>1,600</td><td>11</td><td>8,000</td></tr>
<tr><td>4</td><td>2,000</td><td>12</td><td>9,600</td></tr>
<tr><td>5</td><td>3,200</td><td>13</td><td>10,000</td></tr>
<tr><td>6</td><td>3,600</td><td>14</td><td>16,000</td></tr>
<tr><td>7</td><td>4,000</td><td>15</td><td>20,000</td></tr>
</table></td><td></td><td>0</td><td>15</td><td>0</td></tr>
<tr><td>1</td><td>Axis Max Speed :
When position moving commands (absolute move, incremental move) are given, this parameter 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 in pps (pulse/s).
Upper Limit value has limited by Pulse per resolution value
In case of 10,000 : 500,000
In case of 16,000 : 800,000</td><td>pps</td><td>1</td><td>800,000</td><td>500,000</td></tr>
<tr><td>2</td><td>Axis Start Speed :
When position moving commands (absolute move, incremental move) are given, this parameter sets the operation start speed in pps (pulse/s)</td><td>pps</td><td>1</td><td>35,000</td><td>1</td></tr>
<tr><td>3</td><td>Axis Acc Time :
When position moving commands (absolute move, incremental move) are given, this parameter sets the acceleration time in milliseconds</td><td>msec</td><td>1</td><td>9,999</td><td>100</td></tr>
<tr><td>4</td><td>Axis Dec Time :
When position moving commands (absolute move, incremental move) are given, this parameters sets the deceleration time in milliseconds.</td><td>msec</td><td>1</td><td>9,999</td><td>100</td></tr>
<tr><td>~~5~~</td><td>Reserved</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>Jog Speed :
When jog command is given, this parameter sets the motor speed in pps (pulse/s).</td><td>pps</td><td>1</td><td>800,000</td><td>5,000</td></tr>
<tr><td>7</td><td>Jog Start Speed :
When jog position moving command is given, this parameter sets the operation start speed in pps (pulse/s).</td><td>pps</td><td>1</td><td>35,000</td><td>1</td></tr>
</table>

8	**Jog Acc Dec Time :** In case of jog operation, this parameter sets the time of acceleration and deceleration in milliseconds.	msec	1	9,999	100
9	**S/W Limit Plus Value :** When position moving commands (absolute move, incremental move, jog) are given, this parameter sets the maximum position limit that the motor can move to the plus(+) direction with 32 bits.	pulse	-2,147,483, 648	+2,147,483, 647	+2,147,483, 647
10	**S/W Limit Minus Value :** When position moving commands (absolute move, incremental move, jog) are given, this parameter sets the minimum position limit that the motor can move to the minus(-) direction with 32 bits.	pulse	-2,147,483, 648	+2,147,483, 647	+2,147,483, 647
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	2
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	**Reserved**	-	-	-	-
14	**Org Speed :** In case of origin return command, this parameter sets the operation speed until the motor senses the origin sensor in pps(pulse/s).	pps	1	800,000	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 in pps(pulse/s) by this parameter.	pps	1	80,000	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 in milliseconds by this mode	msec	1	9,999	50

17	**Origin Method :** The user can select origin return command types. 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'. For more information, refer to '6-3 Origin Return'.		0	7	0
18	**Org Dir :** In case of origin return, this parameter sets the direction of the motor. 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	-2,147,483,648	+2,147,483,647	0
20	**Org Position Set:** After origin return is completed, 'Command Pos/Actual Pos'value is set to this setting value.	pulse	-2,147,483,648	+2,147,483,647	0
21	**Reserved**		-	-	-

22

Position Loop Gain :

After the motor stops, this mode controls the motor's response by a load attached to the motor. This 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. 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.

Set this mode as follows.

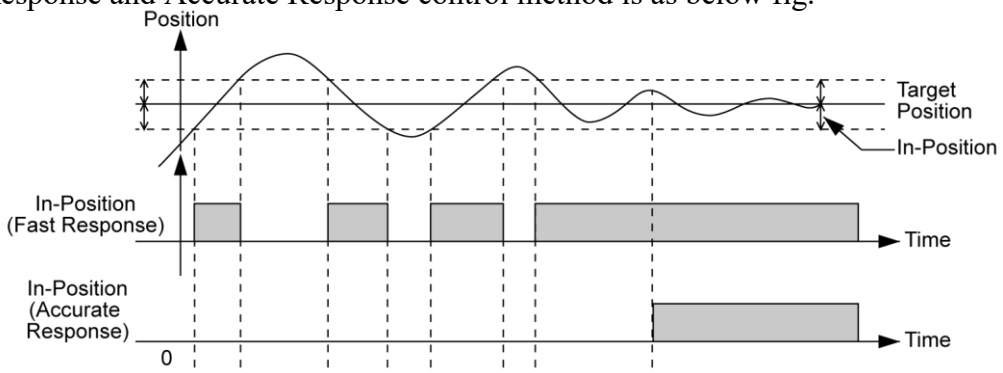
1)Set the value to '0'

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.

Value	Integral Part's Time Constant	Proportional Gain	Value	Integral Part's Time Constant	Proportional 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

23	**Inpos Value :** Sets the output condition of the in-position 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.		0	127	3
	Fast Response and Accurate Response control method is as below fig.  				
24	**Pos Tracking Limit :** 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	2,500
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	**Reserved**	-	-	-	-
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.	%	20	90	50
28	**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.	pulse	1	+134,217,727	2,500
29	**Reserved**	-	-	-	-

30	**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. Precaution: 1)To be notified If Run Current value is high, heat temperature can be increasing. 2)Run Current is automatically controlled according to load, so please use in case of lacking torque in operation.	*10[%]	5	15	10
31	**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 : 1) 28L (Current: 0.9[A]) 2) Run Current : 10(100[%]) 3) Boost Current : 1(50[%]) 4) Control current in case of acceleration : 0.9[A]+0.9[A]*50[%] = 1.35[A] Precaution: To be notified If Run Current value is high, heat temperature can be increasing.	*50[%]	0	7	0
32	**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%.	*10[%]	2	10	5
33	**EMG Mode:** When EMG input is activated(open), do 0 : Quick Stop 1 : Quick Stop, Servo Off 2 : Deceleration Stop 3 : Deceleration Stop, Servo Off 4 : Servo Off		0	4	0
34	**Brake Mode in EMG:** Selecting the brake control when EMG state 0 : Hold Brake 1 : Unlock Brake (Excitation brake)		0	1	0

35	**Operating mode:** Setting drive operating mode. The change of this parameter requires power-off/on cycle. 0 : 1 pulse mode (Pulse/Dir) 1 : 2 pulse mode (CCW/DIR) 2 : Quadrature mode (A/B) 3 : Plus-R mode 4 : MODBUS RTU mode 5 : MODBUS ASC mode		0	5	3
36	**Tact Switch(SW3) Function :** 0 : No function 1 : Alarm Reset If SW3 is kept pressed when power is on, the drive will be set to 115,200 bps & Plus-R mode temporarily		0	1	0
37	**Baudrate:** Setting the communication speed. The change of this parameter requires power-off/on cycle. 0 : 9,600 1 : 19,200 2 : 38,400 3 : 57,600 4 : 115,200		0	4	4
38	**Restore ActPos/PT-No:** CK10 stores current position and PT-No to non-volatile memory when the power is turned off. This parameter sets whether to restore them or not. * Note that the restored position value may not be same with the real position. 0 ：Disable 1 ：Enable		0	1	1
39	**Motor No Display:** CK10 can display the motor number by blinking the LEDs. This parameter sets whether to blink the motor number. This function adds delay of a few seconds to initialize. 0 ：Disable 1 ：Enable		0	1	0

9. Protection Function

9-1. Type of Alarm

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

Times	Alarm name	Condition
1	Over Current Error	The current through power devices in drive exceeds 4.8A
2	Over Speed Error	Motor speed exceeds 3,000 [rpm]
3	Position Tracking Error	Position error value is higher than 90˚in motor run state *1
4	Over Load Error	The motor is continuously operated more than 5 seconds under a load exceeding the max. torque
5	Over Temperature Error	Inside temperature of drive exceeds 85℃
6	Over Regenerative Voltage Error	Back-EMF is higher than 70V
7	Motor Connect Error	The power is ON without connection of the motor cable to drive
8	Encoder Connect Error	Cable connection error in Encoder connection of drive
10	In-Position Error	After operation is finished, a position error occurs
12	ROM Error	Error occurs in parameter storage device(ROM)
15	Position Overflow Error	Position error value is higher than 90˚ in motor stop state *2

*1. The setting value [pulse] in ‘Pos Tracking Limit[No.24]’parameter

*2. The setting value[pulse] in ‘Pos Error Overflow Limit[No28]’ parameter

9-2. 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

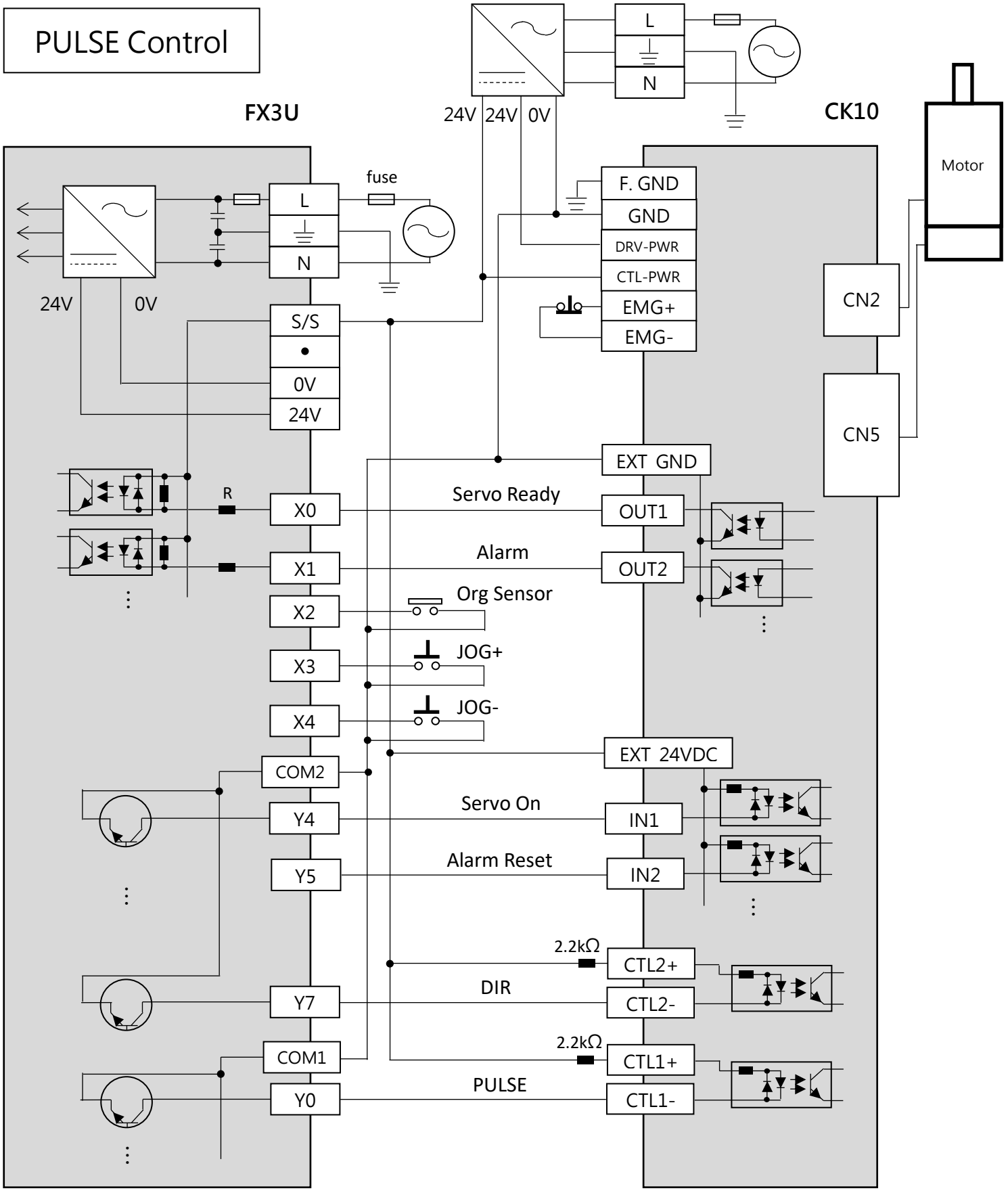


9-3. Alarm Check and Release

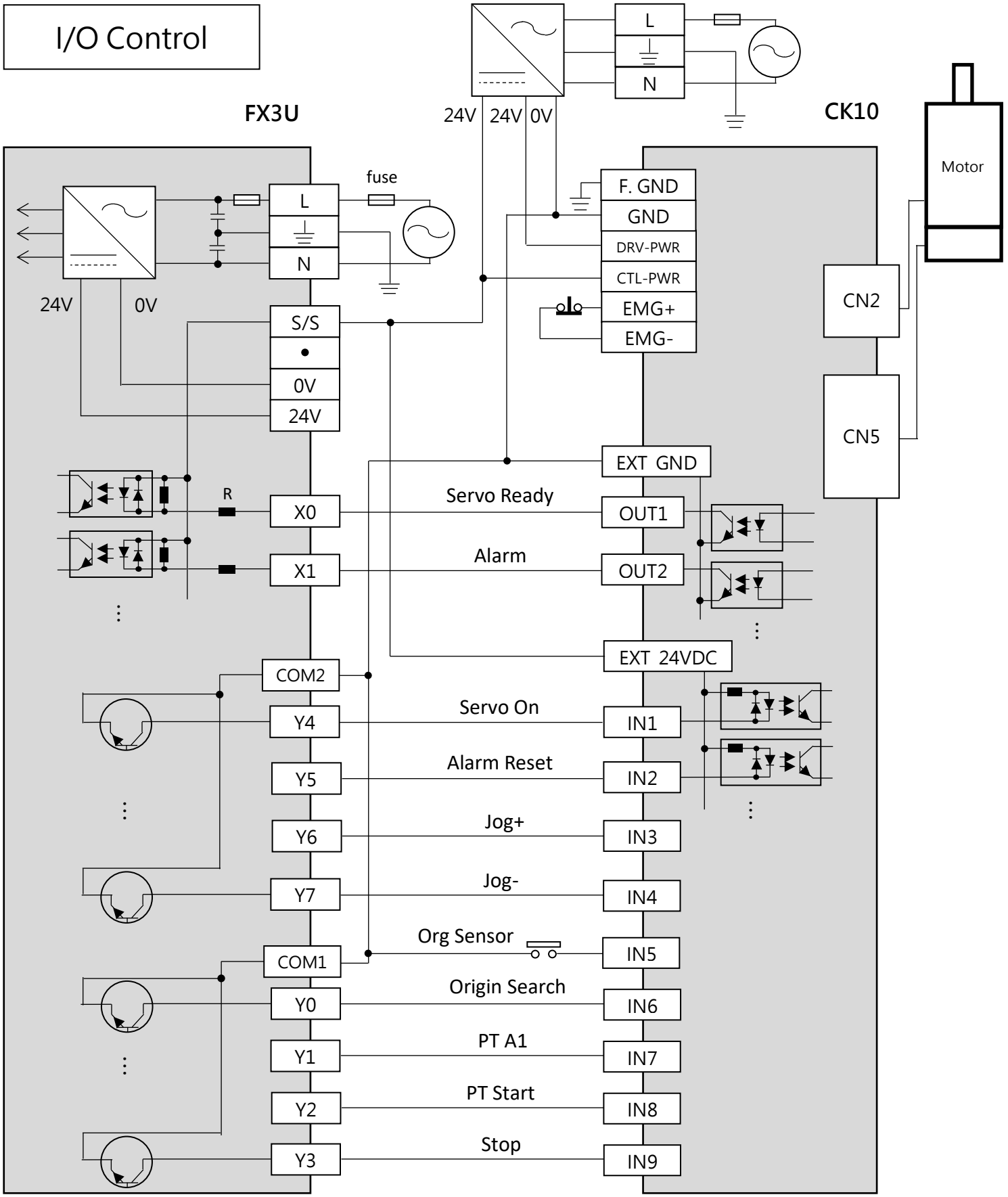
If an alarm occurs, remove its cause and then release it. The alarm can be released as follows. In case of alarms of which 'Reset 'column is indicated to 'Invalid', power must get down prior to releasing the alarms

Flash Count	Alarm Name	Description	Reset
1	Over Current Error	1) Check the motor's short-circuit (A, /A, B, /B) 2) Check the mechanical status, parameter settings.	Valid
2	Over Speed Error	1) Check parameter setting, and abnormal operation of the motor. 2) Check the speed command of upper controller(ex:PLC).	Valid
3	Position Tracking Error	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	Over Load Error	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.	Valid
5	Over Temperature Error	1) Get down the ambient temperature or install a cooling fan. 2) Check the distance is over 50mm between drivers.	Valid
6	Over Regenerative Voltage Error	1)In case of high-speed operation, check if the acceleration or deceleration speed is low.	Valid
7	Motor Connect Error	1)Check if power is supplied to the drive. 2)Check the diameter and length of power cable	Invalid
8	Encoder Connect Error	1) Please contact to distributor if it occurs again after power OFF / ON.	Invalid
10	In-Position 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 encoder.	Valid
12	ROM Error	1) Contact to distributor..	Invalid
15	Position Overflow Error	1) Get down the load or increase the acceleration or deceleration speed. 2) Check the brake and encoder is working correctly or not.	Valid

Appendix. Wiring Diagram Example of MITSUBISHI FX3U Series



I/O Control


FX3U
CK10
24V
24V
0V
L
N
fuse
24V
0V
L
N
S/S
0V
24V
F. GND
GND
DRV-PWR
CTL-PWR
EMG+
EMG-
Motor
CN2
CN5
EXT GND
EXT 24VDC
R
X0
X1
Servo Ready
Alarm
OUT1
OUT2
COM2
Y4
Y5
Y6
Y7
Servo On
Alarm Reset
Jog+
Jog-
IN1
IN2
IN3
IN4
COM1
Y0
Y1
Y2
Y3
Org Sensor
Origin Search
PT A1
PT Start
Stop
IN5
IN6
IN7
IN8
IN9