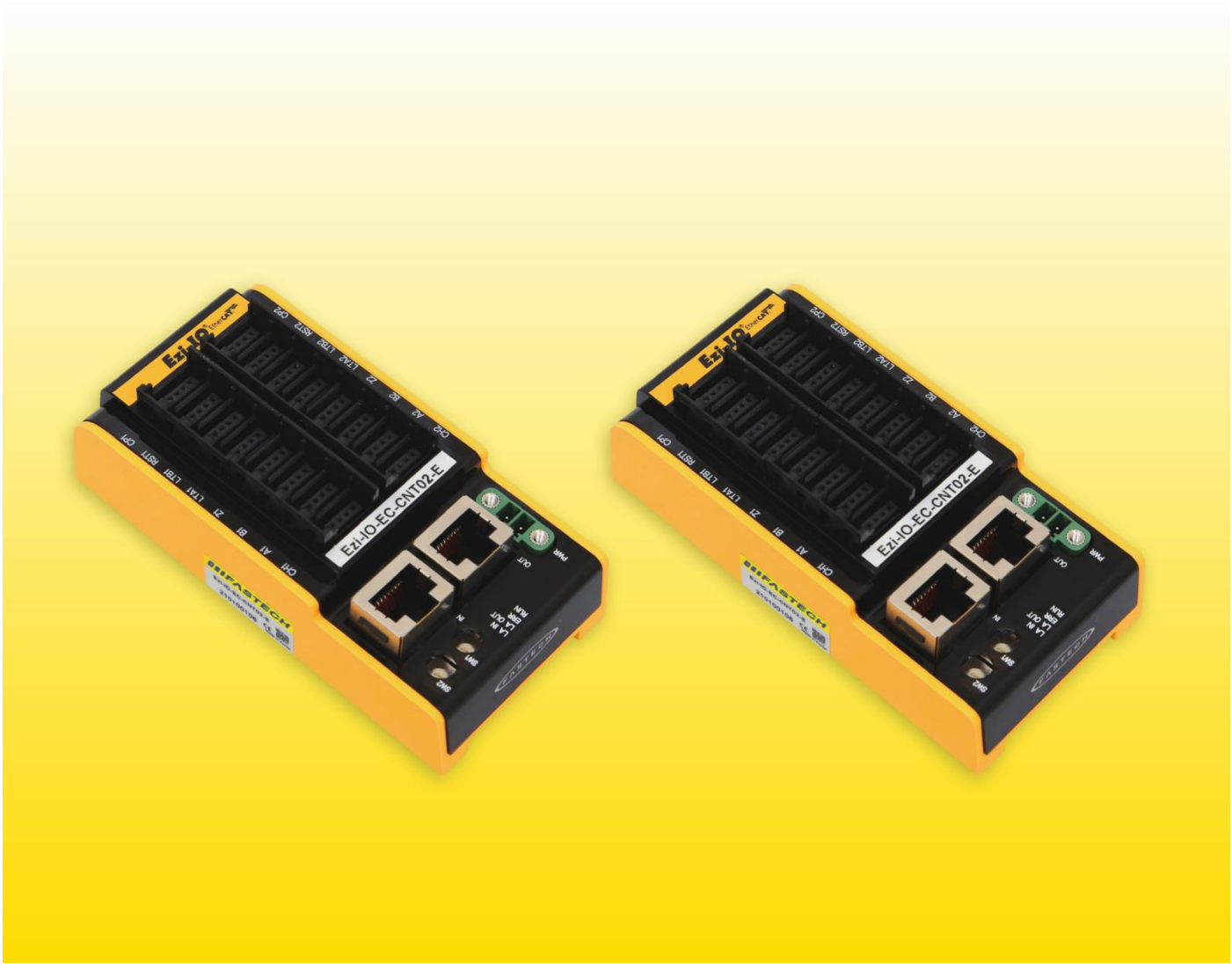
Ezi-IO®

EtherCAT®

Input/Output Module

CNT

User manual



FASTECH

Fast, Accurate, Smooth Motion

Part 1 Safety and Installment Precautions

1.1 Before using

- Thank you for purchasing FASTECH's Ezi-IO EtherCAT CNT.
- Ezi-IO EtherCAT CNT is a high-speed counter module with EtherCAT Salve Controller Chip.
- This manual includes operating instructions, safety precautions, specifications and etc. of Ezi-IO EtherCAT CNT.
- Please use the Ezi-IO EtherCAT CNT safely after a full comprehension of the User Manual.
- Make sure that the end users read this manual and then keep the manual in a place for future reference.

1.2 Precautions

1.2.1 General Precaustions

- The User Manual may be altered for product improvement, specification changes, or for a more accessible manual without prior notification. Please confirm there is a User Manual along with the purchased product.
- Should you damage or mislocate your Usual Manual, please contact your authorized dealer or head office for a new one.
- Any alterations made to the product by user is not in the range of the warranty thus, the company will not be held responsible.

1.2.2 Installment Precautions

- This product must be used indoors, between the temperatures of 0°~ 50°C.
- If the case goes over 50°C, it must be cooled down.
- It must not be installed near direct sunlight, magnetic or radioactive objects.
- In the case 2 or more are installed side by side, the products must be at least 20mm apart vertically and 50mm apart horizontally.

1.2.3 Safety Precautions

- Make sure you have a full comprehension of the User Manual before installation, operation, examination and or repairs. Also, please use the product after a full comprehension about machinery and safety information.
- In this manual, the safety precautions are classified into two levels: ⚠ Attention and ⚠ Warning .

⚠ Attention	**Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.**
⚠ Warning	**Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.**

- Though the contents correspond to ⚠ Attention , under some circumstances, results may be more serious. Observe all safety instructions.

1.2.3.1 Design Precaution

⚠ Warning	**Please design an appropriate protection circuit to protect the system from defects in external power or other connected equipment.** **Please take steps to safely protect the system from communication errors (emergency shutdown, interlock circuits, limit circuits, etc.).**

1.2.3.2 Installment Precautions

⚠ Attention	**Please check for damages or omitted parts.** There is a danger of damage to the product in the case of the installment or operation of an abnormal product. **Take exceptional caution when moving the product.** If dropped, the product can be damaged and cause an injury if dropped on the foot. **Please use non-flammables such as metals in place of handling the product.** There is a risk of fire. **If there are several Ezi-IO CC-Link IE TSN DIO installed in a closed space,** **please install cooling fans to keep the temperature around the modules below 50℃.** In the case overheating, there is a danger of fires or other accidents.
⚠ Warning	**Installment, connection, handling, operation and inspection or fault diagnosis should be done by qualified personnel.** It can be a cause for fires, injuries or damage of device.

1.2.3.3 Wiring Instructions

⚠ Attention	**Properly observe regular range for module power input voltage.** It can be a cause for fires or damages. **Closely abide by the wiring diagram for connection.** It can be a cause for fires or malfunction.
⚠ Warning	**Make sure the power is OFF before working on the module.** There is a risk of electric shock or fire.

1.2.3.4 Operation and Setting Precaution

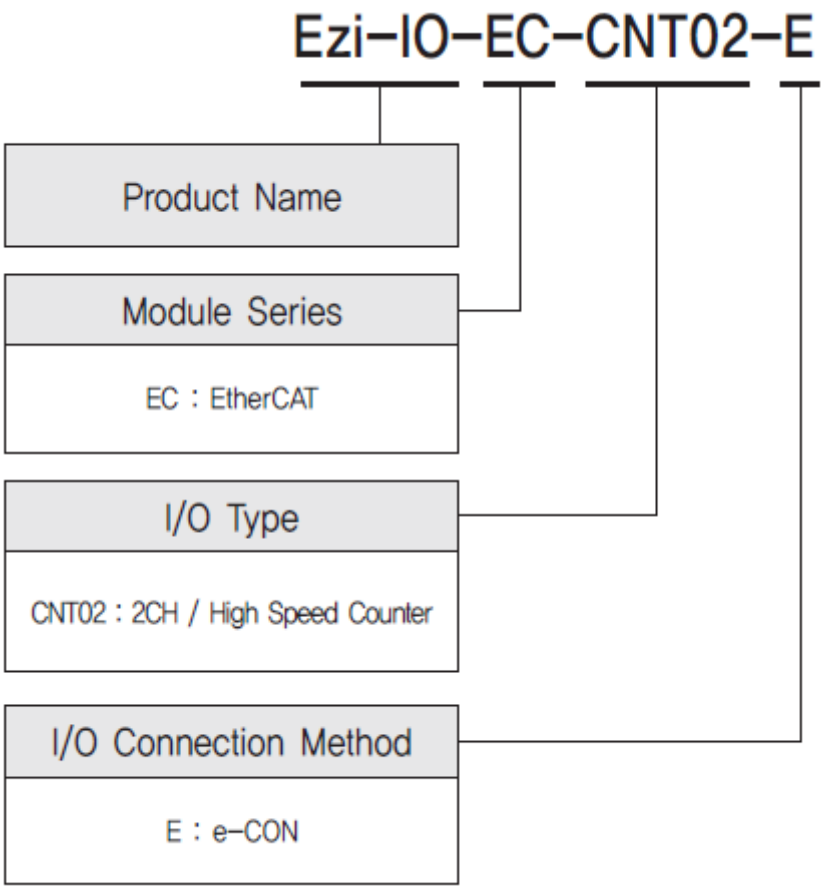
⚠ Attention	**Make sure you have a full comprehension of the User Manual before changing settings.** There is a risk of damaging machinery or the product.

1.2.3.5 Repair and Inspection

⚠ Warning	**The Ezi-IO CC-Link IE TSN DIO should be repaired and inspected only after considerable time has passed since shutting off the circuit power.** There is a risk of electric shock from remaining condenser power. **Do not change wiring when there is a current flow.** There is a risk of electric shock, damage to product or machinery. **Modifications are strictly prohibited.** There is a risk of electric shock, damage to product or machinery and any modifications will not be subject for after-sales service from FASTECH.

Part 2 Product Composition

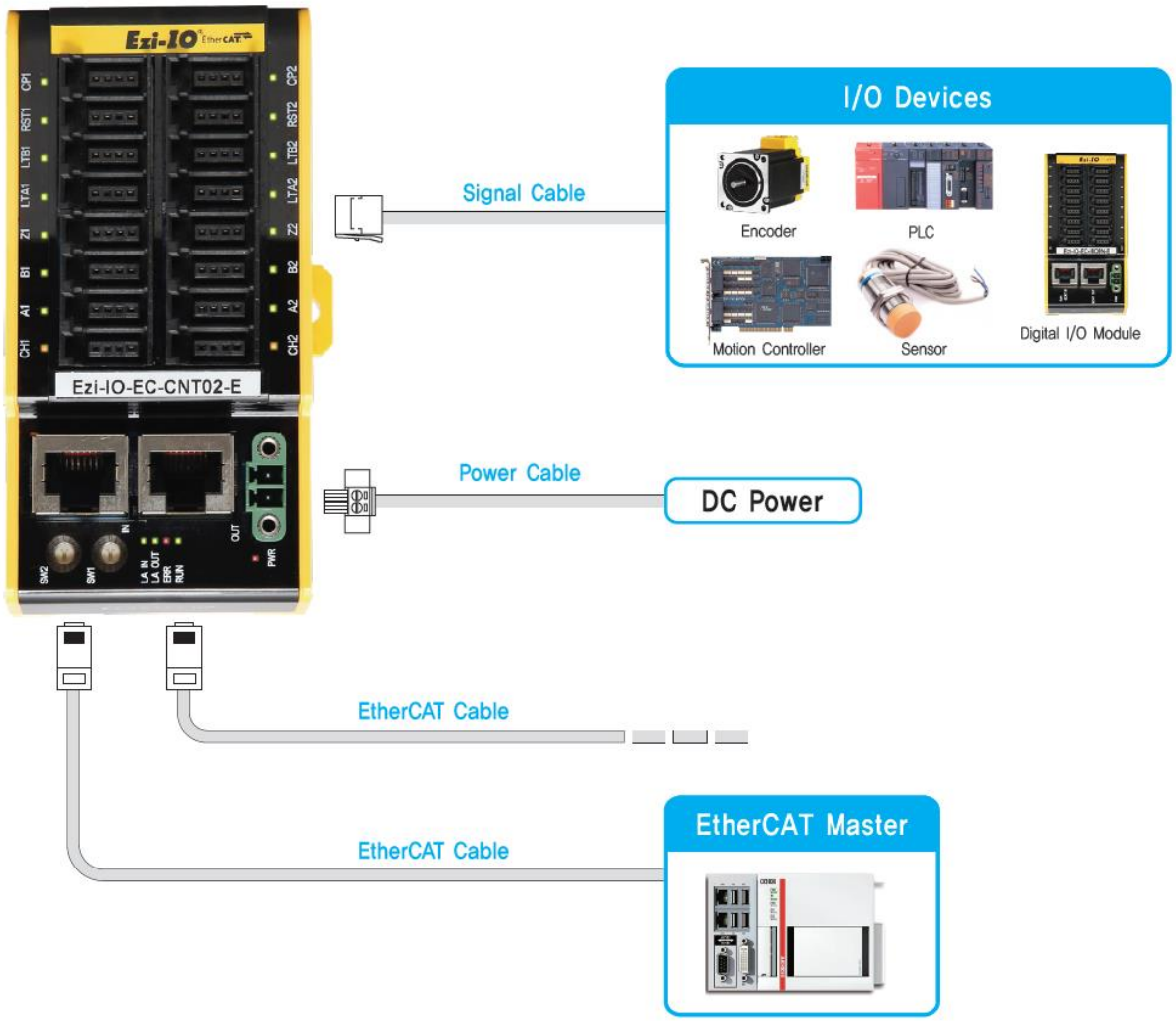
2.1 Ezi-IO EtherCAT CNT Product Name



2.2 Product List

Part Number
Ezi-IO-EC-CNT02-E

2.3 System Diagram



Part 3 Product Specifications

3.1 EtherCAT Specifications

Communication	EtherCAT
Physical Layer	Ethernet – 100BASE-TX
Connector Type	RJ45 IN: EtherCAT input OUT: EtherCAT output
ECAT Device ID	Configured Station Alias Setting by Rotary Switch : 0 ~ 99 Physical Address Setting in Master Unig : 1 ~ 65535
Topology	Line (Configured by I/O modules only) Tree, Star, Ring (When using a switching hub)
Protocol	CoE(CANopen application protocol over EtherCAT) FoE(File Access over EtherCAT)
Distributed Clock	Free Run, SM Event, DC SYNC Event (Min. Communication Cycle : 250us)
Processing Data	Fixed PDO Mapping
Cable	STP (Shielded Twisted Pair) Cable, Category 5e or higher / Max. 100m

3.2 Module Specification

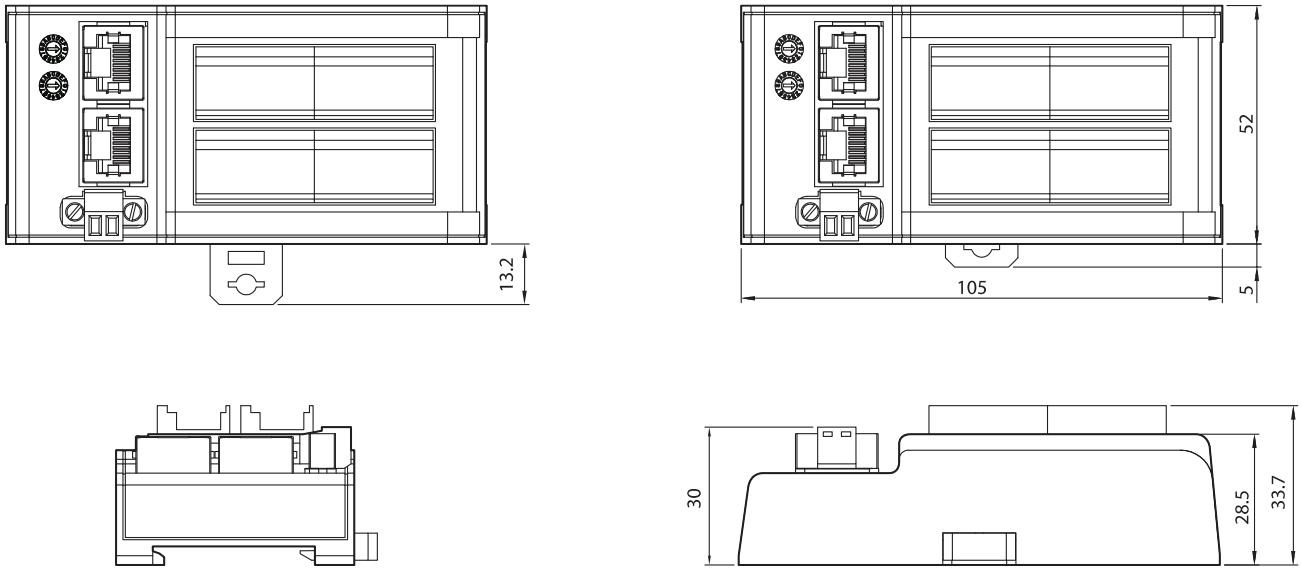
Part Number			Ezi-IO-EC-CNT02-E	
Input Voltage			DC24V±10%	
Current Consupmtion			Max. 160mA (Excluding DC5V encoder supply current and load current)	
Operating	Ambient Temperature		· In Use : 0~50℃ · In Storage : -20~70℃	
	Humidity		· In Use : 35~85% RH (Non-Condensing) · In Storage : 10~90% RH (Non-Condensing)	
	Vib. Resist.		0.5g	
Function	Number of Channels		2CH	
	Counting Range		0~4,294,967,295 (32bit)	
	Counter Function		• Counter Value Latch • Counter Value Reset • Counter Value Preset • Pulse Rate Measurement • Comparison Output	
	Pulse Input	Input Signal	3 dedicated Inputs (A phase, B phase, Z phase) for each channel	
		Input Type	Line Receiver Input (Line Driver Output)	DC Input (NPN/PNP Open Collector Output)
		Rated Input Voltage	DC5V	DC24V, DC5V
		Rated Input Current	6.3mA	
		Pulse Input Method	• Phase Differential Pulse Input (Multiplication X2, X4) • 1 Pulse Input (Pulse/Direction Input) • 2 Pulse (CW/CCW Input)	
		Max Response Frequency	• A Phase, B Phase: - Phase Differential Pulse Input: 1MHz (When multiplied by 4, 4MHz) - 1 Pulse / 2 Pulse Input: 4MHz • Z Phase: 100kHz	
		Isolation Method	Photocoupler Isolation	
	Control Input	Input Siganl	3 dedicated Inputs (Latch A, Latch B, Reset) for each channel	
		Input Type	DC Input (NPN/PNP Open Collector Output Supported)	
		Rated Input Voltage	DC24V	DC5V
		Rated Input Current	4.4mA	4.6mA
		Off → On Response Time	3μs or lower	
		On → Off Response Time	3μs or lower	
		Isolation Method	Photocoupler Isolation	
	Compare Output	Output Signal	1 dedicated Input (Comparison Output) for each channel	
		Output Type	TTL Output	Open Collector Output (Transistor Output)
		Rated Output Voltage	DC5V	DC30V or lower
		Rated Output Current	Max. 20mA	Max. 20mA
		Off → On Response Time	150ns or lower	About 20μs*
		On → Off Response Time	150ns or lower	About 20μs*
		Isolation Method	None	Photocoupler Isolation
LED Display			• Power Status (PWR) • EtherCAT Status (RUN) • Operation Error (ERR) • EtherCAT Connection (LA IN, LA OUT) • Counter Operation Status (CH1, CH2) • I/O Status(A1, B1, Z1, LTA1, LTB1, RST1, CP1, A2, B2, Z2, LTA2, LTB2, RST2, CP2)	

* This is the value when 24V DC power and a load ersistance of 2kΩ are connected, and the value may change depending on the cicruit configuration.

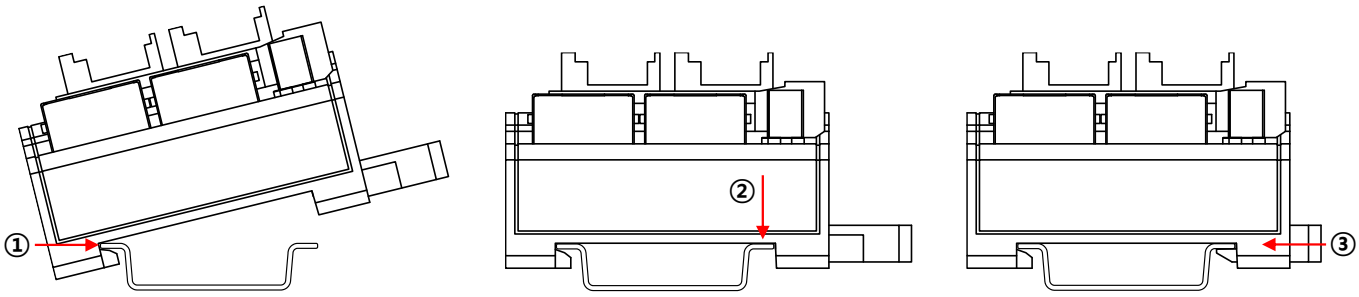
3.3 Product Size

[Unit: mm]

* Install product on a DIN rail with a width of 35mm.



3.4 Installing Product



The Ezi-IO EtherCAT CNT can be installed on a DIN rail with a width of 35mm. The installation order is as follows.

① Hang the notch on the back on the DIN rail.

② Slide the product in the direction of the DIN rail so the opposite side of the notch reaches the DIN rail.

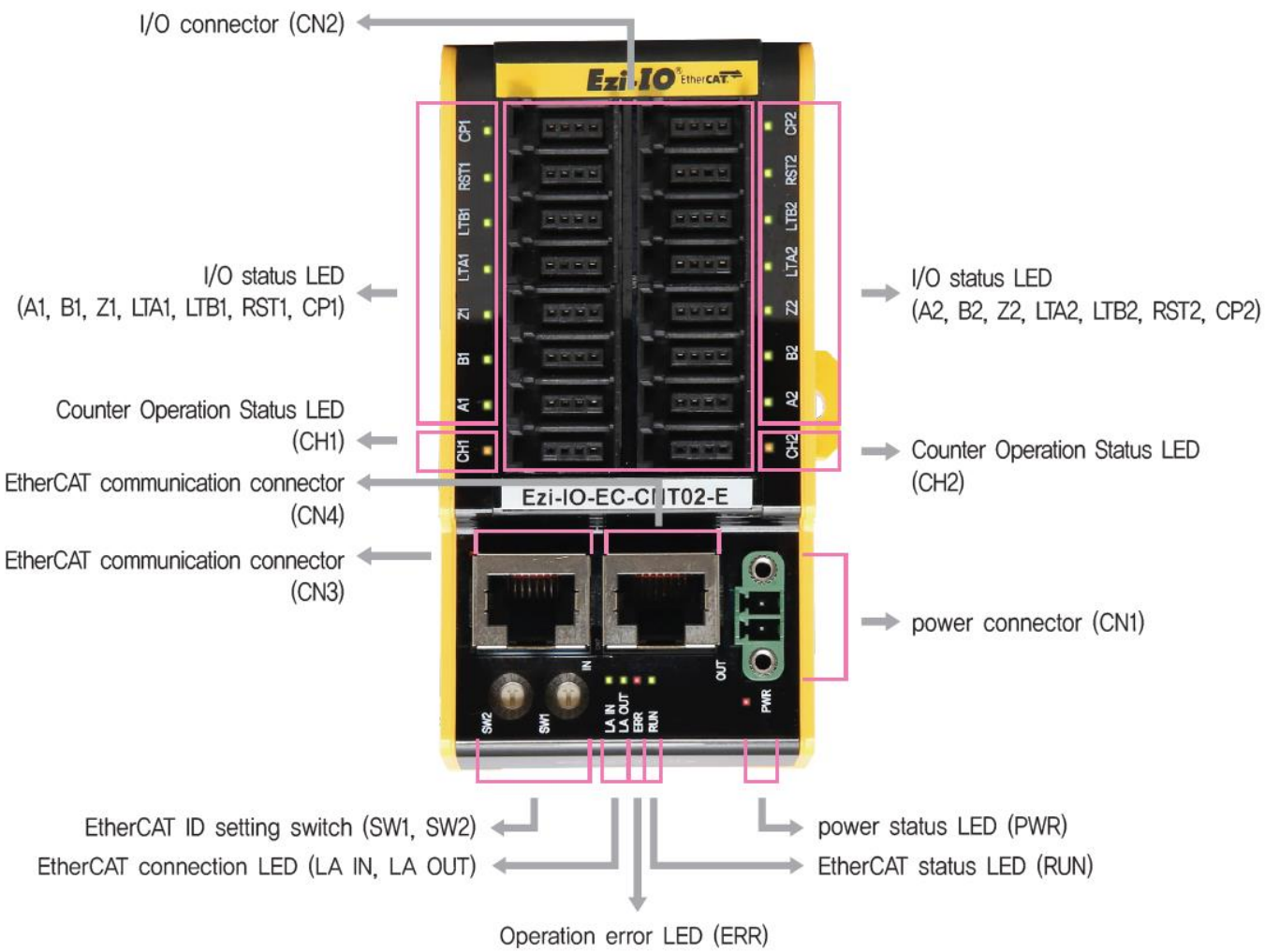
③ Push the hook lever in the direction of the arrow and fixate.

Information

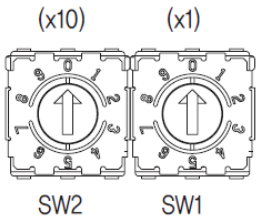
The Ezi-IO EtherCAT CNT has been designed to effectively radiate through the DIN rail. Thus, cooling the DIN rail is a more effective way to radiate the product.

Part 4 Exterior Names and Functions

4.1 Ezi-IO-EC-CNT02-E



4.1.1 EtherCAT ID Setting Switch(SW1, SW2)



They are switches to set the EtherCAT ID (ECAT Device ID) node address, and they represent a decimal number.
SW1 indicates the units digit (×1), and SW2 indicates the tens digit (×10).

* Configured Alias ID set by the rotary switches is applied when the module is turned on.

4.1.2 Status LED

Name	Color	Status	Description
PWR	Red	OFF	Power is OFF
		ON	Power is ON

Name	Color	Status	Description
RUN	Green	OFF	State INIT or Power OFF
		Blinking	State PRE-OPERATIONAL
		Single Flash	State SAFE-OPERATIONAL
		ON	State OPERATIONAL
		Flickering	State BOOTSTRAP

Name	Color	Status	Description
ERR	Red	OFF	No Error or Power OFF
		Blinking	Invalid Configuration
		Single Flash	Local Error
		Double Flash	Watchdo Time Out

Name	Color	Status	Description
Link/ Activity	Green	OFF	Link not Established
		ON	Link Established
		Flickering	Link Established and in Operation

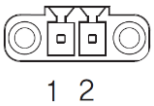
* Please refer to 6.3.2 EtherCAT Communicate State Indication for LED Status

Name	Color	Status	Description
CH1 CH2	Yellow	OFF	CH1 / CH2 is not ready to count
		ON	CH1 / CH2 is ready to count

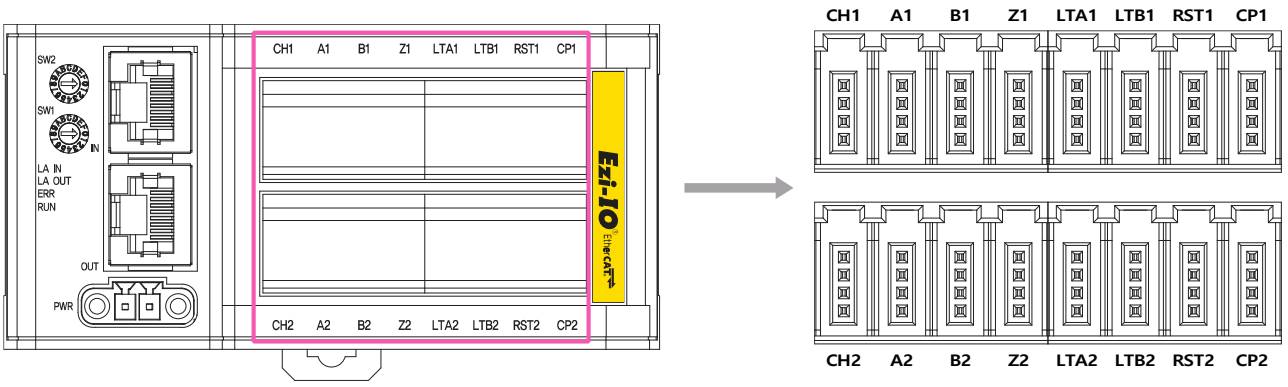
Name	Color	Status	Description
A1 A2	Green	OFF	A signal is OFF
		ON	A signal is ON
B1 B2	Green	OFF	B signal is OFF
		ON	B signal is ON
Z1 Z2	Green	OFF	Z signal is OFF
		ON	Z signal is ON
LTA1 LTA2	Green	OFF	LTA(Latch A) signal is OFF
		ON	LTA(Latch A) signal is ON
LTB1 LTB2	Green	OFF	LTA(Latch B) signal is OFF
		ON	LTA(Latch B) signal is ON
RST1 RST2	Green	OFF	RST(Reset) signal is OFF
		ON	RST(Reset) signal is ON
CP1 CP2	Green	OFF	CP(Comparison Out) signal is OFF
		ON	CP(Comparison Out) signal is ON

4.1.3 Power Connector (CN1)

No.	Function	I/O
1	DC24V	Input
2	GND	Input



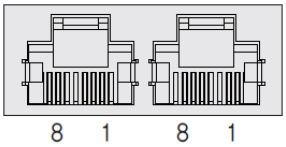
4.1.4 Input / Output Connector (CN2)



CN 1					CN 2				
Mark	No.	Name	Function	I/O	Mark	No.	Name	Function	I/O
CH1	1	NC	----	----	CH2	33	NC	----	----
	2	5V	DC5V	Output		34	5V	DC5V	Output
	3	GND	GND	Output		35	GND	GND	Output
	4	NC	----	----		36	NC	----	----
A1	5	AV1	A Pulse Input Power (24V)	Input	A2	37	AV2	A Pulse Input Power (24V)	Input
	6	A1+	A+	Input		38	A2+	A+	Input
	7	A1-	A-	Input		39	A2-	A-	Input
	8	AG1	A Pulse Input GND	Input		40	AG2	A Pulse Input GND	Input
B1	9	BV1	B Pulse Input Power (24V)	Input	B2	41	BV2	B Pulse Input Power (24V)	Input
	10	B1+	B+	Input		42	B2+	B+	Input
	11	B1-	B-	Input		43	B2-	B-	Input
	12	BG1	B Pulse Input GND	Input		44	BG2	B Pulse Input GND	Input
Z1	13	ZV1	Z Pulse Input Power (24V)	Input	Z2	45	ZV2	Z Pulse Input Power (24V)	Input
	14	Z1+	Z+	Input		46	Z2+	Z+	Input
	15	Z1-	Z-	Input		47	Z2-	Z-	Input
	16	ZG1	Z Pulse Input GND	Input		48	ZG2	Z Pulse Input GND	Input
LTA1	17	LAV1	Latch A Input Power (24V)	Input	LTA2	49	LAV2	Latch A Input Power (24V)	Input
	18	LTA1+	Latch A(+)	Input		50	LTA2+	Latch A(+)	Input
	19	LTA1-	Latch A(-)	Input		51	LTA2-	Latch A(-)	Input
	20	LAG1	Latch A Input GND	Input		52	LAG2	Latch A Input GND	Input
LTB1	21	LBV1	Latch B Input Power (24V)	Input	LTB2	53	LBV2	Latch B Input Power (24V)	Input
	22	LTB1+	Latch B(+)	Input		54	LTB2+	Latch B(+)	Input
	23	LTB1-	Latch B(-)	Input		55	LTB2-	Latch B(-)	Input
	24	LBG1	LBG1 Input GND	Input		56	LBG2	LBG1 Input GND	Input
RST1	25	RV1	Reset Input Power (24V)	Input	RST2	57	RV2	Reset Input Power (24V)	Input
	26	RST1+	Reset(+)	Input		58	RST2+	Reset(+)	Input
	27	RST1-	Reset(-)	Input		59	RST2-	Reset(-)	Input
	28	RG1	Reset Input GND	Input		60	RG2	Reset Input GND	Input
CP1	29	UCP1+	User Comparison Output(+)	Output	CP2	61	UCP2+	User Comparison Output(+)	Output
	30	5CP1	5V Comparison Output	Output		62	5CP2	5V Comparison Output	Output
	31	GND	GND	Output		63	GND	GND	Output
	32	UCP1-	User Comparison Output(-)	Output		64	UCP2-	User Comparison Output(-)	Output

4.1.5 EtherCAT Communication Connector (CN3, CN4)

No.	Function
1	TD+
2	TD-
3	RD+
4	----
5	----
6	RD-
7	----
8	----
Connector Hood	F.GND



4.1.6 Accessories

- **Connectors**

Purpose	Item	Part Number	Manufacturer
Power (CN1)	Terminal Block	MC421-38102	DECA
Signal (CN2)	e-CON Plug Connector	CNE-P04-YW	Autonics

* The connectors above are supplied with the product. If you are using other parts, please make sure they meet the specifications

4.1.7 Options

- **EtherCAT Cable**

Purpose	Part Number	Length [m]	Remarks
EtherCAT Connection (CN3, CN4)	CGNR-EC-0001F	1	• ·STP(Shielded Twisted Pair) Cable • ·Category 5e or higher • ·Maximum Length: 100m • ·Normal Cable
	CGNR-EC-0002F	2	
	CGNR-EC-0003F	3	
	CGNR-EC-0005F	5	

* If you need cables with length (in units of 1m) not listed on the table or robot cables, please contact FASTECH for more information.

Part 5 IO Connector Diagram

Ezi-IO EtherCAT CNT provides e-CON connector type products. e-CON connectors respond to the industry standards and can be easily connected to various equipment thus simplifying and reducing wiring work.

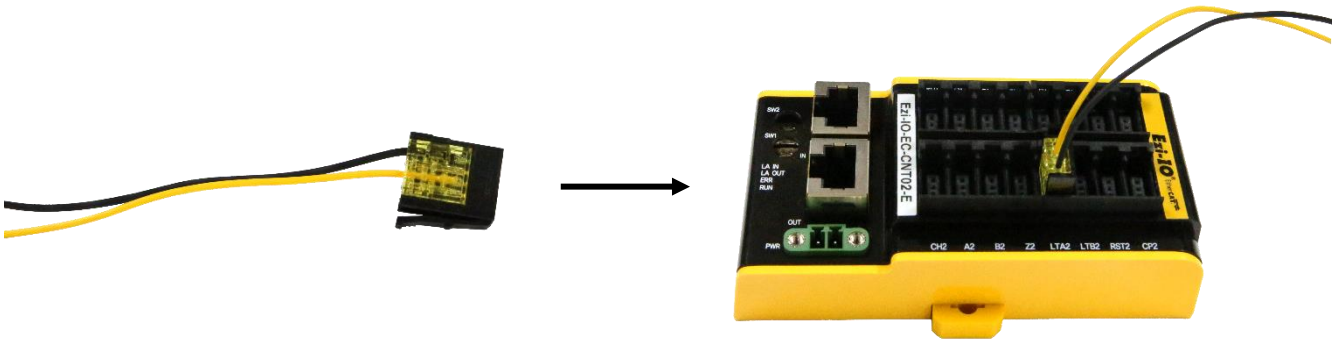
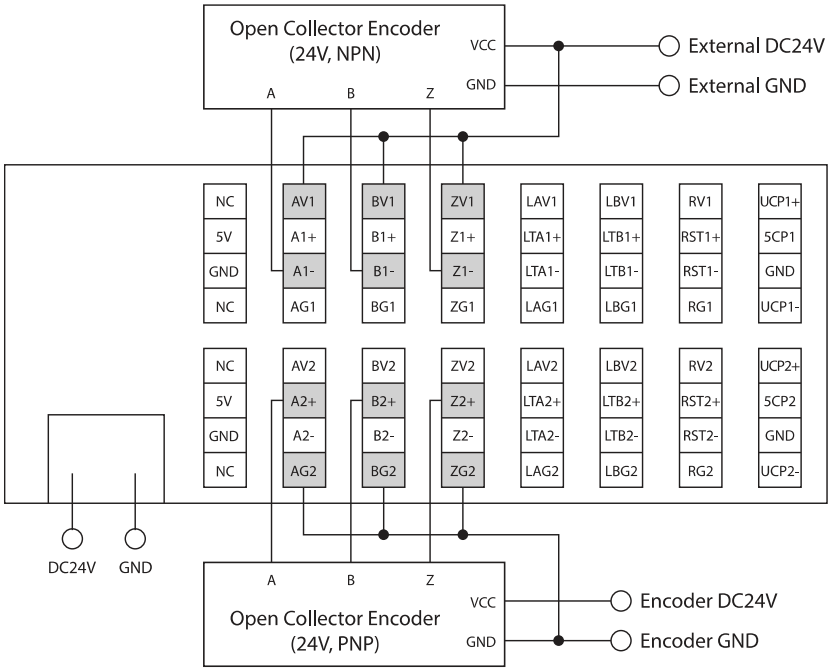


Figure 5-1. e-CON plug connector binding

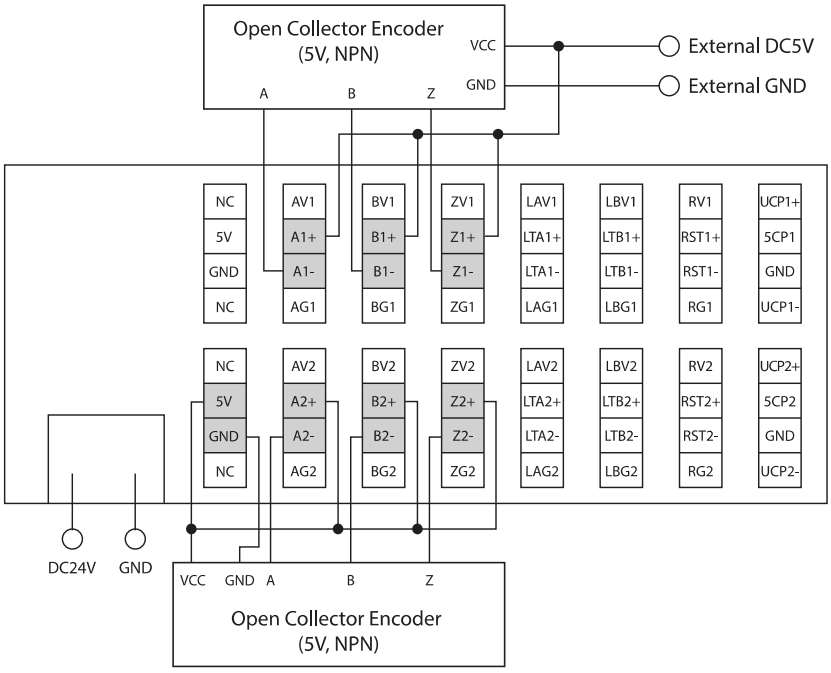
5.1 External Wiring Diagram (Pulse Input Part)

5.1.1 When connecting with DC24V open collector output type encoder



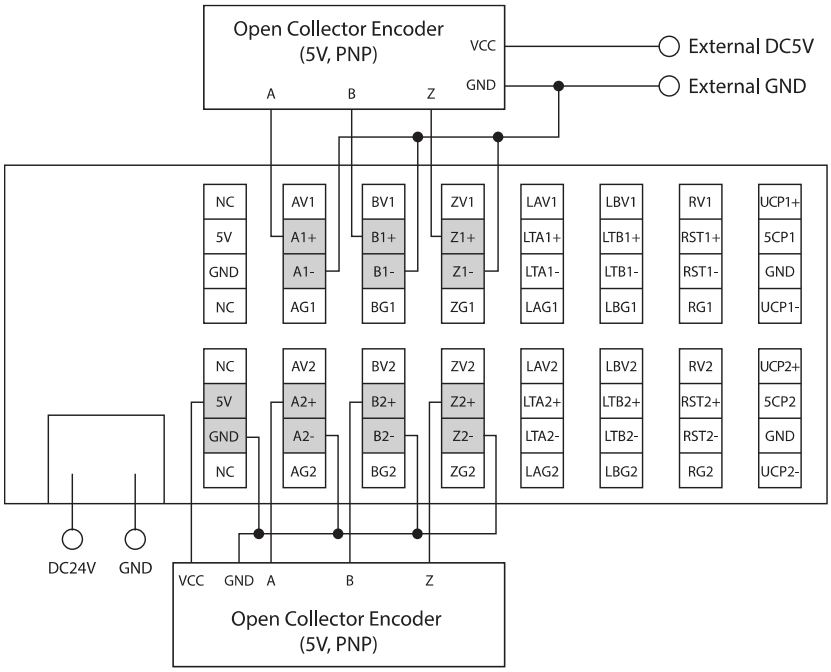
* If the module and the encoder use the same power supply, the photocoupler isolation is not possible.

5.1.2 When connecting with DC5V NPN open collector output type encoder



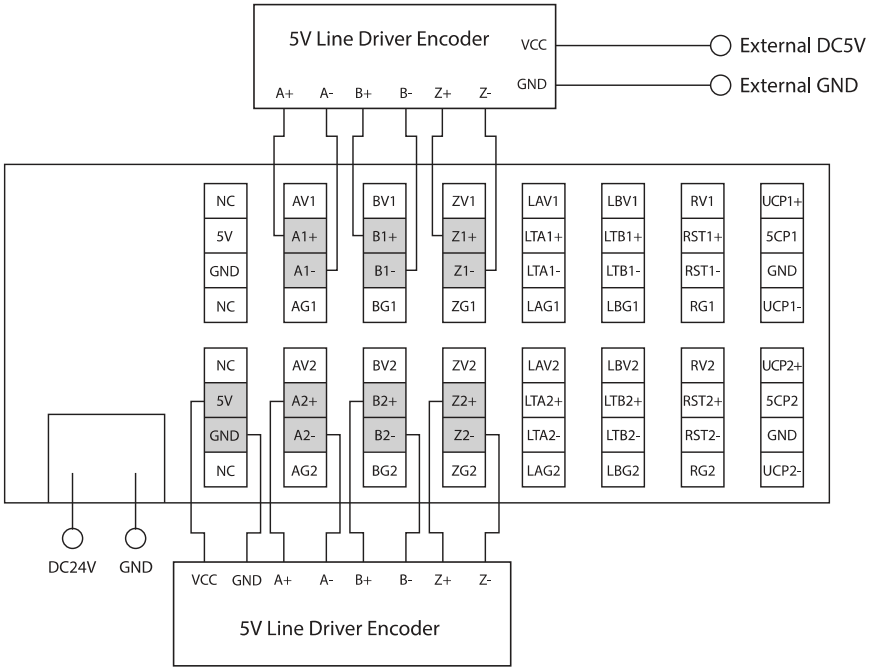
* If the DC5V output inside the product is used as the encoder power, photocoupler isolation is not possible.제품 내부의 DC5V 출력을 인코더 전원을 사용하는 경우에는 포토커플러 절연이 되지 않습니다.

5.1.3 When connecting with DC5V PNP open collector output type encoder



* If the DC5V output inside the product is used as the encoder power, photocoupler isolation is not possible.

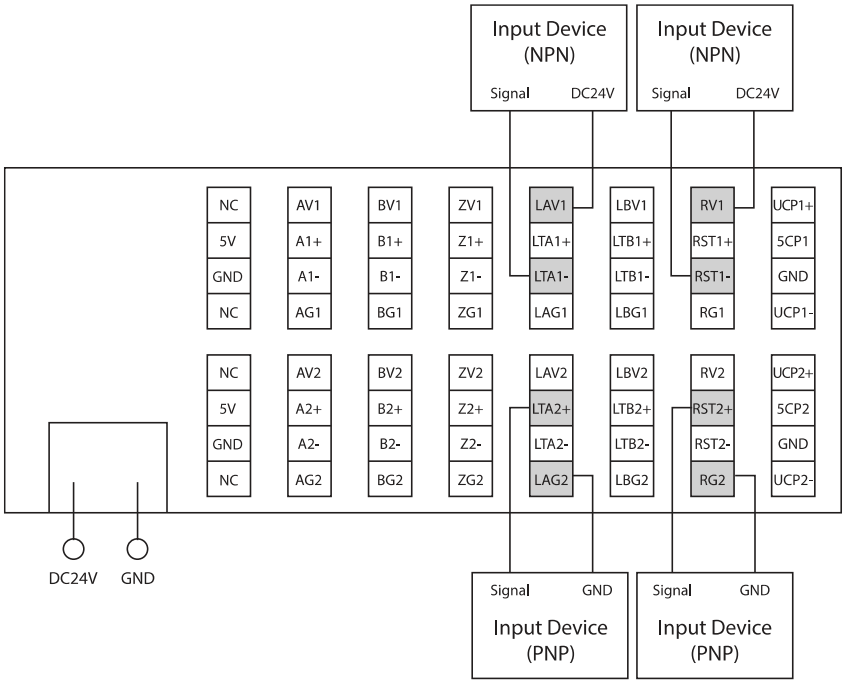
5.1.4 When connecting with DC5V line driver output type encoder



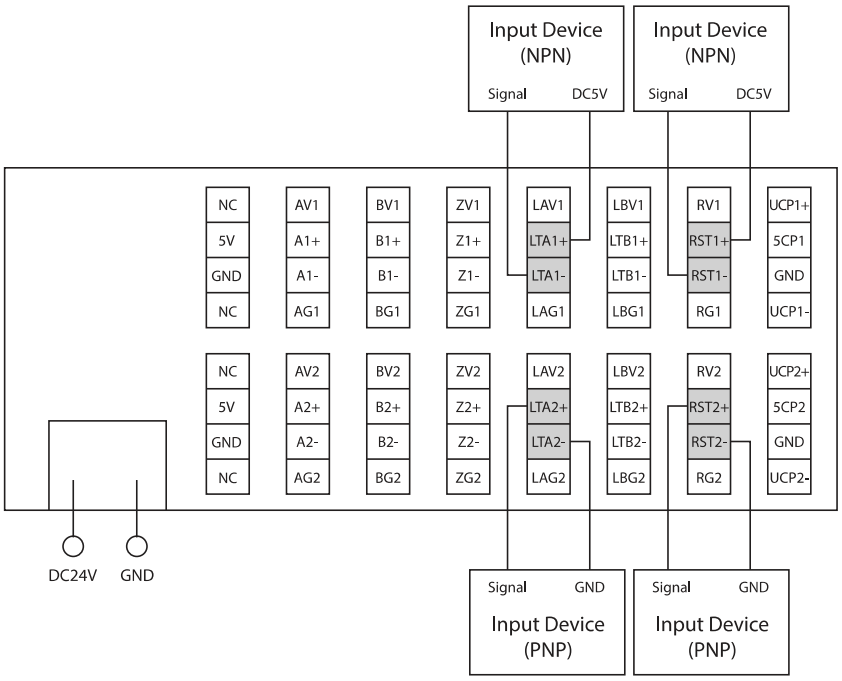
* If the DC5V output inside the product is used as the encoder power, photocoupler isolation is not possible.

5.2 External Wiring Diagram (Control Input Part)

5.2.1 When connecting with DC24V open collector output type input device



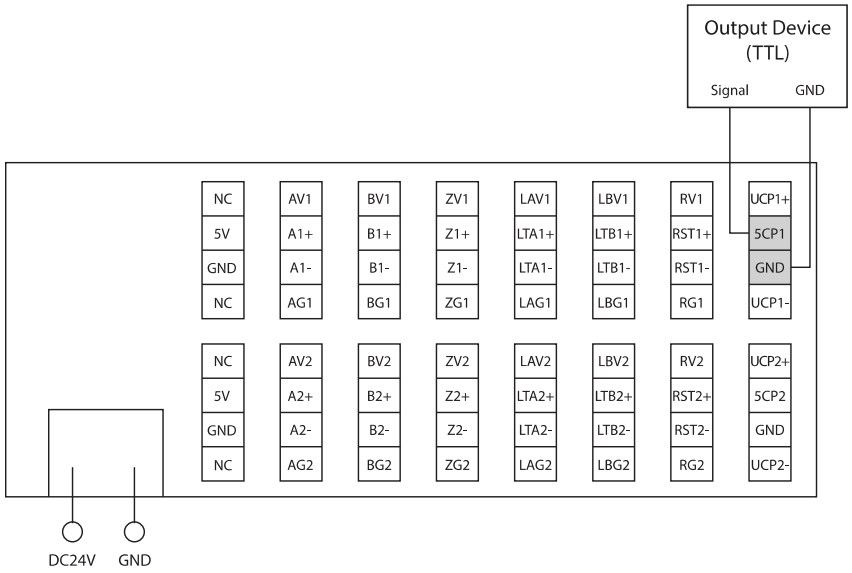
5.2.2 When connecting with DC5V open collector output type input device



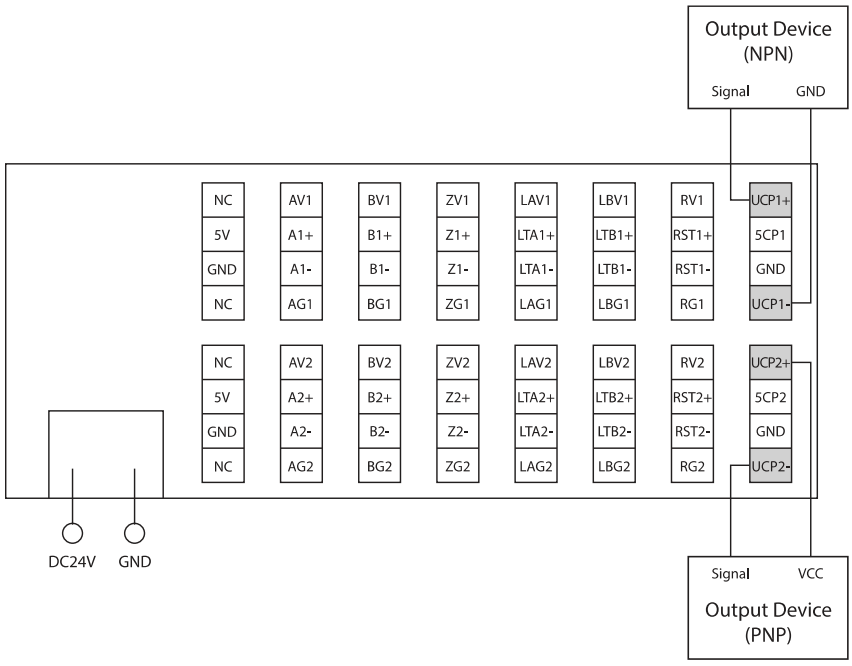
* e.g.) Input Device: PLC, Motion Controller, Digital Output Module, Limit Sensor, Proximity Sensor, etc.

5.3 External Wiring Diagram (Comparison Output Part)

5.3.1 TTL Output



5.3.2 Open Collector Output

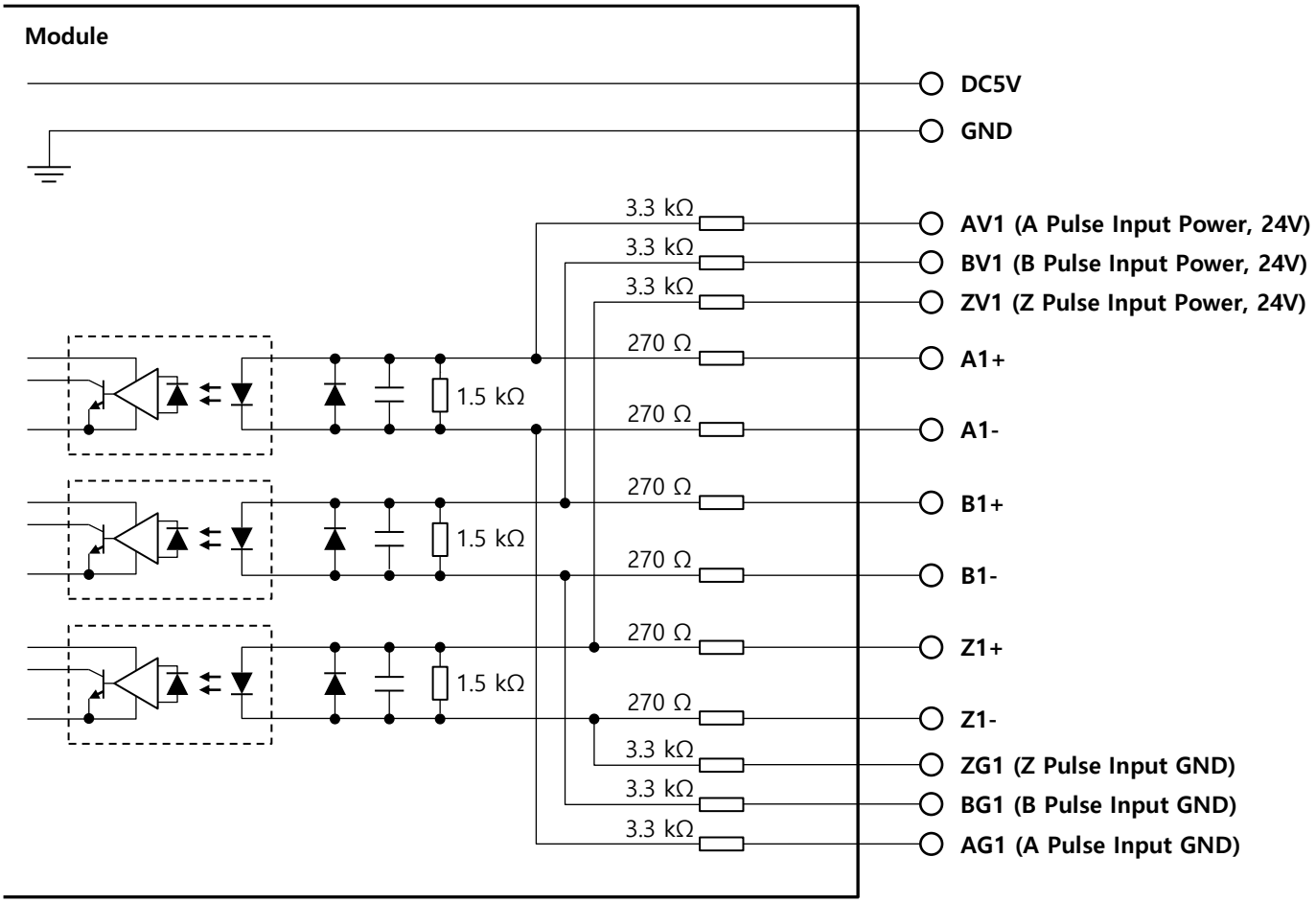


* e.g.) Output Device: PLC, Motion Controller, Digital Input Module, etc.

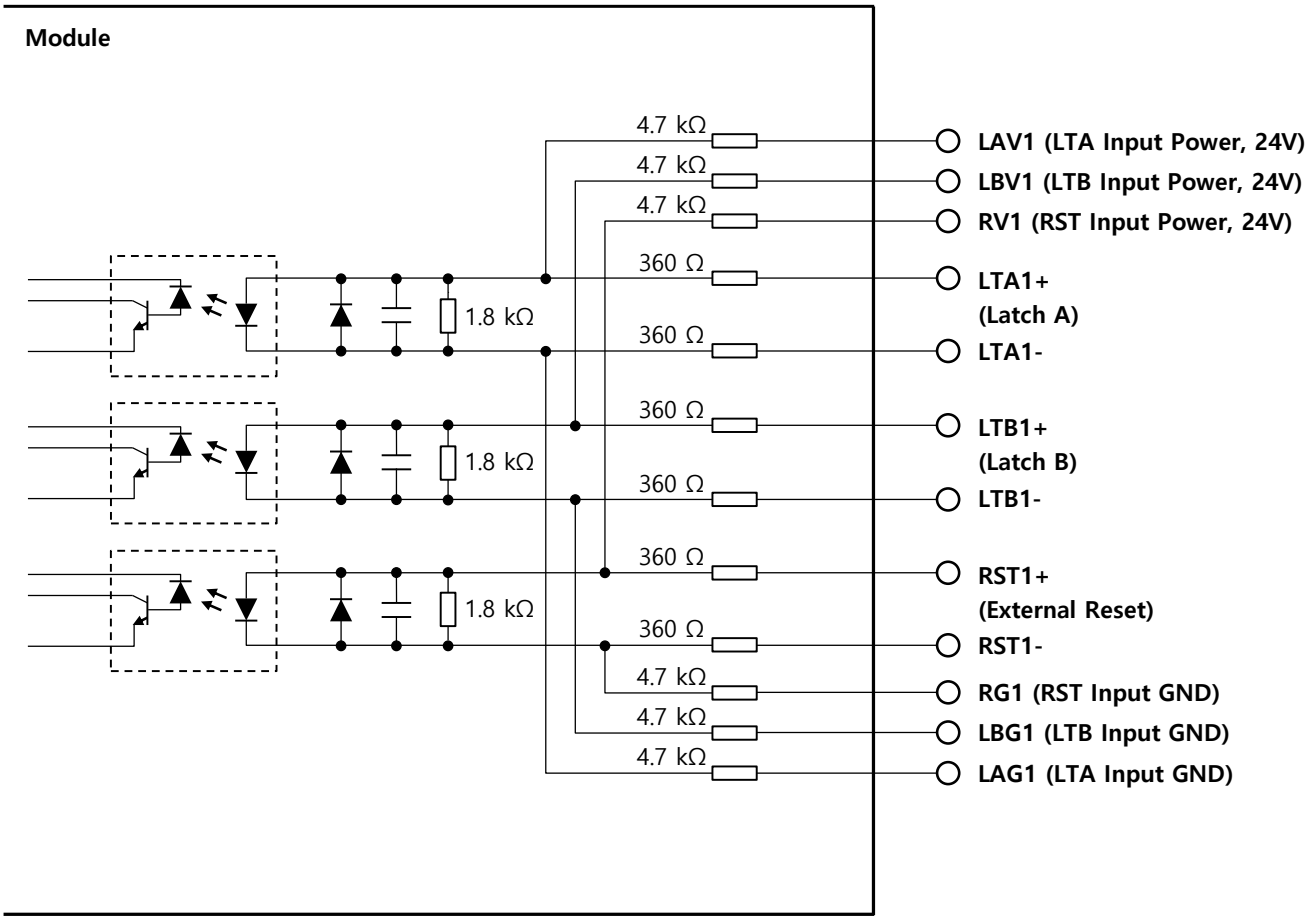
5.4 Internal Circuit Diagram

This manual only shows the circuit diagram for Channel 1, and Channel 2 has the same circuit structure.

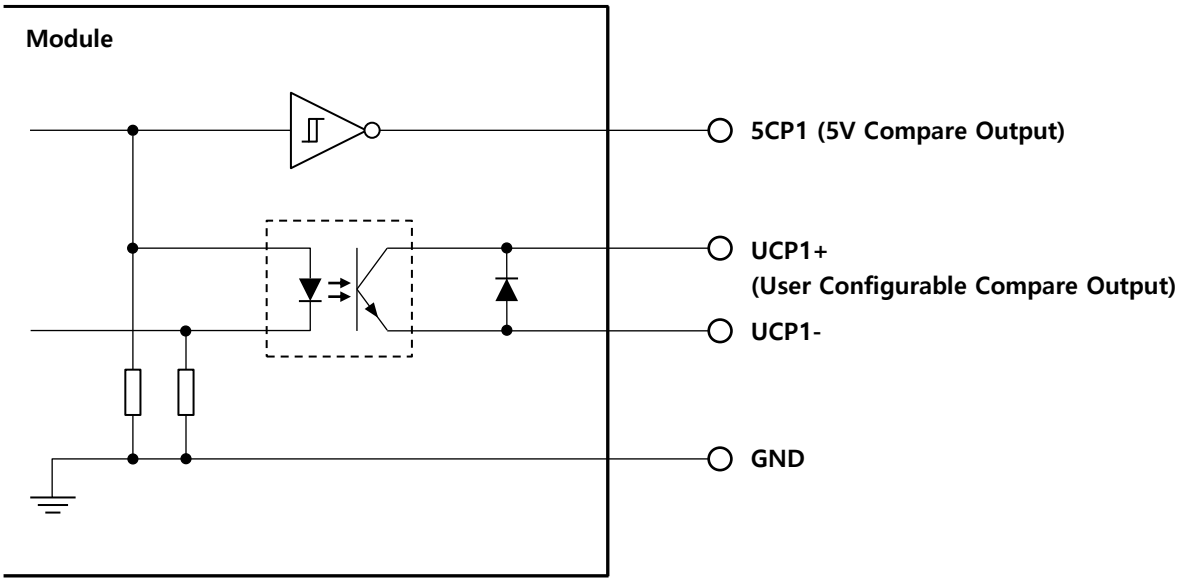
5.4.1 Pulse input



5.4.2 Control Input



5.4.3 Compare Output



Part 6 EtherCAT Communication

6.1 CAN application protocol over EtherCAT

Ezi-IO EtherCAT CNT is a high-speed counter module that supports CAN application protocol over EtherCAT (CoE). Ezi-IO EtherCAT CNT has the following network structure.

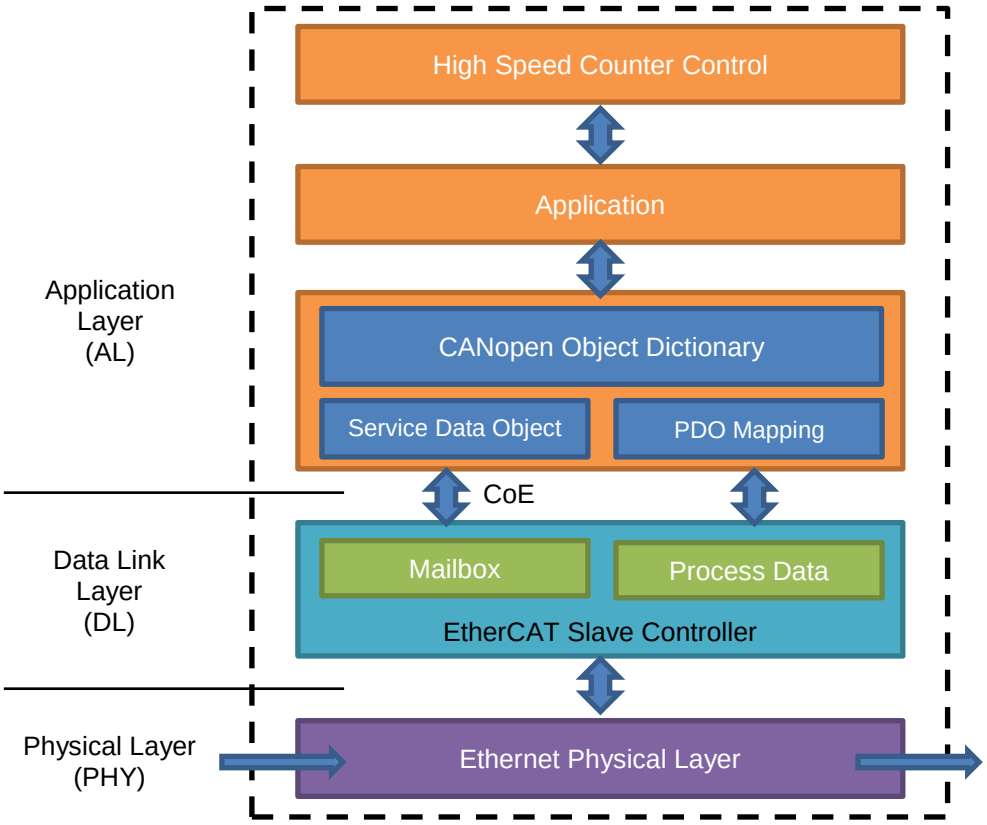


Figure 6-1. Ezi-IO EtherCAT CNT Structure

6.1.1 Object Dictionary

The Object Dictionary is the group of data objects which are saved in an EtherCAT slave unit. EtherCAT masters can read and write data through the index or sub-index of objects.

6.1.2 Mailbox Communication

In the Mailbox (SDO) communication, a master and a slave exchange the service data object (SDO). It is a message transmission and reception method. If the master sends a command, the slave answers to it. The SDO communication is used for setting or checking objects in the Object Dictionary when the Ezi-IO EtherCAT CNT is in Pre-Operational, Safe-Operational, or Operational state.

6.1.3 Process Data Communication

In Process Data (PDO) communication, a slave exchanges the process data object (PDO) with a master every cycle. The data to be exchanged is pre-determined by PDO Mapping in the communication initialization state. PDO communication is categorized as transmission PDO (following TxPDO) delivers controller status information and Receipt PDO (following RxPDO) delivers command from master, and is used when the Ezi-IO EtherCAT CNT is in Operational state or Safe-Operational.

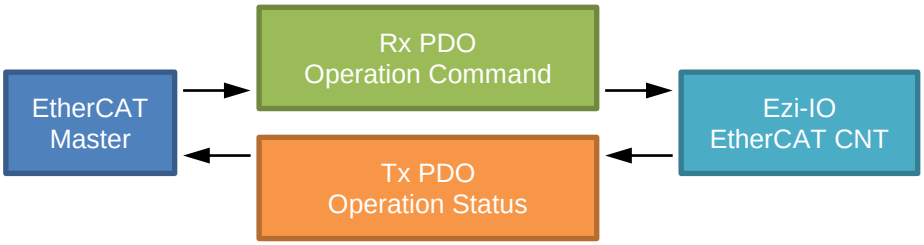


Figure 6-2. EtherCAT PDO Communication

6.2 PDO Mapping

PDO Mapping is to set Application Object will be delivered and received by PDO communication.

6.2.1 PDO Mapping

TxPDO Mapping information to be delivered to Master is to set at 1A00h ~ 1A03h Object and RxPDO Mapping information to be received command from master is to set at 1600h ~ 1602h Object.
Object ID value, Low level Index value, length of data (bit unit) of data that will be delivered and received are recorded at Mapping Table.

RxPDO Mapping

PDO Map Object		Object Contents		
Index	Sub	Object	Sub	Size
0x1600	1	0x3030	0x01	0x01
0x1600	2	0x3030	0x02	0x01
0x1600	3	0x3030	0x03	0x01
0x1600	4	0x3030	0x04	0x01

Application Object List

Object	Sub	Name
0x3030	0x01	CH1 Count Enable
0x3030	0x02	CH1 Internal Reset Execution
0x3030	0x03	CH1 Preset Execution
0x3030	0x04	CH1 Compare Output Enable
⋮	⋮	
0x0000	0x00	

RxPDO 0

CH1 Count Enable	CH1 Internal Reset Execution	CH1 Preset Execution	CH1 Compare Output Enable

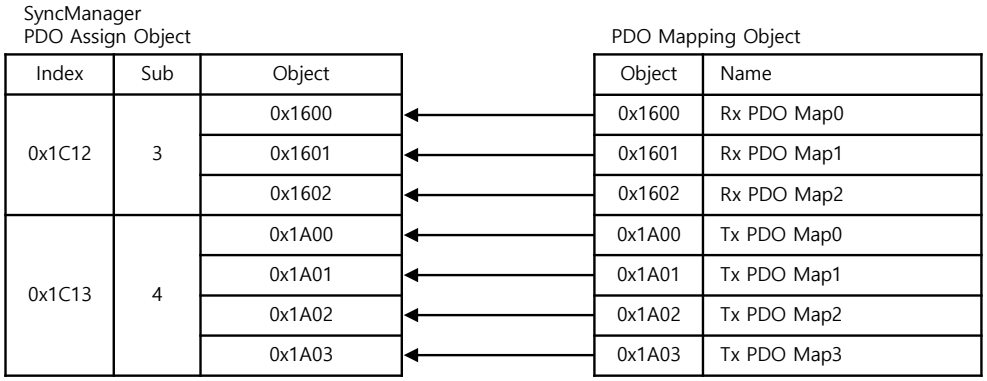
Figure 6-3. PDO Mapping

6.2.2 PDO Assign

PDO Assign is to set PDO Mapping Object will be assigned at SyncManager.

1C12h is object to assign RxPDO and can assign RxPDO Object 1600h, 1601h, and 1602h.

1C13h is object to assign TxPDO and can assign TxPDO Object 1A00h, 1A01h, 1A02h, and 1A03h.



Index	Sub	Object
0x1C12	3	0x1600
		0x1601
		0x1602
0x1C13	4	0x1A00
		0x1A01
		0x1A02
		0x1A03

Object	Name
0x1600	Rx PDO Map0
0x1601	Rx PDO Map1
0x1602	Rx PDO Map2
0x1A00	Tx PDO Map0
0x1A01	Tx PDO Map1
0x1A02	Tx PDO Map2
0x1A03	Tx PDO Map3

Figure 6-4. PDO Assign

6.3 EtherCAT Communicatino State

6.3.1 EtherCAT State Machine

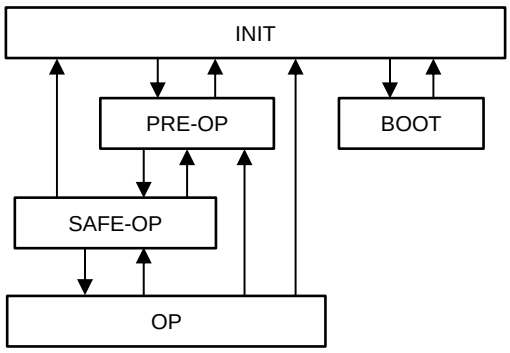


그림 6-5. EtherCAT State Machine

The operational states of EtherCAT products are controlled by EtherCAT masters.

State	Rx PDO	Tx PDO	Description
INIT	Disabled	Disabled	EtherCAT communication is initialized. Communication is disabled.
PRE-OP	Disabled	Disabled	After the communication initialization is done, this state begins. Communication settings are initialized. Only Mailbox communication is enabled.
SAFE-OP	Disabled	Enabled	Tx PDO communication is enabled.
OP	Enabled	Enabled	All the communications are enabled.
BOOT	Disabled	Disabled	Only Mailbox communication is enabled. FoE is enabled, and the product firmware can be updated via FoE protocol.

표 6-1. EtherCAT Operational State

* FoE (File over EtherCAT): It is an EtherCAT slave node through which the product firmware can be updated.

6.3.2 EtherCAT Communication State Indication

The RUN LED indicates EtherCAT network state of the product.

LED	Color	Status	Description
RUN	Green	OFF	INIT State or Power OFF
		Blinking	PRE-OPERATIONAL State
		Single Flash	SAFE-OPERATIONAL State
		ON	OPERATIONAL State
		Flickering	BOOTSTRAP State

Table 6-2. EtherCAT Communication State LED

The ERR LED indicates operational errors of the product.

LED	Color	Status	Description
ERR	Red	OFF	No Error or Power OFF
		Blinking	Invalid Configuration
		Single Flash	Local Error
		Double Flash	Watchdog Time Out

Table 6-3. Operational Error LED

Refer to Figure 6-6 to see the indication pattern of RUN LED and ERR LED.

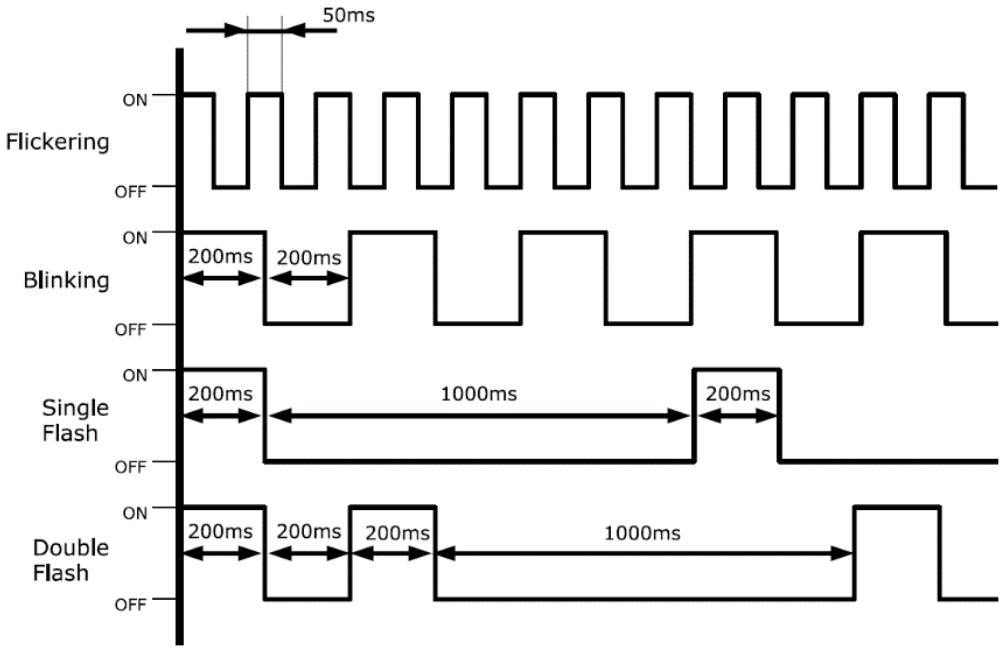


Figure 6-6. EtherCAT LED

6.4 Synchronization

Ezi-IO EtherCAT CNTprovides the following synchronization modes.

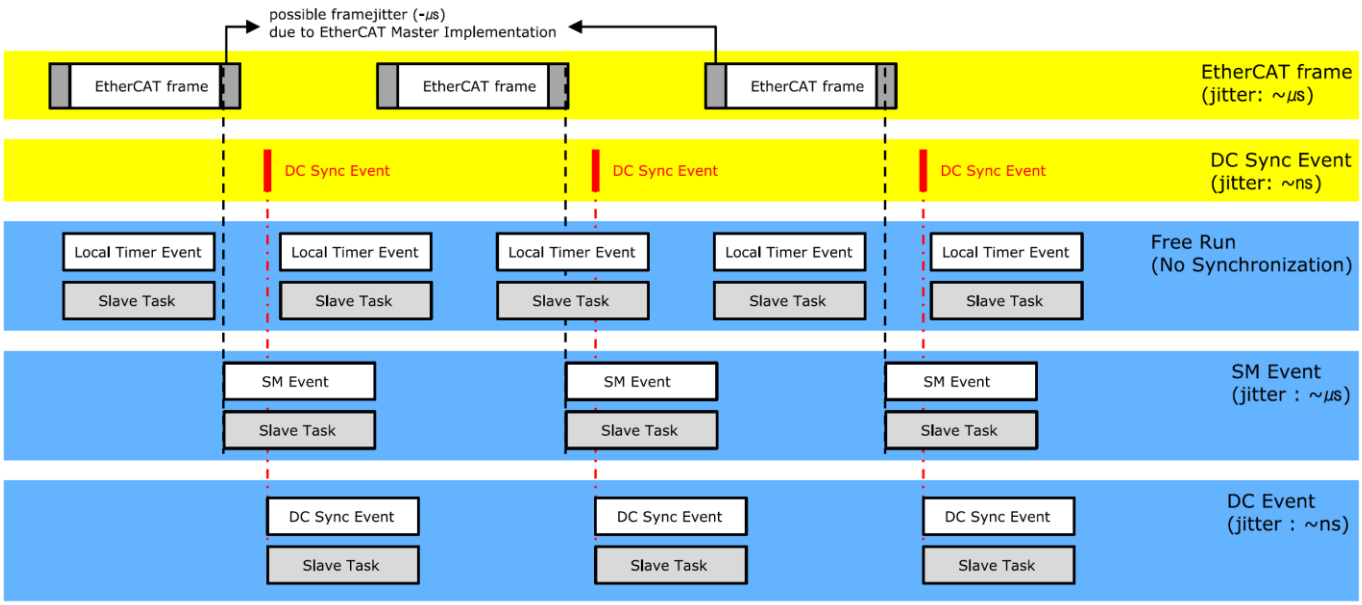


Figure 6-7. Types of EtherCAT Synchronization

6.4.1 Free Run

The module operates without being synchronized with the master. In Free Run mode, the master and the module operate in their own cycles independently.

6.4.2 SM Event

The module operates synchronously with the SyncManager (SM) Event of EtherCAT communication.
SM Event occurs when an EtherCAT Frame is received by the module, and each SM Event synchronized module has a range of jitter in μs or less.

6.4.3 DC Sync Event

The module operates synchronously with the Sync-Interrupt generated according to Distributed Clock (DC). DC is a synchronized time clock that is shared by the master and module. Using DC, it generates perfectly synchronized interrupts so that the module executes commands in exact timing. Each product has a range of jitter in ns or less.

6.5 EtherCAT Slave Information

To connect the I/O module to an EtherCAT master, an ESI (EtherCAT Slave Information) file is required. In the file, the information of slave device which is developed based on the EtherCAT specification is included in XML format. The Slave device can set up the PDO and SDO simply as it writes the ESI file to the EtherCAT master through the EtherCAT setting device.

Information

Download ESI files from the DOWNLOADS page on the FASTECH website.

6.6 EtherCAT Device ID

To use the EtherCAT communication, you must configure a master and all slaves. The master must assign the EtherCAT Device IDs to the slaves to identify them and to send messages to each node. The EtherCAT Device ID is either Configured Station Alias or Physical Address. Configured Station Alias is set by rotary switches or the master, and it can be changed flexibly by user. Physical Address is automatically assigned by the master according to the connected order of slaves.

Part 7 Setting and Operation

Operate the product according to the following procedure.

1. Install the product according to installation conditions with no power connected. Refer to Chapter 1. Safety and Installation Precautions.
2. Make sure to connect the power cable, I/O connector, EtherCAT communication cable, etc. to the module correctly. Refer to the System Configuration.
3. Turn ON the power of module. Then, check the following.
   - Check the power status LED (PWR) turns Red.
   - After connecting the communication, check EtherCAT Link/Activity LED (LA IN, LA OUT) turns Green.
4. Run the software of EtherCAT Master. (Example of Master Software : Beckhoff TwinCAT)
5. Run the TwinCAT in the following sequence.
   ① Click 'New TwinCAT Project'.
   ② Go to 'New Project' → 'TwinCAT XAE Project'.
   ③ Select the project name or path, and then click 'OK'..

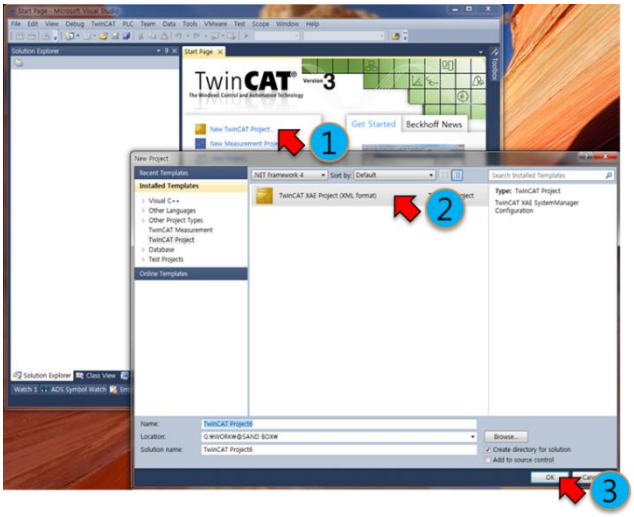


Figure7-1. Running TwinCAT

6. If TwinCAT is in 'Run Mode', new connection and setting may be disabled. Set TwinCAT to 'Config Mode'.

   - Stop Mode: Red Icon
   - Config Mode: Blue Icon
   - Run Mode: Green Icon(Unable to connect)

7. After creating a project,

① Go to 'Solution Explorer'→ 'I/O'. Right-click on the 'Device', and open the menu.

② Select 'Scan' on the menu.

③ When a 'Hint' pops up, click 'OK'.

④ On the 'new I/O devices founds' window, check correct devices and click 'OK'.

(If no device is found on the 'new I/O devices founds' window, check the power and cable connection for the product and try again.)

⑤ When 'Scan for boxes' pops up, click 'Yes'.

⑥ Make sure a device or box is added under the 'Device'. When 'Activate Free Run' pops up, click 'Yes'.

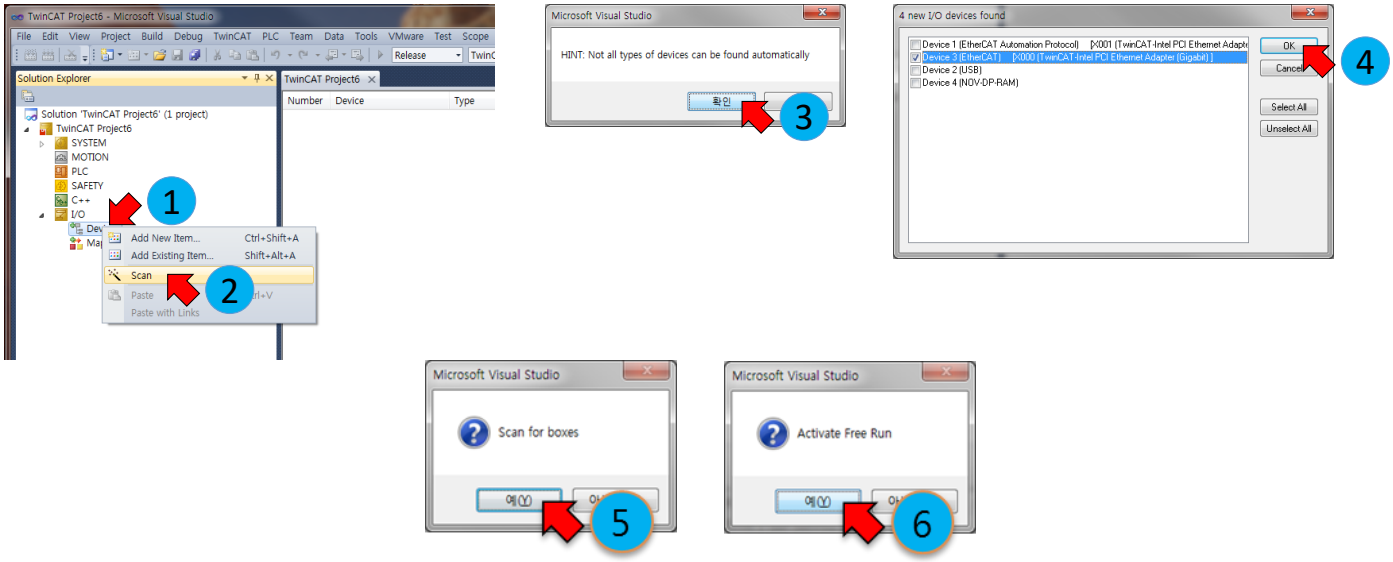


Figure 7-2. Order of Product Scanning

8. Check the followings.

- Check the EtherCAT network is in 'OP' state as shown in Figure 7-3.
- Check the EtherCAT Communication State LED (RUN) turns Green.

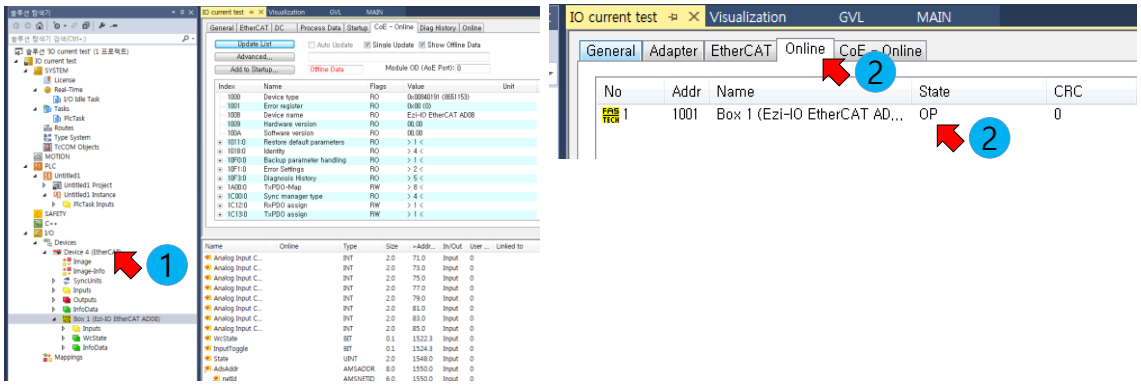


Figure 7-3. Checking EtherCAT Communication State

9. Then, you can configure and control local device with EtherCAT network by setting and programming in your preferences.

Part 8 Description of Functions

8.1 Summary of Functions

Table 8-1 summarizes the main features provided by Ezi-IO EtherCAT CNT.

Function	Description	Reference
Count mode	Displays the count mode for each channel. Ezi-IO EtherCAT CNT only supports ring counter mode.	8.4
Max counter value	Can set the maximum value that each channel's counter can display.	8.4
Pulse input method	Can set the pulse input method for each channel. Ezi-IO EtherCAT CNT can count phase difference pulse input (2/4 multiplications), 1-pulse input (pulse/direction input), and 2-pulse input (CW/CCW input).	8.5
Count direction	Can set the pulse count direction input to each channel.	8.6
Counter value preset	The user can arbitrarily preset each channel's counter value as desired. Can use PDO commands to execute.	8.7
Counter value reset	Can reset each channel's counter value to 0. Can execute the reset with PDO commands, reset (RST) signal input, and Phase Z signal input.	8.8
Counter value latch	Can save each channel's counter value. Can execute the latch with latch A (LTA) signal input, latch B (LTB) signal input, and Phase Z signal input.	8.9
Input logic	Can set operating logic for each channel's latch A (LTA) signal, latch B (LTB) signal, reset (RST) signal, and Phase Z signal.	8.10
Pulse rate measurement	Pulse rate means the number of pulse signals input during a set time. Can measure the pulse rate input to each channel.	8.11
Comparison output	If each channel's counter value matches the comparison value, can output a signal.	8.12

Table 8-1. Ezi-IO EtherCAT CNT's main functions

8.2 Signal Input

The Ezi-IO EtherCAT CNT has 4 input pins per input port (e-CON connector), and 2 of this input pins are used for pulse or control signals, standard voltage (DC24V or DC5V), GND, etc. At these times, signals from the previous input position enter the photocoupler inside the product as in Fig. 8-1. The input signals discussed in Part 8 and 9.5 Manufacturer Specific Object (A, B, Z, LTA, LTB, RST) are signals input to the internal photocoupler.

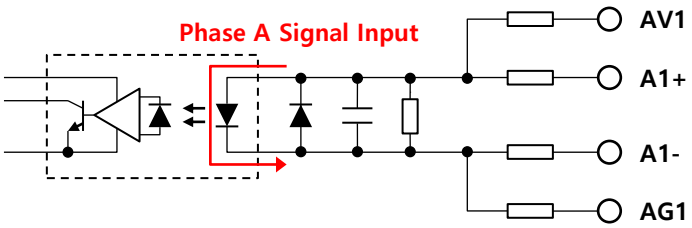


Fig. 8-1. Ezi-IO EtherCAT CNT's A phase signal input

8.3 Basic Operation

8.3.1 Counter Activation

If "1" is input into the Count Enable (3030h:01, 3030h:05) bit, the relevant channel's counter is activated and pulse input can be counted. If "0" is input, that channel's counter is inactivated and pulse input is not counted.
Count Enable bits can be set through PDO communication. For details, see 9.5.26 Object 3030h: Counter Command.

Whether or not the counter is active is displayed on the Count Enabled (3020h:01, 3020h:17) bit. The status is inactive if the bit value is 0 and active if the bit value is 1. For more information on the Count Enabled bit, refer to 9.5.18 Object 3020h: Counter Status.

8.3.2 Checking Counter Values

The value of counted pulse inputs (counter value) is saved in the Present Counter Value (3022h) object. The counter value can display values within the range of 0-4,294,967,295 (32-bit). See 9.5.20 Object 3022h: Present Counter Value for more on the present counter value object.

8.4 Count Mode

8.4.1 Description

The Ezi-IO EtherCAT CNT only operates in ring counter mode.

8.4.2 Ring Counter

The Ezi-IO EtherCAT CNT can have overflow and underflow occur in the counter value. If the counter value exceeds the Maximum Counter Value (3003h) object's set value (max value), it instantly becomes 0, and if the counter value is reduced from 0, it instantly becomes the max value.
If overflow occurs, the Counter Overflow Flag (3020h:03, 3020h:19) bit changes from 0 to 1, and if underflow occurs, the Counter Underflow Flag (3020h:04, 3020h:20) bit changes from 0 to 1. If each bit is reset or preset, it resets to 0. See 9.5.18 Object 3020h: Counter Status for more details.

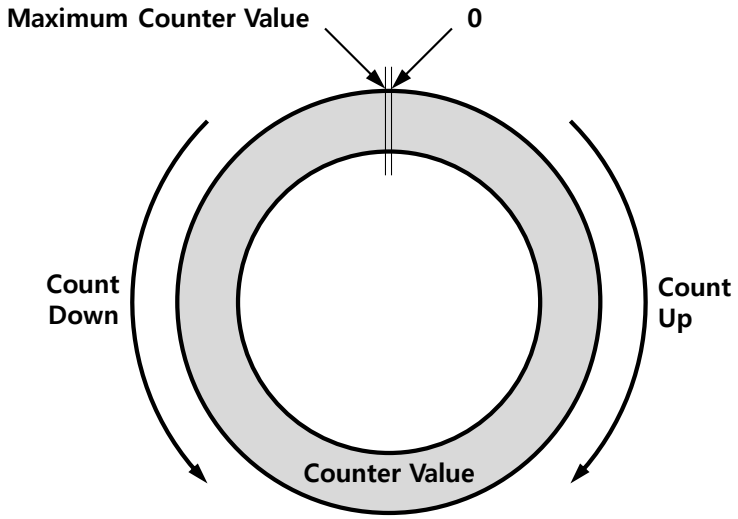


Fig. 8-2. Ring counter operation

8.4.3 Setup Method

(1) The Count Mode (3000h) object displays the count mode for each channel. This object's value is fixed at 0 (ring counter) and cannot change.
(2) The Maximum Counter Value (3003h) object can set the measurable range for each channel's counter. This object can be set through SDO communication, and its initial setting is 0. For more details, see 9.5.5 Object 3003h: Maximum Counter Value.

Note

- Each channel's Count Enable (3030h:01, 3030h:05) bit must be changed from 0 to 1 to be reflected in the Maximum Counter Value (3003h) object.

8.5 Pulse Input Method

8.5.1 Description

The Ezi-IO EtherCAT CNT can receive phase difference pulses, 1 pulse, and 2 pulse input.

8.5.2 Phase Difference Pulse Input

The Ezi-IO EtherCAT CNT can count by doubling or quadrupling 2-phase pulse input of square waves with identical frequencies but a 90˚ phase difference. If the A-phase signal precedes the B-phase signal, the counter value increases, and if the B-phase signal precedes the A-phase signal, the counter value decreases.

(1) Multiplication ×4 count
Count is executed from the rising or falling edge of A phase and B phase signals.

(2) Multiplication ×2 count

Count is executed from the rising or falling edge of the A phase signal, and the B phase signal orders the count direction.

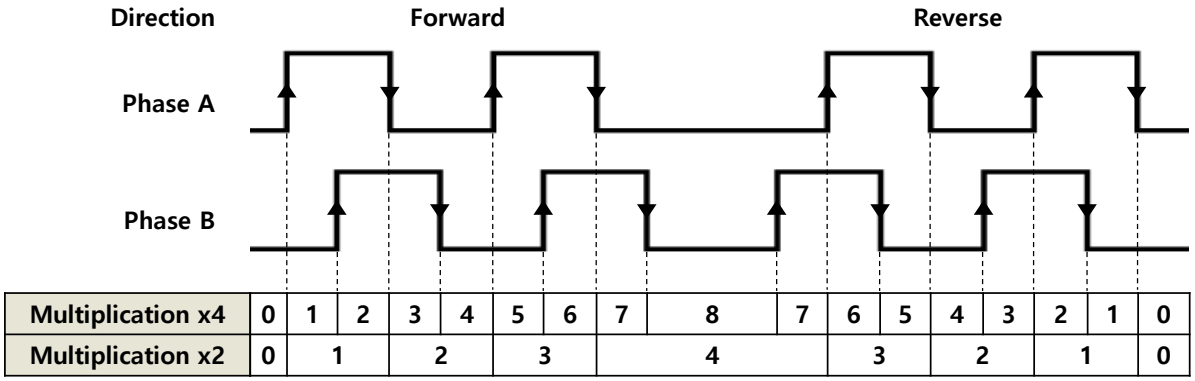


Fig. 8-3. Counter operation by phase difference pulse input

8.5.3 1-Pulse Input (Pulse/Direction Input)

The count is executed from the rising edge of the A phase signal, and the B phase signal orders the count direction, If the B phase signal is high-level, the counter value increases, and if the B phase signal is low-level, the counter value decreases.

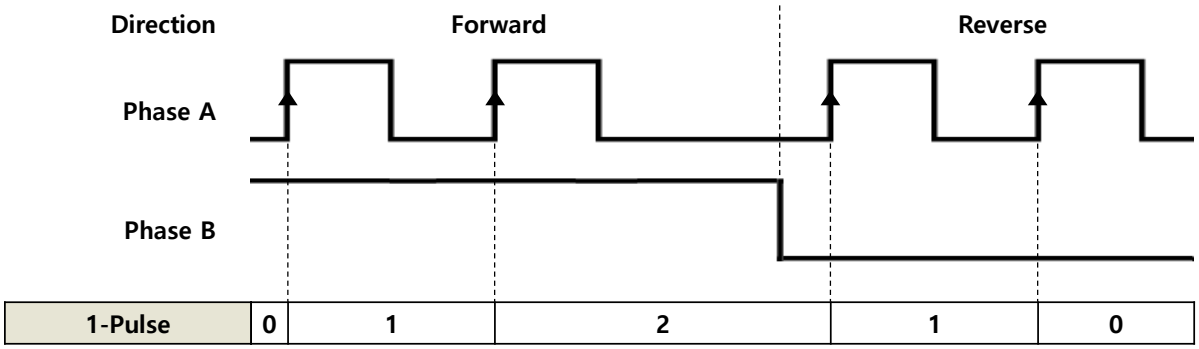


Fig. 8-4. Counter operation by pulse input

8.5.4 2-Pulse Input (CW/CCW Input)

The counter value at the rising edge of the A-phase signal increases, and the counter value at the rising edge of the B-phase signal decreases.

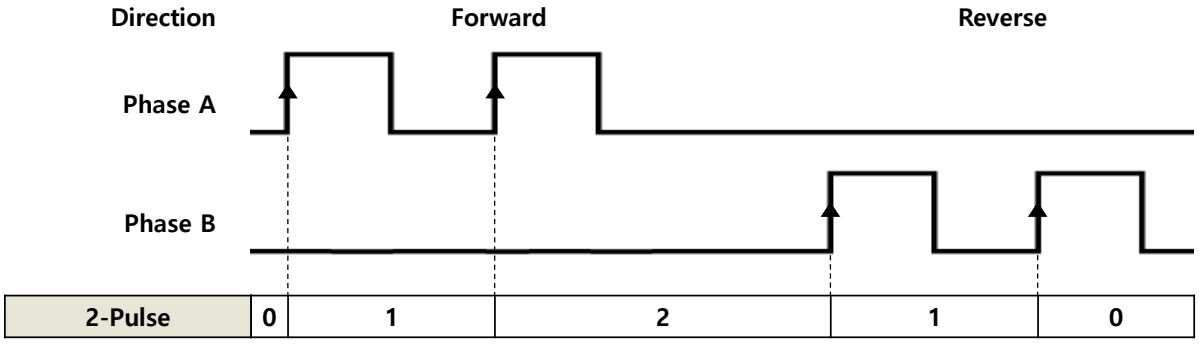


Fig. 8-5. Counter operation for 2-pulse input

8.5.5 Setup Method

You can set the pulse input method for each channel using the Pulse Input Method (3001h) object. This object can be set through SDO communication, and the initial setting is phase difference pulse input (4x measuring). For more details on setup, see 9.5.3 Object 3001h: Pulse Input Method.

Note

- Each channel's Count Enable (3030h:01, 3030h:05) bit must be changed from 0 to 1 after setup to be reflected in the Pulse Input Method (3001h) object.

8.6 Count Direction

8.6.1 Description

Ezi-IO EtherCAT CNT can set the count direction for each channel. The following two settings are provided.

(1) Forward count
This is the standard count direction. When forward counting is set, the counter operation for each pulse input method follows Figs. 8-3, 8-4, and 8-5 in 8.5 Pulse Input Methods.

(2) Reverse count
Sets to the opposite of the forward direction in which the counter value increases or decreases. When reverse counting is set, the counter operation for each pulse input method follows Figs. 8-6, 8-7, and 8-8.

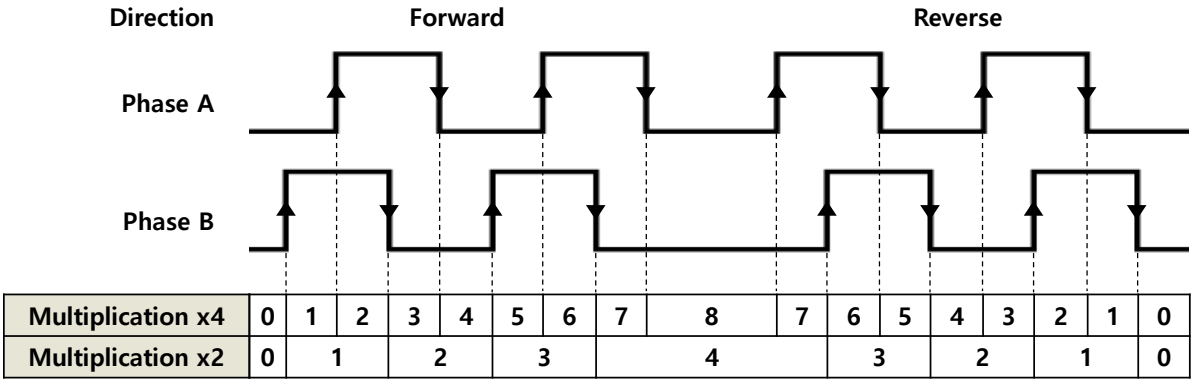


Fig. 8-6. Counter operation for phase difference pulse input when set to reverse

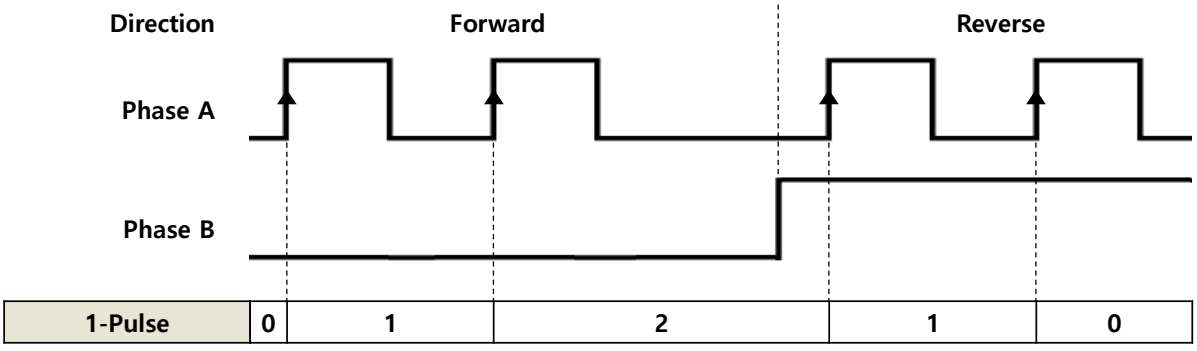


Fig. 8-7. Counter operation for 1-phase pulse input when set to reverse

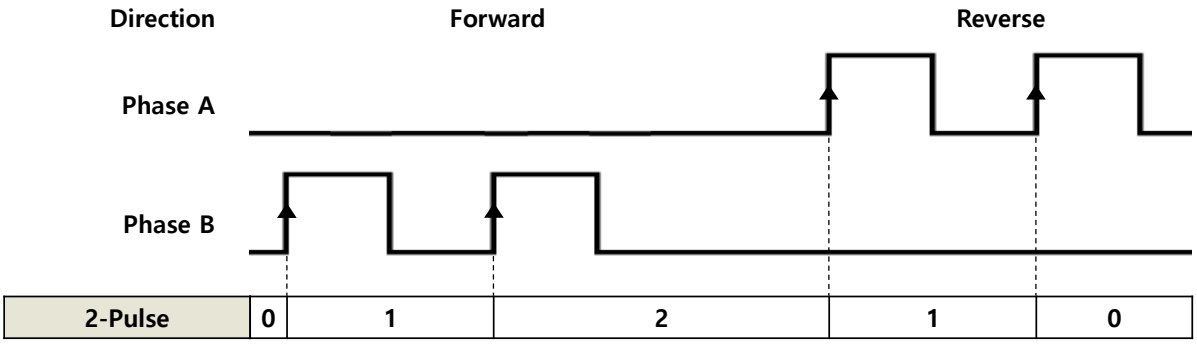


Fig. 8-8. Counter operation for 2-phase pulse input when set to reverse

8.6.2 Setup Method

You can set the count direction for each channel's pulse input using the Count Direction (3002h) object. This object can be set through SDO communication, and the initial setting is forward counting. For details, see 9.5.4. Object 3002h: Count Direction.

Note

- The Count Enable (3030h:01, 3030h:05) bit for each channel must be changed from 0 to 1 after setup to be reflected in the Count Direction (3002h) object.

8.7 Counter Value Presets

8.7.1 Description

The Ezi-IO EtherCAT CNTprovides a preset function so the counter value can be set to start at a different value than 0. If you execute the preset, the counter value instantly changes to the previously set preset value.

8.7.2 Preset Value Settings

You can set each channel's preset value using the Preset Value(3032h) object. This object can be set using PDO communication, and the specific details are described in 9.5.28 Object 3032h: Preset Value.

If a value is input that is outside the counter's measuring range (0 – Maximum Counter Value object setting) to the Preset Value object, the value of the Invalid Preset Value Error (3020h:13, 3020h:29) bit changes to 1. In this state, the preset is not executed, and if a value within the counter's measuring range is input to the Preset Value object, it resets to 0.
For more information about the Invalid Preset Value Error bit, see 9.5.18 Object 3020h: Counter Status.

8.7.3 Preset Execution

You can execute each channel's preset by inputting "1" to the Preset Execution (3030h:03, 3030h:07) bit.
The Preset Execution bit can be set using PDO communication, and the specific details are described in 9.5.26 Object 3030h: Counter Command.

8.7.4 Preset Flags

If the preset is executed, the Preset Completed (3020h:06, 3020h:22) bit's value changes from 0 to 1. When the Preset Completed bit becomes 1, the preset cannot be executed again. This bit is reset by inputting "0" to the Preset Execution bit.
More information about the Preset Completed bit is in 9.5.18 Object 3020h: Counter Status.

8.8 Counter Value Reset

8.8.1 Description

The Ezi-IO EtherCAT CNT provides a reset feature to reset the counter value to 0. You can execute the reset in the following three ways:

(1) PDO command (internal reset)
(2) Reset (RST) signal input (external reset)
(3) Phase Z signal input (Phase Z reset)

8.8.2 Reset Activation

(1) Internal reset can be immediately used without any separate activation process.
(2) To use external reset, the External Reset Enable (3031h:13, 3031h:29) bit must be set to 1.
(3) To use Phase Z reset, the Phase Z Reset Enable (3031h:15, 3031h:31) bit must first be set to 1. If Phase Z reset is activated while the Phase Z latch is activated, the Phase Z latch immediately becomes inactive. See 8.9 Counter Value Latches for more on the Phase Z latch.

The Reset Enable bit can be set using PDO communication. See 9.5.27 Object 3031h: Latch and External Reset Command for details.

8.8.3 Checking for Reset Activation

Whether to activate external reset and Phase Z reset is indicated on the External Reset Enabled (3021h:10, 3021h:26) and Phase Z Reset Enabled (3021h:13, 3021h:29) bits respectively. If a bit's value is 0 it is inactive, and if the value is 1 it is active.
See 9.5.19 Object 3021h: Latch and External Reset Status for more on the External Reset Enabled bit.

8.8.4 Reset Execution

(1) If the Internal Reset Execution (3030h:02, 3030h:06) bit is changed from 0 to 1, the counter value is reset to 0.
The Internal Reset Execution bit can be set through PDO communication. See 9.5.26 Object 3030h: Counter Command for more details.
(2) If external reset has been activated, the counter value is reset to 0 at the rising or falling edge of the RST signal.
(3) If Phase Z reset has been activated, the counter value is reset to 0 at the rising or falling edge of the RST signal.
(4) Operating logic (rising or falling edge) for RST signal and Phase Z signal input can be set using the Input Logic (3006h) object. See 9.5.8 Object 3006h: Input Logic for more details.

8.8.5 Reset Flags

(1) When internal reset is executed, the Internal Reset Completed (3020h:05, 3020h:21) bit's value changes from 0 to 1. When the Internal Reset Completed bit's value becomes 1, internal reset cannot be executed again.
(2) When external reset is executed, the External Reset Completed (3021h:11, 3021h:27) bit's value changes from 0 to 1. When the External Reset Completed bit's value becomes 1, external reset cannot be executed again.
(3) When Phase Z reset is executed, the Phase Z Reset Completed (3021h:14, 3021h:30) bit's value changes from 0 to 1. When the Phase Z Reset Completed bit's value becomes 1, Phase Z reset cannot be executed again.

The Reset Completed bit can be set through PDO communication. See 9.5.19 Object 3021h: Latch and External Reset Status for more details.

8.8.6 Reset Flag Resetting

(1) When the Internal Reset Execution (3030h:02, 3030h:06) bit's value changes from 1 to 0, the Internal Reset Completed bit's value is reset to 0.
(2) When the External Reset Completed Flag Clear (3031h:14, 3031h:30) bit's value changes from 0 to 1, the External Reset Completed bit's value is reset to 0.
(3) When the Phase Z Reset Completed Flag Clear (3031h:16, 3031h:32) bit's value changes from 0 to 1, the Phase Z Reset Completed bit's value is reset to 0.

For more on the Reset Completed Flag Clear bit, see 9.5.27 Object 3031h: Latch and External Reset Command.

8.9 Counter Value Latches

8.9.1 Description

The Ezi-IO EtherCAT CNT provides a latch function to save the counter value for each channel. Latches can be executed in the following ways:
(1) Latch A (LTA) signal input (latch A)
(2) Latch B (LTB) signal input (latch B)
(3) Phase Z signal input (latch Z)

Different data objects can save counter values for each input, and you can simultaneously save counter values for the above 3 inputs for each channel.

8.9.2 Latch Activation

(1) To use Latch A, the Latch A Enable (3031h:01, 3031h:17) bit must first be set to 1.
(2) To use Latch B, the Latch B Enable (3031h:05, 3031h:21) bit must first be set to 1.
(3) To use the Phase Z latch, the Phase Z Latch Enable (3031h:09, 3031h:25) bit must first be set to 1. If the Phase Z latch is activated while Phase Z reset is activated, Phase Z reset is immediately deactivated.

The Latch Enable bit can be set using PDO communication. For more details, see 9.5.27 Object 3031h: Latch and External Reset Command.

8.9.3 Checking for Latch Activation

Whether or not the latch function is enabled is displayed on the Latch A Enabled (3021h:01, 3021h:17), Latch B Enabled (3021h:04, 3021h:20), and Phase Z Latch Enabled (3021h:07, 3021h:23) bits. It is disabled if the bit's value is 0 and enabled if the bit's value is 1.
See 9.5.19 Object 3021h: Latch and External Reset Status for more on latch enabled bits.

8.9.4 Latch Execution

(1) If Latch A has been activated, the counter value is saved on the Latch A Value (3023h) object on the rising or falling edge of the LTA signal. For more on the Latch A Value object, see 9.5.21 Object 3023h: Latch A Value.
(2) If Latch B has been activated, the counter value is saved on the Latch B Value (3024h) object on the rising or falling edge of the LTB signal. For more on the Latch B Value object, see 9.5.22 Object 3024h: Latch B Value.
(3) If the Phase Z latch has been activated, the counter value is saved on the Phase Z Latch Value (3025h) object on the rising or falling edge of the Phase Z signal. For more on the Phase Z Latch Value object, see 9.5.23 Object 3025h: Phase Z Latch Value.
(4) Operating logic (rising or falling edge) for LTA, LTB, and Phase Z signal input can be set using the Input Logic (3006h) object. For more details, see 9.5.8 Object 3006h: Input Logic.

8.9.5 Latch Flags

(1) When Latch A is executed, the value of the Latch A Completed (3021h:02, 3021h:18) bit changes from 0 to 1.
(2) When Latch B is executed, the value of the Latch B Completed (3021h:05, 3021h:21) bit changes from 0 to 1.
(3) When the Phase Z latch is executed, the value of the Phase Z Latch Completed (3021h:08, 3021h:24) bit changes from 0 to 1.

The Latch Completed bit can be set using PDO communication. For more details, see 9.5.27 Object 3031h: Latch and External Reset Command.

8.9.6 Latch Flag Resetting

(1) When the Latch A Completed Flag Clear (3031h:02, 3031h:18) bit's value changes from 0 to 1, the Latch A Completed bit's value is reset to 0.
(2) When the Latch B Completed Flag Clear (3031h:06, 3031h:22) bit's value changes from 0 to 1, the Latch B Completed bit's value is reset to 0.
(3) When the Phase Z Latch Completed Flag Clear (3031h:10, 3031h:26) bit's value changes from 0 to 1, the Phase Z Latch Completed bit's value is reset to 0.

For more on Latch Completed Flag Clear bits, see 9.5.19 Object 3021h: Latch and External Reset Status.

8.9.7 Latch Modes

The Ezi-IO EtherCAT CNT supports two latch reset modes as in Table 8-2.

Mode	Description
Single latch mode	When a latch signal is input, the latch is executed once, and the latch flag bit responding to each function changes from 0 to 1. If the latch flag bit's value is not reset to 0, that latch is not executed again.
Sequential latch mode	When a latch signal is input, the latch is executed once, and the latch flag bit responding to each function changes from 0 to 1. However, the latch continues to be executed each time a latch signal is input regardless of the latch flag bit's value.

Table 8-2. Ezi-IO EtherCAT CNT's latch modes

The latch mode can be set with the Latch A Operation Mode (3031h:03, 3031h:19), Latch B Operation Mode (3031h:07, 3031h:23), or Phase Z Latch Operation Mode (3031h:11, 3031h:27) bit.
The Latch Operation Mode bit can be set through PDO communication, and its initial setting is single latch mode. See 9.5.27 Object 3031h: Latch and External Reset Command for more details.

Note

- If a preset and internal reset are executed simultaneously, the internal reset is executed first, followed by the preset. The counter value is therefore the same as the preset value.
- If a latch, external reset, or Phase Z reset is input simultaneously with the preset or internal reset command, the function execution order cannot be guaranteed.
- If a latch and external reset or Phase Z reset is input simultaneously, the function execution order cannot be guaranteed.

8.10 Input Logic

8.10.1 Description

The Ezi-IO EtherCAT CNT provides a function to set operating logic (rising or falling edge) for 3 control input (LTA, LTB, RST) signals.

8.10.2 Setup Method

You can set the operating logic for each channel's signal input using the Input Logic (3006h) object. This object can be set using SDO communication, and the initial settings have each function operating on the rising edge of the signal. For more details, see 9.5.8 Object 3006h: Input Logic.

Note

- The Count Enable (3030h:01, 3030h:05) bit must be changed from 0 to 1 for each channel after setup to be reflected in the Input Logic (3006h) object.

8.11 Pulse Rate Measurement

8.11.1 Description

The Ezi-IO EtherCAT CNT provides a function that measures the pulse rate of each signal input into pases A and B. Pulse rate means the number of pulse signal input during a certain time window. The number of pulse signals is counted based on the signal's rising edge.

8.11.2 Time Window

The time window is a fixed time interval for data processing; that is, the unit of time needed to calculate the pulse rate. When using pulse rate measurement, the pulse rate value is calculated by counting the number of pulse signals input each hour with the set time window. The refresh cycle of the pulse rate measured value is therefore proportional to the time window setting, and the bigger the time window, the slower the value's refresh cycles.

The measured pulse rate value is displayed on the Pulse Rate Value (3026h) object. For more on the Pulse Rate Value object, see 9.5.24 Object 3026h: Pulse Rate Value.
* Pulse Rate Value (3026h) = Number of pulse signals input during 1ms x Time Window (3004h)

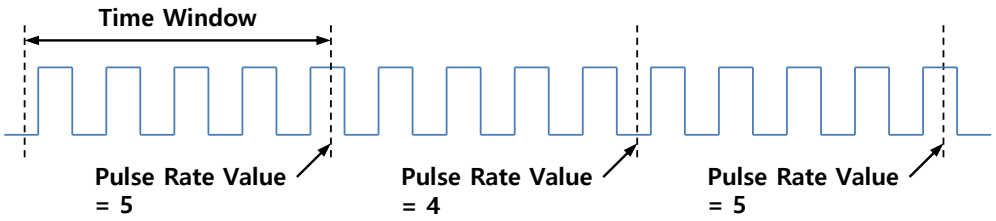


Fig. 8-9. Operation when measuring pulse

8.11.3 Moving Average Filter

The measured pulse rate value for each time window can fluctuate greatly depending on the pulse rate measuring settings (size of the actual pulse frequency time window). The Ezi-IO EtherCAT CNT has a moving average filter function to reduce such fluctuations.
You can set the moving average filter's time interval through the Time Window (3004h) and Filter Buffer Length (3005h) objects.
* Moving average filter time = Time Window (3004h) × Filter Buffer Length (3005h) × 1ms

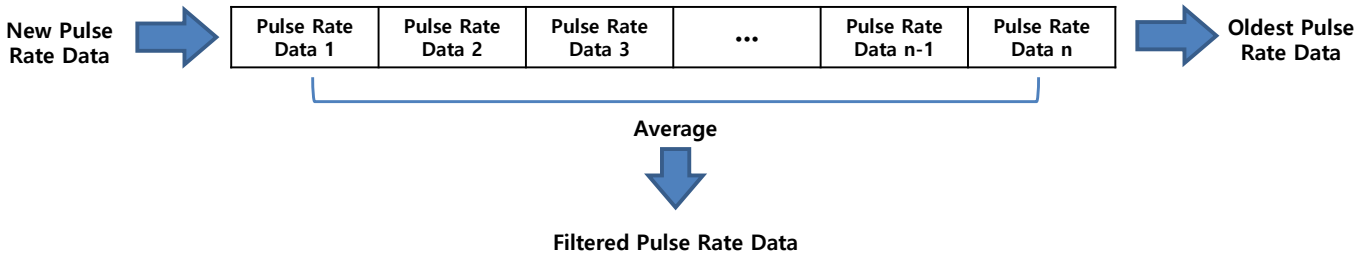


Fig. 8-10. Moving average filter algorithm

8.11.4 Setup Method

(1) The time window can be set through the Time Window (3004h) object. If this value is set to 0, the pulse rate is not measured. This object can be set using SDO communication, and it is initially set not to measure pulse rate. For more details, see 9.5.6 Object 3004h: Time Window.

(2) The moving average filter can be set using the Filter Buffer Length (3005h) object. If this value is set to 0 or 1, the moving average filter is not used. This object can be set using SDO communication, and it is initially set not to use the moving average filter. For more details, see 9.5.7 Object 3005h: Filter Buffer Length.

8.12 Comparison Output

The Ezi-IO EtherCAT CNT has a function that can output a signal when the counter value of each channel matches the comparison reference value. Comparison output is used when informing externally when the counter reaches a particular value during count operation.

8.12.1 Comparison Output Activation

If "1" is input to the Comparison Output Enable (3030h:04, 3030h:08) bit, that channel's comparison output is activated. If "0" is input, that channel's comparison output is deactivated.
The Comparison Output Enable bit can be set through PDO communication. For details, see 9.5.26 Object 3030h: Counter Command.

Whether or not comparison output is enabled is displayed in the Count Enabled (3020h:09, 3020h:25) bit. It is disabled if the bit's value is 0 and enabled if the bit's value is 1. For more on the Comparison Output Enabled bit, see 9.5.18 Object 3020h: Counter Status.

8.12.2 Comparison Output Mode

The Ezi-IO EtherCAT CNT provides the following two comparison output modes.

Mode	Description
Periodic comparison mode	This mode can perform comparison output consecutively at set counter value intervals according to settings when the counter value matches a particular comparison reference value and comparison output occurs.
Sequential comparison mode	This mode provides up to 60 comparison reference values per channel. When comparison output occurs because the counter value matches the first comparison reference value, comparison output is then performed with the second comparison reference value. Once comparison output has been performed all the way to the final comparison reference value, comparison output restarts from the first comparison reference value.

Table 8-3. Ezi-IO EtherCAT CNT's comparison output modes

Comparison output mode can be set using the Comparison Output Mode (3010h) object. This object can be set using SDO communication, and its initial setting is to periodic comparison mode. For more details, see 9.5.9 Object 3010h: Comparison Output Mode.

8.12.3 Periodic Comparison Mode

(1) Comparison start reference value
The initial comparison starting reference value is set to output a signal as in Fig. 8-11. This value is saved as-is on the Present Comparison Reference Value (3027h) object.
The comparison starting reference value can be set using the Comparison Start Position (3011h) object. This object can be set through SDO communication, and it is initially set to 0. For details, see 9.5.10 Object 3011h: Comparison Start Position.

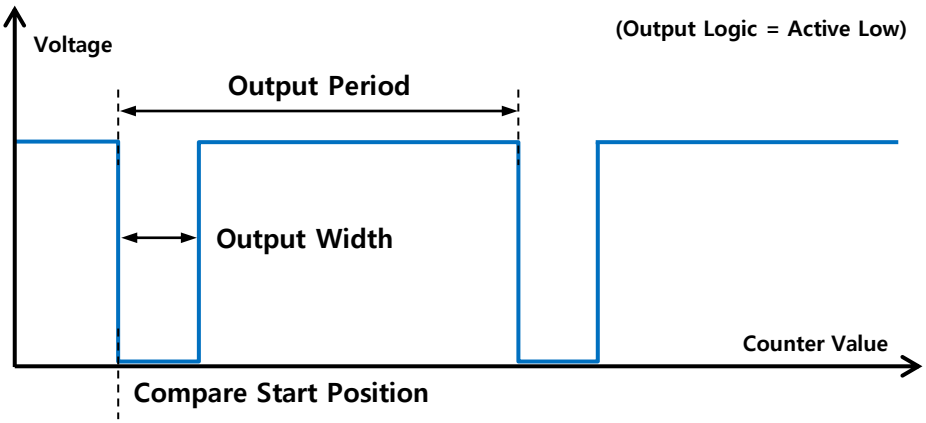


Fig. 8-11. Periodic comparison mode's signal output

(2) Output period
Sets the output period after the first comparison output is generated as in Fig. 8-11. When the first signal output occurs, the value of the Present Comparison Reference Value (3027h) object increases or decreases according to the output period. If the period is set to 0, comparison output repeatedly operates at the comparison starting output reference value.
The output period can be set through the Output Period (3013h) object. This object can be set using SDO communication, and its initial setting is 0. For details, see 9.5.12 Object 3013h: Output Period.

(3) Output width
Sets the time to output the signal (= output signal's width) as in Fig. 8-11.
The output width can be set using the Output Width (3014h) object. This object can be set using SDO communication, and its initial setting is 1. For details, see 9.5.13 Object 3014h: Output Width.

The output width's time is set in units of ms or μs through the Output Width Unit (3015h) object. This object can be set using SDO communication, and it is initially set to ms. For details, see 9.5.14 Object 3015h: Output Width Unit.

Note

- The Count Enable (3030h:01, 3030h:05) bit must be changed from 0 to 1 for each channel after setup to be reflected in the Output Width (3014h) and Output Width Unit (3015h) objects.

(4) Comparison direction
Sets whether to increase (+ direction) or decrease (- direction) from the current comparison reference value according to the output period when calculating the comparison reference value after the first comparison output occurs.
The comparison direction can be set through the Comparison Direction (3012h) object. This object can be set using SDO communication and is initially set to the + direction. For details, see 9.5.11 Object 3012h: Comparison Direction.

8.12.4 Sequential Comparison Mode

(1) Comparison reference value array
Sets the comparison starting reference value to output signals as in Fig. 8-12. When comparison output operates from some comparison reference value, the value of the Comparison Reference Value (3027h) object refreshes to the next comparison reference value, and when comparison output operates to the final reference value, comparison output restarts from the first reference value. Up to 60 comparison reference value arrays are provided per channel.
The comparison reference value array is set using the Comparison Reference Value Array (301Bh) object. This object can be set through SDO communication, and all comparison reference values are initially set to 0. For more details, see 9.5.17 Object 301Bh: Comparison Reference Value Array.

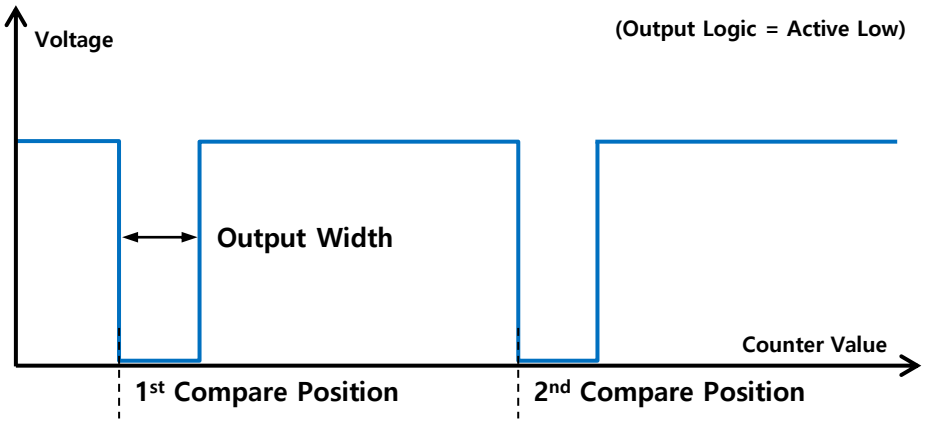


Fig. 8-12. Sequential comparison mode's signal output

(2) Output width
Sets the time to output signals (= width of output signals) as in Fig. 8-12. For details, see (3) Output width in 8.12.3 Periodic Comparison Mode.

(3) Comparison reference value array size
Sequential comparison mode performs comparison output sequentially from the first comparison reference value to match a set number through the comparison reference value array size.
If the user has set the 1st-5th comparison reference values of the Comparison Reference Value Array object sequentially but the Comparison Reference Value Array Size object was set to 4, the function will operate up to the 4th comparison reference value as in Fig. 8-13 and then will ignore the 5th.

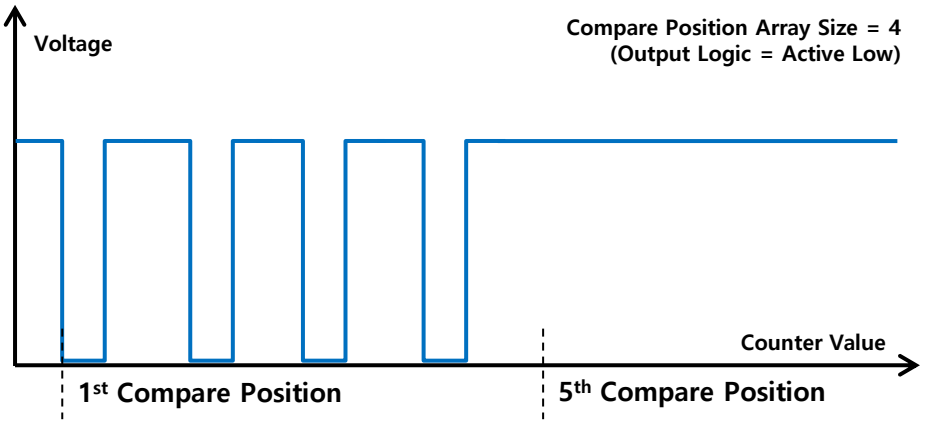


Fig. 8-13. Operation when the Comparison Reference Value Array Size object was set to a number lower than the actual number of comparison reference values

The size of the comparison reference value array can be set through the Comparison Reference Value Array Size (301Ah) object. This object can be set using SDO communication, and it is initially set to 1 comparison reference value array. For details, see 9.5.16 Object 301Ah: Comparison Reference Value Array Size.

8.12.5 Checking the Current Comparison Reference Value

The comparison reference value to perform comparison output at the present time is displayed in the Present Comparison Reference Value (3027h) object. For details, see 9.5.25 Object 3027h: Present Comparison Reference Value.

If the value of the Present Comparison Reference Value object exceeds the counter's measuring range ('0' - Maximum Counter Value object setting), the Invalid Comparison Reference Value Error (3020h:14, 3020h:30) bit's value changes from 0 to 1. In this status, comparison output is not executed and the comparison reference value must be reset.

(1) If this error occurs when operating in periodic comparison mode, reset the Comparison Start Position object. After initial setup, the Present Comparison Reference Value object is refreshed taking the Maximum Counter Value object settings into account and the error does not occur.
(2) If this error occurs when operating in sequential comparison mode, reset the Comparison Reference Value Array object. The Present Comparison Reference Value object is then refreshed to the 1st comparison reference value.

For more on the Invalid Comparison Reference Value Error bit, see 9.5.18 Object 3020h: Counter Status.

Part 9 EtherCAT Object Dictionary

9.1 Object Display Formats

The table below shows the format in which information is displayed for each object.

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
6000h	0	Number of Entries	U8	RO	No	No	-	4
	1	Input 1st byte	U8	RO	No	TxPDO	0 - 255	0
	2	Input 2nd byte	U8	RO	No	TxPDO	0 - 255	0
	3	Input 3rd byte	U8	RO	No	TxPDO	0 - 255	0
	4	Input 4th byte	U8	RO	No	TxPDO	0 - 255	0

Objects displaying fixed information such as the Device Name (1008h) display in the following format.

Index	Sub-index	Name	Type	Access	Constant Value
1008h	0	Device Name	STR(20)	RO	Ezi-IO EtherCAT IN32

9.1.1 Indexes and Sub-indexes

The table below shows fields classified by hexadecimal 4-digit index for objects.

Index	Field	Description
0000h - 0FFFh	Data format field	Defines data format
1000h - 1FFFh	CoE communication field	Defines variables that can be used on all servers for dedicated communication
2000h - 5FFFh	Manufacturer unique field	Variable defined exclusively for Fastech modules
6000h - 9FFFh	Device profile field	Variable defined by CiA401 module profile
A000h - FFFFh	Reserved	Other variables

Table 9-1. Objects' index structure

Sub-indexes are used for access in the event of structure objects bundling multiple variables in a single object.
For the maximum accessible sub-indexes, see each object's sub-index 0: 'Number of entries'.

9.1.2 Name

This is the name describing the relevant object.

9.1.3 Data Type

Objects' variable types are as follows.

Data Type	Length	Range
U8	1 byte	0 - 255
U16	2 byte	0 - 65535
U32	4 byte	0 - 4294967295
I8	1 byte	-128 - 127
I16	2 byte	-32768 - 32767
I32	4 byte	-2147483648 - 2147483647
BOOL	1 bit	0 - 1
STR(n)	n byte	Text strings with length n

Table 9-2. Data Types

9.1.4 Access

The properties of each object are as follows, and permissions to access each object are described.

Access	Definition
RO	Read Only / Variables that can only be read
RW	Read/Write / Variables that can be read or written to

Table 9-3. Objects' access format

9.1.5 Saving

This product automatically saves object values in EEPROM.

9.1.6 PDO Mapping

Shows whether that object can be mapped to EtherCAT's PDO communication.

PDO Type	Description
No	Object that cannot be mapped to PDO.
Tx PDO	Object that can be mapped to Tx PDO.
Rx PDO	Object that can be mapped to Rx PDO.

Table 9-4. PDO mapping description

9.1.7 Constant Value

The fixed value each object displays. This value may be displayed differently depending on the product's model and version.

9.1.8 Value Range

The value range displays the range of values for that object. This range can display as a user-defined range or can display a data type range.

9.1.9 Default Value

Displays the default value of an object.

9.2 Communication Objects

9.2.1 Object 1000h: Device Type

Index	Sub-index	Name	Type	Access	Constant Value
1000h	0	Device Type	U32	RO	0001 0000h

This object includes information about the device type.

Bit	Name	Value	Description
0 - 15	Device profile no.	0000h	Does not follow CiA401 Profile
16 - 22	I/O function	01h	Digital Input
23	M (using PDO)	0h	Predefined standard PDO mapping supported
24 - 31	Certain functions	00h	-

Table 9-5. Device Type

Note

The device type value may be displayed differently depending on product model.

9.2.2 Object 1001h: Error Register

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1001h	0	Error Register	U8	RO	No	No	-	00h

This object displays the types of errors occurring in the product.

Bit	Meaning
0	Standard error
1	Current error
2	Voltage error
3	Temperature error
4	Communication error
5	Device profile error
6	Reserved
7	Manufacturer unique error

Table 9-6. Error types

If a related error has occurred, that bit is set.

9.2.3 Object 1008h: Device Name

Index	Sub-index	Name	Type	Access	Constant Value
1008h	0	Device Name	STR(20)	RO	Ezi-IO EtherCAT CNT02

This object displays the device name.

Note

The device name value may be displayed differently depending on product model.

9.2.4 Object 1009h: Hardware Version

Index	Sub-index	Name	Type	Access	Constant Value
1009h	0	Hardware Version	STR(8)	RO	01.00.00

This object displays the product's hardware version. The value displayed may vary depending on product version.

9.2.5 Object 100Ah: Software Version

Index	Sub-index	Name	Type	Access	Constant Value
100Ah	0	Software Version	STR(8)	RO	01.00.00

This object displays the product's software version. The value displayed may vary depending on product version.

9.2.6 Object 1011h: Restore Default Parameters

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1011h	0	Number of Entries	U8	RO	No	No	-	1
	1	Restore Default Parameters	U32	RW	No	No	-	1

Orders the values of objects saved in the product's EEPROM to become default values.
To revert objects to factory values, "64616F6Ch" must be input into Sub-index 01h.

	MSB			LSB
ASCII	'd'	'a'	'o'	'l'
Hex	64h	61h	6Fh	6Ch

Table 9-1. Restore Parameters value definitions

Note

The object's value is reset to default when the product's power is restarted.

9.2.7 Object 1018h: Identity

Index	Sub-index	Name	Type	Access	Constant Value
1018h	0	Number of Entries	U8	RO	4
	1	Vender ID	U32	RO	0FA0 0000h
	2	Product Code	U32	RO	0000 2203h
	3	Revision Number	U32	RO	0001 0000h
	4	Serial Number	U32	RO	0000 0000h

This object displays the device information.

Note

The values of each identity item may be displayed differently depending on product model and version.

9.2.8 Object 10F1h: Error Setting

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
10F1h	0	Number of Entries	U8	RO	No	No	-	2
	1	Local Error Reaction	U32	RO	No	No	-	0000 0000h
	2	Sync Error Counter Limit	U32	RW	No	No	-	0000 000Ch

9.3 PDO Mapping Objects

9.3.1 Object 1600h: RxPDO-Map 0

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1600h	0	Number of Entries	U8	RO	No	No	-	8
	1	1st PDO Object	U32	RO	Yes	No	-	3030 0101h
	2	2nd PDO Object	U32	RO	Yes	No	-	3030 0201h
	3	3rd PDO Object	U32	RO	Yes	No	-	3030 0301h
	4	4th PDO Object	U32	RO	Yes	No	-	3030 0401h
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	7	7th PDO Object	U32	RO	Yes	No		3030 0701h
	8	8th PDO Object	U32	RO	Yes	No		3030 0801h

This object indicates RxPDO-Map0 setting data.
The following object is mapped: Counter Command (3030h)
See 6.2 PDO Mapping.

9.3.2 Object 1601h: RxPDO-Map 1

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1601h	0	Number of Entries	U8	RO	No	No	-	32
	1	1st PDO Object	U32	RO	Yes	No	-	3031 0101h
	2	2nd PDO Object	U32	RO	Yes	No	-	3031 0201h
	3	3rd PDO Object	U32	RO	Yes	No	-	3031 0301h
	4	4th PDO Object	U32	RO	Yes	No	-	3031 0401h
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	31	31th PDO Object	U32	RO	Yes	No	-	3031 1F01h
	32	32th PDO Object	U32	RO	Yes	No	-	3031 2001h

This object indicates RxPDO-Map1 setting data.
The following object is mapped: Latch and External Reset Command (3031h)
See 6.2 PDO Mapping.

9.3.3 Object 1602h: RxPDO-Map 2

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1602h	0	Number of Entries	U8	RO	No	No	-	2
	1	1st PDO Object	U32	RO	Yes	No	-	3032 0120h
	2	2nd PDO Object	U32	RO	Yes	No	-	3032 0220h

This object indicates RxPDO-Map2 setting data.
The following object is mapped: Preset Value (3032h)
See 6.2 PDO Mapping.

9.3.4 Object 1A00h: TxPDO-Map 0

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1A00h	0	Number of Entries	U8	RO	No	No	-	32
	1	1st PDO Object	U32	RO	Yes	No	-	3020 0101h
	2	2nd PDO Object	U32	RO	Yes	No	-	3020 0201h
	3	3rd PDO Object	U32	RO	Yes	No	-	3020 0301h
	4	4th PDO Object	U32	RO	Yes	No	-	3020 0401h
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	31	31th PDO Object	U32	RO	Yes	No	-	3020 1F01h
	32	32th PDO Object	U32	RO	Yes	No	-	3020 2001h

This object indicates TxPDO-Map0 setting data.
The following object is mapped: Counter Status (3020h)
See 6.2 PDO Mapping.

9.3.5 Object 1A01h: TxPDO-Map 1

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1A01h	0	Number of Entries	U8	RO	No	No	-	32
	1	1st PDO Object	U32	RO	Yes	No	-	3021 0101h
	2	2nd PDO Object	U32	RO	Yes	No	-	3021 0201h
	3	3rd PDO Object	U32	RO	Yes	No	-	3021 0301h
	4	4th PDO Object	U32	RO	Yes	No	-	3021 0401h
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	31	31th PDO Object	U32	RO	Yes	No	-	3021 1F01h
	32	32th PDO Object	U32	RO	Yes	No	-	3021 2001h

This object indicates TxPDO-Map1 setting data.
The following object is mapped: Latch and External Reset Status (3021h)

9.3.6 Object 1A02h: TxPDO-Map 2

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1A02h	0	Number of Entries	U8	RO	No	No	-	8
	1	1st PDO Object	U32	RO	Yes	No	-	3022 0120h
	2	2nd PDO Object	U32	RO	Yes	No	-	3023 0120h
	3	3rd PDO Object	U32	RO	Yes	No	-	3024 0120h
	4	4th PDO Object	U32	RO	Yes	No	-	3025 0120h
	5	5th PDO Object	U32	RO	Yes	No	-	3022 0220h
	6	6th PDO Object	U32	RO	Yes	No	-	3023 0220h
	7	7th PDO Object	U32	RO	Yes	No	-	3024 0220h
	8	8th PDO Object	U32	RO	Yes	No	-	3025 0220h

This object indicates TxPDO-Map2 setting data.
The following objects are mapped: Present Counter Value (3022h), Latch A Value (3023h), Latch B Value (3024h), Phase Z Latch Value (3025h)
See 6.2 PDO Mapping.

9.3.7 Object 1A03h: TxPDO-Map 3

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1A03h	0	Number of Entries	U8	RO	No	No	-	4
	1	1st PDO Object	U32	RO	Yes	No	-	3026 0120h
	2	2nd PDO Object	U32	RO	Yes	No	-	3027 0120h
	3	3rd PDO Object	U32	RO	Yes	No	-	3026 0220h
	4	4th PDO Object	U32	RO	Yes	No	-	3027 0220h

This object indicates TxPDO-Map3 setting data.
The following objects are mapped: Pulse Rate Value (3026h), Present Comparison Reference Value (3027h)
See 6.2 PDO Mapping.

9.4 Sync Manager Object

9.4.1 Object 1C00h: Sync Manager Type

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1C00h	0	Number of Entries	U8	RO	No	No	-	4
	1	SM0	U8	RO	No	No	-	01h
	2	SM1	U8	RO	No	No	-	02h
	3	SM2	U8	RO	No	No	-	03h
	4	SM3	U8	RO	No	No	-	04h

Sync Manager Type	Description
1	Mailbox Out
2	Mailbox In
3	PDO Output
4	PDO Input

Table 9-8. Sync Manager Type Value

9.4.2 Object 1C32h: SM Output Parameter

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1C32h	0	Number of Entries	U8	RO	No	No	-	32
	1	Synchronization Type	U16	RW	No	No	-	0002h
	2	Cycle Time	U32	RO	No	No	-	0000 0000h
	4	Synchronization Type Supported	U16	RO	No	No	-	401Fh
	5	Minimum Cycle Time	U32	RO	No	No	-	0003 D090h
	6	Calc And Copy Time	U32	RO	No	No	-	0000 2710h
	8	Get Cycle Time	U16	RW	No	No	-	0000h
	9	Delay Time	U32	RO	No	No	-	0000 0000h
	10	Sync0 Cycle Time	U32	RW	No	No	-	0000 0000h
	11	SM-Event Missed	U16	RO	No	No	-	0000h
	12	Cycle Time Too Small	U16	RO	No	No	-	0000h
	32	Sync Error	BOOL	RO	No	No	-	0000h

9.4.3 Object 1C33h: SM Input Parameter

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
1C33h	0	Number of Entries	U8	RO	No	No	-	32
	1	Synchronization Type	U16	RW	No	No	-	0002h
	2	Cycle Time	U32	RO	No	No	-	0000 0000h
	4	Synchronization Type Supported	U16	RO	No	No	-	401Fh
	5	Minimum Cycle Time	U32	RO	No	No	-	0003 D090h
	6	Calc And Copy Time	U32	RO	No	No	-	0000 2710h
	8	Get Cycle Time	U16	RW	No	No	-	0000h
	9	Delay Time	U32	RO	No	No	-	0000 0000h
	10	Sync0 Cycle Time	U32	RW	No	No	-	0000 0000h
	11	SM-Event Missed	U16	RO	No	No	-	0000h
	12	Cycle Time Too Small	U16	RO	No	No	-	0000h
	32	Sync Error	BOOL	RO	No	No	-	0000h

9.5 Manufacturer Specific Object

9.5.1 Manufacturer Specific Object List

Table 9-9 summarizes the characteristics of objects related to functions provided by the Ezi-IO EtherCAT CNT.

Index	Name	Attribute	PDO Mapping	Data Save
3000h	Count Mode	-	-	-
3001h	Pulse Input Method	CE	-	O
3002h	Count Direction	CE	-	O
3003h	Maximum Counter Value	CE	-	O
3004h	Time Window	I	-	O
3005h	Filter Buffer Length	I	-	O
3006h	Input Logic	CE	-	O
3010h	Comparison Output Mode	I	-	O
3011h	Comparison Start Position	I	-	O
3012h	Comparison Direction	I	-	O
3013h	Output Period	I	-	O
3014h	Output Width	CE	-	O
3015h	Output Width Unit	CE	-	O
301Ah	Comparison Reference Value Array Size	I	-	O
301Bh	Comparison Reference Value Array	I	-	O
3020h	Counter Status	-	TxPDO	-
3021h	Latch and External Reset Status	-	TxPDO	-
3022h	Present Counter Value	-	TxPDO	-
3023h	Latch A Value	-	TxPDO	-
3024h	Latch B Value	-	TxPDO	-
3025h	Phase Z Latch Value	-	TxPDO	-
3026h	Pulse Rate Value	-	TxPDO	-
3027h	Present Comparison Reference Value	-	TxPDO	-
3030h	Counter Command	I	RxPDO	-
3031h	Latch and External Reset Command	I	RxPDO	-
3032h	Preset Value	I	RxPDO	-

Table 9-9. Manufacturer Specific Object List

The meanings of signs displayed in the Attribute column are as follows:

(1) CE: Each channel's Count Enable (3030h:01, 3030h:05) bit must be changed from 0 to 1 after setup to be reflected.
(2) I: Reflected immediately after setting.
(3) -: This is a read-only object that cannot be set.

Set values of objects displayed as "O" in the Data Save column are automatically saved in the product's internal EEPROM. Existing settings can therefore be used even if power is restarted.

9.5.2 Object 3000h: Count Mode

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3000h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Count Mode	BOOL	RO	No	No	0	0
	2	CH2 Count Mode	BOOL	RO	No	No	0	0

This object displays the count mode for pulse input. The value is fixed at 0 (ring counter).

9.5.3 Object 3001h: Pulse Input Method

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3001h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Pulse Input Method	U8	RW	Yes	No	0 - 3	0
	2	CH2 Pulse Input Method	U8	RW	Yes	No	0 - 3	0

This object sets the pulse input method.

Value	Description
0	Phase difference pulse input (4x measurement)
1	Phase difference pulse input (2x measurement)
2	1 pulse input (pulse/direction input)
3	2 pulse input (CW/CCW input)

Table 9-10. Pulse Input Method

9.5.4 Object 3002h: Count Direction

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3002h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Count Direction	BOOL	RW	Yes	No	0 - 1	0
	2	CH2 Count Direction	BOOL	RW	Yes	No	0 - 1	0

This object sets the count direction for pulse input.

Value	Description
0	Forward count
1	Reverse count

Table 9-11. Count Direction

9.5.5 Object 3003h: Maximum Counter Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3003h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Maximum Counter Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	2	CH2 Maximum Counter Value	U32	RW	Yes	No	0 - 4,294,967,295	0

This object sets the maximum value that the Present Counter Value (3022h) object can display. If it is set to 0, it is automatically refreshed to 4,294,967,295 in the product.

9.5.6 Object 3004h: Time Window

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3004h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Time Window	U16	RW	Yes	No	0 - 65,535	0
	2	CH2 Time Window	U16	RW	Yes	No	0 - 65,535	0

This object sets the time window length applied to pulse rate measurement. The value is in ms. If the value is set to 0, pulse rate is not measured.

9.5.7 Object 3005h: Filter Buffer Length

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3005h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Filter Buffer Length	U8	RW	Yes	No	0 - 255	0
	2	CH2 Filter Buffer Length	U8	RW	Yes	No	0 - 255	0

This object sets the number of moving average filter buffers applied to pulse rate measurement. If it is set to 0, moving average filters are not used.

9.5.8 Object 3006h: Input Logic

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3006h	0	Number of Entries	U8	RO	No	No	-	8
	1	CH1 Latch A Input Logic	BOOL	RW	Yes	No	0 - 1	1
	2	CH1 Latch B Input Logic	BOOL	RW	Yes	No	0 - 1	1
	3	CH1 External Reset Input Logic	BOOL	RW	Yes	No	0 - 1	1
	4	SubIndex 004	BOOL	RO	No	No	0	0
	5	CH2 Latch A Input Logic	BOOL	RW	Yes	No	0 - 1	1
	6	CH2 Latch B Input Logic	BOOL	RW	Yes	No	0 - 1	1
	7	CH2 External Reset Input Logic	BOOL	RW	Yes	No	0 - 1	1
	8	SubIndex 008	BOOL	RO	No	No	0	0

This object sets the operating logic for each control input that can execute Latch A, Latch B, and external resets.

Value	Description
0	Operates at the signal's falling edge
1	Operates at the signal's rising edge

Table 9-12. Input Logic

9.5.9 Object 3010h: Comparison Output Mode

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3010h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Comparison Output Mode	BOOL	RW	Yes	No	0 - 1	0

This object sets the comparison output operating mode.

Value	Description
0	Periodic comparison mode
1	Sequential comparison mode

Table 9-13. Comparison Output Mode

9.5.10 Object 3011h: Comparison Start Position

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3011h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Comparison Start Position	U32	RW	Yes	No	0 - 4,294,967,295	0
	2	CH2 Comparison Start Position	U32	RW	Yes	No	0 - 4,294,967,295	0

This object sets the initial comparison starting reference value to output signals in periodic comparison mode.
This object's settings do not affect operation of sequential comparison mode.

9.5.11 Object 3012h: Comparison Direction

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3012h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Comparison Direction	BOOL	RW	Yes	No	0 - 1	0
	2	CH2 Comparison Direction	BOOL	RW	Yes	No	0 - 1	0

This object sets the direction to compare counter values in periodic comparison mode.
This object's settings do not affect operation of sequential comparison mode.

Value	Description
0	Next comparison reference value = current comparison reference value + output period
1	Next comparison reference value = current comparison reference value - output period

Table 9-14. Comparison Direction

9.5.12 Object 3013h: Output Period

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3013h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Output Period	U32	RW	Yes	No	0 - 2,147,483,647	0
	2	CH2 Output Period	U32	RW	Yes	No	0 - 2,147,483,647	0

This object sets the comparison output period in periodic comparison mode. If the value is set to 0, comparison output repeats at the reference value set in the Comparison Start Position (3011h) object.
This object's settings do not affect operation of sequential comparison mode.

9.5.13 Object 3014h: Output Width

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3014h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Output Width	U16	RW	Yes	No	1 - 20,000	1
	2	CH2 Output Width	U16	RW	Yes	No	1 - 20,000	1

This object sets the comparison output signal width. The value's units can be set using the Output Width Unit (3015h) object.

9.5.14 Object 3015h: Output Width Unit

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3015h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Output Width Unit	BOOL	RW	Yes	No	0 - 1	0
	2	CH2 Output Width Unit	BOOL	RW	Yes	No	0 - 1	0

This object sets the unit for the Output Width (3014h) object to ms or μs.

Value	Description
0	Set to ms
1	Set to μs

Table 9-15. Output Width Unit

9.5.15 Object 301Ah: Comparison Reference Value Array Size

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
301Ah	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Comparison Reference Value Array Size	U8	RW	Yes	No	1 - 60	1
	2	CH2 Comparison Reference Value Array Size	U8	RW	Yes	No	1 - 60	1

This object sets the number of comparison reference values to output signals in sequential comparison mode.
This object's settings do not affect operation of periodic comparison mode.

9.5.16 Object 301Bh: Comparison Reference Value Array

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
301Bh	0	Number of Entries	U8	RO	No	No	-	120
	1	CH1 1st Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	2	CH1 2nd Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	59	CH1 59th Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	60	CH1 60th Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	61	CH2 1st Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	62	CH2 2nd Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	119	CH2 59th Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0
	120	CH2 60th Comparison Reference Value	U32	RW	Yes	No	0 - 4,294,967,295	0

This object sets the comparison reference value to output signals in sequential comparison mode.
This object's settings do not affect operation of periodic comparison mode.

9.5.17 Object 3020h: Counter Status

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3020h	0	Number of Entries	U8	RO	No	No	-	32
	1	CH1 Count Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	2	CH1 Input Pulse Direction	BOOL	RO	No	TxPDO	0 - 1	0
	3	CH1 Counter Overflow Flag	BOOL	RO	No	TxPDO	0 - 1	0
	4	CH1 Counter Underflow Flag	BOOL	RO	No	TxPDO	0 - 1	0
	5	CH1 Internal Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	6	CH1 Preset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	7	SubIndex 007	BOOL	RO	No	TxPDO	0	0
	8	SubIndex 008	BOOL	RO	No	TxPDO	0	0
	9	CH1 Comparison Output Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	10	SubIndex 010	BOOL	RO	No	TxPDO	0	0
	11	SubIndex 011	BOOL	RO	No	TxPDO	0	0
	12	SubIndex 012	BOOL	RO	No	TxPDO	0	0
	13	CH1 Invalid Preset Value Error	BOOL	RO	No	TxPDO	0 - 1	0
	14	CH1 Invalid Comparison Reference Value Error	BOOL	RO	No	TxPDO	0 - 1	0
	15	SubIndex 015	BOOL	RO	No	TxPDO	0	0
	16	SubIndex 016	BOOL	RO	No	TxPDO	0	0
	17	CH2 Count Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	18	CH2 Input Pulse Direction	BOOL	RO	No	TxPDO	0 - 1	0
	19	CH2 Counter Overflow Flag	BOOL	RO	No	TxPDO	0 - 1	0
	20	CH2 Counter Underflow Flag	BOOL	RO	No	TxPDO	0 - 1	0
	21	CH2 Internal Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	22	CH2 Preset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	23	SubIndex 023	BOOL	RO	No	TxPDO	0	0
	24	SubIndex 024	BOOL	RO	No	TxPDO	0	0
	25	CH2 Comparison Output Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	26	SubIndex 026	BOOL	RO	No	TxPDO	0	0
	27	SubIndex 027	BOOL	RO	No	TxPDO	0	0
	28	SubIndex 028	BOOL	RO	No	TxPDO	0	0
	29	CH2 Invalid Preset Value Error	BOOL	RO	No	TxPDO	0 - 1	0
	30	CH2 Invalid Comparison Reference Value Error	BOOL	RO	No	TxPDO	0 - 1	0
	31	SubIndex 031	BOOL	RO	No	TxPDO	0	0
	32	SubIndex 032	BOOL	RO	No	TxPDO	0	0

This object displays all operating statuses of counters, excluding latches and external reset.

Bit	Name	Description
1, 17	Count Enabled	0: Cannot count pulse input (count disabled) 1: Can count pulse input (count enabled)
2, 18	Input Pulse Direction	0: Pulses input increase counter value 1: Pulses input decrease counter value
3, 19	Counter Overflow Flag	0 → 1: Overflow occurs in the Present Counter Value object 1 → 0: Reset or preset is executed
4, 20	Counter Underflow Flag	0 → 1: Underflow occurs in the Present Counter Value object 1 → 0: Reset or preset is executed
5, 21	Internal Reset Completed	0 → 1: Internal reset is executed
6, 22	Preset Completed	0 → 1: Preset is executed
9, 25	Comparison Output Enabled	0: Comparison output does not operate 1: Comparison output operates
13, 29	Invalid Preset Value Error	0: Preset works normally 1: The Preset Value object's set value is outside the range that the Present Counter Value object can display
14, 30	Invalid Comparison Reference Value Error	0: Comparison output works normally 1: The Preset Comparison Reference Value object's set value is outside the range that the Present Counter Value object can display

Table 9-17. Counter Status

9.5.18 Object 3021h: Latch and External Reset Status

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3021h	0	Number of Entries	U8	RO	No	No	-	32
	1	CH1 Latch A Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	2	CH1 Latch A Completed	BOOL	RO	No	TxPDO	0 - 1	0
	3	CH1 Latch A Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	4	CH1 Latch B Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	5	CH1 Latch B Completed	BOOL	RO	No	TxPDO	0 - 1	0
	6	CH1 Latch B Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	7	CH1 External Reset Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	8	CH1 External Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	9	CH1 External Reset Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	10	SubIndex 010	BOOL	RO	No	TxPDO	0	0
	11	CH1 Phase Z Latch Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	12	CH1 Phase Z Latch Completed	BOOL	RO	No	TxPDO	0 - 1	0
	13	CH1 Phase Z Reset Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	14	CH1 Phase Z Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	15	CH1 Phase Z Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	16	SubIndex 016	BOOL	RO	No	TxPDO	0	0
	17	CH2 Latch A Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	18	CH2 Latch A Completed	BOOL	RO	No	TxPDO	0 - 1	0
	19	CH2 Latch A Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	20	CH2 Latch B Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	21	CH2 Latch B Completed	BOOL	RO	No	TxPDO	0 - 1	0
	22	CH2 Latch B Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	23	CH2 External Reset Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	24	CH2 External Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	25	CH2 External Reset Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	26	SubIndex 026	BOOL	RO	No	TxPDO	0	0
	27	CH2 Phase Z Latch Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	28	CH2 Phase Z Latch Completed	BOOL	RO	No	TxPDO	0 - 1	0
	29	CH2 Phase Z Reset Enabled	BOOL	RO	No	TxPDO	0 - 1	0
	30	CH2 Phase Z Reset Completed	BOOL	RO	No	TxPDO	0 - 1	0
	31	CH2 Phase Z Input Status	BOOL	RO	No	TxPDO	0 - 1	0
	32	SubIndex 032	BOOL	RO	No	TxPDO	0	0

This object displays the operating status of latches and external reset.

Bit	Name	Description
1, 17	Latch A Enabled	0: Latch A cannot be used 1: Latch A can be used
2, 18	Latch A Completed	0 → 1: Latch A executed 1 → 0: Latch A Completed Clear bit set from 0 → 1
3, 19	Latch A Input Status	0: Low-level signals input to LTA input terminal 1: High-level signals input to LTA input terminal
4, 20	Latch B Enabled	0: Latch B cannot be used 1: Latch B can be used
5, 21	Latch B Completed	0 → 1: Latch B executed 1 → 0: Latch B Completed Clear bit set from 0 → 1
6, 22	Latch B Input Status	0: Low-level signals input to LTB input terminal 1: High-level signals input to LTB input terminal
7, 23	External Reset Enabled	0: External reset cannot be used 1: External reset can be used
8, 24	External Reset Completed	0 → 1: External reset executed 1 → 0: External Reset Completed Clear bit set from 0 → 1
9, 25	External Reset Input Status	0: Low-level signals input to RST input terminal 1: High-level signals input to RST input terminal
11, 27	Phase Z Latch Enabled	0: Phase Z latch cannot be used 1: Phase Z latch can be used
12, 28	Phase Z Latch Completed	0 → 1: Phase Z executed 1 → 0: Phase Z Completed Clear bit set from 0 → 1
13, 29	Phase Z Reset Enabled	0: Phase Z reset cannot be used 1: Phase Z reset can be used
14, 30	Phase Z Reset Completed	0 → 1: Phase Z reset executed 1 → 0: Phase Z Reset Completed Clear bit set from 0 → 1
15, 31	Phase Z Input Status	0: Low-level signals input to Z input terminal 1: High-level signals input to Z input terminal

Table 9-18. Latch and External Reset Status

9.5.19 Object 3022h: Present Counter Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3022h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Present Counter Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Present Counter Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the counter value measured from pulse input.

9.5.20 Object 3023h: Latch A Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3023h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Latch A Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Latch A Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the counter value measured from Latch A.

9.5.21 Object 3024h: Latch B Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3024h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Latch B Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Latch B Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the counter value measured from Latch B.

9.5.22 Object 3025h: Phase Z Latch Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3025h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Phase Z Latch Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Phase Z Latch Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the counter value measured from the Phase Z latch.

9.5.23 Object 3026h: Pulse Rate Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3026h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Pulse Rate Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Pulse Rate Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the pulse rate measured value.

9.5.24 Object 3027h: Present Comparison Reference Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3027h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Present Comparison Reference Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0
	2	CH2 Present Comparison Reference Value	U32	RO	No	TxPDO	0 - 4,294,967,295	0

This object displays the current comparison reference value. If comparison output is used, it occurs when this value matches the value of the Present Counter Value (3022h) object.

9.5.25 Object 3030h: Counter Commands

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3030h	0	Number of Entries	U8	RO	No	No	-	8
	1	CH1 Count Enable	BOOL	RW	No	RxPDO	0 - 1	0
	2	CH1 Internal Reset Execution	BOOL	RW	No	RxPDO	0 - 1	0
	3	CH1 Preset Execution	BOOL	RW	No	RxPDO	0 - 1	0
	4	CH1 Comparison Output Enable	BOOL	RW	No	RxPDO	0 - 1	0
	5	CH2 Count Enable	BOOL	RW	No	RxPDO	0 - 1	0
	6	CH2 Internal Reset Execution	BOOL	RW	No	RxPDO	0 - 1	0
	7	CH2 Preset Execution	BOOL	RW	No	RxPDO	0 - 1	0
	8	CH2 Comparison Output Enable	BOOL	RW	No	RxPDO	0 - 1	0

This object sets pulse output measuring activation, internal reset execution, preset execution, and comparison output activation commands.

Bit	Name	Description
1, 5	Count Enable	0: Pulse input not counted 1: Pulse input counted
2, 6	Internal Reset Execution	0 → 1: Internal reset executed 1 → 0: Internal Reset Completed bit reset to 0
3, 7	Preset Execution	0 → 1: Preset executed 1 → 0: Preset Completed bit reset to 0
4, 8	Comparison Output Enable	0: Comparison output not used 1: Comparison output used

Table 9-19. Counter Commands

9.5.26 Object 3031h: Latch and External Reset Commands

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3031h	0	Number of Entries	U8	RO	No	No	-	32
	1	CH1 Latch A Enable	BOOL	RW	No	RxPDO	0 - 1	0
	2	CH1 Latch A Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	3	CH1 Latch A Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	4	SubIndex 004	BOOL	RO	No	RxPDO	0	0
	5	CH1 Latch B Enable	BOOL	RW	No	RxPDO	0 - 1	0
	6	CH1 Latch B Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	7	CH1 Latch B Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	8	SubIndex 008	BOOL	RO	No	RxPDO	0	0
	9	CH1 Phase Z Latch Enable	BOOL	RW	No	RxPDO	0 - 1	0
	10	CH1 Phase Z Latch Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	11	CH1 Phase Z Latch Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	12	SubIndex 012	BOOL	RO	No	RxPDO	0	0
	13	CH1 External Reset Enable	BOOL	RW	No	RxPDO	0 - 1	0
	14	CH1 External Reset Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	15	CH1 Phase Z Reset Enable	BOOL	RW	No	RxPDO	0 - 1	0
	16	CH1 Phase Z Reset Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	17	CH2 Latch A Enable	BOOL	RW	No	RxPDO	0 - 1	0
	18	CH2 Latch A Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	19	CH2 Latch A Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	20	SubIndex 020	BOOL	RO	No	RxPDO	0	0
	21	CH2 Latch B Enable	BOOL	RW	No	RxPDO	0 - 1	0
	22	CH2 Latch B Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	23	CH2 Latch B Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	24	SubIndex 024	BOOL	RO	No	RxPDO	0	0
	25	CH2 Phase Z Latch Enable	BOOL	RW	No	RxPDO	0 - 1	0
	26	CH2 Phase Z Latch Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	27	CH2 Phase Z Latch Operation Mode	BOOL	RW	No	RxPDO	0 - 1	0
	28	SubIndex 028	BOOL	RO	No	RxPDO	0	0
	29	CH2 External Reset Enable	BOOL	RW	No	RxPDO	0 - 1	0
	30	CH2 External Reset Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0
	31	CH2 Phase Z Reset Enable	BOOL	RW	No	RxPDO	0 - 1	0
	32	CH2 Phase Z Reset Completed Clear	BOOL	RW	No	RxPDO	0 - 1	0

This object sets commands related to latches and external reset.

Bit	Name	Description
1, 17	Latch A Enable	0: Latch A not used 1: Latch A used
2, 18	Latch A Completed Clear	0 → 1: Latch A Completed bit reset to 0
3, 19	Latch A Operation Mode	0: Sets Latch A to single latch mode 1: Sets Latch A to sequential latch mode
5, 21	Latch B Enable	0: Latch B not used 1: Latch B used
6, 22	Latch B Completed Clear	0 → 1: Latch B Completed reset to 0
7, 23	Latch B Operation Mode	0: Sets Latch B to single latch mode 1: Sets Latch B to sequential latch mode
9, 25	Phase Z Latch Enable	0: Phase Z latch not used 1: Phase Z latch used
10, 26	Phase Z Latch Completed Clear	0 → 1: Phase Z Latch Completed reset to 0
11, 27	Phase Z Latch Operation Mode	0: Sets the Phase Z latch to single latch mode 1: Sets the Phase Z latch to sequential latch mode
13, 29	External Reset Enable	0: External reset not used 1: External reset used
14, 30	External Reset Completed Clear	0 → 1: External Reset Completed reset to 0
15, 31	Phase Z Reset Enable	0: Phase Z reset not used 1: Phase Z reset used
16, 32	Phase Z Reset Completed Clear	0 → 1: Phase Z Reset Completed reset to 0

Table 9-20. Latch and External Reset Commands

9.5.27 Object 3032h: Preset Value

Index	Sub-index	Name	Type	Access	SAVE	PDO Mapping	Value Range	Default Value
3032h	0	Number of Entries	U8	RO	No	No	-	2
	1	CH1 Preset Value	U32	RW	No	RxPDO	0 - 4,294,967,295	0
	2	CH2 Preset Value	U32	RW	No	RxPDO	0 - 4,294,967,295	0

This object sets the value input to the Present Counter Value (3022h) object when preset is executed.

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