EC4 Series EtherCAT SubDevice I/O Slim Modules User Manual

English Ver. 1.1, Jan 2026

WARRANTY

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

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If you have any questions, please feel free to contact us via email at:

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SUPPORT

EC4-P16
EC4-C16/A16
EC4-R8/POR8/POR16
EC4-DA4P/DA4/DA2
EC4-AD8/AD4/AD2

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1. Introduction

The EC4 series is an EtherCAT slim SubDevice module, designed as a modular hardware component specifically for EtherCAT networks, suitable for various industrial automation applications. Its compact design allows users to flexibly combine digital/analog I/O, communication interfaces, and sensor modules to build high-performance, low-latency automation systems, meeting the requirements for precise control and high-speed data transmission.

The EC4 series has undergone a series of qualification tests and complies with RoHS environmental standards. With a qualified EtherCAT MainDevice and configuration tools, it can be easily operated to fulfill various applications. Fig 1.1 illustrates a typical application of the EC4 series.

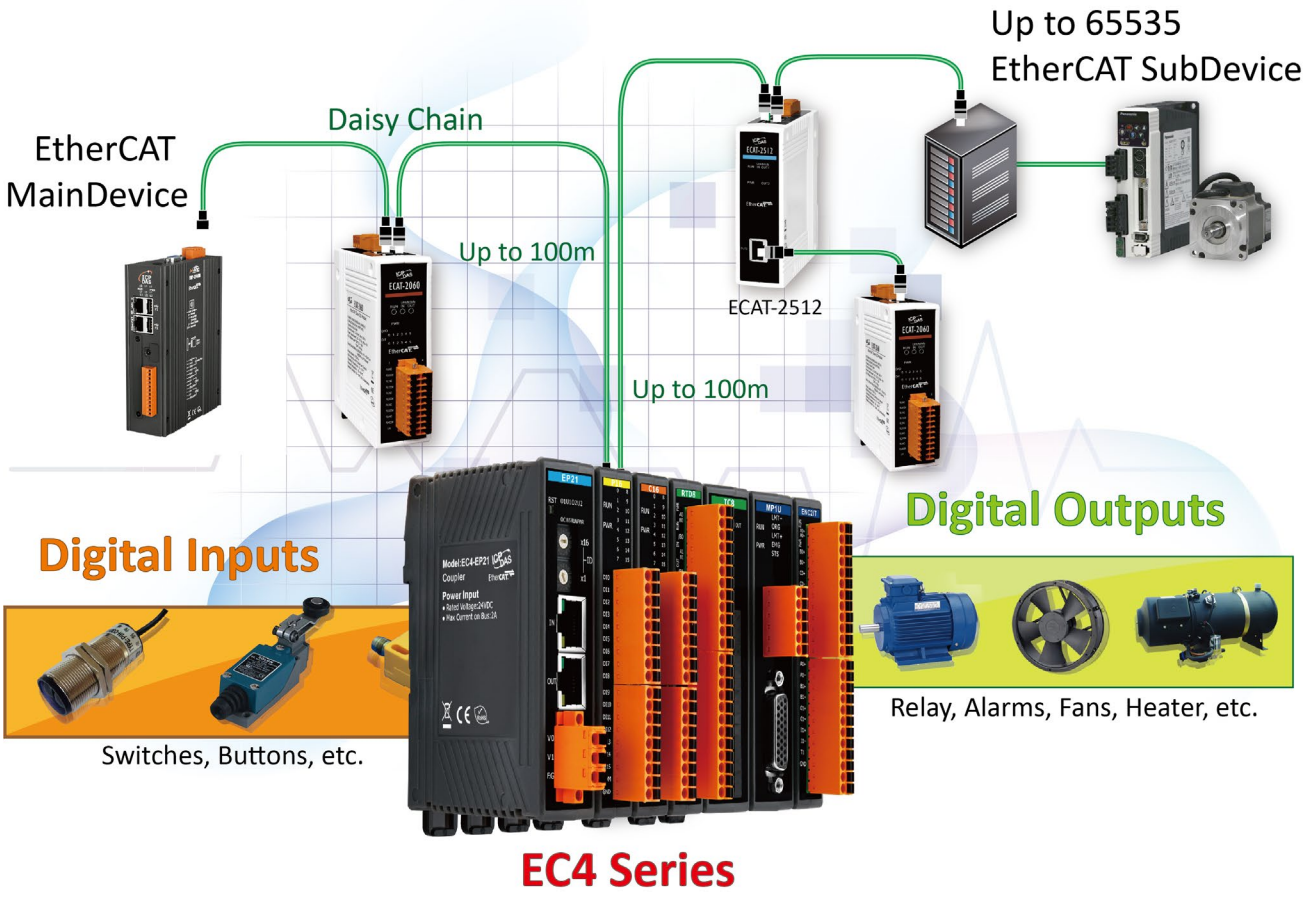


Figure 1.1 Typical Application of EC4 Series

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1.1 Package List

The shipping package includes the following items:



EC4 Series



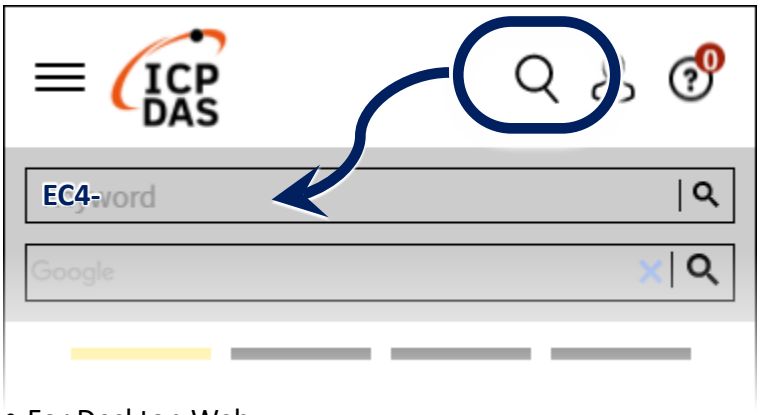
Quick Start

NOTE	If any of these items is missing or damaged, please contact your local distributor for more information. Keep the shipping materials and overall package in case you want to ship the module back in the future.

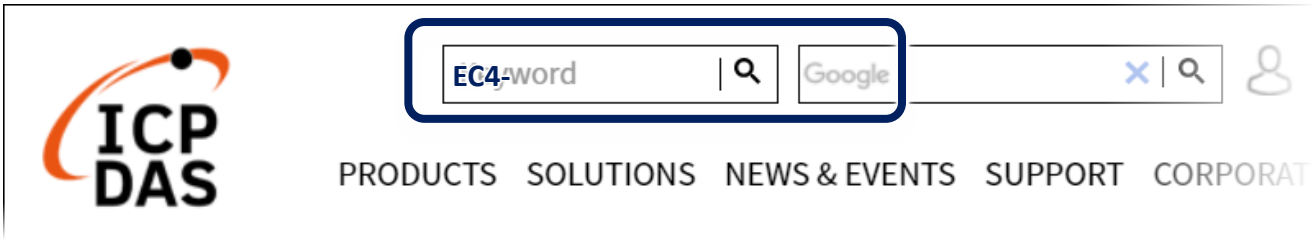
Resources

How to search for ESI, manuals and spec information on ICP DAS website(www.icpdas.com).

- For Mobile Web



- For Desktop Web



- For more detailed information related to the manual, hardware manual:
https://www.icpdas.com/en/product/guide+Industrial_Communication+EtherCAT+IO

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1.2 Feature

- **Modular Design**: Allows users to select and combine different modules as needed to build a customized automation system.
- **High-Speed Communication**: Utilizes EtherCAT's high-speed data transmission capabilities, providing low-latency and efficient data transfer.
- **Flexibility**: Modules can be added or removed as needed, making it convenient for system upgrades and expansions.
- **Reliability**: The design typically emphasizes industrial-grade stability, suitable for use in harsh industrial environments.

1.3 Model List

Model	Description
EC4-P16	Isolated 16-ch Digital Intputs
EC4-C16	Isolated 16-ch Digital Outputs (Sink)
EC4-A16	Isolated 16-ch Digital Outputs (Source)
EC4-POR16	Isolated 16-ch PhotoMos Relay Outputs
EC4-POR8	Isolated 8-ch PhotoMos Relay Outputs
EC4-R8	Isolated 8-ch Relay Outputs
EC4-DA4P	4-ch Analog Outputs
EC4-DA4	4-ch Analog Outputs
EC4-DA2	2-ch Analog Outputs
EC4-AD8	8-ch Analog Inputs
EC4-AD4	4-ch Analog Inputs
EC4-AD2	2-ch Analog Inputs

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1.4 Specification

System Specification

Model	EC4-P16	EC4-C16/A16	EC4-DA4P/DA4/DA2	EC4-AD8/AD4/AD2	EC4-POR8/POR16	EC4-R8
Communication						
Protocol	EtherCAT					
Cycle time	100 us					
Distributed Clocks	Ethernet/EtherCAT Cable (Min. CAT 5), Shielded					
LED Indicators						
PWR	1					
RUN	1					
EMS Protection						
ESD (IEC 61000-4-2)	±8 KV(Air for Random Point)					
Power						
Power Consumption	2 W @ 24 VDC	2 W @ 24 VDC	3.5 W @ 24 VDC	1.5 W @ 24 VDC	2 W @ 24 VDC	
Mechanical						
Installation	DIN-Rail Mounting					
Environment						
Operating Temperature	-25 ~ +70°C					
Storage Temperature	-30 ~ +80°C					
Relative Humidity	10 ~ 90% RH, Non-condensing					
Dimensions (W x L x D)	17.5 x 108 x 73					25 x 108 x 73

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I/O Specification

Model	EC4-P16	EC4-C16	EC4-A16
Digital Input			
Channels	16	-	
Contact	Dry/Wet	-	
Sink/Source(NPN/PNP)	Dry: Sink Wet: Sink/Source	-	
On Voltage Level	Dry: Close to GND Wet: +19 V_{DC} ~ +30 V_{DC}	-	
Off Voltage Level	Dry: Open Wet: +11 V_{DC} Max.	-	
Isolation Voltage	3000 V_{DC}	-	
Digital Output			
Channels	-	16	
Type	-	Open Collector (Sink),with internal flywheel diode	N-MOS (Source), with internal flywheel diode
Sink/Source(NPN/PNP)	-	Sink	Source
Load Voltage	-	40 VDC Max.	
Max. Load Current	-	500 mA/Channel (Sink) @ 25℃	500 mA/Channel (Source) @ 25℃
Isolation Voltage	-	3000 V_{DC}	

Model	EC4-R8	EC4-POR8	EC4-POR16
Digital Output			
Channels	8	8	16
Type	-	PhotoMos Relay, Form A	
Load Voltage	-	40 VDC Max.(ohmic load only)	
Max. Load Current	-	2A/Channel (Sink) @ 25℃	500 mA/Channel (Source) @ 25℃
Isolation Voltage	-	3000 V_{DC}	

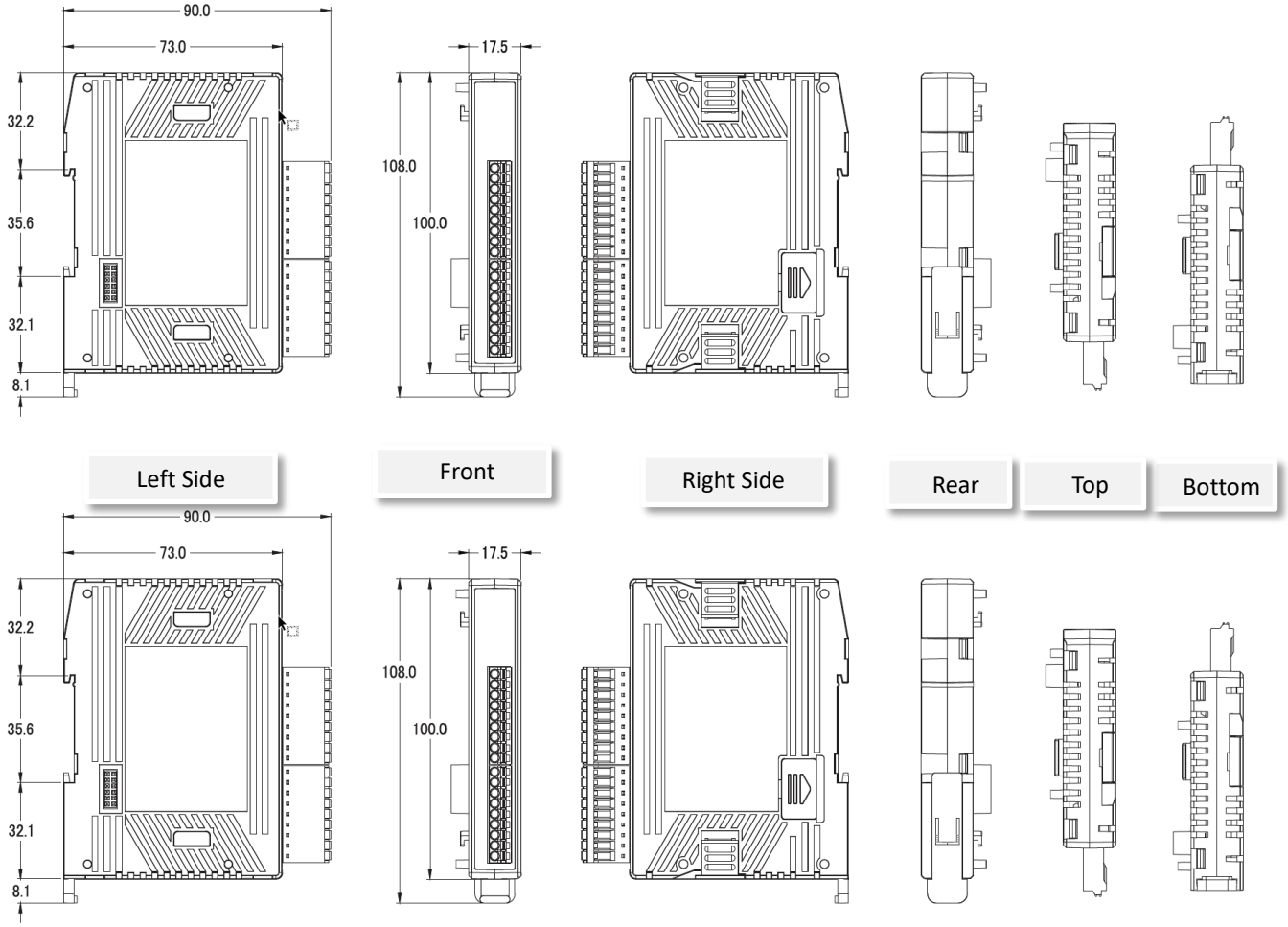
Model	EC4-AD8	EC4-AD4	EC4-AD2
Analog Input			
Channels	8 Diff	4 Diff	2 Diff
Type	Voltage		
Range	0~10V, ±10 V, ±5 V, ±2.5 V(Software selectable)-		
Resultion	16-bit		
Accuracy	0.05% of FSR		
Sampling Rate	1k Hz per channel	2k Hz per channel	4k Hz per channel
Overvoltage Protection	±35 V_{DC}		
Individual Channel Configuration	Yes(Range & Filter setting is not supported)		
Open Wire Detection	No		

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Model	EC4-DA4P	EC4-DA4	EC4-DA2
Analog Output			
Channels	4	4	2
Type	Voltage/Current		
Range	±5 V, ±10 V, 0 ~ 5V, 0 ~ 10V, 0 ~ 20 mA, 4 ~20 mA	±5 V, ±10 V, 0 ~ 5V, 0 ~ 10V, 0 ~ 10 mA, 0 ~ 20 mA	
Resultion	16-bit	12-bit	
Accuracy	±0.1% of FSR		
Slew Rate	0.25V/us	0.71 V/μs	

1.5 Dimensions



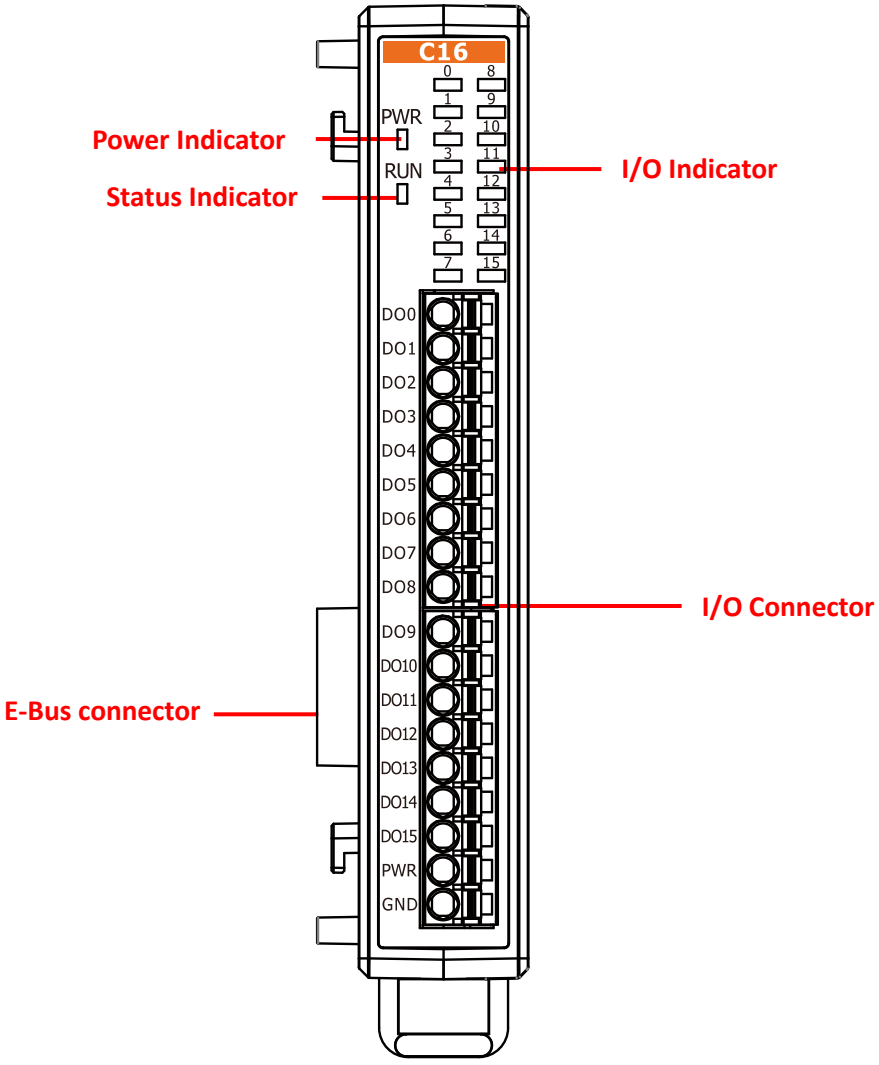
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2. Module Information

2.1 EC4-C16

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

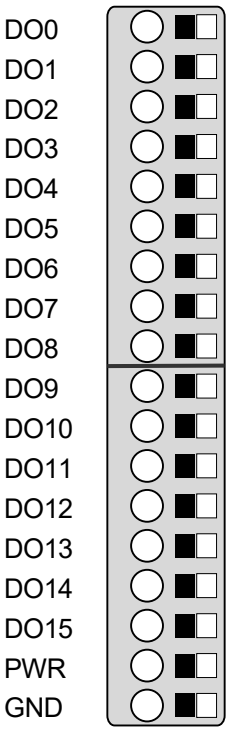
I/O Indicator

Notation	Color	States	Description
DOx	Red	Off	Digital output status is “Off”
		On	Digital output status is “On”

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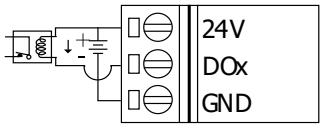
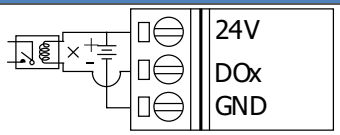
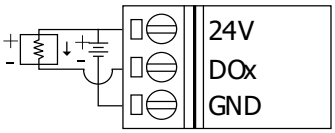
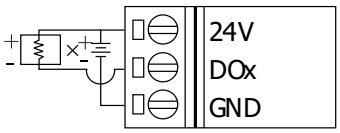
I/O Connector



Pin Description

DOx(x=0~15)	Isolated digital output
PWR	External power
GND	External ground

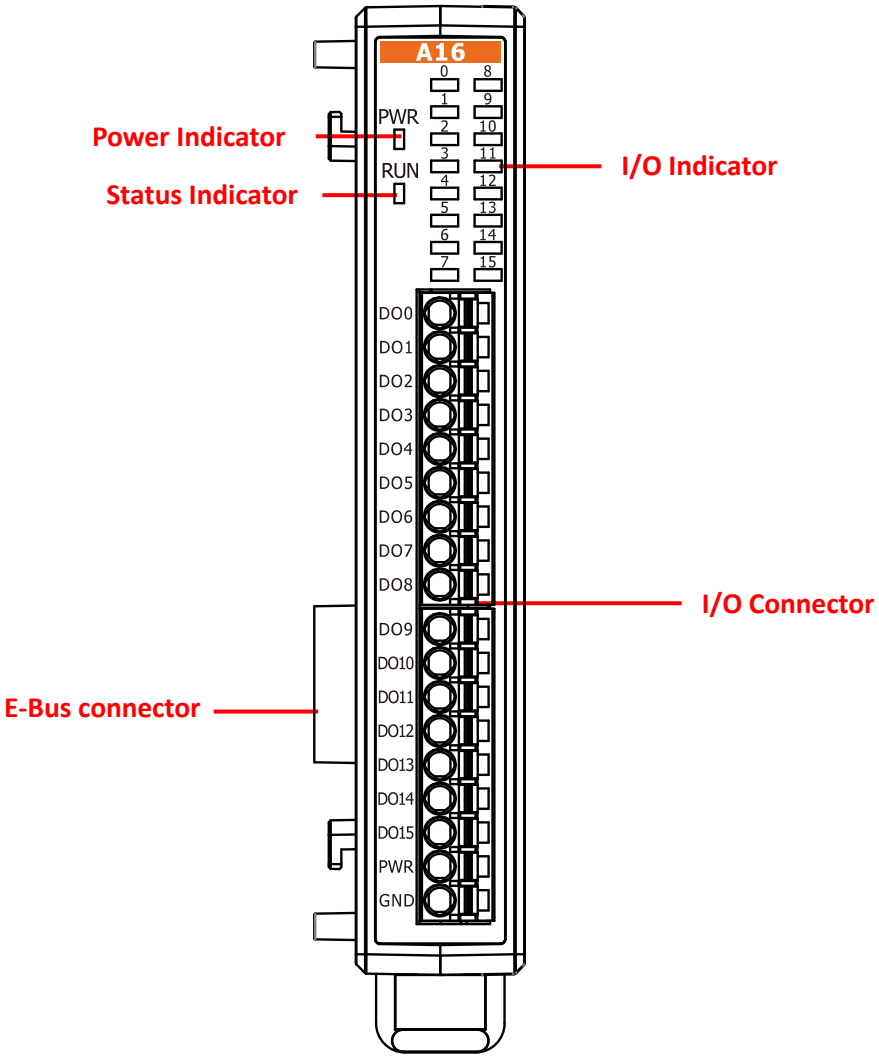
Wiring Diagram

Output Type	ON State Readback as 1	OFF State Readback as 0
Driver Relay		
Resistance Load		

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2.2 EC4-A16

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

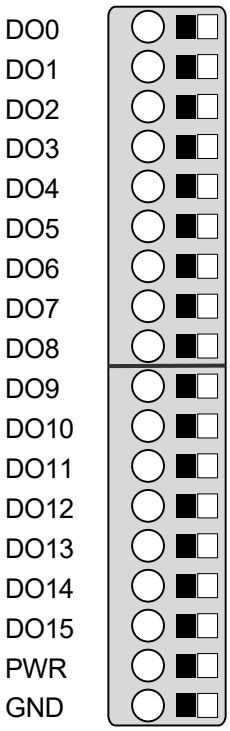
I/O Indicator

Notation	Color	States	Description
DOx	Red	Off	Digital output status is “Off”
		On	Digital output status is “On”

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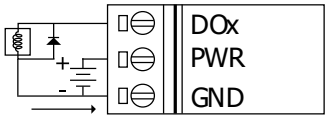
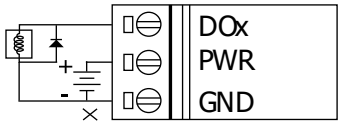
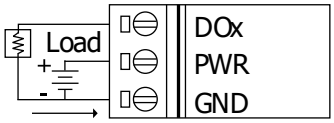
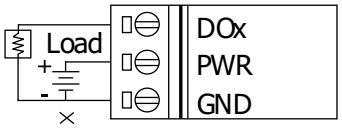
I/O Connector



Pin Description

DOx(x=0~15)	Isolated digital output
PWR	External power
GND	External ground

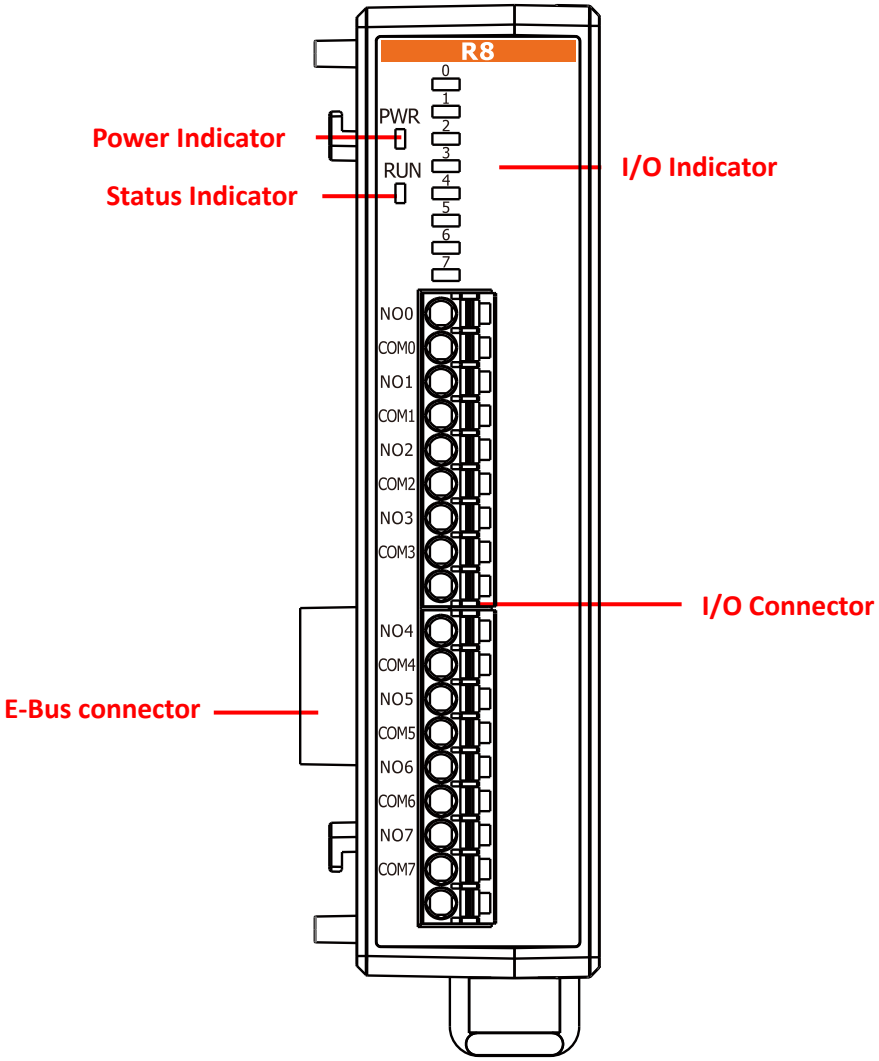
Wiring Diagram

Output Type	ON State Readback as 1	OFF State Readback as 0
Driver Relay		
Resistance Load		

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2.3 EC4-R8

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

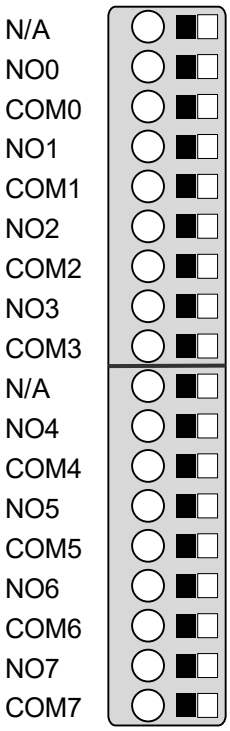
I/O Indicator

Notation	Color	States	Description
DOx	Red	Off	Digital output status is “Off”
		On	Digital output status is “On”

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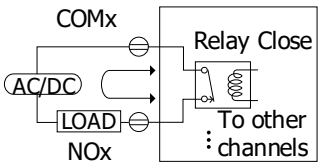
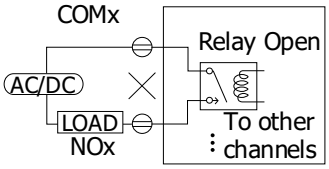
I/O Connector



Pin Description

NOx(x=0~7)	Normally Open Contact
COMx(x=0~7)	Common Terminal

Wiring Diagram

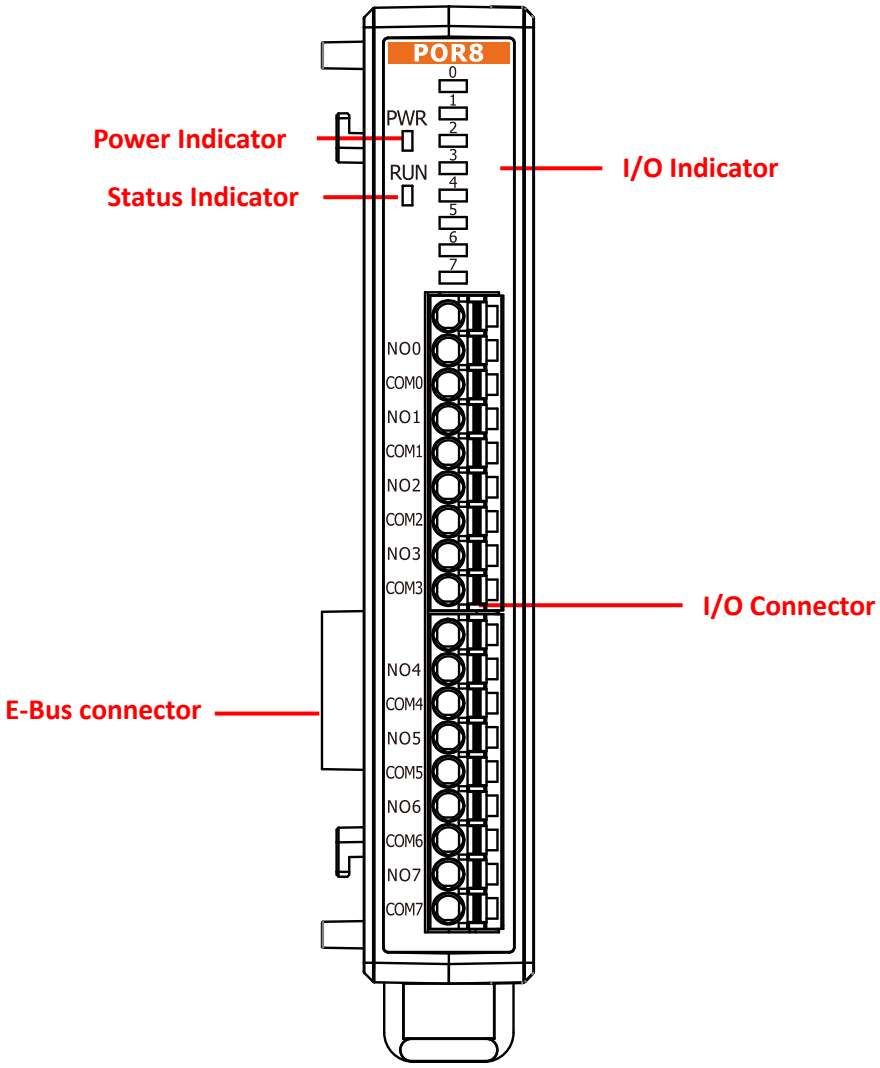
Output Type	ON State Readback as 1	OFF State Readback as 0
Relay Output		

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2.4 EC4-POR8

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

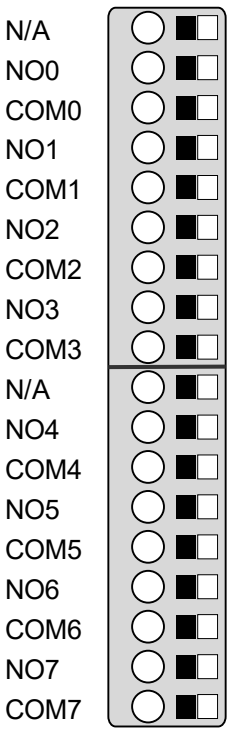
I/O Indicator

Notation	Color	States	Description
DOx	Red	Off	Digital output status is “Off”
		On	Digital output status is “On”

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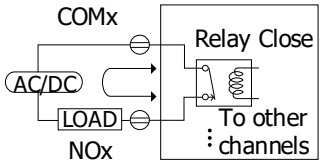
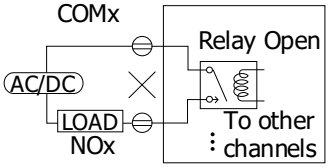
I/O Connector



Pin Description

NOx(x=0~7)	Normally Open Contact
COMx(x=0~7)	Common Terminal

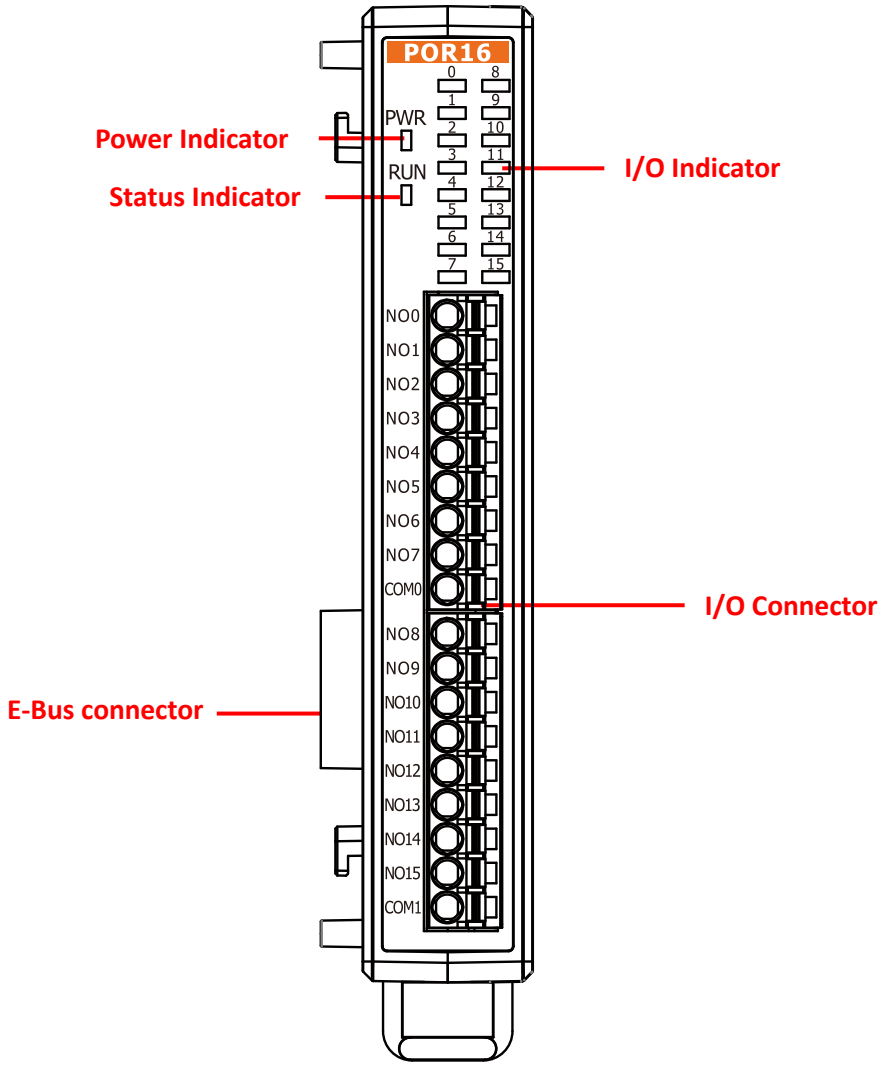
Wiring Diagram

Output Type	ON State Readback as 1	OFF State Readback as 0
Relay Output		

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2.5 EC4-POR16

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

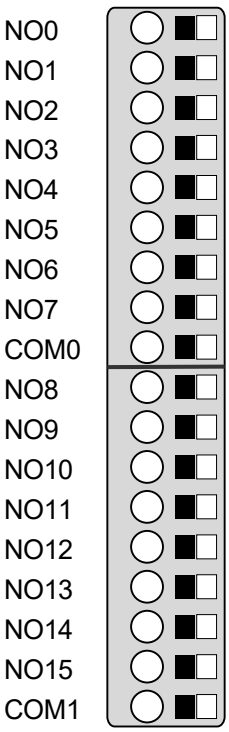
I/O Indicator

Notation	Color	States	Description
DOx	Red	Off	Digital output status is “Off”
		On	Digital output status is “On”

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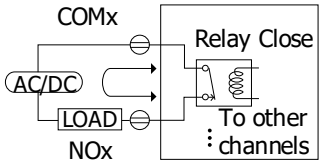
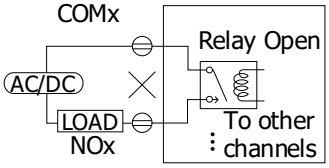
I/O Connector



Pin Description

NOx(x=0~15)	Normally Open Contact
COMx(x=0~1)	Common Terminal

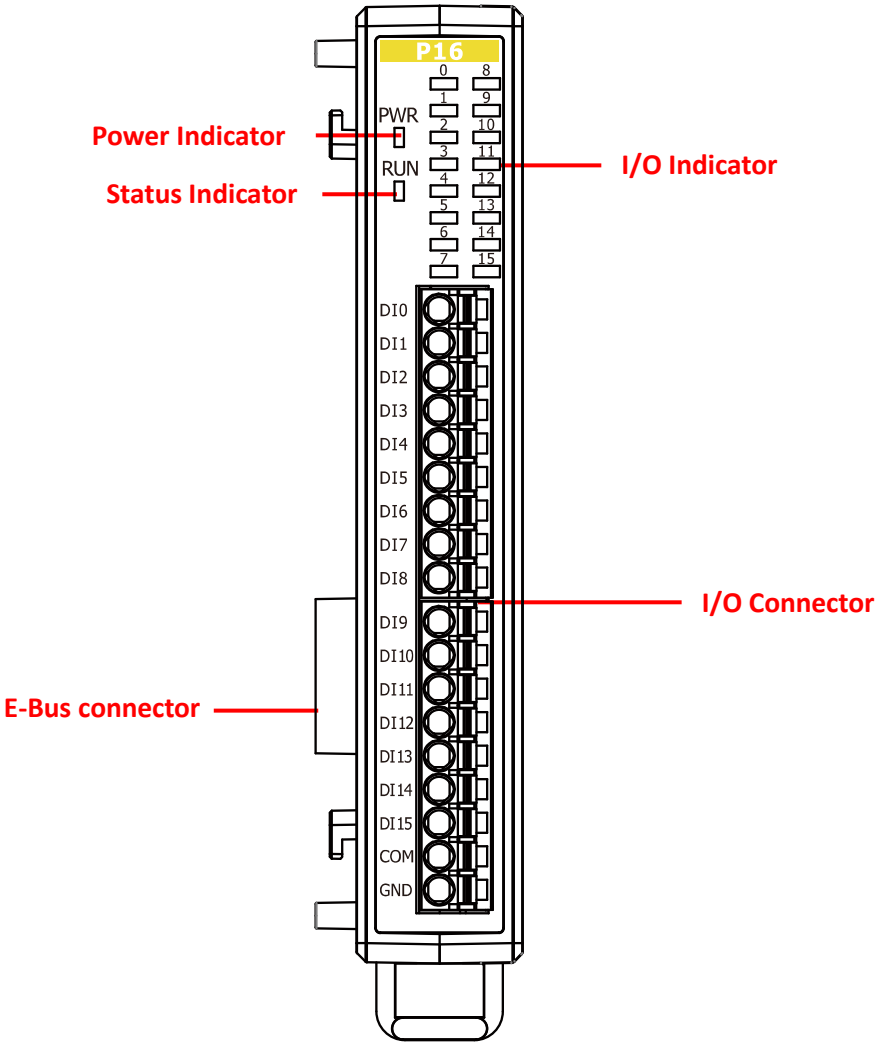
Wiring Diagram

Output Type	ON State Readback as 1	OFF State Readback as 0
Relay Output		

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2.6 EC4-P16

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

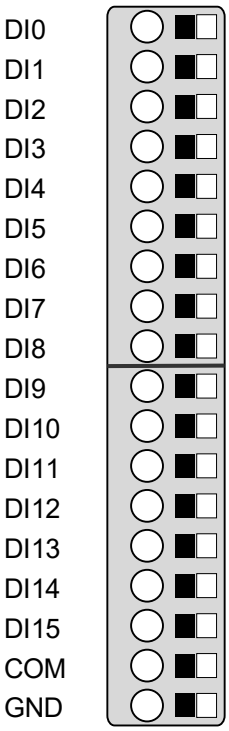
I/O Indicator

Notation	Color	States	Description
DIx	Green	Off	Input voltage is below the lower switching threshold
		On	Input voltage is above the upper switching threshold

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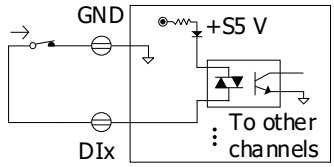
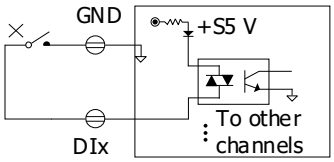
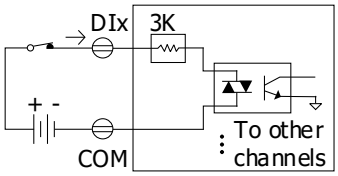
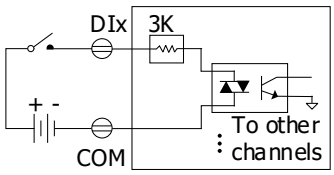
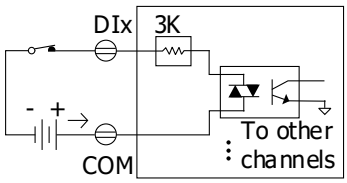
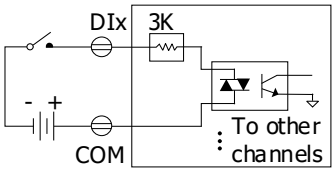
I/O Connector



Pin Description

DIx(x=0~15)	Isolated digital input
COM	External command Vcc/GND
GND	External ground

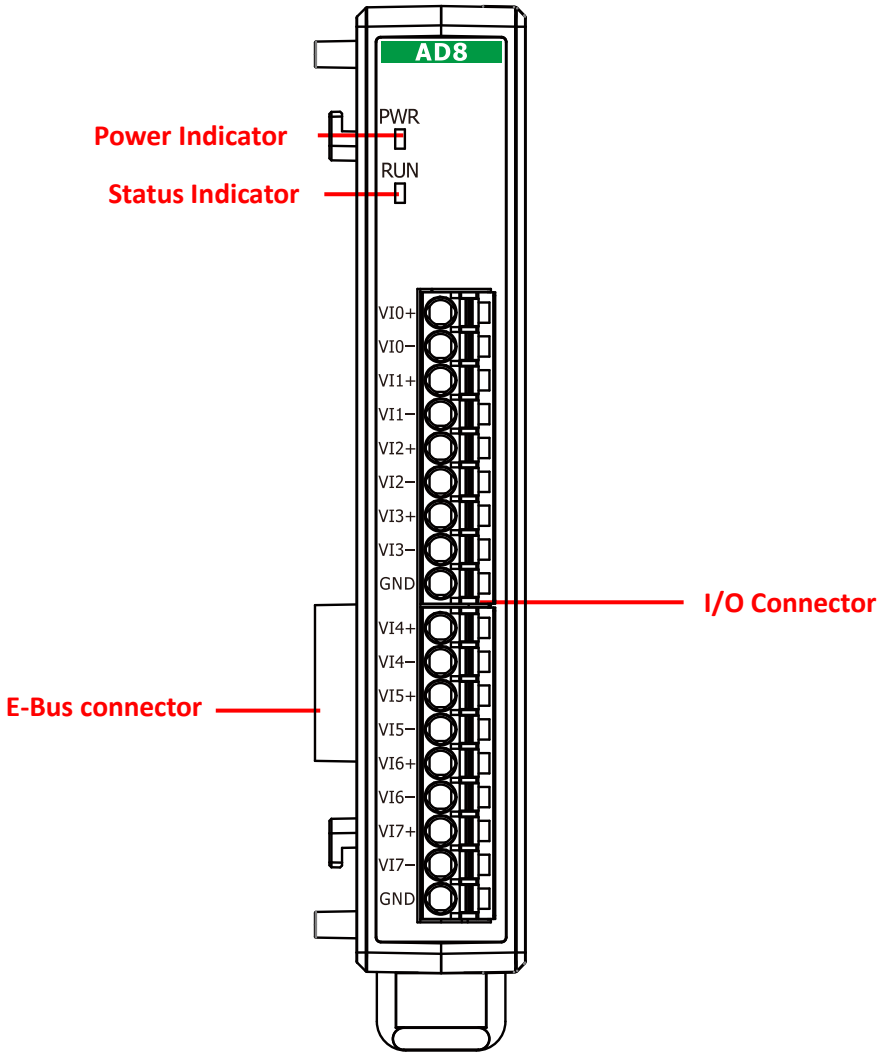
Wiring Diagram

Digital Input	Readback as 1	Readback as 0
Dry Contact	Close to GND	Open
		
Sink	+5 ~ +24 VDC	OPEN or <5 VDC
		
Source	+5 ~ +24 VDC	OPEN or <5 VDC
		

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2.7 EC4-AD8/AD4/AD2

The front panel and top panel of the EC4 series module contain the I/O connector, LEDs, Ethernet Port and power connector.



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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

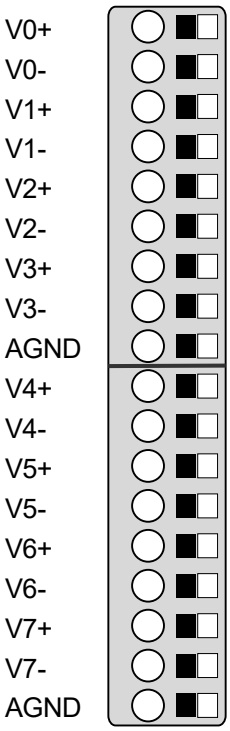
When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

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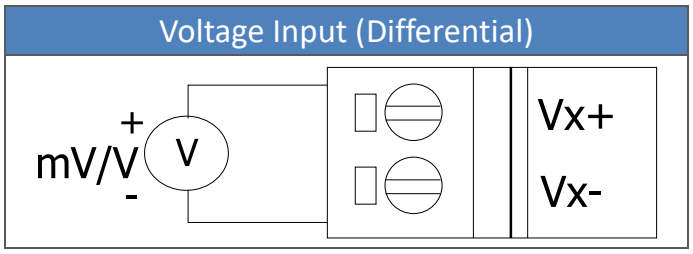
I/O Connector



Pin Description

Vx+(x=0~7)	Analog input channel+
Vx-(x=0~7)	Analog input channel-
AGND	Analog ground

Wiring Diagram

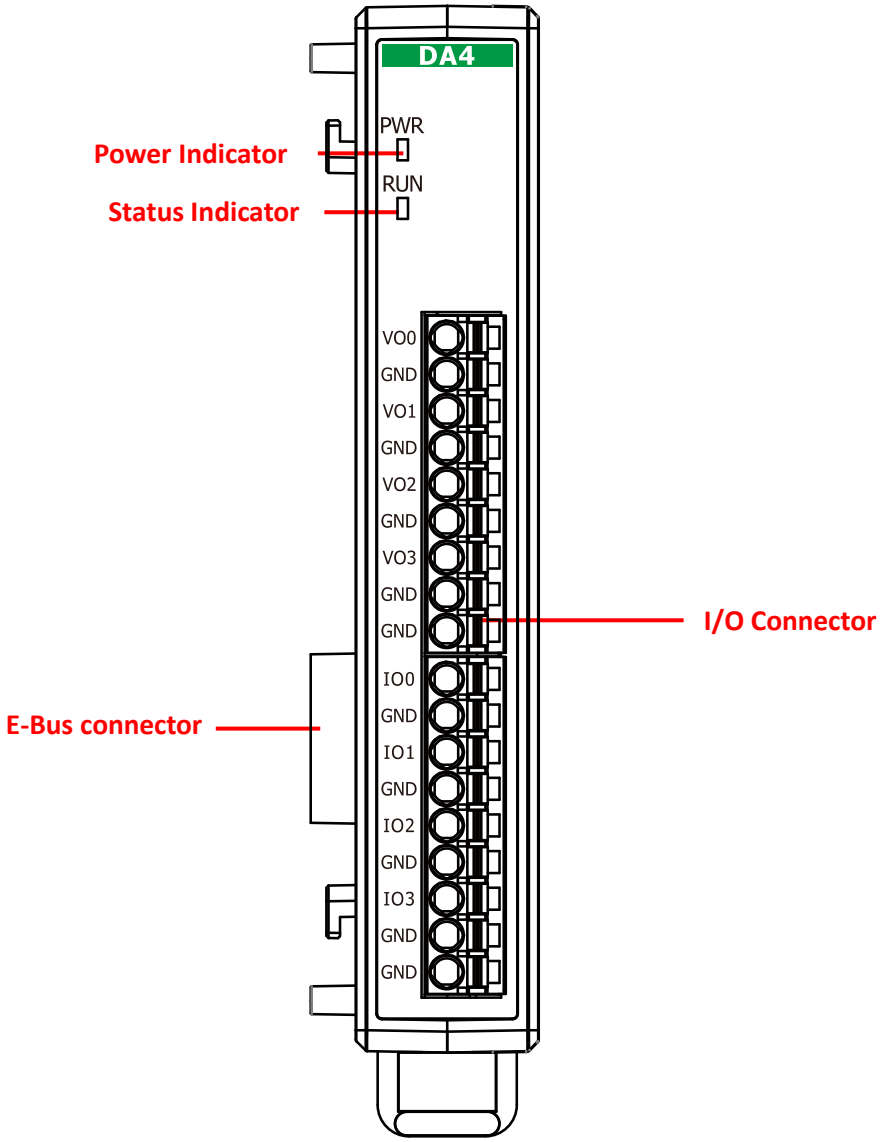


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2.8 EC4-DA4/DA4P

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E-Bus Connector

Applicable to the EC4 series modules, it provides power and EtherCAT communication through the E-Bus connection.

Status Indicator

Notation	Color	States	Description
RUN	Green	Off	The device is in state INIT
		Blinking	The device is in state PRE-OPERARIONAL
		Single Flash	The device is in state SAFE-OPERARIONAL
		On	The device is in state OPERARIONAL

Power Indicator

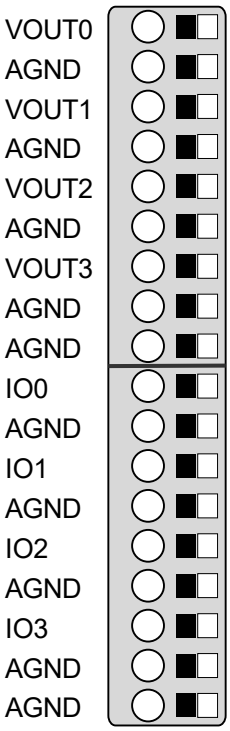
When the EC4 series module is powered on, the PWR indicator light on the module will illuminate.

Notation	Color	States	Description
PWR	Green	Off	Power Supply Failure
		On	Power Supply Normal

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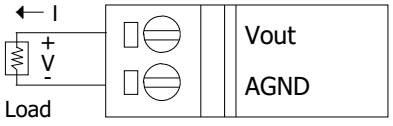
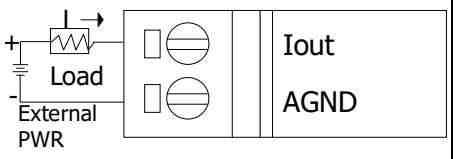
I/O Connector



Pin Description

VOUTx(x=0~3)	Voltage output channel
IOx(x=0~3)	Current output channel
AND	Analog ground

Wiring Diagram

Voltage Output	Current Output
	

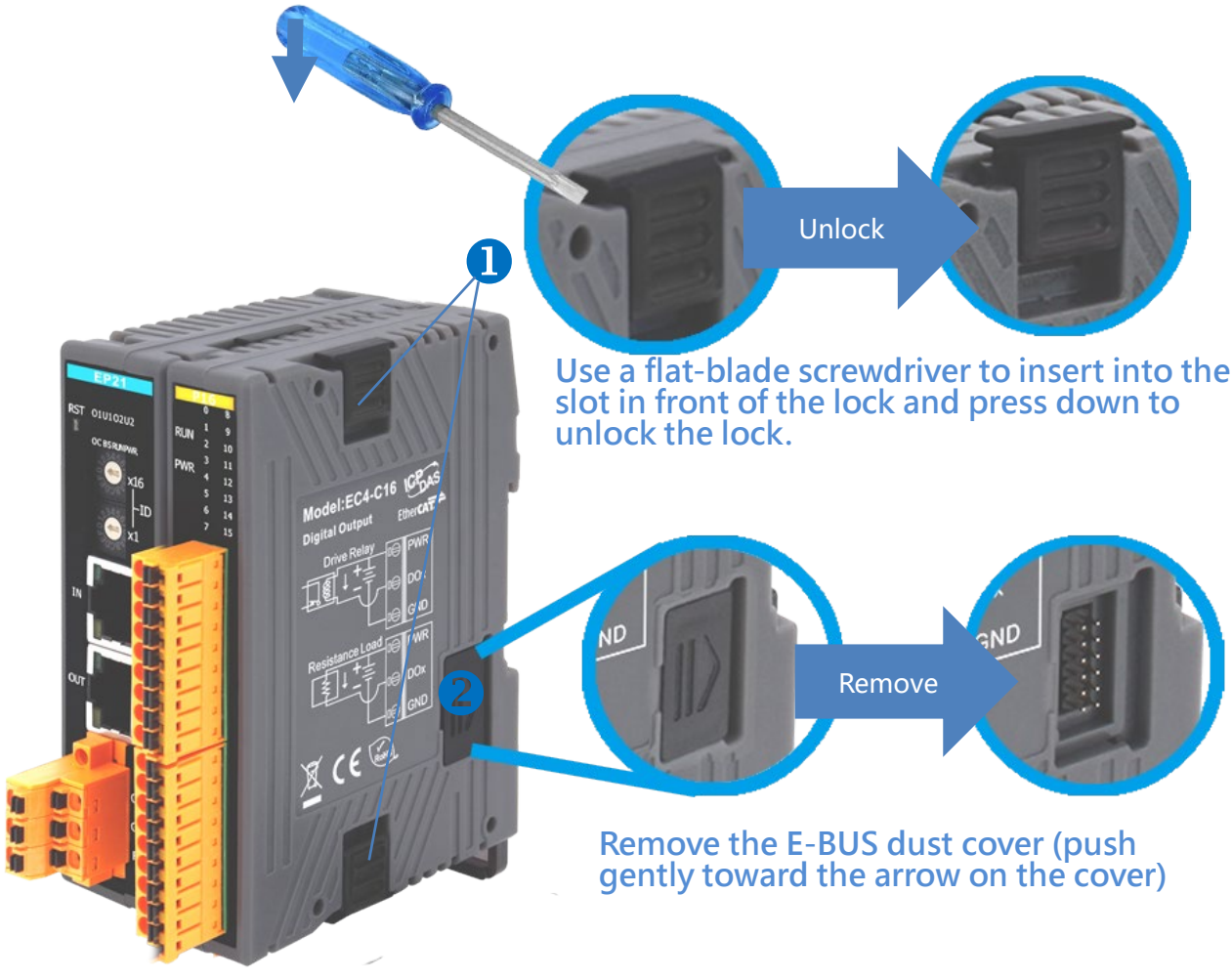
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3. Installiton Information

3.1 Assembling system

The system can be composed of an EC4-EP21 coupler and multiple EC4 series modules.

Connect the module to the system as shown in the figure below:

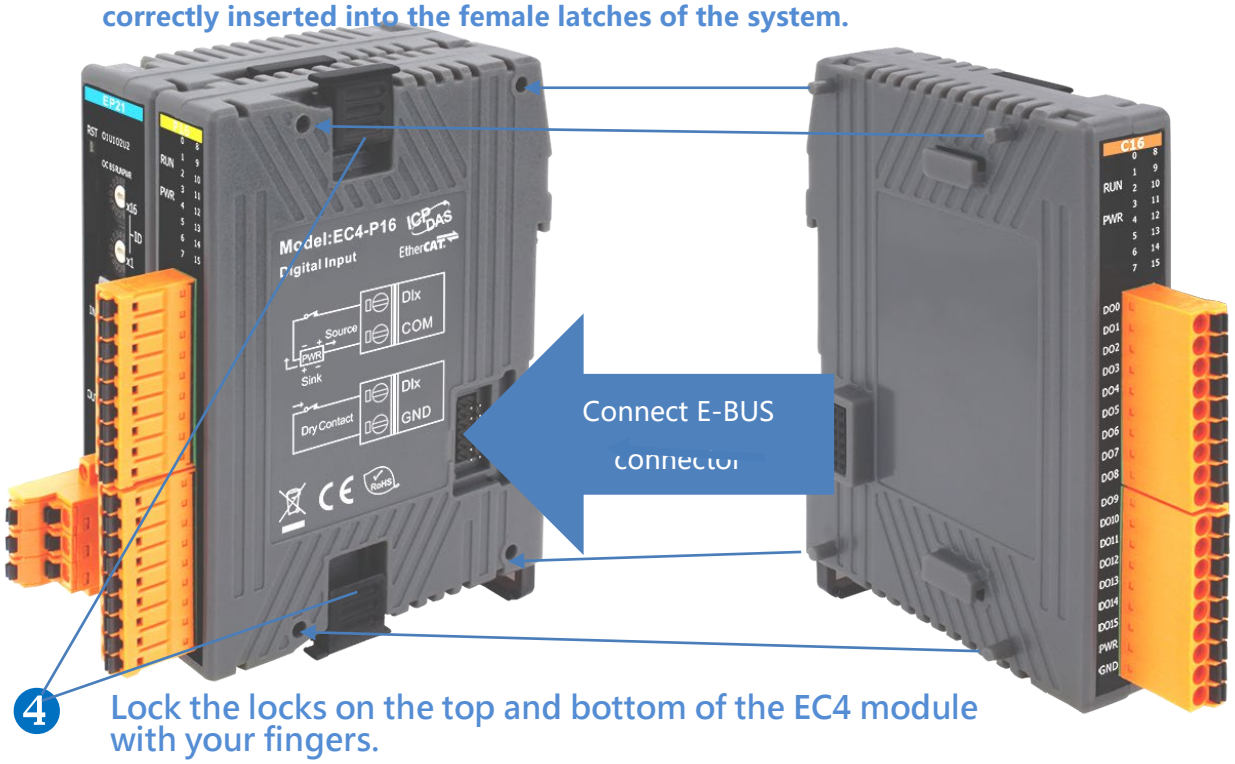


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❸ Align the EC4 module parallel to the system so that the E-BUS connector is firmly connected

❖ Please ensure that the male latches at the four corners of the module are correctly inserted into the female latches of the system.



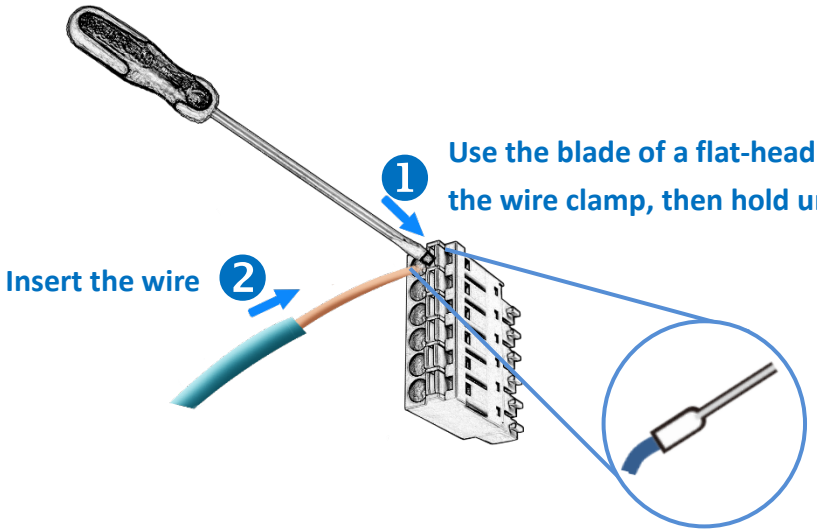
❹ Lock the locks on the top and bottom of the EC4 module with your fingers.

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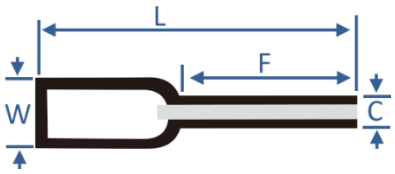
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3.2 Wiring the connector

A tip for connection the wire to the connector

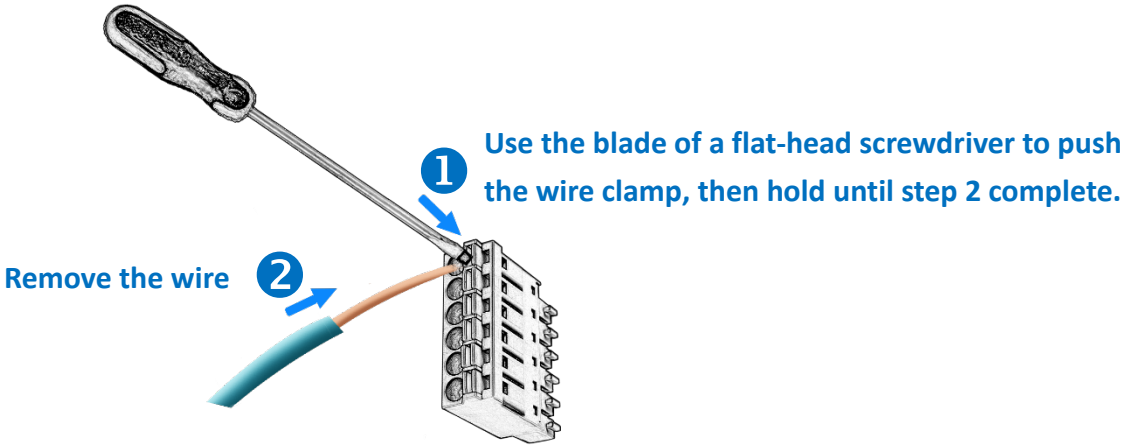


Insulated Terminals Dimensions



Dimensions (Unit: mm)				
Item NO.	F	L	C	W
CE007512	12.0	18.0	1.2	2.8

A tip for removing the wire from the connector



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3.3 Install Positions

Installation Position and Operating Temperature Limits

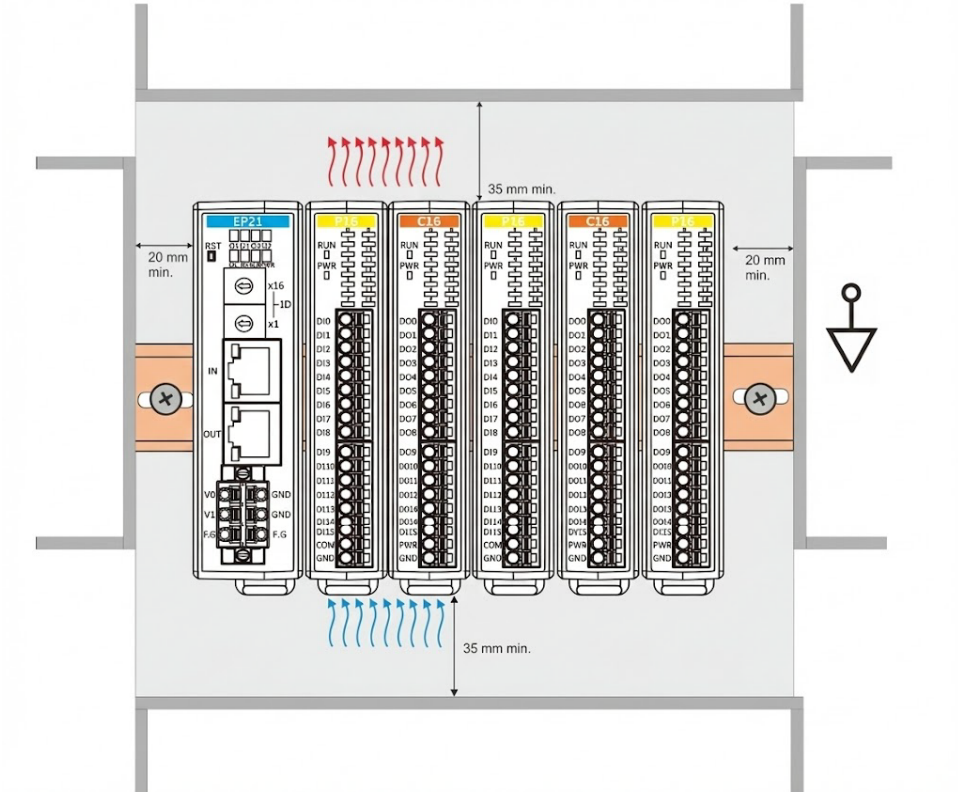
Please refer to the device's technical data to determine if there are any restrictions regarding the installation position and/or operating temperature range. When installing devices with high heat dissipation, ensure sufficient clearance above and below the device during operation to guarantee proper ventilation!

The installation positions and designations for rail-mounted devices are listed below. The illustrations provided are for example purposes only.

The following applies to all installation positions: The reference direction "down" (see arrow) indicates the direction of gravity.

Horizontal Mounting (Standard Installation)

1. The mounting rail is installed horizontally on a vertical mounting plate.
2. The front of the device (connection side) faces forward.
3. The device is ventilated from below, allowing for optimal cooling of the system via convection.



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4. Getting Started

This chapter provides a basic overview of how to configure and operate your EC4 series module.

4.1 Connecting the Power and the Host PC

Step 1

Connect both the IN port of EC4-EP21 module and RJ-45 Ethernet port of Host PC.

Ensure that the network settings on the Host PC have been correctly configured and are functioning normally. Ensure that the Windows firewall or any Anti-Virus firewall is properly configured to allow incoming connections, or temporarily disable these functions.

NOTE: It is recommended to use an independent network card and do not connect to the external network to avoid broadcast storm.

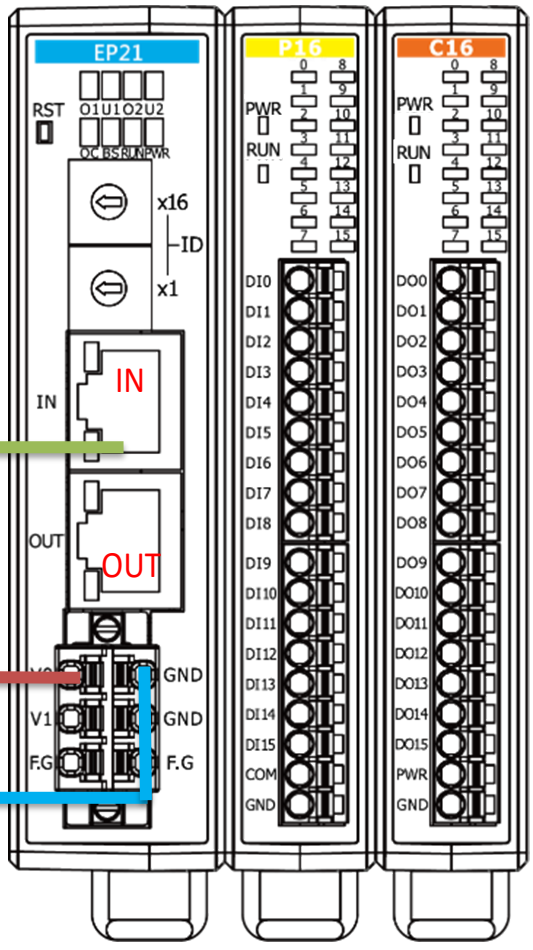
Step 2

Apply power to the EC4-EP21 module

❶ Connect the Host device to the **IN Port**.



Ethernet Cable



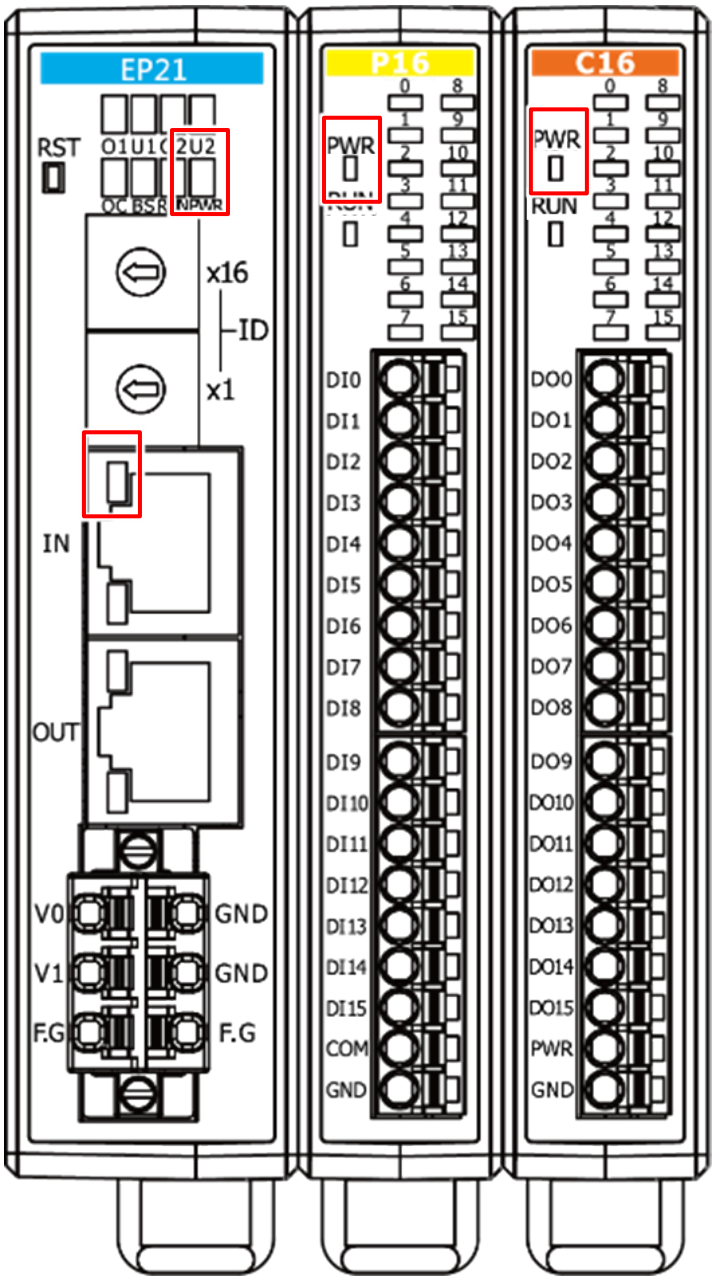
❷ Connect the **V0 pin** to positive terminal on a **+10 ~ +30 V_{DC} power supply**, and connect the **GND pin** to the **negative terminal**.

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Step 3

Verify the each “PWR” LED indicator on the EC4 module is Green, “Activeity” LED indicator is Green.



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4.2 Configuration and Operation

Beckhoff TwinCAT 3.X is most commonly used EtherCAT Master software to operate EC4 series module.

Inserting into the EtherCAT network

NOTE

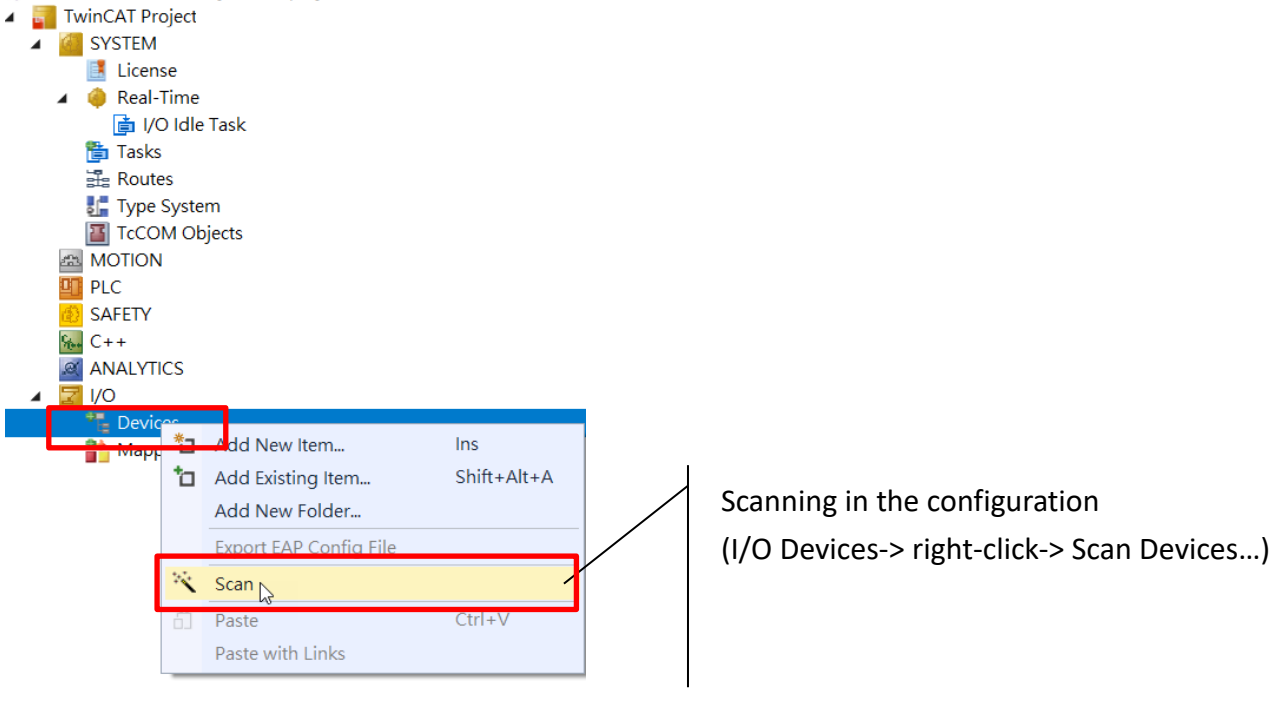
Installation of the latest XML device description(ESI)

Please ensure that you have installed the latest XML device description in TwinCAT. This can be downloaded and unzip file from the ICP DAS website (https://www.icpdas.com/tw/download/file.php?num=20257) and installed according to the installation instructions.

Step 1

Automatic Scanning

- The EtherCAT system must be in a safe, de-energized state before the module connected to EtherCAT network!
- Switch on the operating voltage, open TwinCAT System Manager in Config mode, and scan for devices. Confirm all dialogs with "OK" to set the configuration to FreeRun mode.

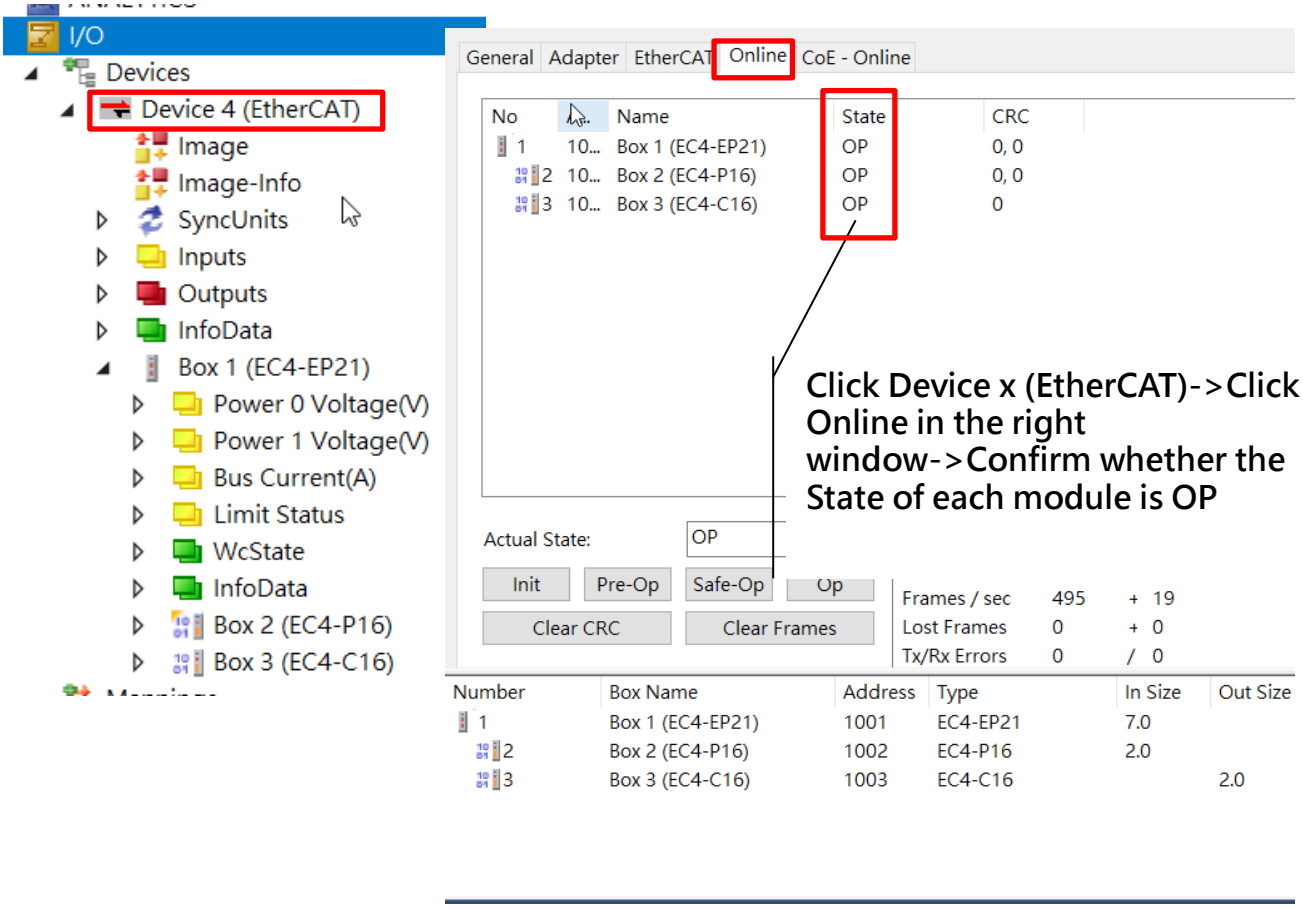


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Step 2

Confirm EC4 module status

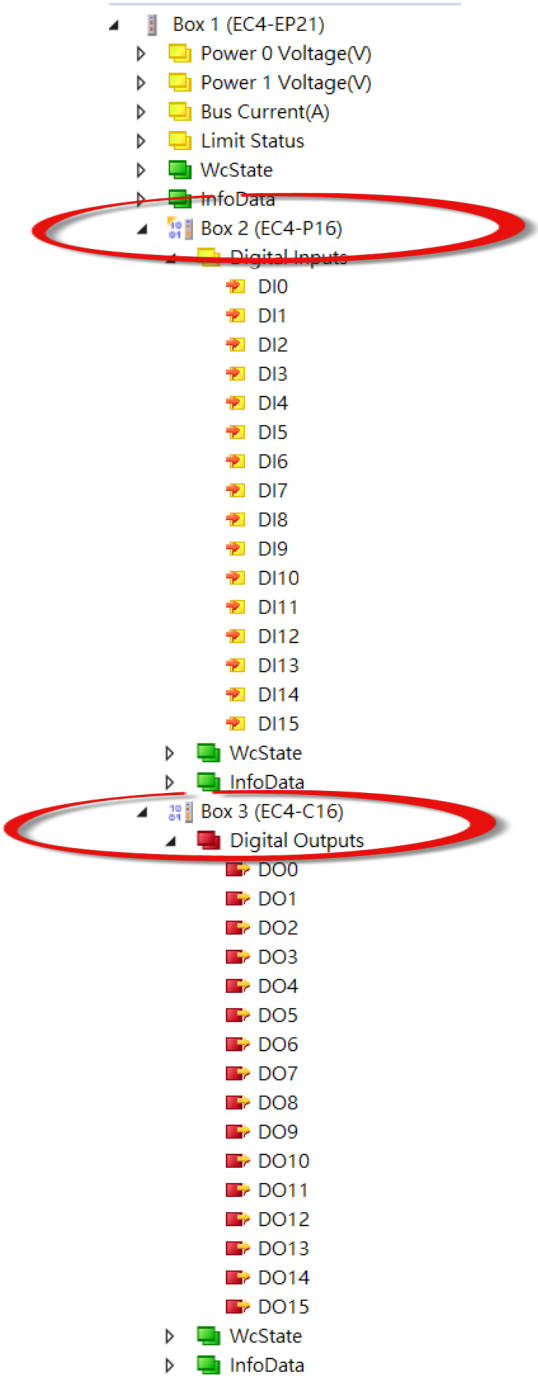


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Step 3

Configuration via TwinCAT



In the left-hand of the TwinCAT System Manager, click on the branch of the EtherCAT Box you wish to configure (EC4-P16 and EC4-C16 in this example). Click DIx or DOx to get and configure state.

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5. Object Description and Parameterization

5.1 Standard Object(0x1000-0x1FFF)

[ALL]Index 1000 Device Type

Index	Name	Meaning	Data type	Flags	Default
1000:00	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	0x00030191 (197009dec)

[ALL]Index 1008 Device Name

Index	Name	Meaning	Data type	Flags	Default
1008:00	Device name	EtherCAT Slave Device Name	String	RO	Refer to following table

Table 5-1-1: Device Name

Model	Device Name
EC4-EP21	EC4-EP21
EC4-C16	EC4-C16
EC4-P16	EC4-P16
EC4-DA4	EC4-DA4
EC4-DA2	EC4-DA2
EC4-AD8	EC4-AD8
EC4-AD4	EC4-AD4
EC4-AD2	EC4-AD2

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[ALL]Index 1009 Hardware Version

Index	Name	Meaning	Data type	Flags	Default
1009:00	Hardware version	Hardware version	String	RO	1.0.0

[ALL]Index 100A Software Version

Index	Name	Meaning	Data type	Flags	Default
100A:00	Software version	Firmware version	String	RO	1.0.0

[ALL]Index 1018 Identity

Index	Name	Meaning	Data type	Flags	Default
1018:00	Identity	Information for identifying	INT8	RO	0x04(4dec)
1018:01	Vendor ID	Vendor ID	UINT32	RO	0x00494350 (4801360dec)
1018:02	Product code	Product code	UINT32	RO	Refer to following table
1018:03	Revision	Revision number	UINT32	RO	Depend on device
1018:04	Serial number	Serial number	UINT32	RO	Depend on device

➢ **Table 5-1-2: Product Code**

Model	Product Code	Revision
EC4-EP21	0x40C00201(1086325249dec)	0x00000001(0000001dec)
EC4-P16	0x40D10010 (1087438864dec)	0x00000001(0000001dec)
EC4-C16	0x40D00010 (1087373328dec)	0x00000001(0000001dec)
EC4-A16	0x40D00010 (1087373328dec)	0x00100001(1048577dec)
EC4-POR16	0x40D30010 (1087569936dec)	0x00100001(1048577dec)
EC4-POR8	0x40D30010 (1087569936dec)	0x00100001(1048577dec)
EC4-R8	0x40D30010 (1087569936dec)	0x00000001(0000001dec)
EC4-DA4P	0x40A00004 (1084227588dec)	0x00100001(1048577dec)
EC4-DA4	0x40A00004 (1084227588dec)	0x00000001(0000001dec)
EC4-DA2	0x40A00002 (1084227586dec)	0x00000001(0000001dec)
EC4-AD8	0x40A10008 (1084293128dec)	0x00000001(0000001dec)
EC4-AD4	0x40A10004 (1084293124dec)	0x00000001(0000001dec)
EC4-AD2	0x40A10002 (1084293122dec)	0x00000001(0000001dec)

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[EC4-C16/A16/PORx/R8]Index 1600 DO Process Data Mapping

Index	Name	Meaning	Data type	Flags	Default
1600:00	DO process data mapping	PDO Mapping RxPDO 1	UINT8	RO	0x11(17dec)
1600:01	SubIndex 001	PDO Mapping entry (object 0x7000,entry 0x01)	UINT32	RO	0x7000:01,1
1600:02	SubIndex 002	PDO Mapping entry (object 0x7000,entry 0x02)	UINT32	RO	0x7000:02,1
1600:03	SubIndex 003	PDO Mapping entry (object 0x7000,entry 0x03)	UINT32	RO	0x7000:03,3
1600:04	SubIndex 004	PDO Mapping entry (object 0x7000,entry 0x04)	UINT32	RO	0x7000:04,1
1600:05	SubIndex 005	PDO Mapping entry (object 0x7000,entry 0x05)	UINT32	RO	0x7000:05,1
1600:06	SubIndex 006	PDO Mapping entry (object 0x7000,entry 0x06)	UINT32	RO	0x7000:06,1
1600:07	SubIndex 007	PDO Mapping entry (object 0x7000,entry 0x07)	UINT32	RO	0x7000:07,1
1600:08	SubIndex 008	PDO Mapping entry (object 0x7000,entry 0x08)	UINT32	RO	0x7000:08,1
1600:09	SubIndex 009	PDO Mapping entry (object 0x7000,entry 0x09)	UINT32	RO	0x7000:09,1
1600:0A	SubIndex 010	PDO Mapping entry (object 0x7000,entry 0x0A)	UINT32	RO	0x7000:0A,1
1600:0B	SubIndex 011	PDO Mapping entry (object 0x7000,entry 0x0B)	UINT32	RO	0x7000:0B,1
1600:0C	SubIndex 012	PDO Mapping entry (object 0x7000,entry 0x0C)	UINT32	RO	0x7000:0C,1
1600:0D	SubIndex 013	PDO Mapping entry (object 0x7000,entry 0x0D)	UINT32	RO	0x7000:0D,1
1600:0E	SubIndex 014	PDO Mapping entry (object 0x7000,entry 0x0E)	UINT32	RO	0x7000:0E,1
1600:0F	SubIndex 015	PDO Mapping entry (object 0x7000,entry 0x0F)	UINT32	RO	0x7000:0F,1
1600:10	SubIndex 016	PDO Mapping entry (object 0x7000,entry 0x10)	UINT32	RO	0x7000:10,1

[EC4-DAx]Index 160n AO Process Data Mapping

Notice: EC4-DA4/DA4P: 0<= **n** <=3; EC4-DA2: 0<= **n** <=1

Index	Name	Meaning	Data type	Flags	Default
160n:00	AO process data mapping	PDO Mapping RxPDO n+1	UINT8	RO	0x01(1dec)
160n:01	SubIndex 001	PDO Mapping entry (object 0x70n0 (AO outputs Ch n+1),entry 0x01(Analog output))	UINT32	RO	0x70n0:01,16

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[EC4-P16]Index 1A00 DI Process Data Mapping

Index	Name	Meaning	Data type	Flags	Default
1A00:00	DI process data mapping	PDO Mapping TxPDO 1	UINT8	RO	0x11(17dec)
1A00:01	SubIndex 001	PDO Mapping entry (object 0x6000,entry 0x01)	UINT32	RO	0x6000:01,1
1A00:02	SubIndex 002	PDO Mapping entry (object 0x6000,entry 0x02)	UINT32	RO	0x6000:02,1
1A00:03	SubIndex 003	PDO Mapping entry (object 0x6000,entry 0x03)	UINT32	RO	0x6000:03,3
1A00:04	SubIndex 004	PDO Mapping entry (object 0x6000,entry 0x04)	UINT32	RO	0x6000:04,1
1A00:05	SubIndex 005	PDO Mapping entry (object 0x6000,entry 0x05)	UINT32	RO	0x6000:05,1
1A00:06	SubIndex 006	PDO Mapping entry (object 0x6000,entry 0x06)	UINT32	RO	0x6000:06,1
1A00:07	SubIndex 007	PDO Mapping entry (object 0x6000,entry 0x07)	UINT32	RO	0x6000:07,1
1A00:08	SubIndex 008	PDO Mapping entry (object 0x6000,entry 0x08)	UINT32	RO	0x6000:08,1
1A00:09	SubIndex 009	PDO Mapping entry (object 0x6000,entry 0x09)	UINT32	RO	0x6000:09,1
1A00:0A	SubIndex 010	PDO Mapping entry (object 0x6000,entry 0x0A)	UINT32	RO	0x6000:0A,1
1A00:0B	SubIndex 011	PDO Mapping entry (object 0x6000,entry 0x0B)	UINT32	RO	0x6000:0B,1
1A00:0C	SubIndex 012	PDO Mapping entry (object 0x6000,entry 0x0C)	UINT32	RO	0x6000:0C,1
1A00:0D	SubIndex 013	PDO Mapping entry (object 0x6000,entry 0x0D)	UINT32	RO	0x6000:0D,1
1A00:0E	SubIndex 014	PDO Mapping entry (object 0x6000,entry 0x0E)	UINT32	RO	0x6000:0E,1
1A00:0F	SubIndex 015	PDO Mapping entry (object 0x6000,entry 0x0F)	UINT32	RO	0x6000:0F,1
1A00:10	SubIndex 016	PDO Mapping entry (object 0x6000,entry 0x10)	UINT32	RO	0x6000:10,1

[EC4-ADx]Index 1A0n AI Process Data Mapping (for 0 ≤ n ≤ 7)

Notice: EC4-AD8: 0<= **n** <=7; EC4-AD4: 0<= **n** <=3; EC4-AD2: 0<= **n** <=1

Index	Name	Meaning	Data type	Flags	Default
1A0n:00	AI Process Data Mapping	PDO Mapping TxPDOn	UINT8	RO	0x0A(10dec)
1A0n:01	SubIndex 001	PDO Mapping entry (object 0x60n0,entry 0x01)	UINT32	RO	0x60n0:01,1
1A0n:02	SubIndex 002	PDO Mapping entry (object 0x60n0,entry 0x02)	UINT32	RO	0x60n0:02,1
1A0n:03	SubIndex 003	PDO Mapping entry (object 0x60n0,entry 0x03)	UINT32	RO	0x60n0:03,2
1A0n:04	SubIndex 004	PDO Mapping entry (object 0x60n0,entry 0x05)	UINT32	RO	0x60n0:05,2
1A0n:05	SubIndex 005	PDO Mapping entry (object 0x60n0,entry 0x07)	UINT32	RO	0x60n0:07,1
1A0n:06	SubIndex 006	PDO Mapping entry (2 bits align)	UINT32	RO	0x0000:00,1
1A0n:07	SubIndex 007	PDO Mapping entry (6 bits align)	UINT32	RO	0x0000:00,6
1A0n:08	SubIndex 008	PDO Mapping entry (object 0x60n0,entry 0x0F)	UINT32	RO	0x60n0:0F,1
1A0n:09	SubIndex 009	PDO Mapping entry (object 0x60n0,entry 0x10)	UINT32	RO	0x60n0:10,1
1A0n:0A	SubIndex 010	PDO Mapping entry (object 0x60n0,entry 0x11)	UINT32	RO	0x60n0:11,16

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[ALL]Index 1C00 Sync Manager Type

Index	Name	Meaning	Data type	Flags	Default
1C00:00	Sync manager type	Using the sync managers	UINT8	RO	0x04(4dec)
1C00:01	SubIndex 001	Sync-Manager Channel 1:Mailbox write	UINT8	RO	0x01(1dec)
1C00:02	SubIndex 002	Sync-Manager Channel 2:Mailbox read	UINT8	RO	0x02(2dec)
1C00:03	SubIndex 003	Sync-Manager Channel 3:Process data write	UINT8	RO	0x03(3dec)
1C00:04	SubIndex 004	Sync-Manager Channel 4:Process data read	UINT8	RO	0x04(4dec)

[EC4-C16/A16/PORx/R8]Index 1C12 SyncManager 2 Assignment

Index	Name	Meaning	Data type	Flags	Default
1C12:00	Sync-Manager 2 assignment	RxPDO assign	UINT8	RO	0x01(1dec)
1C12:01	SubIndex 001	1st allocated RxPDO	UINT16	RO	0x1600(5632dec)

[EC4-DAx]Index 1C12 SyncManager 2 Assignment

Index	Name	Meaning	Data type	Flags	Default
1C12:00	Sync-Manager 2 assignment	RxPDO assign	UINT8	RO	0x04(4dec)
1C12:01	SubIndex 001	1st allocated RxPDO	UINT16	RO	0x1600(5632dec)
1C12:02	SubIndex 002	2nd allocated RxPDO	UINT16	RO	0x1601(5633dec)
1C12:03(EC4-DA4/DA4P only)	SubIndex 003	3rd allocated RxPDO	UINT16	RO	0x1602(5634dec)
1C12:04(EC4-DA4/DA4P only)	SubIndex 004	4th allocated RxPDO	UINT16	RO	0x1603(5635dec)

[EC4-P16]Index 1C13 SyncManager 3 Assignment

Index	Name	Meaning	Data type	Flags	Default
1C13:00	Sync-Manager 3 assignment	TxPDO assign	UINT8	RO	0x01(1dec)
1C13:01	SubIndex 001	1st allocated TxPDO	UINT16	RO	0x1A00(6656dec)

[EC4-ADx]Index 1C13 SyncManager 3 Assignment

Index	Name	Meaning	Data type	Flags	Default
1C13:00	Sync-Manager 3 assignment	TxPDO assign	UINT8	RW	0x010(16dec)
1C13:01	SubIndex 001	1st allocated TxPDO	UINT16	RW	0x1A00(6656dec)
1C13:02	SubIndex 002	2nd allocated TxPDO	UINT16	RW	0x1A01(6657dec)
1C13:03(EC4-AD4/AD8 only)	SubIndex 003	3rd allocated TxPDO	UINT16	RW	0x1A02(6658dec)
1C13:04(EC4-AD4/AD8 only)	SubIndex 004	4th allocated TxPDO	UINT16	RW	0x1A03(6659dec)
1C13:05(EC4-AD8 only)	SubIndex 005	5th allocated TxPDO	UINT16	RW	0x1A04(6660dec)
1C13:06(EC4-AD8 only)	SubIndex 006	6th allocated TxPDO	UINT16	RW	0x1A05(6661dec)
1C13:07(EC4-AD8 only)	SubIndex 007	7th allocated TxPDO	UINT16	RW	0x1A06(6662dec)
1C13:08(EC4-AD8 only)	SubIndex 008	8th allocated TxPDO	UINT16	RW	0x1A07(6663dec)

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[All]Index 1C32 SM Output Parameter

Index	Name	Meaning	Data type	Flags	Default
1C32:00	SM output parameter	Synchronization parameters for the outputs	UINT8	RO	0x20(32dec)
1C32:01	Synchronization type	Current synchronization type: Bit0 = 0: Free Run Bit1 = 1:Synchron with SM 2 Event Bit15 = 0: Standard Bit15 = 1: FastOp mode (CoE deactivated)	UINT16	RW	0x0000(0dec) Only support Free Run
1C32:02	Cycle time	Cycle time (in ns): **Free Run:** Cycle time of the local timer Synchronous with SM 2 event: Master cycle time	UINT32	RO	0x00000000 (0dec)
1C32:04	Synchronization type supported	Supported synchronization modes: **Bit0** = free run is supported **Bit1**= synchronous with SM 2 event is supported (outputs available) **Bit1**= synchronous with SM 3 event is supported (no outputs available) **Bit4-5**= 01: input shift with SYNC 1 event (no outpus available) **Bit14**= 1: dynamic times	UINT16	RO	0x401F (16415dec)
1C32:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x000186A0 (100000dec)
1C32:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master	UINT32	RO	0x000061A8 (2500dec)
1C32:08	Get cycle time	With this entry the real required process data provision time can be measured. **0:** Measurement of the local cycle time is stopped **1:** Measurement of the local cycle time is statred	UINT16	RW	0x0001(1dec)
1C32:09	Delay time	Time between SYNC1 event and reading of the inputs	UINT32	RO	0x000009C4 (2500dec)
1C32:0A	Sync0 cycle time	SYNC0 cycle time (in ns)	UINT32	RW	0x00000000 (0dec)
1C32:0B	SM-event missed	Number of missed SM events in OPERATIONAL	UINT16	RO	0x0000(0dec)
1C32: 0C	Cycle time too small	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000(0dec)
1C32: 20	Sync Error	The synchronization was not correct in the last cycle	BOOLEAN	RO	FALSE(0dec)

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[All]Index 1C33 SM Input Parameter

Index	Name	Meaning	Data type	Flags	Default
1C33:00	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20(32dec)
1C33:01	Synchronization Type	Current synchronization type: Bit0 = 0: Free Run Bit1 = 1:Synchron with SM 2 Event Bit15 = 0: Standard Bit15 = 1: FastOp mode (CoE deactivated)	UINT16	RW	0x0000(0dec)
1C33:02	Cycle time	Cycle time (in ns): **Free Run:** Cycle time of the local timer Synchronous with SM 2 event: Master cycle time	UINT32	RO	0x00000000 (0dec)
1C33:04	Synchronization Type supported	Supported synchronization modes: **Bit0** = free run is supported **Bit1**= synchronous with SM 2 event is supported (outputs available) **Bit1**= synchronous with SM 3 event is supported (no outputs available) **Bit4-5**= 01: input shift with SYNC 1 event (no outpus available) **Bit14**= 1: dynamic times	UINT16	RO	0x401F (16415dec)
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x000186A0 (100000dec)
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master	UINT32	RO	0x000061A8 (2500dec)
1C33:08	Get cycle time	With this entry the real required process data provision time can be measured. **0:** Measurement of the local cycle time is stopped **1:** Measurement of the local cycle time is statred	UINT16	RW	0x0000(0dec)
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs	UINT32	RO	0x000009C4 (2500dec)
1C33:0A	SYNC 0 Cycle Time	SYNC0 cycle time (in ns)	UINT32	RW	0x00000000 (0dec)
1C33:0B	SM-Event Missed	Number of missed SM events in OPERATIONAL	UINT16	RO	0x0000(0dec)
1C33:0C	Cycle time to small	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000(0dec)
1C33:20	Sync error	The synchronization was not correct in the last cycle	BOOLEAN	RO	FALSE(0dec)

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5.2 Profile Specific Objects(0x6000-0x7FFF)

[EC4-P16]Index 6000 Digital Inputs

Index	Name	Meaning	Data type	Flags	Default
6000:00	Digital Inputs		UINT8	RO	0x21(33dec)
6000:01	DI0	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:02	DI1	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:03	DI2	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:04	DI3	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:05	DI4	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:06	DI5	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:07	DI6	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:08	DI7	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:09	DI8	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0A	DI9	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0B	DI10	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0C	DI11	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0D	DI12	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0E	DI13	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:0F	DI14	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)
6000:10	DI15	0:Logic 0 1:Logic 1	BOOLEAN	RO	0x00(0dec)

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[EC4-ADx]Index 60n0 Analog Inputs

Notice: EC4-AD8: 0<= n <=7; EC4-AD4: 0<= n <=3; EC4-AD2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
60n0:00	AI Inputs	Maximum subindex	UINT16	RO P	0x11(17dec)
60n0:01	Underrange	Value below measuring range	BOOLEAN	RO P	FALSE(0dec)
60n0:02	Overrange	Measuring range exceeded	BOOLEAN	RO P	FALSE(0dec)
60n0:03	Limit 1	Limit value monitoring Limit 1 **0:** not active **1:** Value is smaller than Limit Value1 **2:** Value is larger than Limit Value1 **3:** Value is equal to Limit Value1	Bit2	RO P	
60n0:05	Limit 2	Limit value monitoring Limit 2 **0:** not active **1:** Value is smaller than Limit Value2 **2:** Value is larger than Limit Value2 **3:** Value is equal to Limit Value2	Bit2	RO P	
60n0:07	Error	The error bit is set if the data is invalid (over-rang, un-der-range)	BOOLEAN	RO P	FALSE(0dec)
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0=valid, 1=invalid)	BOOLEAN	RO P	FALSE(0dec)
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO P	TRUE(1dec)
60n0:11	Value	Analgo input data	INT16	RO P	0x000B(11dec)

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[EC4-C16/A16/PORx/R8]Index 7000 Digital Outputs

Index	Name	Meaning	Data type	Flags	Default
7000:00	Digital Outputs		UINT8	RO	0x21(33dec)
7000:01	DO0	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:02	DO1	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:03	DO2	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:04	DO3	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:05	DO4	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:06	DO5	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:07	DO6	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:08	DO7	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:09	DO8	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0A	DO9	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0B	DO10	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0C	DO11	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0D	DO12	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0E	DO13	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:0F	DO14	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)
7000:10	DO15	0:Logic 0 1:Logic 1	BOOLEAN	RW	0x00(0dec)

[EC4-DAx]Index 70n0 Analog Outputs

Notice: EC4-DA4/DA4P: 0<= **n** <=3; EC4-DA2: 0<= **n** <=1

Index	Name	Meaning	Data type	Flags	Default
70n0:00	EC4-DAx: AO Outputs Chx		UINT8	RWP	0x02(2dec)
70n0:01	Output	Analog output data (DA4/DA2 Detailed reference Table 5-3-4) (DA4P Detailed reference Table 5-3-5 Table 5-3-6 Table 5-3-7 Table 5-3-8)	INT16	RWP	0x0000(0dec)

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5.3 Profile Specific Objects(0x8000-0x8FFF)

[EC4-P16]Index 8000 DI Settings

Index	Name	Meaning	Data type	Flags	Default
8000:00			UINT8	RO	0xC(12dec)
80n0:03	Digital input invert value	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x00(1dec)
80n0:12	Digital input filter	Digital input debounce time 0:Disable Other:1-65535 ms	UDINT	RW	0x0000(0dec)

[EC4-C16/A16/PORx/R8]Index 8000 DO Settings

Index	Name	Meaning	Data type	Flags	Default
8000:00			UINT8	RO	0xC(12dec)
8000:01	Digital output keep value	**0:** Disable **1:** Enable	BOOLEAN	RW	0x00(0dec)
80n0:02	Digital output invert value	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x00(0dec)
80n0:11	Digital output initial value	Default output value **(0x0~0xFFFF)**	UDINT	RW	0x00(0dec)

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[EC4-ADx]Index 80n0 AI Settings

Notice: EC4-AD8 0<= n <=7; EC4-AD4: 0<= n <=3; EC4-AD2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80n0:00	AI Settings	Maximum subindex	UINT8	RW	0x1A(26dec)
80n0:01	Enalbe user scale	User scale is active	BOOLEAN	RW	FALSE(0dec)
80n0:02	Presentation	Change the method of representation of the measured value. **0:** Signed presentation (Detailed reference Table 5-3-1) **1:** Unsigned presentation (Detailed reference Table 5-3-2) **2:** Absolute value with MSB as sign Signed amount representation (Detailed reference Table 5-3-3)	Bit3	RW	Signed(0dec)
80n0:05	Enable Channel	Enable Channel	BOOLEAN	RW	TRUE(1dec)
80n0:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	FALSE(0dec)
80n0:07	Enable limit 1	Limit 1 enable	BOOLEAN	RW	FALSE(0dec)
80n0:08	Enable limit 2	Limit 2 enable	BOOLEAN	RW	FALSE(0dec)
80n0:09	Analog input type	**0:** Differential input	NIT32	RW	Differential (0dec)
80n0:0A	Enable user calibration	Enabling of the user calibration	BOOLEAN	RO	FALSE(0dec)
80n0:0B	Enable vendor calibration	Enabling of the vendor calibration	BOOLEAN	RW	TRUE(1dec)
80n0:0E	Swap limit bits	Swap limit bits **FALSE:** 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value **TRUE:** 0: not active 1: value < limit value 2: value > limit value 3: value is equal to the limit value	BOOLEAN	RW	FALSE(0dec)

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Index	Name	Meaning	Data type	Flags	Default
80n0:11	User scale offset	User scaling offset	INT16	RW	0x00(0dec)
80n0:12	User scale gain	User scaling gain. The value 1 corresponds to 65535 dec (0x00010000) and is limited to ±0x7FFFF.	INT32	RW	0x0x0001000 (65535dec)
80n0:13	Limit 1	First limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:14	Limit 2	Second limit value for setting the status bits	INT16	RW	0x00(0dec)
80n0:15	Filter settings	This object determines the digital filter settings, if it is active via Enable filter (Index 0x80n0:06). The possible settings are sequentially numbered. **0:** Without Filter **1:** N/A **2:** IIR 1 (168 Hz) **3:** IIR 2 (88 Hz) **4:** IIR 3 (43 Hz) **5:** IIR4 (21 Hz) **6:** IIR5 (10.5 Hz) **7:** IIR 6 (5.2 Hz) **8:** IIR 7 (2.5 Hz) **9:** IIR 8 (1.2 Hz)	UINT16	RW	Without Filter (0dec)
80n0:17	User calibration offset	User offset compensation	INT16	RW	0x0000(0dec)
80n0:18	User calibration gain	User calibration gain	INT16	RW	0x4000(16384dec)
80n0:19	AI Range	**0:** ±10V **1:** ±5V **2:** ±2.5V **3:** 0~10V	UINT32	RW	±10V(0dec)
80n0:1A	FactoryCMD	Factory Command	UINT32	RW	0x00000000(0dec)

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➢ **Table 5-3-1: Signed Integer the representation is as follows:**

The output value is in two's complement notation. 16 bits maximum representation range = -32768 ~ +32767 dec.

Input signal				Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	Decimal	Hexadecimal
10	5	2.5	10	32767	0x7FFF
5	2.5	1.25	5	16383	0x3FFF
					0x0001
0	0	0	0	0	0x0000
					0xFFFF
-5	- 2.5	-1.25		-16383	0xC001
-10	-5	-2.5		-32768	0x8000

➢ **Table 5-3-2: Unsigned Integer the representation is as follows:**

The output value is expressed in unsigned 15-bit resolution, since there are no positive or negative signs displayed. 16 bits maximum representation range = 0 ~ +32767.

Input signal				Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	Decimal	Hexadecimal
10	5	2.5	10	32767	0x7FFF
5	2.5	1.25	5	16383	0x3FFF
					0x0001
0	0	0	0	0	0x0000
					0xFFFF
-5	- 2.5	-1.25		-16383	0xC001
-10	-5	-2.5		-32768	0x8000

➢ **Table 5-3-3: The most significant bit (MSB) is represented as follows:**

The output value is represented by the Most Significant Bit (MSB). MSB = 1 (high) represents a negative number, and MSB=0 (Low) represents a positive number. 16 bits maximum representation range = -32768 ~ +32767 dec

Input signal				Value	
±10 (V)	±5 (V)	±2.5 (V)	0-10 (V)	Decimal	Hexadecimal
10	5	2.5	10	32767	0x7FFF
5	2.5	1.25	5	16383	0x3FFF
					0x0001
0	0	0	0	0	0x0000
					0x8001
-5	- 2.5	-1.25		[-16383]	0xBFFF
-10	-5	-2.5		[-32768]	0xFFFF

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[EC4-DA4/DA2]Index 80n0 AO Settings

Notice: EC4-DA4 0<= n <=3; EC4-DA2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80n0:00	ECAT-2024: AO Settings Ch. 1-4 ECAT-2028: AO Settings Ch. 1-8		UINT8	RO	0x25(37dec)
80n0:05	Watchdog	**0: Default watchdog value** The default value (80n0:13) is active. **1: Watchdog ramp** The ramp (80n0:14) for moving to the default value is active. **2: Last output value** In the event of a watchdog drop the last process data is issued.	BIT2	RW	0x00(0dec)
80n0:07	Enable User Calibration	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x00(0dec)
80n0:08	Enable Vendor Calibration	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x01(1dec)
80n0:09	AO Range	**0:** Unipolar 5V (0-5V) **1:** Bipolar 5V (±5V) **2:** Unipolar 10V (0-10V) **3:** Bipolar 10V (±10V) **4:** Unipolar 10mA (0-10mA) **5:** N/A **6:** Unipolar 20mA (0-20mA) **7**:N/A	BIT4	RW	0x03(3dec)
80n0:13	Default output	Default output value	INT16	RW	0x0000(0dec)
80n0:14	Default output ramp	Ramp for ramping down to the default value. Value in digits/ms.	UINT16	RW	0xFFF(4095dec)
80n0:17	User Calibration Offset	User calibration offset	INT16	RW	0x0000(0dec)
80n0:18	User Calibration Gain	User calibration gain	UINT16	RW	0x7FFF(32767dec)

➢ **Table 5-3-4: The range representation is as follows:**

Output signal						Value	
±10 (V)	**±5 (V)**	**0-10 (V)**	**0-5 (V)**	**0-10 (mA)**	**0-20 (mA)**	**Decimal**	**Hexadecimal**
10	5	10	5	10	20	32767	0x7FFF
5	2.5	5	2.5	5	10	16383	0x3FFF
							0x0001
0	0	0	0	0	0	0	0x0000
							0xFFFF
-5	- 2.5					-16383	0xC001
-10	-5					-32768	0x8000

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[EC4-DA4P]Index 80n0 AO Settings

Notice: EC4-DA4P 0<= n <=3

Index	Name	Meaning	Data type	Flags	Default
80n0:00	EC4- DA4P Settings Ch. 0-3		UINT8	RO	0x25(37dec)
80n0:02	Presentation	**0: Signed presentation** The measured value is displayed in two's complement. Maximum presentation range at 16 bits: -32768dec ... +32767dec (Detailed reference 表 5-3-5) **1: Unsigned presentation** Maximum presentation range for 16 bits: 0 ... +65535dec (Detailed reference 表 5-3-6) **2: Absolute value with MSB as sign** The measured value is output in the signed amount representation. Maximum presentation range at 16 bits: - 32768dec .. +32767dec (Detailed reference 表 5-3-7) **3: Absolute value** The negative number range is also output as positive (Detailed reference 表 5-3-8)	BIT3	RW	0x00(0dec)
80n0:05	Watchdog	**0: Default watchdog value** The default value (80n0:13) is active. **1: Watchdog ramp** The ramp (80n0:14) for moving to the default value is active. **2: Last output value** In the event of a watchdog drop the last process data is issued.	BIT2	RW	0x00(0dec)
80n0:07	Enable User Calibration	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x00(0dec)
80n0:08	Enable Vendor Calibration	**0:** FALSE **1:** TRUE	BOOLEAN	RW	0x01(1dec)
80n0:09	AO Range	**0:** Unipolar 5V (0-5V) **1:** Bipolar 5V (±5V) **2:** Unipolar 10V (0-10V) **3:** Bipolar 10V (±10V) **4:** N/A	BIT4	RW	0x03(3dec)

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		5: N/A **6:** Unipolar 20mA (0-20mA) **7**: Bipolar 20mA (±20mA) **8:** Unipolar 4-20mA (4-20mA) **9**: N/A			
80n0:13	Default output	Default output value	INT16	RW	0x0000(0dec)
80n0:14	Default output ramp	Ramp for ramping down to the default value. Value in digits/ms.	UINT16	RW	0xFFF(4095dec)
80n0:17	User Calibration Offset	User calibration offset	INT16	RW	0x0000(0dec)
80n0:18	User Calibration Gain	User calibration gain	UINT16	RW	0x7FFF(32767dec)

➢ **Table 5-3-5: Signed presentation:**

The output value is represented in two's complement format. 16-bit maximum representation range = -32768 ~ +32767 dec.

Output signal							Value	
±10 (V)	**±5 (V)**	**0-10 (V)**	**0-5 (V)**	**±20 (mA)**	**0-20 (mA)**	**4-20 (mA)**	**Decimal**	**Hexadecimal**
10	5	10	5	20	20	20	32767	0x7FFF
5	2.5	5	2.5	10	10	12	16383	0x3FFF
								0x0001
0	0	0	0	0	0	4	0	0x0000
								0xFFFF
-5	- 2.5			-10			-16383	0xC001
-10	-5			-20			-32768	0x8000

➢ **Table 5-3-6: Unsigned presentation:**

The output value is represented with unsigned 16-bit resolution. Since there is no sign display, the full resolution is used. 16-bit maximum representation range = 0 ~ +65535 dec.

Input signal				Value	
0-10 (V)	**0-5 (V)**	**0-20 (mA)**	**4-20 (mA)**	**Decimal**	**Hexadecimal**
10	5	20	20	65535	0xFFFF
				49153	0xC001
				32768	0x8000
5	2.5	2.5	10	32767	0x7FFF
				16383	0x3FFF
				1	0x0001
0	0	0	4	0	0x0000

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➢ **Table 5-3-7: Absolute value with MSB as sign:**

The output value uses the Most Significant Bit (MSB) for sign representation. MSB = 1 (high) indicates a negative number, and MSB = 0 (Low) indicates a positive number. 16-bit maximum representation range = -32767 ~ +32767 dec.

Output signal							Value	
±10 (V)	±5 (V)	0-10 (V)	0-5 (V)	±20 (mA)	0-20 (mA)	4-20 (mA)	Decimal	Hexadecimal
10	5	10	5	20	20	20	32767	0x7FFF
5	2.5	5	2.5	10	10	12	16383	0x3FFF
								0x0001
0	0	0	0	0	0	4	0	0x0000
								0x8001
-5	- 2.5			-10			-16383	0xBFFF
-10	-5			-20			-32768	0xFFFF

➢ **Table 5-3-8: Absolute value:**

The output value corresponds to the mathematical absolute value of the input data. 16-bit maximum representation range = 0 ~ +32767 dec.

Output signal							Value	
±10 (V)	±5 (V)	0-10 (V)	0-5 (V)	±20 (mA)	0-20 (mA)	4-20 (mA)	Decimal	Hexadecimal
10	5	10	5	20	20	20	32767	0x7FFF
5	2.5	5	2.5	10	10	12	16383	0x3FFF
								0x0001
0	0	0	0	0	0	4	0	0x0000
								0xFFFF
5	2.5			10			-16383	0xC001
10	5			20			-32768	0x8000

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[EC4-ADx]Index 80nE AI Internal Data

Notice: EC4-AD8 0<= n <=7; EC4-AD4: 0<= n <=3; EC4-AD2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80nE:00	AI Internal data	Maximum subindex	UINT8	RO	0x1(1dec)
80nE:01	ADC raw value	ADC raw value	UINT16	RO	0x0008(8dec)

[EC4-ADx]Index 80nF AI Vendor Data

Notice: EC4-AD8 0<= n <=7; EC4-AD4: 0<= n <=3; EC4-AD2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80nF:00	AI Vendor data	Maximum subindex	UINT8	RW	0x2(2dec)
80nF:01	Calibration offset	Offset (vendor calibration)	UINT16	RW	0xFFED(-19dec)
80nF:02	Calibration gaing	Gain (vendor calibration)	UINT16	RW	0x40AD (16557dec)

[EC4-DAx]Index 80nE AO Internal Data

Notice: EC4-DA4: 0<= n <=3; EC4-DA2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80nE:0	AO internal data	Maximum subindex	UINT8	RO	0x01(1dec)
80nE:01	DAC raw value	DAC raw value	UINT16	RO	0x800(2048dec)

[EC4-DAx]Index 80nF AO Internal Data

Notice: EC4-DA4: 0<= n <=3; EC4-DA2: 0<= n <=1

Index	Name	Meaning	Data type	Flags	Default
80nF:0	AO Vendor data	Maximum subindex	UINT8	RO	0x02(2dec)
80nF:01	Calibration Offset	Vendor calibration offset	INT16	RW	0x0000(0dec)
80nF:02	Calibration Gain	Vendor calibration gain	UINT16	RW	0x7E9F (32415dec)

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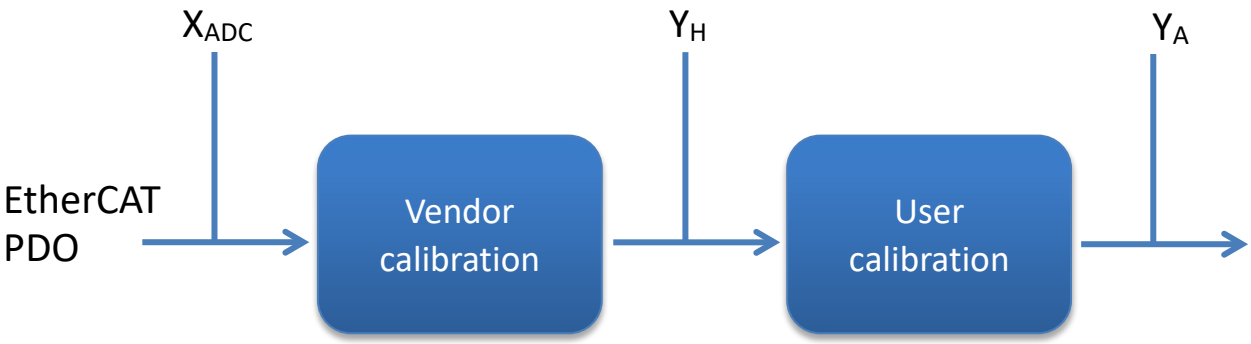
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5.4 Calculating of process data

Analog input calibration calculating

"Calibration" is the process of adjusting a device to ensure its accuracy. During operation, calibration and adjustment of data are performed by the device's vendor or user to maintain precise measurement accuracy.

In the ADC raw value object 0x80nE:01, the terminal continuously records measurement values and stores raw values from the AD converter. Each time an analog signal is recorded, when the following parameters are enabled, the calculated values from the calibration will align with those from the vendor calibration and user calibration.



Calculation formula	Description
X_{ADC}	Output value for ADC converter
$Y_H = (X_{ADC} – B_H) \times A_H \times 2^{-14}$	Output value after Vendor calibration
$Y_A = (Y_H – B_A) \times A_A \times 2^{-14}$	Output value after Vendor and user calibration

Parameter name	Description	Index
X_{ADC}	Output value for ADC converter	0x8000:04
B_H	Vendor calibration offset (cannot be changed, Can be enabled via index 0x80n0:0B)	0x80nF:01
A_H	Vendor calibration gain (cannot be changed, Can be enabled via index 0x80n0:0B)	0x80nF:02
B_A	User calibration offset (Can be enabled via index 0x80n0:0A)	0x80n0:11
A_A	User calibration gain (Can be enabled via index 0x80n0:0A)	0x80n0:12

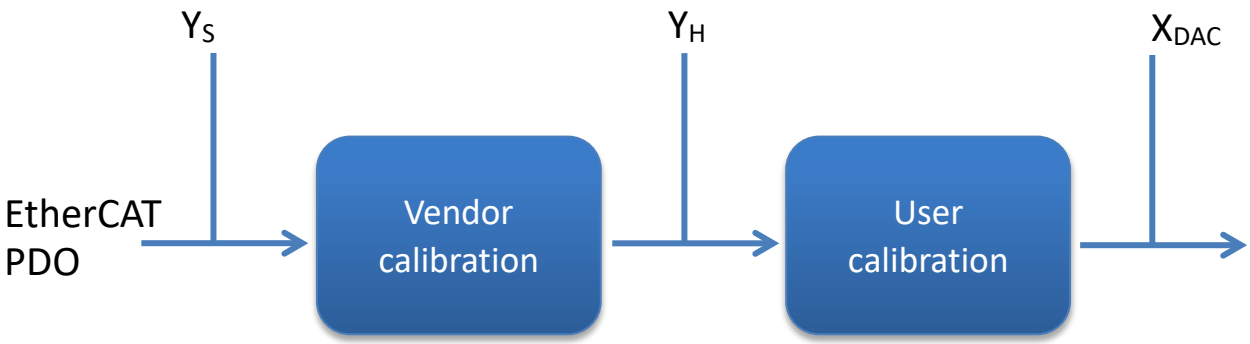
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Analog output calibration calculating

"Calibration" is the process of adjusting a device to ensure accuracy. During operation, calibration/adjustment of data is performed by the equipment vendor or user to maintain precise measurement accuracy.

In the DAC raw value Object 0x800E:01, the terminal continuously records output values and saves the raw values from the DA converter. After each analog signal is recorded, once the parameter shown below is enabled, the calibrated values will align with both the vendor and user calibration values.



Calculation formula	Description
X_{DAC}	Input value for DAC Converter
$X_{DAC} = Ys \times Gain_{VENDOR} \times 2^{-16} + Offset_{VENDOR}$	Input value after Vendor calibration
$X_{DAC} = Y_H \times ((Gain_{USER} – 0x8000)/0x8000) + Offset_{USER}$	Input value after Vendor and User calibration

Parameter name	Description	Index
X_{DAC}	Input value for DAC Converter	-
$Offset_{vendor}$	Vendor calibration offset (cannot be changed)	0x800F:01
$Gain_{vendor}$	Vendor calibration gain (cannot be changed)	0x800F:02
$Offset_{user}$	User calibration offset (Can be enabled via index 0x80n0:07)	0x80n0:17
$Gain_{user}$	User calibration gain (Can be enabled via index 0x80n0:08)	0x80n0:18

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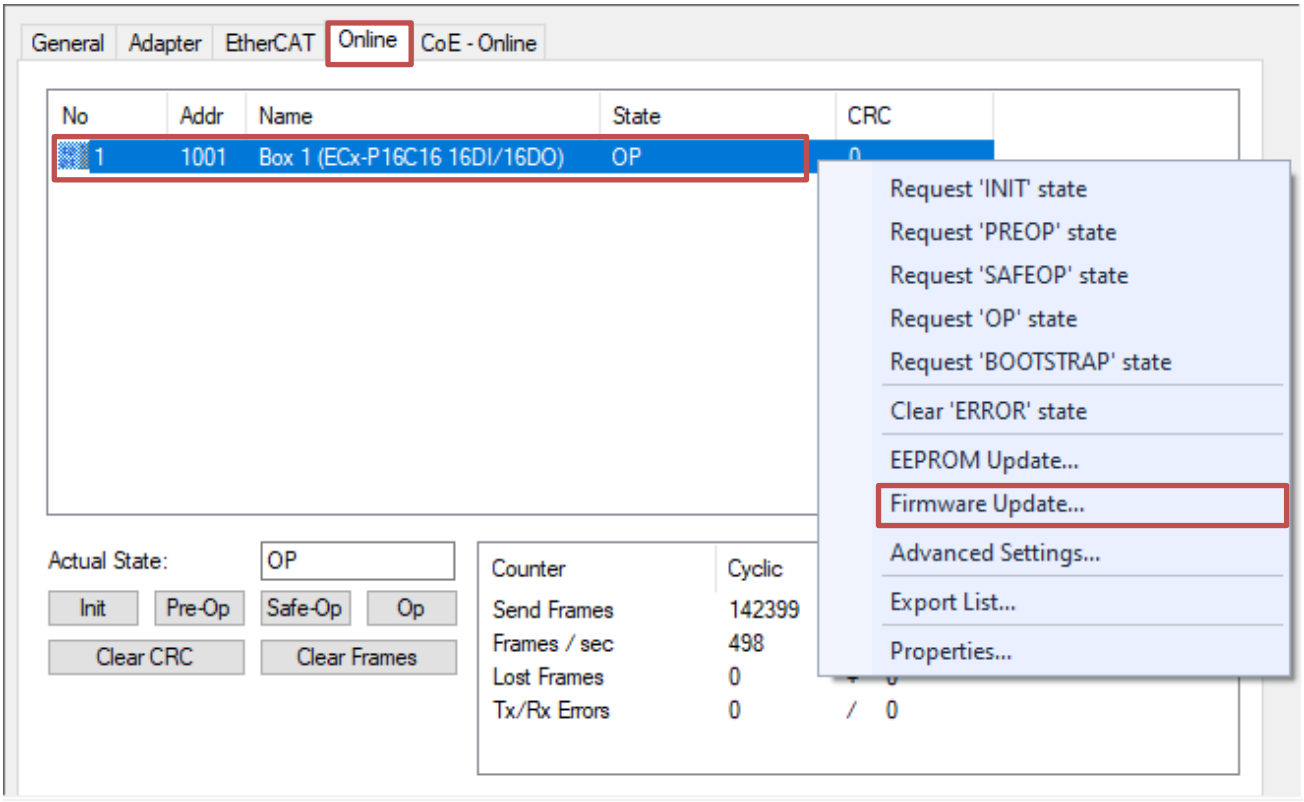
6. Firmware upgrade through EtherCAT FoE

This section describes the device update for ICP DAS EtherCAT slaves from the EC1, EC2 and EC4 series.

Demonstrate how to update firmware using Beckhoff TwinCAT 3 EtherCAT maindevice.

Step 1

Right-click the ECx-DIO Module, click “**Firmware Update…**”.

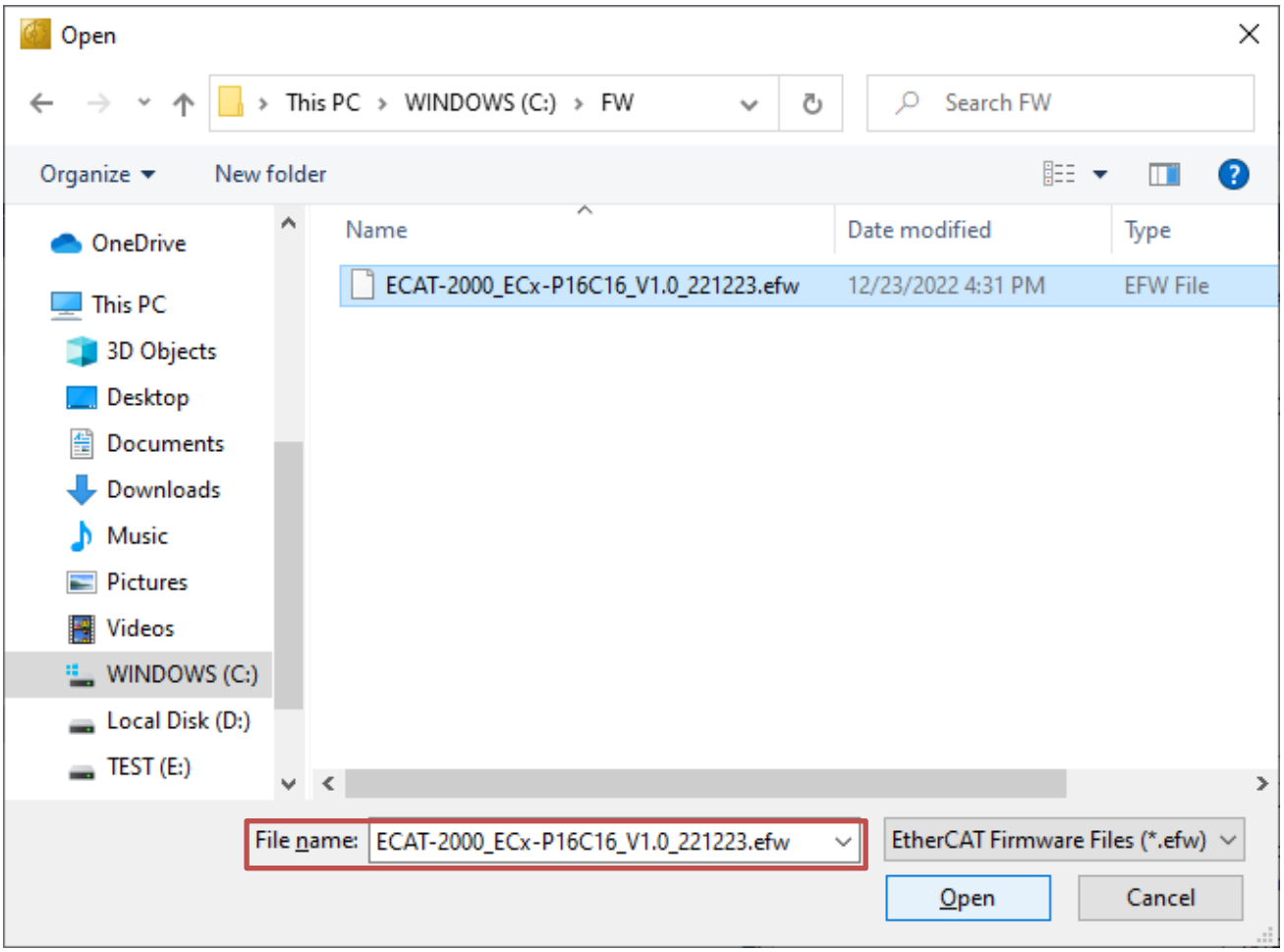


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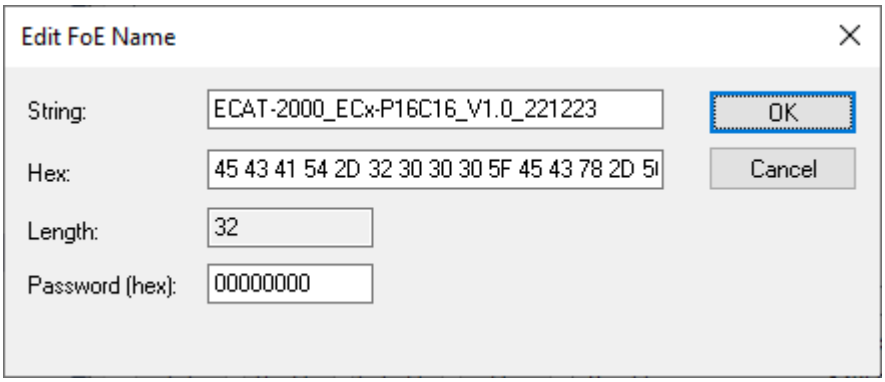
Step 2

Select the firmware file(*.efw).



Step 3

Click ok button to start upgrade firmware.

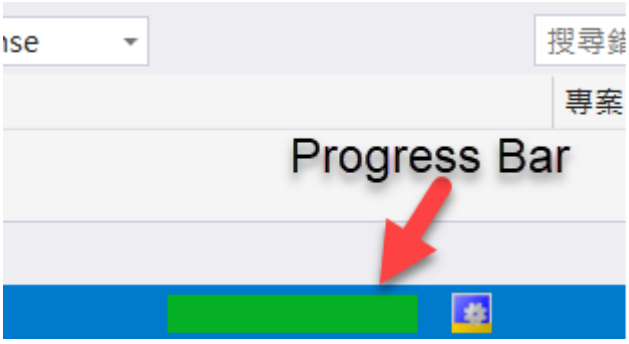


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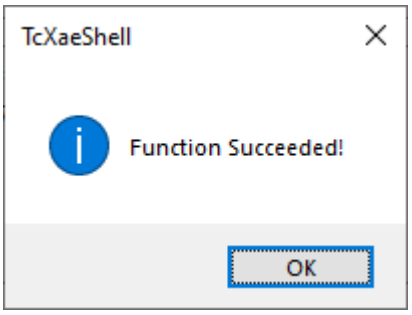
Step 4

Check out the progress bar and wait for it finish.

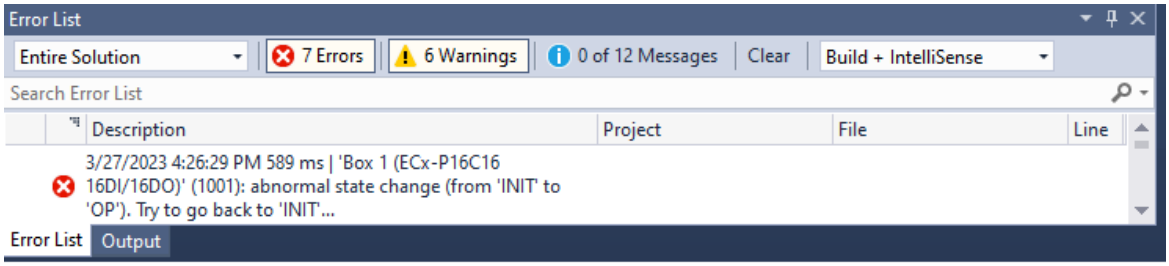


Step 5

TwinCAT master will notice user the function successes, just click “OK”.



NOTE: Due to the ECx-DIO will restart the system after firmware upgrading so that TwinCAT will indicate the slave not in the expected state. Don’t worry, this is a normal situation. TwinCAT will try to switch the slave to original state (ex: OP or BOOTSTRAP).



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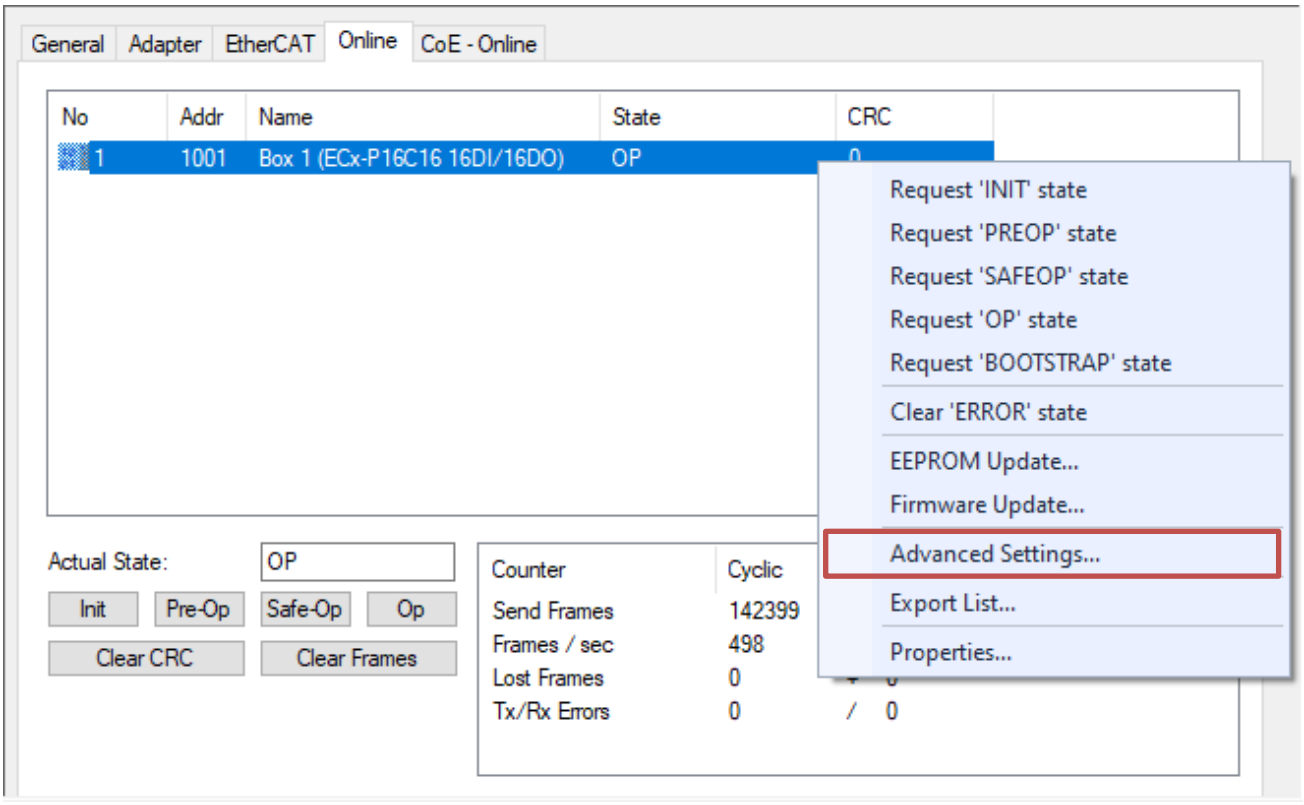
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7. Explicit Device ID

Explicit Device ID is used for met identification function of TwinCAT master.
User can specify an ID at EtherCAT slave side and setup identification at TwinCAT master side.
TwinCAT master will check if the ID of the slave matched with the expected identification value during startup the slave.

Step 1

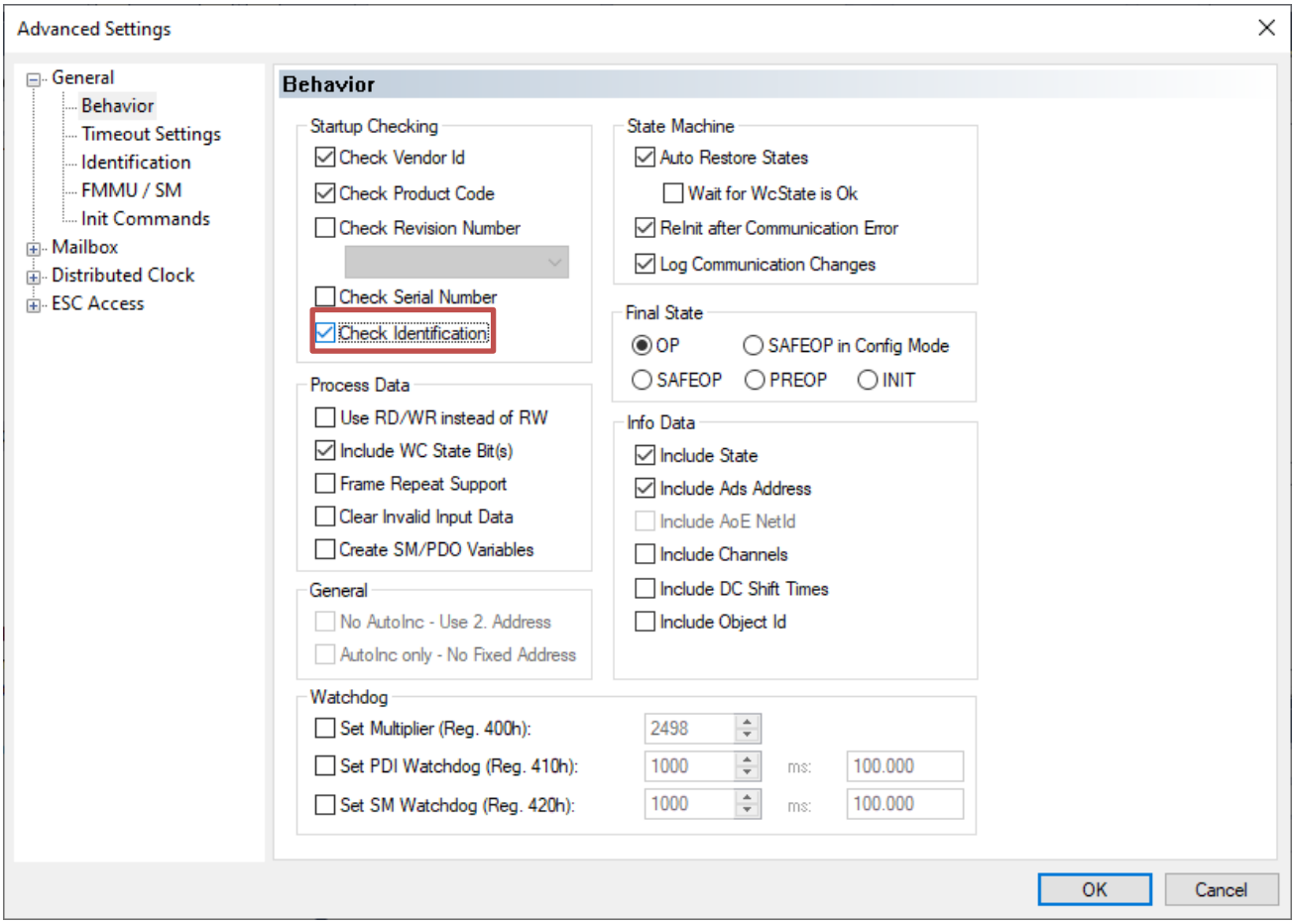
This setting will let TwinCAT master turn on the identification function for the slave.
Select the slave, right-click and select "**Advanced Settings…**".



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Step 2

Go to **“General -> Behavior”** and turn on the “Check Identification”.



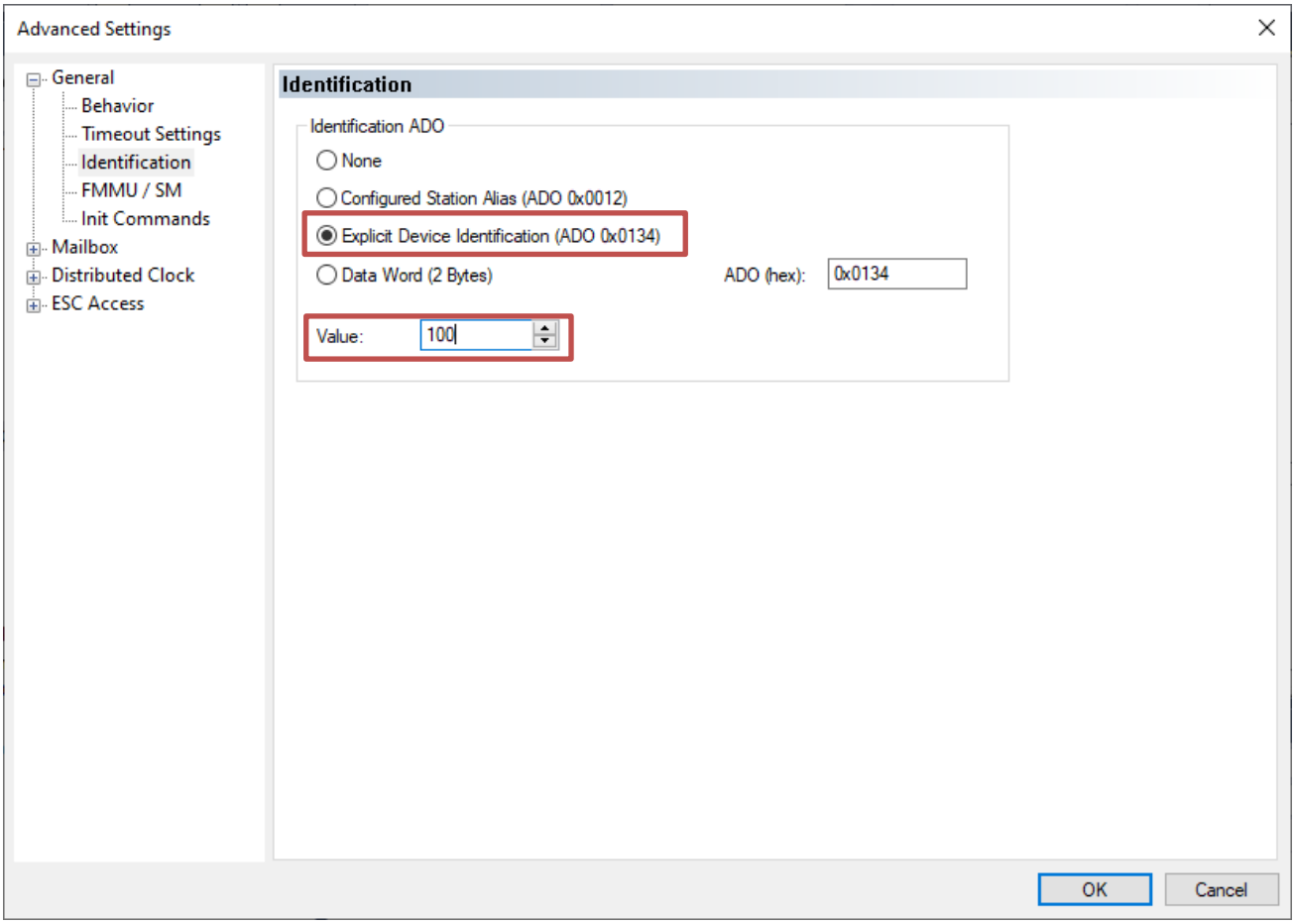
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Step 3

Confirm current identification ADO (Address Offset) is "**(ADO 0x0134)**".

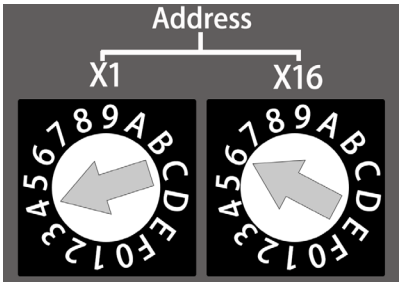
Don't forget to assign the value in decimal. The value "**100**" is just an example here.



Step 4

User should also setup the same value on moduel like following:

The digit format "Rotary Switch" is hex so that we should set it to "**0x64**".



Step 5

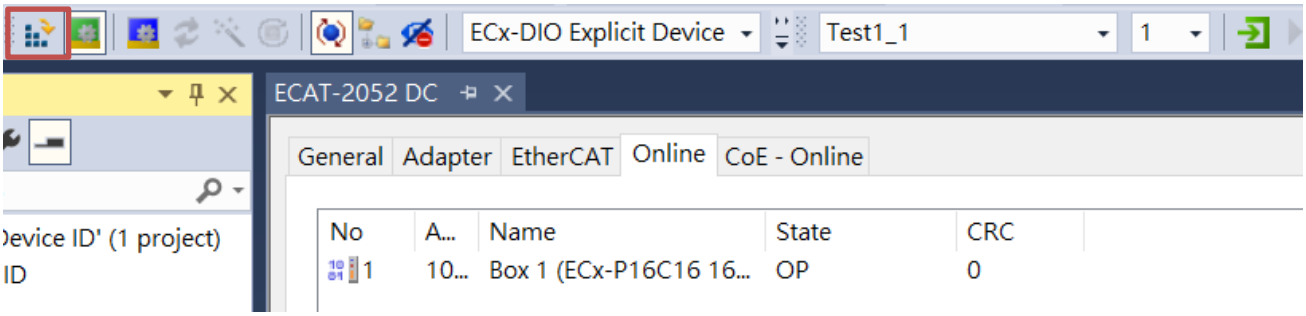
Please disconnect the power connect to **reboot** the module

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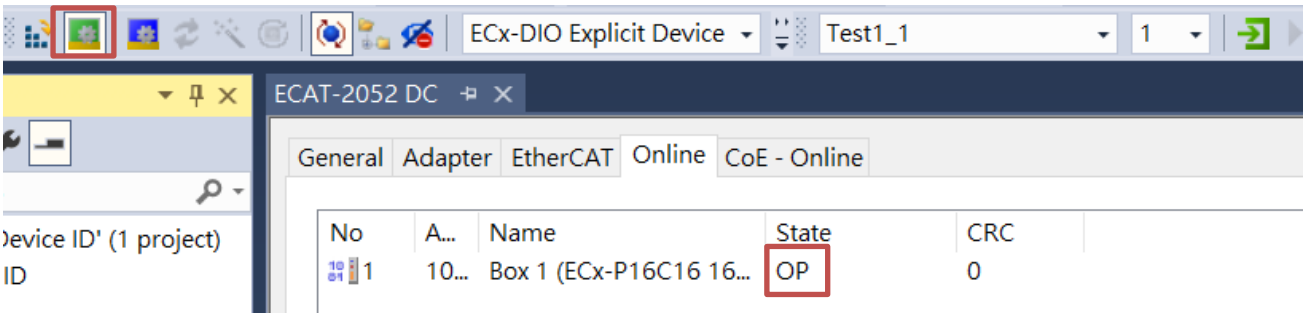
Step 6

Re-activate the TwinCAT master.



Step 7

If user see the below screen, that means that TwinCAT master already enter running mode successfully and the slave also passed the identification checking so that it can enter OP state.



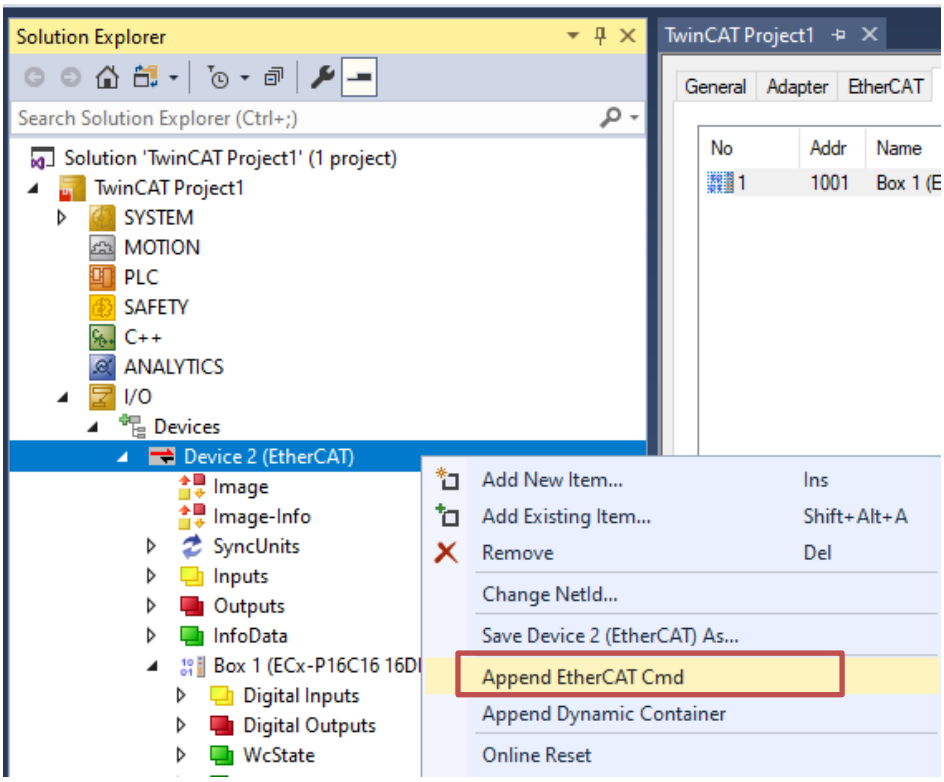
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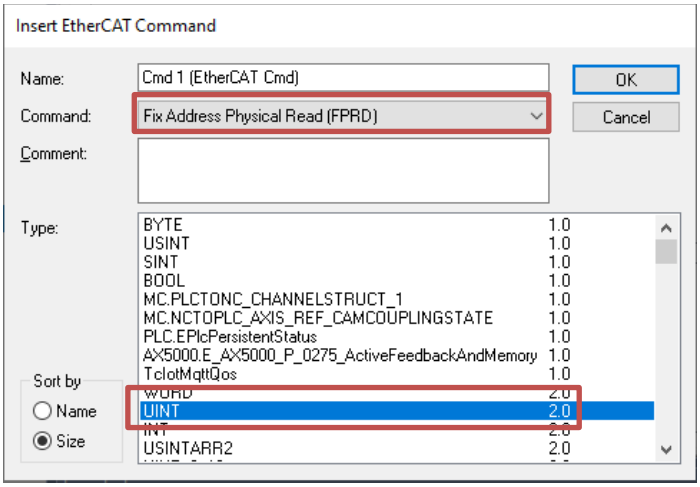
Step 8

The slave will also accept frames from TwinCAT master with 2 kinds of address (1001 or 100) at the same time.But it needs to turn on second address function in ESC register. However, we arrange command for observe this behavior first.

You can append an EtherCAT command to TwinCAT master for confirm the second address.
Click "**Device N (EtherCAT) -> Append EtherCAT Cmd**".



Please assign "**Command**" and "**Type**".
I demonstrate "**FPRD**" and "**UINT**" in this example.



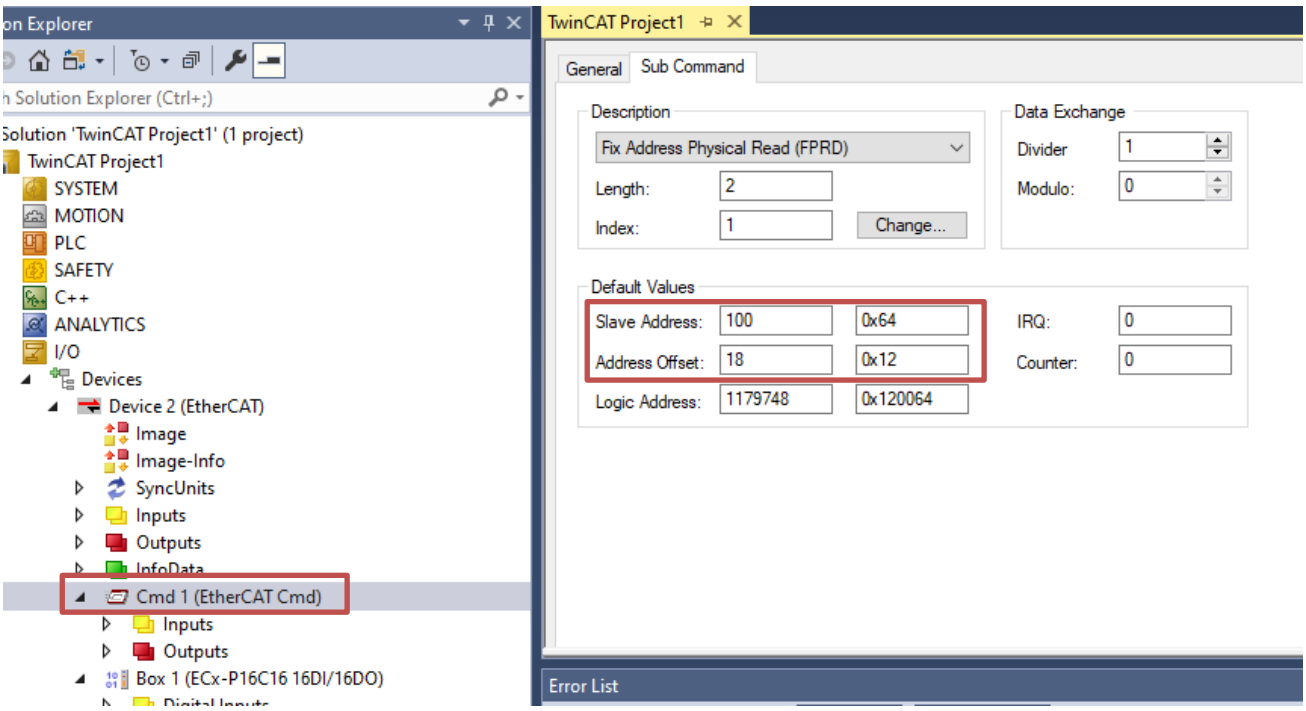
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Step 9

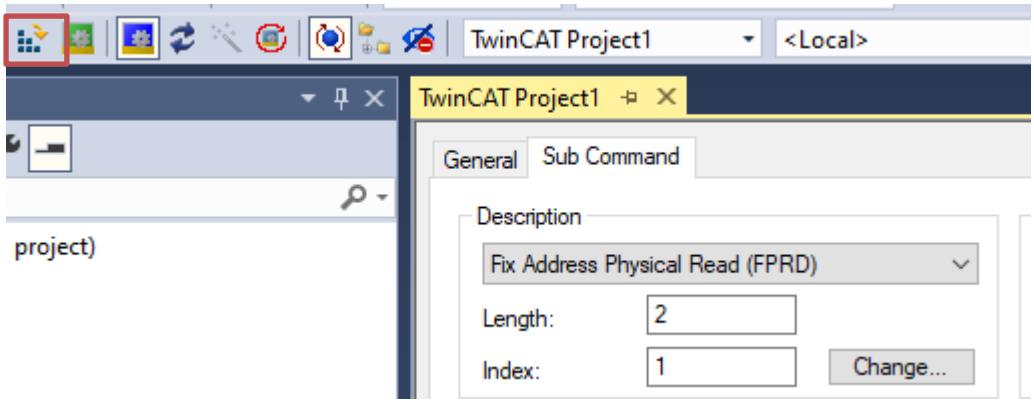
Double-click “**Cmd 1**” and setup “**Slave Address**” and “**Address Offset**”.

I setup slave address = **0x64** and address offset = **0x12** in this example.



Step 10

Re-activate the TwinCAT master again.



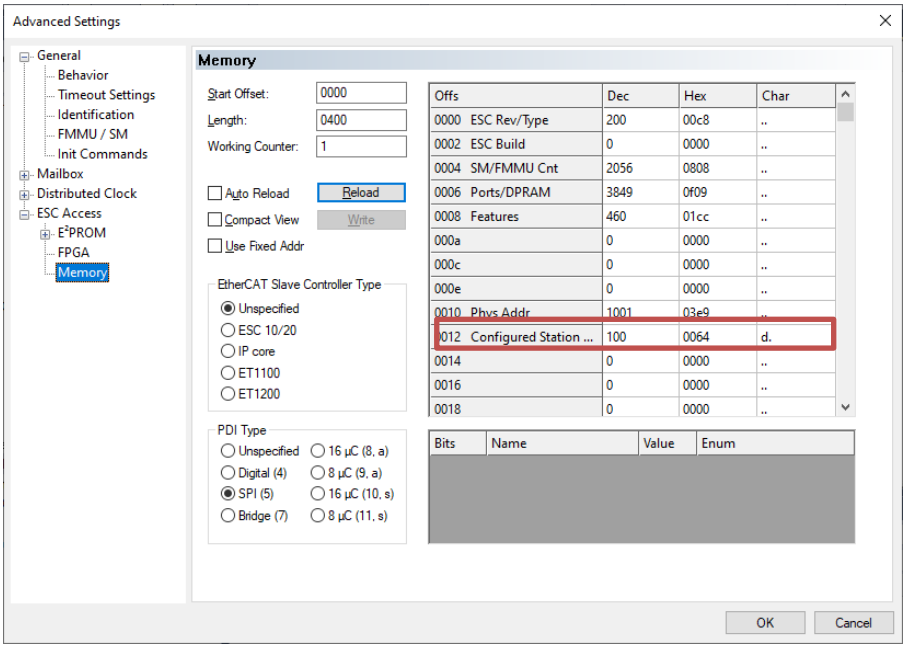
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Step 11

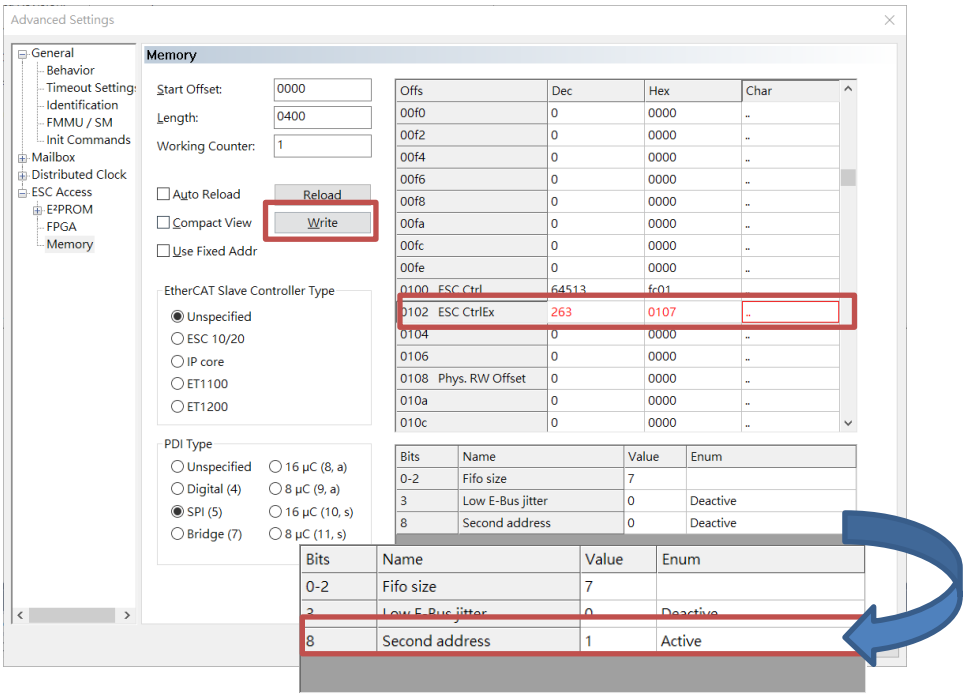
Go to “**ESC Access** -> **Memory**” in “Advanced Settings” and check out the address 0x0012.

The firmware will write the user specified Switch ID value into ESC register 0x0012 (the register named Configured Station Alias).



Step 12

If user expect that the slave can also use this Switch ID value as second slave address. user just turn on “Seconds address” bit (bit8 = 1) in ESC register 0x0102 (Need click “**Write**” button).

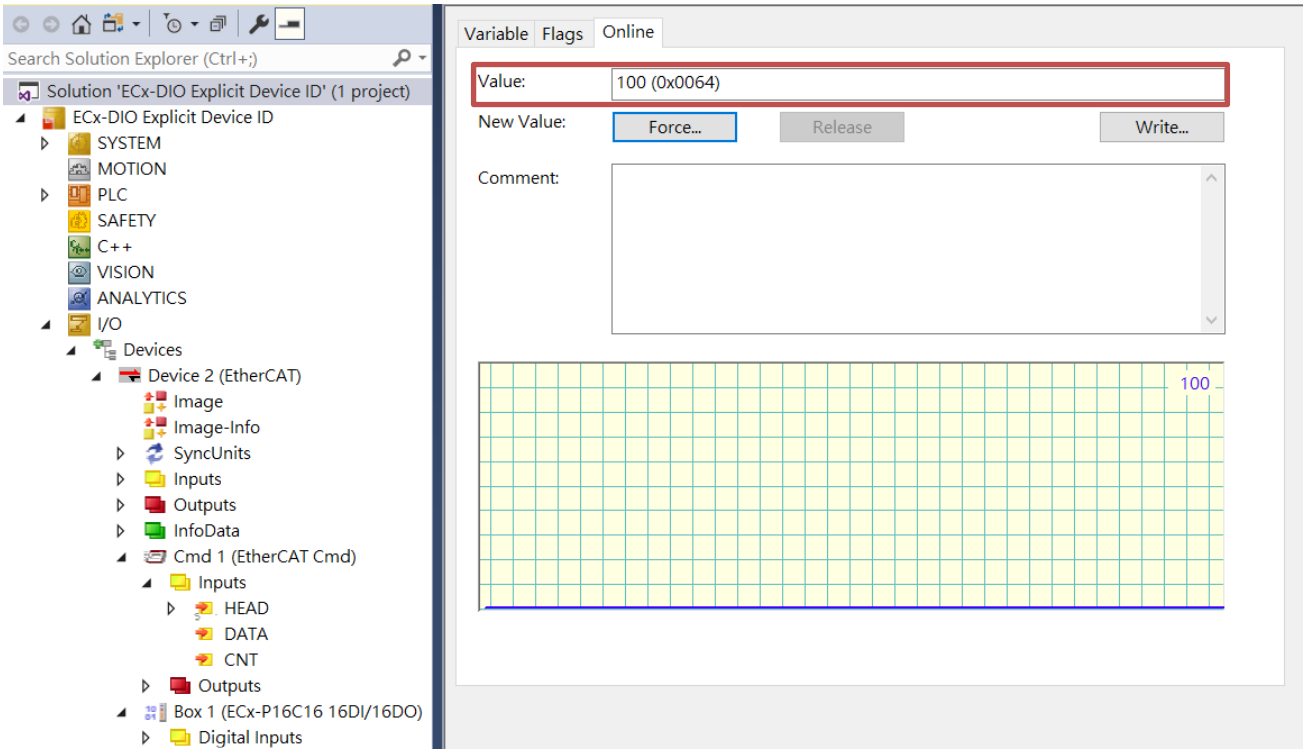


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Step 13

Click “Device N (EtherCAT) -> Cmd 1 -> DATA”, you will see the command get the value of ESC register 0x0012 back successfully. It is correct, the “0x0064” in UINT data type.



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Appendix: Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
1.0	2024.Oct	Initial issue
1.1	2026.Jan	Add EC4-A16/POR16/POR8/R8/DA4P Add Install Position Chapter EC4-P16 Voltage Level correction ESD Protection spec. correction

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