User Manual

QEC-RXXAXXS

EtherCAT SubDevice ADC/DAC Converter

Up to 8 slots of 16-bit Analog Input and 16-bit Analog Output

(Revision 1.2)

REVISION

Date	Version	Description
2024/9/16	Version 1.0	New Release.
2024/10/15	Version 1.1	• Update resolution for Analog Output. • Add Index 0x5010 ~ 0x5017 Index's subindex 1: status information.
2026/1/9	Version 1.2	• The EtherCAT device name has been changed from "Slave" to "SubDevice". • Add device items: QEC-RXXA40S and QEC-RXXA04S. • Add QEC-RXXA40S and QEC-RXXA04S Specification table in Ch. 1.2. • Add QEC-RXXA40S and QEC-RXXA04S LEDs in Ch. 2.2.3. • Add QEC-RXXA40S and QEC-RXXA04S Connectors in Ch. 2.2.4. • Update Ch. 5 Getting Started, change the 86Duino IDE 500 to 86Duino IDE 501. • Update object dictionary: ◦ Add PDO objects table: 0x1C00, 0x1C12, 0x1C13, 0x1C32, 0x1C33. ◦ Add Index 0xA000 Output Times. ◦ Add Index 0xA001 Application Times. ◦ Add Index 0xA002 Input Times. ◦ Add Index 0xF000 Modular Device Profile.

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Ver.1.2 January, 2026

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- QEC: https://www.qec.tw/

This Manual is for the QEC series.

SAFETY INFORMATION

- Read these safety instructions carefully.
- Please carry the unit with both hands and handle it with caution.
- Power Input voltage +19 to +50VDC Power Input (Typ. +24VDC)
- Make sure the voltage of the power source is appropriate before connecting the equipment to the power outlet.
- To prevent the QEC device from shock or fire hazards, please keep it dry and away from water and humidity.
- Operating temperature between -20 to +70°C.
- When using external storage as the main operating system storage, ensure the device's power is off before connecting and removing it.
- Never touch un-insulated terminals or wire unless your power adaptor is disconnected.
- Locate your QEC device as close as possible to the socket outline for easy access and avoid force caused by the entangling of your arms with surrounding cables from the QEC device.
- If your QEC device will not be used for a period of time, make sure it is disconnected from the power source to avoid transient overvoltage damage.

WARNING!

DO NOT ATTEMPT TO OPEN OR TO DISASSEMBLE THE CHASSIS (ENCASING) OF THIS PRODUCT. PLEASE CONTACT YOUR DEALER FOR SERVICING FROM QUALIFIED TECHNICIAN.

CONTENT

Ch. 1

General Information

1.1 Introduction

The QEC-RXXA series is an EtherCAT analog I/O module that integrates Analog-to-Digital Conversion (ADC) and Digital-to-Analog Conversion (DAC) in a compact, industrial-grade design. It supports up to 8 slots of analog channels, allowing customers to freely configure analog input and analog output channel combinations to match application needs. The series has been verified with the EtherCAT Conformance Testing Tools (CTT), ensuring reliable integration into EtherCAT systems.

High-Accuracy Analog Input
The analog input channels support multiple voltage ranges (both bipolar and unipolar) to accommodate a wide variety of sensors and transducers. With a constant input impedance ≥ 1 MΩ and overvoltage protection up to ±20 V, the module delivers stable, durable performance in harsh industrial environments. A 16-bit ADC provides precise measurement, achieving ±0.2% FSR accuracy at 25°C.

Flexible Analog Output for Control and Signal Conditioning
For analog output, the QEC-RXXA series offers versatile signal conditioning with 0–24 mA current output and up to ±12 V voltage output options. Outputs are delivered at 16-bit resolution with ±0.2% FSR accuracy at 25°C, making the module ideal for driving actuators or interfacing with external control systems.

EtherCAT-Ready Design for Reliable Operation
The module supports firmware updates via File over EtherCAT (FoE) and includes dual RJ-45 ports to enhance network reliability and support EtherCAT cabling redundancy. Onboard LED indicators provide clear diagnostic and operational status for fast system checks and troubleshooting.

Compact, Installation-Friendly, and Topology Flexible
Designed to reduce infrastructure and maintenance costs, the QEC-RXXA series supports common EtherCAT topologies, including line, star, and ring configurations. With a compact footprint of 107.45 × 66 × 30 mm and an operating temperature range of -20 to +70°C (extended temperature options available), it fits well into space-constrained control cabinets. DIN-rail mounting further simplifies installation and service.

The QEC-RXXA44S is a representative model of the series—an excellent choice for applications requiring reliable, high-precision analog input and output within EtherCAT networks.

1.2 Specifications

1.2.1 Analog Input (QEC-RXXA40S/QEC-RXXA80S)

4-slot/8-slot Analog Input.

Analog Input	
Channels	4 / 8 (Differential)
Input Type	Voltage (V)
Input Range	±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
Input Impedance	Constant resistive ≥ 1 MΩ
Overvoltage Protection	Up to ±24 V
Resolution	16-bit with accuracy ±0.2% FSR @25°C
Sample / Update	ADC throughput (IC capability): up to 100 kSPS Configured update (module): Max. 10 kSPS Effective AI scan/update (typ., 4-ch): ~500 µs (≈2 kHz per full scan set)
General	
Connector	Euroblock Push-in Terminal
Connector Color	Analog Input: Green; Negative: Black; Null: Gray;
Protocol	EtherCAT (RJ-45 x 2)
Ethernet Standard	IEEE 802.3
Transmission Rate	100 Mbps
Power Connector	6-pin Power Input/Output
Power Requirement	+19 to +50 VDC Power Input (Typ. +24 VDC @ 200 mA)
Power Consumption	4.8 W
LED Indicator	PWR, RUN, LINK, ERROR, Analog Input/Output status
Certifications	CE, FCC, VCCI
Environment	
Operating Temperature	-20 to +70 °C
Storage Temperature	-40~85°C
Relative Humidity	95% (non-condense)
Hardware	
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)
Weight	245 g
Installation	DIN-Rail Mounting
Internal Monitoring	Temperature, Voltage, Current

1.2.2 Analog Output (QEC-RXXA04S/QEC-RXXA08S)

4-slot/8-slot Analog Output.

Analog Output	
Channels	4 / 8
Output Type	Voltage (V, mV), Current (mA)
Output Current	0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
Output Voltage	0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
Resolution	16-bit with accuracy ±0.2% FSR@25°C
Slew Rate	Configurable (Option)
Drift	±10 ppm/°C
Update Behavior	New output becomes effective after PDO transfer, then DAC update via SPI DAC settling (typ.): ~10–50 µs (range/load dependent)
General	
Connector	Euroblock Push-in Terminal
Connector Color	Analog Output: Orange; Negative: Black; Null: Gray;
Protocol	EtherCAT (RJ-45 x 2)
Ethernet Standard	IEEE 802.3
Transmission Rate	100Mbps
Power Connector	6-pin Power Input/Output
Power Requirement	+19 to +50VDC Power Input (Typ. +24VDC@200mA)
Power Consumption	4.8 W
LED Indicator	PWR, RUN, LINK, ERROR, Analog Input/Output status
Certifications	CE, FCC, VCCI
Environment	
Operating Temperature	-20 to +70 °C
Storage Temperature	-40~85°C
Relative Humidity	95% (non-condense)
Hardware	
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)
Weight	245 g
Installation	DIN-Rail Mounting
Internal Monitoring	Temperature, Voltage, Current

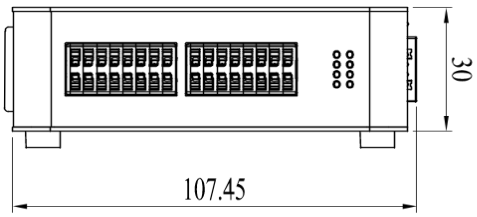
1.2.3 Analog Input/Output (QEC-RXXA44S)

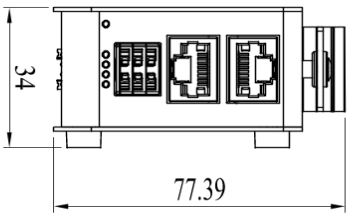
4-slot Analog Input and 4-slot Analog Output.

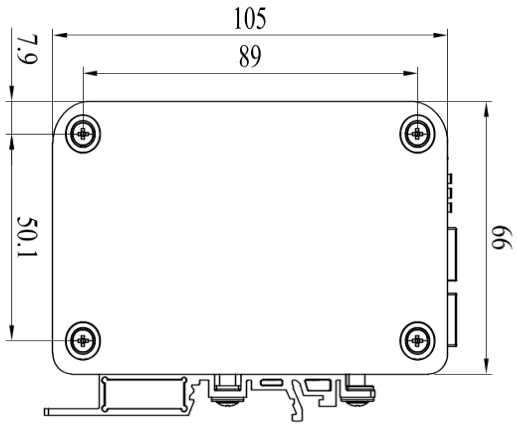
Analog Input	
Channels	4 (Differential)
Input Type	Voltage (V)
Input Range	±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0–22 V; 0–20 V; 0–11 V; 0–10 V
Input Impedance	Constant resistive ≥ 1 MΩ
Overvoltage Protection	Up to ±24 V
Resolution	16-bit with accuracy ±0.2% FSR @25°C
Sample / Update	ADC throughput (IC capability): up to 100 kSPS Configured update (module): Max. 10 kSPS Effective AI scan/update (typ., 4-ch): ~500 µs (≈2 kHz per full scan set)
Analog Output	
Channels	4
Output Type	Voltage (V, mV), Current (mA)
Output Current	0–24 mA; 3.5–23.5 mA; 0–20 mA; 4–20 mA; ±24 mA
Output Voltage	0–5 V; 0–10 V; ±5 V; ±10 V; -6–0 V; 0–12 V; ±6 V; ±12 V
Resolution	16-bit with accuracy ±0.2% FSR @25°C
Slew Rate	Configurable (Option)
Drift	±10 ppm/°C
Update Behavior	New output becomes effective after PDO transfer, then DAC update via SPI DAC settling (typ.): ~10–50 µs (range/load dependent)
General	
Connector	Euroblock Push-in Terminal
Connector Color	Analog Input: Green; Analog Output: Orange; Negative: Black; Null: Gray;
Protocol	EtherCAT (RJ-45 x 2)
Ethernet Standard	IEEE 802.3
Transmission Rate	100Mbps
Power Connector	6-pin Power Input/Output
Power Requirement	+19 to +50VDC Power Input (Typ. +24VDC@200mA)
Power Consumption	4.8 W
LED Indicator	PWR, RUN, LINK, ERROR, Analog Input/Output status
Certifications	CE, FCC, VCCI
Environment	
Operating Temperature	-20 to +70 °C
Storage Temperature	-40~85°C
Relative Humidity	95% (non-condense)

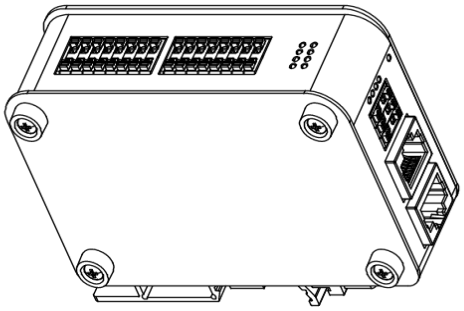
Hardware	
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)
Weight	245 g
Installation	DIN-Rail Mounting
Internal Monitoring	Temperature, Voltage, Current, Startup time

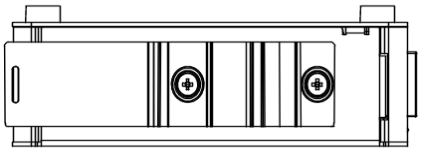
1.3 Dimension

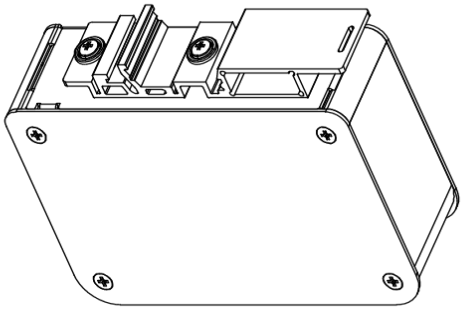










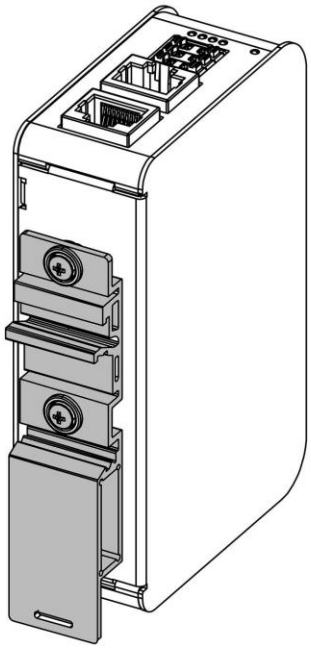


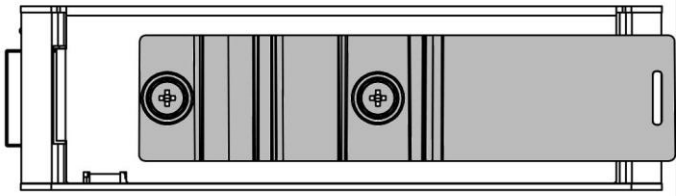
(Unit: mm)

1.4 Mounting Instruction

QEC-RXXA series is an easy-install design to help you set-up your modules easily. Please refer to Ch.3.1 DIN-Rail installation.

- **DIN-Rill**





1.5 Ordering Information

Type	RJ45 power source		Functions			Feature	-	Coating
	Input	Output	Analog	Input	Output	Analog Type		
QEC-R	X	X	A	X	X	X		X

1. Type: Code 1~4

R: EtherCAT SubDevice.

2. RJ45 Power source: Code 5~6

0: RJ45 In/Out w/o power

1: RJ45 PoE Device, Red Plastic Housing

3. Functions: Code 7~9

A: Analog I/O

X: 0 ,4 ,8 input channels

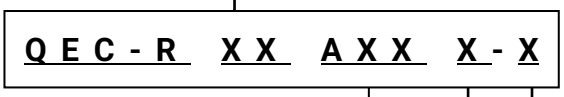
X: 0 ,4 ,8 output channels

4. Feature: Code 10

S: Standard

5. Coating: Code 11

C: Yes / N: Normal



1.5.1 Reference Ordering Part Number

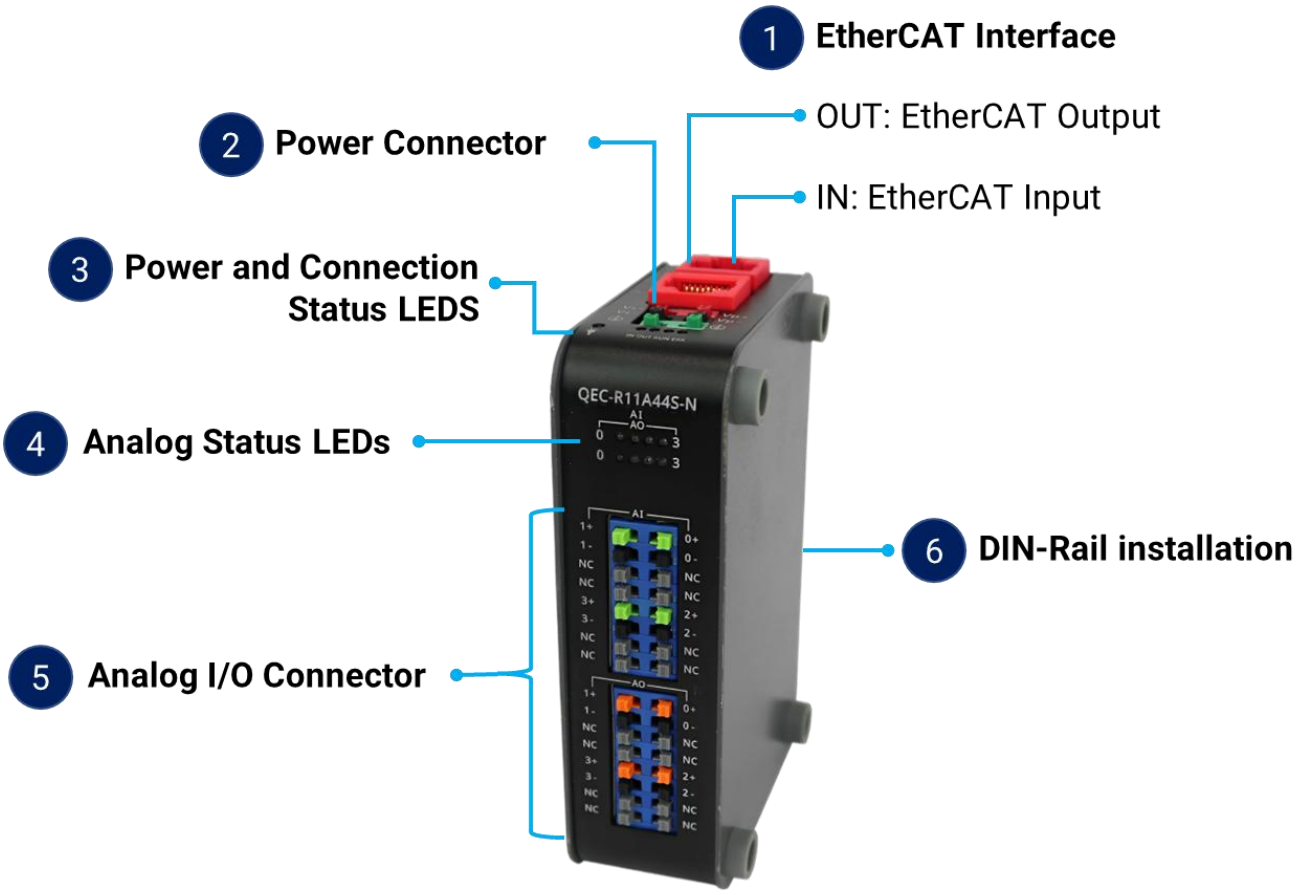
Below is the standard Part Number, please contact our sales if you need to order other part number.

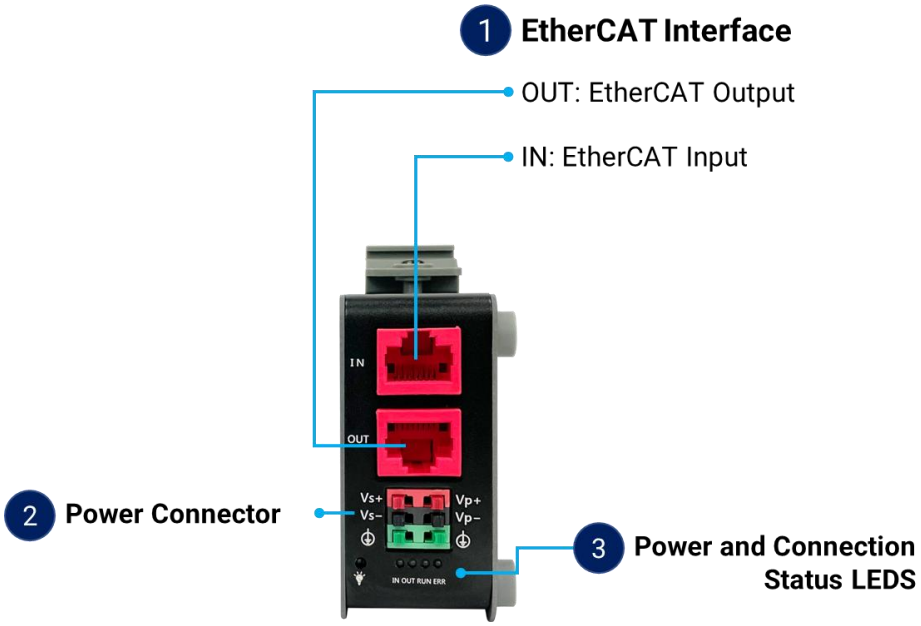
- **QEC-R00A44S-N:** EtherCAT 4-ch Analog Input and 4-ch Analog Output Module.
- **QEC-R11A44S-N:** EtherCAT 4-ch Analog Input and 4-ch Analog Output Module/PoE.
- **QEC-R11A80S-N:** EtherCAT 8-ch Analog Input Module/PoE.
- **QEC-R11A08S-C:** EtherCAT 8-ch Analog Output Module/PoE.
- **QEC-R11A40S-N:** EtherCAT 4-ch Analog Input Module/PoE.
- **QEC-R11A04S-C:** EtherCAT 4-ch Analog Output Module/PoE.

Ch. 2

Hardware System

2.1 General Technical Data



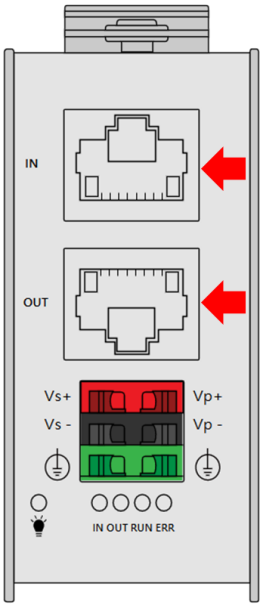


2.2 Connector Summary

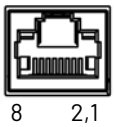
No.	Description		Type Narrative	Num #
1	EtherCAT Interface	OUT	RJ45 Connector (Gold finger)	8-pin
		IN		8-pin
2	Power Connector		Power Socket	6-pin
3	Power and Connection Status LEDs		Status LEDs	-
4	Analog Status LEDs		Status LEDs	-
5	Analog I/O Connector		Push-in Terminal (Euroblock)	8-slot
6	DIN-Rail		-	-

2.2.1 EtherCAT Interface

RJ45 Connectors.



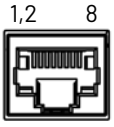
2.2.1.1 EC IN



Pin #	Signal Name	Pin #	Signal Name
1	LAN1_TX+	2	LAN1_TX-
3	LAN1_RX+	4	VS+
5	VP+	6	LAN1_RX-
7	VS- (GND)	8	VP- (GND)

* PoE LAN with the Red Housing; Regular LAN with Black Housing.
* L4, L5, L7, L8 pins are option, for RJ45 Power IN/OUT.

2.2.1.2 EC OUT

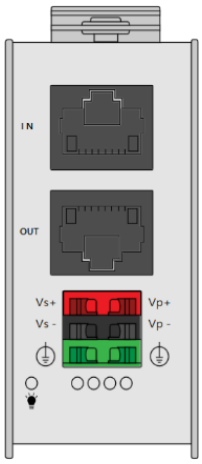
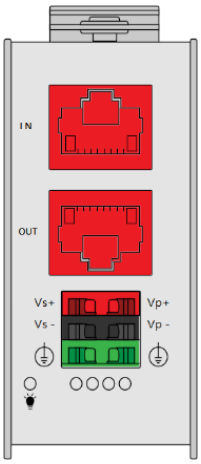


Pin #	Signal Name	Pin #	Signal Name
1	LAN2_TX+	2	LAN2_TX-
3	LAN2_RX+	4	VS+
5	VP+	6	LAN2_RX-
7	VS- (GND)	8	VP- (GND)

* PoE LAN with the Red Housing; Regular LAN with Black Housing.
* L4, L5, L7, L8 pins are option, for RJ45 Power IN/OUT.

Note. QEC's PoE (Power over Ethernet)

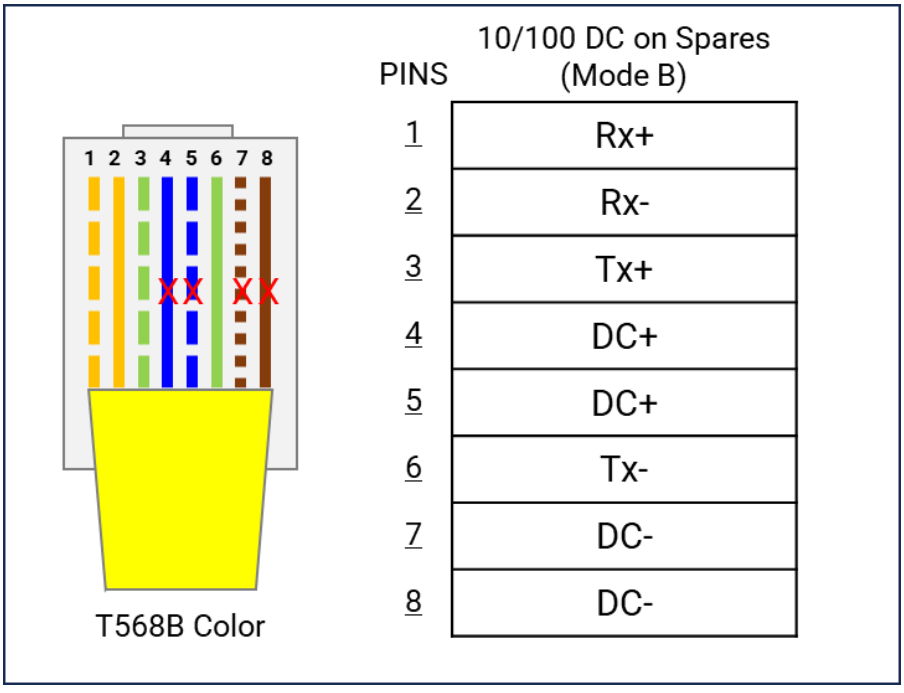
In QEC product installations, users can easily distinguish between PoE and non-PoE: if the RJ45 house is red, it is PoE type, and if the RJ45 house is black, it is non-PoE type.

	
Non-PoE type	PoE type

PoE (Power over Ethernet) is a function that delivers power over the network. QEC can be equipped with an optional PoE function to reduce cabling. In practice, PoE is selected based on system equipment, so please pay attention to the following points while evaluating and testing:

1. When connecting PoE and non-PoE devices, make sure to disconnect Ethernet cables at pins 4, 5, 7, and 8 (e.g., when a PoE-supported QEC EtherCAT MDevice connects with a third-party EtherCAT SubDevice).

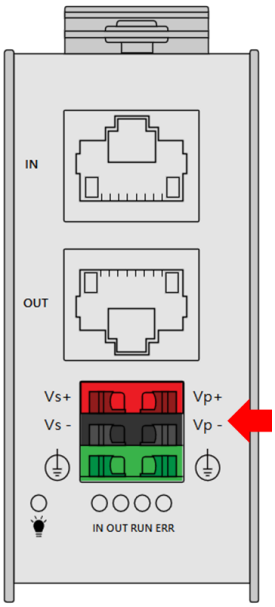
2. The PoE function of QEC is different and incompatible with EtherCAT P, and the PoE function of QEC is based on PoE Type B, and the pin functions are as follows:



3. QEC's PoE power supply is up to **24V/3A**.

2.2.2 Power Connector

Euroblock Connectors.
4-pin Power Input/Output (+V: Red / GND: Black) and 2-pin FGND (Green).



Vs for system power; Vp for peripheral power and backup power.

Pin #	Signal Name	Pin #	Signal Name
1	Vs+	2	Vp+
3	Vs- (GND)	4	Vp- (GND)
5	F.G	6	F.G

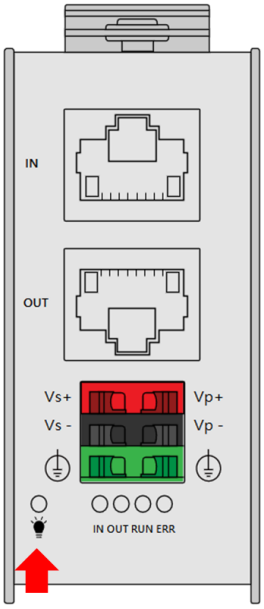
* Power Input voltage +19 to +50VDC Power Input (Typ. +24VDC)

2.2.3 Power and Connection Status LEDs

Power and connection status LEDs information.

2.2.3.1 Power Status LED

Power input is 24V (typical). The LED status provide high/low voltage warning.



Notation	States	Condition	Description
PWR	Green LED On	Voltage <= 50V and >= 45V Voltage <= 26V and >= 19V	When Vs and Vp voltages are confirmed to be normal, the Green LED will remain steady on.
	Green LED On Red LED On	Voltage < 45V and > 26V Voltage < 19V and > 12V	LEDs will alternately flash (at 0.3-second intervals) until the Vs and Vp voltages are correct.
	Orange LED On	Voltage > 50V or < 12V	Orange LED (Green + Red) will continuously flash (at 0.3-second intervals) until the Vs and Vp voltages are correct.

* Vs power status will be displayed first.

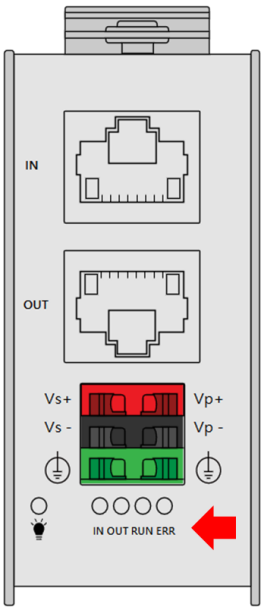
Power ERROR Code table (Red LED Flashing Display (2 seconds/cycle))：

Long Light	Short Flash	Description
0 Long Light	After microchip completes the Bootloader test, it proceeds to the APP program stage.	
	1 short flash	Microchip communication with the EtherCAT chip failed.
	2 short flashes	EtherCAT chip internal RAM test failed.
	5 short flashes or 6 short flashes	Quartz oscillator on the board abnormality.
1 Long Light	Indicates the microchip Bootloader stage during startup, APP program not yet executed.	
	1 short flash	microchip internal SRAM failed.
	2 short flashes	APP software CHECKSUM failed.
2 Long Lights	Not yet defined.	

* **Note**: If you encounter any of the above abnormal states, please contact us.

2.2.3.2 Connection Status LEDs

Connection status LEDs.



There are EtherCAT In, Out, Run, and Error Status LEDs.

Notation	Color	States	Description
In	Green	Off	No link
		Blinking	Link and activity
		On	Link without activity
Out	Green	Off	No link
		Blinking	Link and activity
		On	Link without activity
Run	Green	Off	The device is in state INIT
		Blinking	The device is in state Pre-Operation
		Single Flash	The device is in state Safe-Operation
		On	The device is in state Operation
Err	Red	Off	No error
		Blinking	Invalid Configuration
		Single Flash	Local Error
		Double Flash	Process Data Watchdog Timeout EtherCAT Watchdog Timeout
		On	The device is in state Error

2.2.4 Analog Status LEDs

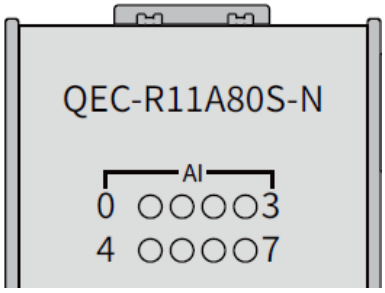
The QEC series modules are equipped with status LEDs that serve as indicators of the operational state of the internal chips rather than the status of the analog input or output channels. These LEDs remain bright to signify that the internal components are functioning correctly.

LED Behavior:

- Always Bright: The internal chips are functioning normally.
- Off: Indicates that the internal chip for the corresponding channel is not operational, which may suggest a fault or failure.

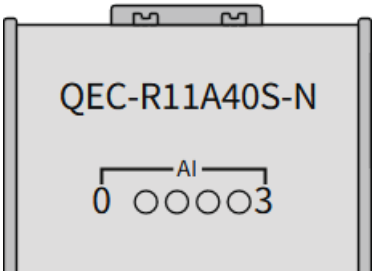
2.2.4.1 Analog Input (QEC-RXXA80S/QEC-RXXA40S)

QEC-RXXA80S: 8-slot Analog Input.



The module features 8 status LEDs corresponding to its 8 analog input channels.
These LEDs are always bright when the internal chips controlling each input channel are operational.

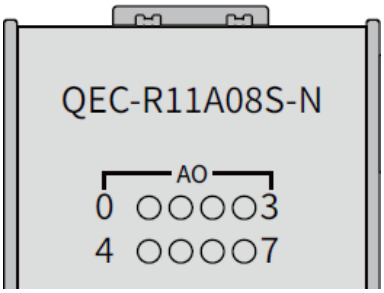
QEC-RXXA40S: 4-slot Analog Input.



The module features 4 status LEDs corresponding to its 4 analog input channels.
These LEDs are always bright when the internal chips controlling each input channel are operational.

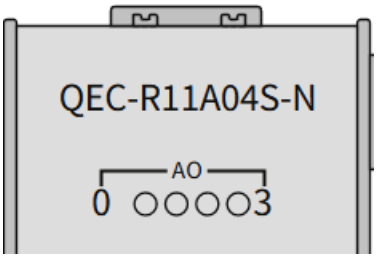
2.2.4.2 Analog Output (QEC-RXXA08S)

QEC-RXXA08S: 8-slot Analog Output.



This module has 8 status LEDs for its 8 analog output channels.
Each LED remains bright to indicate the internal chip for the corresponding output channel is functioning.

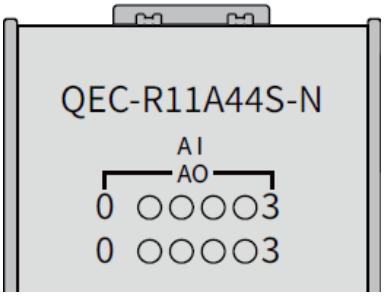
QEC-RXXA04S: 4-slot Analog Output.



This module has 4 status LEDs for its 4 analog output channels.
Each LED remains bright to indicate the internal chip for the corresponding output channel is functioning.

2.2.4.3 Analog Input/Output (QEC-RXXA44S)

4-slot Analog Input and 4-slot Analog Output.



This combination module has 4 status LEDs for the analog inputs (upper side) and 4 status LEDs for the analog outputs (lower side).
The LEDs will be continuously bright, confirming that the internal chips for both the input and output channels are working properly.

2.2.5 Analog I/O Connector

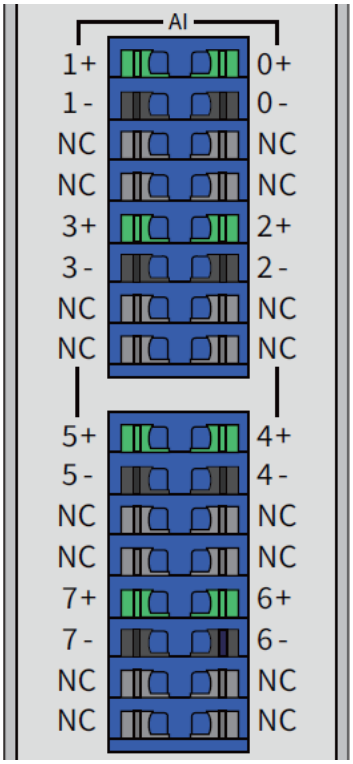
For EtherCAT SubDevice index assignments, refer to 6.2.3 Function Objects.

2.2.5.1 Analog Input (QEC-RXXA80S/QEC-RXXA40S)

QEC-RXXA80S: 8-slot Analog Input.
The QEC-RXXA80S module supports 8 differential analog input channels (AI00 to AI07).

- Analog Input: Positive (Green), Negative (Black).
- Others: NC (Gray).

Pin #	Signal Name
1+	AI01+
1-	AI01-
-	NC
-	NC
3+	AI03+
3-	AI03-
-	NC
-	NC
5+	AI05+
5-	AI05-
-	NC
-	NC
7+	AI07+
7-	AI07-
-	NC
-	NC



Pin #	Signal Name
0+	AI00+
0-	AI00-
-	NC
-	NC
2+	AI02+
2-	AI02-
-	NC
-	NC
4+	AI04+
4-	AI04-
-	NC
-	NC
6+	AI06+
6-	AI06-
-	NC
-	NC

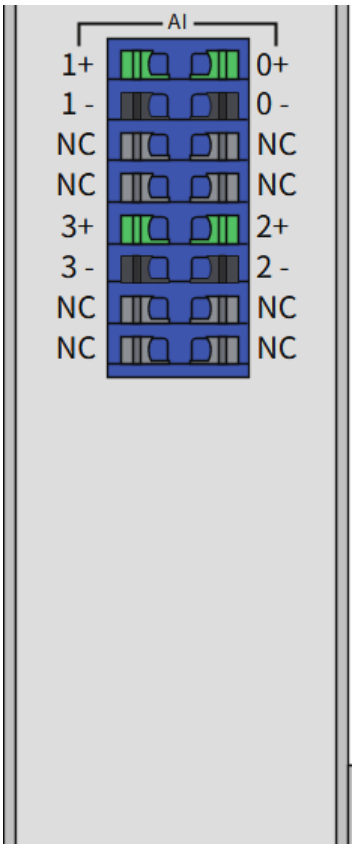
Analog Input Specifications:

- Input Type: Voltage (V)
- Input Range ±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
- Input Impedance: Constant resistive ≥ 1 MΩ
- Overvoltage Protection: Up to ±24 V
- Resolution: 16-bit with accuracy of ±0.2% Full-Scale Range (FSR) at 25°C

QEC-RXXA40S: 4-slot Analog Input.

The QEC-RXXA40S module supports 4 differential analog input channels (AI00 to AI03).

- Analog Input: Positive (Green), Negative (Black).
- Others: NC (Gray).

Pin #	Signal Name		Pin #	Signal Name
1+	AI01+		0+	AI00+
1-	AI01-		0-	AI00-
-	NC		-	NC
-	NC		-	NC
3+	AI03+		2+	AI02+
3-	AI03-		2-	AI02-
-	NC		-	NC
-	NC		-	NC
-	-		-	-
-	-		-	-
-	-		-	-
-	-		-	-
-	-		-	-
-	-		-	-
-	-		-	-
-	-		-	-

Analog Input Specifications:

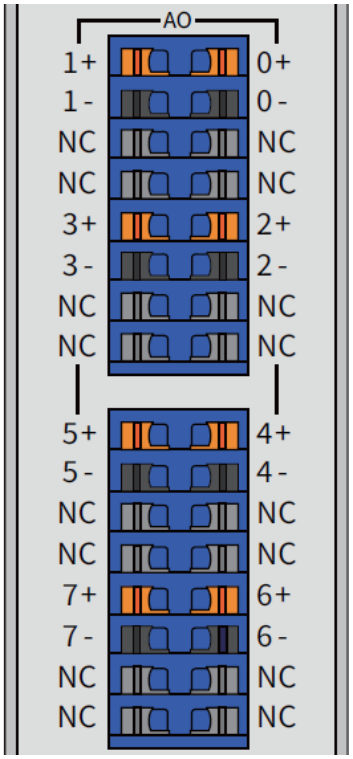
- Input Type: Voltage (V)
- Input Range ±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
- Input Impedance: Constant resistive ≥ 1 MΩ
- Overvoltage Protection: Up to ±24 V
- Resolution: 16-bit with accuracy of ±0.2% Full-Scale Range (FSR) at 25°C

2.2.5.2 Analog Output (QEC-RXXA08S/QEC-RXXA04S)

QEC-RXXA08S: 8-slot Analog Output.
The QEC-RXXA08S module supports 8 analog output channels (AO00 to AO07).

- Analog Output: Positive (Orange), Negative (Black).
- Others: NC (Gray).

Pin #	Signal Name
1+	AO01+
1-	AO01-
-	NC
-	NC
3+	AO03+
3-	AO03-
-	NC
-	NC
5+	AO05+
5-	AO05-
-	NC
-	NC
7+	AO07+
7-	AO07-
-	NC
-	NC



Pin #	Signal Name
0+	AO00+
0-	AO00-
-	NC
-	NC
2+	AO02+
2-	AO02-
-	NC
-	NC
4+	AO04+
4-	AO04-
-	NC
-	NC
6+	AO06+
6-	AO06-
-	NC
-	NC

Analog Output Specifications:

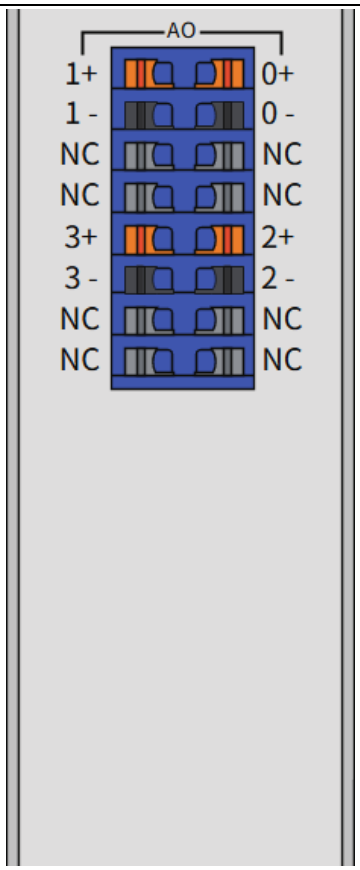
- Output Type: Voltage (V, mV), Current (mA)
- Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
- Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
- Resolution: 16-bit with accuracy ±0.2% FSR@25°C
- Slew Rate: Configurable (Option)
- Drift: ±10 ppm/°C

QEC-RXXA04S: 4-slot Analog Output.

The QEC-RXXA04S module supports 4 analog output channels (AO00 to AO03).

- Analog Output: Positive (Orange), Negative (Black).
- Others: NC (Gray).

Pin #	Signal Name
1+	AO01+
1-	AO01-
-	NC
-	NC
3+	AO03+
3-	AO03-
-	NC
-	NC
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-



Pin #	Signal Name
0+	AO00+
0-	AO00-
-	NC
-	NC
2+	AO02+
2-	AO02-
-	NC
-	NC
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

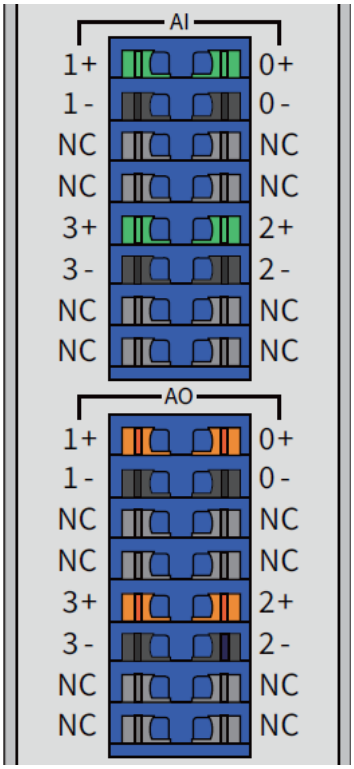
Analog Output Specifications:

- Output Type: Voltage (V, mV), Current (mA)
- Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
- Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
- Resolution: 16-bit with accuracy ±0.2% FSR@25°C
- Slew Rate: Configurable (Option)
- Drift: ±10 ppm/°C

2.2.5.3 Analog Input/Output (QEC-RXXA44S)

The QEC-RXXA44S module supports 4 differential analog input channels (AI00 to AI03) and 4 analog output channels (AO00 to AO03).

- Analog Input: Positive (Green), Negative (Black).
- Analog Output: Positive (Orange), Negative (Black).
- Others: NC (Gray).

Pin #	Signal Name		Pin #	Signal Name
1+	AI01+		0+	AI00+
1-	AI01-		0-	AI00-
-	NC		-	NC
-	NC		-	NC
3+	AI03+		2+	AI02+
3-	AI03-		2-	AI02-
-	NC		-	NC
-	NC		-	NC
1+	AO01+		0+	AO00+
1-	AO01-		0-	AO00-
-	NC		-	NC
-	NC		-	NC
3+	AO03+		2+	AO02+
3-	AO03-		2-	AO02-
-	NC		-	NC
-	NC		-	NC

Analog Input Specifications:

- Input Type: Voltage (V)
- Input Range ±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
- Input Impedance: Constant resistive ≥ 1 MΩ
- Overvoltage Protection: Up to ±24 V
- Resolution: 16-bit with accuracy of ±0.2% Full-Scale Range (FSR) at 25°C

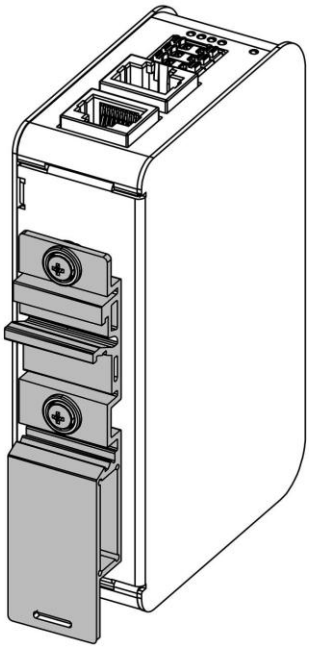
Analog Output Specifications:

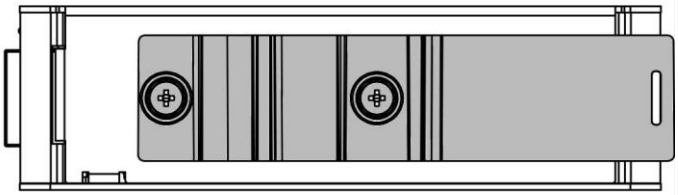
- Output Type: Voltage (V, mV), Current (mA)
- Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
- Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
- Resolution: 16-bit with accuracy ±0.2% FSR@25°C
- Slew Rate: Configurable (Option)
- Drift: ±10 ppm/°C

2.2.6 DIN-Rail installation

QEC-RXXA series is an easy-install design to help you set-up your modules easily. Please refer to Ch.3.1 DIN-Rail installation.

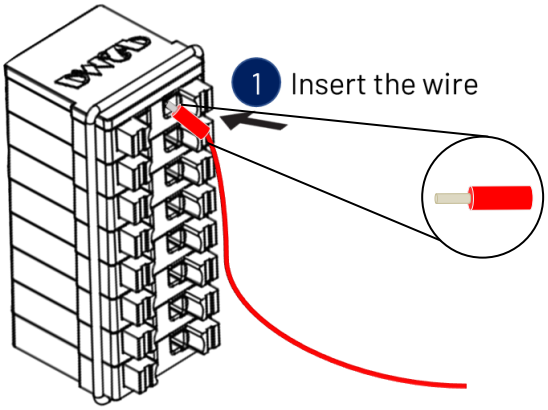
- **DIN-Rill**

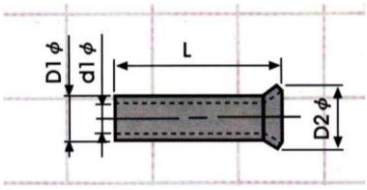




2.3 Wiring to the Connector

2.3.1 Connecting the wire to the connector

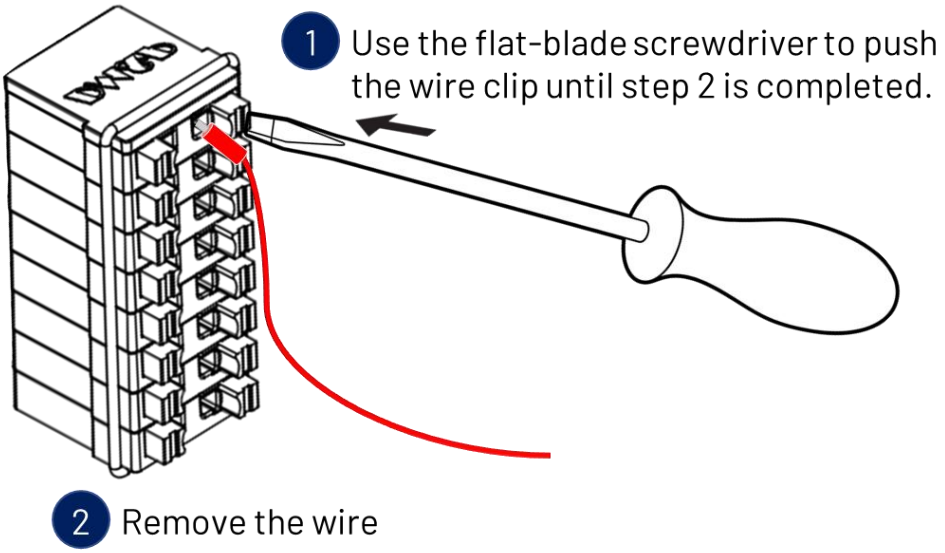




Insulated Terminals Dimensions (mm)

Position	L	ØD1	Ød1	ØD2
CN 0.5-6	6.0	1.3	1.0	1.9
CN 0.5-8	8.0	1.3	1.0	1.9
CN 0.5-10	10.0	1.3	1.0	1.9

2.3.2 Removing the wire from the connector



2.3.3 Application Wiring

For application wiring reference.

2.3.3.1 Analog Input

Example for Analog Input Operation. (QEC-RXXA40S/QEC-RXXA80S/QEC-RXXA44S)

In the following diagram, an analog input operation is shown using Channel 0 (AI00) of the QEC-RXXA module. The positive terminal (AI00+) connects to the signal source, and the negative terminal (AI00-) connects to the ground (GND).

- AI00+: Connects to the positive side of the input signal (e.g., a voltage sensor).
- AI00-: Connects to the negative side (ground) of the input signal.

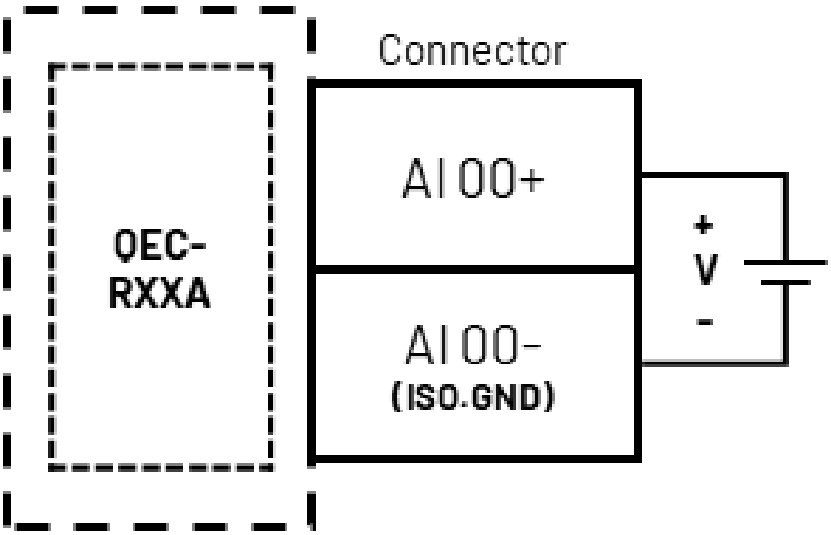


Figure 2.3.3.1: Analog Input Wiring Example

* **Note**: Ensure the input voltage does not exceed the specified range to avoid damaging the device.

Analog Input Specification:

Input Type	Voltage (V)
Input Range	±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
Input Impedance	Constant resistive ≥ 1 MΩ
Overvoltage Protection	Up to ±24 V

2.3.3.2 Analog Output

Example for Analog Output Operation. (QEC-RXXA04S/QEC-RXXA08S/QEC-RXXA44S)

The diagram below illustrates an example of analog output wiring using Channel 0 (AO00) of the QEC-RXXA module. This channel can output either a voltage or current signal, depending on the connected device.

Current:

- AO00+: Connects to the positive side of the device receiving the signal.
- AO00-: Connects to the ground of the device receiving the signal.

Voltage:

- AO01+: Connects to the positive side of the device receiving the signal.
- AO01-: Connects to the ground of the device receiving the signal.

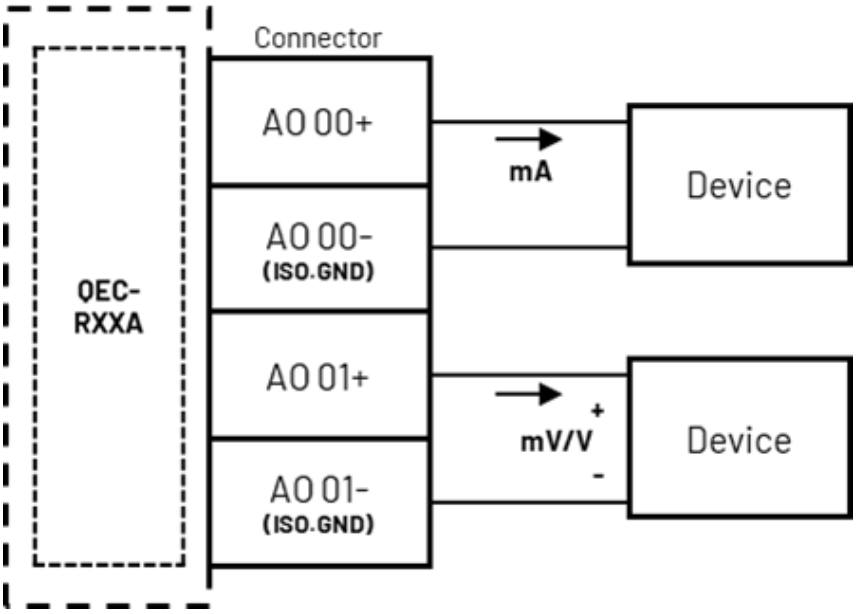


Figure 2.3.3.2: Analog Output Wiring Example

* **Note**: Ensure the connected device supports the output type (voltage or current) to avoid misconfiguration.

Analog Output Specification:

Output Type	Voltage (V, mV), Current (mA)
Output Current	0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
Output Voltage	0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V

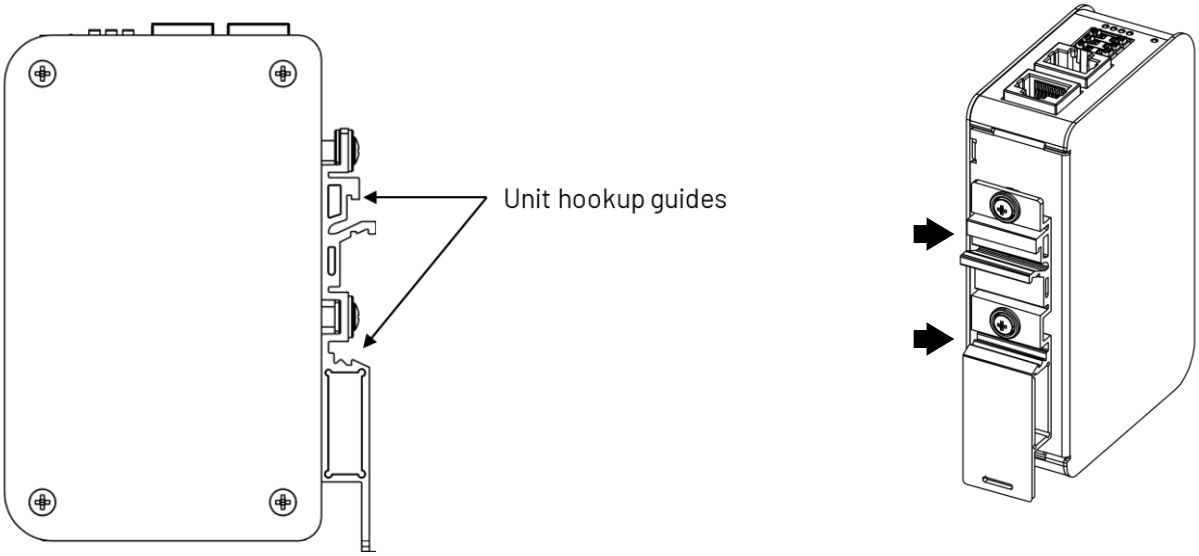
Ch. 3

Hardware Installation

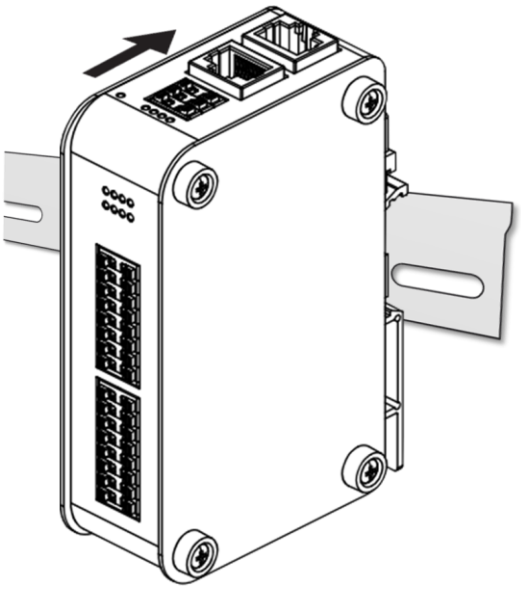
This section describes how to install QEC-RXXA. Please turn OFF the power supply before you mount QEC-RXXA. Always mount QEC-RXXA one at a time.

3.1 DIN-Rail installation

Slide in the QEC-RXXA on the hookup guides and press the QEC-RXXA with a certain amount of force against the DIN track until the DIN Track mounting hook lock into place.



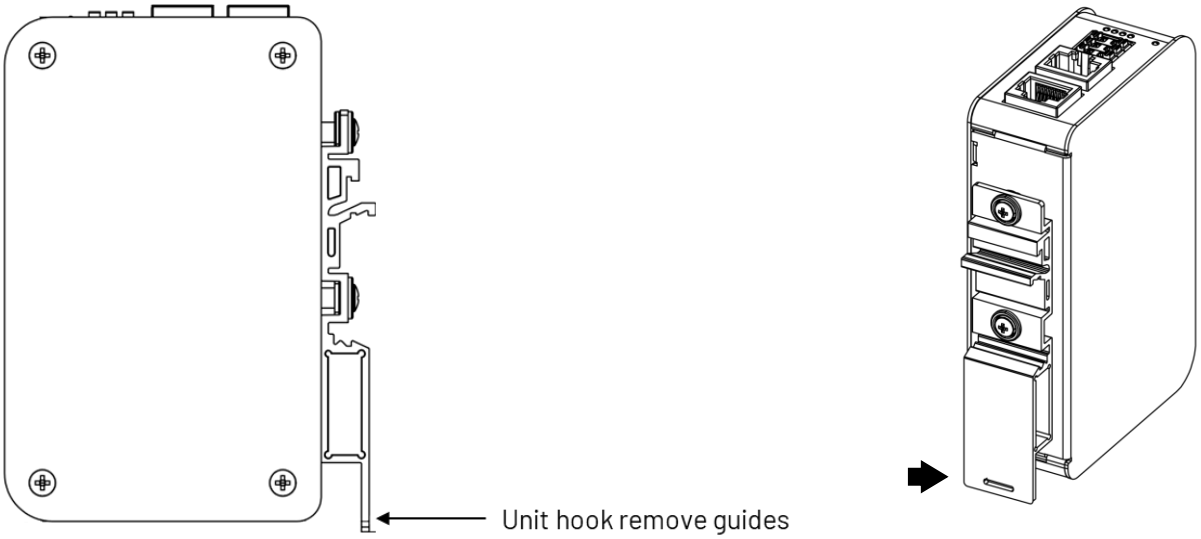
When you mount the QEC-RXXA, releasing the DIN track mounting hook on the QEC-RXXA is unnecessary. After you mount the QEC-RXXA, make sure it is locked to the DIN Track.



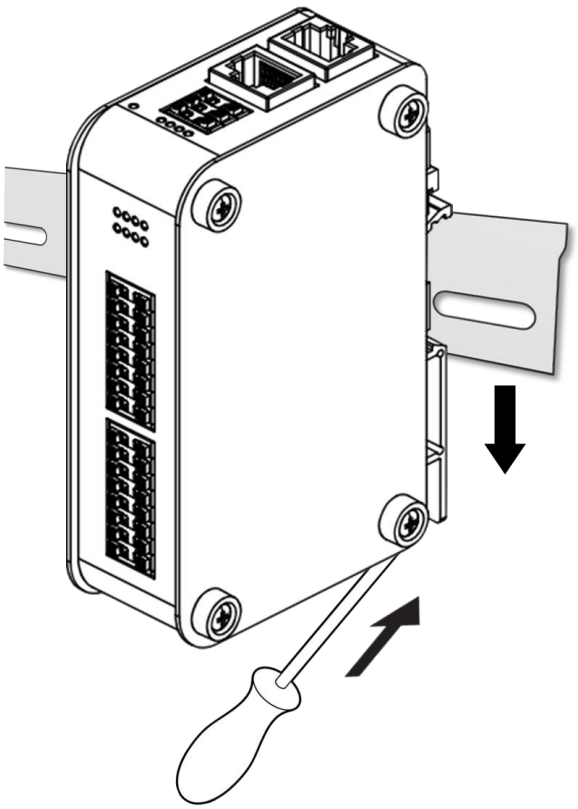
Note: Always turn OFF the Unit power supply and I/O power supply before connecting and removing the QEC-RXXA.

3.2 Removing QEC-RXXA Unit

Use a flat-blade screwdriver to remove the DIN Track mounting hook on the unit.



Pull down and out the flat-blade screwdriver with force against the DIN track until you hear the DIN Track remove the hook.



Ch. 4

EtherCAT Communication

4.1 EtherCAT Basics

EtherCAT (Ethernet for Control Automation Technology) is an Ethernet-based fieldbus system developed by Beckhoff Automation. The protocol is standardized in IEC 61158 and is suitable for both hard and soft real-time computing requirements in automation technology.

The goal during the development of EtherCAT was to apply Ethernet for automation applications requiring short data update times (also called cycle times; ≤ 100 µs) with low communication jitter (for precise synchronization purposes; ≤ 1 µs) and reduced hardware costs. Typical application fields for EtherCAT are machine controls (e.g., semiconductor tools, metal forming, packaging, injection molding, assembly systems, printing machines, robotics). Remote-controlled hump yard facilities are used in the railroad industry.

4.2 EtherCAT Cabling

The cable length between two EtherCAT devices must not exceed 100 m.

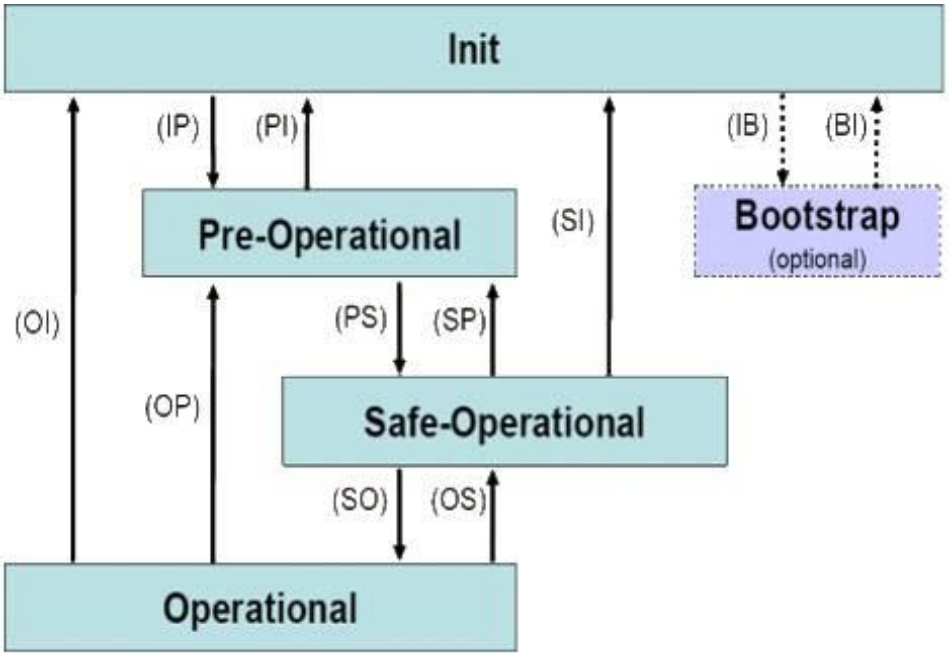
Cables and connectors

For connecting EtherCAT devices, only Ethernet connections (cables + plugs) that meet the requirements of at least category 5 (CAT5) according to EN 50173 or ISO/IEC 11801 should be used. EtherCAT uses 4 wires for signal transfer.
The pin assignment is compatible with the Ethernet standard (ISO/IEC 8802-3).

Pin	Color of conductor	Signal	Description
1	Yellow	TD+	Transmission Data+
2	Orange	TD-	Transmission Data-
3	White	RD +	Receiver Data+
6	Blue	RD -	Receiver Data-

4.3 EtherCAT State Machine

The state of the EtherCAT SubDevice is controlled via the EtherCAT State Machine (ESM). Depending upon the state, different functions are accessible or executable in the EtherCAT SubDevice. Specific commands must be sent by the EtherCAT MDevice to the device in each state, particularly during the bootup of the SubDevice.



A distinction is made between the following states:

- Init
- Pre-Operational
- Safe-Operational and
- Operational
- Boot

The regular state of each EtherCAT SubDevice after bootup is the OP state.

Init

After switch-on the EtherCAT SubDevice in the Init state. No mailbox or process data communication is possible. The EtherCAT MDevice initializes sync manager channels 0 and 1 for mailbox communication.

Pre-Operational (Pre-Op)

During the transition between Init and Pre-Op the EtherCAT SubDevice checks whether the mailbox was initialized correctly. In Pre-Op state mailbox communication is possible, but not process data communication. The EtherCAT MDevice initializes the sync manager channels for process data (from sync manager channel 2), the FMMU channels and, if the SubDevice supports configurable mapping, PDO mapping or the sync manager PDO assignment. In this state the settings for the process data transfer and perhaps terminal-specific parameters that may differ from the default settings are also transferred.

Safe-Operational (Safe-Op)

During transition between Pre-Op and Safe-Op the EtherCAT SubDevice checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct. Before it acknowledges the change of state, the EtherCAT SubDevice copies current input data into the associated DP-RAM areas of the EtherCAT SubDevice controller (ECSC). In Safe-Op state mailbox and process data communication is possible, although the SubDevice keeps its outputs in a safe state, while the input data are updated cyclically

* **Note**: Outputs in SAFEOP state
The default set watchdog monitoring sets the outputs of the module in a safe state - depending on the settings in SAFEOP and OP - e.g. in OFF state. If this is prevented by deactivation of the watchdog monitoring in the module, the outputs can be switched or set also in the SAFEOP state.

Operational (Op)

Before the EtherCAT MDevice switches the EtherCAT SubDevice from Safe-Op to Op it must transfer valid output data. In the Op state the SubDevice copies the output data of the MDevices to its outputs. Process data and mailbox communication is possible.

Bootstrap

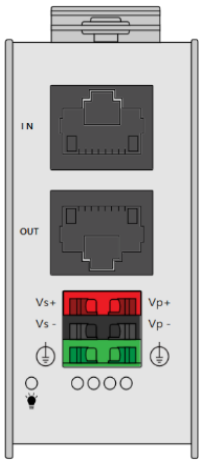
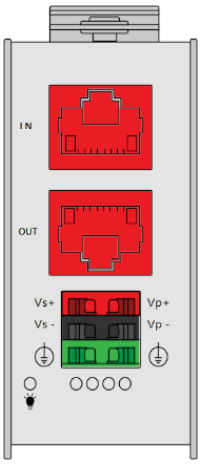
In the Boot state the SubDevice firmware can be updated. The Boot state can only be reached via the Init state. In the Boot state mailbox communication via the file access over EtherCAT (FoE) protocol is possible, but no other mailbox communication and no process data communication

Ch. 5

Getting Started

Note. QEC's PoE (Power over Ethernet)

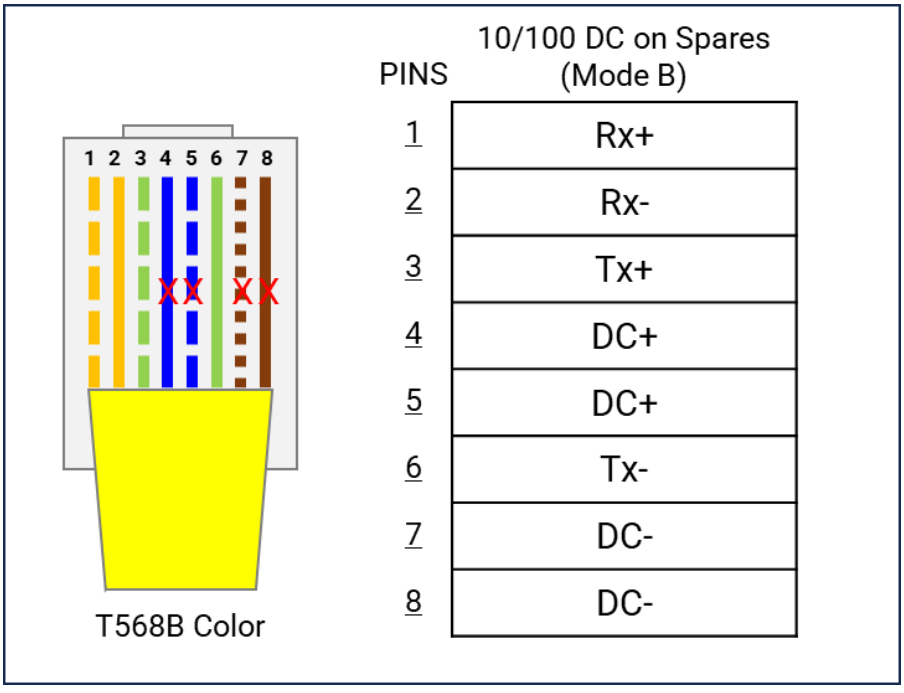
In QEC product installations, users can easily distinguish between PoE and non-PoE: if the RJ45 house is red, it is PoE type, and if the RJ45 house is black, it is non-PoE type.

	
Non-PoE type	PoE type

PoE (Power over Ethernet) is a function that delivers power over the network. QEC can be equipped with an optional PoE function to reduce cabling. In practice, PoE is selected based on system equipment, so please pay attention to the following points while evaluating and testing:

1. When connecting PoE and non-PoE devices, make sure to disconnect Ethernet cables at pins 4, 5, 7, and 8 (e.g., when a PoE-supported QEC EtherCAT MDevice connects with a third-party EtherCAT SubDevice).

2. The PoE function of QEC is different and incompatible with EtherCAT P, and the PoE function of QEC is based on PoE Type B, and the pin functions are as follows:



3. QEC's PoE power supply is up to **24V/3A**.

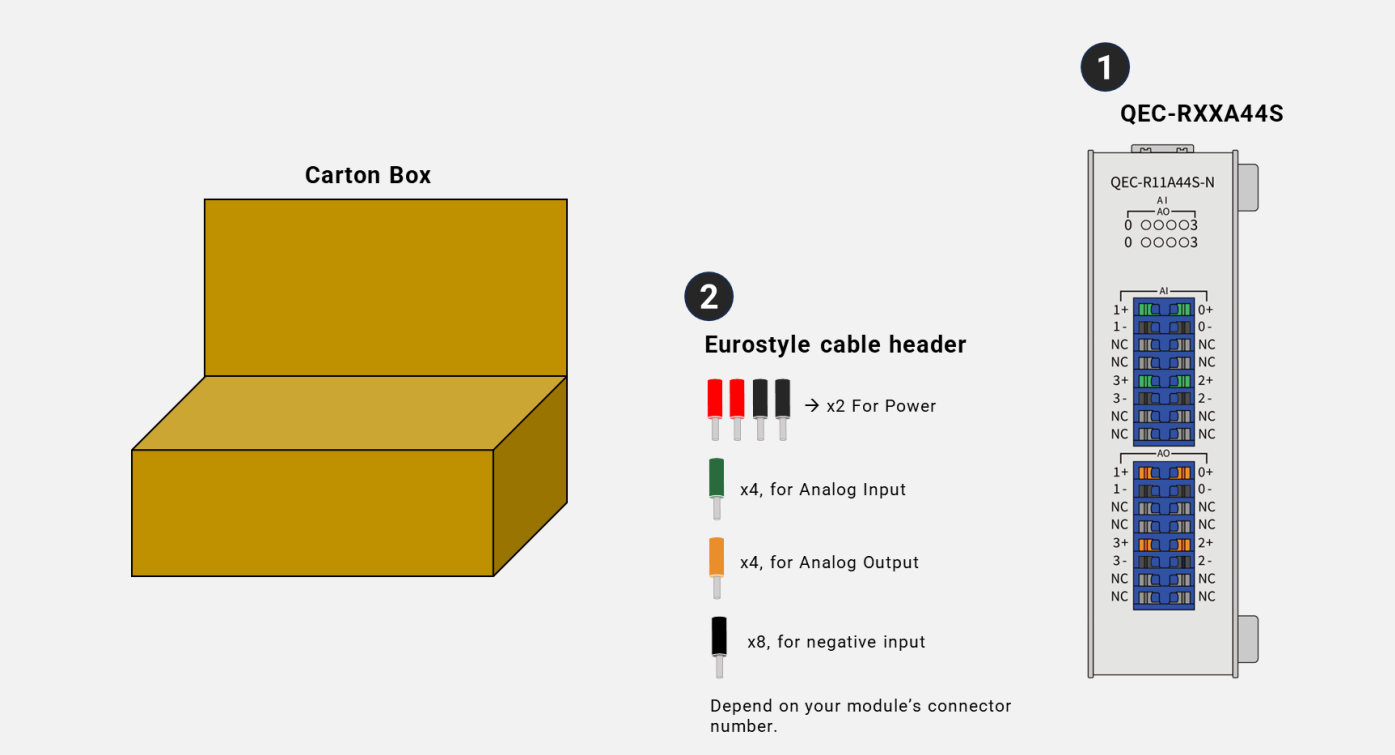
5.1 Hardware Preparation and Connection

Hardware Preparation and Connection.

5.1.1 Package Contents

The package includes the following items:

1. QEC-RXXA Series (Depend on your order)
2. Cable-set (Euro-type connector)

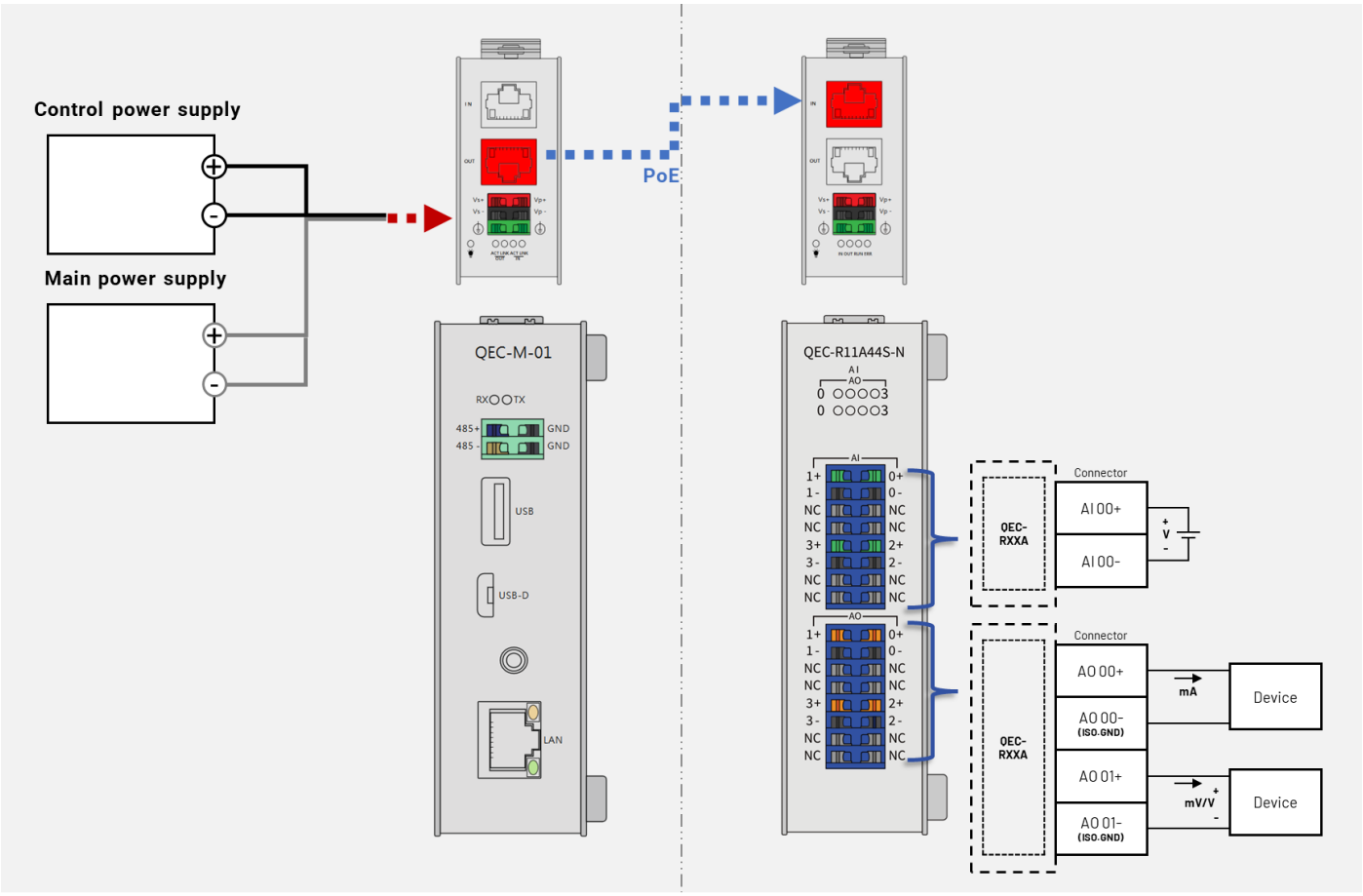


Please get in touch with our sales channels, or email to info@icop.com.tw, if any of the package items are missing or damaged.
Also, feel free to reuse the shipping materials and cartons for further storing and shipping needs in the future.

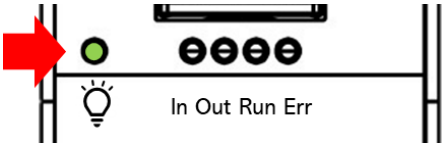
5.1.2 Preparation and Connection

The following devices are used here:

1. QEC-M-01P (EtherCAT MDevice/PoE)
2. QEC-R11A44S-N (EtherCAT SubDevice Analog Input and Output/PoE)
3. 24V power supplier
4. RJ45 cable



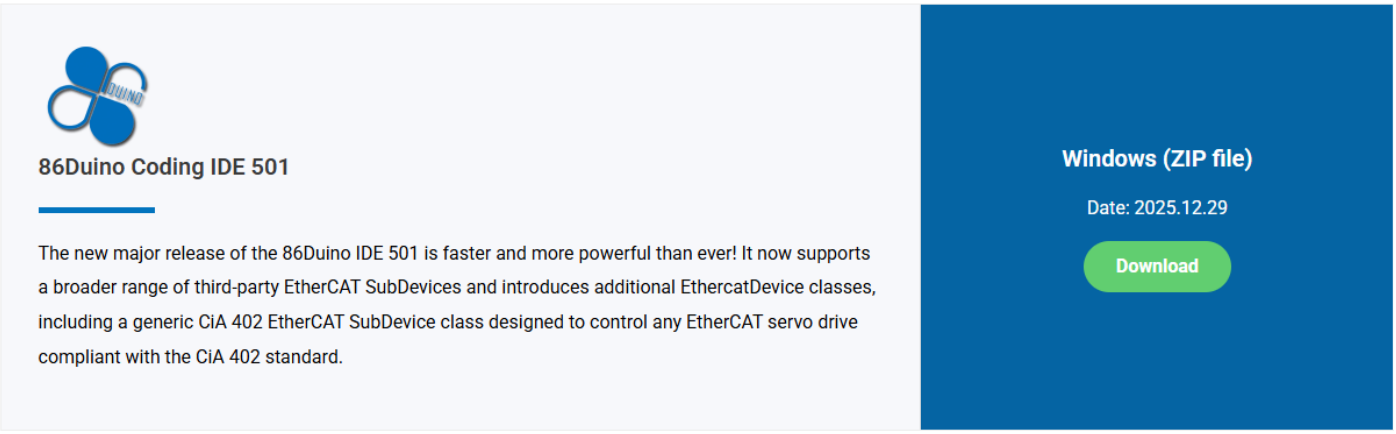
All QEC devices have PoE functions, so we only need to connect to Vs+/Vs and Vp+/Vp power pins (EU terminals) supplies for 19 to 50VDC power on QEC-M-01P, and then other devices will be powered by PoE. After powering on, you'll see the power LED light up and verify that the "PWR" LED indicators are ON (green).



1. Using the EtherCAT Out port (top side) connected to the EtherCAT In port of QEC-R11A44S via RJ45 cable (powered by PoE).
2. Connect to Vs+/Vs- and Vp+/Vp- power supplies via EU terminals for 24V power.

5.2 Software/Development Environment

Download 86duino IDE from https://www.qec.tw/software/.



After downloading, please unzip the downloaded zip file, no additional software installation is required, just double-click **86duino.exe** to start the IDE.

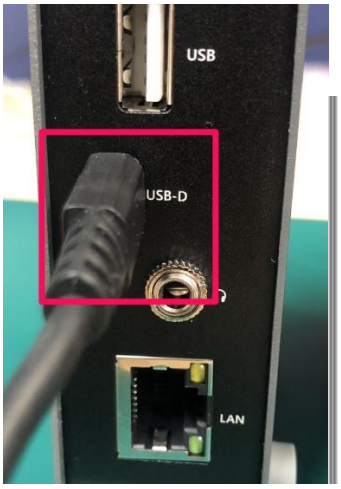
* **Note**: If Windows displays a warning, click Details once and then click the Continue Run button once.

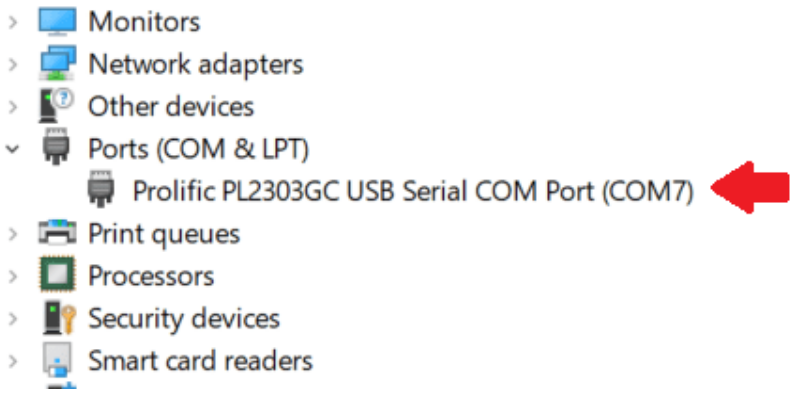
86Duino Coding IDE 501+ looks like below.

5.3 Connect to your PC and set up the environment

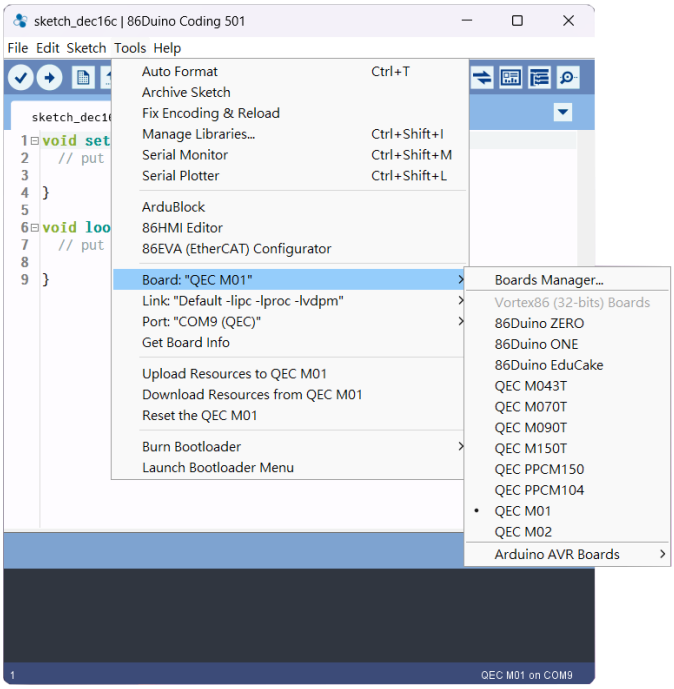
Follow the steps below to set up the environment:

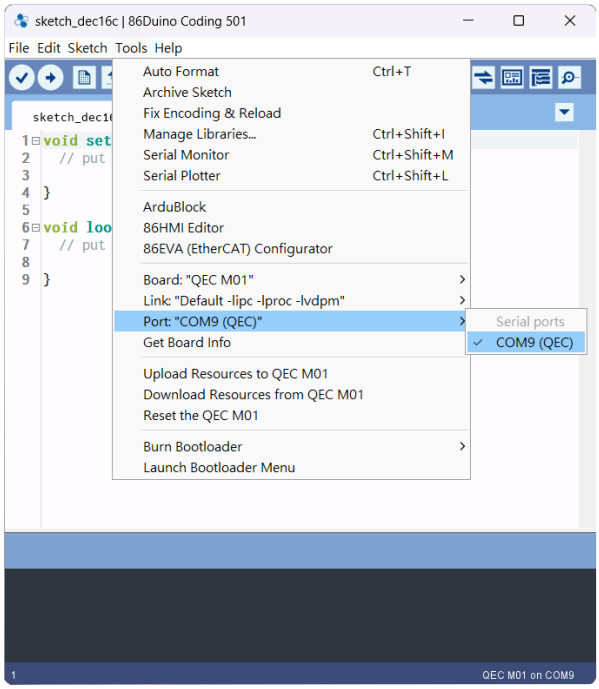
1. Connect the QEC-M-01 to your PC via a Micro USB to USB cable (86Duino IDE installed).
2. Turn on the QEC power.
3. Open "**Device Manager**" (select in the menu after pressing Win+X) ->" **Ports (COM & LPT)**" in your PC and expand the ports; you should see that the "**Prolific PL2303GC USB Serial COM Port (COMx)**" is detected; if not, you will need to install the required drivers.
   (For Windows PL2303 driver, you can download here)





4. Open the 86Duino IDE.
5. Select the correct board: In the IDE's menu, select "**Tools**" > "**Board**" > "**QEC-M01**" (or the QEC MDevice model you use).
6. Select Port: In the IDE's menu, select "**Tools**" > "**Port**" and select the USB port to connect to the QEC MDevice (in this case, COM9 (QEC)).





5.4 Use 86EVA with code

This example shows how to operate the EtherCAT MDevice (QEC-M-01) and the QEC-R11A44S module (EtherCAT Analog I/O module) through the 86Duino IDE's graphical low-code programming tool, 86EVA.

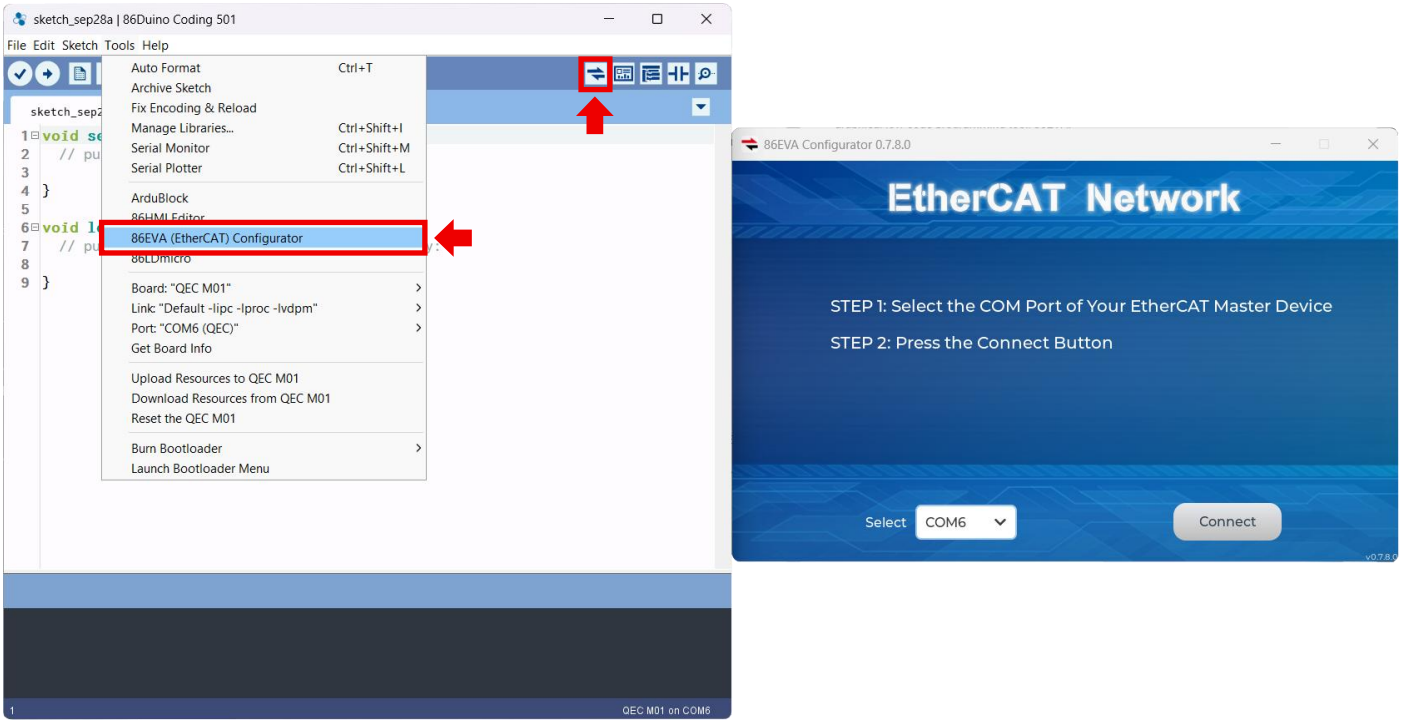
Software Tools Description:

- **86EVA (EVA, EtherCAT-Based Virtual Arduino):**
  is a graphical EtherCAT configuration tool based on the EtherCAT Library in the 86Duino IDE and is one of the development kits for 86Duino.

We will read analog input AI00 (voltage) and sweep analog output AO00 from 0 V → 5 V in 1-V steps every second.

5.4.1 Step 1: Turn on 86EVA and scan

The 86EVA tool can be opened via the following buttons.



Please select the correct COM port and then click the "Connect" button.

Once you have confirmed that the correct COM port has been selected of QEC-M-01, press the Connect button to start scanning the EtherCAT network.

The connected devices will be displayed after the EtherCAT network has been scanned.

5.4.2 Step 2: Set the parameters

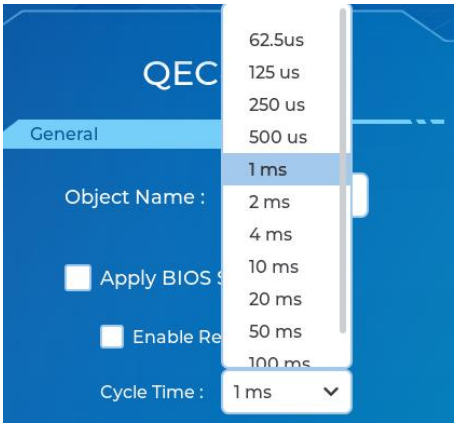
Press twice on the scanned device image to enter the corresponding parameter setting screen.

QEC-M-01

Press twice on the image of the QEC-M-01 to see the parameter settings.

Please check the following configures.

1. Turn off the "**Apply BIOS Settings**".
2. Select "**1ms**" to the Cycle Time.



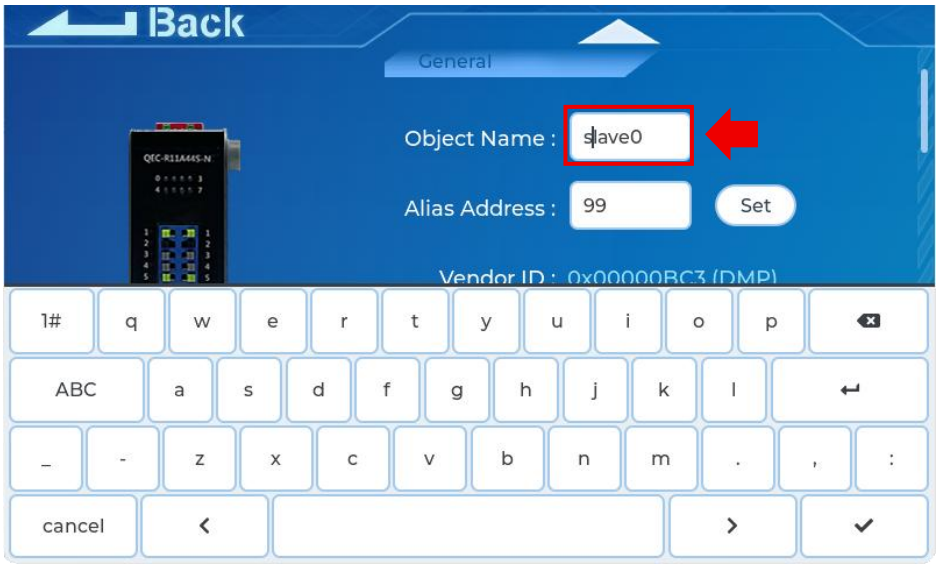
Click "**Back**" in the upper left corner to return.

QEC-R11A44S

Press twice on the image of the QEC-R11A44S to see the parameter settings.

The page will show the Object Name, Alias Address, Vendor ID, Product Code, Virtual Arduino Mapping, and Virtual Servo Configuration parameters.

Please change the Object Name to “**slave0**”.
It’ll appear a keyboard after you click the Object Name.

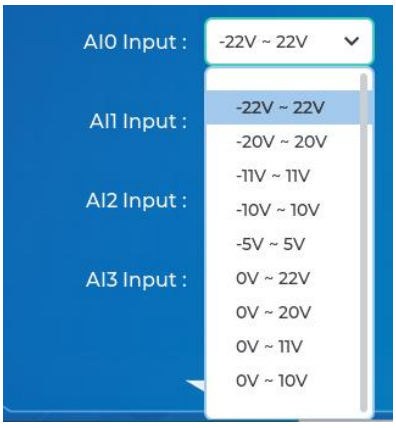


5.4.2.1 Configure Analog I/O Range

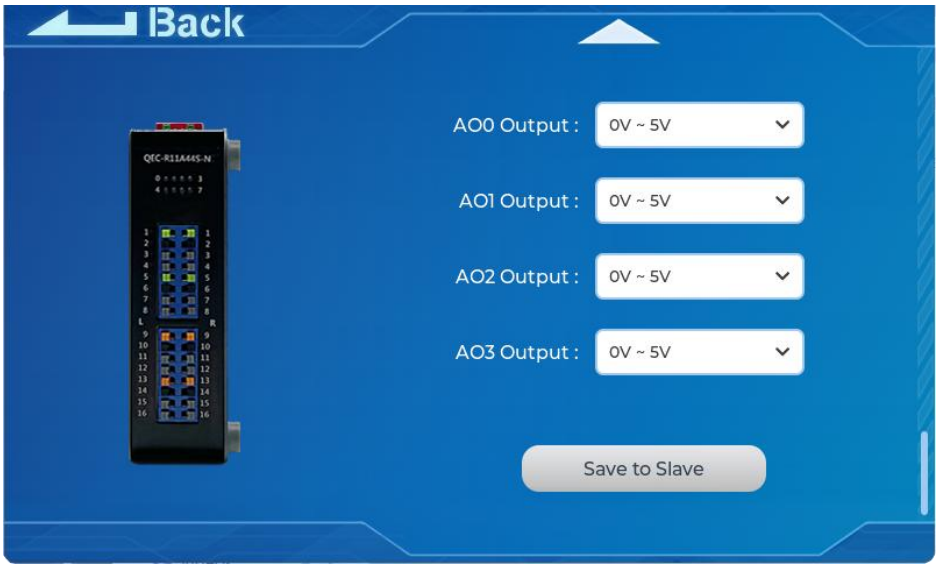
Users can choose different analog input and analog output ranges. In this guide, please select AI0 Input's analog input range to "**-22V ~ 22V**" (default), and AO0 Output's analog output range to "**0V ~ 5V**" (default).

Go down to the "**Range Configuration**" area.
First, you can see 4-channel of analog input range configuration.

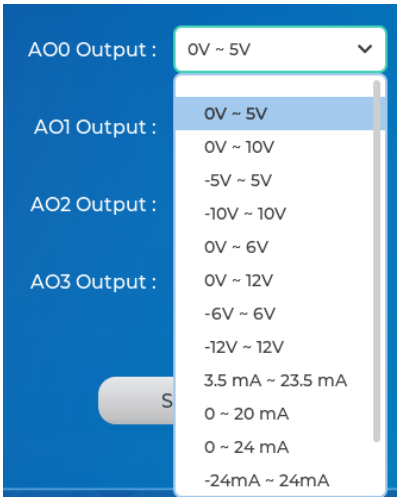
Options in the AI dropdown list are shown in the picture below.



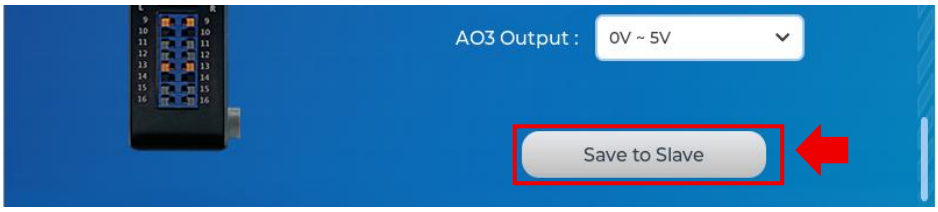
Then, you can see 4-channel of analog output range configuration.



Options in the AO dropdown list are shown in the picture below.



Then, click the "**Save to Slave**" button to save the range configuration to your QEC-R11A44S.

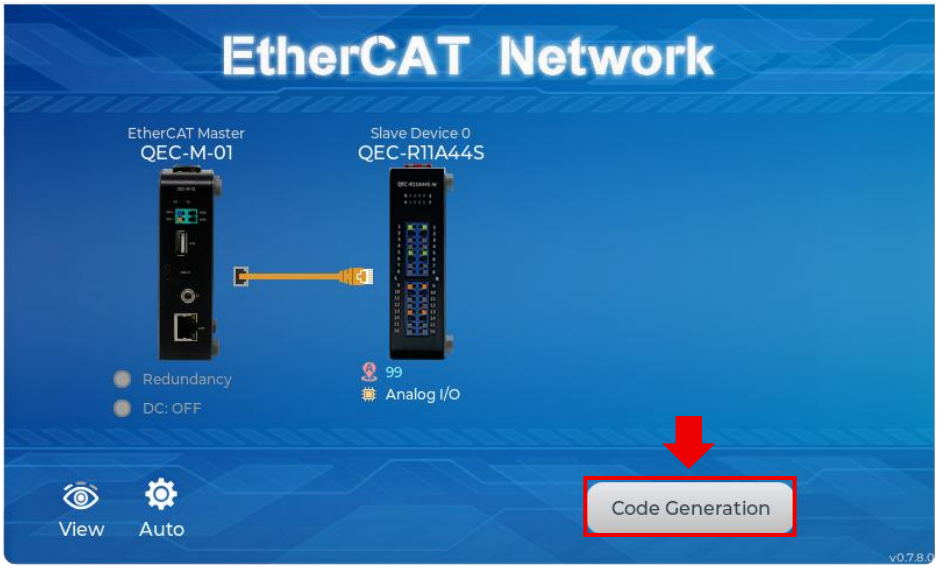


After successfully configuring the SubDevice, it'll display a “**Success**” window, and ask you to reset your SubDevice to apply the new settings.

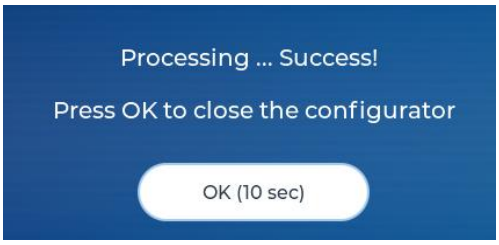
Now, the analog input and output range have been configured.
Click "**Back**" in the upper left corner to return.

5.4.3 Step 3: Generate the code

Once you've set your device's parameters, go back to the home screen and press the "**Code Generation**" button in the bottom right corner.

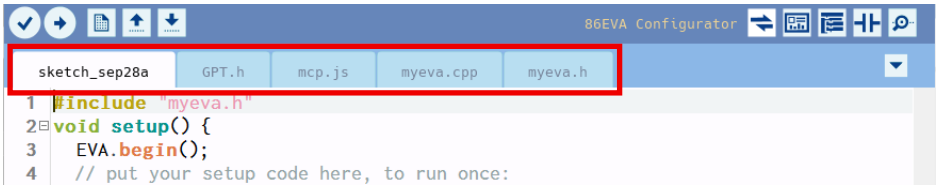


When you're done, double-click the "**OK**" button to turn off 86EVA, or it will close in 10 seconds.



The generated code and files are as follows:

- sketch_sep10b: Main Project (.ino, depending on your project name)
- myeva.cpp: C++ program code of 86EVA
- myeva.h: Header file of 86EVA



***Additional note:**

After 86EVA generates code, the following code will be automatically generated in the main program (.ino), and any of them missing will cause 86EVA not to work.

1. `#include "myeva.h"` : Include EVA Header file
2. `EVA.begin();` in `setup()` : Initialize the EVA function

5.4.4 Step 4: Write the code

Before operating the EtherCAT network, you must configure it once. The process should be from Pre-OP to OP mode in EtherCAT devices. 86EVA will automatically handle the EtherCAT State Machine in the background.

The programming code from 86EVA are set as the following by default:

- QEC-R11 module: `EthercatDevice_QECR11A44S` object.
- EtherCAT mode: ECAT_SYNC.

And here is the setting by users:

- EtherCAT Cycle time: 1 millisecond.
- The `EthercatMaster` object (“EcatMaster”) represents the QEC-M-01, while the `EthercatDevice_QECR11A44S` object (“slave0”) represents the QEC-R11A44S module.

In this section, we will read analog input AI00 (voltage) and sweep analog output AO00 from 0 V → 5 V in 1-V steps every second.

A. In Setup Function:

In the `setup()` function, initialize communication, enter OP, and configure the analog ranges. Follow the steps below:

1. Initialize Serial Communication
    - Start serial communication at a baud rate of 115200.
2. Start the 86EVA
    - Use the `EVA.begin()` function to start and initialize the EtherCAT network.

B. In Loop Function:

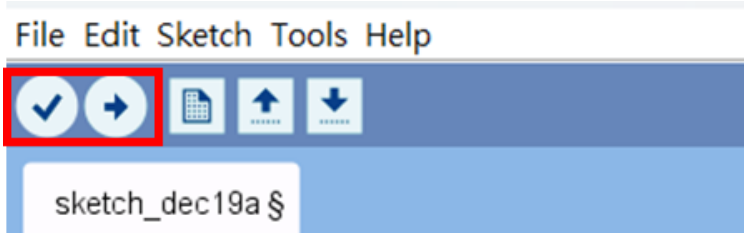
In the `loop()` function, print the measured AI voltage and step the AO voltage.

1. Logic
    - Read AI00 with `voltageRead(0)` and print the value.
    - Write AO00 with `voltageWrite(0, i)`, where i sweeps 0 → 5 → 0 (in volts), updating every 1 s.
2. Code Logic Summary
    - Use `voltageRead(ch)` to get the analog input voltage of channel ch.
    - Use `voltageWrite(ch, volts)` to set the analog output voltage of channel ch.

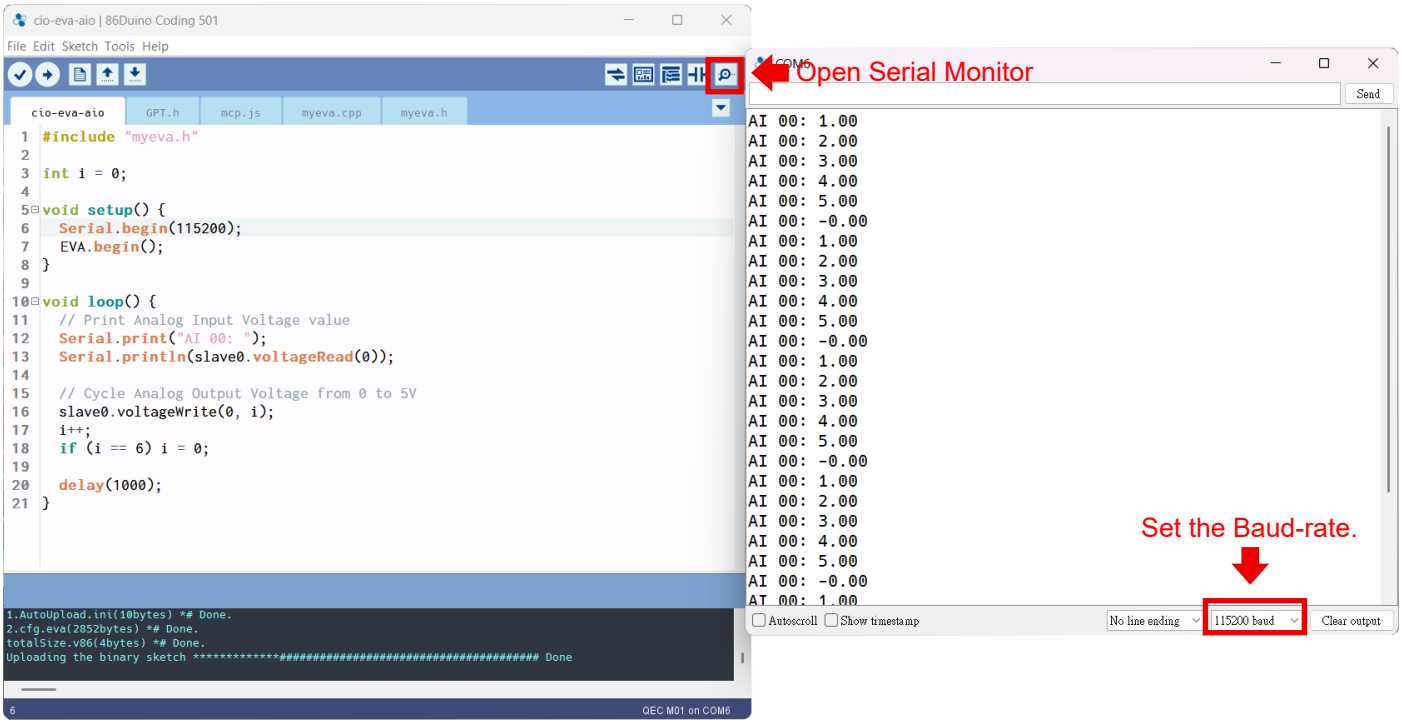
The example code is as follows:

```
#include "myeva.h"

int i = 0;

void setup() {
  Serial.begin(115200);
    EVA.begin();
}

void loop() {
  // Print Analog Input Voltage value
  Serial.print("AI 00: ");
  Serial.println(slave0.voltageRead(0));

  // Cycle Analog Output Voltage from 0 to 5V
  slave0.voltageWrite(0, i);
  i++;
  if (i == 6) i = 0;

  delay(1000);
}
```

***Note:** Once the code is written, click on the toolbar to compile, and to confirm that the compilation is complete and error-free, you can click to upload.



After you successfully upload the program to the QEC-M-01, you can open the Serial Monitor on the 86Duino IDE. Please check that the Serial baud rate is the same as your setting.



It will print the analog input AI00 value (Voltage) to the serial monitor.

```
AI 00: -0.00
AI 00: -0.00
AI 00: 1.00
AI 00: 2.00
AI 00: 3.00
AI 00: 4.00
AI 00: 5.00
AI 00: -0.00
AI 00: 1.00
```

Ch. 6

SubDevice Information

6.1 ESI (EtherCAT SubDevice Information) file

The ESI files contain information unique to the EtherCAT SubDevice Terminals in XML format. You can load an ESI file into the Support Software to easily allocate SubDevice Terminal process data and other settings. The ESI files for QEC EtherCAT SubDevices are already installed in the Support Software.

* **Note: Ensuring Up-to-date Installation of the XML Device Description File (ESI)**

  To ensure smooth functioning, it is important to install the latest version of the XML device description file in the EtherCAT MDevice software. The latest version of the XML device description file can be downloaded from the QEC website.

  https://www.qec.tw/

6.2 Object Dictionary

The object dictionary defined here shall be used complementary with ETG.5001 and ETG.1000.

- Device Profile: 5001
- Modul Profile: 0

Usage Notes:

- The PDO mapping object and SyncManager assignment object doesn't need to be defined. In that case they are created automatically.
- The following objects are fixed included in the SSC and shall not be defined in the file: 0x1000, 0x1001, 0x1008, 0x1009, 0x100a, 0x1010, 0x1011, 0x1018, 0x10F0, 0x10F1, 0x10F3, 0x1c00, 0x1c32, 0x1c33
- Entries less or equal one 8Bit shall not overlap byte borders.
- Entries greater 8Bit shall always start at an exact word border

The following objects used QEC-R11A44S-N as an example.

6.2.1 Standard Objects (0x1000-0x1FFF)

Standard Objects.

Index 1000 Device type

Index	Name	Data type	Flags	Default
1000	Device type	UINT32	RO	0x00001389 (5001)

Index 1001 Error register

Index	Name	Data type	Flags	Default
1001	Error register	UINT8	RO	0x00 (0)

Index 1008 Device name

Index	Name	Data type	Flags	Default
1008	Device name	STRING	RO	Refer to following table 6-1.

Table 6-1: Device Name

Type	Device Name
Analog Input 8-slot	QEC-R00A80S
Analog Input 8-slot (PoE)	QEC-R11A80S
Analog Input 4-slot, Analog Output 4-slot	QEC-R00A44S
Analog Input 4-slot, Analog Output 4-slot (PoE)	QEC-R11A44S
Analog Output 8-slot	QEC-R00A08S
Analog Output 8-slot	QEC-R11A08S

Index 1009 Manufacturer Hardware version

Index	Name	Data type	Flags	Default
1009	Manufacturer Hardware version	STRING	RO	DM433D

Index 100A Manufacturer Software version

Index	Name	Data type	Flags	Default
100A	Manufacturer Software version	STRING	RO	Depends on the version of the product you have.

Index 1018 Identity

Index	Name	Data type	Flags	Default
1018:0	Identity	UINT8	RO	> 4 <
1018:01	Vendor ID	UINT32	RO	0x00000BC3 (3011)
1018:02	Product code	UINT32	RO	Refer to following table 6-2.
1018:03	Revision	UINT32	RO	Refer to following table 6-2.
1018:04	Serial number	UINT32	RO	0x00000000 (0).

Table 6-2: Product code & Revision Number

Model Name	Product code	Revision Number
QEC-R11A44S	0x0086D880	0x20231215
QEC-R11A40S	0x0086D881	0x20231215
QEC-R11A04S	0x0086D882	0x20231215
QEC-R00A44S	0x0086D883	0x20231215

Index 10F1 Error Settings

Index	Name	Data type	Flags	Default
10F1:0	Error Settings	UINT8	RO	> 2 <
10F1:01	Local Error Reaction	UINT32	RW	0x00000001 (1)
10F1:02	Sync Error Counter Limit	UINT32	RW	0x0004 (4)

Index 10F8 Timestamp Object

Index	Name	Data type	Flags	Default
10F8	Timestamp Object	UINT64	RW P	9E 04 CA F3 20 00 00 00

6.2.1.1 RxPDO Mapping Objects

RxPDO Mapping (0x1600 - 0x17FF).
If no RxPDO mapping object is defined the will be created automatically.

Index 0x1600 Output mapping 0

Index	Name	Data type	Flags	Default	Description
1600:0	Output mapping 0	UINT8	RO	> 4 <	-
1600:01	SubIndex 001	UINT32	RO	0x7000:00, 16	DigitalOutput0
1600:02	SubIndex 002	UINT32	RO	0x7001:00, 16	DigitalOutput1
1600:03	SubIndex 003	UINT32	RO	0x7002:00, 16	DigitalOutput2
1600:04	SubIndex 004	UINT32	RO	0x7003:00, 16	DigitalOutput3

6.2.1.2 TxPDO Mapping Objects

TxPDO Mapping (0x1A00 - 0x1BFF).
If no TxPDO mapping object is defined the will be created automatically.

Index 0x1A00 Input mapping 0

Index	Name	Data type	Flags	Default	Description
1A00:0	Input mapping 0	UINT8	RO	> 4 <	-
1A00:01	SubIndex 001	UINT32	RO	0x6000:00, 16	AnalogInput0
1A00:02	SubIndex 002	UINT32	RO	0x6001:00, 16	AnalogInput1
1A00:03	SubIndex 003	UINT32	RO	0x6002:00, 16	AnalogInput2
1A00:04	SubIndex 004	UINT32	RO	0x6003:00, 16	AnalogInput3

6.2.1.3 Sync Manager Objects

Sync Manager Objects.

Index 0x1C00 Sync manager type

SyncManager type.

Index	Name	Data type	Flags	Default
1C00:0	Sync manager type	UINT8	R0	> 4 <
1C00:01	SubIndex 001	UINT8	RO	0x01 (1)
1C00:02	SubIndex 002	UINT8	RO	0x02 (2)
1C00:03	SubIndex 003	UINT8	RO	0x03 (3)
1C00:04	SubIndex 004	UINT8	RO	0x04 (4)

Index 0x1C12 SM2 assignment

SyncManager 2 Assignment. RX PDO Assign.

Index	Name	Data type	Flags	Default
1C12:0	SyncManager 2 assignment	UINT8	R0	> 1 <
1C12:01	SubIndex 001	UINT16	RO	0x1600 (5632)

Index 0x1C13 SM3 assignment

SyncManager 3 Assignment. TX PDO Assign.

Index	Name	Data type	Flags	Default
1C13:0	SyncManager 3 assignment	UINT8	R0	> 1 <
1C13:01	SubIndex 001	UINT16	RO	0x1A00 (6656)

Index 0x1C32 SM output Parameter

SM output parameter.

Index	Name	Data type	Flags	Default
1C32:0	SM output parameter	UINT8	RO	> 32 <
1C32:01	Synchronization Type	UINT16	RW	0x0000 (0)
1C32:02	Cycle Time	UINT32	RO	0x00000000 (0)
1C32:04	Synchronization Types supported	UINT16	RO	0x4003 (16387)
1C32:05	Minimum Cycle Time	UINT32	RO	0x0007A120 (500000)
1C32:06	Calc and Copy Time	UINT32	RO	0x00000000 (0)
1C32:08	Get Cycle Time	UINT16	RW	0x0000 (0)
1C32:09	Delay Time	UINT32	RO	0x00000000 (0)
1C32:0A	Sync0 Cycle Time	UINT32	RW	0x00000000 (0)
1C32:0B	SM-Event Missed	UINT16	RO	0x0000 (0)
1C32:0C	Cycle Time Too Small	UINT16	RO	0x00AC (172)
1C32:0D	Shift Time Too Short Counter	UINT16	RO	0x0000 (0)
1C32:20	Sync Error	BOOL	RO	TRUE

Index 0x1C33 SM input parameter

SM input parameter.

Index	Name	Data type	Flags	Default
1C33:0	SM input parameter	UINT8	RO	> 32 <
1C33:01	Synchronization Type	UINT16	RW	0x0022 (34)
1C33:02	Cycle Time	UINT32	RO	0x00000000 (0)
1C33:04	Synchronization Types supported	UINT16	RO	0x4003 (16387)
1C33:05	Minimum Cycle Time	UINT32	RO	0x0007A120 (500000)
1C33:06	Calc and Copy Time	UINT32	RO	0x00000000 (0)
1C33:08	Get Cycle Time	UINT16	RW	0x0000 (0)
1C33:09	Delay Time	UINT32	RO	0x00000000 (0)
1C33:0A	Sync0 Cycle Time	UINT32	RW	0x00000000 (0)
1C33:0B	SM-Event Missed	UINT16	RO	0x0000 (0)
1C33:0C	Cycle Time Too Small	UINT16	RO	0x0095 (149)
1C33:0D	Shift Time Too Short Counter	UINT16	RO	0x0000 (0)
1C33:20	Sync Error	BOOL	RO	FALSE

6.2.2 Manufacturer Objects (0x5000-0x5FFF)

Manufacturer Objects (0x5000-0x5FFF).

Index 0x5000 to 0x5007 Manufacturer Object

Index	Object Code	DataType	Name	Default	Description
5000	VARIABLE	UINT16	SP_Voltage	0	Read SP Voltage.
5001	VARIABLE	UINT16	SP_Current	0	Read SP Current.
5002	VARIABLE	UINT16	PP_Voltage	0	Read PP Voltage.
5003	VARIABLE	UINT16	PP_Current	0	Read PP Current.
5004	VARIABLE	INT16	Temperature	0	Read Temperature.
5005	VARIABLE	UINT8	BoxStatus	0	Read Box Status, refer to Table 6-3.
5006:0	RECORD		OrderInformation	> 4 <	Order Information.
5006:01		STRING(6)	Customer	0	Customer.
5006:02		STRING(8)	OrderNo	0	Order No.
5006:03		STRING(11)	InvNo	0	Inv No.
5006:04		STRING(4)	DelyDate	0	Dely Date.
5007:0	RECORD	UINT32	MTBF	> 2 <	-
5007:01		INT32	WorkingHours	0	If return -1, the mean is EEPROM have error.
5007:01		INT32	BootTimes	0	If return -1, the mean is EEPROM have error.

Table 6-3: Index 0x5005 BoxStatus Definitions

Value	Description
0	Normal Operation
3	ESC 3p3 Power NG
4	DIQ 3p3 Power NG
5	External XTgal Stop
6	External XTgal Over Range
0x10	Power Voltage Low or High
0x11	Power Voltage Too Low or Too High

6.2.2.1 Function Objects

The following objects correspond to each analog input and output slot, providing a range of settings for status, voltage range, threshold levels, and resolution.

- Analog Input Slots (Index 0x5010~0x5017)
- Analog Output Slots (Index 0x5020~0x5027)

Index 0x5010 Analog Input 0

Index	Name	Data type	Flags	Default	Description
5010:0	Analog Input 0	UINT8	-	> 5 <	Read/Write Analog Input.
5010:01	Status	UINT16	RO	0x0000 (0)	Refer to Table 6-4.
5010:02	Range	UINT8	RW	0x00 (0)	Refer to Table 6-5.
5010:03	Threshold_of_Input_High	UINT16	RW	0xFFFF (65535)	Threshold of Input High.
5010:04	Threshold_of_Input_Low	UINT16	RW	0x0000 (0)	Threshold of Input Low.
5010:05	Resolution	REAL32	RO	-	Resolution.

Table 6-4: Index 0x5010:01 Analog Input voltage Status

Bit	Description
Bit 0	Input too low
Bit 1	Input too high
Bit 2	AVDD low
Bit 3	AVDD high

Table 6-5: Index 0x5010:02 Analog Input voltage range

Bit	Value	Description
0000b	0	Full voltage ≒ ±22V
0001b	1	Full voltage ≒ ±20V
0010b	2	Full voltage ≒ ±11V
0011b	3	Full voltage ≒ ±10V
0100b	4	Full voltage ≒ ±5V
0101b	5	Full voltage ≒ 22V
0110b	6	Full voltage ≒ 20V
0111b	7	Full voltage ≒ 11V
1000b	8	Full voltage ≒ 10V

Index 0x5011 Analog Input 1

Index	Name	Data type	Flags	Default	Description
5011:0	Analog Input 1	UINT8	-	> 5 <	Read/Write Analog Input.
5011:01	Status	UINT16	RO	0x0000 (0)	Refer to Table 6-6.
5011:02	Range	UINT8	RW	0x00 (0)	Refer to Table 6-7.
5011:03	Threshold_of_Input_High	UINT16	RW	0xFFFF (65535)	Threshold of Input High.
5011:04	Threshold_of_Input_Low	UINT16	RW	0x0000 (0)	Threshold of Input Low.
5011:05	Resolution	REAL32	RO	-	Resolution.

Table 6-6: Index 0x5011:01 Analog Input voltage Status

Bit	Description
Bit 0	Input too low
Bit 1	Input too high
Bit 2	AVDD low
Bit 3	AVDD high

Table 6-7: Index 0x5011:02 Analog Input voltage range

Bit	Value	Description
0000b	0	Full voltage ≒ ±22V
0001b	1	Full voltage ≒ ±20V
0010b	2	Full voltage ≒ ±11V
0011b	3	Full voltage ≒ ±10V
0100b	4	Full voltage ≒ ±5V
0101b	5	Full voltage ≒ 22V
0110b	6	Full voltage ≒ 20V
0111b	7	Full voltage ≒ 11V
1000b	8	Full voltage ≒ 10V

Index 0x5012 Analog Input 2

Index	Name	Data type	Flags	Default	Description
5012:0	Analog Input 2	UINT8	-	> 5 <	Read/Write Analog Input.
5012:01	Status	UINT16	RO	0x0000 (0)	Refer to Table 6-8.
5012:02	Range	UINT8	RW	0x00 (0)	Refer to Table 6-9.
5012:03	Threshold_of_Input_High	UINT16	RW	0xFFFF (65535)	Threshold of Input High.
5012:04	Threshold_of_Input_Low	UINT16	RW	0x0000 (0)	Threshold of Input Low.
5012:05	Resolution	REAL32	RO	-	Resolution.

Table 6-8: Index 0x5012:01 Analog Input voltage Status

Bit	Description
Bit 0	Input too low
Bit 1	Input too high
Bit 2	AVDD low
Bit 3	AVDD high

Table 6-9: Index 0x5012:02 Analog Input voltage range

Bit	Value	Description
0000b	0	Full voltage ≒ ±22V
0001b	1	Full voltage ≒ ±20V
0010b	2	Full voltage ≒ ±11V
0011b	3	Full voltage ≒ ±10V
0100b	4	Full voltage ≒ ±5V
0101b	5	Full voltage ≒ 22V
0110b	6	Full voltage ≒ 20V
0111b	7	Full voltage ≒ 11V
1000b	8	Full voltage ≒ 10V

Index 0x5013 Analog Input 3

Index	Name	Data type	Flags	Default	Description
5013:0	Analog Input 3	UINT8	-	> 5 <	Read/Write Analog Input.
5013:01	Status	UINT16	RO	0x0000 (0)	Refer to Table 6-10.
5013:02	Range	UINT8	RW	0x00 (0)	Refer to Table 6-11.
5013:03	Threshold_of_Input_High	UINT16	RW	0xFFFF (65535)	Threshold of Input High.
5013:04	Threshold_of_Input_Low	UINT16	RW	0x0000 (0)	Threshold of Input Low.
5013:05	Resolution	REAL32	RO	-	Resolution.

Table 6-10: Index 0x5013:01 Analog Input voltage Status

Bit	Description
Bit 0	Input too low
Bit 1	Input too high
Bit 2	AVDD low
Bit 3	AVDD high

Table 6-11: Index 0x5013:02 Analog Input voltage range

Bit	Value	Description
0000b	0	Full voltage ≒ ±22V
0001b	1	Full voltage ≒ ±20V
0010b	2	Full voltage ≒ ±11V
0011b	3	Full voltage ≒ ±10V
0100b	4	Full voltage ≒ ±5V
0101b	5	Full voltage ≒ 22V
0110b	6	Full voltage ≒ 20V
0111b	7	Full voltage ≒ 11V
1000b	8	Full voltage ≒ 10V

Index 0x5020 Digital Output 0

Index	Name	Data type	Flags	Default	Description
5020:0	DigitalOutput0	UINT8	RO P	> 2 <	Read/Write Analog Output.
5020:01	Status	UINT16	RO	0x0000 (0)	Status.
5020:02	Range	UINT8	RW	0x00 (0)	Range, refer to Table 6-12.

Table 6-12: Index 0x5020:02 Analog Output Range

Bit	Value	Description
0000	0	Voltage output 0 to +5 V (default)
0001	1	Voltage output 0 to +10 V
0010	2	Voltage output ±5 V
0011	3	Voltage output ±10 V
0100	4	Current output 3.5 mA to 23.5 mA
0101	5	Current output 0 to 20 mA
0110	6	Current output 0 to 24 mA
0111	7	Current output ±24 mA
1000	8	Voltage output 0 to +6 V
1001	9	Voltage output 0 to +12 V
1010	10	Voltage output ±6 V
1011	11	Voltage output ±12 V
1100	12	Current output 4 mA to 20 mA
Other number will Disable output		

Index 0x5021 Digital Output 1

Index	Name	Data type	Flags	Default	Description
5021:0	DigitalOutput1	UINT8	RO P	> 2 <	Read/Write Analog Output.
5021:01	Status	UINT16	RO	0x0000 (0)	Status.
5021:02	Range	UINT8	RW	0x00 (0)	Range, refer to Table 6-13.

Table 6-13: Index 0x5021:02 Analog Output Range

Bit	Value	Description
0000	0	Voltage output 0 to +5 V (default)
0001	1	Voltage output 0 to +10 V
0010	2	Voltage output ±5 V
0011	3	Voltage output ±10 V
0100	4	Current output 3.5 mA to 23.5 mA
0101	5	Current output 0 to 20 mA
0110	6	Current output 0 to 24 mA
0111	7	Current output ±24 mA
1000	8	Voltage output 0 to +6 V
1001	9	Voltage output 0 to +12 V
1010	10	Voltage output ±6 V
1011	11	Voltage output ±12 V
1100	12	Current output 4 mA to 20 mA
Other number will Disable output		

Index 0x5022 Digital Output 2

Index	Name	Data type	Flags	Default	Description
5022:0	DigitalOutput2	UINT8	RO P	> 2 <	Read/Write Analog Output.
5022:01	Status	UINT16	RO	0x0000 (0)	Status.
5022:02	Range	UINT8	RW	0x00 (0)	Range, refer to Table 6-14.

Table 6-14: Index 0x5022:02 Analog Output Range

Bit	Value	Description
0000	0	Voltage output 0 to +5 V (default)
0001	1	Voltage output 0 to +10 V
0010	2	Voltage output ±5 V
0011	3	Voltage output ±10 V
0100	4	Current output 3.5 mA to 23.5 mA
0101	5	Current output 0 to 20 mA
0110	6	Current output 0 to 24 mA
0111	7	Current output ±24 mA
1000	8	Voltage output 0 to +6 V
1001	9	Voltage output 0 to +12 V
1010	10	Voltage output ±6 V
1011	11	Voltage output ±12 V
1100	12	Current output 4 mA to 20 mA
Other number will Disable output		

Index 0x5023 Digital Output 3

Index	Name	Data type	Flags	Default	Description
5023:0	DigitalOutput3	UINT8	RO P	> 2 <	Read/Write Analog Output.
5023:01	Status	UINT16	RO	0x0000 (0)	Status.
5023:02	Range	UINT8	RW	0x00 (0)	Range, refer to Table 6-15.

Table 6-15: Index 0x5023:02 Analog Output Range

Bit	Value	Description
0000	0	Voltage output 0 to +5 V (default)
0001	1	Voltage output 0 to +10 V
0010	2	Voltage output ±5 V
0011	3	Voltage output ±10 V
0100	4	Current output 3.5 mA to 23.5 mA
0101	5	Current output 0 to 20 mA
0110	6	Current output 0 to 24 mA
0111	7	Current output ±24 mA
1000	8	Voltage output 0 to +6 V
1001	9	Voltage output 0 to +12 V
1010	10	Voltage output ±6 V
1011	11	Voltage output ±12 V
1100	12	Current output 4 mA to 20 mA
Other number will Disable output		

6.2.3 Especial Objects (0x6000-0xFFFF)

Especial Objects (0x6000-0xFFFF).

6.2.3.1 Index 0x6nnx Input Data of the Module (0x6000 - 0x6FFF)

This section of the object dictionary defines the input data for the module, focusing on the analog input channels. Each index represents a unique analog input, with corresponding resolution settings and data conversion formulas for accurate signal acquisition.

Index 0x6000 Analog Input 0

Index	Name	Data type	Flags	Default
6000	AnalogInput0	UINT16	RO	-

Description:

- For ranges 0, 1, 2, 3, 4:
  Vin = ($AnalogInput0$ − 32768) × Resolution
- For ranges 5, 6, 7, 8:
  Vin = ($AnalogInput0$) × Resolution
- Resolution is specified at Index 0x5010:05.

Index 0x6001 Analog Input 1

Index	Name	Data type	Flags	Default
6001	AnalogInput1	UINT16	RO	-

Description:

- For ranges 0, 1, 2, 3, 4:
  Vin = ($AnalogInput1$ − 32768) × Resolution
- For ranges 5, 6, 7, 8:
  Vin = ($AnalogInput1$) × Resolution
- Resolution is specified at Index 0x5011:05.

Index 0x6002 Analog Input 2

Index	Name	Data type	Flags	Default
6002	AnalogInput2	UINT16	RO	-

Description:

- For ranges 0, 1, 2, 3, 4:
  Vin = ($AnalogInput2$ − 32768) × Resolution
- For ranges 5, 6, 7, 8:
  Vin = ($AnalogInput2$) × Resolution
- Resolution is specified at Index 0x5012:05.

Index 0x6003 Analog Input 3

Index	Name	Data type	Flags	Default
6003	AnalogInput3	UINT16	RO	-

Description:

- For ranges 0, 1, 2, 3, 4:
  Vin = ($AnalogInput0$ − 32768) × Resolution
- For ranges 5, 6, 7, 8:
  Vin = ($AnalogInput0$) × Resolution
- Resolution is specified at Index 0x5013:05.

6.2.3.2 Index 0x7nnx Output Data of the Module (0x7000 - 0x7FFF)

This section of the object dictionary defines the output data for the module, focusing on the analog output channels. Each index from 0x7000 onwards corresponds to a specific digital output channel.

Index 0x7000 Digital Output 0

Index	Name	Data type	Flags	Default
7000	DigitalOutput0	UINT16	RW	-

Index 0x7001 Digital Output 1

Index	Name	Data type	Flags	Default
7001	DigitalOutput1	UINT16	RW	-

Index 0x7002 Digital Output 2

Index	Name	Data type	Flags	Default
7002	DigitalOutput2	UINT16	RW	-

Index 0x7003 Digital Output 3

Index	Name	Data type	Flags	Default
7003	DigitalOutput3	UINT16	RW	-

6.2.3.3 Index 0x8nnx-0xFFFF Objects

Index 0x8nnx-0xFFFF Objects.

Index 0xA000 Output Times

Index	Name	Data type	Flags	Default
A000	OutputTimes	UINT32	RW	0

Index 0xA001 Application Times

Index	Name	Data type	Flags	Default
A001	ApplicationTimes	UINT32	RW	0

Index 0xA002 Input Times

Index	Name	Data type	Flags	Default
A002	InputTimes	UINT32	RW	0

Index 0xF000 Modular Device Profile

Index	Name	Data type	Flags	Default
F000:00	Modular Device Profile	UINT8	RO	> 2 <
F000:01	Index distance	UINT16	RO	0x0010 (16)
F000:02	Maximum number of modules	UINT16	RO	0x0000 (0)

Warranty

This product is warranted to be in good working order for a period of one year from the date of purchase. Should this product fail to be in good working order at any time during this period, we will, at our option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster. Vendor assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, originality to use this product. Vendor will not be liable for any claim made by any other related party. Return authorization must be obtained from the vendor before returned merchandise will be accepted. Authorization can be obtained by calling or faxing the vendor and requesting a Return Merchandise Authorization (RMA) number. Returned goods should always be accompanied by a clear problem description.