ICOP Technology Inc.

User Manual

QEC-RXXAXXS

EtherCAT Slave ADC/DAC Converter

Up to 8 slots of Analog Input or Output

(Revision 1.1)

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.**

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TRADEMARKS ACKNOWLEDGMENT

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- USA: www.icoptech.com
- Japan: www.icop.co.jp
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For technical support or drivers download, please visit our websites at:

- https://www.icop.com.tw/resource_entrance

For EtherCAT solution service, support or tutorials, 86Duino Coding IDE 500+ introduction, functions, languages, libraries, etc. Please visit the QEC website:

- 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.

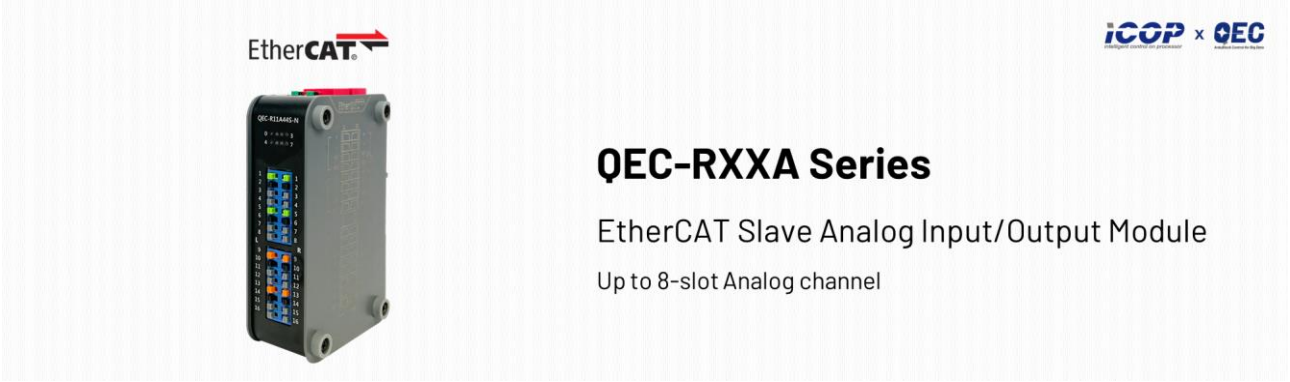
Content

Ch. 1

General Information

1.1 Introduction

The QEC-RXXA series is an EtherCAT Analog Input/Output Converter. It supports up to 8-slot Analog channels, and customers can customize the Analog Input and Output configuration. This series has passed the verification of conformance testing tools.



The Analog input channels of the QEC-RXXA series offer multiple voltage ranges, both bipolar and unipolar, to accommodate various sensors and transducers. It features a constant resistive input impedance of at least 1 MΩ and is equipped with robust overvoltage protection up to ±20 V, ensuring durability and stability in harsh industrial settings. The high-resolution 16-bit ADC guarantees precision data acquisition with an accuracy of ±0.2% Full Scale Range (FSR) at 25°C. Conversely, the Analog output channels of the QEC-RXXA series provide flexible signal conditioning capabilities with output current ranging from 0 mA to 24 mA and output voltage settings up to ±12 V. These outputs are characterized by a 16-bit resolution and an impressive accuracy of ±0.2% FSR at 25°C, suitable for controlling actuators or interfacing with other control systems.

The QEC-RXXA series module supports firmware updates via the File over EtherCAT (FoE) protocol and includes dual RJ-45 ports to facilitate EtherCAT cable redundancy, enhancing network reliability. Diagnostic and operational statuses are easily visible through LED indicators, simplifying troubleshooting and system checks.

The module reduces infrastructure and operational costs by being designed for flexibility in installation and connectivity. It supports various network topologies, such as star, line, or ring, ensuring adaptability to specific project requirements. Measuring 107.45 x 66 x 30 mm, the QEC-RXXA series operates efficiently within a standard temperature range of -20 to +70°C, with options available for extended temperature conditions. The device can be easily mounted using a Din Rail kit that simplifies installation and maintenance.
The QEC-RXXA44S from ICOP is an exemplary solution for industries seeking reliable and precise analog input and output functionality within their EtherCAT networks.

1.2 Specifications

Analog Input (QEC-RXXA80S)

8-slot Analog Input.

Analog Input	
Channels	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 Rate	Max. 10 kSPS
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	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

Analog Output (QEC-RXXA08S)

8-slot Analog Output.

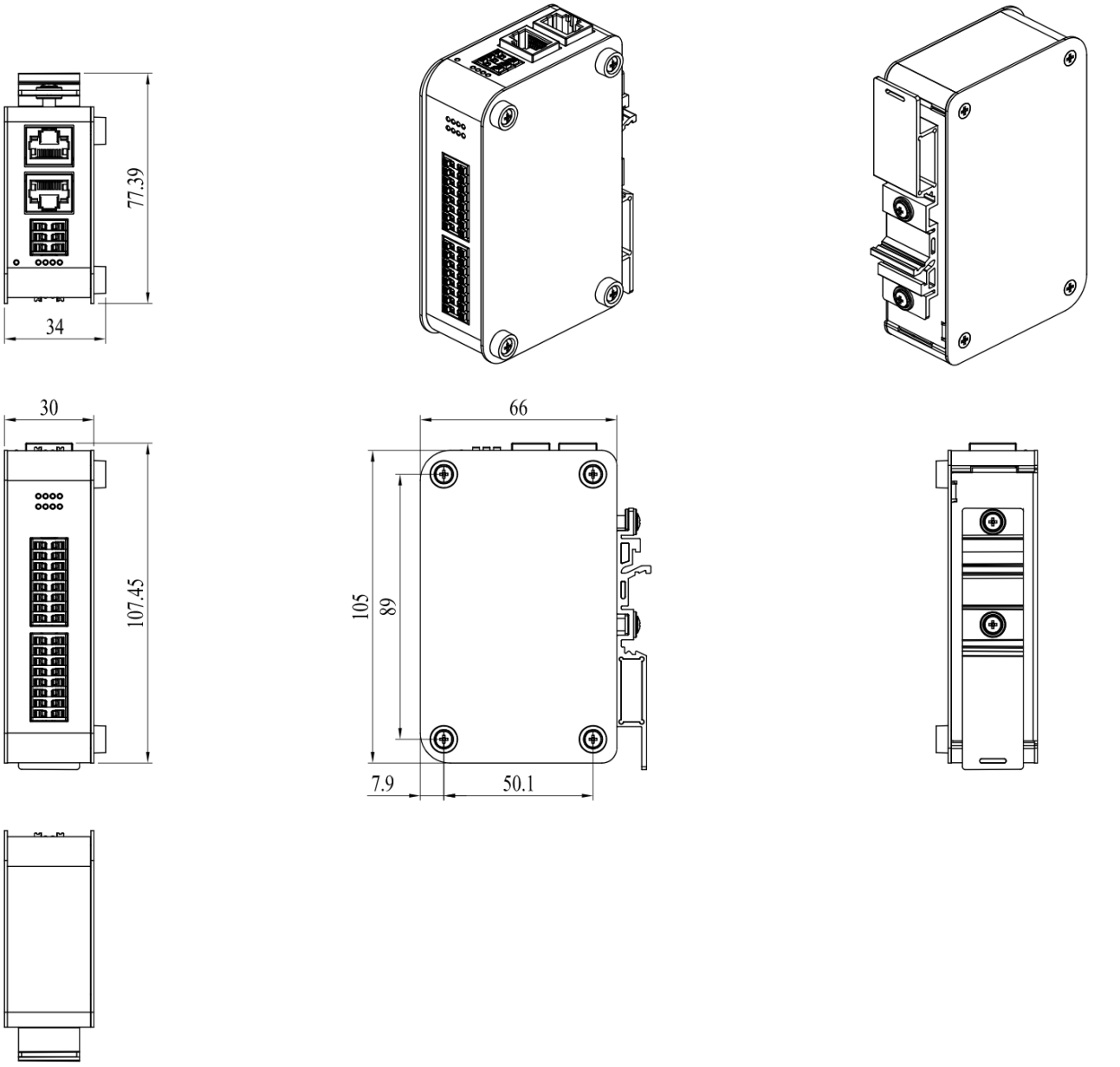
Analog Output	
Channels	8
Output Type	Voltage (V, mV), Current (mA)
Output Current	0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
Output Voltage	0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
Resolution	16-bit with accuracy ±0.2% FSR@25°C
Slew Rate	Configurable (Option)
Drift	±10 ppm/°C
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

Analog Input/Output (QEC-RXXA44S)

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

Analog Input		**Analog Output**	
Channels	4 (Differential)	Channels	4
Input Type	Voltage (V)	Output Type	Voltage (V, mV), Current (mA)
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	Output Current	0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
Input Impedance	Constant resistive ≥ 1 MΩ	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
Overvoltage Protection	Up to ±24 V	Resolution	16-bit with accuracy ±0.2% FSR@25°C
Resolution	16-bit with accuracy ±0.2% FSR @25°C	Slew Rate	Configurable (Option)
Sample Rate	Max. 10 kSPS	Drift	±10 ppm/°C
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		

1.3 Dimension



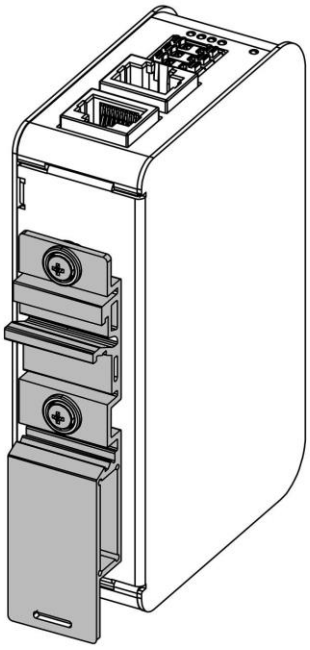
1:1.5

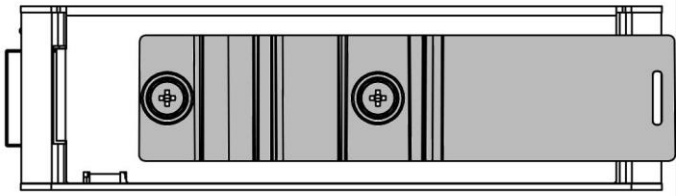
(Unit: mm)

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 Slave.

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

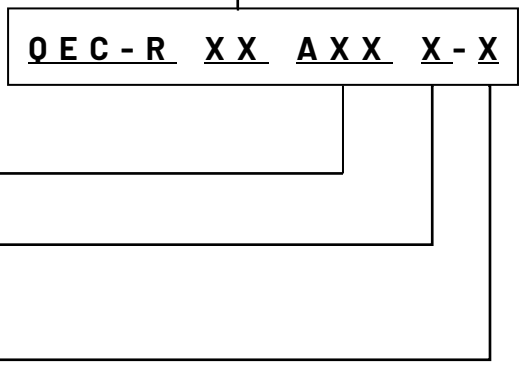
X: 0 ,4 ,8 output channels

4. Feature: Code 10

S: Standard

5. Coating: Code 11

C: Yes / N: Normal



1.5.1 Reference Ordering Part Number:

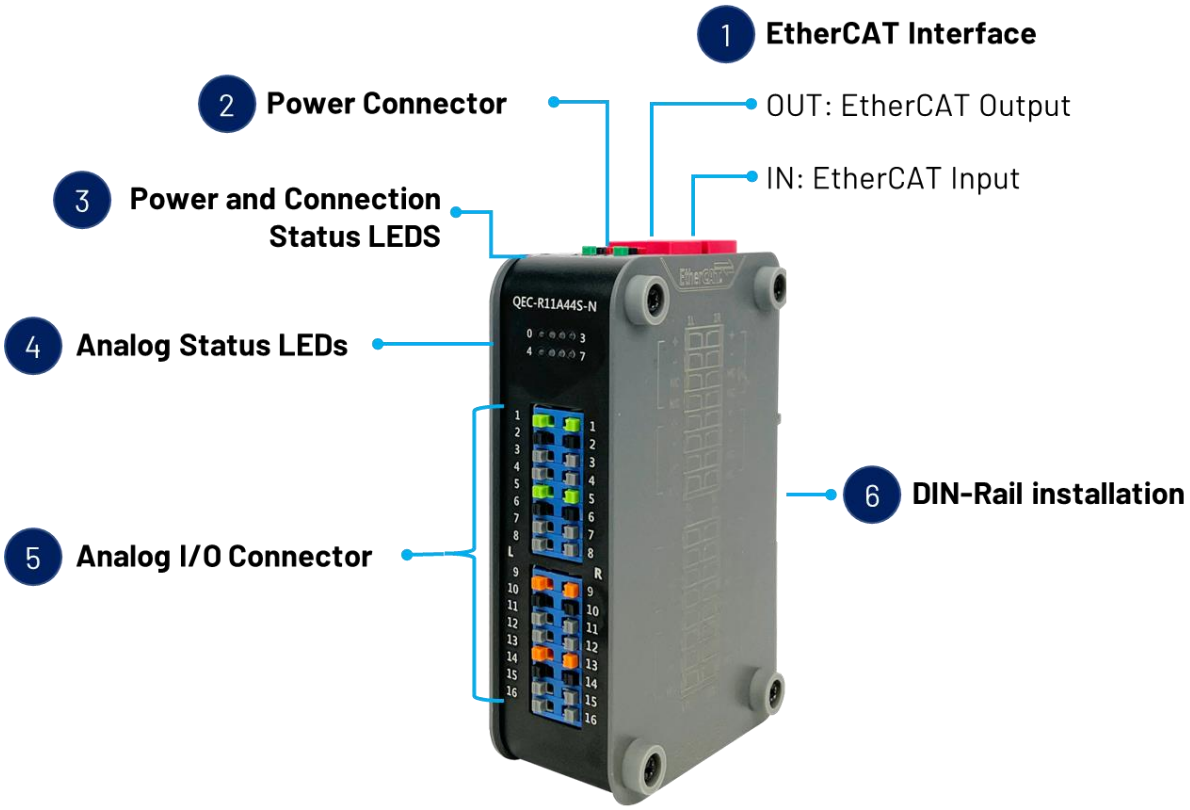
Above is the standard Part Number, please contact our sales if you need to order other part number.

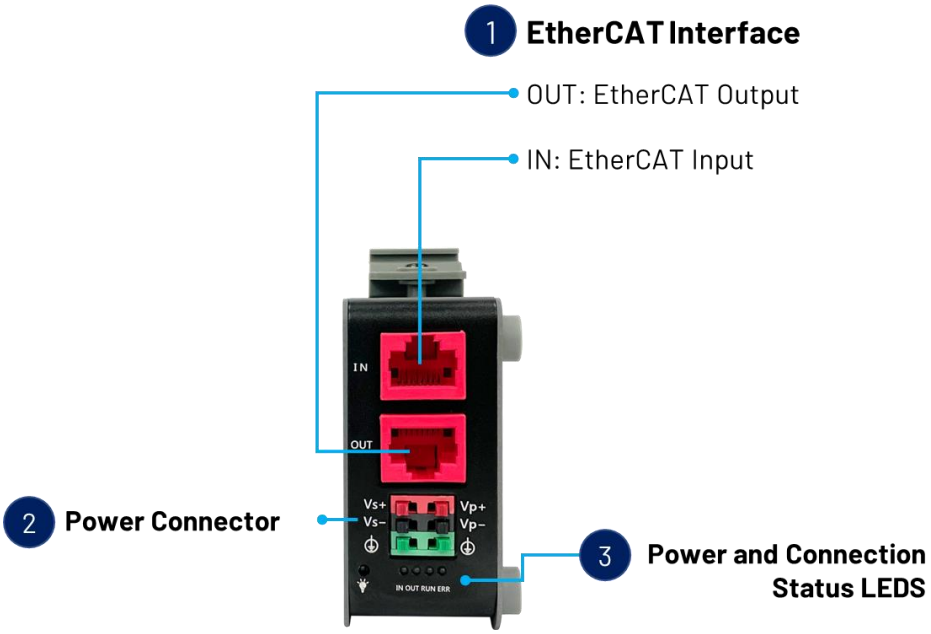
- **QEC-R00A44S-N:** EtherCAT Slave 4-ch Analog Input and 4-ch Analog Output Module.
- **QEC-R11A80S-N:** EtherCAT Slave 8-ch Analog Input Module/PoE.
- **QEC-R11A08S-C:** EtherCAT Slave 8-ch Analog Output Module/PoE.

Ch. 2

Hardware System

2.1 General Technical Data



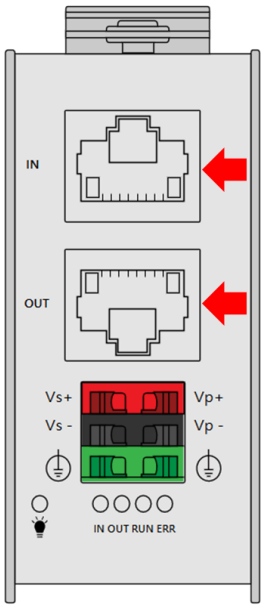


2.2 Connector Summary

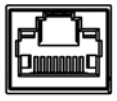
No.	Description		Type Narrative	Num #
1	EtherCAT Interface	OUT	RJ45 Connector	8-pin
		IN	(Gold finger)	8-pin
2	Power Connector		Power Socket	6-pin
3	Power and Connection Status LEDs		Status LEDs	-
4	Analog Status LEDs		Status LEDs	-
5	Analog I/O Connector		Push-in Terminal (Euroblock)	8-slot
6	DIN-Rail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

2.2.1 EtherCAT Interface

RJ45 Connectors.



EC IN

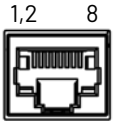


Pin #	Signal Name	Pin #	Signal Name
1	LAN1_TX+	2	LAN1_TX-
3	LAN1_RX+	4	VS+
5	VP+	6	LAN1_RX-
7	VS-(GND)	8	VP-(GND)

* PoE LAN with the Red Housing; Regular LAN with Black Housing.

* L4, L5, L7, L8 pins are option, for RJ45 Power IN/OUT.

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)

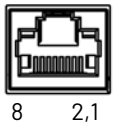
In QEC product installations, users can easily distinguish between PoE and non-PoE: if the RJ45 house is red, it is PoE type, and if the RJ45 house is black, it is non-PoE type.

	
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 master connects with a third-party EtherCAT slave).

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:



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)

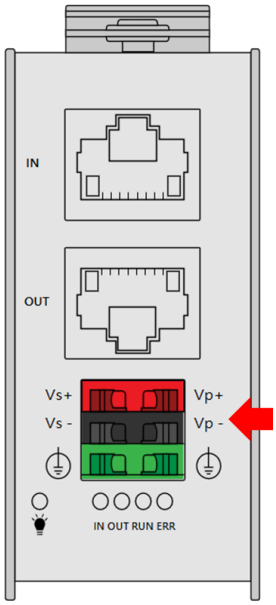
* PoE LAN with the Red Housing; Regular LAN with Black Housing.

* L4, L5, L7, L8 pins are option, for RJ45 Power IN/OUT.

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

2.2.2 Power Connector

Euroblock Connectors.
4-pins Power Input/Output & 2-pins FGND.



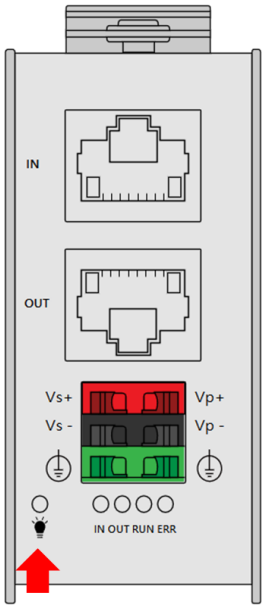
Vs for system power; Vp for peripheral power and backup power.

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 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.

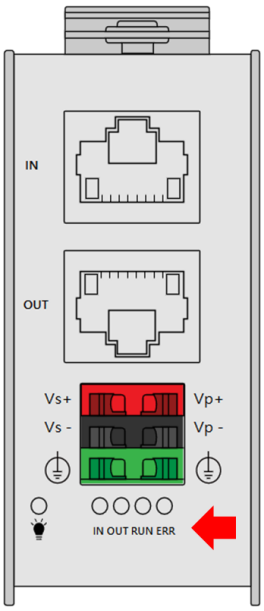
* Vs power status will be displayed first.

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

Long Light	Short Flash	Description
0 Long Light	After microchip completes the BootLoad 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	Quartz oscillator on the board abnormality.
1 Long Light	Indicates the microchip BootLoad 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.

Connection Status LEDs



EtherCAT: PWR, RUN, LINK, 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

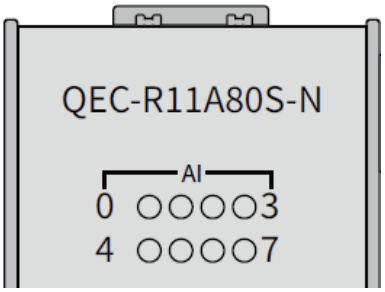
The QEC series modules are equipped with status LEDs that serve as indicators of the operational state of the internal chips rather than the status of the analog input or output channels. These LEDs remain bright to signify that the internal components are functioning correctly.

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.

Analog Input (QEC-RXXA80S)

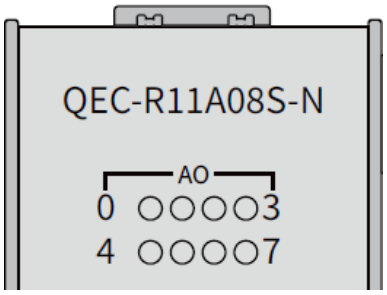
8-slot Analog Input.



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.

Analog Output (QEC-RXXA08S)

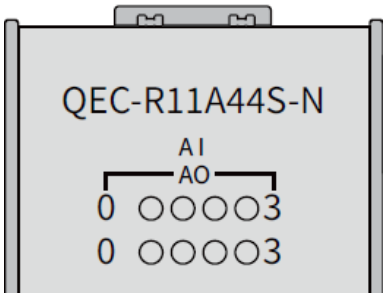
8-slot Analog Output.



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.

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.

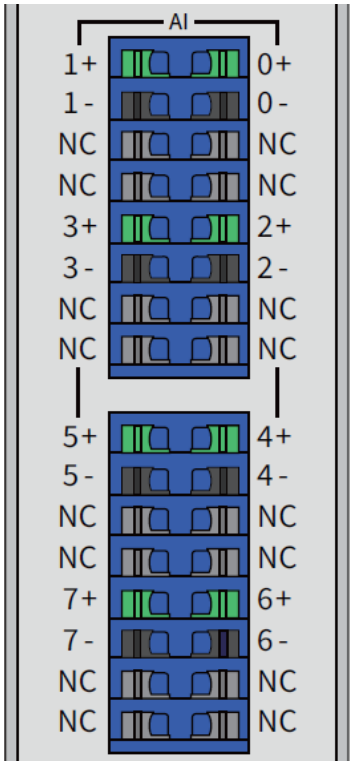
2.2.5 Analog I/O Connector

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

Analog Input (QEC-RXXA80S)

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		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
5+	AI05+		4+	AI04+
5-	AI05-		4-	AI04-
-	NC		-	NC
-	NC		-	NC
7+	AI07+		6+	AI06+
7-	AI07-		6-	AI06-
-	NC		-	NC
-	NC		-	NC



Analog Input Specifications:

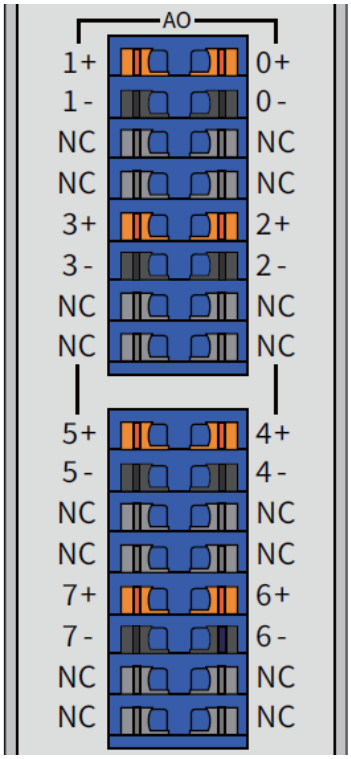
- Input Type: Voltage (V)
- Input Range ±22 V; ±20 V; ±11 V; ±10 V; ±5 V; 0 V – 22V; 0 V – 20 V; 0 V – 11 V; 0 V – 10 V
- Input Impedance: Constant resistive ≥ 1 MΩ
- Overvoltage Protection: Up to ±24 V
- Resolution: 16-bit with accuracy of ±0.2% Full-Scale Range (FSR) at 25°C

Analog Output (QEC-RXXA08S)

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:

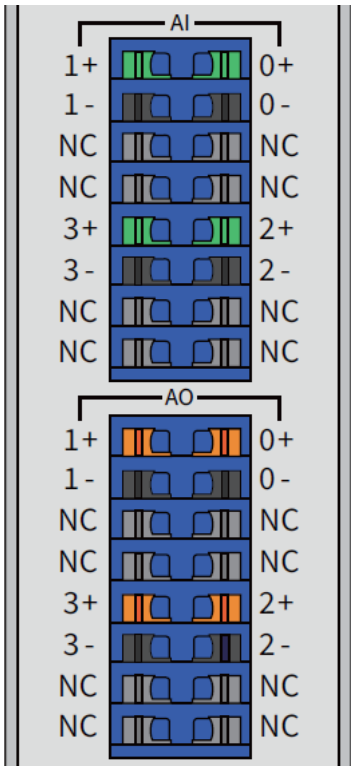
- Output Type: Voltage (V, mV), Current (mA)
- Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
- Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V
- Resolution: 16-bit with accuracy ±0.2% FSR@25°C
- Slew Rate: Configurable (Option)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

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
1+	AI01+
1-	AI01-
-	NC
-	NC
3+	AI03+
3-	AI03-
-	NC
-	NC
1+	AO01+
1-	AO01-
-	NC
-	NC
3+	AO03+
3-	AO03-
-	NC
-	NC



Pin #	Signal Name
0+	AI00+
0-	AI00-
-	NC
-	NC
2+	AI02+
2-	AI02-
-	NC
-	NC
0+	AO00+
0-	AO00-
-	NC
-	NC
2+	AO02+
2-	AO02-
-	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

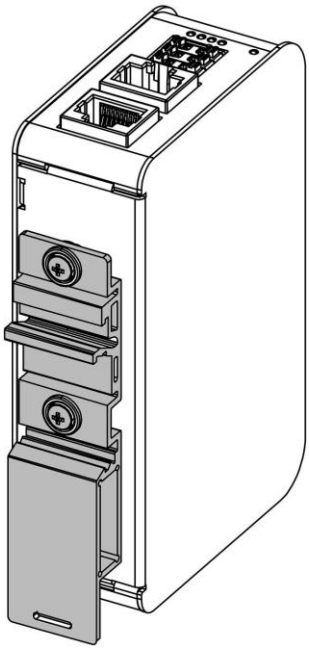
Analog Output Specifications:

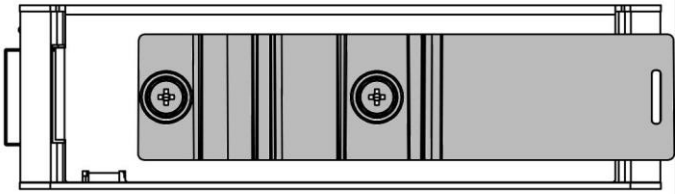
- Output Type: Voltage (V, mV), Current (mA)
- Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA
- Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V

- Resolution: 16-bit with accuracy ±0.2% FSR@25°C
- Slew Rate: Configurable (Option)
- Drift: ±10 ppm/°C

2.2.6 DIN-Rail installation

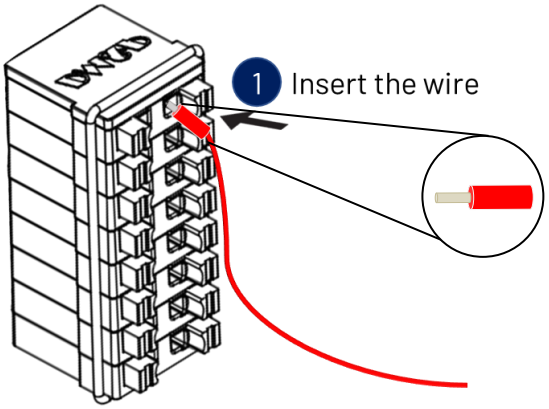
Please refer to Ch.3.1 DIN-Rail installation.

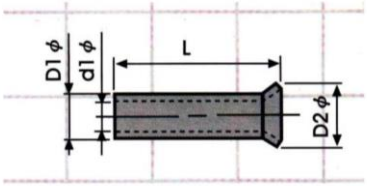




2.3 Wiring to the Connector

2.3.1 Connecting the wire to the connector

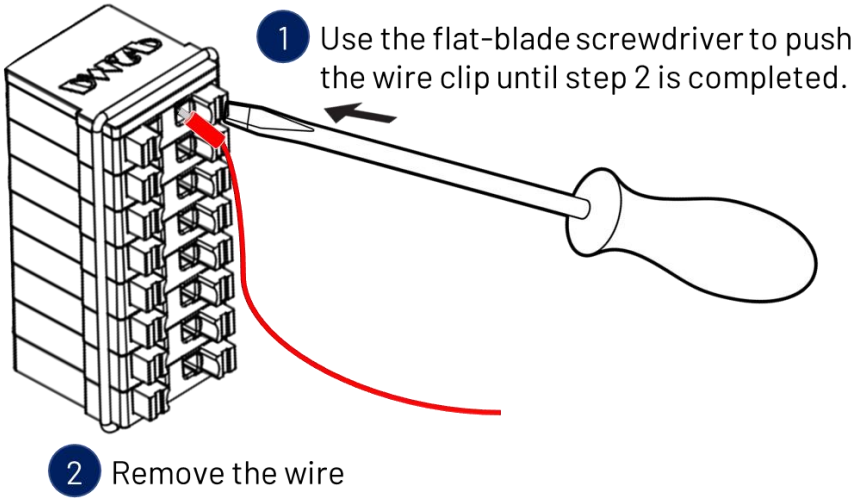




Insulated Terminals Dimensions (mm)

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

Analog Input

Example for Analog Input Operation. (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.

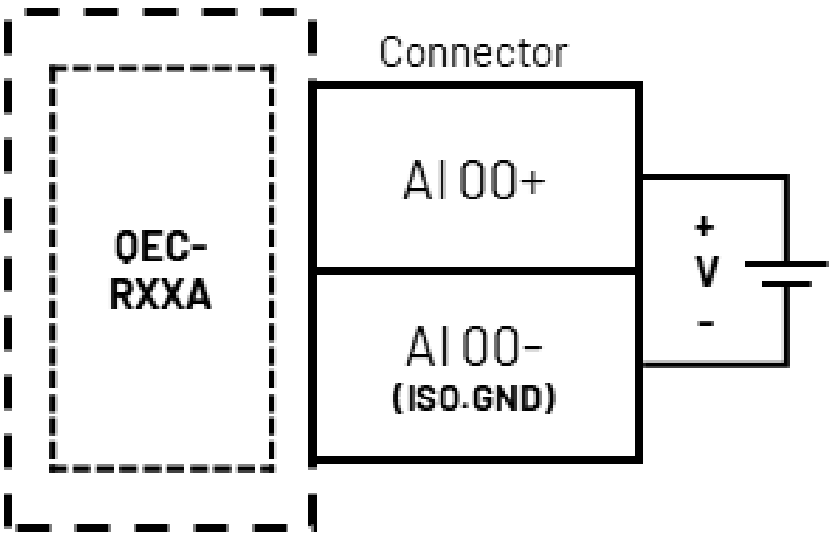


Figure 1: Analog Input Wiring Example

* Important 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

Analog Output

Example for Analog Output Operation. (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.

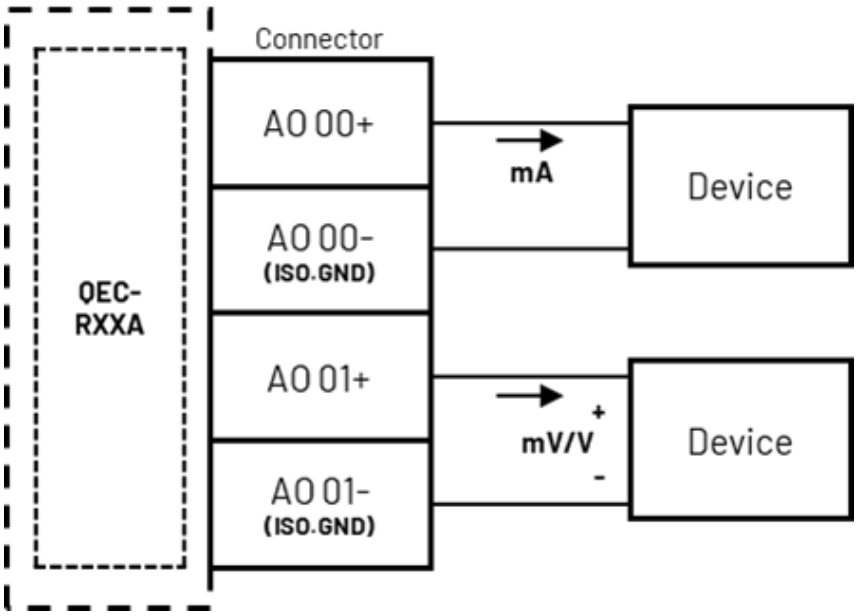


Figure 2: Analog Output Wiring Example

* Important 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

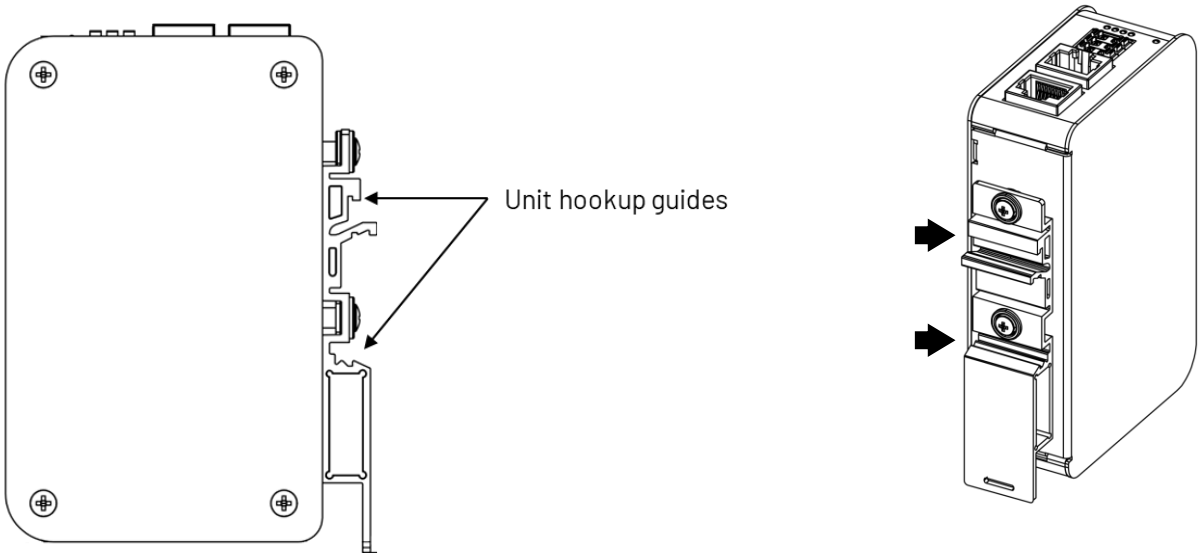
Ch. 3

Hardware Installation

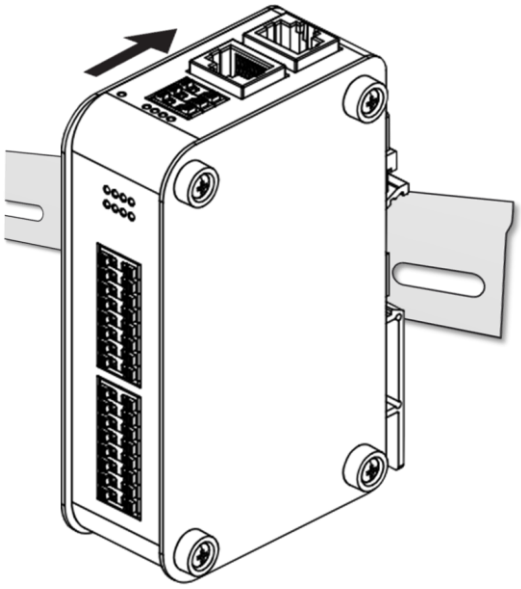
This section describes how to install QEC-RXXA. Please turn OFF the power supply before you mount QEC-RXXA. Always mount QEC-RXXA one at a time.

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.



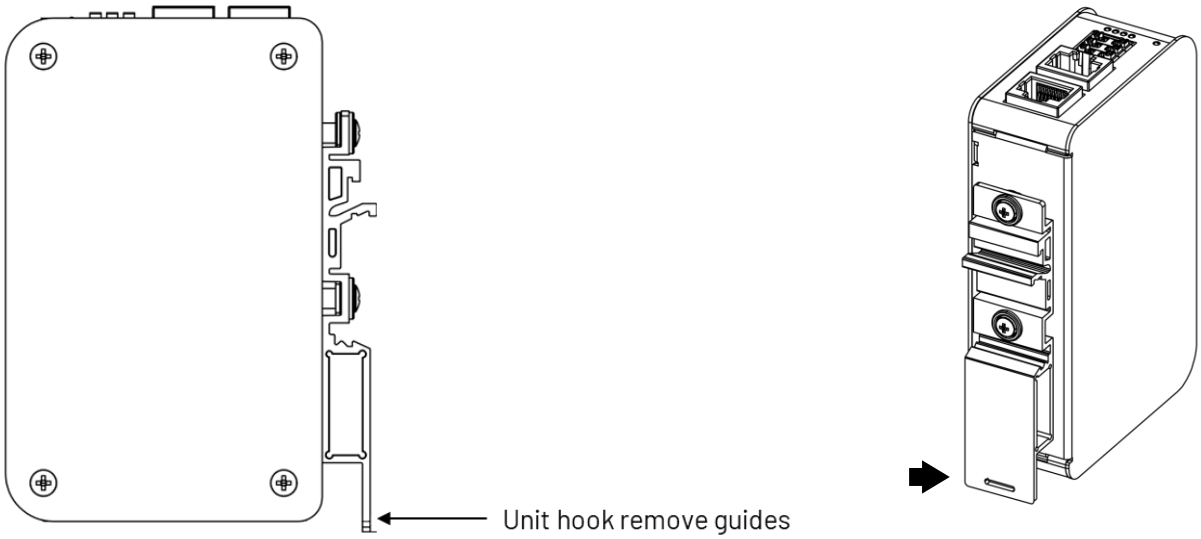
When you mount the QEC-RXXA, releasing the DIN track mounting hook on the QEC-RXXA is unnecessary. After you mount the QEC-RXXA, make sure it is locked to the DIN Track.



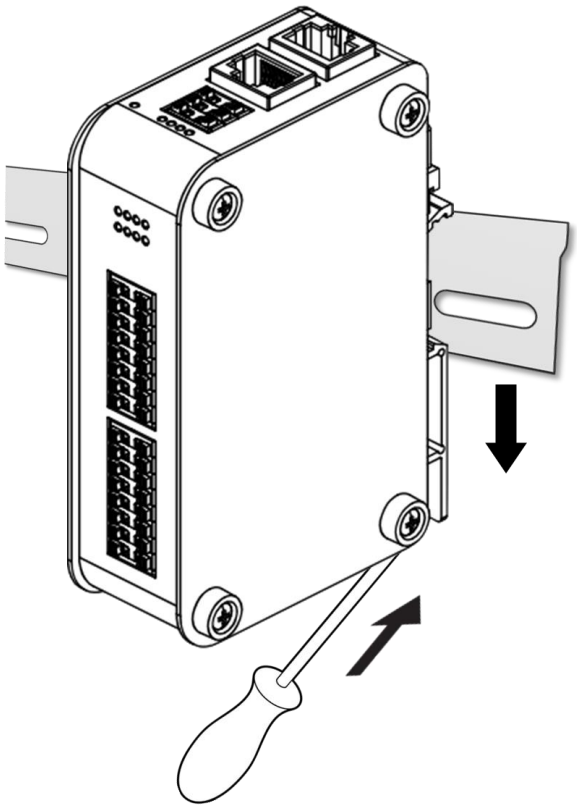
Note: Always turn OFF the Unit power supply and I/O power supply before connecting and removing the QEC-RXXA.

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.

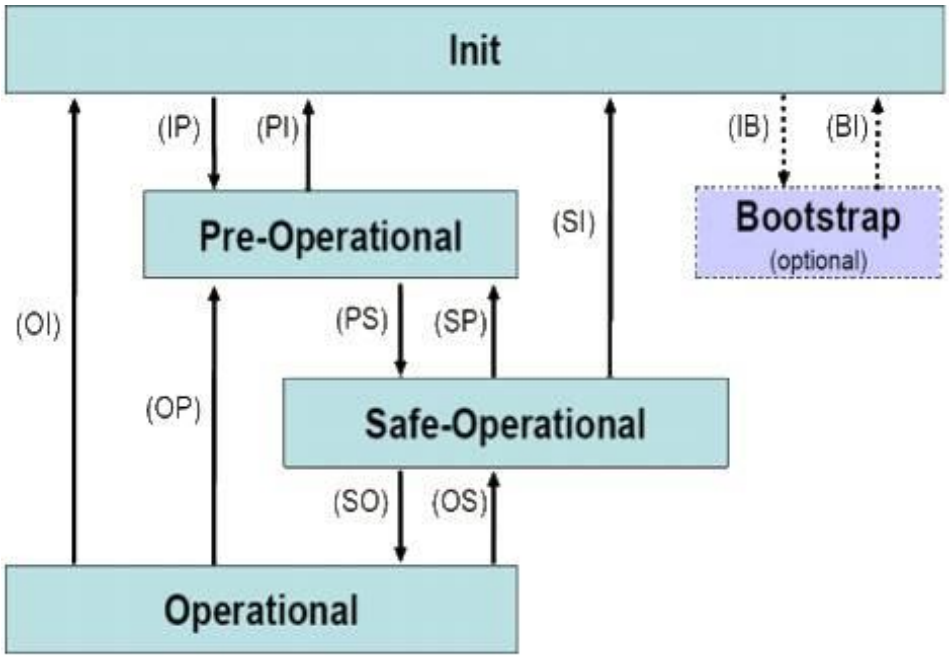
Cables and connectors

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



A distinction is made between the following states:

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

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

Init

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

Pre-Operational (Pre-Op)

During the transition between Init and Pre-Op the EtherCAT slave checks whether the mailbox was initialized correctly. In Pre-Op state mailbox communication is possible, but not process data communication. The EtherCAT master initializes the sync manager channels for process data (from sync manager channel 2), the FMMU channels and, if the slave 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 slave 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 slave copies current input data into the associated DP-RAM areas of the EtherCAT slave controller (ECSC). In Safe-Op state mailbox and process data communication is possible, although the slave 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 master switches the EtherCAT slave from Safe-Op to Op it must transfer valid output data. In the Op state the slave copies the output data of the masters to its outputs. Process data and mailbox communication is possible.

Boot

In the Boot state the slave 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

This chapter explains how to access the QEC-RXXA Series modules through the QEC-M-01 (EtherCAT Master) and its software, 86Duino Coding IDE. The parameter settings are easy to configure, shortening the system installation and evaluation time.

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.

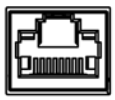
Non-PoE type

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:

4. 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 master connects with a third-party EtherCAT slave).

5. 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:



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)

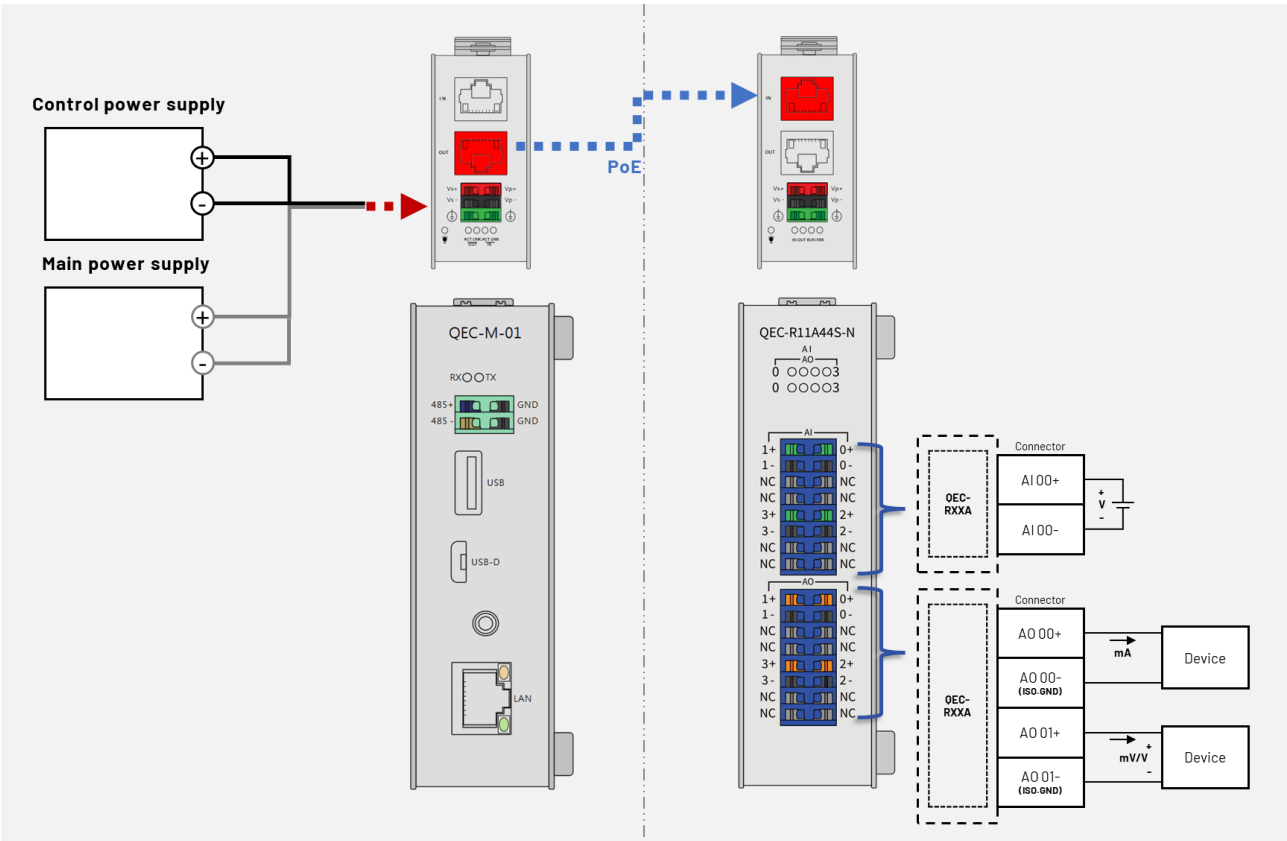
* PoE LAN with the Red Housing; Regular LAN with Black Housing.
* L4, L5, L7, L8 pins are option, for RJ45 Power IN/OUT.

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

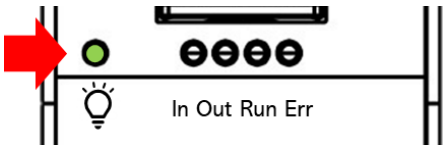
5.1 Hardware Preparation and Connection

The following devices are used here:

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



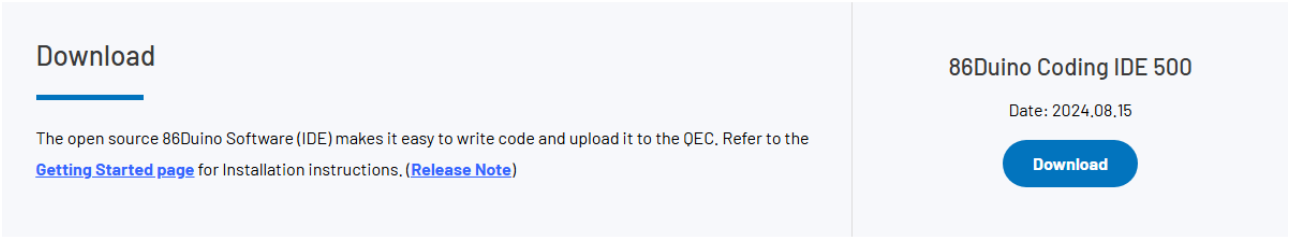
All QEC devices have PoE functions, so we only need to connect to Vs+/Vs and Vp+/Vp power pins (EU terminals) supplies for 19 to 50VDC power on QEC-M-01P, and then other devices will be powered by PoE. After powering on, you'll see the power LED light up and verify that the "PWR" LED indicators are ON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

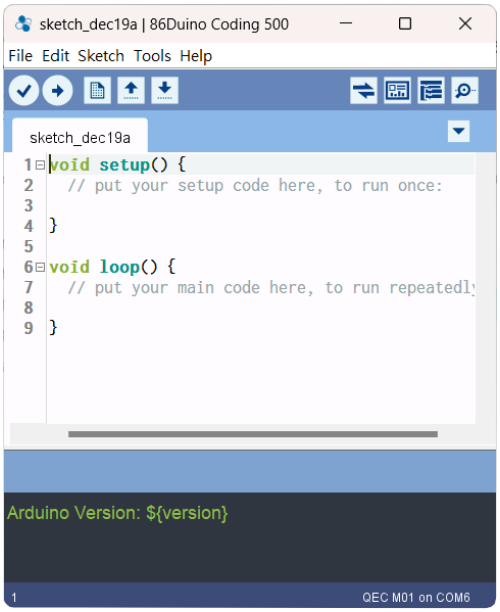
Download 86duino IDE from https://www.qec.tw/software/.



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.

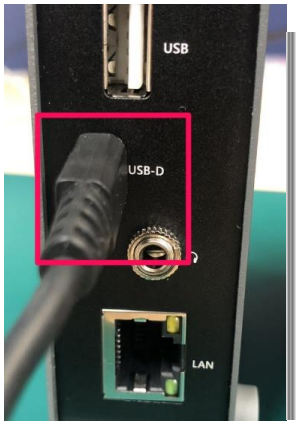
86Duino Coding IDE 500+ looks like below.

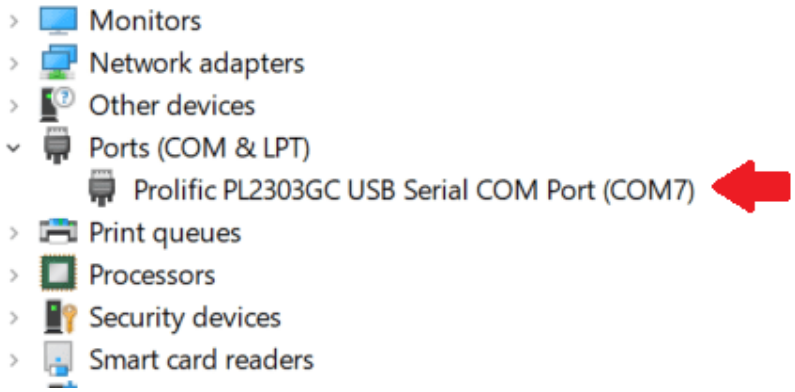


5.3 Connect to your PC and set up the environment

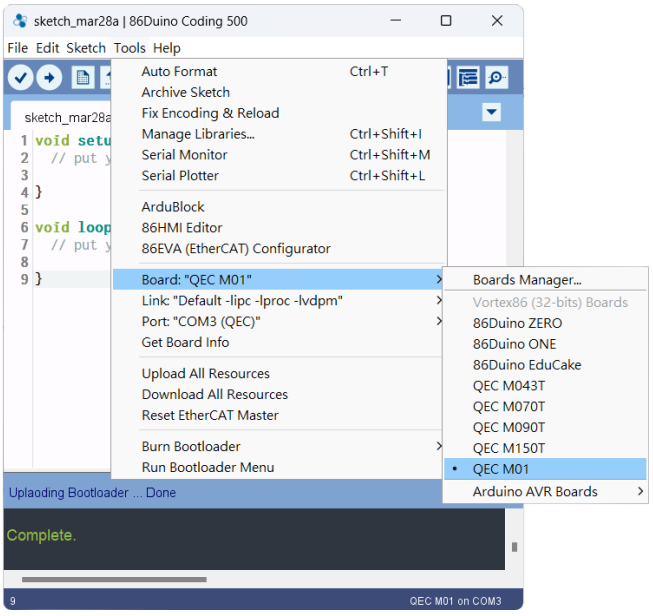
Follow the steps below to set up the environment:

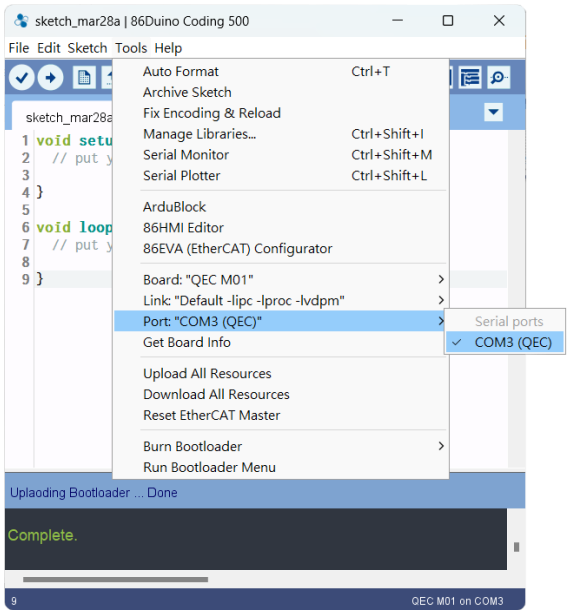
1. Connect the QEC-M-01P to your PC via a Micro USB to USB cable (86Duino IDE installed).
2. Turn on the QEC power.
3. Open "Device Manager" -> "Ports (COM & LPT)" in your PC and expand the ports; you should see that the "Prolific PL2303GC USB Serial COM Port (COMx)" is detected; if not, you will need 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-M-01 (or the QEC-M master model you use).
6. Select Port: In the IDE's menu, select "Tools"- >" Port" and select the USB port to connect to the QEC-M master (in this case, COM3 (QEC)).





5.4 Configuration and Operation

This section shows how to operate the EtherCAT Master (QEC-M-01) and QEC-RXXA44S module through the 86Duino IDE's graphical low-code programming tools, 86EVA.

We'll operate the following things:

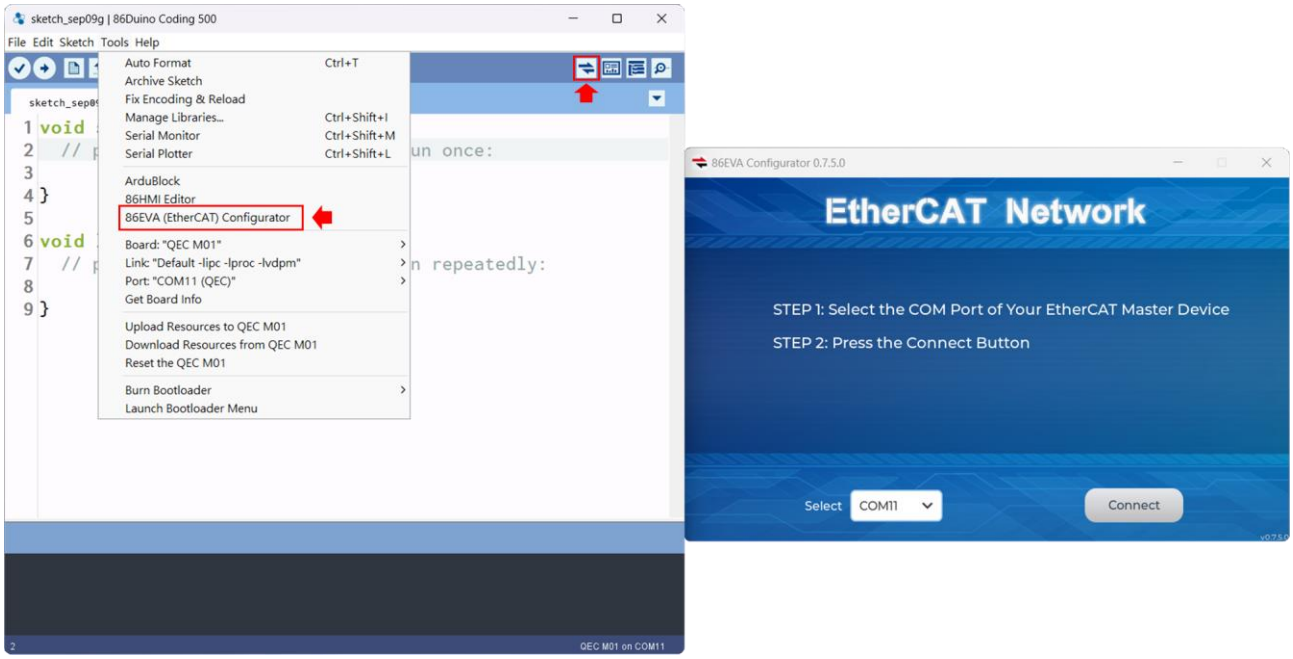
1. Configure Analog Input Range.
2. Configure Analog Output Range.
3. Read the Analog Input channel 0.
4. Write the Analog Output channel 0.

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.

Step 1: Turn on 86EVA and scan

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



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

The connected devices will be displayed after the EtherCAT network has been scanned. Press the "View" button in the lower left corner to check the device's status (Voltage, Current, and Temperature; View2) and operating time (Hours; View3).

Step 2: Set the parameters

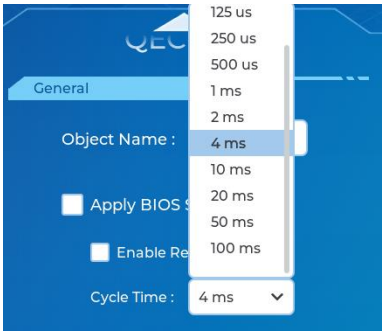
Press twice on the scanned device image to enter the corresponding parameter setting screen.

QEC-M-01

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

Please check the following configures.

A. Turn off the “Apply BIOS Settings”.
B. Select “4ms” to the Cycle Time.



After the setting and configuration, please 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.

In the "General" area, it will show the Object Name, Alias Address, Vendor ID, Product Code, and Firmware about the QEC-R11A44S.

For the Device Information, you can refer to 6.2.1 Standard Objects and 6.2.2 Manufacturer Objects.

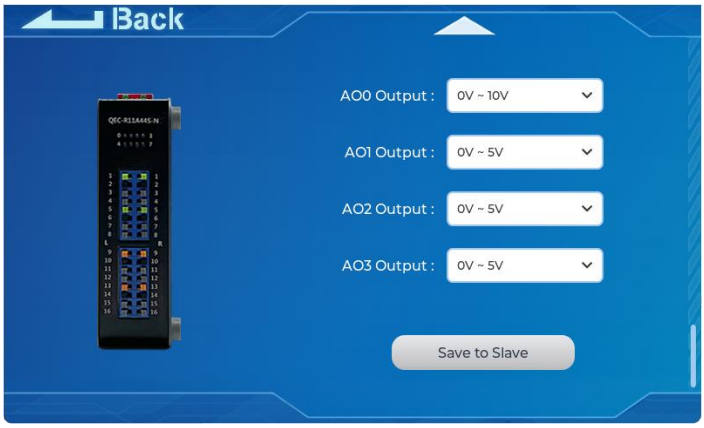
Users can go down of the settings page to the "Range Configuration" area to configure the Analog Input and Analog Output range.

- Analog Input:

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

In this case, we select -22V ~ 22V.

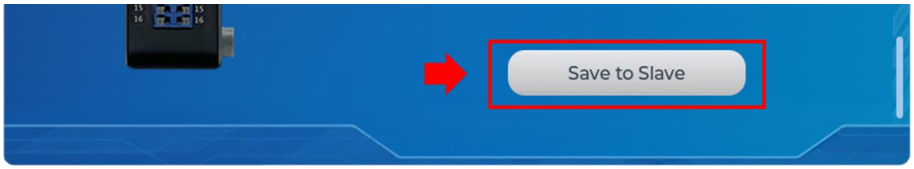
- Analog Output:



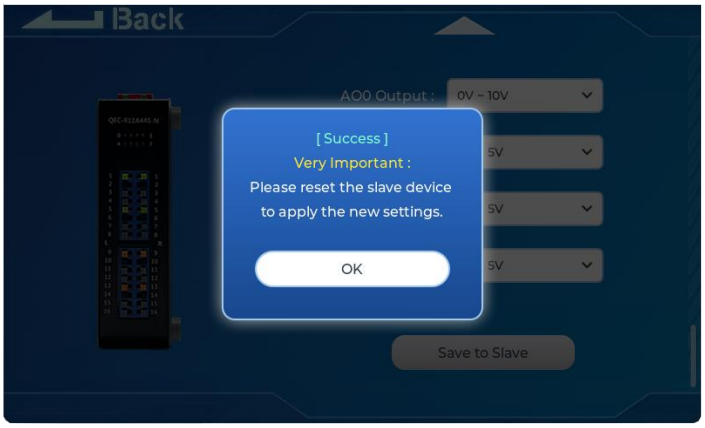
Output Current: 0 mA - 24 mA; 3.5 mA - 23.5 mA; 0 mA - 20 mA; 4 mA - 20 mA; ±24 mA.
Output Voltage: 0 V - 5 V; 0 V - 10 V; ±5 V; ±10 V; – 0 V - 6 V; 0 V - 12 V; ±6 V; ±12 V.

In this case, we select 0V ~ 10V.

After setting the Analog IO range configuration, please click the “Save to Slave” button so your settings will be written into the QEC-R11A44S after you reboot its power.

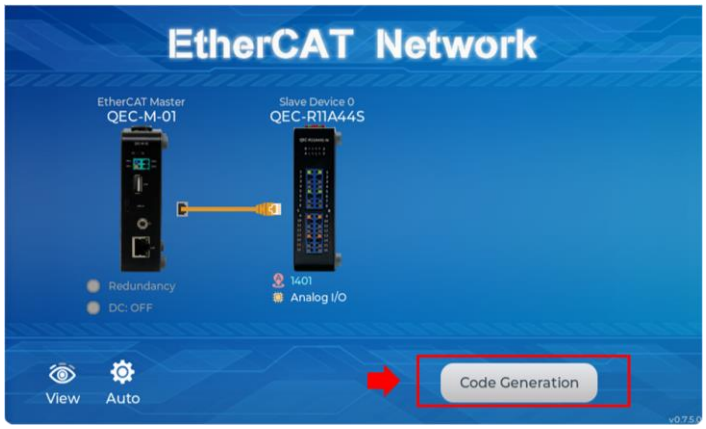


The windows will appear to notice you need to reset the device.



Step 3: Generate the code

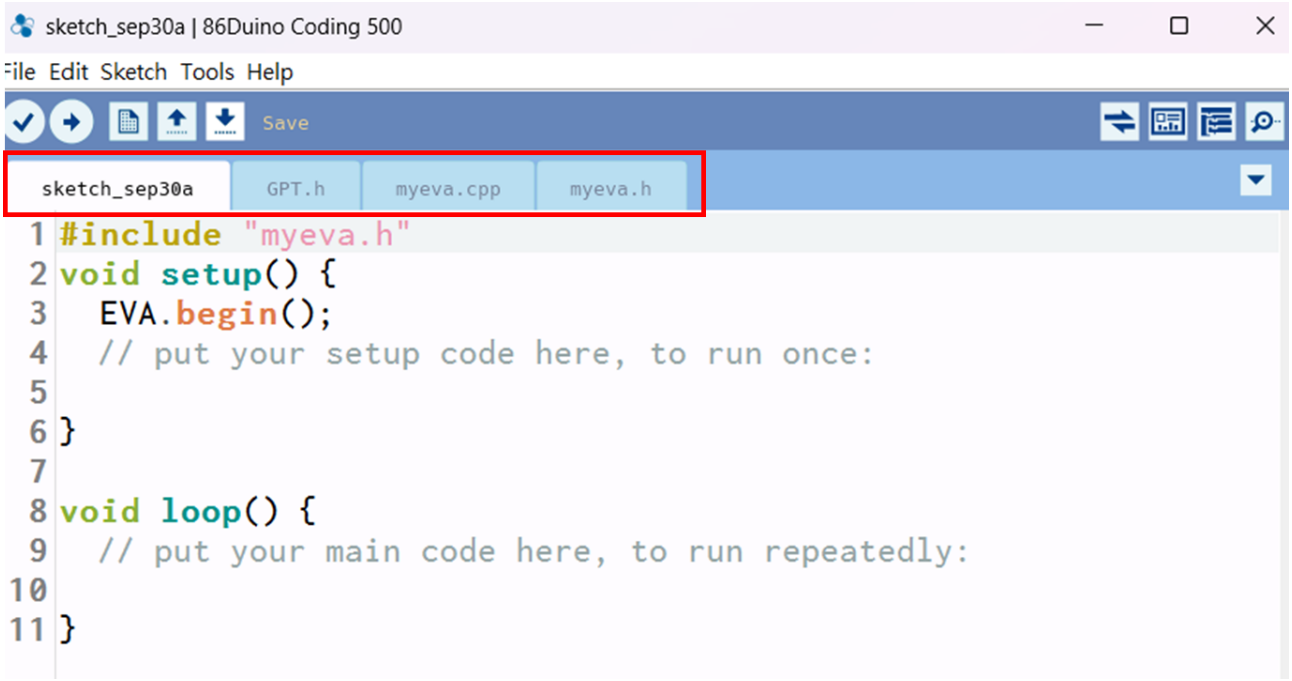
After configuring all settings, click the "Code Generation" button.



After clicking, the result and completion screen will appear, click OK to leave the program; If you do not click OK, you will leave the program after 10 seconds.

The generated code and files are as follows:

- sketch_sep30a: Main Project (depends on your project name)
- ChatGPT.h: Parameters to provide to ChatGPT referred
- myeva.cpp: C++ program code of 86EVA
- myeva.h: Header file of 86EVA

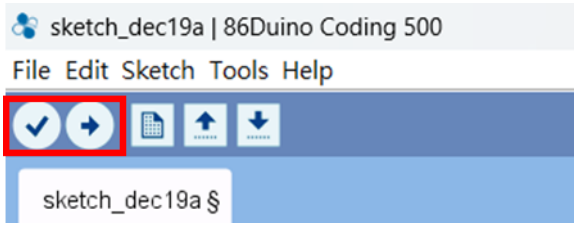


* **Additional note:** After 86EVA generates code, the following code will be automatically generated in the main program (.ino), and any of them missing will cause 86EVA not to work.

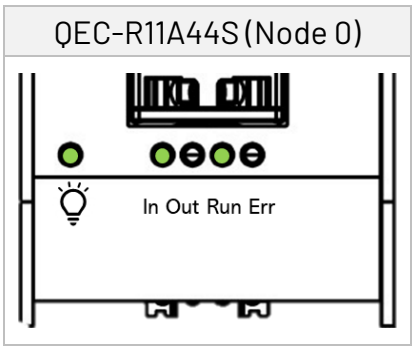
1. `#include “myeva.h” :` Include EVA Header file
2. `EVA.begin();` in `setup()` : Initialize the EVA function

Step 4: Upload the code

Once the code is generated, click on the toolbar to compile, and to confirm that the compilation is complete and error-free, you can click to upload. The program will run when the upload is complete.

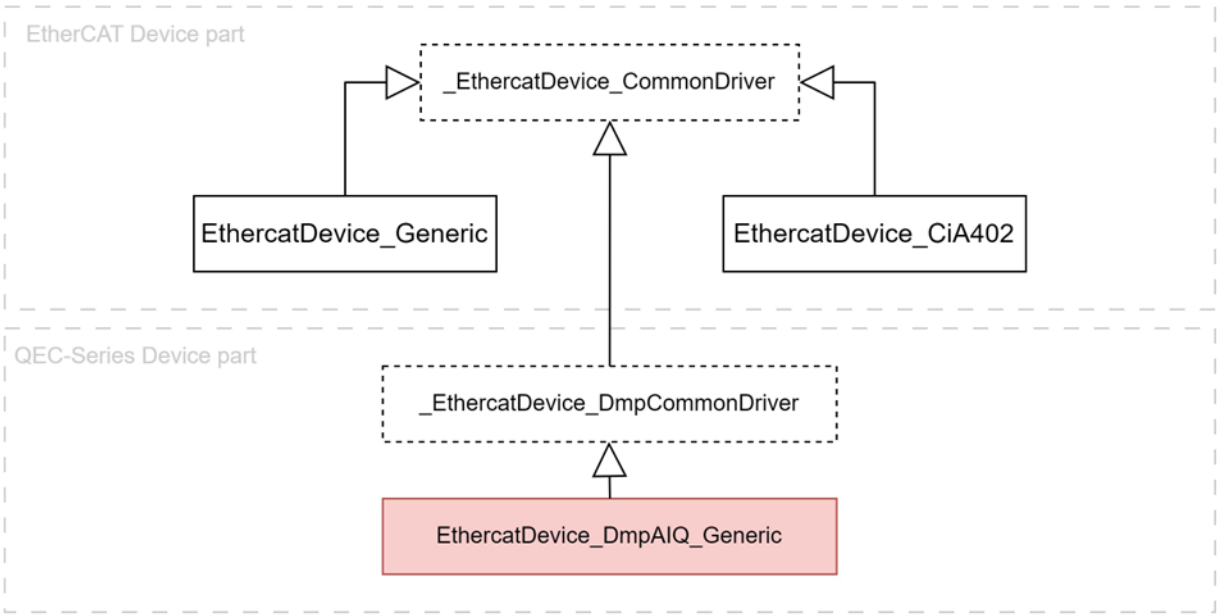


After the upload, if the EtherCAT Network is running successfully, it will enter OPERATION mode.
You can confirm this by the RUN LED on your QEC slave device, which should light up. Additionally, the LED on the EtherCAT LAN ports will start blinking, indicating active operation.



5.5 Write the code

In this section, we will operate the EthercatDevice_DmpAIQ_Generic Class to control QEC-R11A44S.
The EthercatDevice_DmpAIQ_Generic is an EtherCAT slave class specifically developed by ICOP for Analog I/O EtherCAT slave modules. It provides APIs for analog input, analog output, and other functionalities.



To effectively utilize your EtherCAT device, it's important to understand which functions are compatible with different modules (For EtherCAT Slave index assignments, please refer to 6.2.3 Function Objects).

Analog Output Functions

Analog output functions for the EthercatDevice_DmpAIQ_Generic class.

- analogWrite()
- voltageWrite()
- currentWrite()

Analog Input Functions

Analog input functions for the EthercatDevice_DmpAIQ_Generic class.

- analogRead()
- voltageRead()

5.5.1 Examples

When using these functions, reference the Object Name of your QEC device as set in the 86EVA.

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

- QEC-M-01: `EthercatMaster` object.
- QEC-R11A44S device: `EthercatDevice_DmpAIO_Generic` object.
- EtherCAT mode: `ECAT_SYNC`.

And here is the setting by users:

- EtherCAT Cycle time: 4 milisecond.
- Device Object Name: QEC-M-01 is “EcatMaster”, and QEC-R11A44S is “Slave0”.

1. In Setup Function:

- Initializes the serial (115200).
- Use `EVA.begin();` to initialize the EtherCAT system.

2. In Loop Function:

- Reads the voltage value from Analog Input Channel 0 (AI00) using `Slave0.voltageRead(0);` and prints the result to the serial monitor.
  This gives continuous feedback on the input voltage.
- Use `Slave.voltageWrite(0, 10);` for Analog Output Channel 0 (AO00) output 10V.
- Use `delay(10);` to wait for stability.

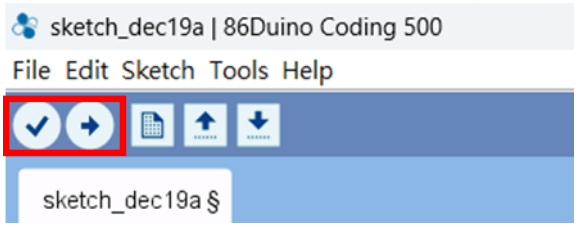
In summary, this example code initializes communication with the QEC-R11A44S-N module, reads the analog input voltage, and sets an output voltage. It continuously prints the input voltage to the serial monitor, demonstrating basic analog signal acquisition and control using the module.

Code Example:

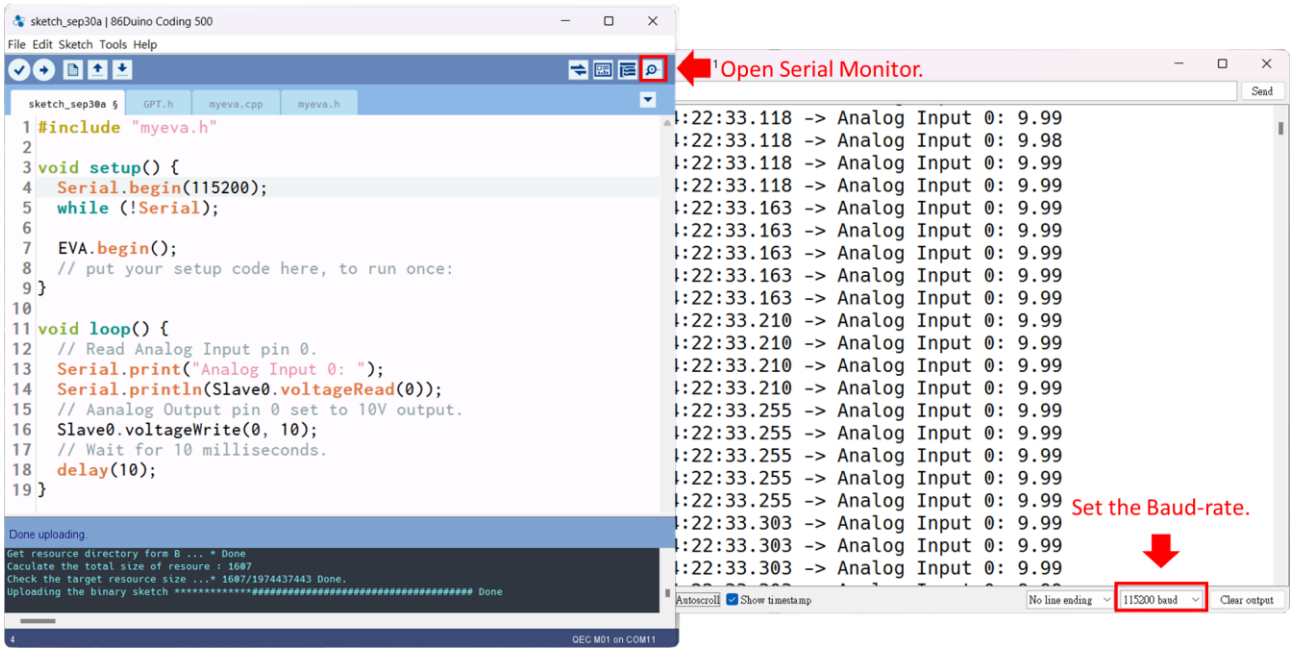
```
#include "myeva.h"  // Include the necessary library for EVA control.

void setup() {
  // Start serial communication with a baud rate of 115200.
  Serial.begin(115200);
  while (!Serial);  // Wait for the serial port to connect.

  // Initialize the QEC system.
  EVA.begin();
}

void loop() {
  // Read the voltage from Analog Input pin 0.
  Serial.print("Analog Input 0: ");
  Serial.println(Slave0.voltageRead(0));  // Print the analog input value
from pin 0 to the serial monitor.

  // Set Analog Output pin 0 to 10V.
  Slave.voltageWrite(0, 10);

  // Wait for 10 milliseconds before continuing.
  delay(10);
}
```

Note:

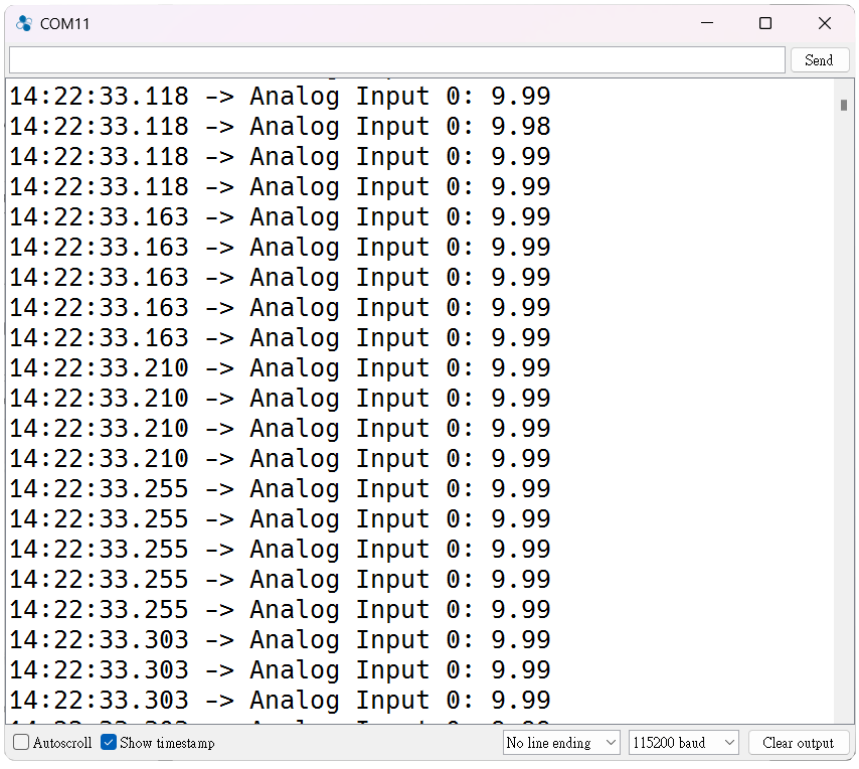
Once the code is written, click on the toolbar to compile, and to confirm that the compilation is complete and error-free, you can click to upload. The program will run when the upload is complete.



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



It will print the Analog Input channel 0's voltage value to the serial monitor.



5.5.2 Access Further Documentation

For a comprehensive understanding of the EtherCAT Master API, please refer to the EtherCAT Master API User Manual. This manual provides an in-depth overview of the API, detailing advanced features and capabilities to enhance your experience with EtherCAT technology.

For further exploration of programming beyond the basic setup, we recommend consulting the Language Reference Home and Libraries Reference Home. These resources offer extensive information on programming functions and libraries related to EtherCAT, supporting both beginner and advanced users.

To access the full EtherCAT Master API User Manual, please contact our sales team or email us at info@icop.com.tw. Our dedicated team is here to support you with detailed information and assistance for all your needs.

For online documentation, you can also visit:

- EtherCAT Library API User Manual: https://www.qec.tw/ethercat/api/ethercat-library-api-user-manual/

For further inquiries or sample requests, feel free to:

- Email: info@icop.com.tw
- Call your nearest ICOP branch or
- Contact our Worldwide Official Distributor.

Ch. 6

Slave Information

6.1 ESI (EtherCAT Slave Information) file

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

6.2.1 Standard Objects

Index 1000 Device type

Index	Name	Data type	Flags	Default
1000	Device type	UINT32	RO	0x00040192 (262546)

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.

Table 4-1: 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 Hardware version

Index	Name	Data type	Flags	Default
1009	Hardware version	STRING	RO	Depends on the version of the product you have.

Index 100A Software version

Index	Name	Data type	Flags	Default
100A	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.
1018:03	Revision	UINT32	RO	Depending by model.
1018:04	Serial number	UINT32	RO	0x00000001 (1)

Table 4-3: Product code & Revision Number

Model Name	Product code
QEC-R11A44S	0x0086d880

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

6.2.2 Manufacturer Objects

Index 0x5xxn Manufacturer Objects

Index	Name	Data type	Flags	Default
5000	SP_Voltage	UINT16	RW	0
5001	SP_Current	UINT16	RW	0
5002	PP_Voltage	UINT16	RW	0
5003	PP_Current	UINT16	RW	0
5004	Temperature	INT16	RW	0
5005	BoxStatus	UINT8	RW	0
5006	OrderInformation	-	-	> 4 <
5006:01	Customer	STRING (6)	RO	-
5006:02	OrderNo	STRING (8)	RO	-
5006:03	InvNo	STRING (11)	RO	-
5006:04	DelyDate	STRING (14)	RO	-
5007	MTBF	-	-	> 2 <
5007:01	WorkingHours	INT32	RO	0
5007:02	BootTimes	INT32	RO	0

6.2.3 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

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5010:0	AnalogInput0	-	TX	-
5010:01	Status	UINT16	RO	0
5010:02	Range	UINT8	RW	0
5010:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5010:04	Threshold_of_Input_Low	UINT16	RW	0
5010:05	Resolution	REAL32	RO	0

The Status object (Index 0x5010:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5010:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5011 Analog Input 1

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5011:0	AnalogInput1	-	TX	-
5011:01	Status	UINT16	RO	0
5011:02	Range	UINT8	RW	0
5011:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5011:04	Threshold_of_Input_Low	UINT16	RW	0
5011:05	Resolution	REAL32	RO	0

The Status object (Index 0x5011:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5011:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5012 Analog Input 2

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5012:0	AnalogInput2	-	TX	-
5012:01	Status	UINT16	RO	0
5012:02	Range	UINT8	RW	0
5012:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5012:04	Threshold_of_Input_Low	UINT16	RW	0
5012:05	Resolution	REAL32	RO	0

The Status object (Index 0x5012:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5012:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5013 Analog Input 3

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5013:0	AnalogInput3	-	TX	-
5013:01	Status	UINT16	RO	0
5013:02	Range	UINT8	RW	0
5013:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5013:04	Threshold_of_Input_Low	UINT16	RW	0
5013:05	Resolution	REAL32	RO	0

The Status object (Index 0x5013:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5013:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5014 Analog Input 4

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5014:0	AnalogInput4	-	TX	-
5014:01	Status	UINT16	RO	0
5014:02	Range	UINT8	RW	0
5014:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5014:04	Threshold_of_Input_Low	UINT16	RW	0
5014:05	Resolution	REAL32	RO	0

The Status object (Index 0x5014:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5014:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5015 Analog Input 5

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5015:0	AnalogInput5	-	TX	-
5015:01	Status	UINT16	RO	0
5015:02	Range	UINT8	RW	0
5015:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5015:04	Threshold_of_Input_Low	UINT16	RW	0
5015:05	Resolution	REAL32	RO	0

The Status object (Index 0x5015:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5015:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5016 Analog Input 6

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5016:0	AnalogInput6	-	TX	-
5016:01	Status	UINT16	RO	0
5016:02	Range	UINT8	RW	0
5016:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5016:04	Threshold_of_Input_Low	UINT16	RW	0
5016:05	Resolution	REAL32	RO	0

The Status object (Index 0x5016:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5016:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5017 Analog Input 7

The configuration objects allow for the setup of operational parameters such as voltage range, threshold values, and resolution for precise data acquisition.

Index	Name	Data type	Flags	Default
5017:0	AnalogInput7	-	TX	-
5017:01	Status	UINT16	RO	0
5017:02	Range	UINT8	RW	0
5017:03	Threshold_of_Input_High	UINT16	RW	0xFFFF
5017:04	Threshold_of_Input_Low	UINT16	RW	0
5017:05	Resolution	REAL32	RO	0

The Status object (Index 0x5017:01) shows the current condition of the analog input. It is divided into several bits that indicate specific issues:

- Bit 0: Input To Low By subindex 4
- Bit 1: Input To High By subindex 4
- Bit 2: AVDD low
- Bit 3: AVDD High

The Range object (Index 0x5017:02) offers multiple predefined voltage settings, allowing the module to be adapted for various voltage inputs:

- 0000b: Full voltage ≒ ±22V
- 0001b: Full voltage ≒ ±20V
- 0010b: Full voltage ≒ ±11V
- 0011b: Full voltage ≒ ±10V
- 0100b: Full voltage ≒ ±5V
- 0101b: Full voltage ≒ 22V
- 0110b: Full voltage ≒ 20V
- 0111b: Full voltage ≒ 11V
- 1000b: Full voltage ≒ 10V

Index 0x5020 Digital Output 0

Index 0x5020 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5020:0	DigitalOutput0	-	TX	-
5020:01	Status	UINT16	RO	0
5020:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5020:02):
This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5021 Digital Output 1

Index 0x5021 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5021:0	DigitalOutput1	-	TX	-
5021:01	Status	UINT16	RO	0
5021:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5021:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5022 Digital Output 2

Index 0x5022 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5022:0	DigitalOutput2	-	TX	-
5022:01	Status	UINT16	RO	0
5022:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5022:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5023 Digital Output 3

Index 0x5023 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5023:0	DigitalOutput3	-	TX	-
5023:01	Status	UINT16	RO	0
5023:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5023:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5024 Digital Output 4

Index 0x5024 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5024:0	DigitalOutput4	-	TX	-
5024:01	Status	UINT16	RO	0
5024:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5024:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5025 Digital Output 5

Index 0x5025 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5025:0	DigitalOutput5	-	TX	-
5025:01	Status	UINT16	RO	0
5025:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5025:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5026 Digital Output 6

Index 0x5026 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5026:0	DigitalOutput6	-	TX	-
5026:01	Status	UINT16	RO	0
5026:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5026:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

Index 0x5027 Digital Output 7

Index 0x5027 is designated for configuring digital output operations in the QEC-RXXA series module. The configuration objects allow for setting operational parameters such as voltage range, threshold values, and resolution.

Index	Name	Data type	Flags	Default
5027:0	DigitalOutput7	-	TX	-
5027:01	Status	UINT16	RO	0
5027:02	Range	UINT8	RW	0

DAC Output Range Settings (Index 5027:02):

This module supports a variety of output ranges, both in voltage and current modes, which can be configured through the Range object to meet diverse application needs:

- Voltage Output Settings:
  - 0000: 0 to +5 V (default)
  - 0001: 0 to +10 V
  - 0010: ±5 V
  - 0011: ±10 V
  - 1000: 0 to +6 V
  - 1001: 0 to +12 V
  - 1010: ±6 V
  - 1011: ±12 V
- Current Output Settings:
  - 0100: 3.5 mA to 23.5 mA
  - 0101: 0 to 20 mA
  - 0110: 0 to 24 mA
  - 0111: ±24 mA
  - 1100: 4 mA to 20 mA

Any setting outside these specified ranges will disable the output.

6.2.4 Especial Objects (0x6000-0xFFFF)

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	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5010:05.

Index 0x6001 Analog Input 1

Index	Name	Data type	Flags	Default
6001	AnalogInput1	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5011:05.

Index 0x6002 Analog Input 2

Index	Name	Data type	Flags	Default
6002	AnalogInput2	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5012:05.

Index 0x6003 Analog Input 3

Index	Name	Data type	Flags	Default
6003	AnalogInput3	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5013:05.

Index 0x6004 Analog Input 4

Index	Name	Data type	Flags	Default
6004	AnalogInput4	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5014:05.

Index 0x6005 Analog Input 5

Index	Name	Data type	Flags	Default
6005	AnalogInput5	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5015:05.

Index 0x6006 Analog Input 6

Index	Name	Data type	Flags	Default
6006	AnalogInput6	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5016:05.

Index 0x6007 Analog Input 7

Index	Name	Data type	Flags	Default
6007	AnalogInput7	UINT16	RO	-

- For ranges 0, 1, 2, 3, 4:
  $Vin = (AnalogInput0 - 32768) \times$ Resolution
- For ranges 5, 6, 7, 8:
  $Vin = (AnalogInput0) \times$ Resolution

Resolution is specified at 0x5017:05.

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	-

Index 0x7004 Digital Output 4

Index	Name	Data type	Flags	Default
7004	DigitalOutput4	UINT16	RW	-

Index 0x7005 Digital Output 5

Index	Name	Data type	Flags	Default
7005	DigitalOutput5	UINT16	RW	-

Index 0x7006 Digital Output 6

Index	Name	Data type	Flags	Default
7006	DigitalOutput6	UINT16	RW	-

Index 0x7007 Digital Output 7

Index	Name	Data type	Flags	Default
7007	DigitalOutput7	UINT16	RW	-

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.