ICOP Technology Inc.

User Manual

QEC-RXXD

EtherCAT Slave Digital I/O Module

With Isolated 16-ch Digital Input/Output

(Revision 2.2)

REVISION

DATE	VERSION	DESCRIPTION
2022/05/27	**Version1.0A**	**New Release.**
2022/09/01	**Vesrion1.0B**	**Words Modification.**
2023/11/02	**Version2**	**Updated Product Specifications.**
2023/11/23	**Version2.1**	**Add Getting Started.**
2024/01/09	**Version2.2**	**Updated Getting Started**

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Ver.2.2 January, 2024

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/-40 to +85°C (Option).
- 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

ICOP's QEC-RXXD series are standard industrial EtherCAT slave digital I/O modules, with standalone isolated design on each channel to protect from harmful interference and influences critical environment. The modules offer a wide variety of I/O channels that can be intermixed between 4, 8, 12 and up to 16 I/O channels.

Comply with EtherCAT Conformance Test Tool (ET9400), the QEC-RXXD is qualified and can be cooperated with the EtherCAT master systems for quickly implement in industrial applications.

Capable up to 100 μs EtherCAT cycle time, as well as the Distributed Clock (DC) mode, QEC-RXXD is aimed for high precision and synchronous applications requirement. Designed with the up-to-date silicon components, it also reduces heat generation and extend product life while also providing automatic internal status monitoring, including voltage, current and operating temperature, to help provide effective carbon footprint tracking. For Digital Input of QEC-RXXD series, the maximum input frequency is 8KHz, it equipped with various of optional features, including polarity separated digital input channel pins, input wire break detection lines and up to 2500Vrms ESD isolation protection. And for Digital Output of QEC RXXD series, the maximum frequency is also 8KHz, all channels are polarity neutral, with up to 3750Vrms ESD isolation protection, and can drive up to 56Vdc@500mA.

QEC-RXXD offer users an easy way to update the firmware via FOE and features two networks available for EtherCAT Cable Redundancy. The module status can be indicated by LEDs for troubleshooting and verifying I/O status.
QEC-RXXD measures 107.45 x 77.4 x 30 mm, supports standard system operation from -20 to +70°C and optional -40 to +85°C. It can be easily installed by Din Rail mounting kit and features a European style terminal block that provides easy installation and removable wiring terminals for easy deployment.

1.2 Specifications

1.2.1 Digital Input

Model Name	QEC-RXXDF0S/D	QEC-RXXDF0H
Channel	16 (Isolated Channel)	
Input Type	Sink	
Frequency	500Hz	8KHz
Propagation delay time	150ns	
Load Voltage	Max. 56VDC	
Wire-break detection	Option	No
Distributed Clocks (DC)	No	Yes
General		
Connector	Push-in Terminal (Euroblock)	
Connector Color	Positive: Red Negative: Black	
Protocol	EtherCAT (RJ-45 x 2)	
Ethernet Standard	IEEE 802.3	
Transmission Rate	100Mbps	
Power Connector	4-pin Power Input/Output & 2-pin FGND	
Power Requirement	+19 to +50VDC Power Input (Typ. +24VDC@100mA)	
Power Consumption	2.4W	
LED Indicator	PWR, RUN, LINK, ERROR, DI status	
Certifications	CE, FCC, VCCI	
Environment		
Isolation Protection, Optocoupler	2500 Vrms	
Operating Temperature	-20 to +70 °C	
Hardware		
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)	
Weight	245 g	250 g
Installation	DIN rail	
Internal Monitoring	Temperature, Voltage, Current, Startup time	

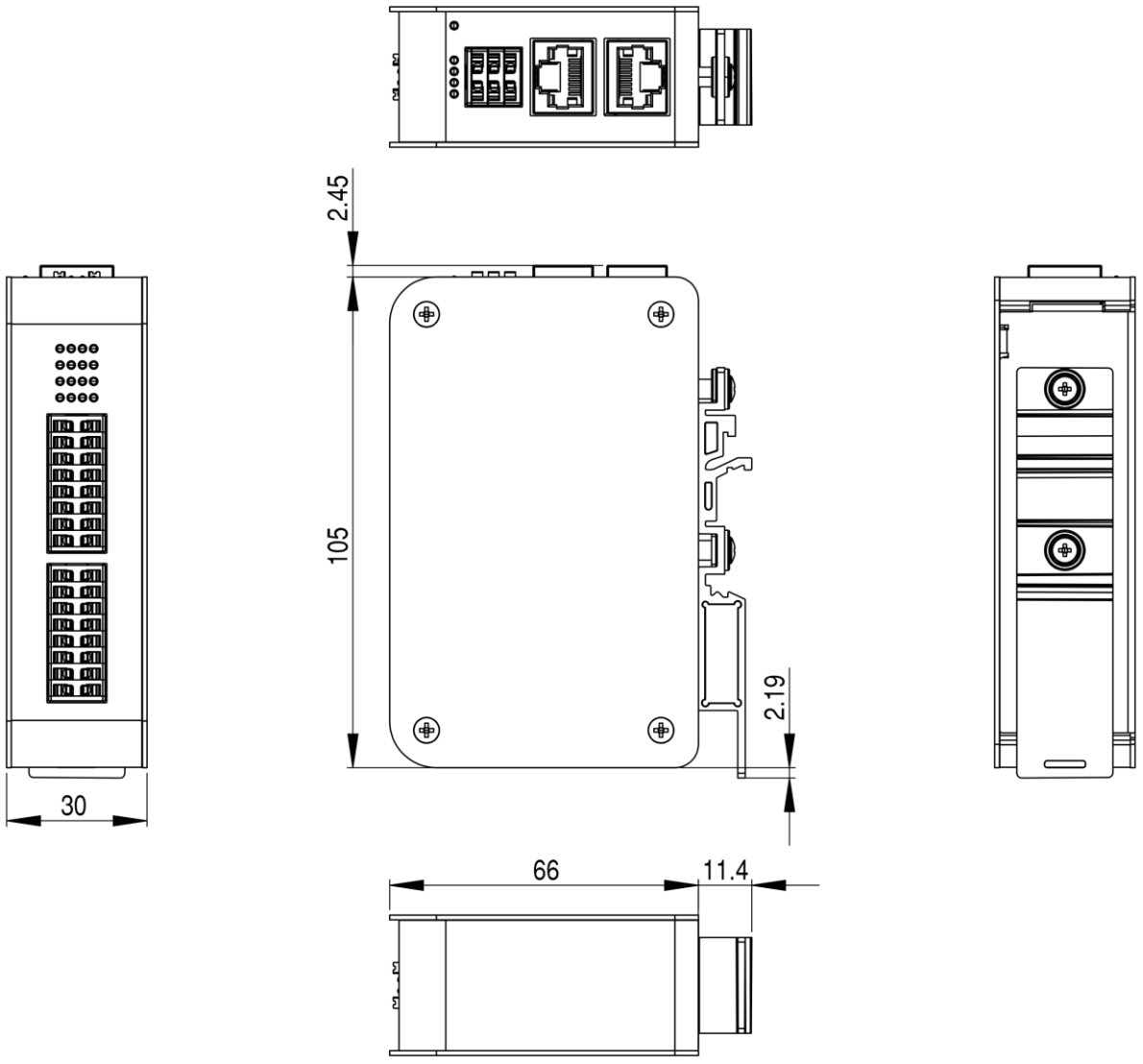
1.2.2 Digital Output

Model Name	QEC-RXXD0FS	QEC-RXXD0FH
Channel	16 (Isolated Channel)	
Input Type	Sink	
MOSFET	MOS-FET Relay	MOS-FET
Frequency	500Hz	8KHz
Propagation delay time	50μs	
Load Voltage	Max. 56VDC (AC peak/DC)	
Load Current	1A per channel (Option to 2A)	1A per channel
Distributed Clocks (DC)	No	Yes
General		
Connector	Push-in Terminal (Euroblock)	
Connector Color	Positive: Orange Negative: Black	
Protocol	EtherCAT (RJ-45 x 2)	
Ethernet Standard	IEEE 802.3	
Transmission Rate	100Mbps	
Power Connector	4-pin Power Input/Output & 2-pin FGND	
Power Requirement	+19 to +50VDC Power Input (Typ. +24VDC@140mA)	
Power Consumption	3.4W	
LED Indicator	PWR, RUN, LINK, ERROR, DO status	
Certifications	CE, FCC, VCCI	
Environment		
Isolation Protection, Optocoupler	1500 Vrms	3750 Vrms
Operating Temperature	-20 to +70 °C	
Hardware		
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)	
Weight	245 g	280 g
Installation	DIN rail	
Internal Monitoring	Temperature, Voltage, Current, Startup time	

1.2.3 Digital Input/Output

Model Name	QEC-RXXD88S/D	QEC-RXXD88H
Digital Type	8-ch Digital Input & 8-ch Digital Output	
I/O Type	Sink	
Channel	16 (Isolated Channel)	
MOSFET	MOS-FET Relay	MOS-FET
I/O Frequency	500Hz	8KHz
Propagation delay time	Digital Input: 150ns; Digital Output: 50μs	
Load Voltage	Digital Input: Max. 56VDC; Digital Output: Max. 56VDC (AC peak/DC)	
Distributed clocks	No	Yes
Digital Input		
Wire-break detection	Option	No
Digital Output		
MOSFET	MOS-FET Relay	MOSFET
Load Current	1A per channel (Option to 2A)	1A per channel
General		
Connector	16-channel Push-in Terminal (Euroblock)	
Connector Color	Positive: Digital Input for Red; Digital Output for Orange Negative: Black	
Protocol	EtherCAT (RJ-45 x 2)	
Ethernet Standard	IEEE 802.3	
Transmission Rate	100Mbps	
Power Connector	4-pin Power Input/Output & 2-pin FGND	
Power Requirement	+19 to +50VDC Power Input (Typ. +24VDC@140mA)	
Power Consumption	3.4W	
LED Indicator	PWR, RUN, LINK, ERROR, DO status	
Certifications	CE, FCC, VCCI	
Environment		
Isolation Protection, Optocoupler	Digital Input: 2500 Vrms Digital Output: 1500 Vrms	Digital Input: 2500 Vrms Digital Output: 3750 Vrms
Operating Temperature	-20 to +70 °C	
Hardware		
Dimension	107.45 x 66 x 30mm (Without DIN-Rail)	
Weight	260 g	280 g
Installation	DIN rail	
Internal Monitoring	Temperature, Voltage, Current, Startup time	

1.3 Dimension

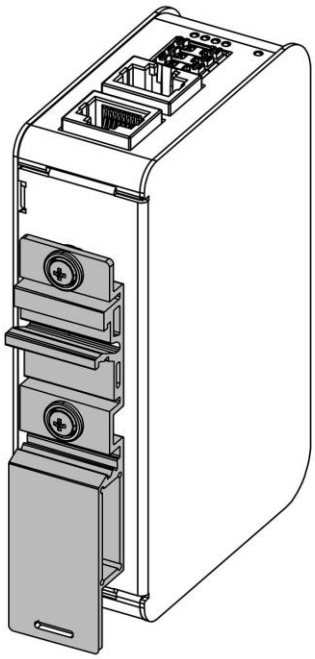


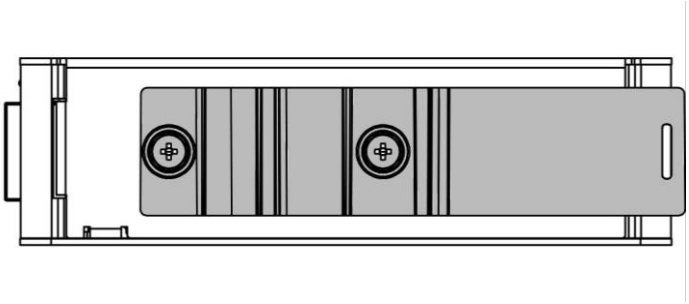
(Unit: mm)

1.4 Mounting Instruction

QEC-RXXD 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	Digital	Input	Output	Digital Type		
QEC-R	X	X	D	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

D: Digital I/O

X: 0 ,4 ,8, C (12), F (16) input channels

X: 0 ,4 ,8, C (12), F (16) output channels

4. Feature: Code 10

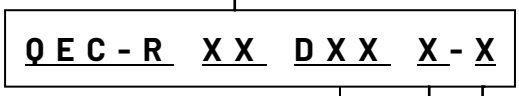
D: Wire-break detection

S: Standard

H: High-speed Digital Frequency

5. Coating: Code 11

C: Yes / N: Normal



1.5.1 Reference Ordering Part Number:

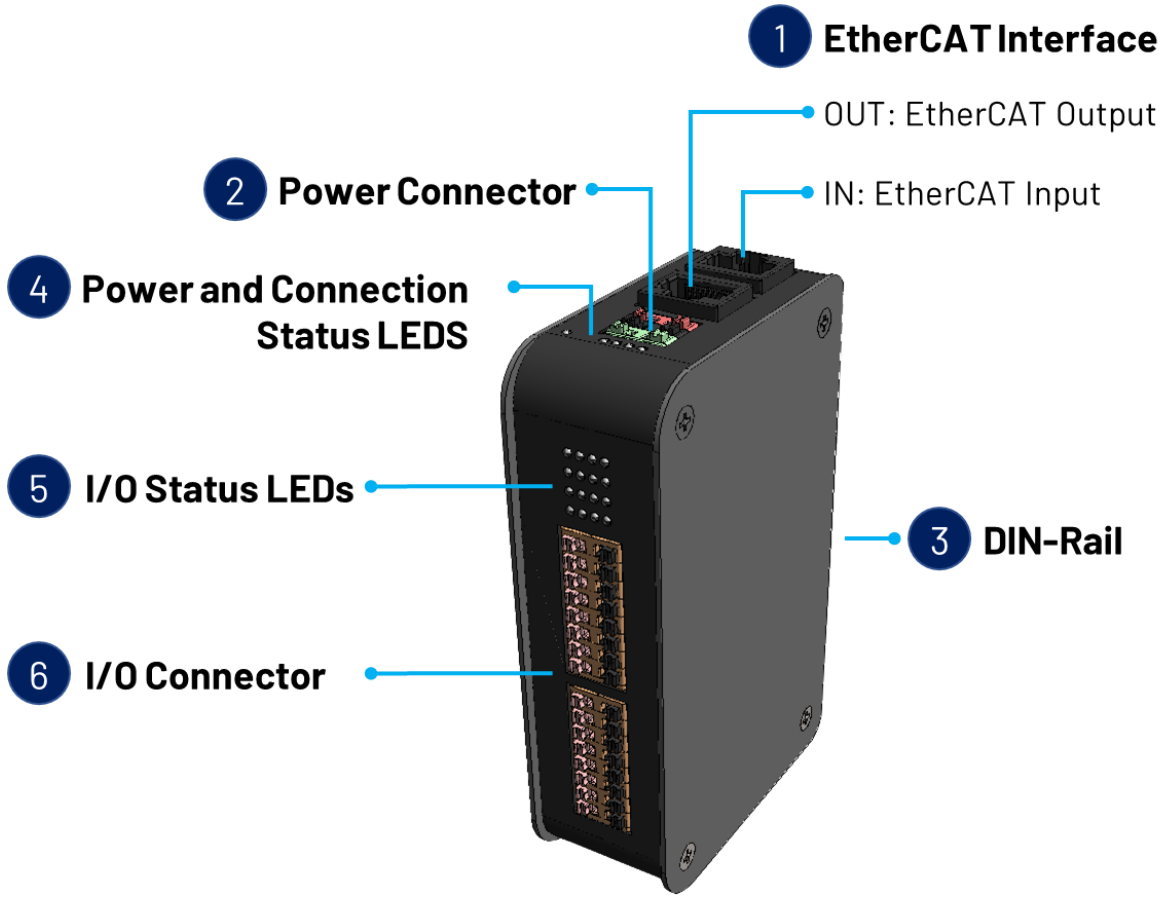
Above is the standard Part Number, please contact our sales if you need to order other part number.

- **QEC-R00DF0D-N**: EtherCAT Slave Digital Input 16 channels modules/Wire-break detection
- **QEC-R11D0FS-N**: EtherCAT Slave Digital Output 16 channels modules/PoE
- **QEC-R00DF0H-N**: EtherCAT Slave High-speed Digital Input 16 channels modules
- **QEC-R00D0FH-N**: EtherCAT Slave High-speed Digital Output 16 channels modules

Ch. 2

Hardware System

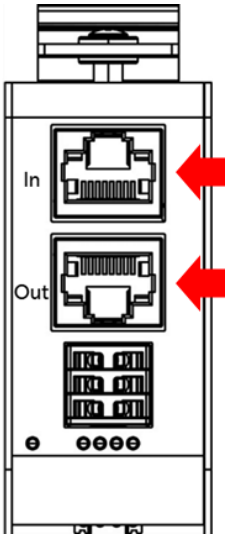
2.1 General Technical Data



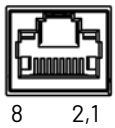
2.2 Connector Summary

No.	Description		Type Narrative	Pin #
1	EtherCAT Interface	OUT	External RJ45 Connector	8-pin
		IN	(Gold finger)	8-pin
2	Power Connector		Terminal Block Interface	6-pin
3	DIN-Rail		-	-
4	Power and Connection Status LEDs		External Status LEDs	-
5	I/O Status LEDs		External Status LEDs	-
6	I/O Connector	1 ~ 16	16-ch Push-in Terminal	16-pin
		17 ~ 32	(Euroblock)	16-pin

2.2.1 EtherCAT Interface



EC IN

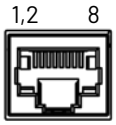


Pin #	Signal Name	Pin #	Signal Name
1	LAN1_TX+	2	LAN1_TX-
3	LAN1_RX+	4	VS+
5	VP+	6	LAN1_RX-
7	VS-(GND)	8	VP-(GND)

* 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

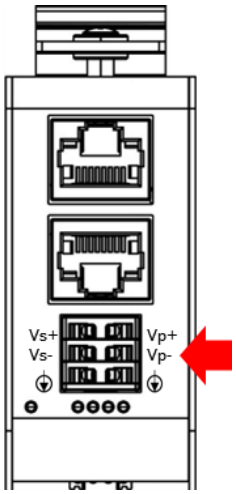


Pin #	Signal Name	Pin #	Signal Name
1	LAN2_TX+	2	LAN2_TX-
3	LAN2_RX+	4	VS+
5	VP+	6	LAN2_RX-
7	VS-(GND)	8	VP-(GND)

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

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

2.2.2 Power Connector



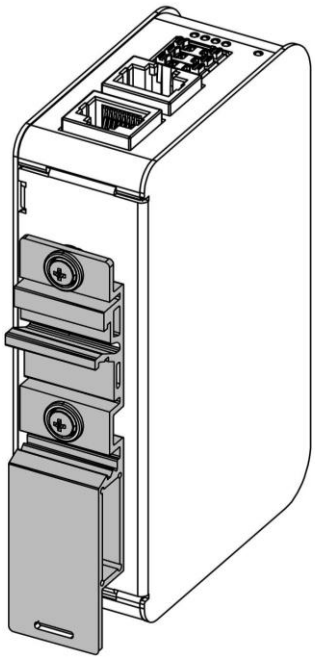
Vs for system power; Vp for peripheral power and backup power.

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 DIN-Rail installation

Please refer toCh.3.1 DIN-Rail installation.



2.2.4 Power and Connection Status LEDs

Power Status LED

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

Notation	Color	States	Description
PWR 	Green / Red	Green LED On	Voltage <= 48V and Voltage >= 19V
		Green LED On Red LED On	1. Voltage < 50V and Voltage > 48V 2. Voltage < 19V and Voltage < 17V
		Red LED On	Voltage >= 50V and Voltage <= 17V

* Vs power status will be displayed first.

Connection Status LEDs

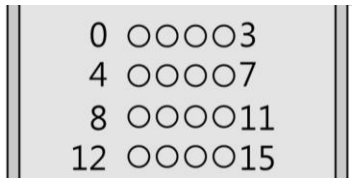
Notation	Color	States	Description
In	Green	Off	No link
		Blinking	Link and activity
		On	Link without activity
Out	Green	Off	No link
		Blinking	Link and activity
		On	Link without activity
Run	Green	Off	The device is in state INIT
		Blinking	The device is in state Pre-Operation
		Single Flash	The device 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

2.2.5 I/O Status LEDs

The I/O status LEDs for the digital input and output modules vary from module to module.

Digital Input (QEC-RXXDF0S/QEC-RXXDF0D/QEC-RXXDF0H)

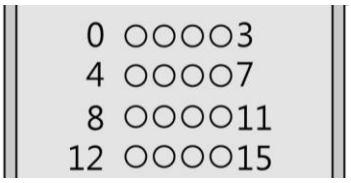
The LEDs of 16 digital inputs are 0 to 16, individually indicating the status of the 16 digital channels.



Notation	Color	States	Description
Digital Input	-	Off	Digital input status is “Off”
	Green	On	Digital input status is “On”

Digital Output (QEC-RXXD0FS/QEC-RXXD0FH)

The LEDs of 16 digital outputs are 0 to 16, individually indicating the status of the 16 digital channels.

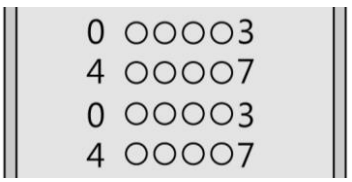


Notation	Color	States	Description
Digital Output	-	Off	Digital input status is “Off”
	Green	On	Digital input status is “On”

Digital Input/Output (QEC-RXXD88S/QEC-RXXD88H)

The LEDs for the 8-channel digital inputs/outputs are 0 through 7, indicating the input and output channels respectively. The first 0 to 7 LEDs are for digital inputs’ status; and then, the next 0 to 7 LEDs are for digital outputs’ status.

Digital Input



Digital Output

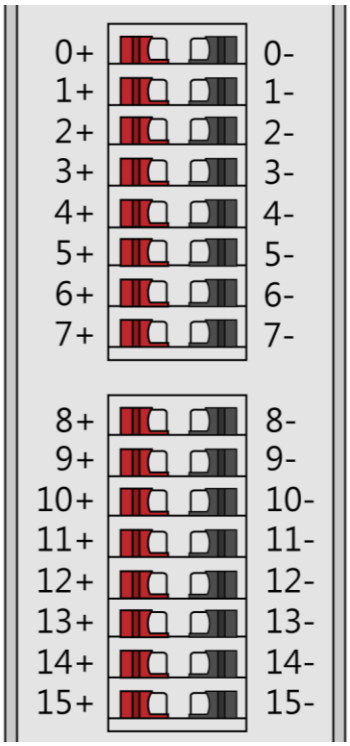
Notation	Color	States	Description
Digital Input	-	Off	Digital input status is “Off”
	Green	On	Digital input status is “On”
Digital Output	-	Off	Digital output status is “Off”
	Green	On	Digital output status is “On”

2.2.6 I/O Connector

For EtherCAT Slave index assignments, refer to 4.2.3 Especial Objects (0x6000-0xFFFF).

Digital Input (QEC-RXXDF0S/QEC-RXXDF0D/QEC-RXXDF0H)

Digital Input: Positive (Red), Negative (Black).

Pin #	Signal Name		Pin #	Signal Name
0+	DI00+		0-	DI00-
1+	DI01+		1-	DI01-
2+	DI02+		2-	DI02-
3+	DI03+		3-	DI03-
4+	DI04+		4-	DI04-
5+	DI05+		5-	DI05-
6+	DI06+		6-	DI06-
7+	DI07+		7-	DI07-
8+	DI08+		8-	DI08-
9+	DI09+		9-	DI09-
10+	DI10+		10-	DI10-
11+	DI11+		11-	DI11-
12+	DI12+		12-	DI12-
13+	DI13+		13-	DI13-
14+	DI14+		14-	DI14-
15+	DI15+		15-	DI15-

For digital input wire-break detection function, only for the **QEC-RXXDF0D** module. Please contact our sales if you need more information.

Digital Input Load Voltage:

- Maximum Load Voltage: 56VDC
  Our modules are designed to handle the load voltage range from 24 to 56VDC.

Channel Isolation:

- Isolated Channels: 16

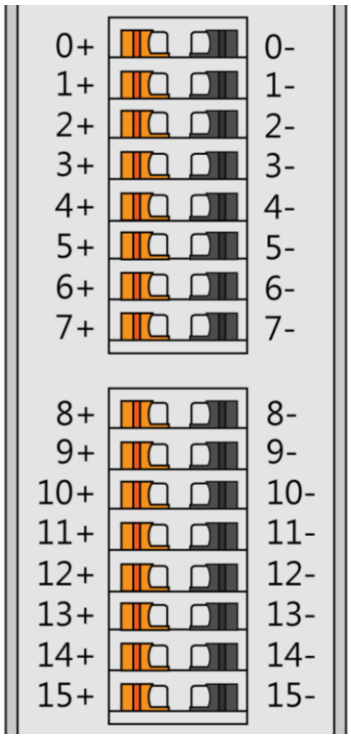
I/O Type:

- Type: Sink

Digital Output (QEC-RXXD0FS/QEC-RXXD0FH)

Digital Output: Positive (Orange), Negative (Black).

Pin #	Signal Name		Pin #	Signal Name
0+	DQ00+		0-	DQ00-
1+	DQ01+		1-	DQ01-
2+	DQ02+		2-	DQ02-
3+	DQ03+		3-	DQ03-
4+	DQ04+		4-	DQ04-
5+	DQ05+		5-	DQ05-
6+	DQ06+		6-	DQ06-
7+	DQ07+		7-	DQ07-
8+	DQ08+		8-	DQ08-
9+	DQ09+		9-	DQ09-
10+	DQ10+		10-	DQ10-
11+	DQ11+		11-	DQ11-
12+	DQ12+		12-	DQ12-
13+	DQ13+		13-	DQ13-
14+	DQ14+		14-	DQ14-
15+	DQ15+		15-	DQ15-



Each channel in the Digital Output module can safely handle a load current of up to 1 A.

Digital Output Load Voltage:

- Maximum Load Voltage: 56VDC
  Our modules are designed to handle the load voltage range from 24 to 56VDC.

Channel Isolation:

- Isolated Channels: 16

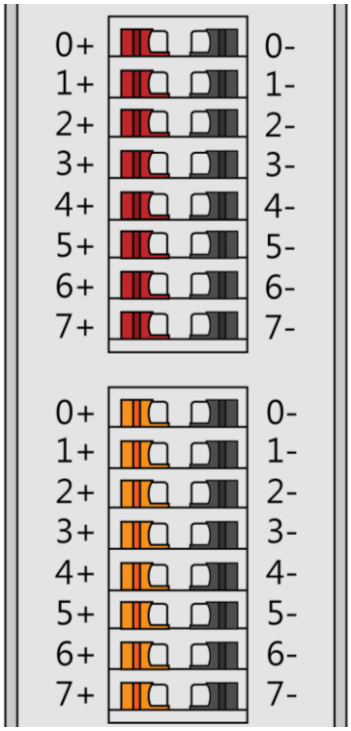
I/O Type:

- Type: Sink

Digital Input/Output (QEC-RXXD88S/QEC-RXXD88H)

Digital Output: Positive (Orange), Negative (Black).
Digital Input: Positive (Red), Negative (Black).

Pin #	Signal Name
0+	DI00+
1+	DI01+
2+	DI02+
3+	DI03+
4+	DI04+
5+	DI05+
6+	DI06+
7+	DI07+
0+	DQ00+
1+	DQ01+
2+	DQ02+
3+	DQ03+
4+	DQ04+
5+	DQ05+
6+	DQ06+
7+	DQ07+



Pin #	Signal Name
0-	DI00-
1-	DI01-
2-	DI02-
3-	DI03-
4-	DI04-
5-	DI05-
6-	DI06-
7-	DI07-
0-	DQ00-
1-	DQ01-
2-	DQ02-
3-	DQ03-
4-	DQ04-
5-	DQ05-
6-	DQ06-
7-	DQ07-

Each channel of the Digital Output can safely handle a load current of up to 1 A.

Digital Input/Output Load Voltage:

- Maximum Load Voltage: 56VDC
  Our modules are designed to handle the load voltage range from 24 to 56VDC.

Channel Isolation:

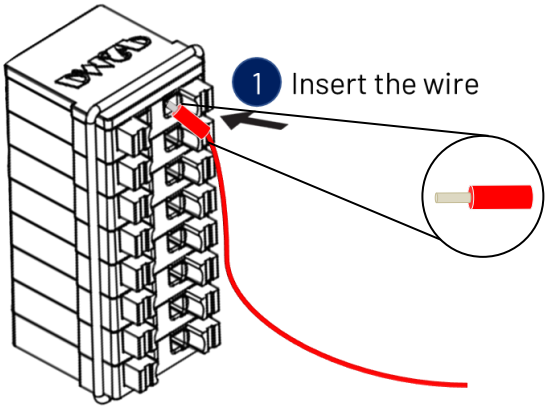
- Isolated Channels: 16

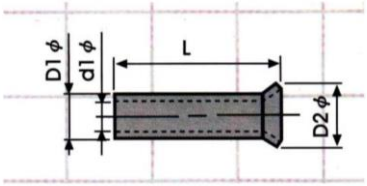
I/O Type:

- Type: Sink

2.3 Wiring to the Connector

2.3.1 Connecting the wire to the connector

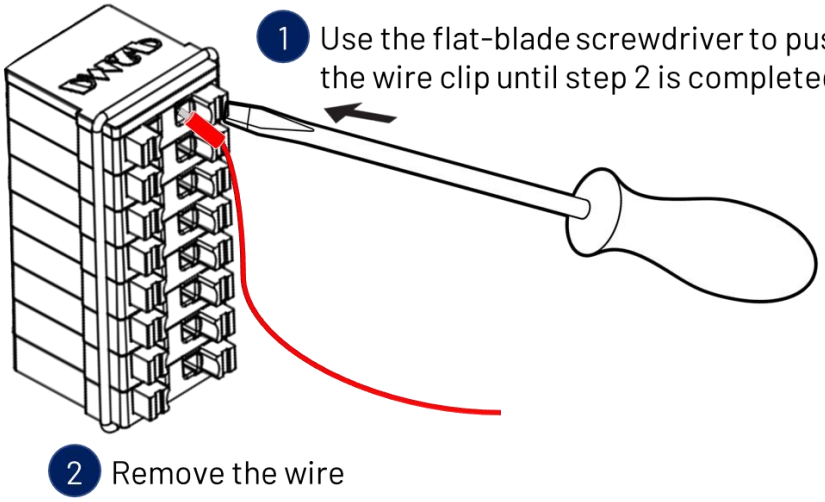




Insulated Terminals Dimensions (mm)

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

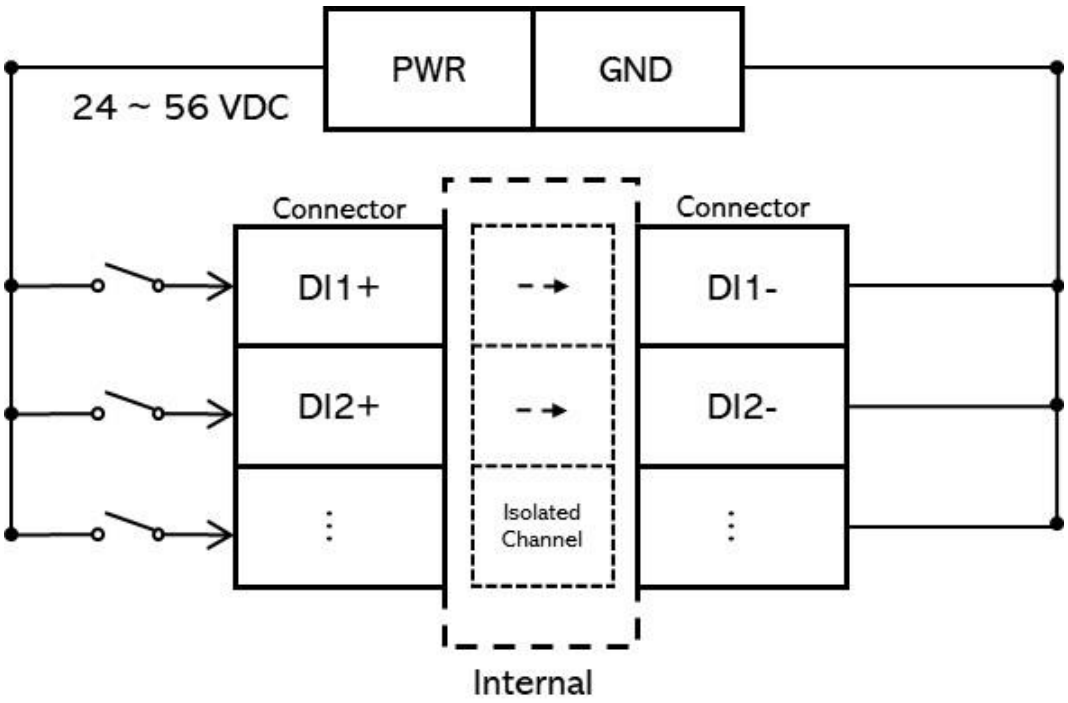
2.3.2 Removing the wire from the connector



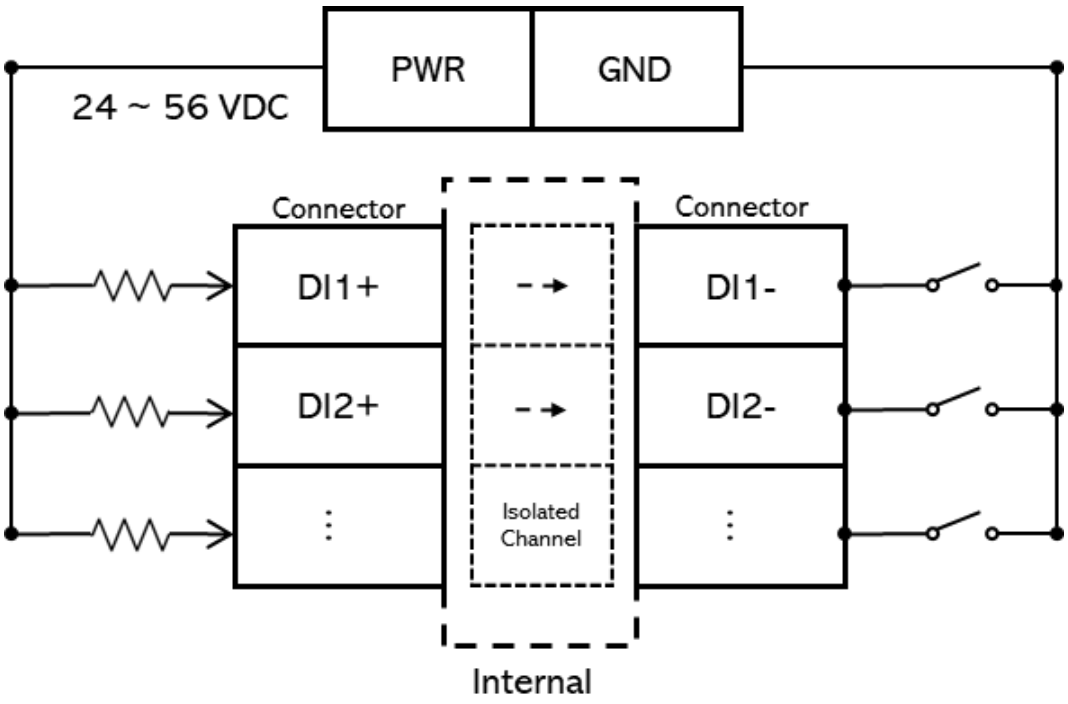
2.3.3 Application Wiring

- **Digital Input**

Example for Basic Digital Input Operation. (QEC-RXXDF0S/QEC-RXXDF0H)

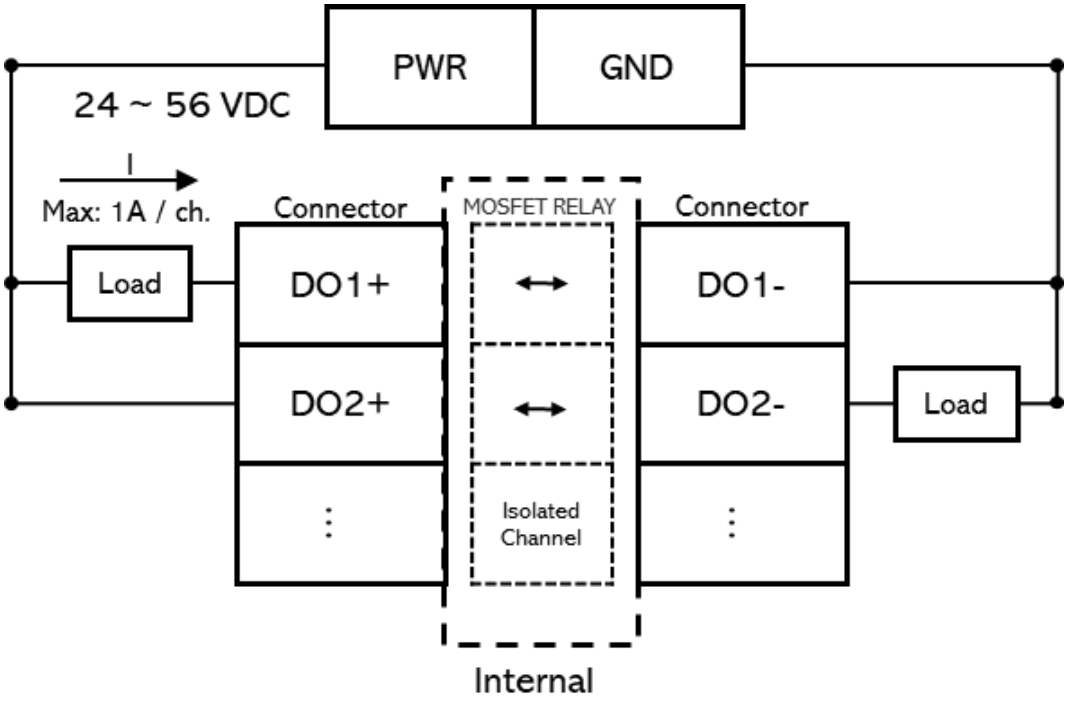


Example for Wire-break detection Operation. (QEC-RXXDF0D)

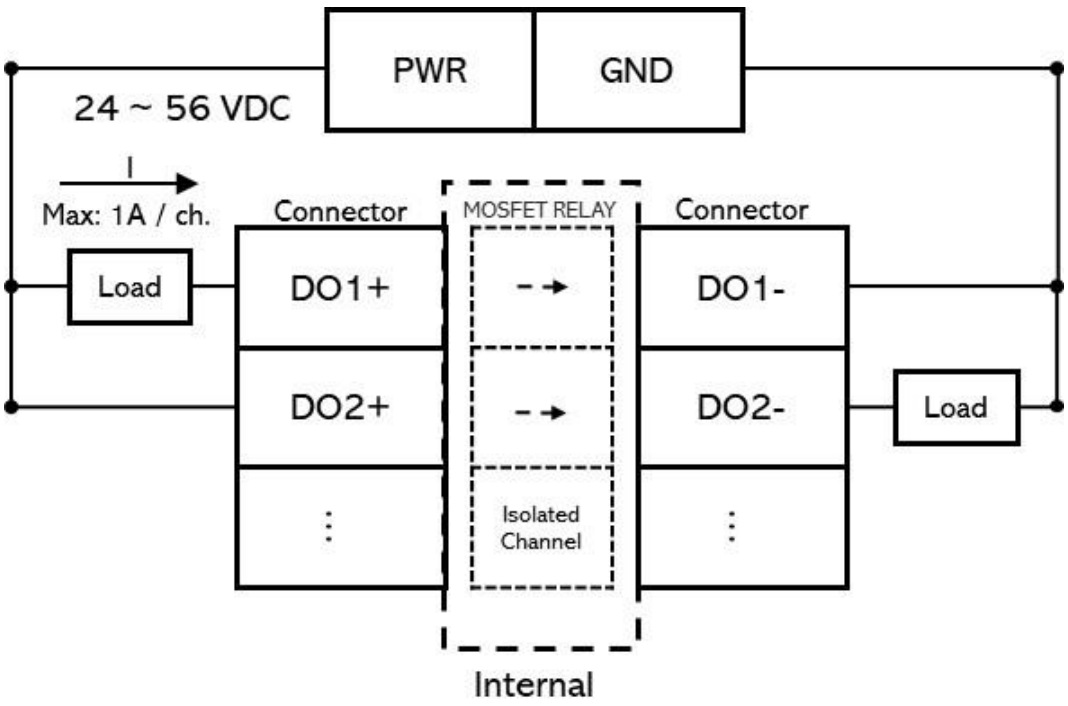


- ## Digital Output

Example for Basic Digital Output Operation. (QEC-RXXD0FS)



Example for High-speed Digital Output Operation. (QEC-RXXD0FH)



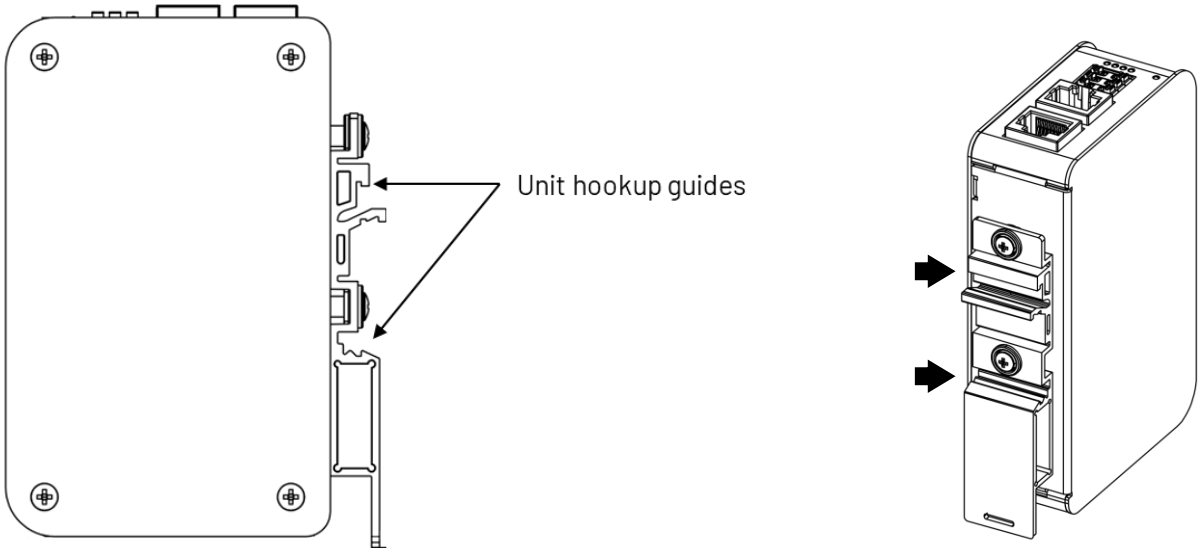
Ch. 3

Hardware Installation

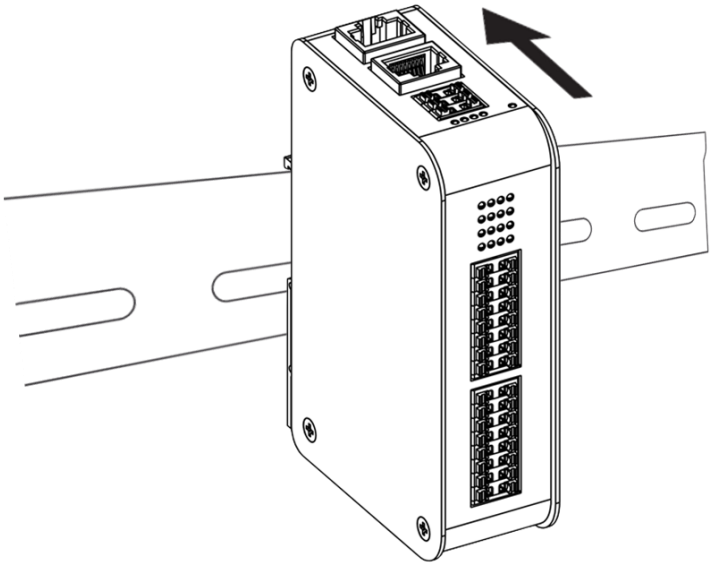
This section describes how to install QEC-RXXD. Please turn OFF the power supply before you mount QEC-RXXD. Always mount QEC-RXXD one at a time.

3.1 DIN-Rail installation

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



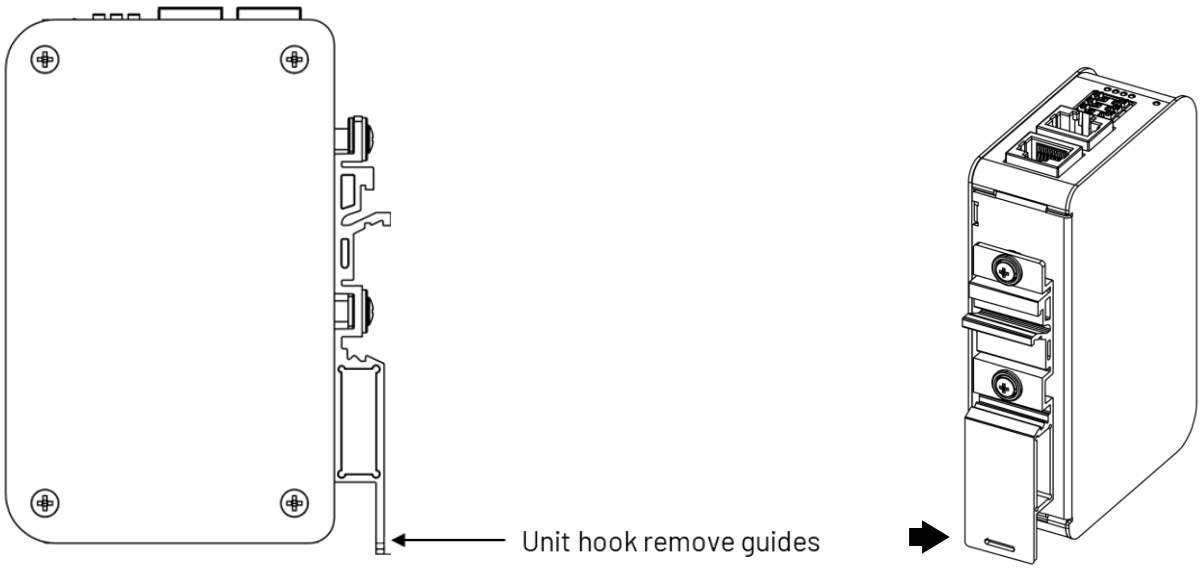
When you mount the QEC-RXXD, releasing the DIN track mounting hook on the QEC-RXXD is unnecessary. After you mount the QEC-RXXD, make sure it is locked to the DIN Track.



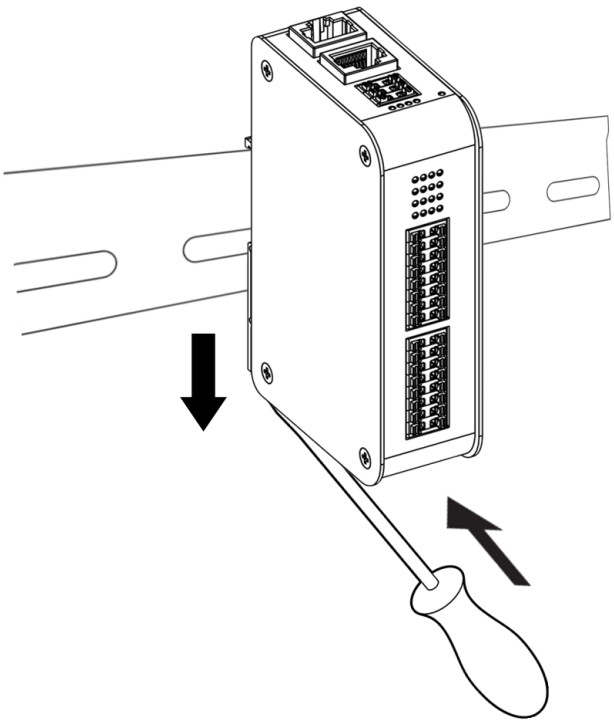
Note: Always turn OFF the Unit power supply and I/O power supply before connecting and removing the QEC-RXXD.

3.2 Removing QEC-RXXD 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

Getting Started

This chapter explains how to access the QEC-RXXD 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.

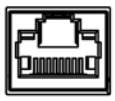
Non-PoE type

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:

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.

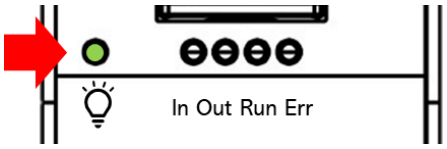
3. QEC's PoE power supply is up to 24V/3A.

4.1 Hardware Preparation and Connection

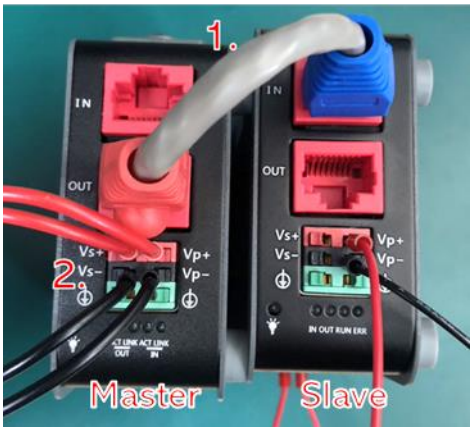
The following devices are used here:

1. QEC-M-01P (EtherCAT Master/PoE)
2. QEC-R11D88H-N (EtherCAT Slave 8-ch digital input and 8-ch digital 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).

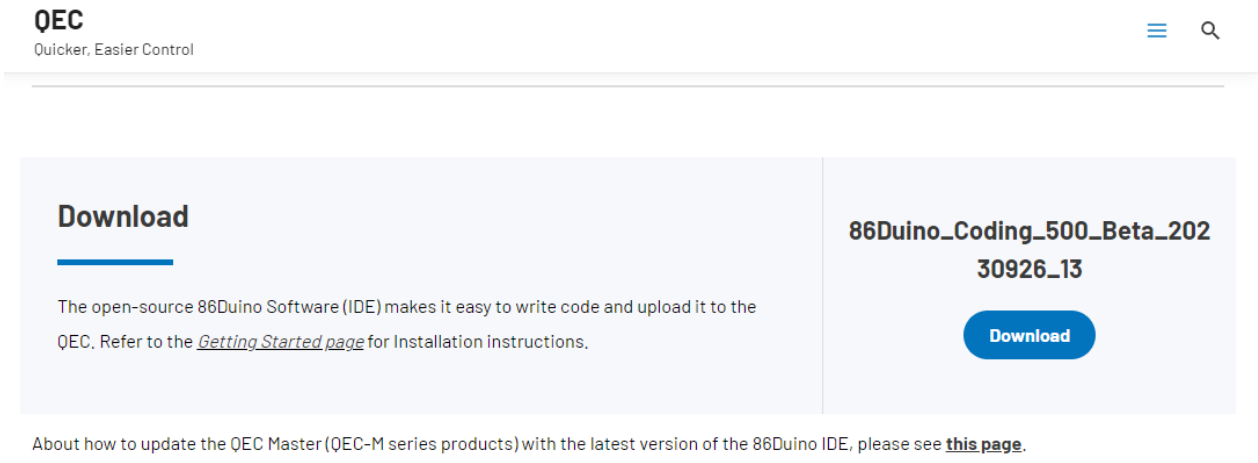


1. Using the EtherCAT Out port (top side) connected to the EtherCAT In port of QEC-R11D88H via RJ45 cable (powered by PoE).
2. Connect to Vs+/Vs- and Vp+/Vp- power supplies via EU terminals for 24V power.



4.2 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.

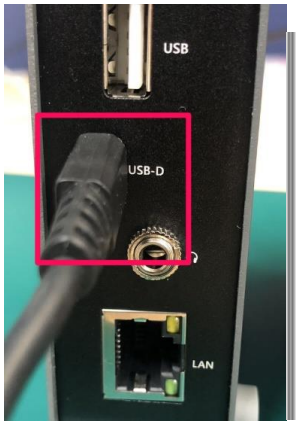
*Note: If Windows displays a warning, click Details once and then click the Continue Run button once.

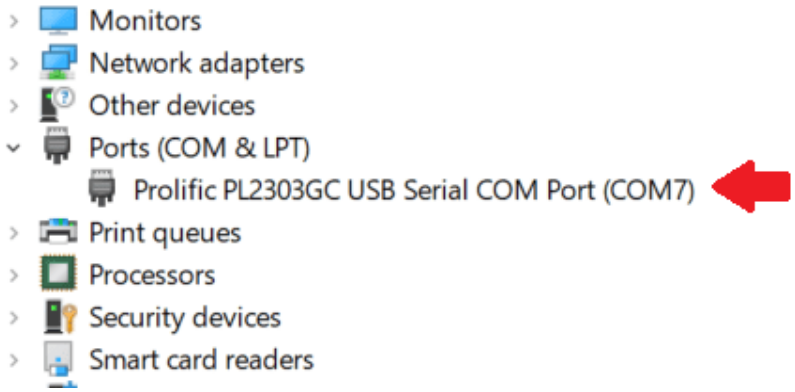
86Duino Coding IDE 500+ looks like below.

4.3 Connect to your PC and set up the environment

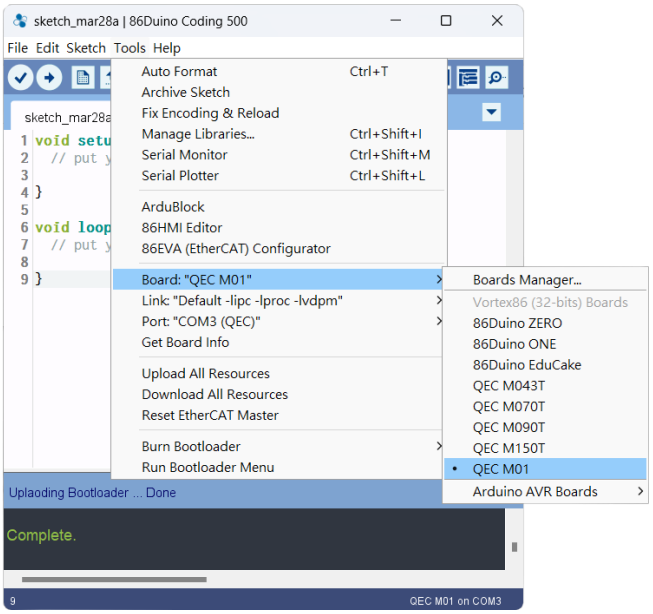
Follow the steps below to set up the environment:

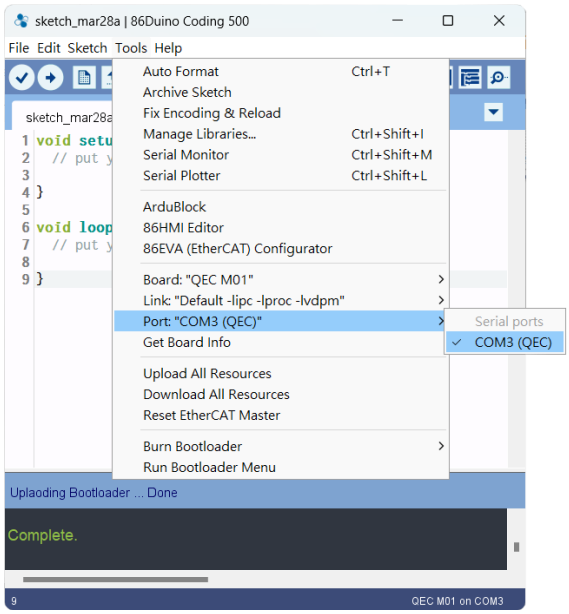
1. Connect the QEC-M-01P to your PC via a Micro USB to USB cable (86Duino IDE installed).
2. Turn on the QEC power.
3. Open "Device Manager" -> "Ports (COM & LPT)" in your PC and expand the ports; you should see that the "Prolific PL2303GC USB Serial COM Port (COMx)" is detected; if not, you will need 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)).



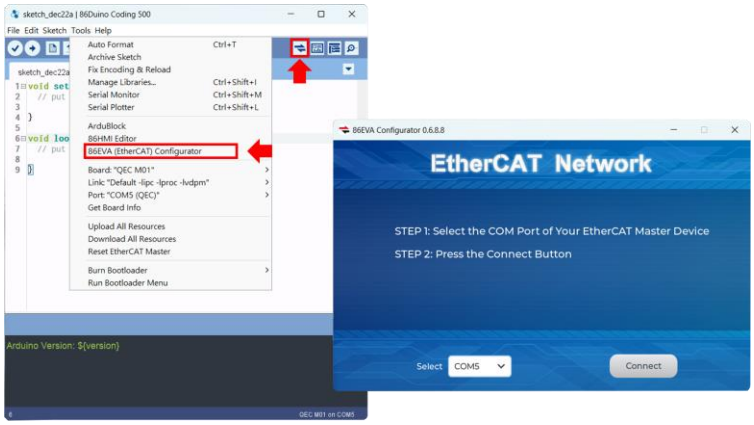


4.4 Configuration and Operation

86EVA is a graphical EtherCAT configurator based on the EtherCAT Library in the 86Duino IDE and is one of the development kits for 86Duino. The user can use it to configure the EtherCAT network quickly and start programming.

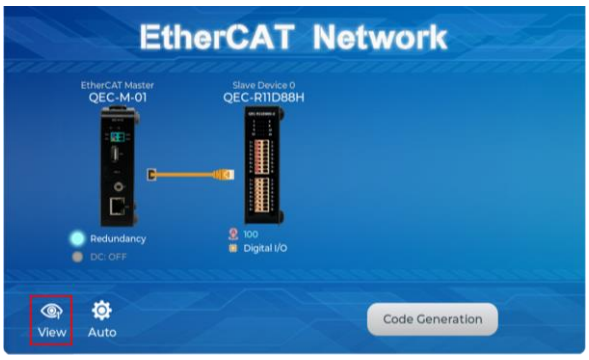
Step 1: Turn on 86EVA and scan

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



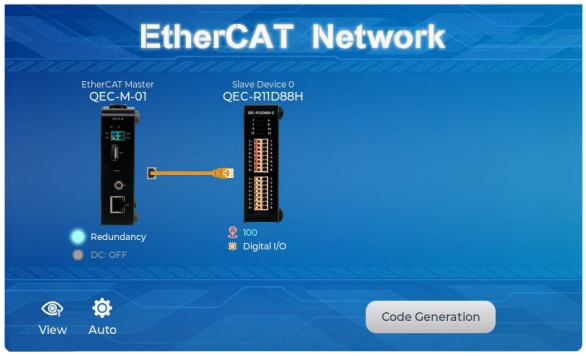
Once you have confirmed that the correct COM port has been selected of QEC-M-01P, press the “Connect” button to start scanning the EtherCAT network.

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.



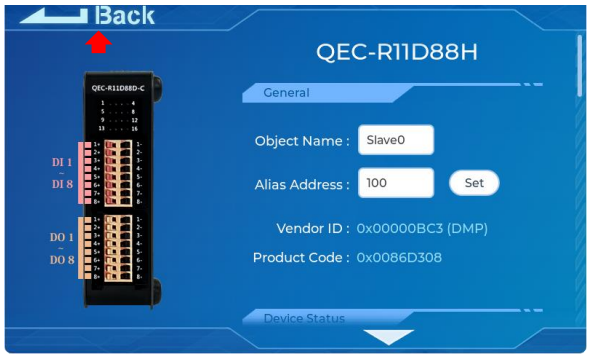
QEC-M-01

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

This example will use the default settings and not change any settings; please click "Back" in the upper left corner to return.

QEC-R11D88H-N

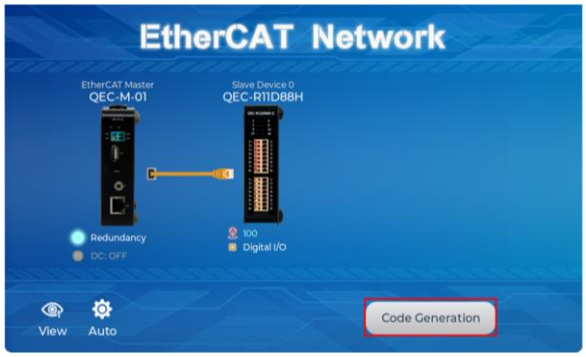
Press twice on the image of the QEC-R11D88H to see the parameter settings. This example will use the default settings and not change any settings; please click "Back" in the upper left corner to return.



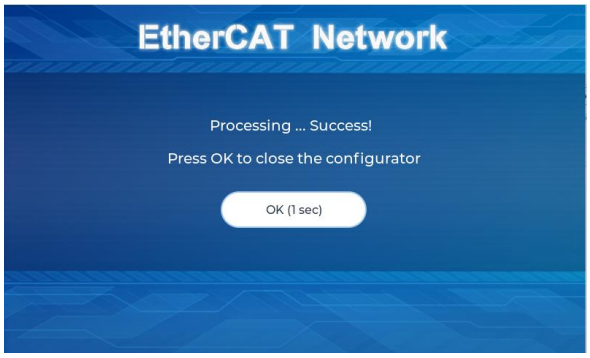
For the Device Information, you can refer to 5.2.1 Standard Objects (0x1000-0x1FFF) and 5.2.2 Manufacturer Objects (0x5000-0x5FFF).

Step 3: Generation the code

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

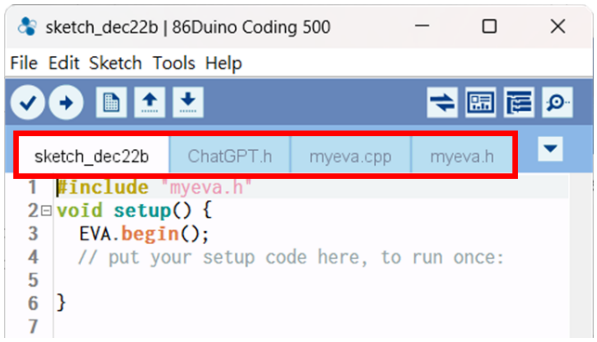


After clicking, the result and completion screen will appear, click OK to leave the program; If you do not click OK, you will leave the program after 10 seconds.



The generated code and files are as follows:

- sketch_dec22b: 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

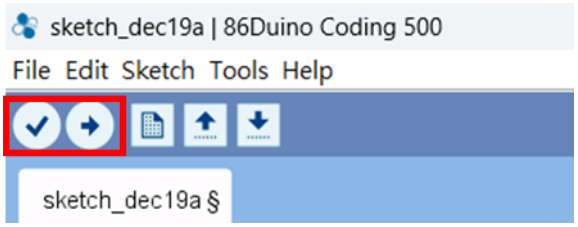


Additional note: After 86EVA generates code, the following code will be automatically generated in the main program (.ino), and any of them missing will cause 86EVA not to work.

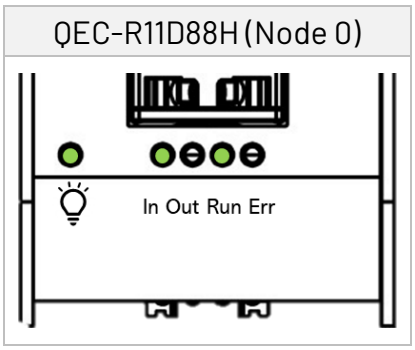
1. #include “myeva.h” : Include EVA Header file
2. EVA.begin() in setup(); : Initialize the EVA function

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.



EthercatDevice_QECRXXD Class

This class within the EtherCAT Library specifically caters to QEC EtherCAT Slave Digital IO Modules. For comprehensive details on the *EthercatDevice_QECRXXD Class*, please refer to EthercatDevice_QECRXXD Class - QEC.

Functionality Overview

To effectively utilize your QEC-RXXD device, it's important to understand which functions are compatible with different modules (For EtherCAT Slave index assignments, please refer to 4.2.3 Especial Objects (0x6000-0xFFFF)).

Below is a breakdown of the functions and their corresponding module applicability:

Initialization Functions: (All)

- attach(): Specify the EC-Slave number and mount it on the EC-Master.

DMP Slave Device Specific Functions: (All)

- getSystemTemperature()
- getSystemPowerVoltage()
- getSystemPowerCurrent()
- getPeripheralPowerVoltage()
- getPeripheralPowerCurrent()

Digital Input Modules:

- digitalRead() : Read the digital input value.
- digitalReadAll(): Read HIGH or LOW values from all digital input pins.

Digital Output Modules:

- digitalWrite(): Write a digital output value.
- digitalWriteAll(): Write HIGH or LOW value to all digital output pins.

High-Speed QEC Slave DIO (DC Mode): (QEC-RXXDXXH)

- setDC(): Configures Distributed Clock (DC) parameters.

To obtain the full EtherCAT Master API User Manual, we encourage you to reach out to our sales team or email us directly at info@icop.com.tw. Our team is dedicated to providing you with comprehensive support and detailed information to enhance your experience with our products.

Practical Application Examples

When using these functions, reference the object name of your QEC-RXXD device as set in the 86EVA or from your code object definition.

1. digitalRead/digitalWrite

Example for Basic I/O Operations.
Suppose your device is named **Slave4**. In this case, the code to read or write would be implemented as follows:

- To read the digital input from the first pin: **Slave4.digitalRead(0);**
- To set the first pin to HIGH: **Slave4.digitalWrite(0, HIGH);**


```ino
#include "myeva.h" // 86EVA

void setup() {
    EVA.begin();    // EtherCAT Slave init.
}

void loop() {
    // put your main code here, to run repeatedly:
    Slave4.digitalRead(0);
    Slave4.digitalWrite(0,HIGH);
}
```

2. Distributed Clock (DC)

For high-speed QEC Slave DIO modules, you might need to configure the DC mode. For instance, to set the DC mode on a device named Slave0: **Slave0.setDc(cycletime0_ns);**

```ino
#include "Ethercat.h"

EthercatMaster EcatMaster;
EthercatDevice_QECR11DF0H Slave0;

void CyclicCallback() {
    // put your cyclic Callback function here.
}
void setup() {
    /* EtherCAT Master Initialize. */
    EcatMaster.begin();
    Slave0.attach(0, EcatMaster);

    /* Configure Distributed Clock (DC) parameters. */
    Slave0.setDc(1000000); // 1000000 ns = 1 ms

    /* Register Cyclic Callback Function. */
    EcatMaster.attachCyclicCallback(CyclicCallback);
    /* Start EtherCAT Master. */
    EcatMaster.start(1000000, ECAT_SYNC); // 1000000 ns = 1 ms
}
void loop() {
    // put your main code here, to run repeatedly:
}
```

Further Information on Distributed Clock (DC): To gain a deeper understanding of the Distributed Clock (DC) functionality in the EtherCAT protocol, consider visiting the EtherCAT Device Protocol Poster provided by the EtherCAT Technology Group, ETG.

Additional Guidance

It's essential to ensure consistency in the object names used in your code and the names assigned to your QEC-RXXD device. For further examples and a more detailed explanation, please visit the EthercatDevice_QECRXXD Class - QEC.

4.5 Access Further Documentation

For those seeking comprehensive details about the EtherCAT Master API, we recommend referring to the EtherCAT Master API User Manual.This manual provides an in-depth exploration of the API, offering insights into more advanced features and capabilities.

Additionally, if you're interested in expanding your knowledge and exploring programming functions beyond the basic setup, the Language Reference Home and Libraries Reference Home are excellent resources. These sections contain valuable information and guides that cover a wide range of programming topics and libraries relevant to the EtherCAT technology.

For more info and sample request, please write to info@icop.com.tw, call your nearest ICOP Branch, or contact our Worldwide Official Distributor.

Ch. 5

Slave Information

5.1 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/

5.2 Object Dictionary

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

- Device Profile: 5001
- Modul Profile: 0
- Modular Device Profile

5.2.1 Standard Objects (0x1000-0x1FFF)

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.

Table 4-1: Device Name

Type	Device Name	Type	Device Name
Digital Input	QEC-R00DF0D	Digital Input/Output	QEC-R00D88D
	QEC-R00DF0S		QEC-R00D4CD
	QEC-R00DF0H		QEC-R00DC4D
	QEC-R11DF0D		QEC-R00D88S
	QEC-R11DF0S		QEC-R00D4CS
	QEC-R11DF0H		QEC-R00DC4S
Digital Output	QEC-R00D0FS		QEC-R00D88H
	QEC-R00D0FH		QEC-R11D88D
	QEC-R11D0FS		QEC-R11D88S
	QEC-R11D0FH		QEC-R11D88H

Index 1009 Hardware version

Index	Name	Data type	Flags	Default
1009	Hardware version	STRING	RO	Depending by model.

Index 100A

Index	Name	Data type	Flags	Default
100A	Software version	STRING	RO	1.00

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	0x00000000 (0)

Table 4-2: Product code & Revision Number

Model Name	Product code	Model Name	Product code
QEC-R00DF0D	0x0086d300	QEC-R11D88S	0x0086d0d5
QEC-R00D88D	0x0086d301	QEC-R00DF0S	0x0086d30D
QEC-R00D4CD	0x0086d302	QEC-R11DF0S	0x0086d30E
QEC-R00D0FS	0x0086d303	QEC-R11D0FH	0x0086d305
QEC-R00DC4D	0x0086d304	QEC-R11D88H	0x0086d308
QEC-R11D88D	0x0086d307	QEC-R11DF0H	0x0086d306
QEC-R00D88S	0x0086d309	QEC-R00D0FH	0x0086d30A
QEC-R11DF0D	0x0086d0d2	QEC-R00DF0H	0x0086d30B
QEC-R11D0FS	0x0086d0d4	-	-

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	UINT8	RW P	E6 25 24 01 0D 00 00 00

Index 1600 DigitalOutput process data mapping

Index	Name	Data type	Flags	Default
1600:0	DigitalOutput process data mapping	UINT8	RO	Maximum of 16, by model.
1600:01	SubIndex 001	UINT32	RO	0x7000:01, 1
1600:02	SubIndex 002	UINT32	RO	0x7000:02, 1
1600:03	SubIndex 003	UINT32	RO	0x7000:03, 1
1600:04	SubIndex 004	UINT32	RO	0x7000:04, 1
1600:05	SubIndex 005	UINT32	RO	0x7000:05, 1
1600:06	SubIndex 006	UINT32	RO	0x7000:06, 1
1600:07	SubIndex 007	UINT32	RO	0x7000:07, 1
1600:08	SubIndex 008	UINT32	RO	0x7000:08, 1
1600:09	SubIndex 009	UINT32	RO	0x7000:09, 1
1600:0A	SubIndex 010	UINT32	RO	0x7000:0A, 1
1600:0B	SubIndex 011	UINT32	RO	0x7000:0B, 1
1600:0C	SubIndex 012	UINT32	RO	0x7000:0C, 1
1600:0D	SubIndex 013	UINT32	RO	0x7000:0D, 1
1600:0E	SubIndex 014	UINT32	RO	0x7000:0E, 1
1600:0F	SubIndex 015	UINT32	RO	0x7000:0F, 1

Index 1A00 DigitalInput process data mapping

Index	Name	Data type	Flags	Default
1A00:0	DigitalInput process data mapping	UINT8	RO	Maximum of 16, by model.
1A00:01	SubIndex 001	UINT32	RO	0x6000:01, 1
1A00:02	SubIndex 002	UINT32	RO	0x6000:02, 1
1A00:03	SubIndex 003	UINT32	RO	0x6000:03, 1
1A00:04	SubIndex 004	UINT32	RO	0x6000:04, 1
1A00:05	SubIndex 005	UINT32	RO	0x6000:05, 1
1A00:06	SubIndex 006	UINT32	RO	0x6000:06, 1
1A00:07	SubIndex 007	UINT32	RO	0x6000:07, 1
1A00:08	SubIndex 008	UINT32	RO	0x6000:08, 1
1A00:09	SubIndex 009	UINT32	RO	0x6000:09, 1
1A00:0A	SubIndex 010	UINT32	RO	0x6000:0A, 1
1A00:0B	SubIndex 011	UINT32	RO	0x6000:0B, 1
1A00:0C	SubIndex 012	UINT32	RO	0x6000:0C, 1
1A00:0D	SubIndex 013	UINT32	RO	0x6000:0D, 1
1A00:0E	SubIndex 014	UINT32	RO	0x6000:0E, 1
1A00:0F	SubIndex 015	UINT32	RO	0x6000:0F, 1

Index 1C00 Sync manager type

Index	Name	Data type	Flags	Default
1C00:0	Sync manager type	UINT8	RO	> 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 1C12 SyncManager 2 assignment

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

Index 1C13 SyncManager 3 assignment

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

Index 1C32 SM output parameter

Index	Name	Data type	Flags	Default
1C32:0	SM output parameter	UINT8	RO	> 32 <
1C32:01	Synchronization Type	UINT16	RW	0x0001 (1)
1C32:02	Cycle Time	UINT32	RO	0x00000000 (0)
1C32:04	Synchronization Types supported	UINT16	RO	0x401F (16415)
1C32:05	Minimum Cycle Time	UINT32	RO	0x000186A0 (100000)
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	0x0107 (263)
1C32:20	Sync Error	BOOL	RO	TRUE

Index 1C33 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	0x401F (16415)
1C33:05	Minimum Cycle Time	UINT32	RO	0x000186A0 (100000)
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	0x010A (266)
1C33:20	Sync Error	BOOL	RO	TRUE

5.2.2 Manufacturer Objects (0x5000-0x5FFF)

Index 0x5xxn Manufacturer Objects

Index	Object Code	DataType	Name	Default	Description
0x5000	VARIABLE	UINT16	SP_Voltage	0	Read SP Voltage
0x5001	VARIABLE	UINT16	SP_Current	0	Read SP Current
0x5002	VARIABLE	UINT16	PP_Voltage	0	Read PP Voltage
0x5003	VARIABLE	UINT16	PP_Current	0	Read PP Current
0x5004	VARIABLE	INT16	Temperature	0	Read Temperature
0x5005	VARIABLE	UINT8	BoxStatus	0	NormalOperation 0 ESC_3p3_Power_NG 3 DIO_3p3_Power_NG 4 EXT_Xtal_Stop 5 EXT_Xtal_OverRang 6 PowerVoltageLowOrHigh 0x10 PowerVoltageTooLowOrTooOVer 0x11
0x5006	RECORD		OrderInformation		
0x5007	VARIABLE	UINT32	MTBF		Record machine operating time. (Counter will push 1 for the Device on/off and per hour)

5.2.3 Especial Objects (0x6000-0xFFFF)

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

Digital input index data.
Users can use it according to the number of digital input pins.

Index	Object Code	DataType	Name	Default	Description
0x6000	RECORD		DigitalInput	tx	Digital Input
		BOOL	DI00		
		BOOL	DI01		
		BOOL	DI02		
		BOOL	DI03		
		BOOL	DI04		
		BOOL	DI05		
		BOOL	DI06		
		BOOL	DI07		
		BOOL	DI08		
		BOOL	DI09		
		BOOL	DI10		
		BOOL	DI11		
		BOOL	DI12		
		BOOL	DI13		
		BOOL	DI14		
		BOOL	DI15		

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

Digital output index data.
Users can use it according to the number of digital output pins.

Index	Object Code	DataType	Name	Default	Description
0x7000	RECORD		DigitalOutput	rx	Digital Output
		BOOL	DQ00	0	
		BOOL	DQ01	0	
		BOOL	DQ02	0	
		BOOL	DQ03	0	
		BOOL	DQ04	0	
		BOOL	DQ05	0	
		BOOL	DQ06	0	
		BOOL	DQ07	0	
		BOOL	DQ08	0	
		BOOL	DQ09	0	
		BOOL	DQ10	0	
		BOOL	DQ11	0	
		BOOL	DQ12	0	
		BOOL	DQ13	0	
		BOOL	DQ14	0	
		BOOL	DQ15	0	

If this is your first time running EtherCAT and using a QEC-M master, we recommend that you read Set up the QEC-M-043T for 86Duino to get your project started.

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.