

Start Guide

EK1100 + EL1889 + EL2889 :
EtherCAT Coupler, DI, and DO



86Duino Coding IDE 501

EtherCAT Library

(Version 1.0)

Revision

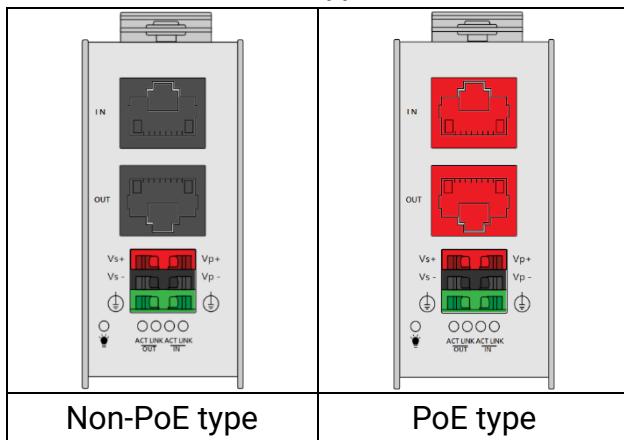
Date	Version	Description
2026/1/13	Version1.0	New release.

Preface

In this guide, we will show you how to use the EtherCAT MDevice **QEC-M-01**, the **EK1100** (EtherCAT Coupler), the **EL1889** (EtherCAT Digital Input terminal), and the **EL2889** (EtherCAT Digital Output terminal).

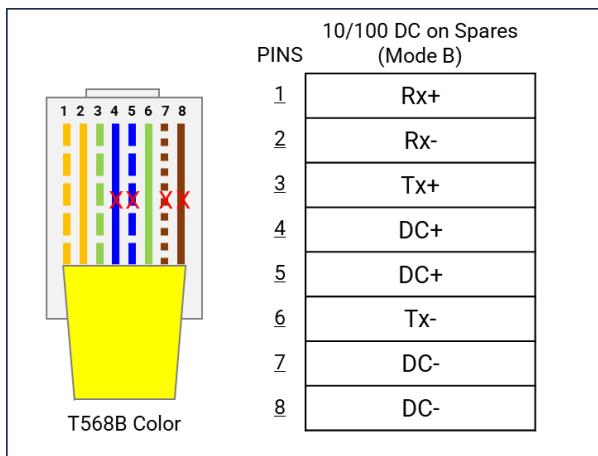
Notes QEC's PoE (Power over Ethernet)

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.



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. 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:

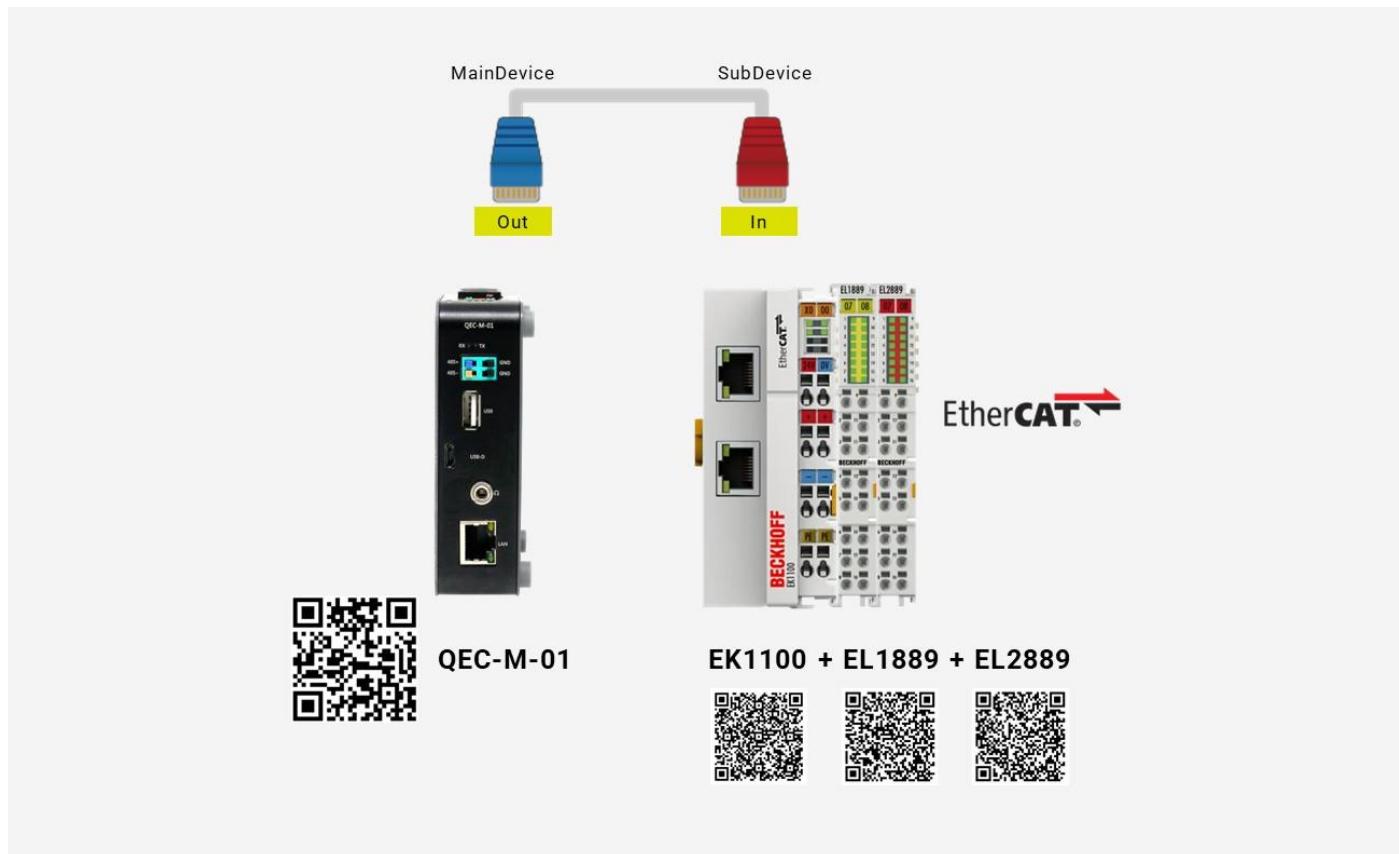


2. When connecting PoE and non-PoE devices, make sure to disconnect Ethernet cables at pins 4, 5, 7, and 8 (e.g., when a PoE-supported QEC EtherCAT MDevice connects with a third-party EtherCAT SubDevice).
3. QEC's PoE power supply is up to 24V/3A.

1. Connection and wiring hardware

The following devices are used here:

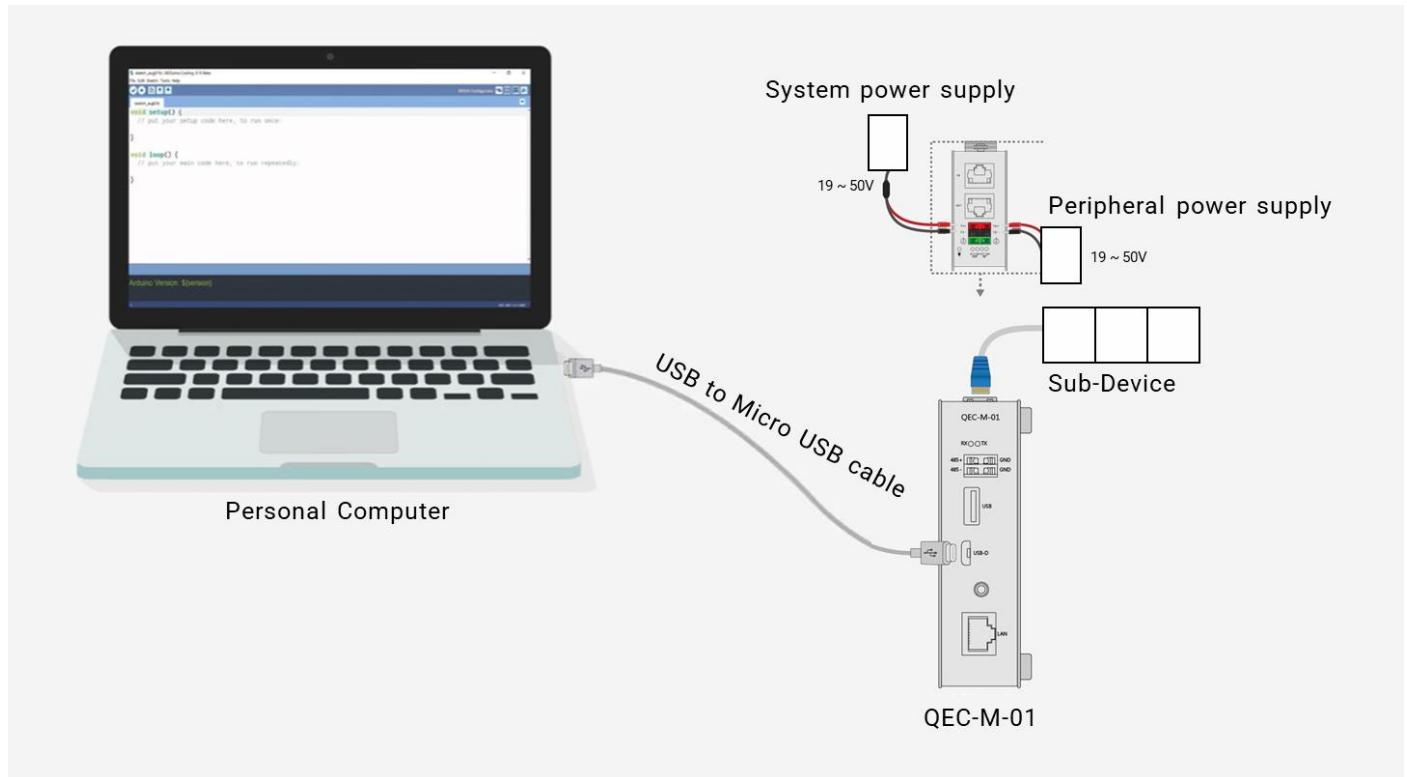
1. QEC-M-01 (EtherCAT MDevice)
2. EK1100 (EtherCAT Coupler)
3. EL1889 (EtherCAT Terminal, 16-channel digital input, 24 V DC, 3 ms, ground switching)
4. EL2889 (EtherCAT Terminal, 16-channel digital output, 24 V DC, 0.5 A, ground switching)
5. 24VDC power supply & EU-type terminal cable & LAN cable



1.1 QEC-M-01

QEC EtherCAT MDevice.

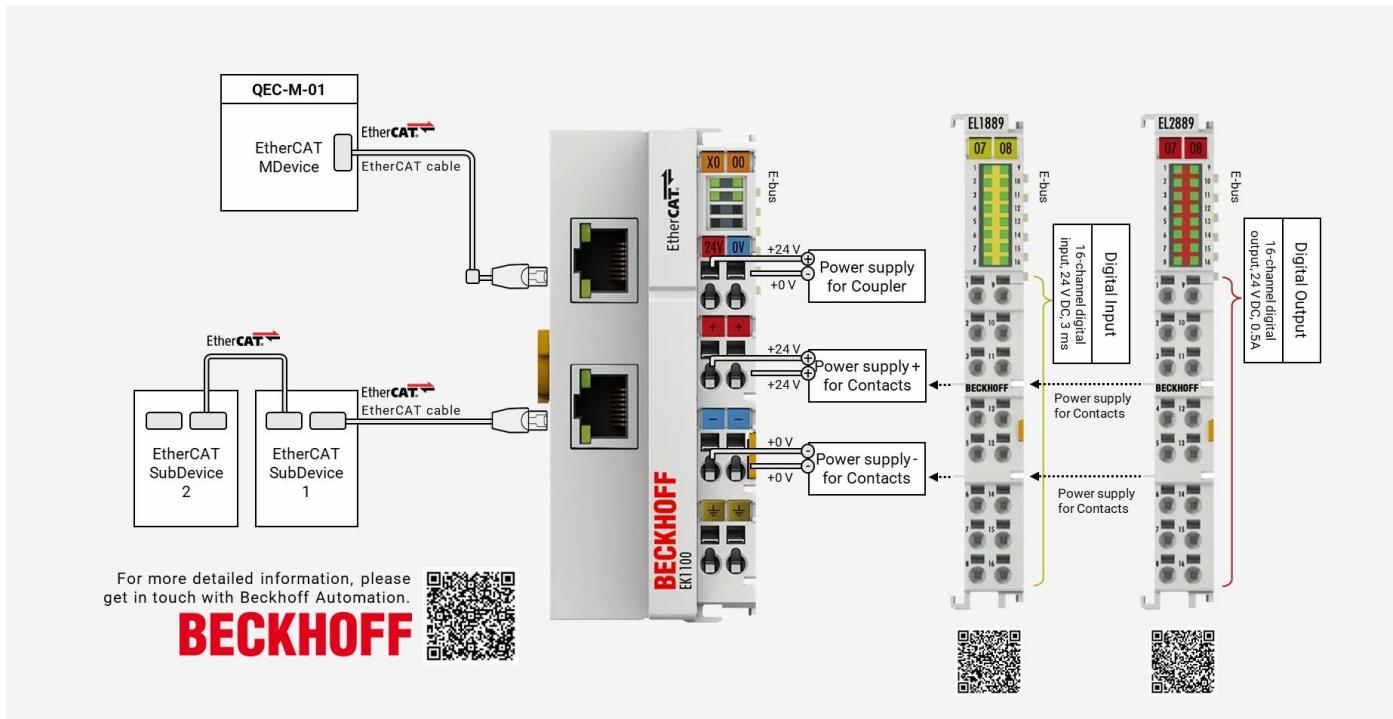
1. Power Supply: Connect to Vs+/Vs- and Vp+/Vp- power supplies via EU terminals for 24V power.
2. EtherCAT Connection: Using the EtherCAT Out port (On the top side) connected to the EtherCAT In port of EtherCAT SubDevice via RJ45 cable.



1.2 EK1100 + EL1889 + EL2889

The **Beckhoff EK1100** is an EtherCAT Coupler used to connect modular EtherCAT Terminals. In this setup, the **EL1889** provides digital inputs (DI) and the **EL2889** provides digital outputs (DO). They can be used as EtherCAT SubDevices in a QEC EtherCAT network to implement basic discrete input sensing and output driving.

The diagram shows a typical wiring example with a **QEC MDevice (e.g., QEC-M-01)** and the Beckhoff EtherCAT coupler and terminal modules.



Connections are grouped by function:

- EtherCAT
 - IN (EK1100): Connect to the QEC MDevice EtherCAT port (or the previous SubDevice).
 - OUT (EK1100): Connect to the next SubDevice (if any).
- Power & Grounding
 - EK1100 power (Coupler / E-bus electronics): Provide +24 V / 0 V (GND) to power the coupler and the terminal electronics.
- Digital Inputs (EL1889, DI)
 - Input channels: Connect external input signals referenced to the DI contact 0 V (GND).
- Digital Outputs (EL2889, DO)
 - Output channels: Powered by the DO contact +24 V supply.
 - Note (DO type): EL2889 outputs are typically Sourcing (PNP). When ON, the output sources +24 V to the load; wire the load return to 0 V (GND).
- Indicators / LEDs
 - EK1100: Status LEDs indicate module power and EtherCAT link/activity.
 - EL1889 / EL2889: Channel LEDs indicate each DI/DO channel state.

2. Software/Development Environment

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

The new major release of the 86Duino IDE 501 is faster and more powerful than ever! It now supports a broader range of third-party EtherCAT sub-devices and introduces additional EthercatDevice classes, including a generic CiA 402 EtherCAT slave class designed to control any EtherCAT servo drive compliant with the CiA 402 standard.

Windows (ZIP file)
Date: 2024.12.06
[Download](#)

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



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

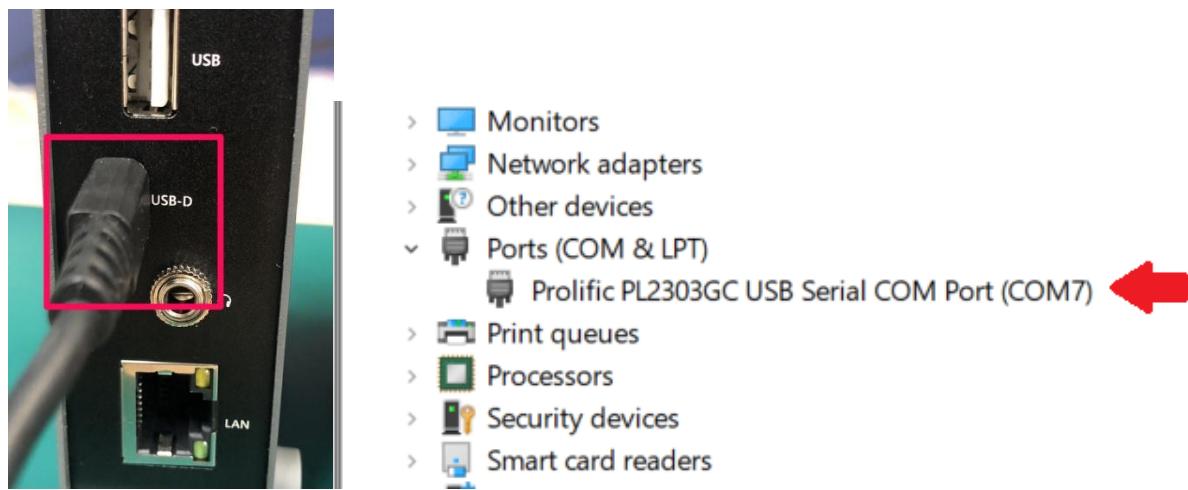
86Duino Coding IDE 501+ looks like below.



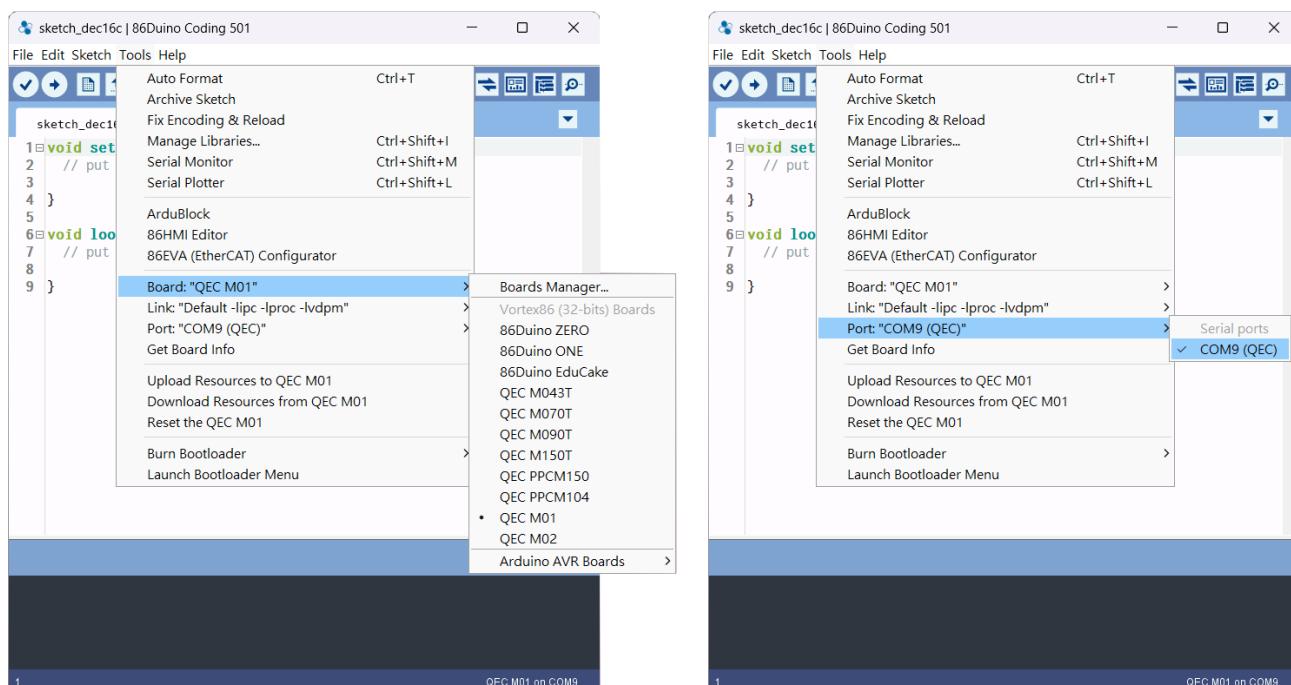
3. Connect to PC and set up the environment

Follow the steps below to set up the environment:

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



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



4. Write code

The EtherCAT MDevice (**QEC-M-01**) and the Beckhoff coupler and terminal modules (**EK1100 + EL1889 + EL2889**) can be configured and programmed via the EtherCAT library in the 86Duino IDE.

The Arduino development environment has two main parts: `setup()` and `loop()`, which correspond to initialization and main programs. Before operating the EtherCAT network, you must configure it once. The process should be from Pre-OP to OP mode in EtherCAT devices.

The following program sets:

- EtherCAT Cycle Time: 3 milliseconds (Depending on DI/DO filter).
- EtherCAT Mode: ECAT_SYNC.

The `EthercatMaster` object (“master”) represents QEC MDevice: **QEC-M-01**.

The `EthercatDevice_Generic` objects represent the Beckhoff terminals: **EK1100** (“ek1100”), **EL1889** (“el1889”), and **EL2889** (“el2889”).

In this section, we periodically toggle **EL2889 D00** (HIGH/LOW), then read and print **EL1889 DIO** after a short settling delay to verify that the input state reflects the output change (for example, using an external loopback wiring between D00 and DI0, or by driving an external signal into DI0).

A. In Setup Function:

In the `setup()` function, initialize Serial communication and bring up the EtherCAT network to OP mode. Follow the steps below:

1. Initialize Serial Communication
 - Start serial communication at a baud rate of 115200 for debug messages.
2. Start the EtherCAT MDevice (QEC-M-01)
 - Call `master.begin()` to initialize the EtherCAT MDevice and enter the EtherCAT state machine (typically to PRE-OP / initialization stage).
3. Attach the SubDevice (`EthercatDevice_Generic` Class)
 - Use `attach(node, master)` to attach the first EtherCAT SubDevice:
 - `ek1100.attach(0, master)` → SubDevice 0: EK1100
 - `el1889.attach(1, master)` → SubDevice 1: EL1889 (DI)
 - `el2889.attach(2, master)` → SubDevice 2: EL2889 (DO)
4. Start EtherCAT and Switch to OPERATIONAL
 - Call `master.start(3000000, ECAT_SYNC)` to start cyclic communication and switch to OPERATIONAL state.
 - This sets the cycle time to 3 ms (3,000,000 ns) and enables ECAT_SYNC mode.

B. In Loop Function:

In the `loop()` function, toggle one PDO output bit periodically and read back one PDO input bit for verification.

1. Set DO Bit via PDO (ON)
 - o Use `el2889.pdoBitWrite(0, HIGH)` to set PDO bit 0 (DO 0) to high.
 - o Wait 50 ms (`delay(50)`) used to wait for DI to reflect the DO change and for EtherCAT to refresh the input PDO data before reading.
2. Read DI Bit via PDO and Print Result
 - o Use `el1889.pdoBitRead(0)` to read PDO bit 0 (DI 0).
 - o Print the value to Serial: "EL1889 DI 0: <value>".
3. Hold Time
 - o Wait 1000 ms (`delay(1000)`) before changing the state.
4. Set DO Bit via PDO (OFF) and Repeat
 - o Use `el2889.pdoBitWrite(0, LOW)` to set PDO bit 0 (DO 0) to LOW.
 - o Wait 50 ms, read back `el1889.pdoBitRead(0)` again, and print the result to Serial.
 - o Wait 1000 ms, and the program repeats this cycle continuously.
5. Code Logic Summary
 - o `pdoBitWrite(n, HIGH/LOW)`: drives PDO bit n (commonly used for DO mapping).
 - o `pdoBitRead(n)`: reads PDO bit n (commonly used for DI mapping).
 - o The example toggles output every second and log the corresponding input bit state.

*** Note** (DO type): EL2889 outputs are typically Sourcing (PNP). When ON, the output sources +24 V to the load; wire the load return to 0 V (GND).

The example code is as follows:

```
#include "Ethercat.h"

EthercatMaster master;
EthercatDevice_Generic ek1100;
EthercatDevice_Generic el1889;
EthercatDevice_Generic el2889;

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

  Serial.print("Begin: "); Serial.println(master.begin());

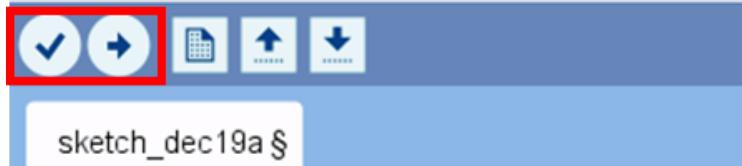
  Serial.print("EK1100: "); Serial.println(ek1100.attach(0, master));
  Serial.print("EL1889: "); Serial.println(el1889.attach(1, master));
  Serial.print("EL2889: "); Serial.println(el2889.attach(2, master));

  Serial.print("Start: ");
}
```

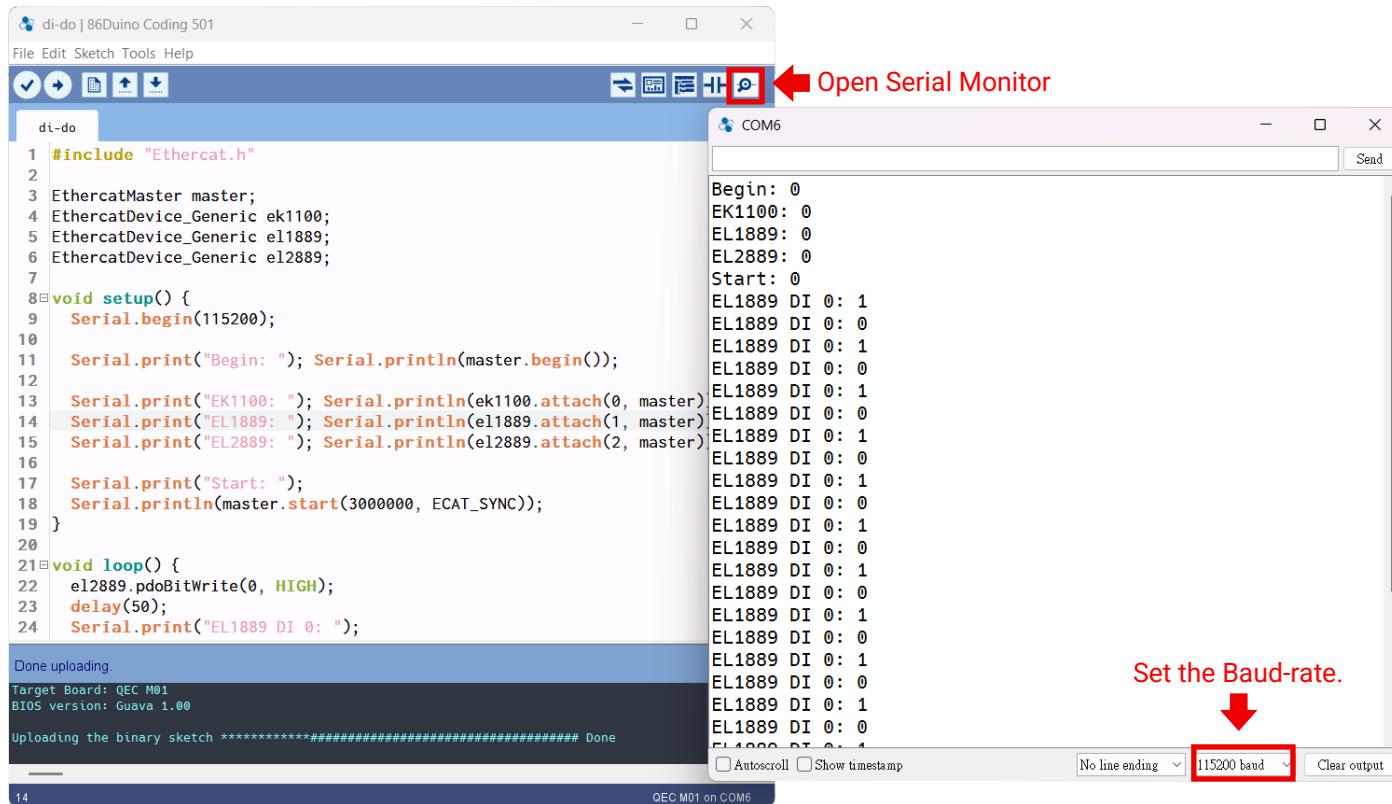
```
Serial.println(master.start(3000000, ECAT_SYNC));  
}  
  
void loop() {  
    el1889.pdoBitWrite(0, HIGH);  
    delay(50);  
    Serial.print("EL1889 DI 0: ");  
    Serial.println(el1889.pdoBitRead(0));  
    delay(1000);  
  
    el1889.pdoBitWrite(0, LOW);  
    delay(50);  
    Serial.print("EL1889 DI 0: ");  
    Serial.println(el1889.pdoBitRead(0));  
    delay(1000);  
}
```

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

File Edit Sketch Tools Help



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.



If the EtherCAT communication configuration is successful, the Serial Monitor will print "0" for each status for EtherCAT.



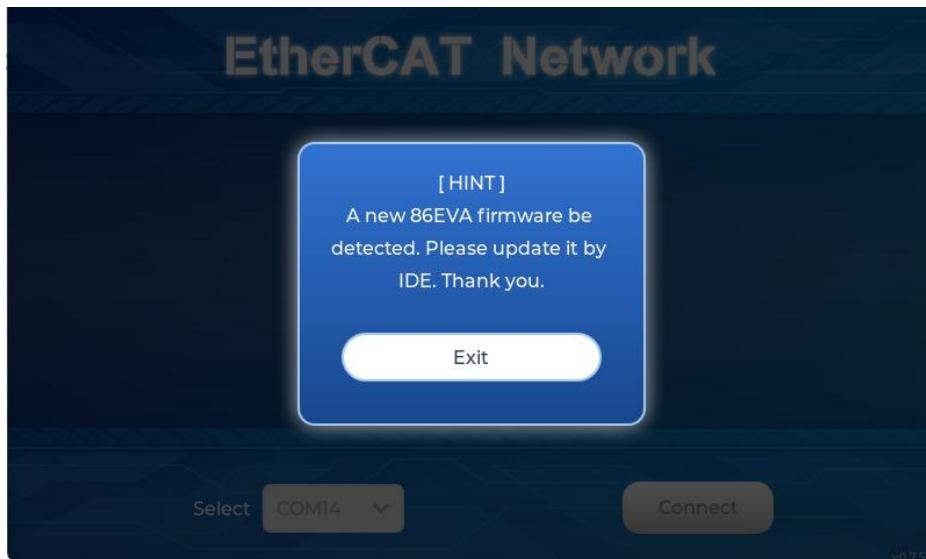
And it will print the FK1889 DI 0 value to the serial monitor



Troubleshooting

QEC-M-01 cannot successfully upload code

When you are unable to successfully upload code, please open 86EVA to check if your QEC EtherCAT MDevice's environment is abnormal. As shown in the figure below, please try updating your QEC EtherCAT MDevice's environment, which will include the following three items: Bootloader, EtherCAT firmware, and EtherCAT tool.



Now, we will further explain how to proceed with the update:

Step 1: Setting up QEC-M

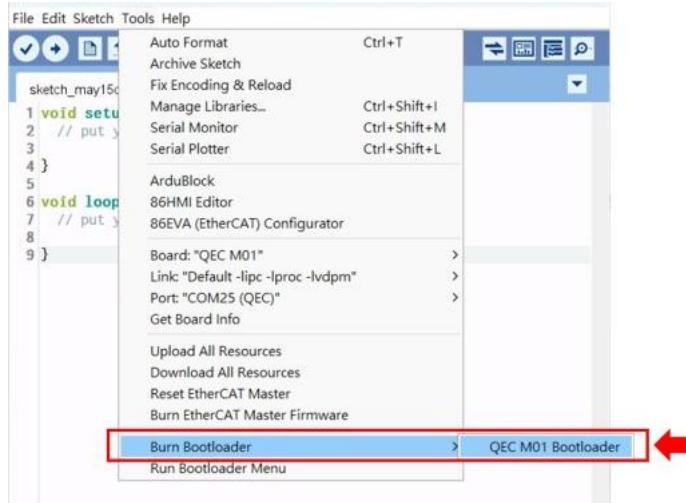
1. Download and install 86Duino IDE 500+ (or a newer version).
You can download it from [Software](#).
2. Connect the QEC-M: Use a USB cable to connect the QEC-M to your computer.
3. Open 86Duino IDE: After the installation is complete, open the 86Duino IDE software.
4. Select Board: From the IDE menu, choose “Tools” > “Board” > “QEC-M-01” (or the specific model of QEC-M you are using).
5. Select Port: From the IDE menu, choose “Tools” > “Port” and select the USB port to which the QEC-M is connected.

Step 2: Click “Burn Bootloader” button

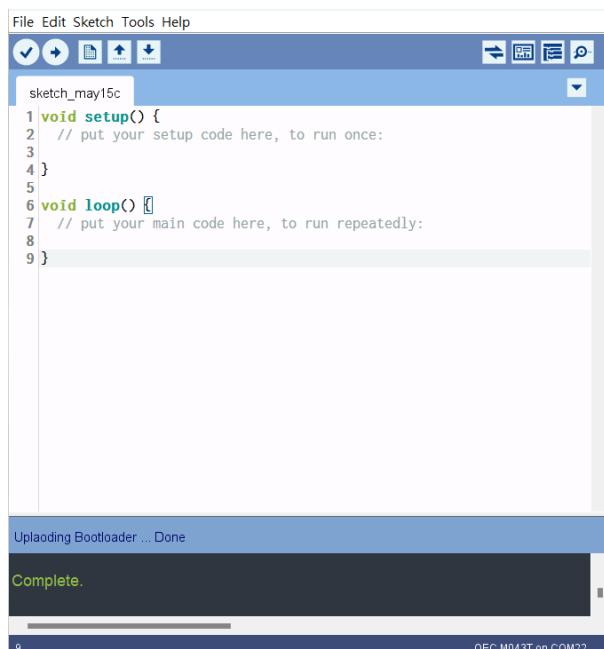
After connecting to your QEC-M product, go to “Tools”> “Burn Bootloader”.

The currently selected QEC-M name will appear. Clicking on it will start the update process, which will take approximately 5-20 minutes.

- QEC-M-01:



Step 3: Complete the Update



After completing the above steps, your QEC-M has been successfully updated to the latest version of the development environment.

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.

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