

Start Guide

OrientalMotor AZ-mini EtherCAT Slave (CSP mode)

86Duino Coding IDE 500

EtherCAT Library

(Version 1.0)

Revision

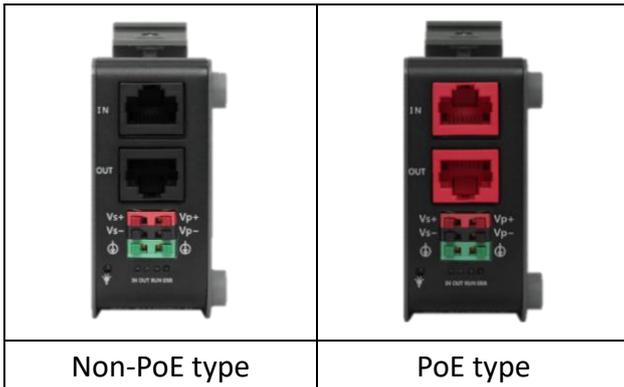
Date	Version	Description
2024/9/9	VERSION1.0	NEW RELEASE.

Preface

In this guide, we will show you how to use the EtherCAT Master QEC-M-01 and OrientalMotor AZ-mini EtherCAT Slave.

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:

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

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

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

2. 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).

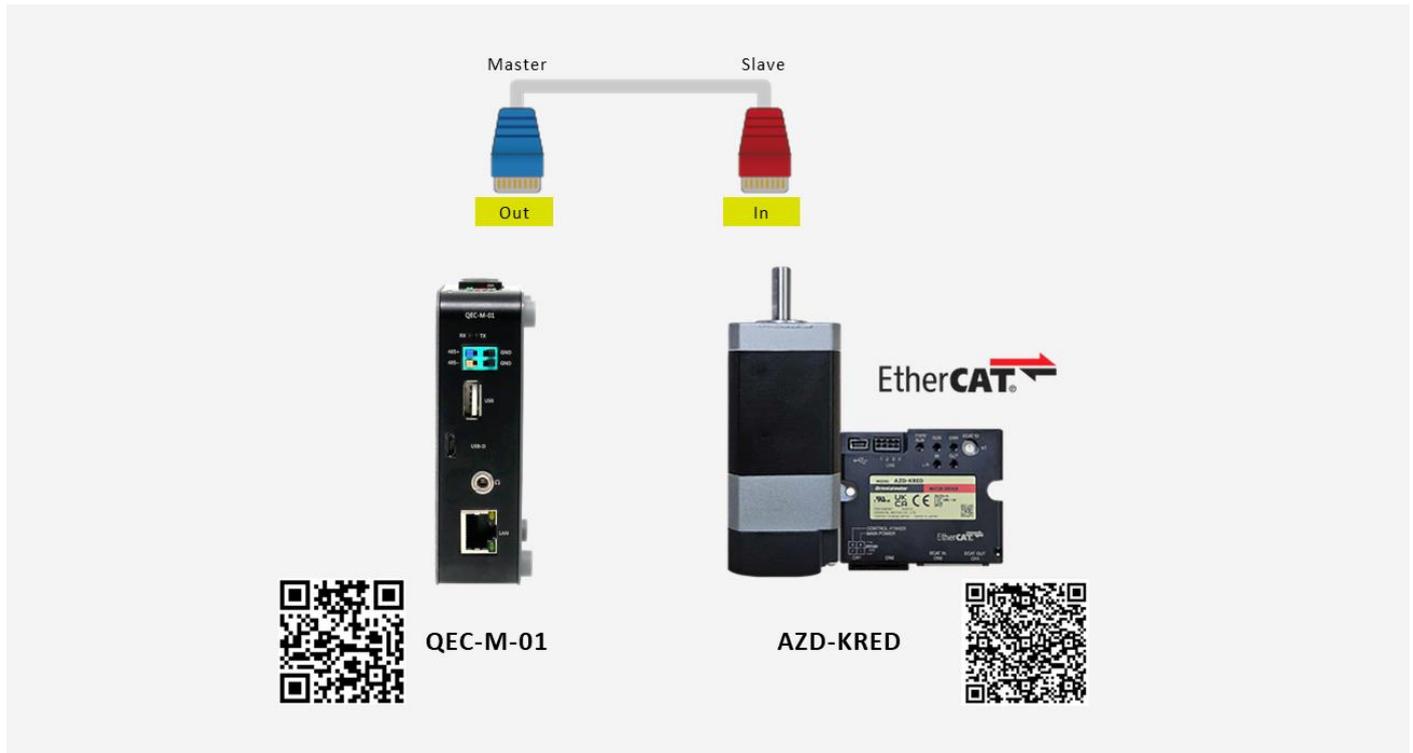


3. QEC's PoE power supply is up to 24V/3A.

1. Connection and wiring hardware

The following devices are used here:

1. QEC-M-01 (EtherCAT Master)
2. AZD-KRED, AZ Series mini EtherCAT Driver (OrientalMotor Step-Servo Driver)
3. AZM48AK, 1.65 in. (42 mm) AZ Series Stepper Motor with Absolute Mechanical Encoder (DC Input)
4. 24V power supply



1.1 QEC-M-01

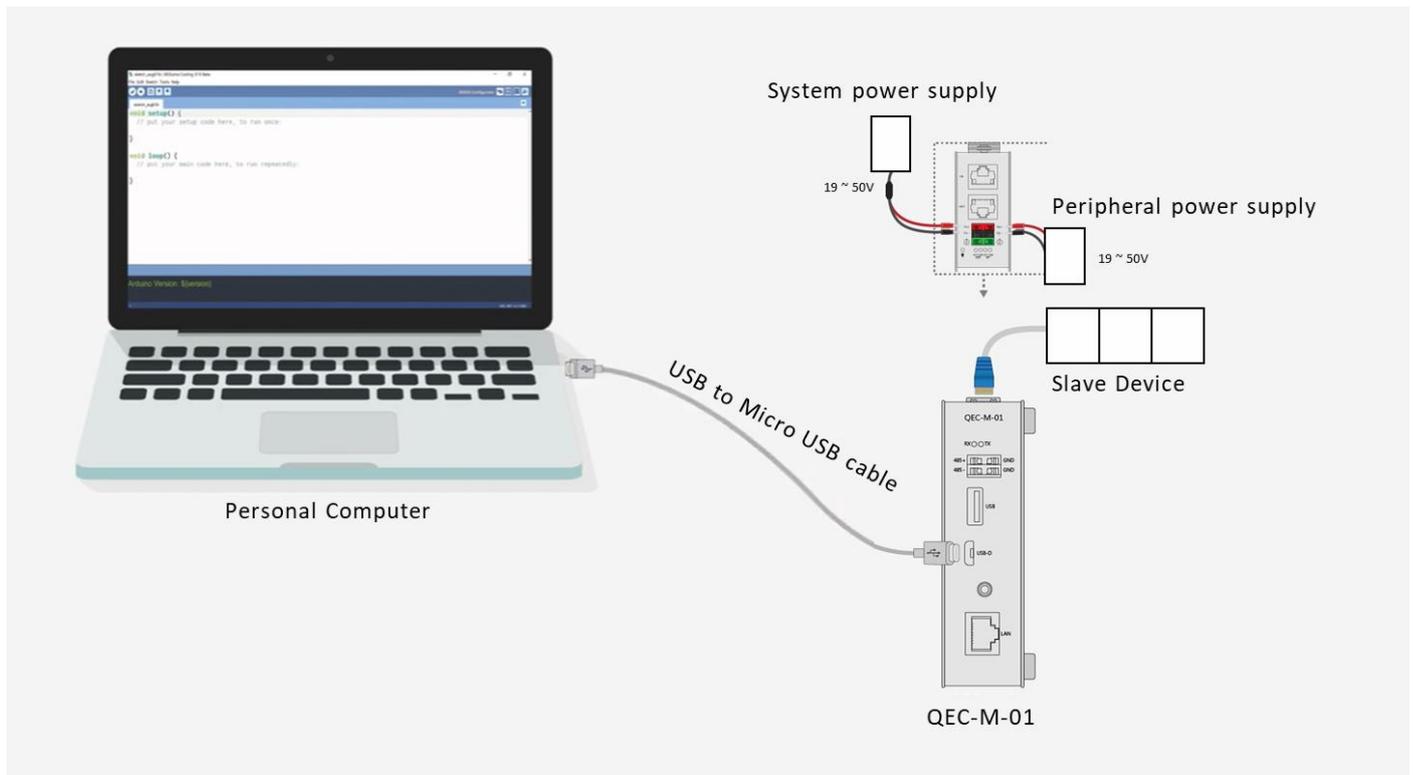
QEC EtherCAT Master.

1. Power Supply:

Connect to Vs+/Vs- and Vp+/Vp- power supplies via EU terminals for 24V power.

2. EtherCAT Connection:

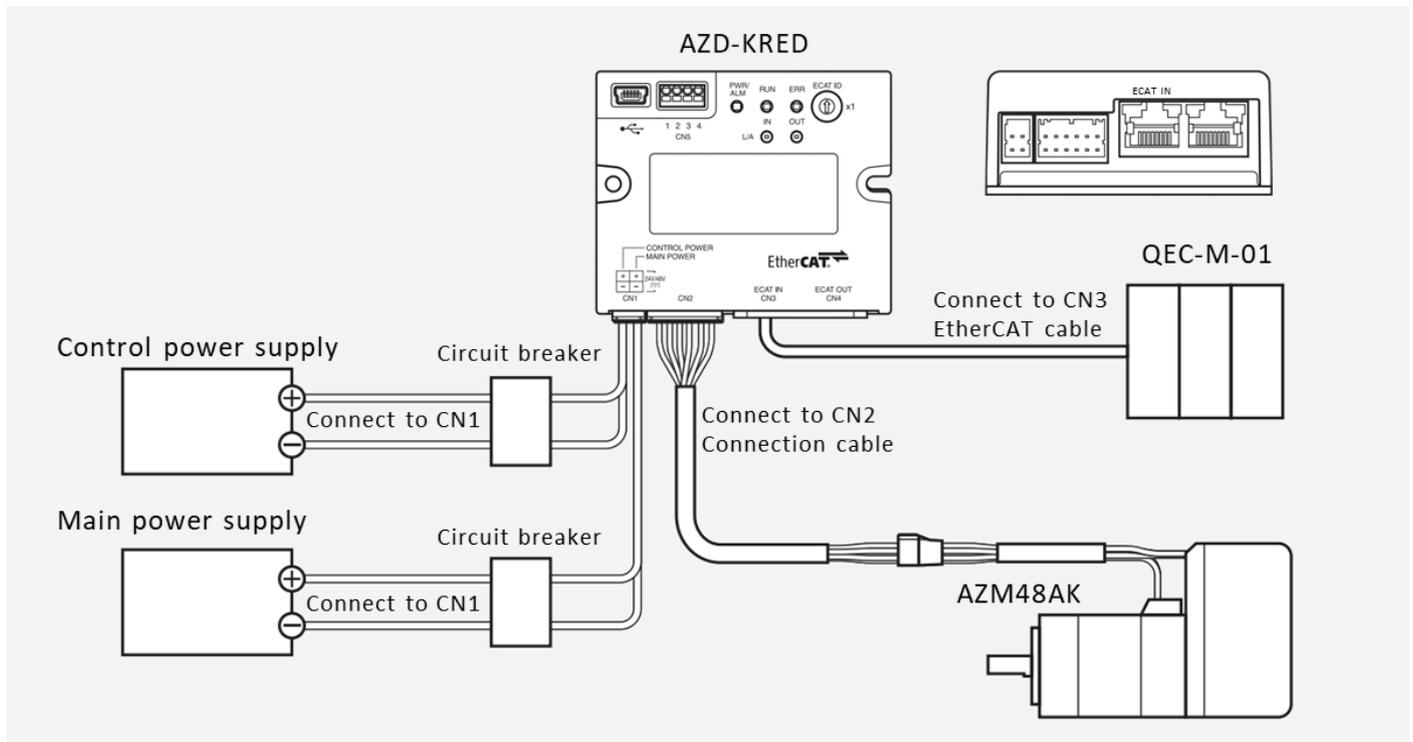
Using the EtherCAT Out port (On the top side) connected to the EtherCAT In port of AZD-KRED via RJ45 cable.



1.2 AZD-KRED

AZD-KRED, an AZ Series mini EtherCAT Driver (OrientalMotor Step-Servo Driver).

This figure shows an example when the **AZM48AK** motor is connected.



1. It is an OrientalMotor cable. Purchase is required separately.
2. Connecting the control power supply allows you to continue monitoring even if the main power supply is shut off. Connect it as necessary.
3. It is recommended that a circuit breaker or a circuit protector is connected because incorrect wiring may cause the internal input circuit to short-circuit.

Note

- Connect the connectors securely. Insecure connections may cause malfunction or damage to the motor or the driver.
- When connecting the cables, secure them so that no load is applied to the connectors. Applying a load to the connector may result in a connection failure, causing the driver to malfunction.
- Keep **10 m (32.8 ft.)** or less for the wiring distance between a motor and a driver. Exceeding **10 m (32.8 ft.)** in the wiring distance may result in an increase of the electrical noise emitted from the driver.
- Keep **2 m (6.6 ft.)** or less for the cable length of the main power supply and control power supply.

Memo

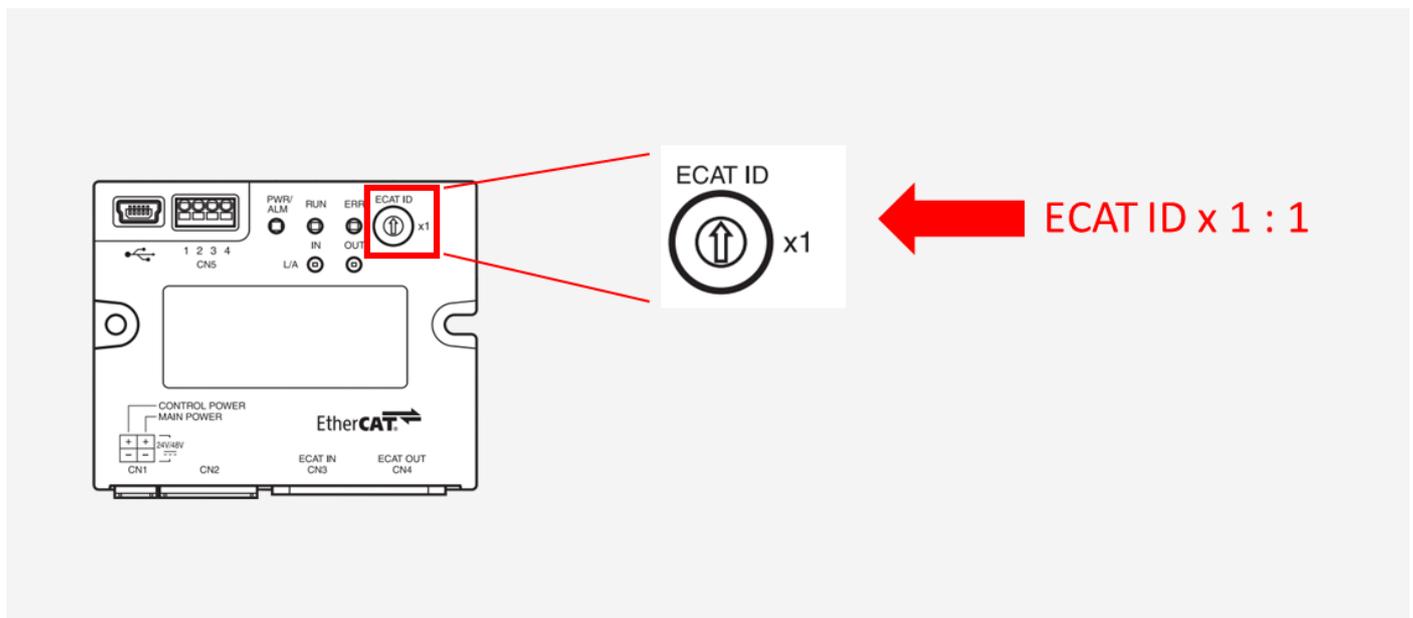
- Before connecting or disconnecting a connector, turn off the main power supply and the control power supply, and check the **PWR/ALM LED** has been turned off.
- When disconnecting the connector, pull out while pressing the latches on the connector with fingers.

Node Address Configuration for AZ-mini Driver:

The node address can be set using the **ECAT ID x1** switch. The switch allows configuration of node addresses ranging from 0 to 15 in hexadecimal.

- The **node address switch** can be set to 16 steps, where addresses 0 to 15 correspond to hexadecimal values 0x0 to 0xF.
- When connecting multiple devices in the EtherCAT network, ensure that no two devices have the same node address to avoid conflicts.

Initial Shipment Setting: 0 (x1:0)



Setting Range	Description
0 (00h)	The master's settings will be applied.
1-15 (01h-0Fh)	The driver's settings will be applied.

* Note: When adjusting the switch settings, ensure that both the main power and control power are turned off. The settings will not take effect if the switch is adjusted while the power is still on.

2. Software/Development Environment

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

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Download

The open source 86Duino Software (IDE) makes it easy to write code and upload it to the QEC. Refer to the [Getting Started page](#) for Installation instructions. ([Release Note](#))

86Duino Coding IDE 500

Date: 2024.08.15

Download

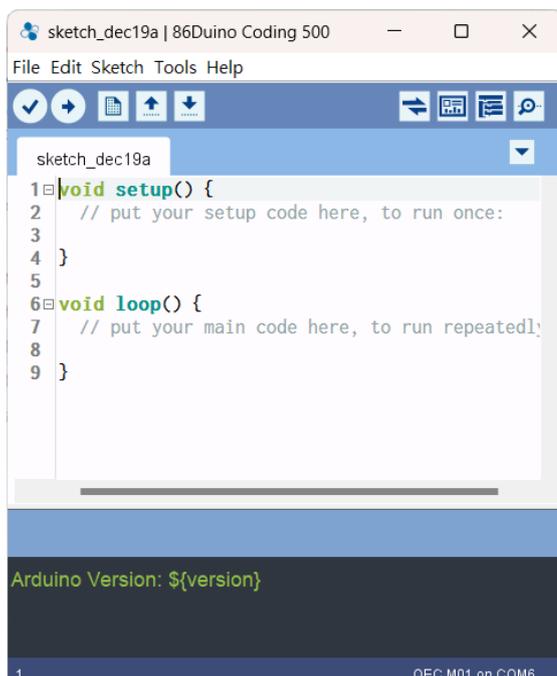
About how to update the QEC Master (QEC-M series products) with the latest version of the 86Duino IDE, please see [this page](#).

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.

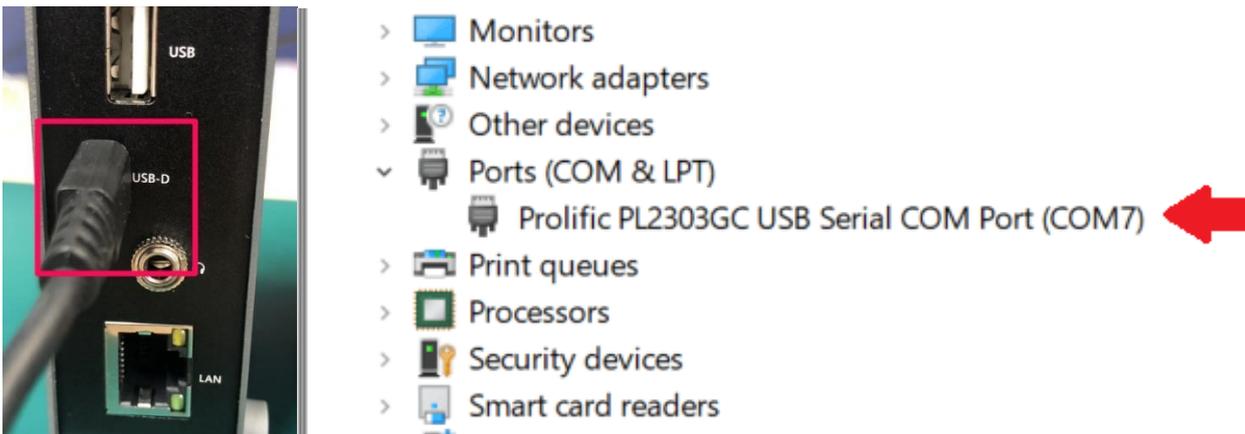


3. Connect to your PC and set up the environment

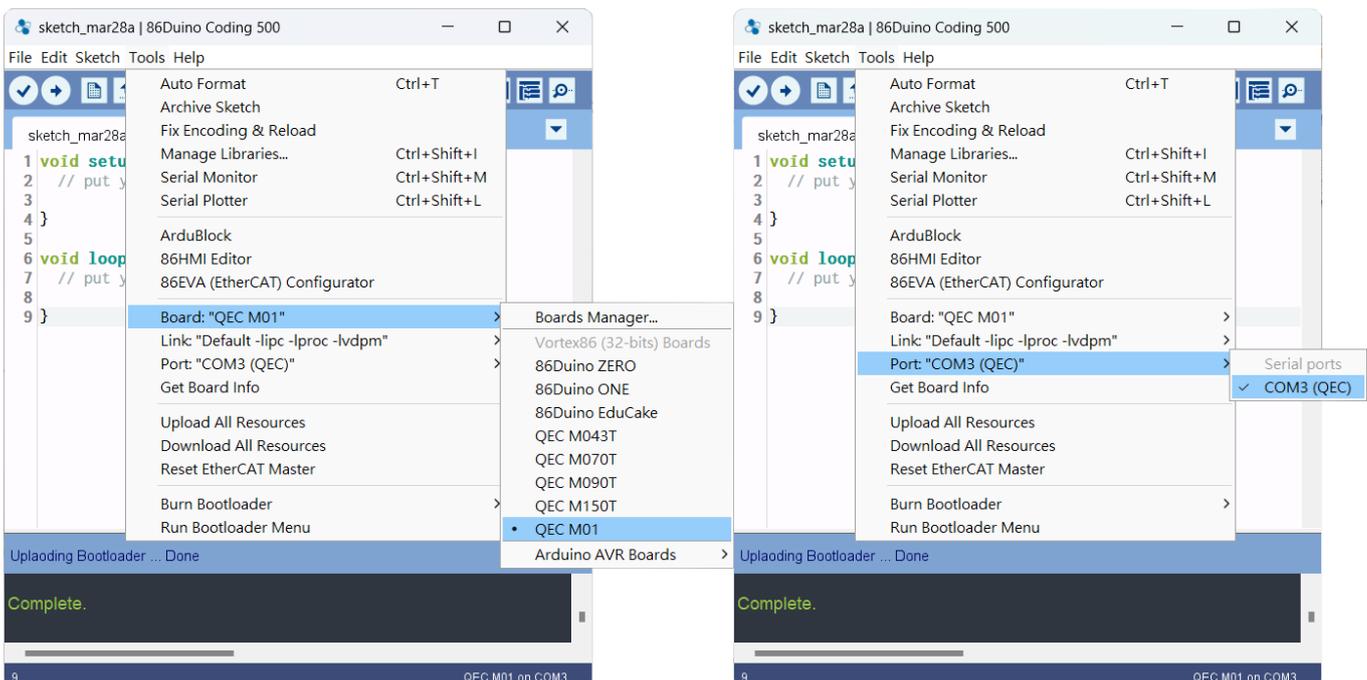
Follow the steps below to set up the environment:

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" (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-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. Write code

The EtherCAT master (QEC-M-01) and the OrientalMotor AZ-mini EtherCAT Driver (AZD-KRED) 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 the AZ-mini driver into CiA402 CSP mode.

- EtherCAT Cycle time: 1 millisecond.
- EtherCAT mode: ECAT_SYNC.
- Distributed Clock: Open. Follow the cycle time.

The `EthercatMaster` object, master, means QEC-M-01; And the `EthercatDevice_CiA402` object, `az_mini`, means AZ-mini driver.

1. In Setup Function:

- Initializes the serial (115200).
- Begin the EtherCAT Master. Switch the EtherCAT state machine to the PRE-OPERATIONAL state.
- Configure the AZ-mini in Cyclic Synchronous Position (CSP) mode.
- Configure the AZ-mini in DC mode and set the same cycle time with EtherCAT communication.
- Register Cyclic Callback Function, which named "myCallback".
- Start the EtherCAT Master. Set the EtherCAT cycle time and mode in the `start()` function. Switch the EtherCAT state machine to the OPERATIONAL state.
- Enable the AZ-mini. Change the CiA402 state to CIA402_OPERATION_ENABLED. Use `delay(1000)` to wait for it to change successfully.

2. In Callback Function:

The motor's position is updated cyclically; we read the actual position value and set the target position as the current position to minus 10.

3. In Loop Function:

The main loop prints the motor's current position to the serial monitor.

In summary, this code establishes EtherCAT communication, reads the AZ-mini motor position, and controls the motor by updating its target position based on its operational state.

Here is the code:

```
#include "Ethercat.h"

#define CYCTIME 1000000

EthercatMaster master;
EthercatDevice_CiA402 az_mini;

int pos = 0;

void myCallback() {
    pos = az_mini.driveGetPositionActualValue();

    if (az_mini.driveGetState() == CIA402_SWITCHED_ON) {
        az_mini.driveSetTargetPosition(az_mini.driveGetPositionActualValue());
    } else if (az_mini.driveGetState() == CIA402_OPERATION_ENABLED) {
        az_mini.driveSetTargetPosition(az_mini.driveGetTargetPosition() - 10);
    }
}

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

    Serial.println(master.begin());
    Serial.println(az_mini.attach(0, master));
    Serial.println(az_mini.setDc(CYCTIME));
    Serial.println(az_mini.driveSetMode(CIA402_CSP_MODE));

    master.attachCyclicCallback(myCallback);
    Serial.println(master.start(CYCTIME, ECAT_SYNC));

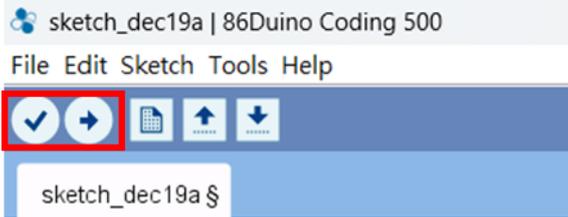
    delay(100);

    Serial.print("Enable: ");
    Serial.println(az_mini.driveEnable());
    delay(1000);
}

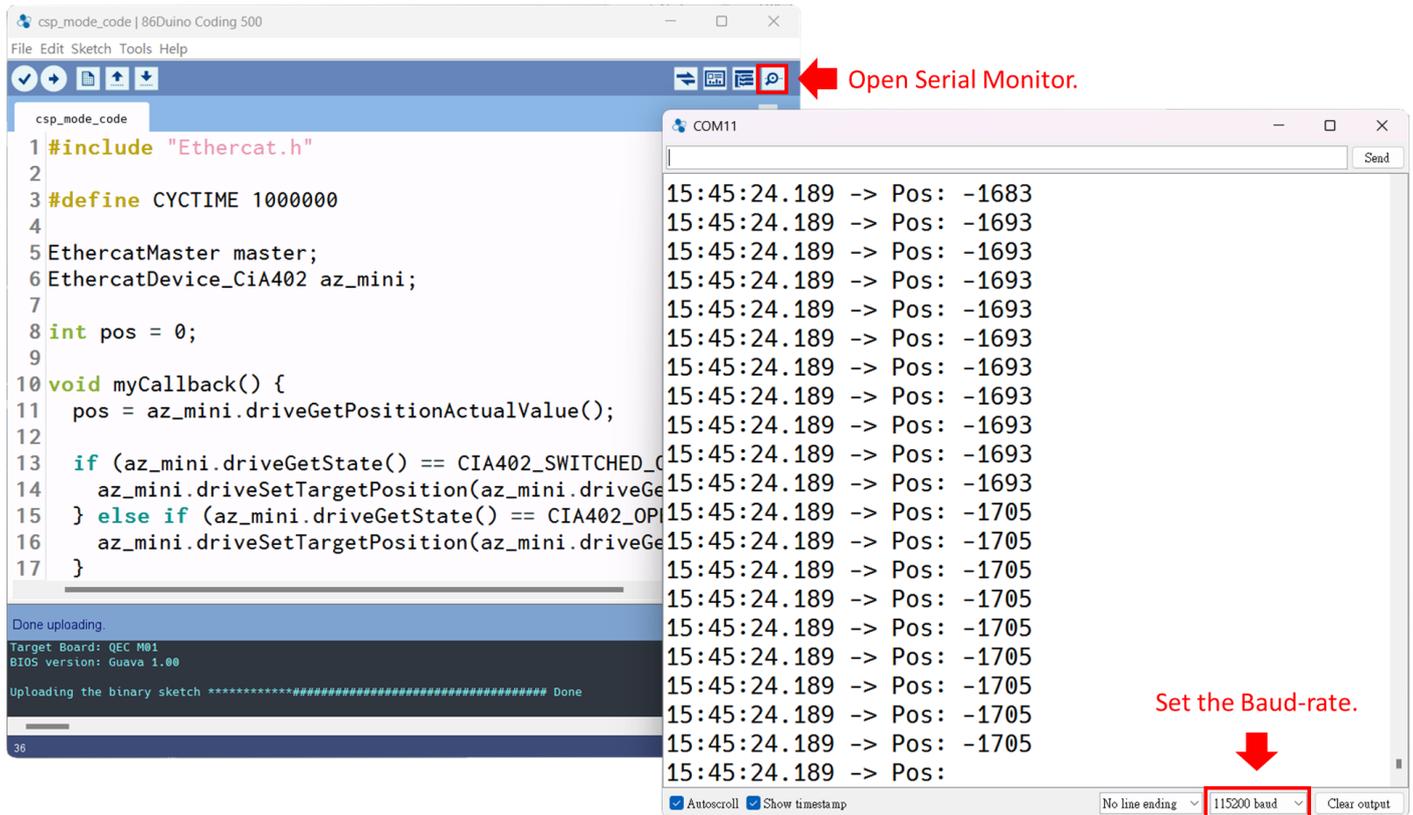
void loop() {
    Serial.print("Pos: ");
```

```
Serial.println(pos);  
}
```

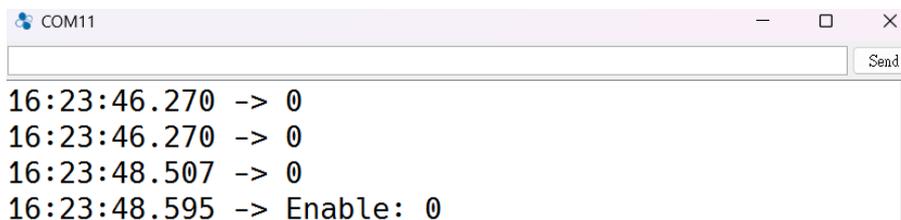
Note: Once the code is written, click on the toolbar to  compile, and to confirm that the compilation is complete and error-free, you can click  to upload.



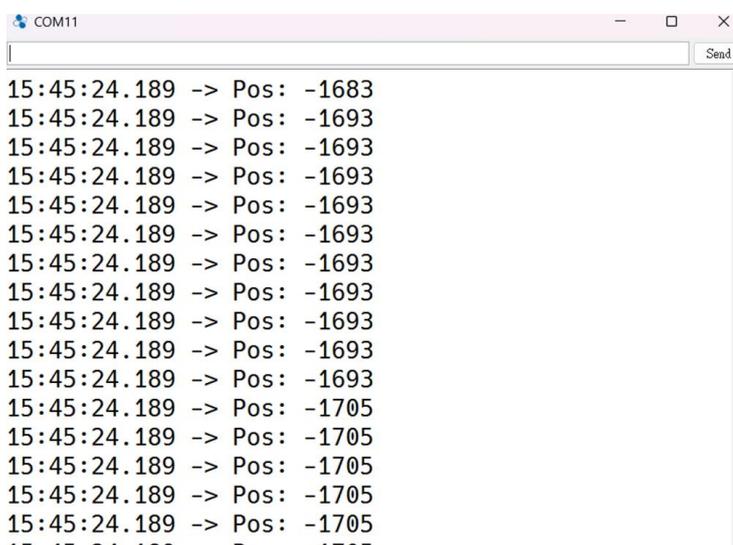
After you successfully upload the program to the QEC-M-01, you can open the Serial Monitor on 86Duino IDE. Please check the Serial baud rate is same as your setting.



If the EtherCAT communication config successful, Serial Monitor will print "0" and "Enable: 0".



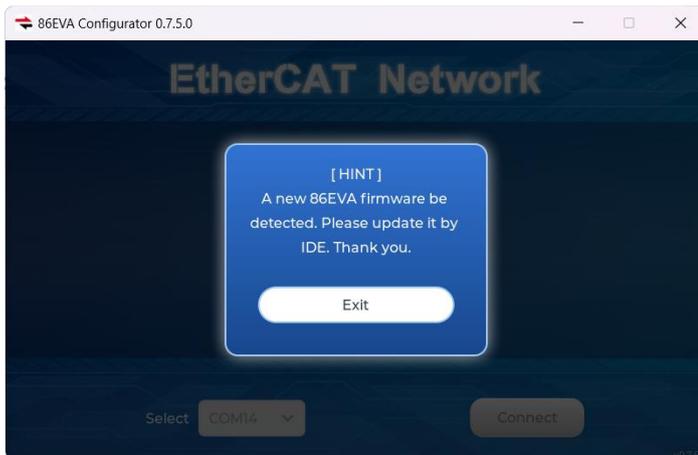
It will print the motor's current position to the serial monitor.



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 Master's environment is abnormal. As shown in the figure below, please try updating your QEC EtherCAT Master'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:

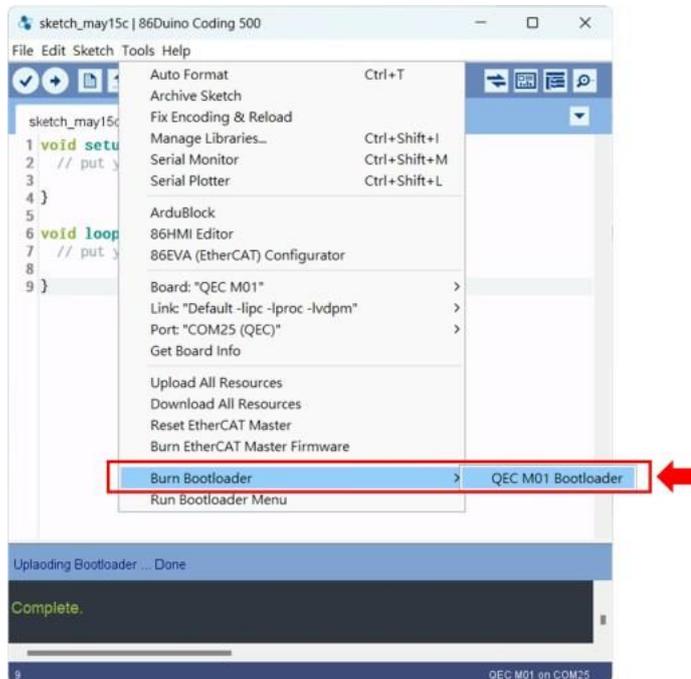
Step 1: Setting up QEC-M

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.

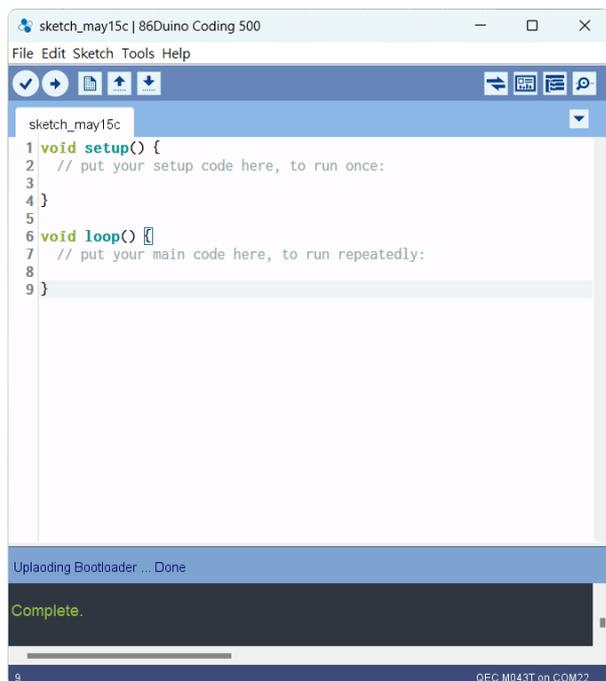
Step 2: Click “Burn Bootloader” button

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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