Start Guide

Delta AC Servo Motors and Drives ASDA-B3/ASDA-A2 Series (PP mode) With 86EVA

86Duino Coding IDE 501

EtherCAT Library

(Version 2.0)

Revision

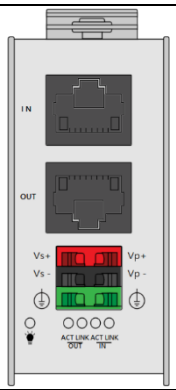
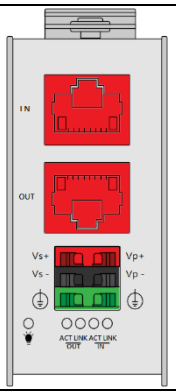
Date	Version	Description
2024/11/5	Version1.0	New release.
2024/12/23	Version1.1	Fixed typos (change CSP to PP).
2026/4/9	Version2.0	• Use 86duino IDE 501 control. • Change Main-Device to MDevice, and Sub-Device or slave to SubDevice

Preface

In this guide, we will show you how to use the EtherCAT MDevice QEC-M-01 and Delta's ASDA-B3 and ASDA-A2 AC Servo Motors and Drives, taking Profile Position (PP) mode as an example.

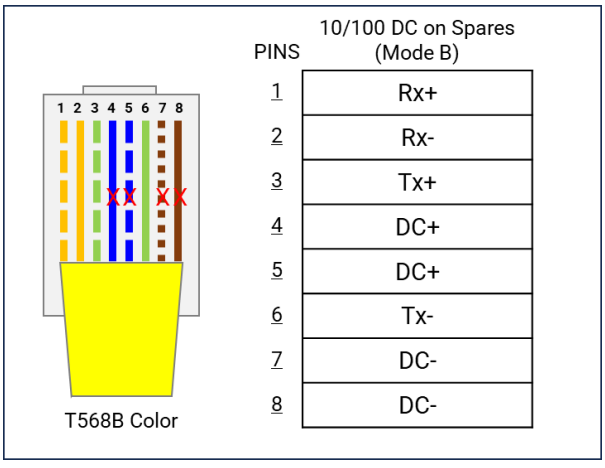
Notes QEC's PoE (Power over Ethernet)

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.

	
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. 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:



PINS	10/100 DC on Spares (Mode B)
1	Rx+
2	Rx-
3	Tx+
4	DC+
5	DC+
6	Tx-
7	DC-
8	DC-

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

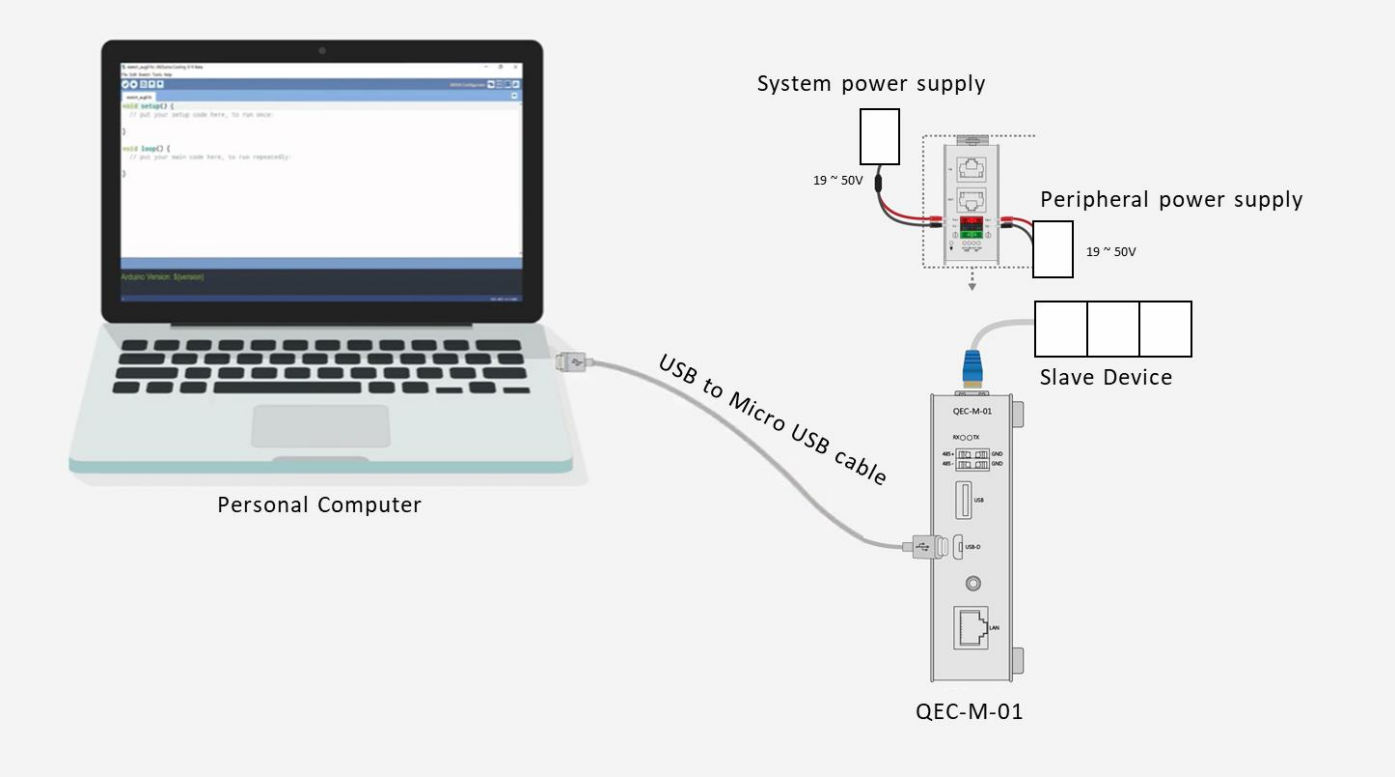
The following devices are used here:

1. QEC-M-01 (EtherCAT MDevice)
2. Delta ASDA-B3 (EtherCAT AC Servo Motor and Drives)
3. Delta ASDA-A2 (EtherCAT AC Servo Motor and Drives)
4. 24V power supply & EU-type terminal cable
5. 220V power supply for Delta AC Servo.
6. RJ45 Cables

1.1 QEC-M-01

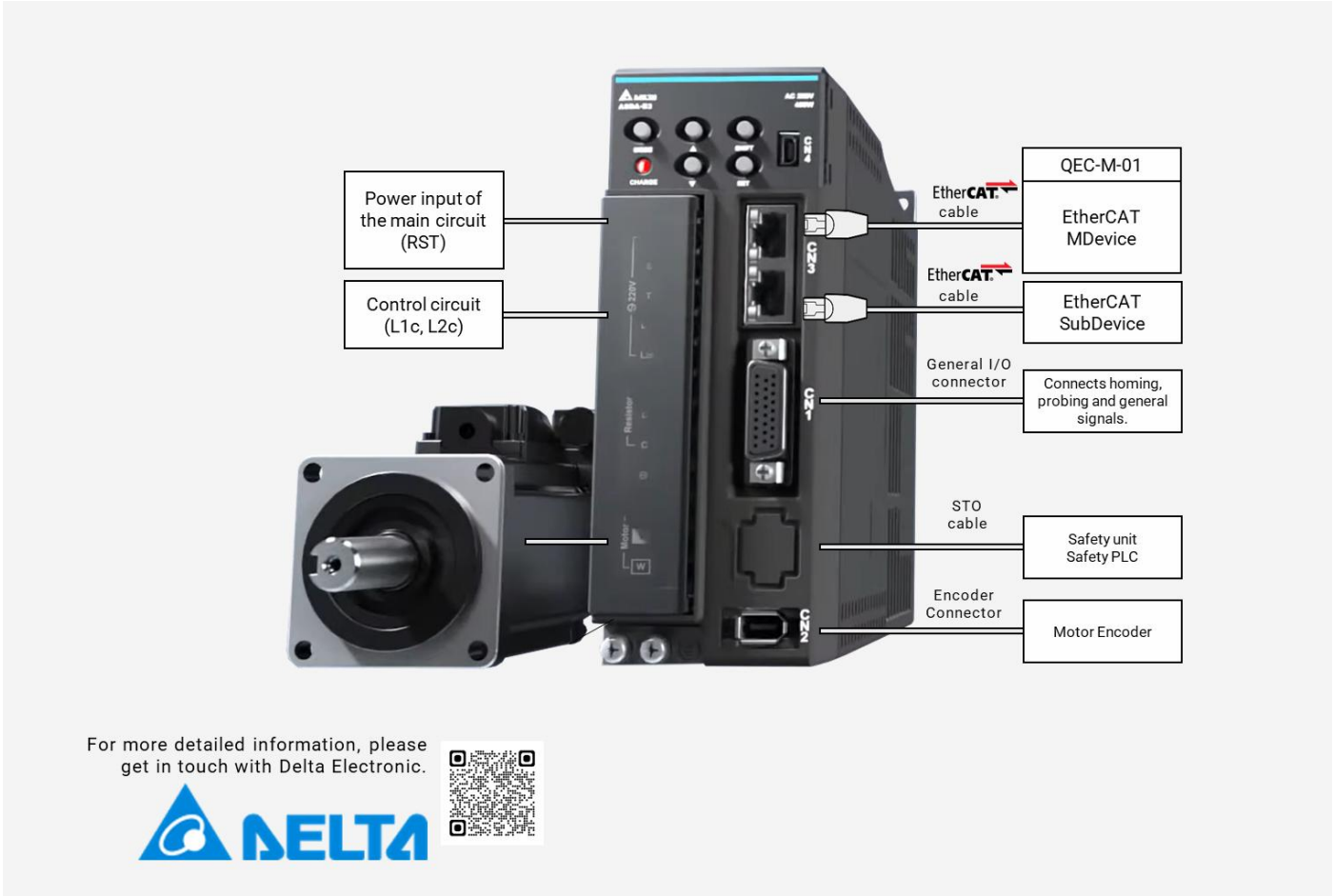
QEC EtherCAT MDevice.

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 the Delta EtherCAT Servos via RJ45 cable.



1.2 Delta ASDA-B3

The **Delta ASDA-B3** is an AC Servo motor and drive, with a built-in EtherCAT interface compliant with CiA402 motion profiles. This figure shows an example of when the ASDA-B3 motor is connected.



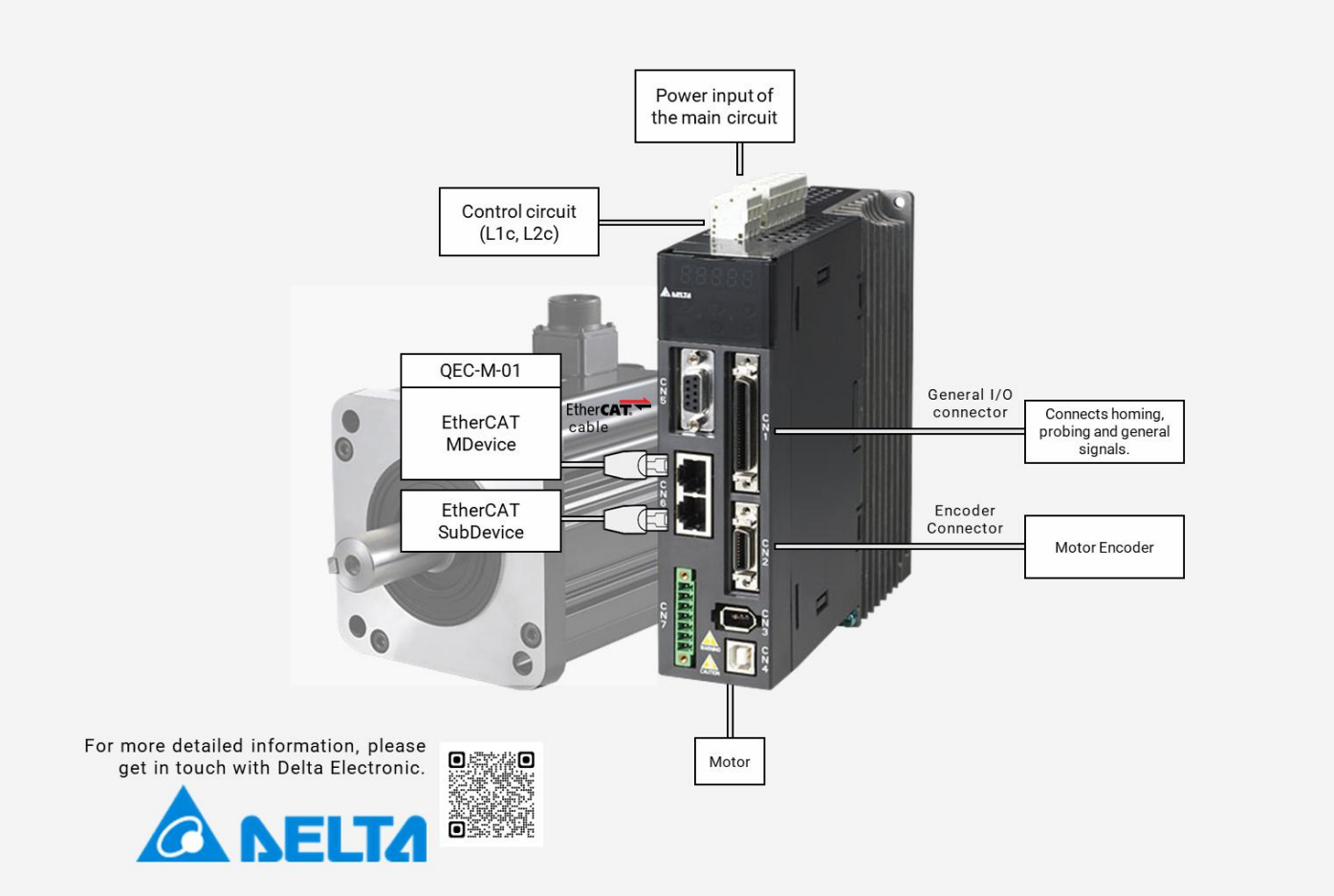
The connections are grouped by function:

1. EtherCAT connectivity
    - QEC-M-01 → Drive EtherCAT IN; EtherCAT OUT → next SubDevice (if any).
    - Put the network to OP before issuing CiA402 commands.
2. Main circuit power (RST)
    - Connect AC power to R/S/T. Install an MCCB and Magnetic Contactor upstream.
    - Supported: single/three-phase 200–230 V (≤3 kW);
      three-phase 380–400 V (1–7.5 kW).
3. Control power (L1C / L2C)
    - Supply control circuitry at L1C/L2C (AC 200–240 V).
4. Servo motor output (UVW)
    - Connect U/V/W to the servo motor power input.
5. Regenerative resistor (P⊕ D C)
    - Built-in resistor is sufficient for most applications.
      Connect external resistor for high-inertia loads.

6. I/O connector (CN1)
    - Connects ORG, POT/NOT limit switches, and general DI/DO signals for QEC homing and motion protection.
7. STO (CN10)
    - Must be active to enable the drive. Bridge the connector during development if no Safety PLC is used.
8. Encoder connector (CN2)
    - Use the manufacturer-supplied encoder cable.

1.3 Delta ASDA-A2

The **Delta ASDA-A2** is an AC Servo motor and drive, with a built-in EtherCAT interface compliant with CiA402 motion profiles. This figure shows an example of when the ASDA-A2 motor is connected.



The connections are grouped by function:

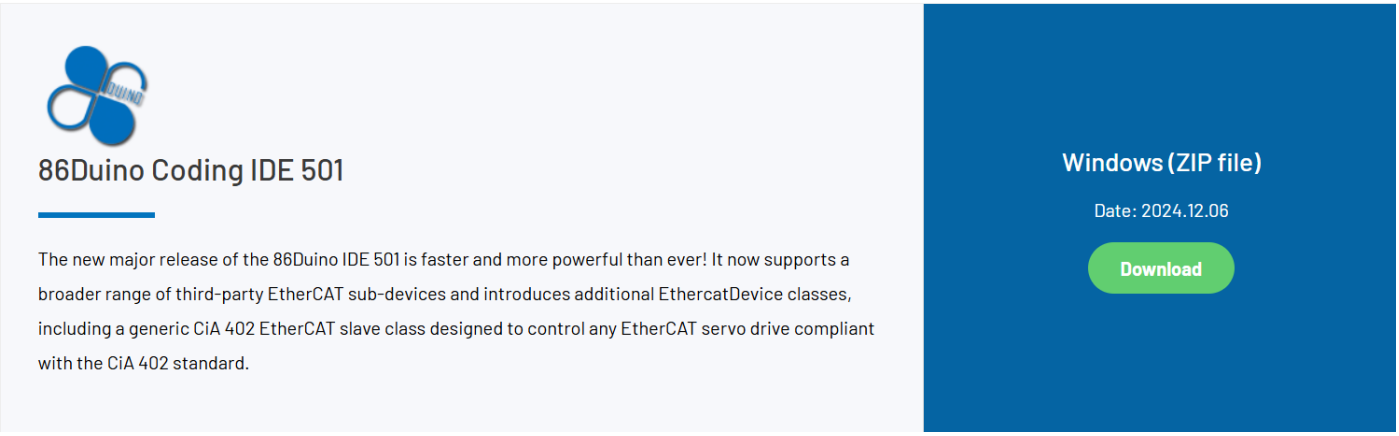
1. EtherCAT connectivity
    - QEC-M-01 → Drive EtherCAT IN; EtherCAT OUT → next SubDevice (if any).
    - Put the network to OP before issuing CiA402 commands.
2. Main circuit power (RST)
    - Connect AC power to R/S/T. Install an NFB (No Fuse Breaker) and Electromagnetic Contactor upstream.
    - Supported: single/three-phase 200–230 V (200 W–1.5 kW); three-phase 200–230 V (2–3 kW).
3. Control power (L1C / L2C)
    - Supply control circuitry at L1C/L2C (AC 200–230 V).
4. Servo motor output (UVW)
    - Connect U/V/W to the servo motor power input.
5. Regenerative resistor (P⊕ / C / D)
    - Built-in resistor is sufficient for most applications.

- For external resistor: connect between P⊕ and C, and open the circuit between P⊕ and D.

6. I/O connector (CN1)
   - Connects ORG, POT/NOT limit switches, and general DI/DO signals for QEC homing and motion protection.
   - An optional terminal block module (ASD-BM-50A) can be used for easier wiring.
7. Encoder connector (CN2)
   - Use the manufacturer-supplied encoder cable.

2. Software/Development Environment

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



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

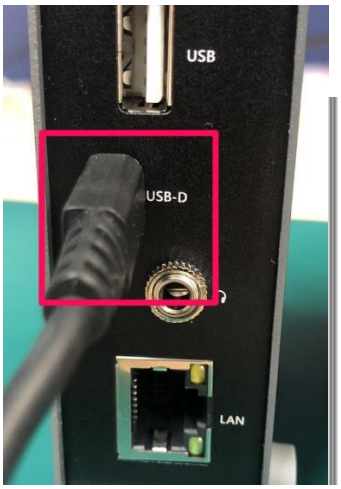
*__Note__: If Windows displays a warning, click Details once and then click the Continue Run button once.

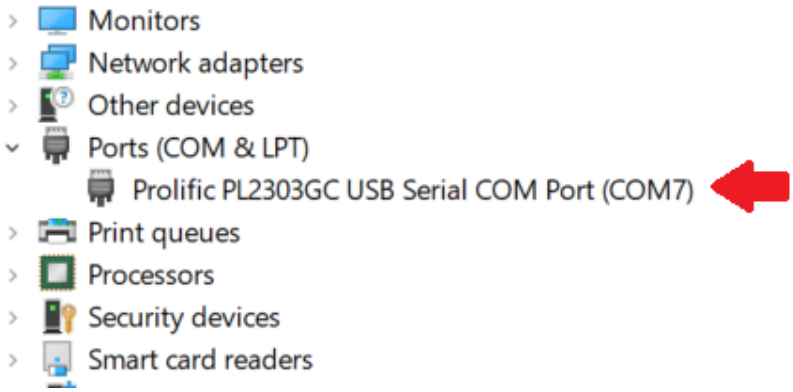
86Duino Coding IDE 501+ looks like below.

3. Connect to PC and set up the environment

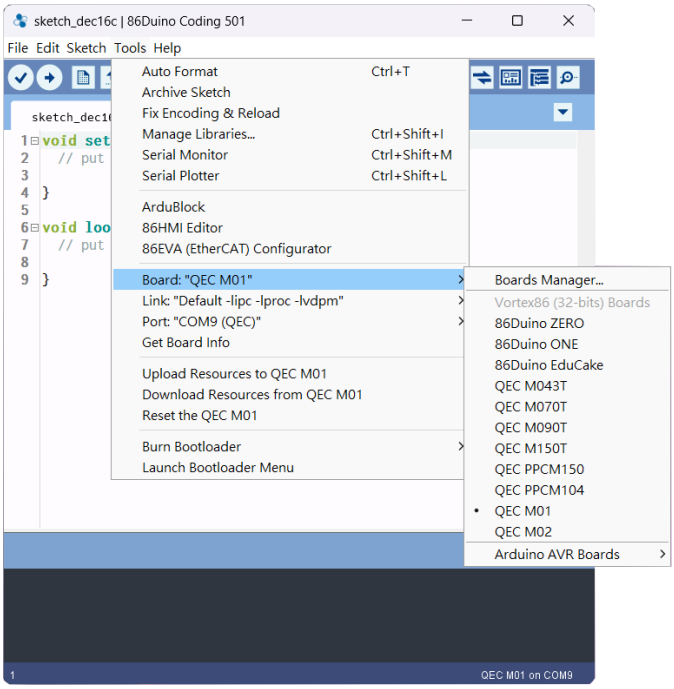
Follow the steps below to set up the environment:

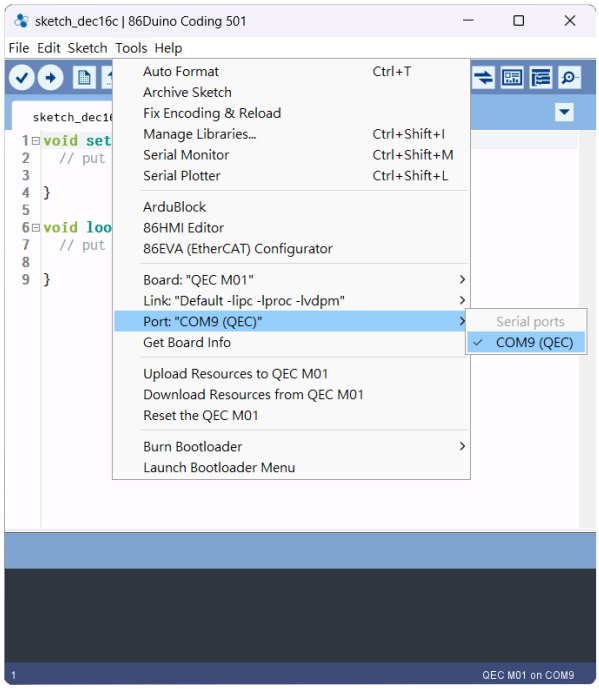
1. Connect the QEC-M-01 to your PC via a Micro USB to USB cable (86Duino IDE installed).
2. Turn on the QEC power.
3. Open “**Device Manager**” (select in the menu after pressing Win+X) ->” **Ports (COM & LPT)**” in your PC and expand the ports; you should see that the “**Prolific PL2303GC USB Serial 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. Use 86EVA with code

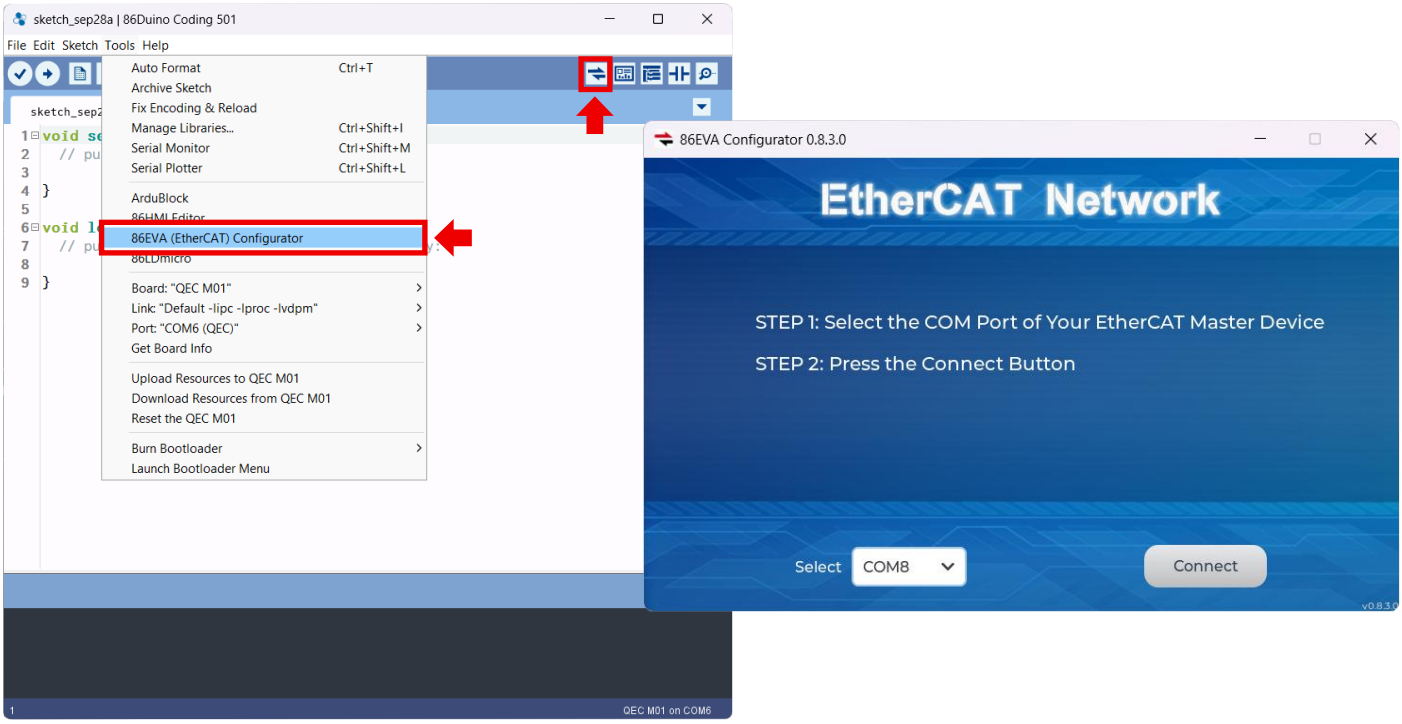
This example shows how to operate the EtherCAT MDevice (QEC-M-01) and the Delta ASDA drives (ASDA-B3 and ASDA-A2) through the 86Duino IDE's graphical low-code programming tool, 86EVA.

Software Tools Description:

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

4.1 Step 1: Turn on 86EVA and scan

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



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

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

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

4.2 Step 2: Set the parameters

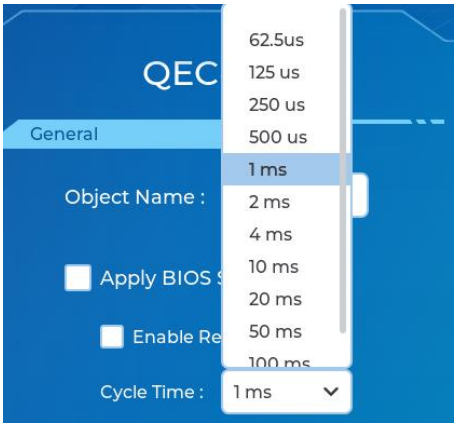
Press twice on the scanned device image to enter the corresponding parameter setting screen.

4.2.1 QEC-M-01

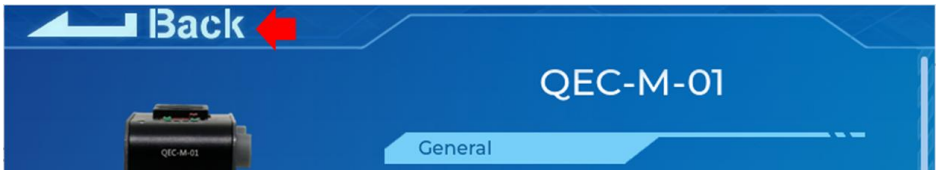
Press twice on the image of the QEC-M-01 to see the parameter settings.

Please check the following configures.

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



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



4.2.2 Delta ASDA-B3

Press twice on the image of the Delta ASDA-B3 to see the parameter settings.

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

Please change the Object Name to “**motor0**”.
It’ll appear a keyboard after you click the Object Name.

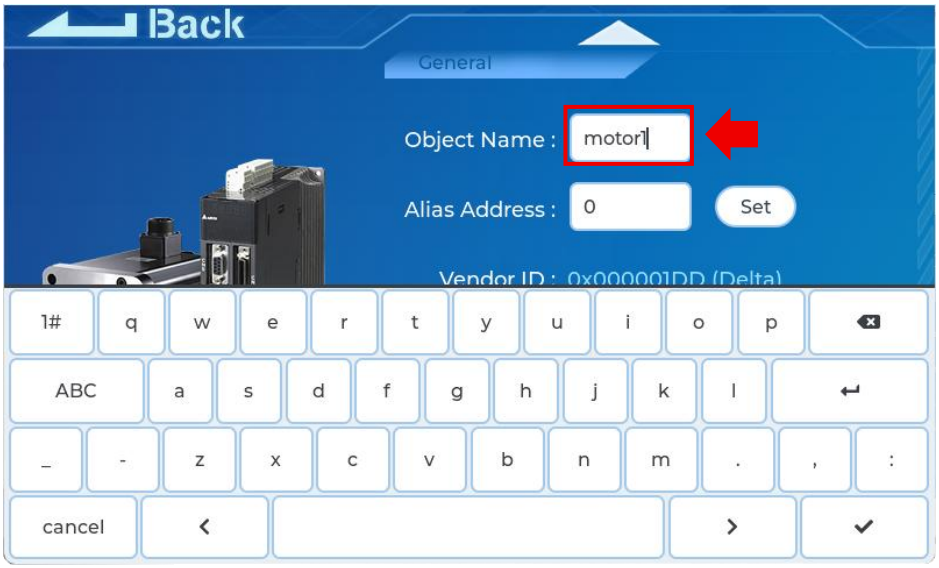
Click "**Back**" in the upper left corner to return.

4.2.3 Delta ASDA-A2

Press twice on the image of the Delta ASDA-A2 to see the parameter settings.

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

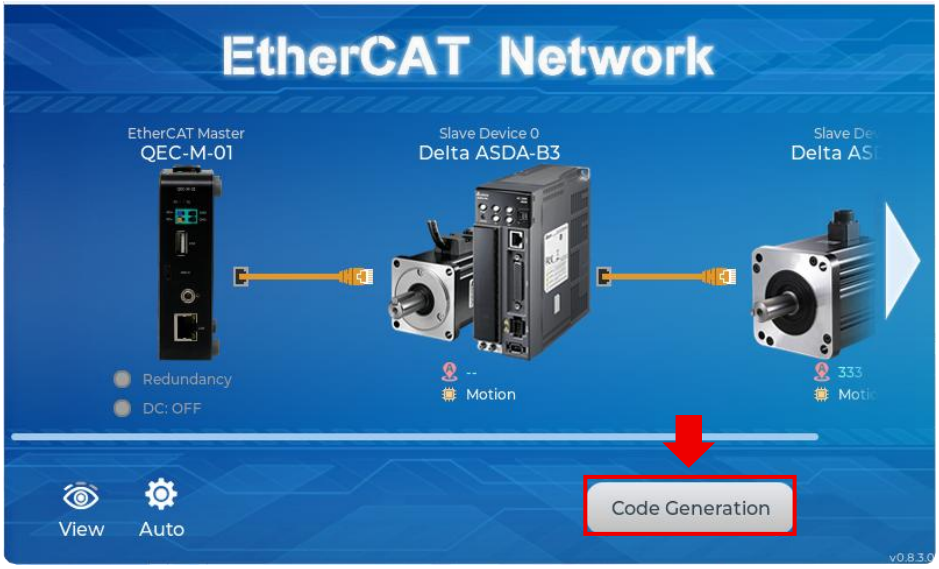
Please change the Object Name to “**motor1**”.
It’ll appear a keyboard after you click the Object Name.



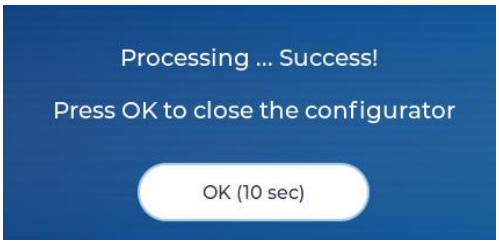
Click "**Back**" in the upper left corner to return.

4.3 Step 3: Generate the code

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



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



The generated code and files are as follows:

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

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

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

4.4 Step 4: Write the code

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

- The `EthercatMaster` object (`EcatMaster`) represents the QEC-M-01, while the `EthercatDevice_CiA402` represents the ASDA-B3 (`motor0`) and ASDA-A2 (`motor1`) drives.
- CiA402 mode: Profile Position (PP) mode.
- EtherCAT mode: ECAT_SYNC.

The following parameter is configured by the user in 86EVA:

- EtherCAT Cycle Time: 1 millisecond.

This code establishes EtherCAT communication via 86EVA and controls two ASDA drives (ASDA-B3 and ASDA-A2) in Profile Position (PP) mode. Each motor's current position is printed to the Serial Monitor on every loop iteration, and the target position alternates between +10,000,000 and −10,000,000 counts, simulating continuous forward and reverse movements on both axes simultaneously.

A. In Setup Function:

In the `setup()` function, initialize communication and configure the motor for CiA402 Profile Position (PP) mode. Follow the steps below:

1. Initialize Serial Communication
    - Start serial communication at a baud rate of 115200.
2. Start the 86EVA
    - Use the `EVA.begin()` function to start and initialize the EtherCAT network.
3. Enable the Motor
    - Use the `enable()` function to enable the motor and transition it to CIA402_OPERATION_ENABLED.
4. Configure Profile Parameters
    - Set motion profile type, velocity, acceleration, and deceleration for each drive.

B. In Loop Function:

In the `loop()` function, the current position of the motor is displayed on the Serial Monitor, and the motor alternates its movement back and forth in a repeating cycle:

1. State Machine Logic
    - case 0: Move to +10,000,000 counts. Once the command is successfully executed, transition to the next state.
    - case 1: Wait for both motors to reach the target position. Once the target is reached, proceed to the next state.
    - case 2: Move to −10,000,000 counts. Once the command is successfully executed, transition to the next state.

- case 3: Wait for both motors to reach the target position. Once the target is reached, reset the state machine back to case 0 to repeat the movement cycle.

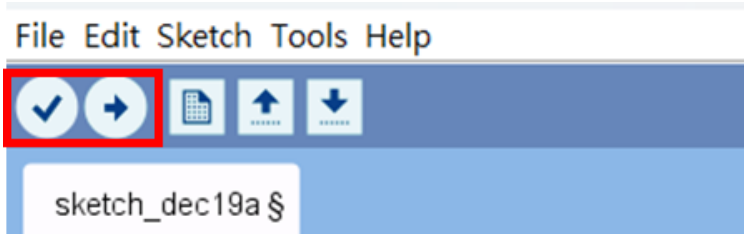
2. Code Logic Summary
   - Use the `pp_Run()` function to initiate position movement.
   - Use the `pp_IsTargetReached()` function to confirm whether the target position has been reached.
   - The state machine starts at case 0 and resets after completing case 3.

The example code is as follows:

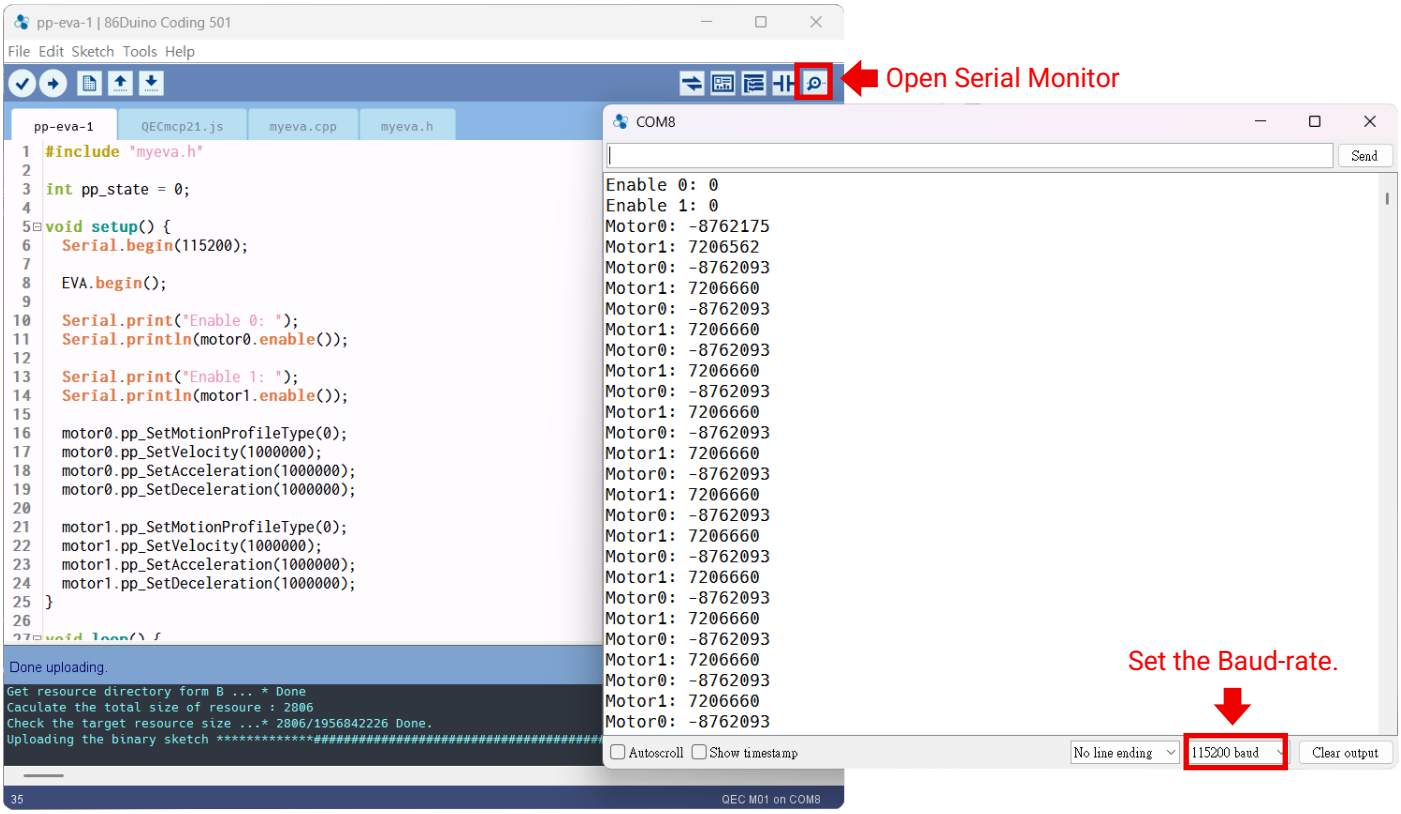
```
#include "myeva.h"

int pp_state = 0;

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

  EVA.begin();

  Serial.print("Enable 0: ");
  Serial.println(motor0.enable());

  Serial.print("Enable 1: ");
  Serial.println(motor1.enable());

  motor0.pp_SetMotionProfileType(0);
  motor0.pp_SetVelocity(1000000);
  motor0.pp_SetAcceleration(1000000);
  motor0.pp_SetDeceleration(1000000);

  motor1.pp_SetMotionProfileType(0);
  motor1.pp_SetVelocity(1000000);
  motor1.pp_SetAcceleration(1000000);
  motor1.pp_SetDeceleration(1000000);
}

void loop() {
  Serial.print("Motor0: ");
  Serial.println(motor0.getPositionActualValue());
  Serial.print("Motor1: ");
  Serial.println(motor1.getPositionActualValue());

  switch (pp_state) {
```

```
    case 0:
      if (motor0.pp_Run(10000000) == 0 && motor1.pp_Run(10000000) == 0)
        pp_state++;
      break;
    case 1:
      if (motor0.pp_IsTargetReached() && motor1.pp_IsTargetReached())
        pp_state++;
      break;
    case 2:
      if (motor0.pp_Run(-10000000) == 0 && motor1.pp_Run(-10000000) == 0)
        pp_state++;
      break;
    case 3:
      if (motor0.pp_IsTargetReached() && motor1.pp_IsTargetReached())
        pp_state = 0;
      break;
  }
}
```

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

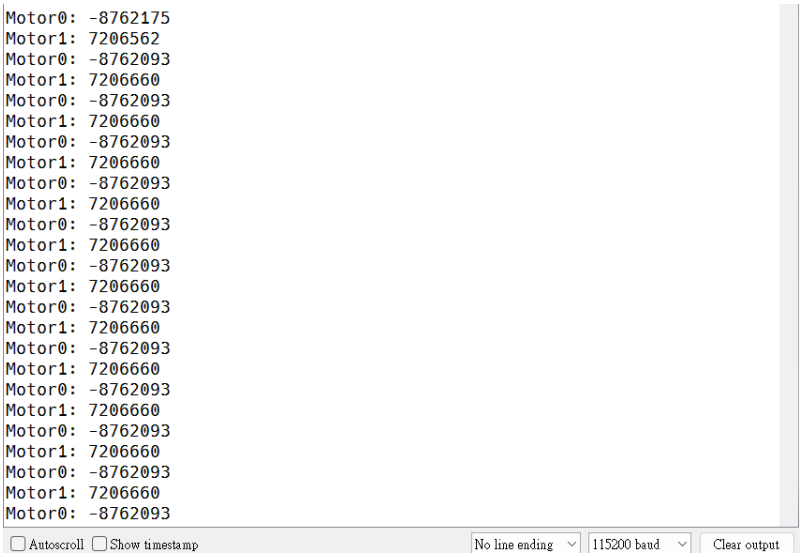


After you successfully upload the program to the QEC-M-01, you can open the Serial Monitor on the 86Duino IDE. Please check that the Serial baud rate is the same as your setting.



If the EtherCAT communication configuration is successful, the Serial Monitor will print "**Enable: 0**" for CiA402.

It will print the motor 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 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:

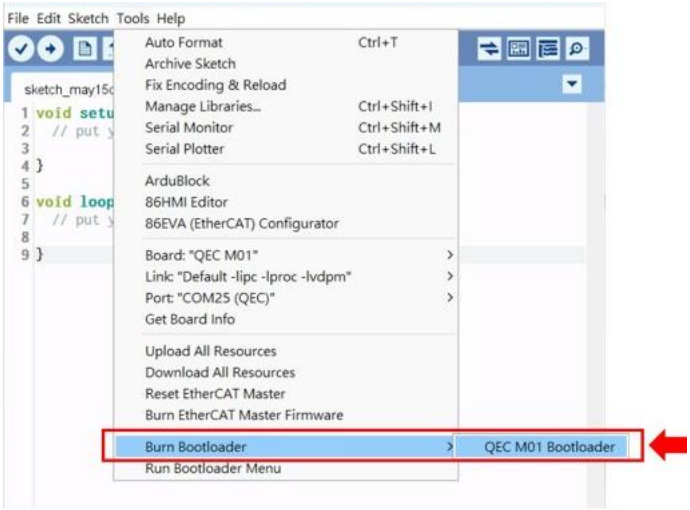
Step 1: Setting up QEC-M

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.

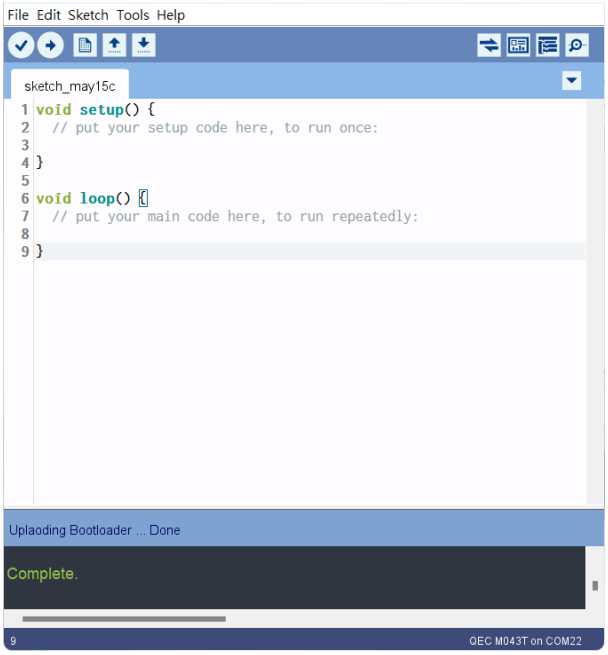
Step 2: Click “Burn Bootloader” button

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.