Start Guide

Panasonic A6B Series
EtherCAT AC Servo Motor & Driver
CiA402 PP Mode with 86EVA

86Duino Coding IDE 501

EtherCAT Library

(Version 1.0)

Revision

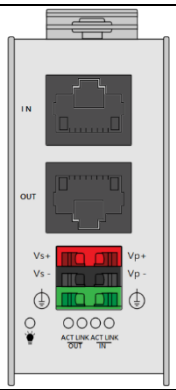
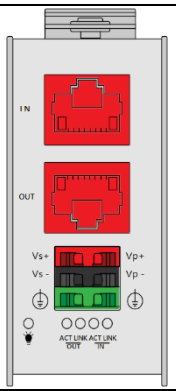
Date	Version	Description
2025/1/21	Version1.0	New Release.

Preface

In this guide, we will show you how to use the EtherCAT MDevice QEC-M-01 and the Panasonic A6B Series EtherCAT AC Servo Motor and Driver.

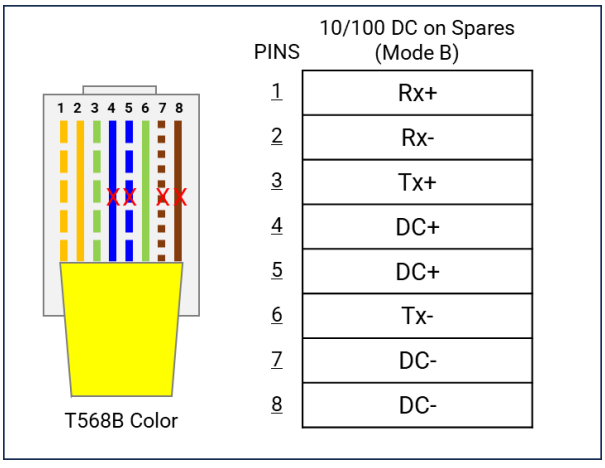
Notes QEC's PoE (Power over Ethernet)

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:



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

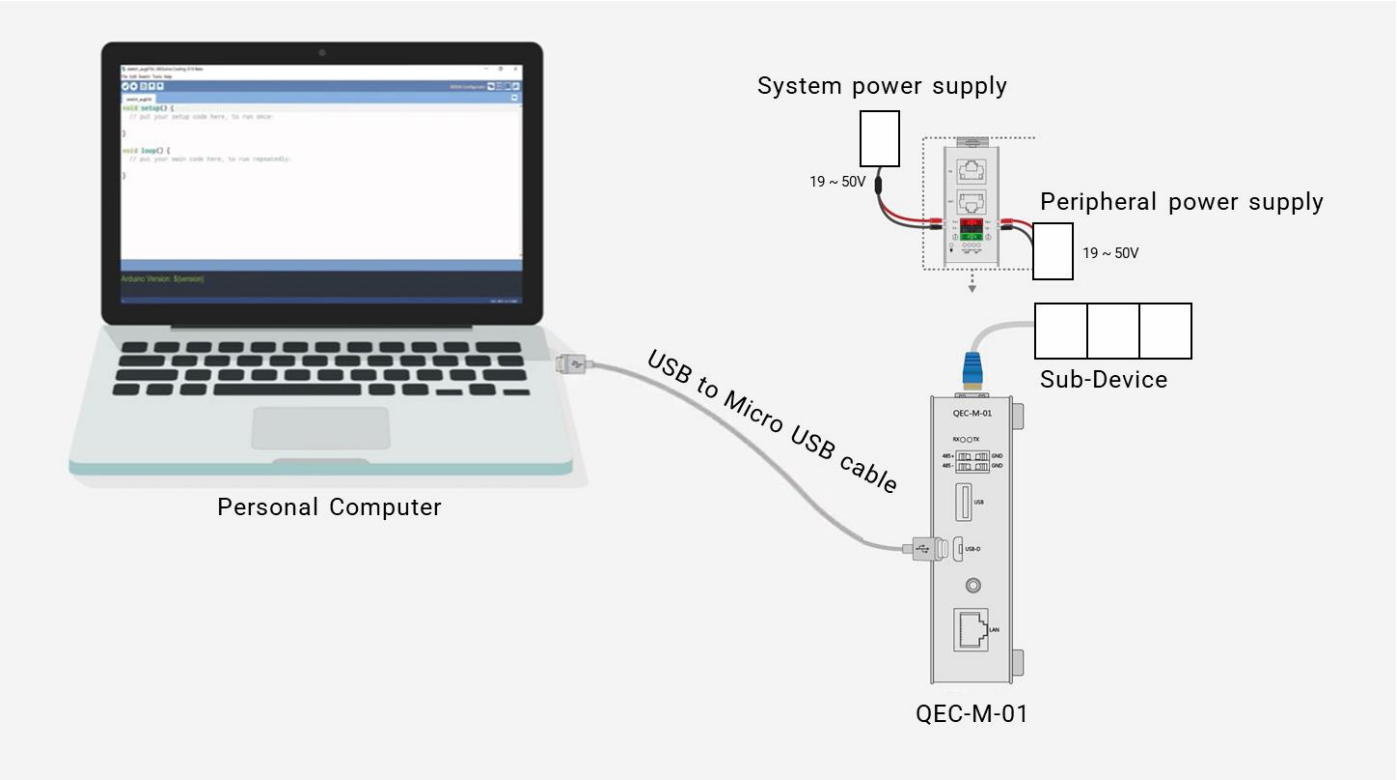
The following devices are used here:

1. QEC-M-01（EtherCAT MDevice）
2. Panasonic A6B Series (EtherCAT AC Servo Motor and Driver)
3. 24V power supply & EU-type terminal cable & LAN cable
4. 200 to 220V power supply for Panasonic A6B Series

1.1 QEC-M-01

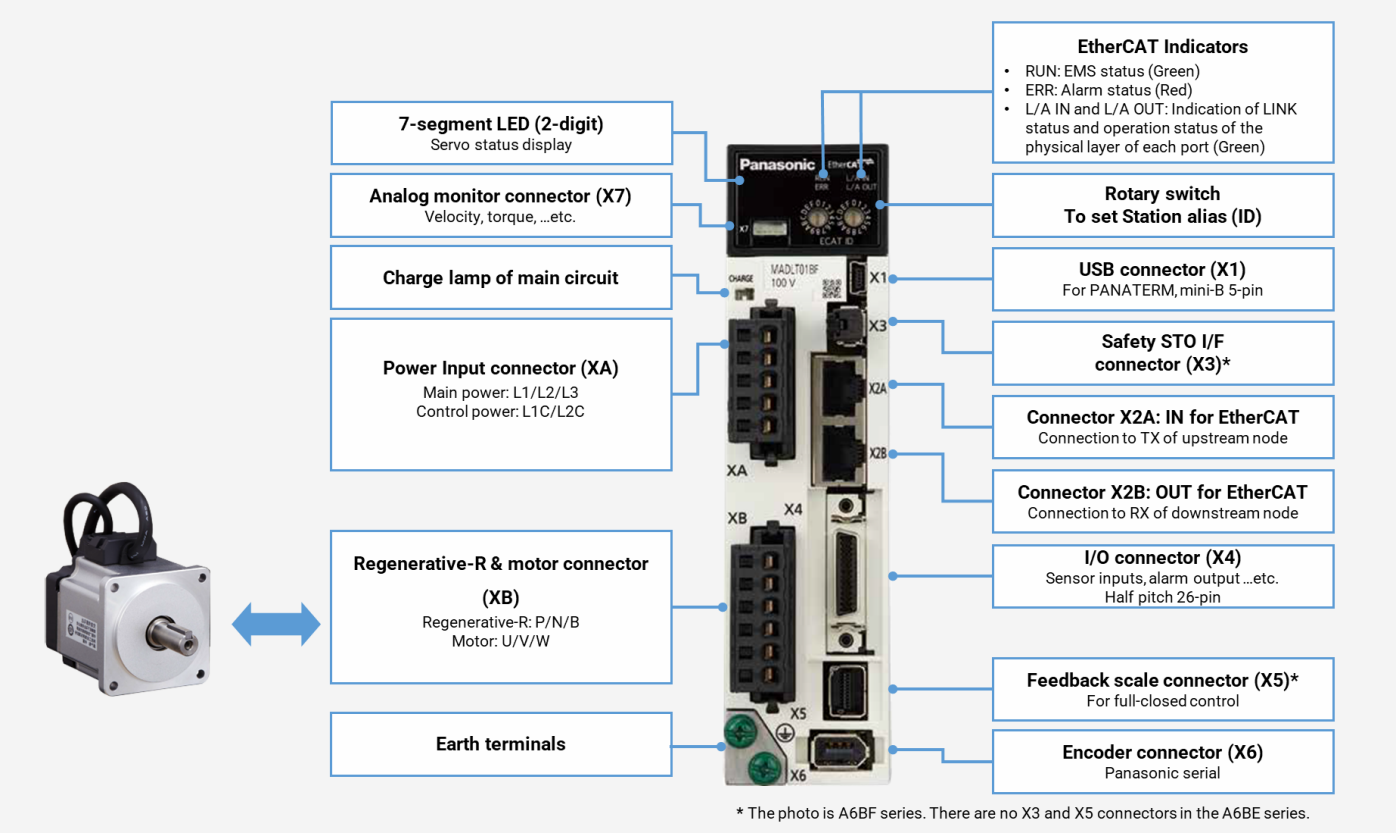
QEC EtherCAT MDevice.

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 Panasonic A6B Series

Panasonic A6B Series is a high-performance integrated EtherCAT AC Servo Motor and Driver. This figure shows an example of when the driver wiring guide



1. EtherCAT Connectivity
   - EtherCAT Input (X2A) and EtherCAT Output (X2B) ports for network communication.
   - Station ID rotary switch for device identification.
2. Signal Connections
   - I/O Signal Interface (X4): For digital inputs and outputs.
   - Encoder Connector (X6): For tracking motor position.
   - Regenerative Resistor & Motor Connector (XB): Provides motor power and control connections.
3. Power Supply
   - Main Power Input (XA): Supplies power to the motor.
   - Control Power Input (XA1/XA2): Provides power for the driver's control circuitry.
4. Safety and Status
   - Safety STO Interface (X3): Supports Safe Torque Off (STO) functionality for emergency stops.
   - LED Indicators: Displays driver status, EtherCAT communication status, and error information.
5. Additional Features
   - Rotary Switch: For setting the station alias (ID).
   - USB Interface (X1): Used for configuration and monitoring.

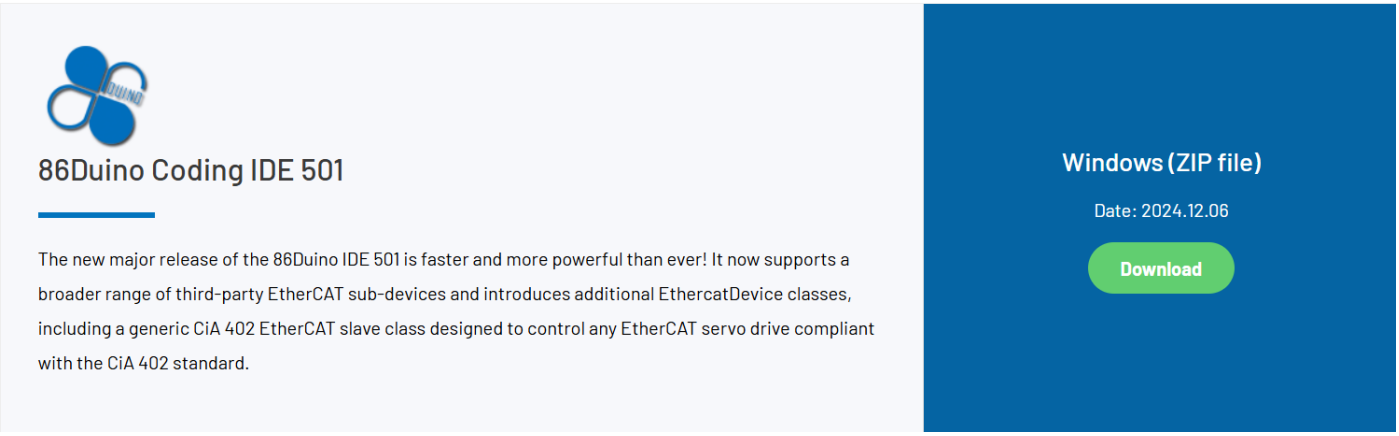
Wiring Diagram Overview

Below is an example of a typical wiring setup for the Panasonic A6B EtherCAT Servo Driver:

1. EtherCAT MDevice Connection:
   - Connect the EtherCAT output port of the QEC-M-01 to the X2A (EtherCAT IN) port of the servo driver.
   - If additional SubDevices are required, connect the X2B (EtherCAT OUT) port to the next SubDevice's EtherCAT input.
2. Motor Connection:
   - Connect the motor's U, V, W wires to the XB connector.
   - Connect the regenerative resistor to the P, N, B terminals.
3. Power Supply Wiring:
   - Connect the main power supply to the XA connector (L1, L2, L3).
   - Connect the control power supply to XA1 and XA2 terminals.
4. Signal Wiring:
   - Connect input/output signals such as sensors and alarms to the X4 connector.
   - Connect encoder signal wires to the X6 connector.
5. Additional Settings:
   - Use the rotary switch to set the Station Alias (ID).
   - Configure the servo driver via the X1 USB interface.

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.

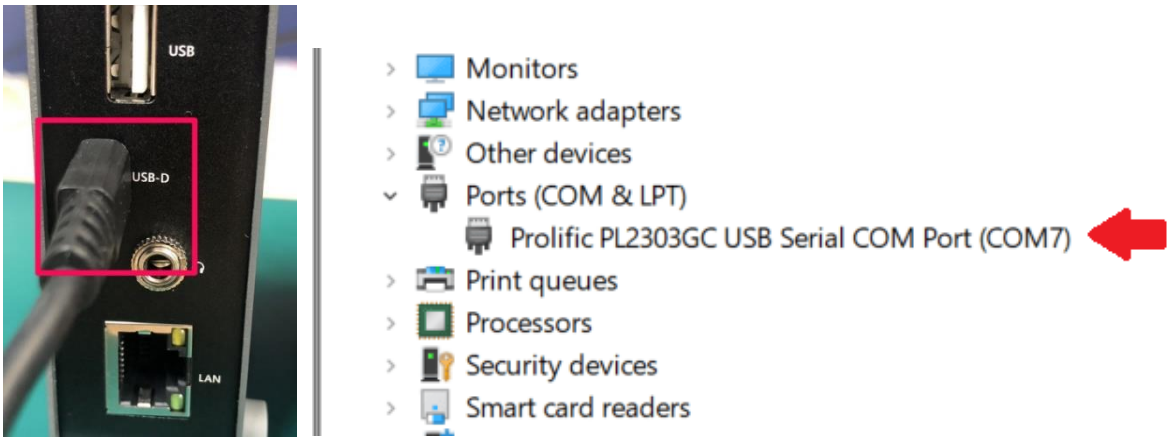
Note:
If Windows displays a warning, click Details once and then click the Continue Run button once.

86Duino Coding IDE 501+ looks like below.

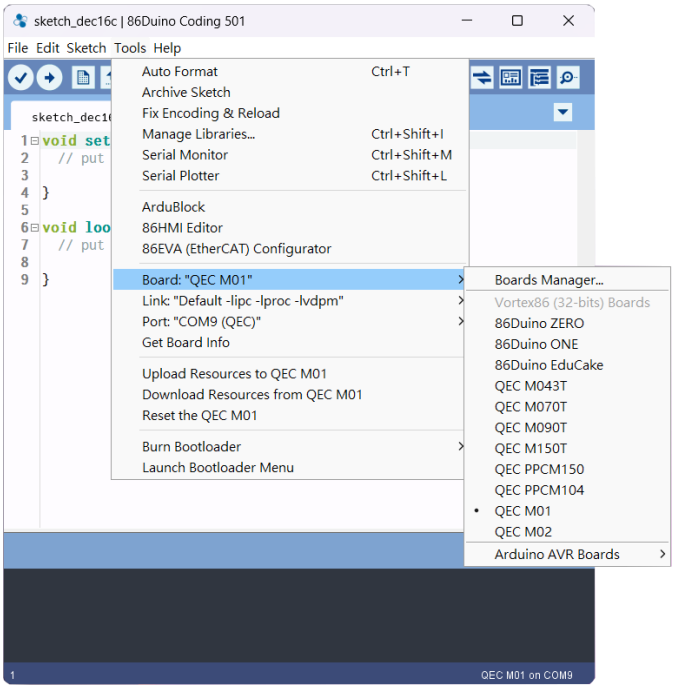
3. Connect to PC and set up the environment

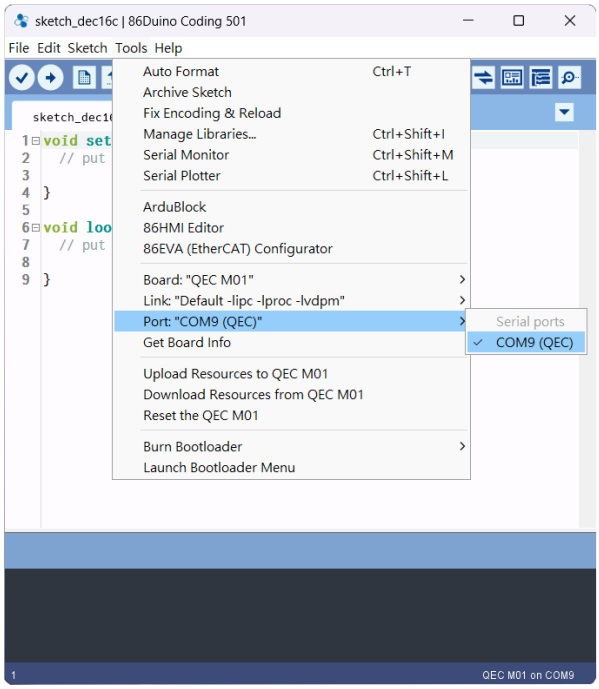
Follow the steps below to set up the environment:

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-M-01 (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 Panasonic A6B (EtherCAT AC Servo Driver) through the 86Duino IDE's graphical low-code programming tool, 86EVA.

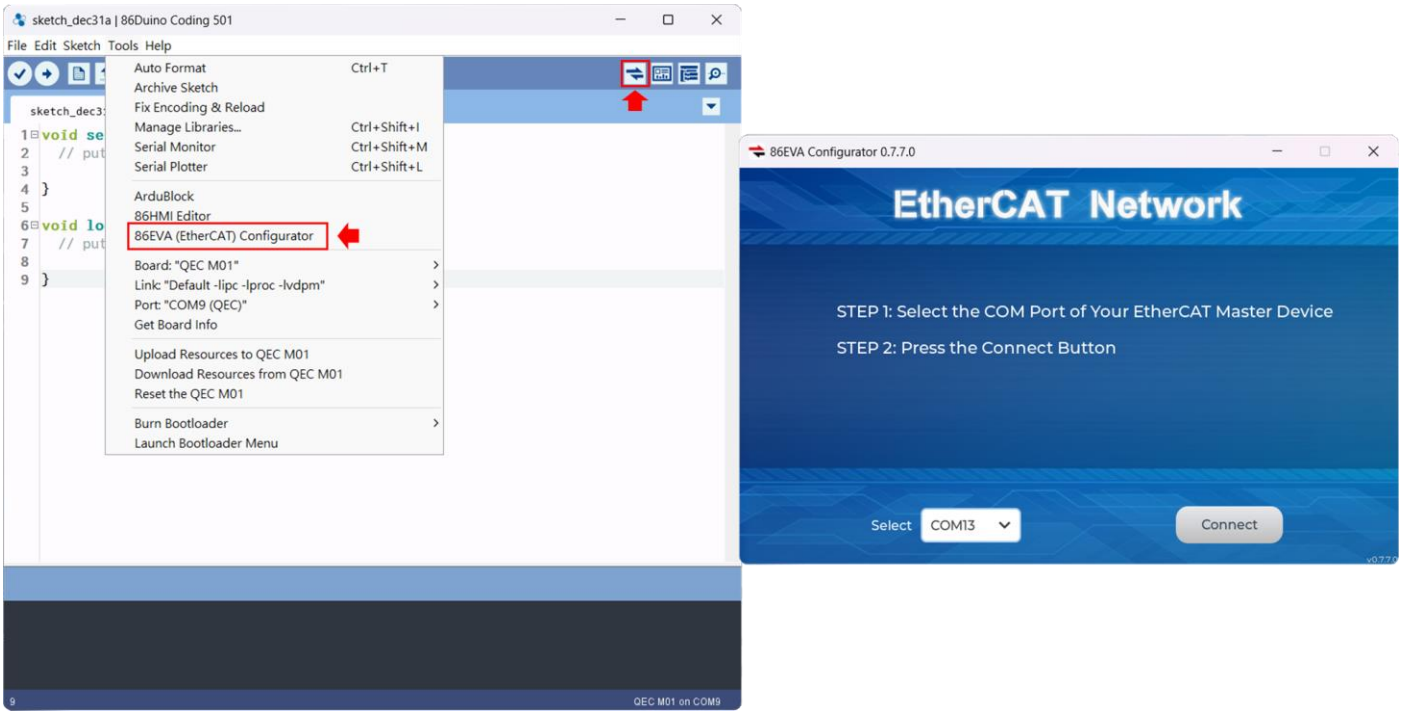
Software Tools Description:

- 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.

This code establishes EtherCAT communication and controls the Panasonic A6B Servo Driver in Profile Position (PP) mode. The motor's position is updated cyclically, and the target position alternates between 100,000,000 and -100,000,000units, simulating continuous forward and reverse movements.

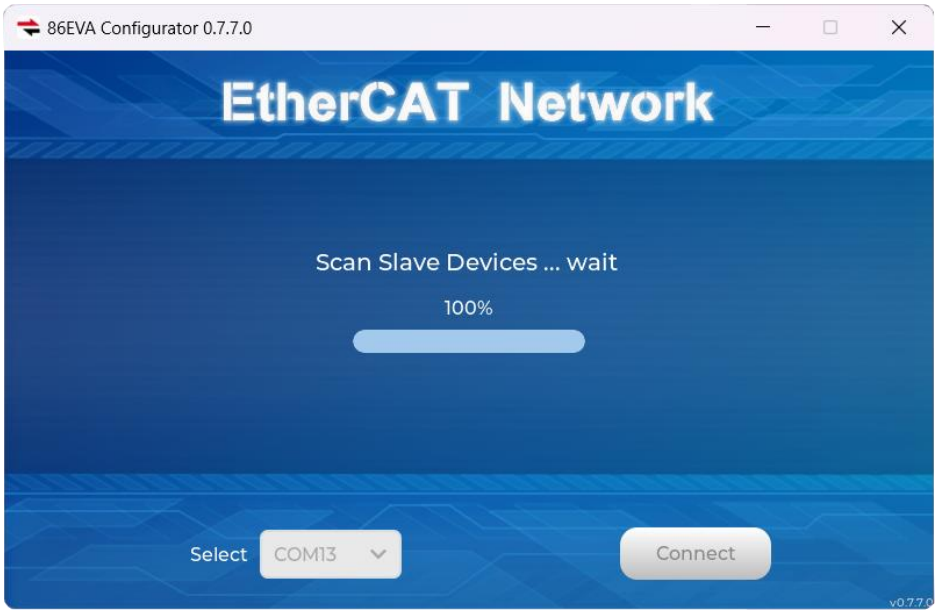
Step 1: Turn on 86EVA and scan

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.



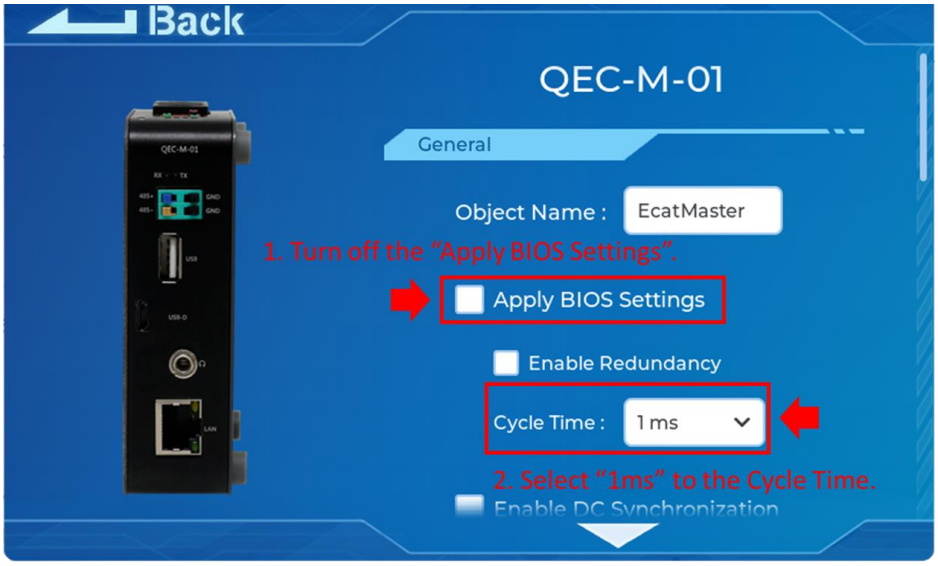
The connected devices will be displayed after the EtherCAT network has been scanned.

Step 2: Set the parameters

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

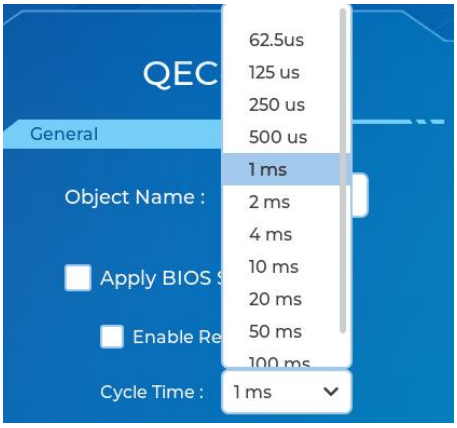
QEC-M-01

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

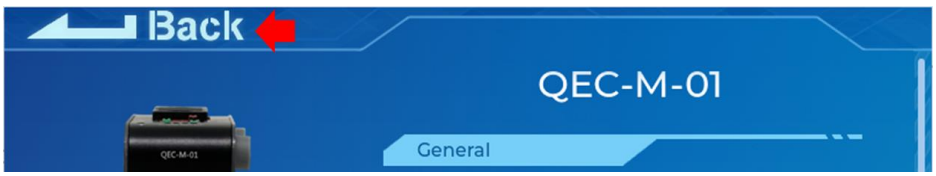


Please check the following configures.

1. Turn off the “Apply BIOS Settings”.
2. Select “1ms” to the Cycle Time.



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

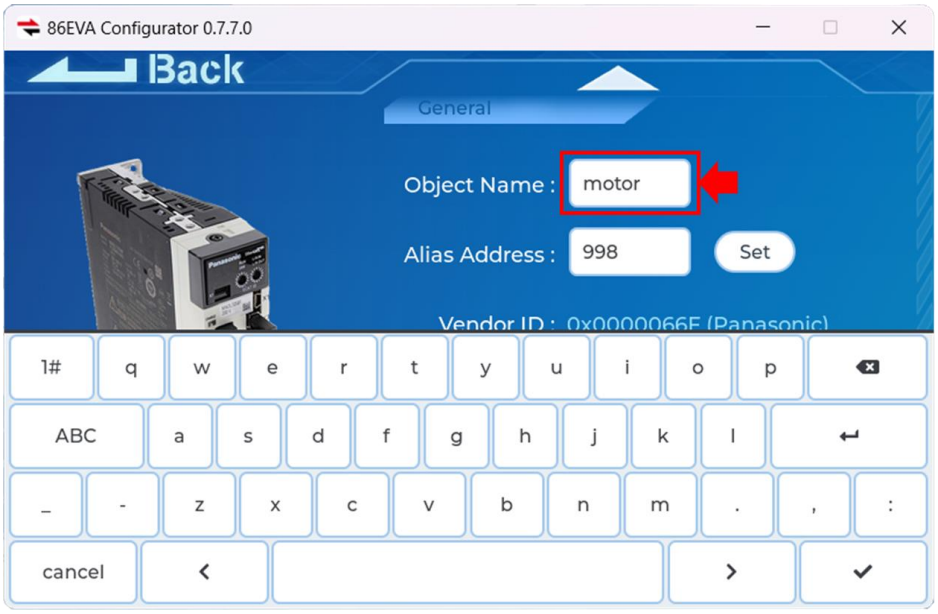


Panasonic A6B Servo Driver

Press twice on the image of the Panasonic A6B Servo Driver 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.

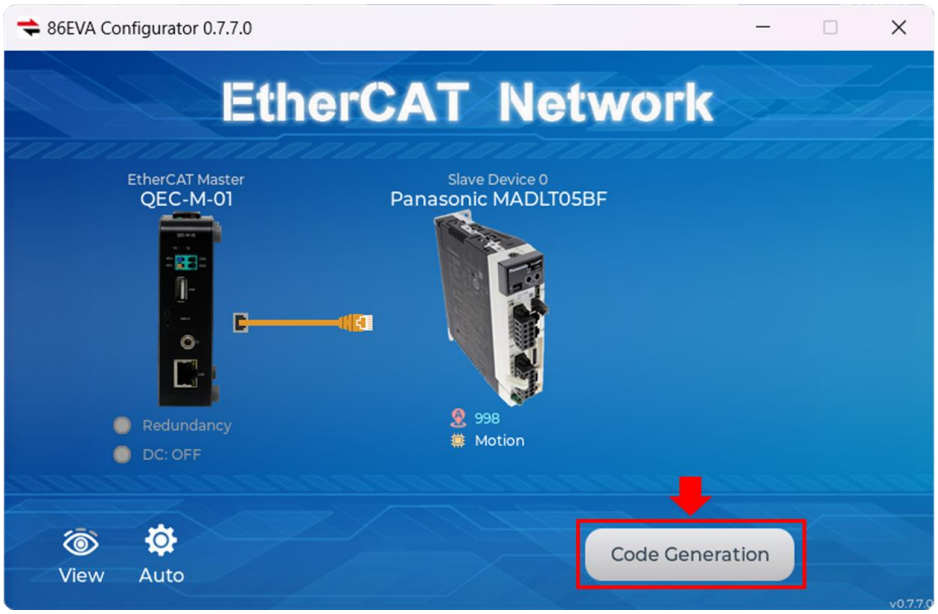
Please change the Object Name to “motor”.
It’ll appear a keyboard after you click the Object Name.



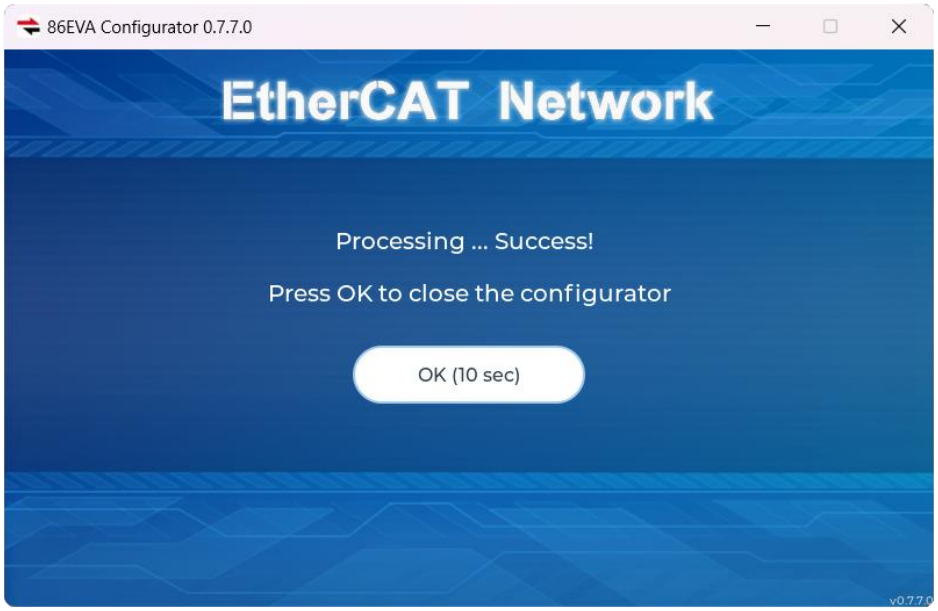
Click "Back" in the upper left corner to return.

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.

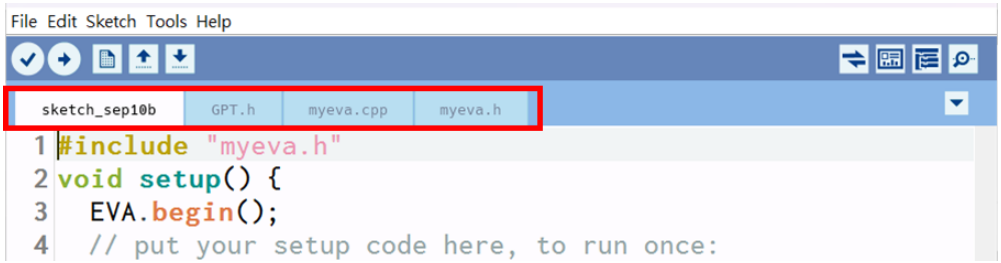


When you're done, double-click the OK button to turn off 86EVA, or it will close in 10 seconds.



The generated code and files are as follows:

- sketch_sep10b: Main Project (.ino, depending on your project name)
- GPT.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: Write the code

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

- Panasonic A6B Driver: EthercatDevice_CiA402 object.
- EtherCAT mode: ECAT_SYNC.
- EtherCAT Distributed Clock (DC) Mode: Enabled.

And here is the setting by users:

- EtherCAT Cycle time: 1 millisecond.
- Device Object Name: QEC-M-01 is “EcatMaster”, and Panasonic A6B Driver is “motor”.

A. In Setup Function:

In the setup() function initializes communication and configures 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. Set Profile Position (PP) Mode
    - Configure the motor to PP mode using setCiA402Mode(CIA402_PP_MODE).
4. Enable the Motor
    - Use the enable() function to enable the motor and transition it to CIA402_OPERATION_ENABLED.
5. Configure Profile Parameters
    - Motion Profile Type: Linear Ramp, Profile Velocity: 10,000,000, Acceleration: 10,000,000, Deceleration: 10,000,000.

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: Start the motor and move to the target position (100,000,000 units). Once the command is successfully executed, transition to the next state.
    - case 1: Wait for the motor to reach the target position. Once the target is reached, proceed to the next state.
    - case 2: Start the motor and move back to the original position (-100,000,000 units). Once the command is successfully executed, transition to the next state.
    - case 3: Wait for the motor to return to the original 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.

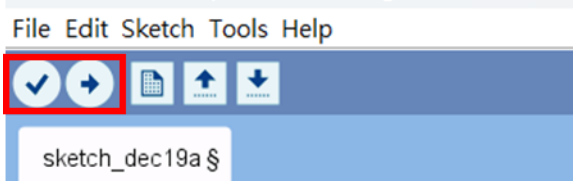
The example code is as follows:

```
#include "myeva.h"

int pp_state = 0;

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

  EVA.begin();
  motor.setCiA402Mode(CIA402_PP_MODE);
  Serial.print("Enable: "); Serial.println(motor.enable());
  motor.pp_SetMotionProfileType(0); // Linear ramp (trapezoidal profile)
  motor.pp_SetVelocity(10000000);
  motor.pp_SetAcceleration(10000000);
  motor.pp_SetDeceleration(10000000);
}

void loop() {
  Serial.print("Pos: "); Serial.println(motor.getPositionActualValue());
  switch (pp_state)
  {
    case 0:
      if (motor.pp_Run(100000000) == 0)
        pp_state++;
      break;
    case 1:
      if (motor.pp_IsTargetReached())
        pp_state++;
      break;
    case 2:
      if (motor.pp_Run(-100000000) == 0)
        pp_state++;
      break;
    case 3:
      if (motor.pp_IsTargetReached())
        pp_state = 0;
```

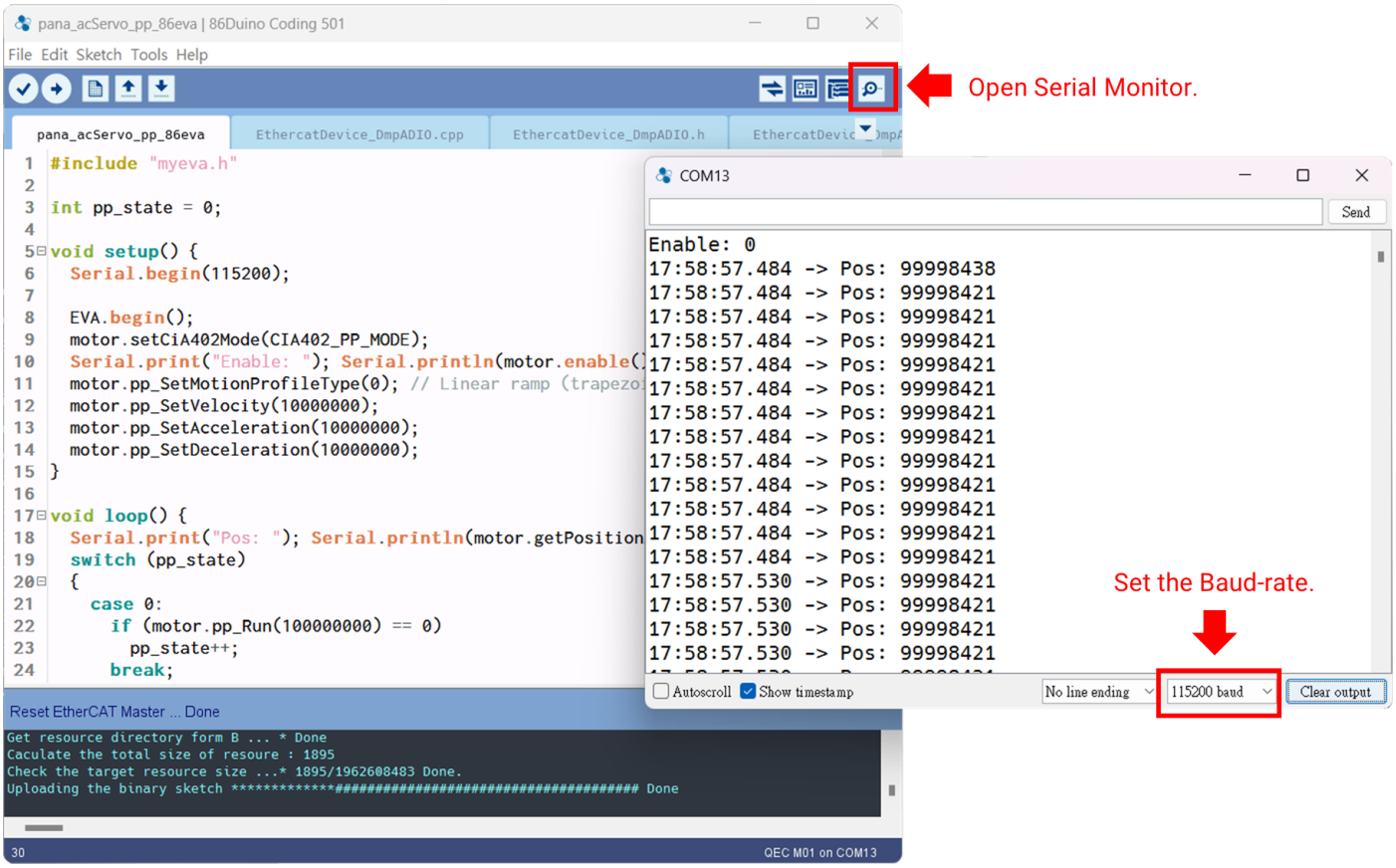
```
      break;
  }
}
```

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.

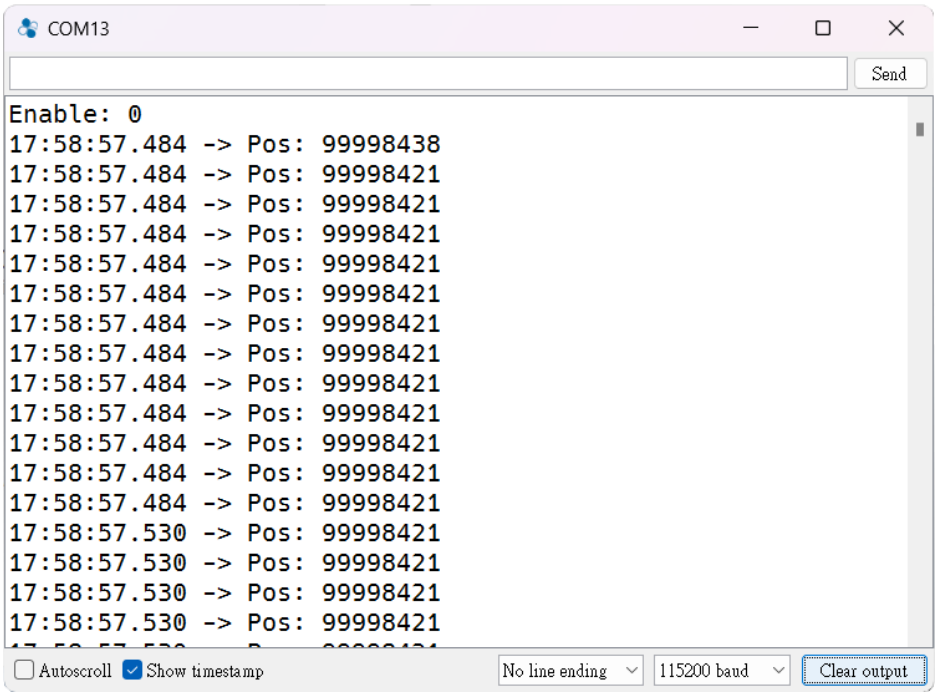


After you successfully upload the program to the QEC-M-01, you can open the Serial Monitor on 86Duino IDE. Please check the Serial baud rate is same as your setting.



If the EtherCAT communication config successful, Serial Monitor will print “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 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:

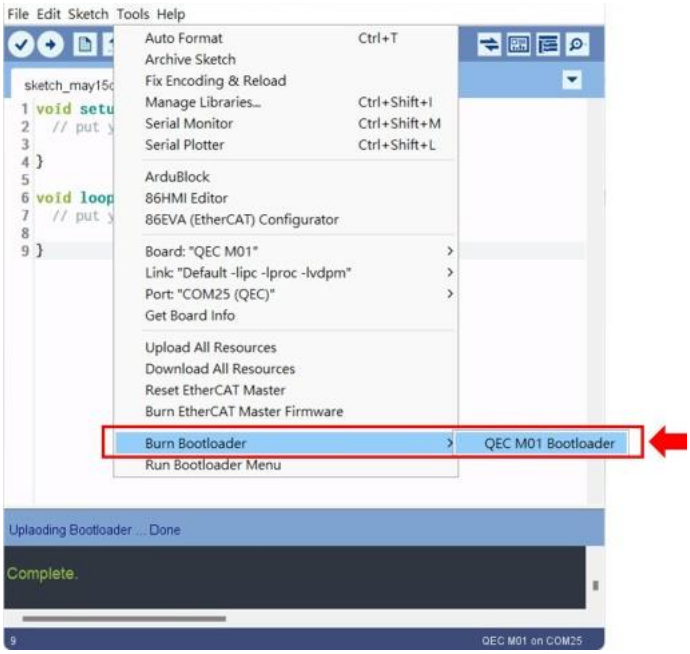
Step 1: Setting up QEC-M

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.

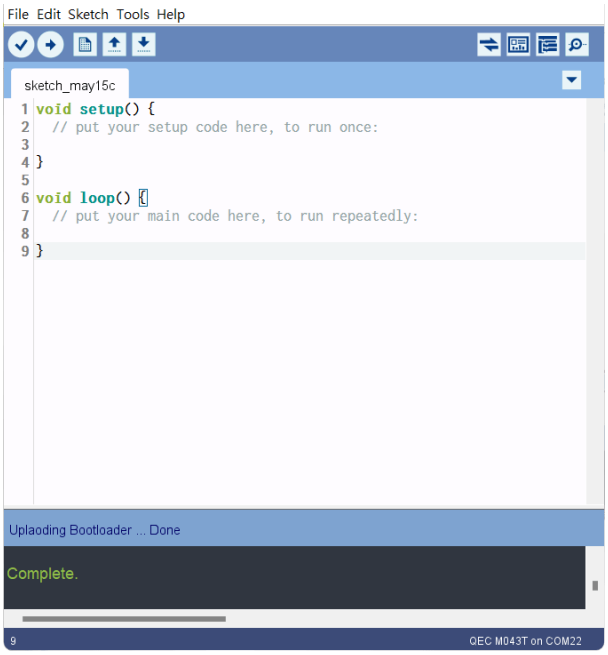
Step 2: Click “Burn Bootloader” button

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.