Start Guide

Delta AC Servo Drive & Motor
ASDA-A2/B3 Series (CSP mode)

86Duino Coding IDE 500

EtherCAT Library

(Version 1.1)

Revision

Date	Version	Description
2024/03/01	VERSION1.0	NEW RELEASE.
2024/10/28	VERSION1.1	UPDATE WRITE CODE SECTION.

Preface

In this guide, we will demonstrate how to use QEC-M-01 (EtherCAT master) to control Delta's ASDA-A2 and ASDA-B3 servo motors, taking Cyclic Synchronous Position (CSP) mode as an example.

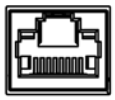
Notes QEC's PoE (Power over Ethernet)

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:

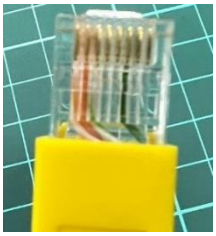


Pin #	Signal Name	Pin #	Signal Name
1	LAN1_TX+	2	LAN1_TX-
3	LAN1_RX+	4	VS+
5	VP+	6	LAN1_RX-
7	VS-(GND)	8	VP-(GND)

* 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).

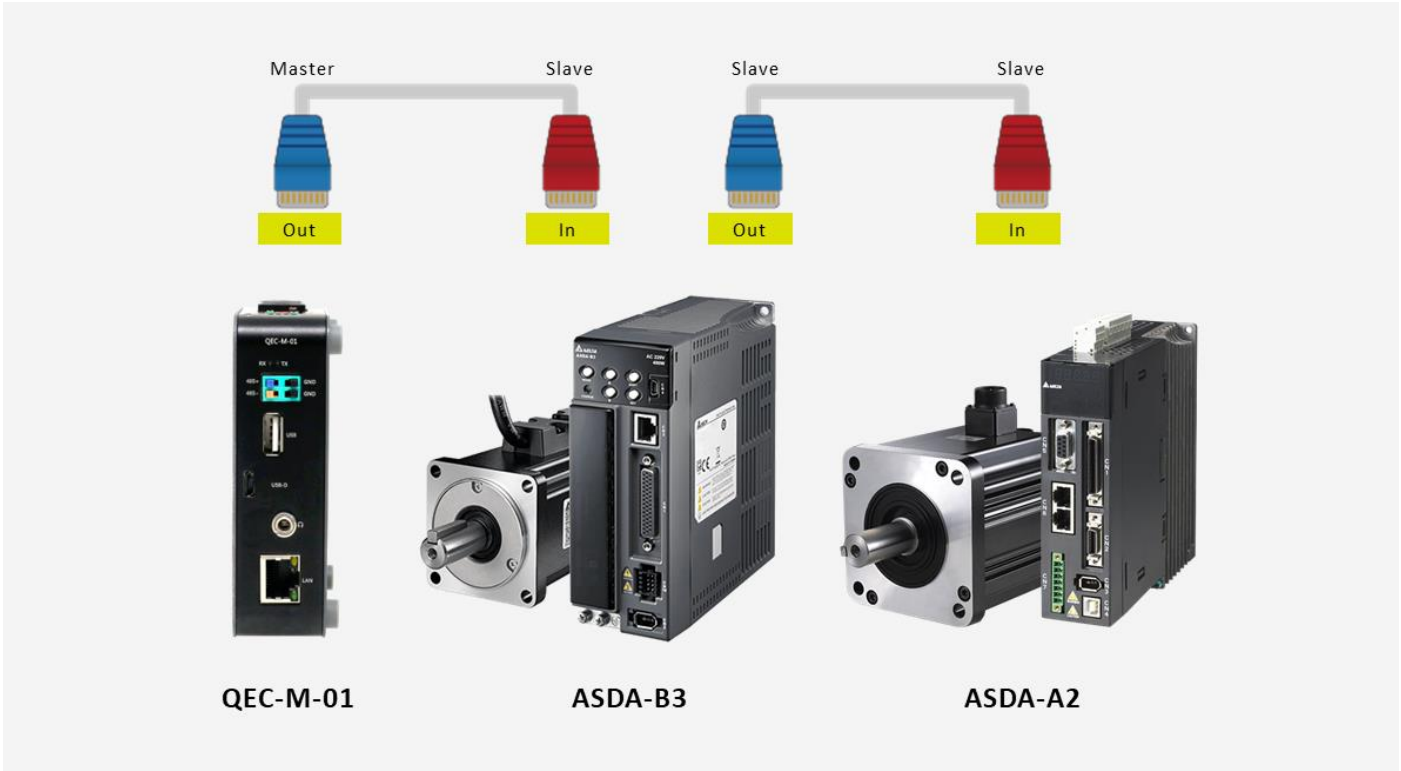


3. QEC's PoE power supply is up to 24V/3A.

1. Connection and wiring hardware

The following devices are used here:

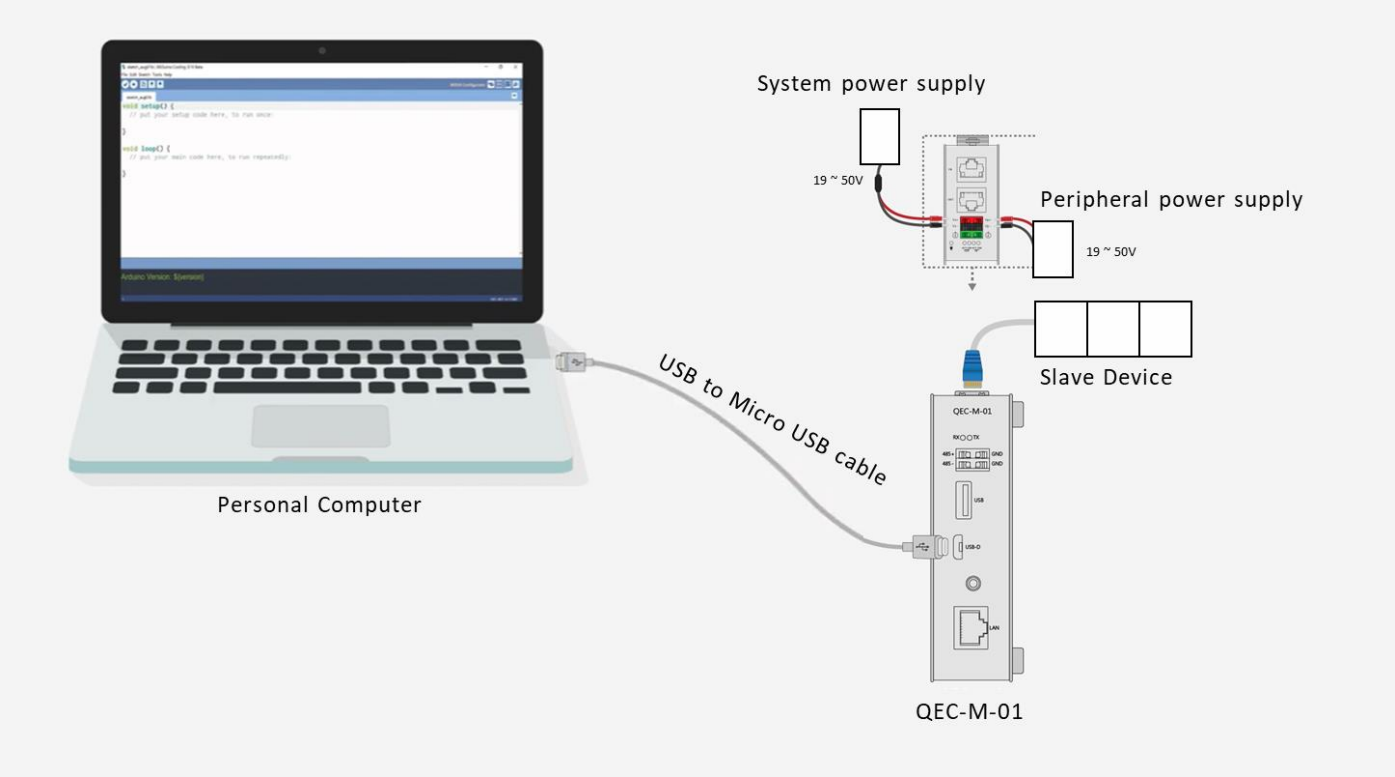
1. QEC-M-01（EtherCAT Master）
2. Delta AC Servo: ASDA-A2-E (EtherCAT)
3. Delta AC Servo: ASDA-B3 (EtherCAT)
4. 24V power supply & EU-type terminal cable
5. RJ45 Cables



1.1 QEC-M-01

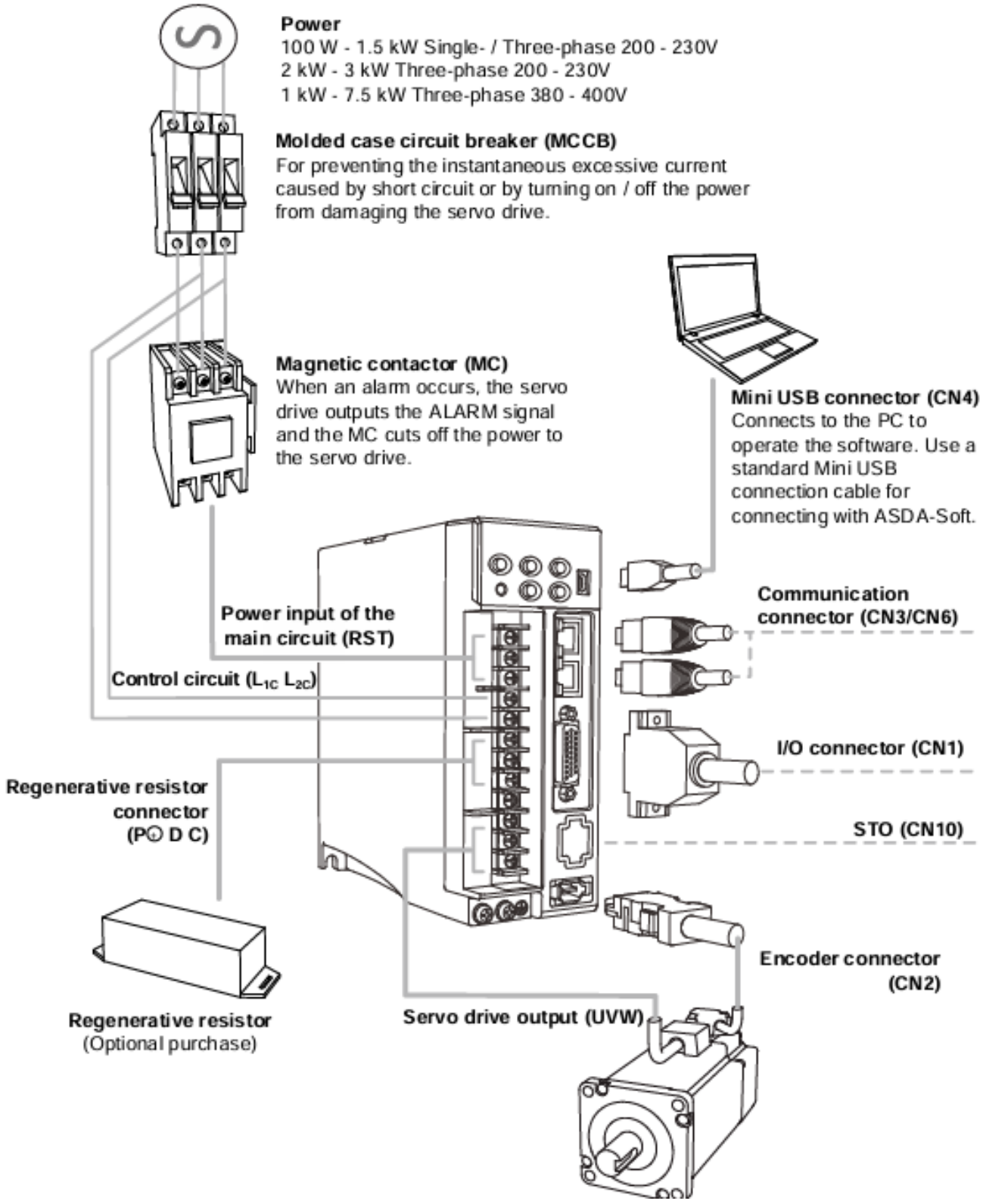
QEC EtherCAT Master.

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 the Delta EtherCAT Servos via RJ45 cable.



1.2 Delta EtherCAT AC Servo

To connect EtherCAT ports on Delta AC Servo, usually should be on CN6 ports.

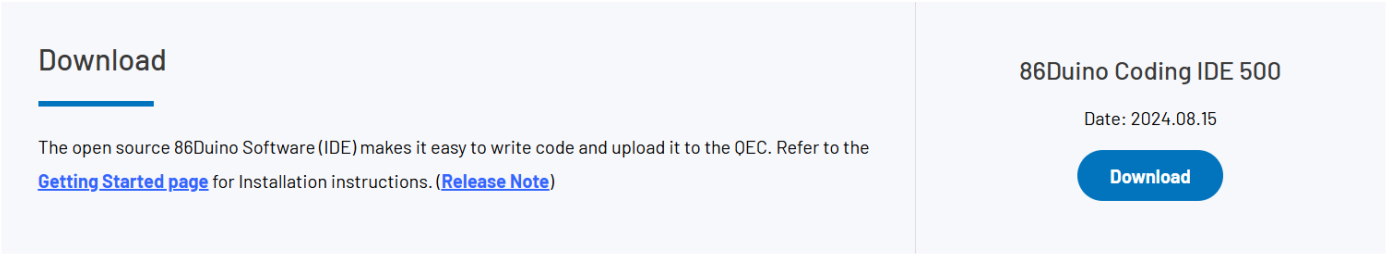


(Figure 1: Connecting to Delta communication type servo motor. From DELTA_IA_ASD_ASDA_B3 Operation User Manual)

ASDA-A2 and ASDA-B3: Provide a 220V power supply, for more details please refer to the Delta Website.

2. Software/Development Environment

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



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.

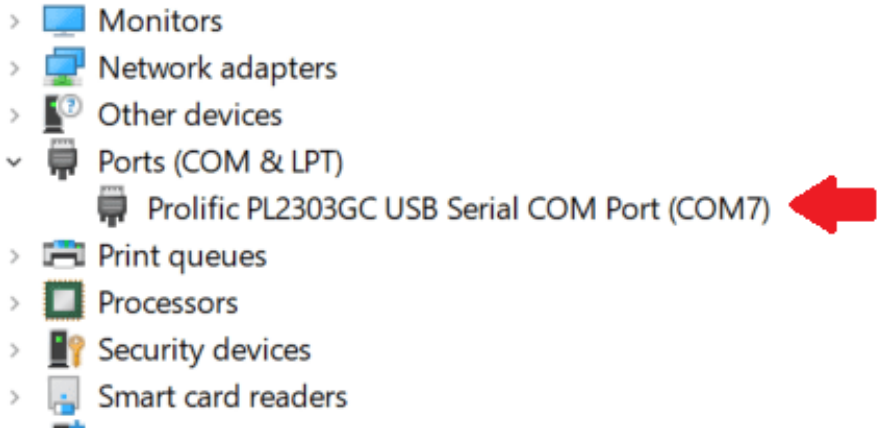
Note:
If Windows displays a warning, click Details once and then click the Continue Run button once.

86Duino Coding IDE 500+ looks like below.

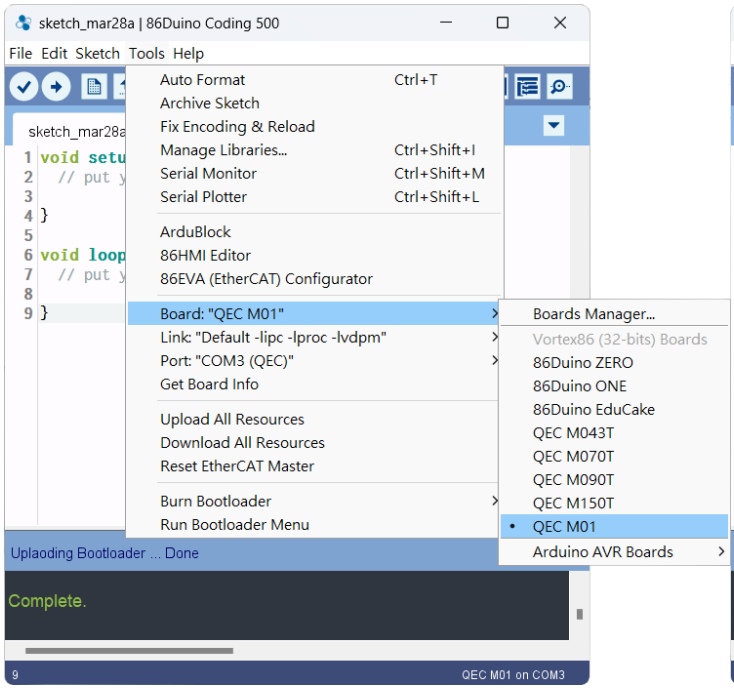
3. Connect to PC and set up the environment

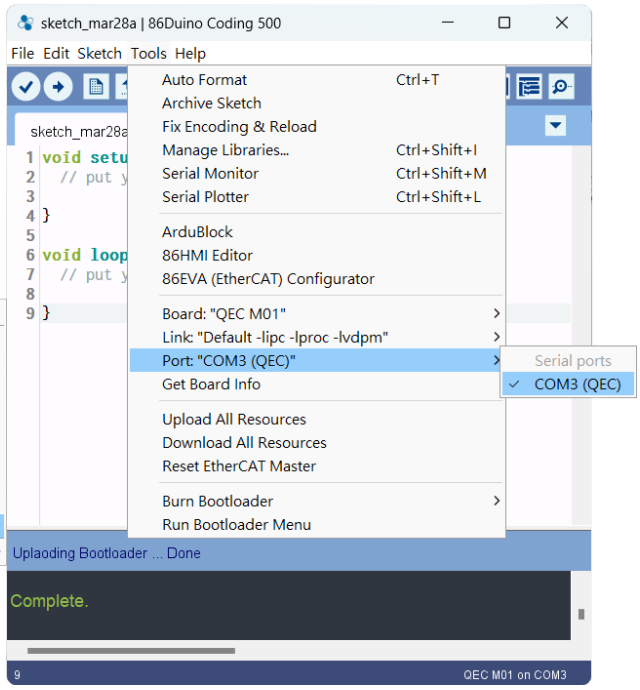
Follow the steps below to set up the environment:

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-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 Delta EtherCAT AC-Servo Series: ASDA-A2-E and ASDA-B3 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 Delta EtherCAT AC-Servos 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, ASDA_A2 means ASDA-A2-E Servo, ASDA_B3 means ASDA-B3 Servo.

1. **In Setup Function:**
   - Initializes the serial (115200).
   - Begin the EtherCAT Master. Switch the EtherCAT state machine to the PRE-OPERATIONAL state.
   - Configure the ASDA_A2 and the ASDA_B3 in Cyclic Synchronous Position (CSP) mode.
   - Configure the ASDA_A2 and the ASDA_B3 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.
     Use delay(100) to wait for it to change successfully.
   - Enable the ASDA_A2 and the ASDA_B3, we change the CiA402 state to CIA402_OPERATION_ENABLED.
     Use delay(1000) to wait for it to change successfully.
2. **In Callback Function:**
   The motors’ position is updated cyclically; we read the actual position value and set the target position as the current position to add 1000.
3. **In Loop Function:**
   The main loop prints the motors’ current position to the serial monitor.

In summary, this code establishes EtherCAT communication, reads the ASDA_A2 and the ASDA_B3 position, and controls the motor by updating its target position based on its operational state.

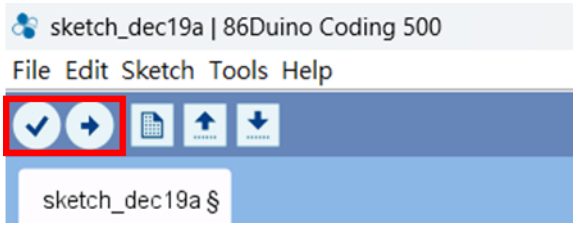
Here is the code:

```
#include "Ethercat.h"

#define CYCTIME 1000000

EthercatMaster master;
EthercatDevice_CiA402 ASDA_A2;
EthercatDevice_CiA402 ASDA_B3;

int A2_pos = 0;
int B3_pos = 0;

void myCallback() {
  // Check the state of the first drive (ASDA_A2) and update its position
  A2_pos = ASDA_A2.driveGetPositionActualValue();
  int stateA2 = ASDA_A2.driveGetState();
  if (stateA2 == CIA402_SWITCHED_ON) {
    ASDA_A2.driveSetTargetPosition(ASDA_A2.driveGetPositionActualValue());
  } else if (stateA2 == CIA402_OPERATION_ENABLED) {
    ASDA_A2.driveSetTargetPosition(ASDA_A2.driveGetTargetPosition() + 1000);
  }

  // Check the state of the second drive (ASDA_B3) and update its position
  B3_pos = ASDA_B3.driveGetPositionActualValue();
  int stateB3 = ASDA_B3.driveGetState();
  if (stateB3 == CIA402_SWITCHED_ON) {
    ASDA_B3.driveSetTargetPosition(ASDA_B3.driveGetPositionActualValue());
  } else if (stateB3 == CIA402_OPERATION_ENABLED) {
    ASDA_B3.driveSetTargetPosition(ASDA_B3.driveGetTargetPosition() + 1000);
  }
}

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

  Serial.println(master.begin());

  Serial.println(ASDA_A2.attach(0, master));
  ASDA_A2.setDc(CYCTIME);
  ASDA_A2.driveSetMode(CIA402_CSP_MODE);
```

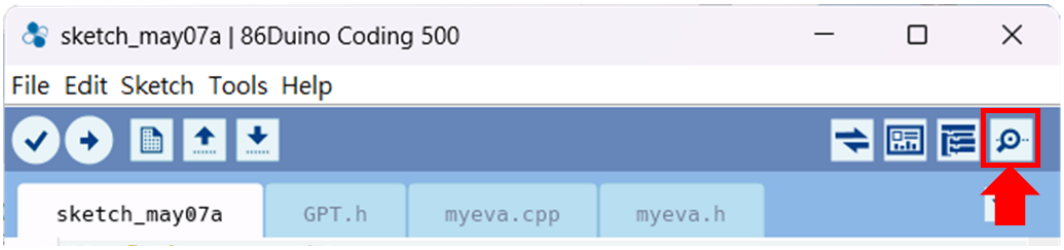
```
  Serial.println(ASDA_B3.attach(1, master));
  ASDA_B3.setDc(CYCTIME);
  ASDA_B3.driveSetMode(CIA402_CSP_MODE);

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

  delay(100);

  Serial.print("ASDA_A2 Enable: ");
  Serial.print(ASDA_A2.driveEnable());
  Serial.print(", ASDA_B3 Enable: ");
  Serial.println(ASDA_B3.driveEnable());
  delay(1000);
}

void loop() {
  Serial.print("A2 Pos: ");
  Serial.print(A2_pos);
  Serial.print("B3 Pos: ");
  Serial.println(B3_pos);
}
```

Note:

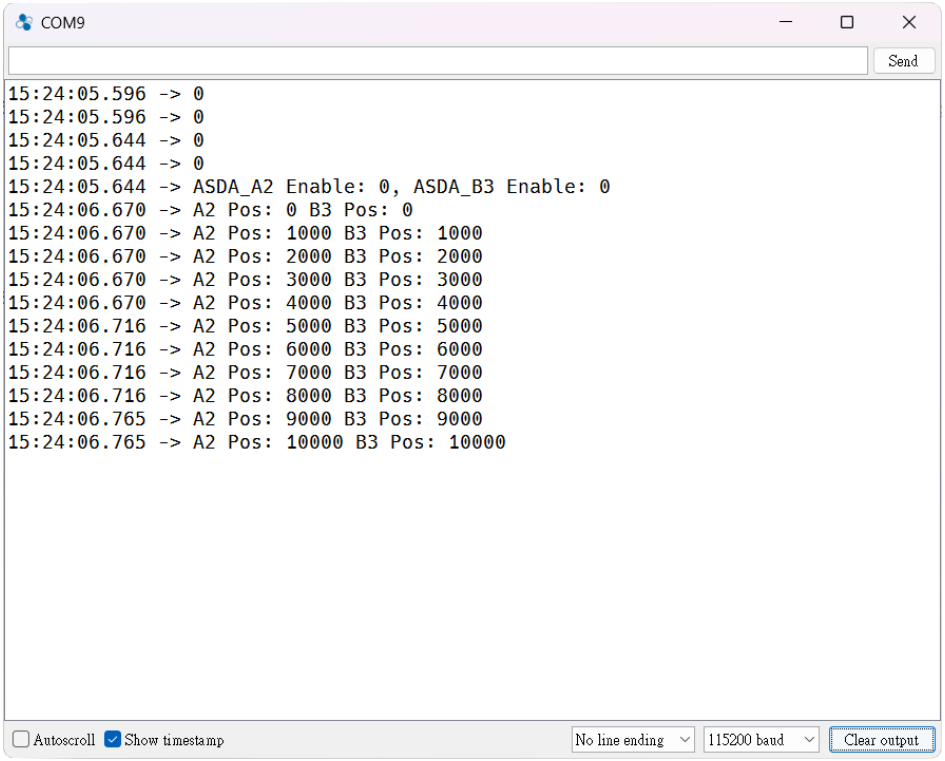
Once the code is written, click on the toolbar to compile, and to confirm that the compilation is complete and error-free, you can click to upload.



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.



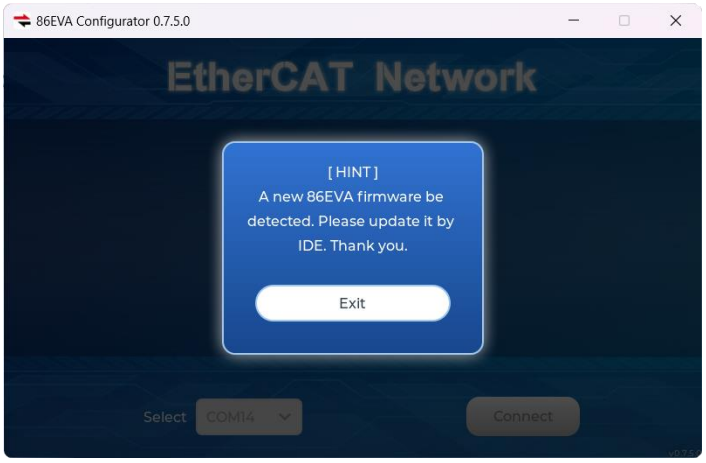
If the EtherCAT communication config successful, Serial Monitor will print 4 “0”, and “ASDA_A2 Enable: 0” and “ASDA_B3 Enable: 0”.
And it will print the motor’s current position to the serial monitor.



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.



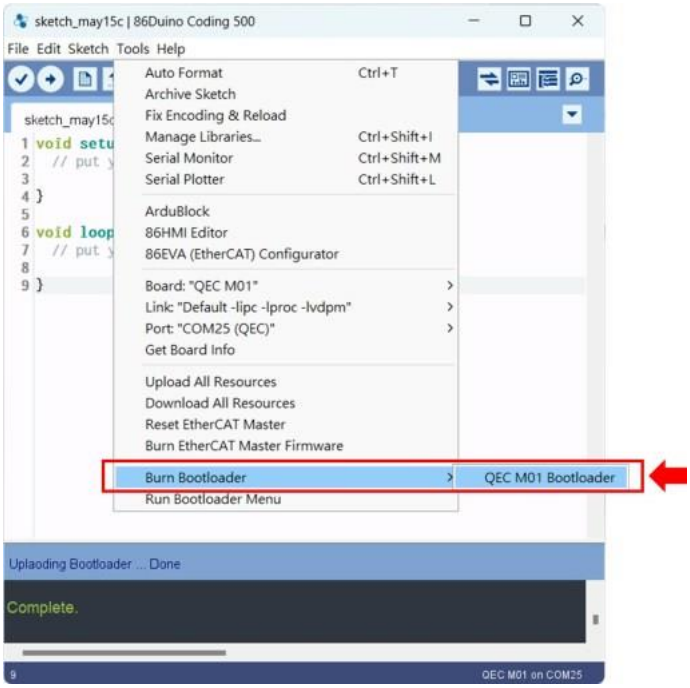
Now, we will further explain how to proceed with the update:

Step 1: Setting up QEC-M

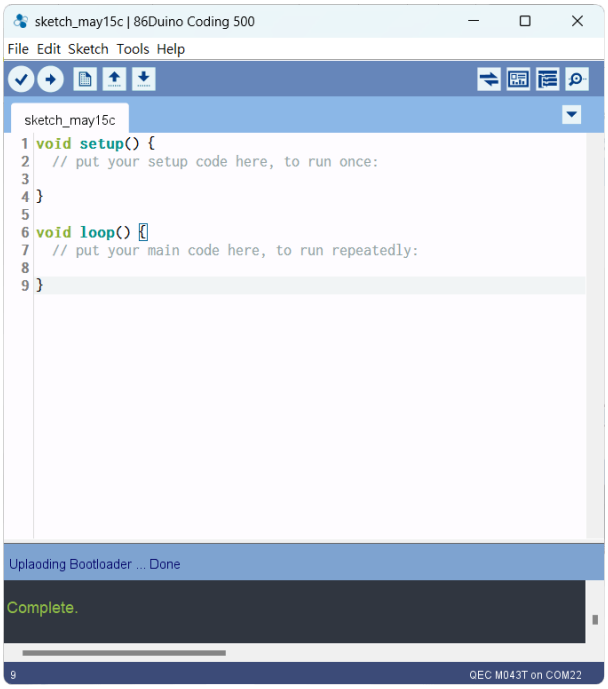
1. Download and install 86Duino IDE 500 (or a newer version): You can download it from Software.
2. Connect the QEC-M: Use a USB cable to connect the QEC-M to your computer.
3. Open 86Duino IDE: After the installation is complete, open the 86Duino IDE software.
4. Select Board: From the IDE menu, choose “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.