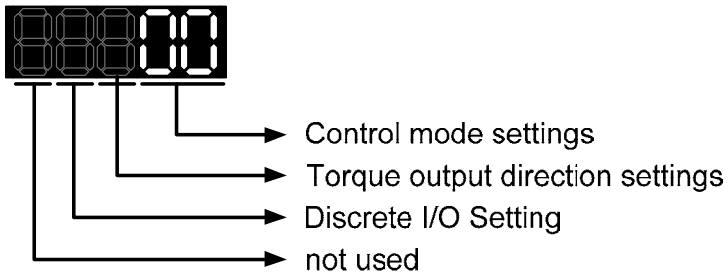
Chapter 2 System Setup

2.1 Parameter Settings of EtherCAT Mode

1. Set parameter **P1-01** to **0x0C$_h$** for EtherCAT communication and CANopen as the application layer.
2. Restart the system of servo drive.

P1 - 01●	CTL	Control Mode and Output Direction		Address: 0102H, 0103H
	Operation Interface:	Keypad / Software	Communication	Related Section: Section 8.1, Table A
	Default:	0		
	Control Mode:	ALL		
	Unit:	pulse (P mode), r/min (S mode), N-m (T mode)		
	Range:	00 ~ 0x110F		
	Data Size:	16-bit		
	Display Format:	Hexadecimal		

Settings:



Control mode settings

	PT	PR	S	T	Sz	Tz
Single Mode						
00	▲					
01		▲				
02			▲			
03				▲		
04					▲	
05						▲
Multiple Mode						
0E	▲	▲	▲			
0F	▲	▲		▲		

	PT	PR	S	T	Sz	Tz
Dual Mode						
06	▲		▲			
07	▲			▲		
08		▲	▲			
09		▲		▲		
0A			▲	▲		
0B	N/A					
0C	CANopen Mode					
0D	▲	▲				

PT: Position control mode. The command is from the external pulse or analog voltage (External analog voltage will be available soon). Execution of the command selection is via DI.PTAS.)

PR: Position control mode. The command is from the internal signal. Execution of 64 positions is via DI.POS0 ~ POS5. A variety of homing control is also provided.

S: Speed control mode. The command is from the external signal or internal signal. Execution of the command selection is via DI.SPD0 and DI.SPD1.

T: Torque control mode. The command is from the external signal or internal signal. Execution of the command selection is via DI.TCM0 and DI.TCM1.

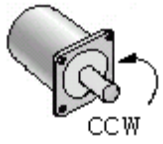
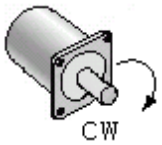
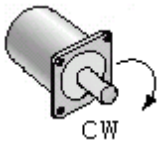
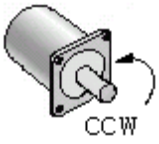
Sz: Zero speed / internal speed command

Tz: Zero torque / internal torque command

Dual Mode: The control mode selection is via DI signals. For example, either PT or S control mode can be selected via DI signal, S-P (see Table A).

Multiple Mode: The control mode selection is via DI signals. For example, PT, PR or S control mode can be selected via DI signals, S-P and PT-PR (see Table A).

Torque output direction settings

Direction	0	1
Forward		
Reverse		

Discrete I/O Setting

1: When switching to different mode, digital inputs/outputs (P2-10 ~ P2-22) will be set to the default value according to the mode you selected.

0: When switching to different mode, the setting value of digital inputs/outputs (P2-10 ~ P2-22) will remain the same and will not be changed.

2.2 TwinCAT Setup

A lot of software can be applied to configure EtherCAT system. The following procedures are the example of TwinCAT of Beckhoff. Please install the software properly before you start to configure the system.

1. Copy Delta XML description to the folder the TwinCAT installed (usually C:\TwinCAT\Io\EtherCAT).
2. Restart ~~the~~ TwinCAT.
3. The configuration procedure can be started by applying TwinCAT manager which shown as below.

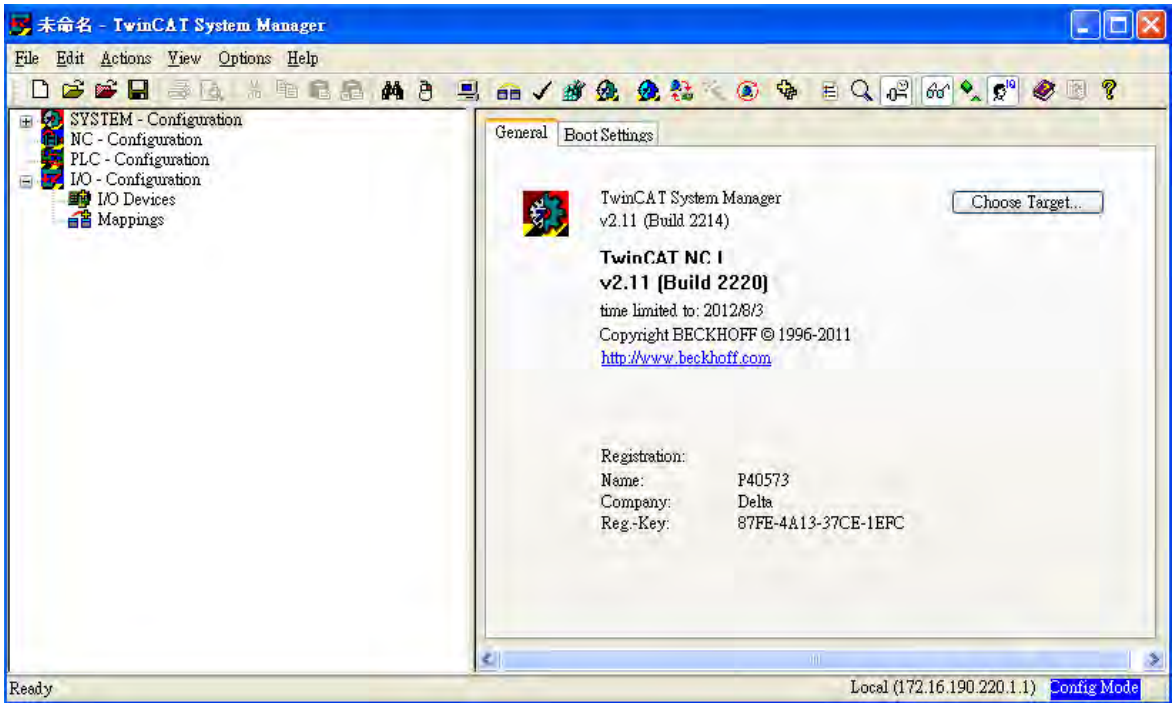


Figure 4

4. Install the Network Interface Card (NIC) for EtherCAT communication.
   - ■ Select Options → Show Real Time Ethernet Compatible Devices.

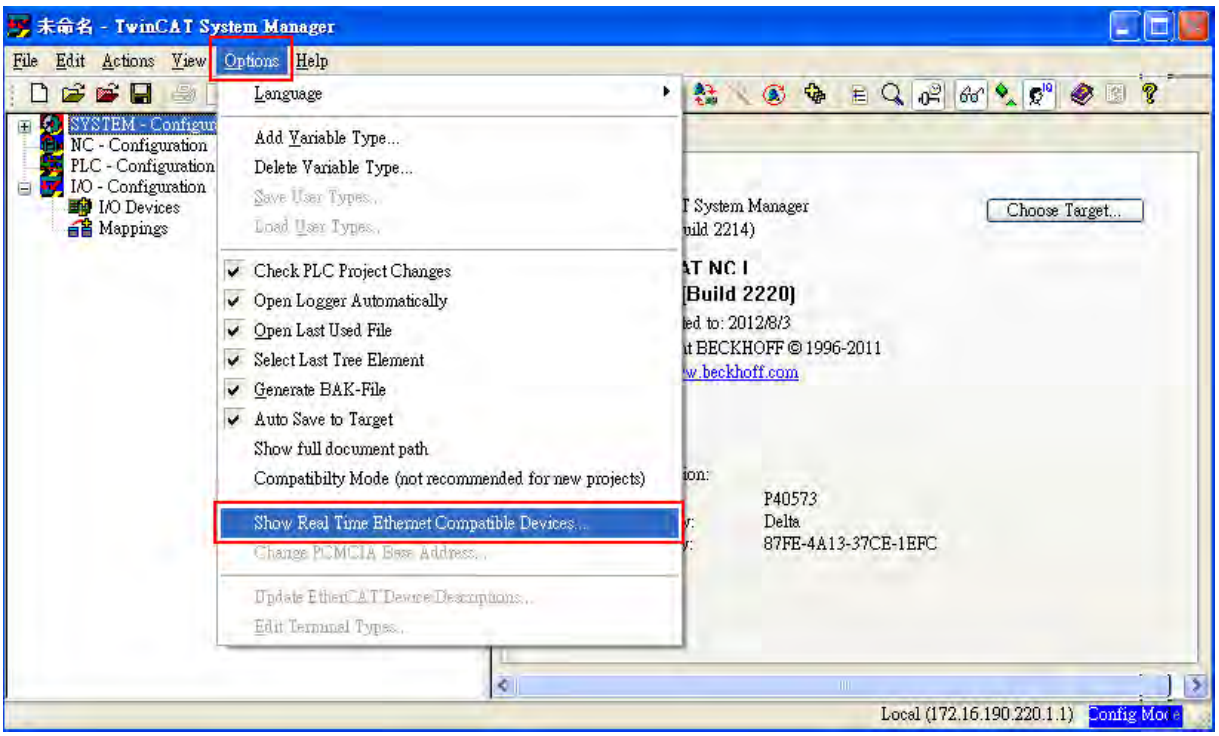


Figure 5

- Select the correct Adapter from the devices (NICs) installed in the computer for EtherCAT communication and click "**Install**".

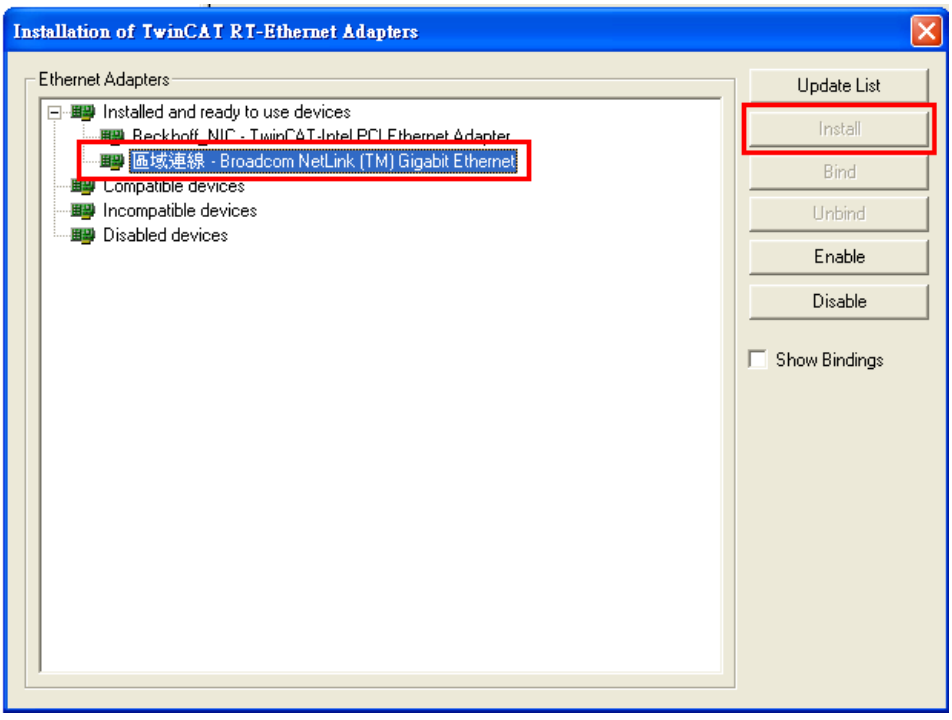


Figure 6

5. Open a new project from the drop down menu File → new.

6. Right click I/O Devices and select **Scan Devices** or Press <**F5**> to scan the devices. Click **OK** in the pop-up dialog window to confirm the information.

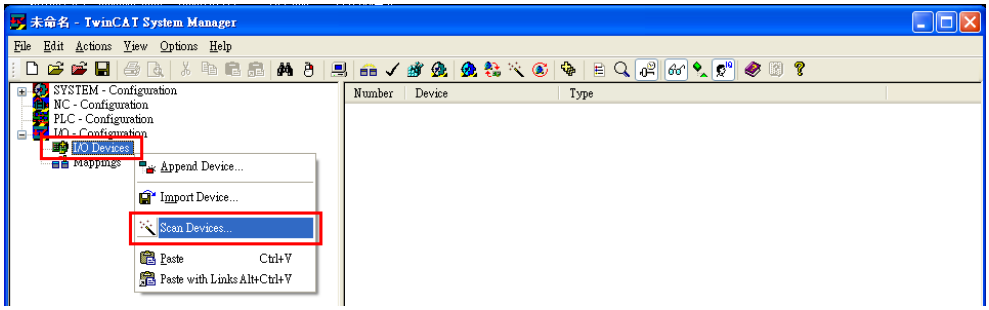


Figure 7

Figure 8

7. Find Device [n] (EtherCAT), select this device and click **OK**.

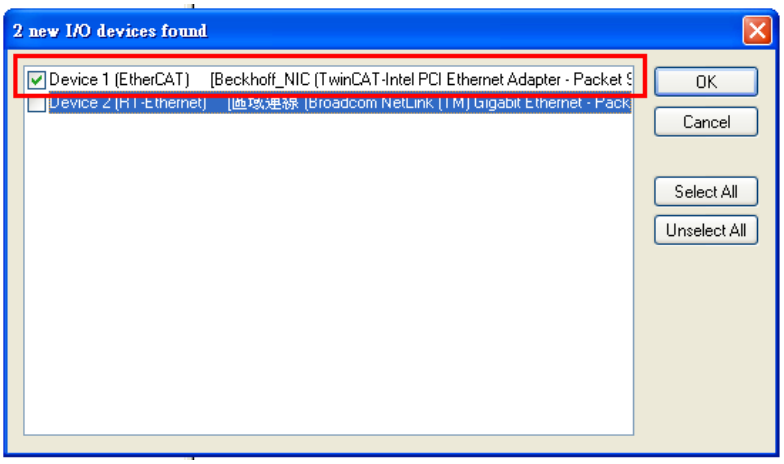


Figure 9

8. Click **Yes** to scan for boxes.

Figure 10

9. Click **Yes** to **Add drives** to **NC-Configuration**.

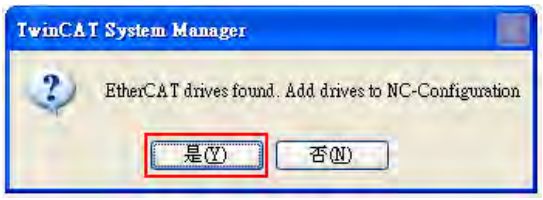


Figure 11

10. Click **No** and TwinCAT will be switched to **Config mode**.

Figure 12

11. TwincAT is in Config Mode. In the left panel, it shows **Device (EtherCAT)** and you can find ASDA A2-E CoE Drive.

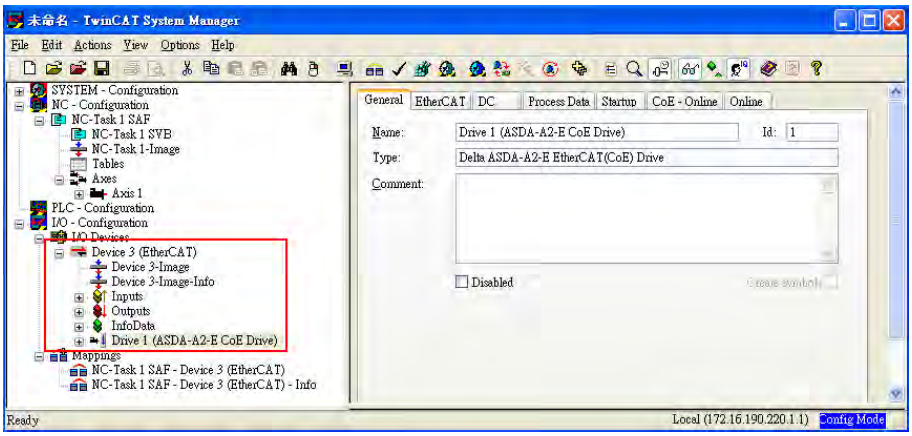


Figure 13

12. Select the Drive (ASDA A2-E) and in **Online** tab you can check if the device's EtherCAT state machine (ESM) is in PREOP state.

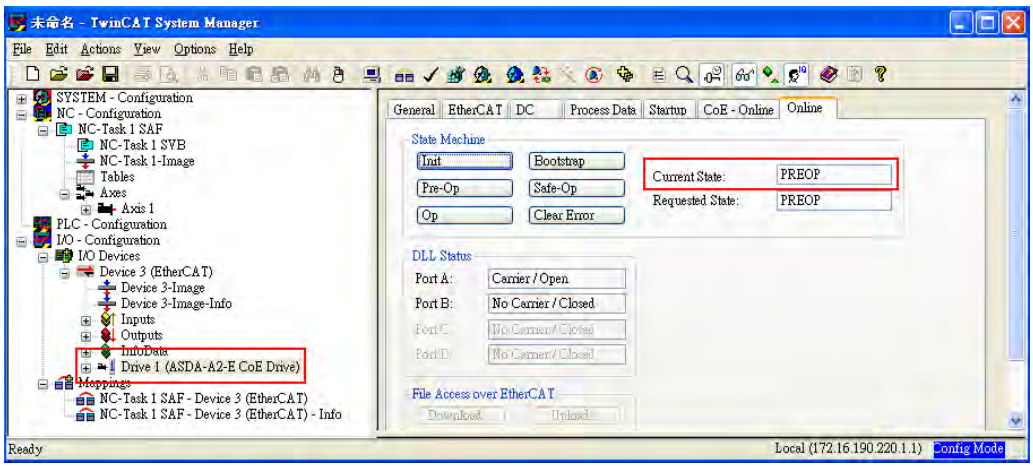


Figure 14

13. Double click on Drive (ASDA A2-E CoE Drive) and it will show:

2nd TxPDO – CoE Tx PDO mapping
3rd RxPDO – CoE Rx PDO mapping
WcState
InfoData

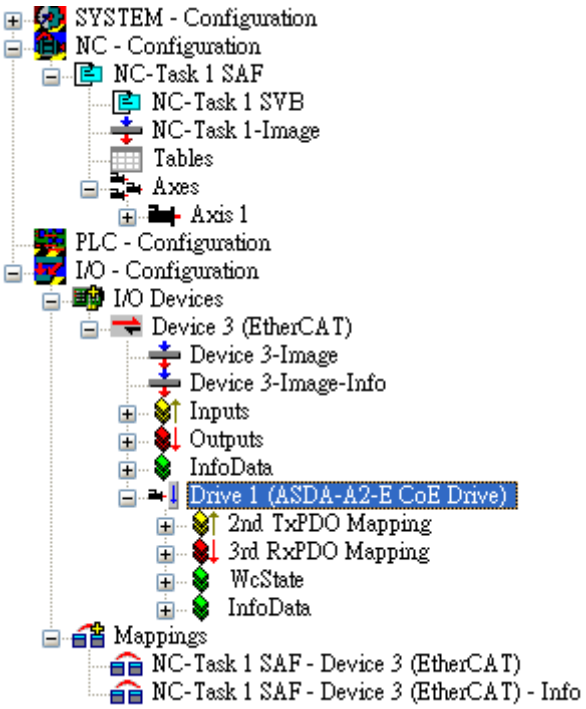


Figure 15

14. Set the communication cycle* and the default value is 2ms.

■ Select **NC-Task 1 SAF** in the left window, and set **Cycle ticks** as communication cycle (The minimum value is 1ms) in the right window.

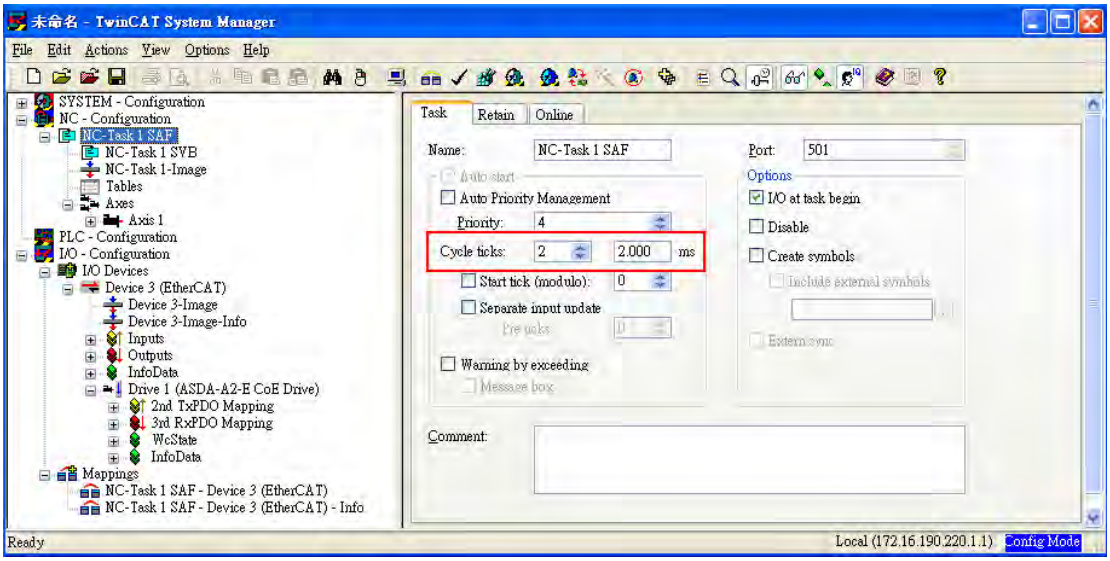


Figure 16

*The communication cycle time, SYNC0 cycle time, and PDO cycle time should be set to the same value.

15. Set **Following Error Calculation** to **Extern**.

■ Select **Axis 1_Drive** in the left window → In parameter column of the right window, select **Extern** in **Following Error Calculation** → click **Download** and then click **OK** in pop-up dialog.

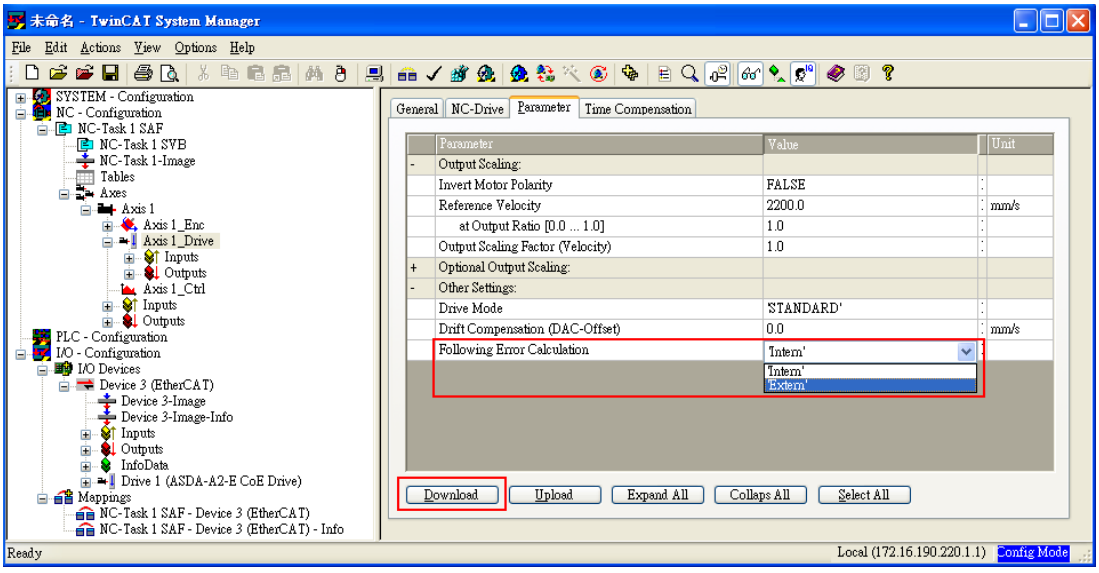


Figure 17

16. Switch TwinCAT to Run Mode.

- Press  to generate Mappings → press  to check confiugration → and press  to activate configuration. TwinCAT will be switched to Run Mode and then click OK in pop-up dialog.

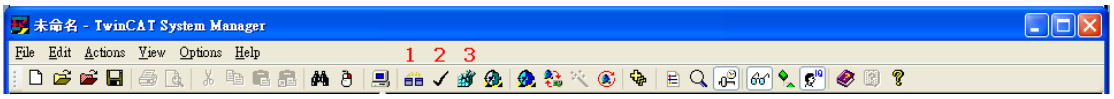


Figure 18

17. Enable the axis (Servo On).

- Under NC-Configuration of the left window, select **Axis 1** → select **Online** tab in the right window → click **Set**.

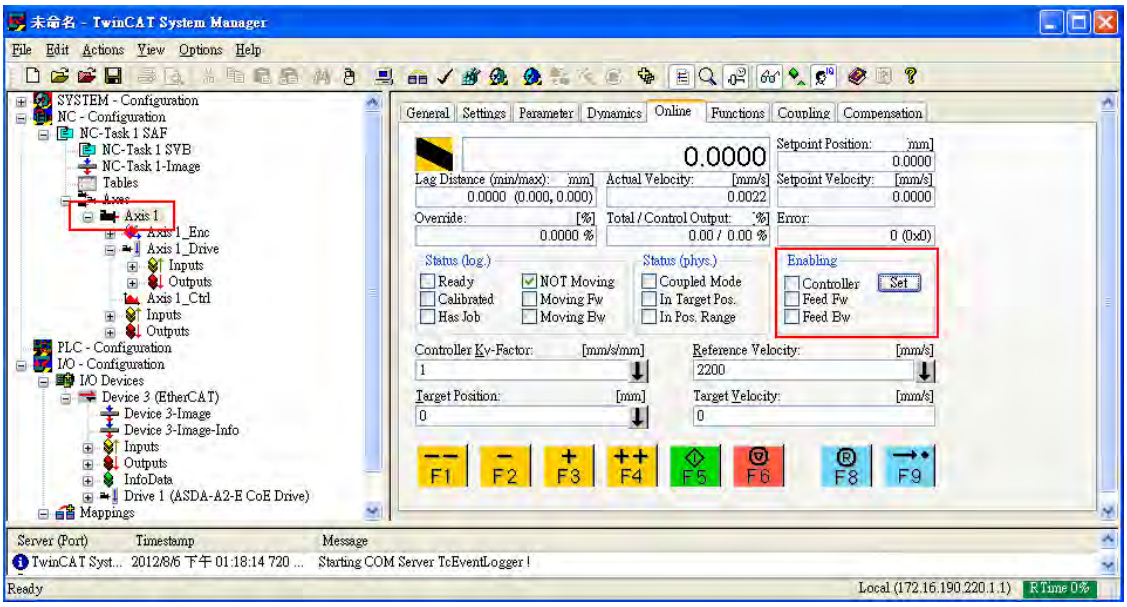


Figure 19

- In pop-up dialog, click **All** to enable the motor.

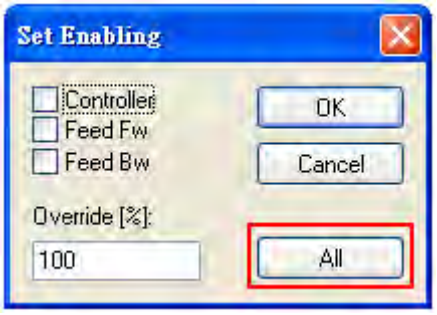


Figure 20

18. In **Online** tab, there are two different speed levels of jogging buttons for forward and backward movement which can test the system. During the operation, please **Be Ensured** that the movement would not damage your system and endanger the personnel safety.

Figure 21

2.3 Synchronization Modes Setting

2.3.1 Two Synchronization Modes of Delta Servo

ASDA A2-E supports two synchronization modes, Free Run mode and DC-Synchronous mode. Please note that the asynchronous Free Run mode is still under the definition of “Synchronization Modes” within EtherCAT specification guide.

■ Free Run Mode (Asynchronous)

The master and slaves are running in an asynchronous manner. The master and the slave both have their own clock to calculate the time. In other words, there is no synchronous clock between the master and the slave. A command sent by the master and a reply from the slave only consists with a sequential order instead of strict clock timing. For example, a master sends a PDO at tick t1 and the slave will receive it at tick t1 or tick t2 and vice versa.

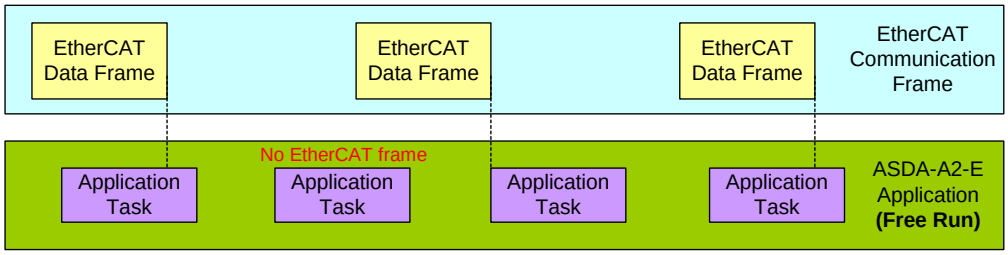


Figure 22. Free Run Mode synchronization

■ DC-Synchronous Mode (SYNC0 synchronization)

There exists a clock tick for the master and all slaves operation. A data sent by the master will be received by slave(s) at the same clock interval. The master will inform all slaves about its clock and ask slaves to align according to the time. A strict clock tick is always running within this system.

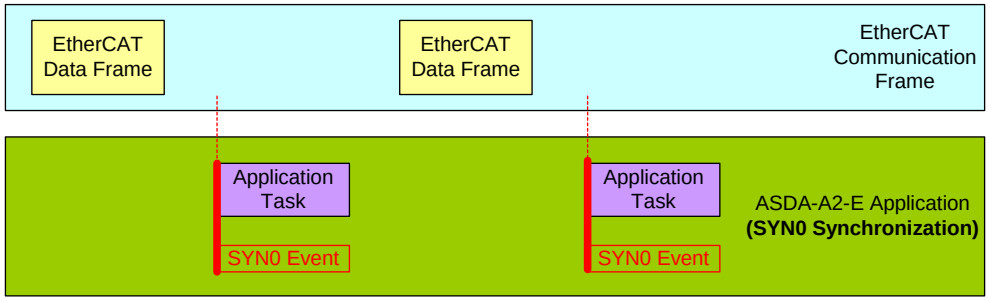


Figure 23. DC-Synchronous mode synchronization

2.3.2 Select the Synchronization Mode

1. Select Drive (ASDA A2-E CoE Drive) in the left window.
2. The DC tab in the right window, users can select DC-Synchronous or Free Run as the Operation Mode. This is for selecting synchronous or asynchronous mode.

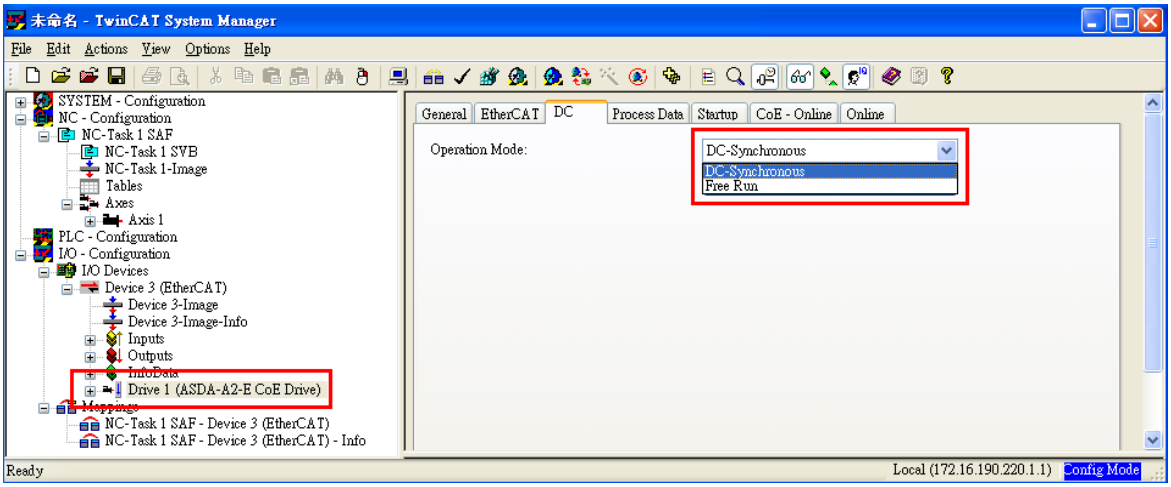


Figure 24

2.3.3 Synchronous Clock Time Setting

1. Select NC-Task 1 SAF in the left window.
2. Click Task in the right window.
3. Cycle ticks are the data exchanging period under the Task tab.

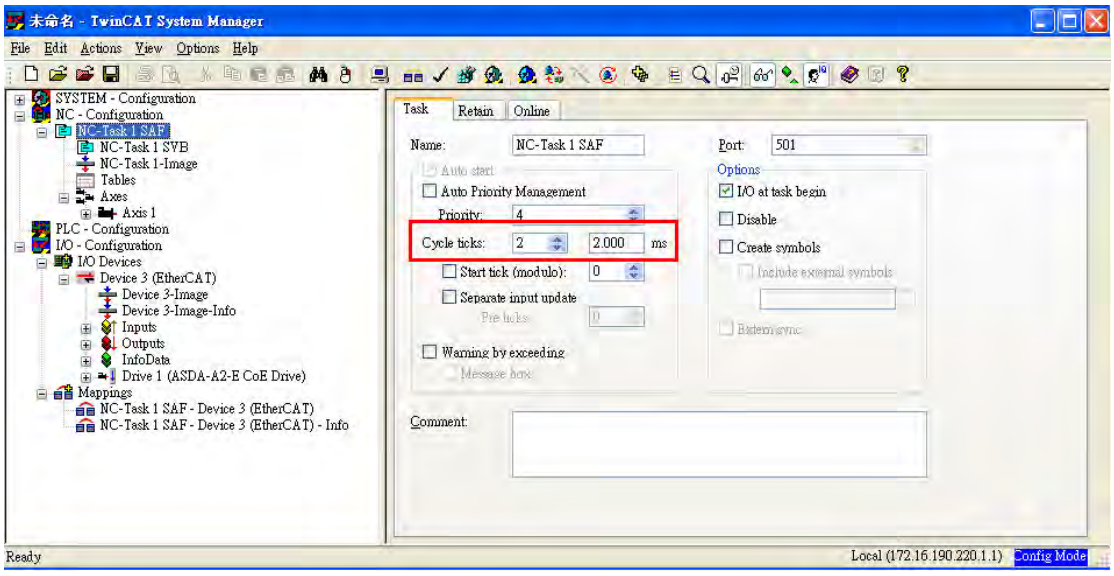


Figure 25

The unit of cycle for SYNC0 cycle time is 1ms.

SYNC0 cycle time supported	1ms (PDO cycle time = 1ms) 2ms (PDO cycle time = 2ms) 3ms (PDO cycle time = 3ms) …
* **SYNC0 cycle time is used to define PDO cycle time.**	

2.4 PDO Mapping

The PDO mapping Objects are allocated from index 0x1600 to 0x1604 for RxPDOs and 0x1A00 ~ 0x1A04 for TxPDOs in Object Dictionary.

2.4.1 Default PDO Mappings

The following tables are the default PDO mappings of ASDA A2-E CoE Drive for cyclic data exchange and are also defined in EtherCAT Slave Information file (XML file).

■ 1st PDO Mapping

RxPDO (0x1600)	Control Word (0x6040)	Target Position (0x607A)	Target Velocity (0x60FF)	Target Torque (0x6071)	Mode of Operation (0x6060)
TxPDO (0x1A00)	Status Word (0x6041)	Actual Position (0x6064)	Actual Velocity (0x606C)	Actual Torque (0x6077)	Mode of Operation Display (0x6061)

■ 2nd PDO Mapping (default PDO assignment)

RxPDO (0x1601)	Control Word (0x6040)	Target Position (0x607A)
TxPDO (0x1A01)	Status Word (0x6041)	Actual Position (0x6064)

■ 3rd PDO Mapping

RxPDO (0x1602)	Control Word (0x6040)	Target Velocity (0x60FF)	
TxPDO (0x1A02)	Status Word (0x6041)	Actual Position (0x6064)	Actual Velocity (0x606C)

■ 4th PDO Mapping

RxPDO (0x1603)	Control Word (0x6040)	Target Torque (0x6071)	
TxPDO (0x1A03)	Status Word (0x6041)	Actual Position (0x6064)	Actual Torque (0x6077)

■ 5th PDO Mapping

Reserved.

2.4.2 Re-define a PDO Mapping

Setup procedure

1. Set 【RxPDO Assignment:0x1C12:0/ TxPDO Assignment: 0x1C13:0】to 0x0 for disabling the PDO assignment.
2. Set 【RxPDO mapping entry: ex. 0x1601:0/ TxPDO mapping entry: ex. 0x1A01:0】to 0x0 for disabling the PDO mapping entry setting.
3. Set 【RxPDO mapping entry: ex. 0x1601:0 - 0x1601:7/ TxPDO mapping entry: ex. 0x1A01:0 - 0x1A01:7】.
4. Set 【RxPDO mapping entry: ex. 0x1601:0/ TxPDO mapping entry: ex. 0x1A01:0】to the number of mapping entries in PDO mapping.
5. Set 【RxPDO Assignment:0x1C12:1/ TxPDO Assignment: 0x1C13:1】to PDO assignment.
6. Set 【RxPDO Assignment:0x1C12:0/ TxPDO Assignment: 0x1C13:0】to 0x1 for enabling the PDO assignment.

2.4.3 Using TwinCAT

1. Press or **Shift** and **F4** to set/reset TwinCAT to Config Mode (Click OK in pop-up dialog).
2. Select Drive (ASDA A2-E CoE Drive) in the left window. In Process Data field, you can change PDO Assignment for another PDO mapping.
3. Right click the PDO Content Window, and find the PDO mapping that you desire to set, and then you can configure (Insert/Delete/Edit/Move Up/Move Down) the PDO mapping content.

   (8 PDOs is the maximum number of PDO which can be assigned in every PDO mappings.)

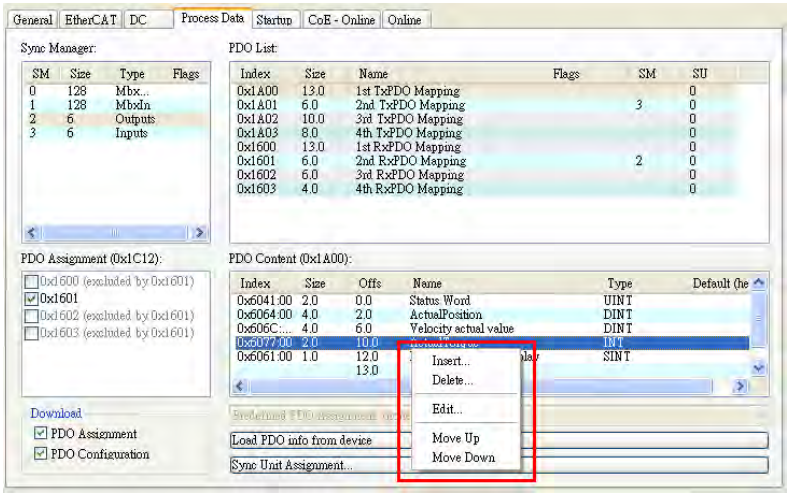


Figure 27

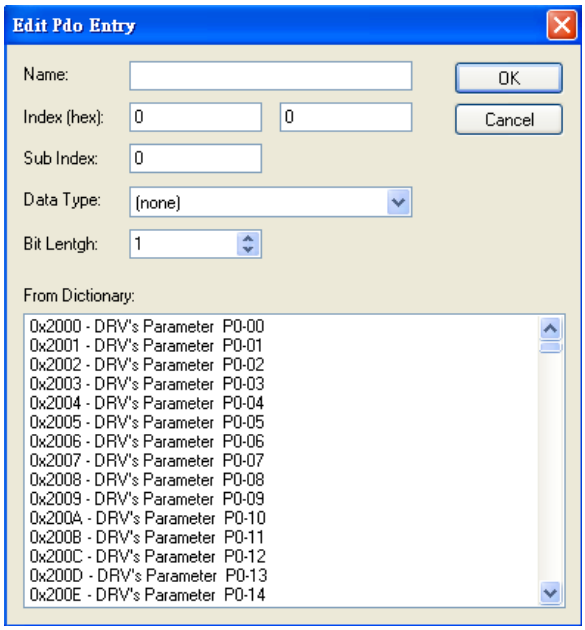


Figure 28. ASD-A2-E CoE drive Object List

4. After changing the PDO Assignment, press  or **F4** to reload I/O devices. (Click **No** in pop-up dialog and stay in Config Mode.)