FBs-CMECAT

User Manual

EtherCAT Master Communication Module

Version 1.3

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Version	Date	Author	Description
V1.0	2018/03/19	Leaigo Chan	Draft
V1.1	2018/03/21	Leaigo Chan	More explanation on module
V1.2	2018/05/28	Leaigo Chan	Correct explanation on module
V1.3	2018/10/12	Leaigo Chan	Add synchronization mode to CMECAT specification

1. Overview

The CMECAT module is an EtherCAT master communication module for FBs-series PLC and can be mounted on the left side extension of the CPU module. Any FBs PLC can effectively control or exchange data with slave devices on the EtherCAT network with it.

EtherCAT is an Ethernet-based fieldbus system with advantage of short cycle times, low jitter for accurate synchronization and low hardware costs. EtherCAT is suitable for both hard and soft real-time computing requirements in automation technology.

The CMECAT module supports the control of the 9-axis (slave device) and supports 4 RPDOs and 4 TPDOs as data exchanges for each axis. PLC register R1000~R3047 are reserved for PDO use. The configuration tool, CMECAT Configurator, automatically allocates PLC registers to PDOs planned by the user. Users can find the mapping information through the view mapping page to facilitate the development of the PLC control program. A variety of ways to configure EtherCAT network allows users to be more flexible in testing and deployment. The SDO task function relieves the programming burden of using SDO operations in ladder programs.

2. Specification

Table 1 CMECAT Specification

item	Characteristics
Compliance with	IEC 61158 Type 12
Compatible EtherCAT slaves	Delta ASDA-A2 Series
EtherCAT master specifications	CoE (CiA 402 profile)
Physical layer	100BASE-TX
Baud	100 Mbps
Working mode	Full duplex
Synchronization mode	Free run (not support SM sync / DC sync)
Supported topology	Line
Max. slave device count	9
Configurable PDO per slave device	4 RPDO, 4 TPDO
Configurable objects per PDO	4 objects
Object size	8, 16 or 32 bits
Configuration mode	Offline/Online
Communication wire	CAT. 5 twisted pair or above
Voltage/current	5V, 150mA
Working temperature	0 ~ 60 ℃

Storage temperature	-20 ~ 80 ℃

3. Installation and Wiring

The CMECAT communication module should be installed on the left side extension of the FBs PLC:

Figure 1 CMECAT top view

The CMECAT module uses a standard Ethernet cable. Network is setup like this:

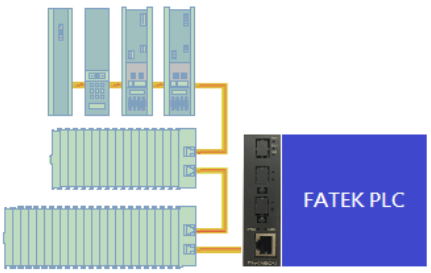

Figure 2 CMECAT network connection topology

4. PLC Application Interface

Communication between PLC and CMECAT is achieved by using the registers of PLC. These registers for communication are divided into the following areas:

4.1 Communication interface area

R3500~R3699 are reserved for communication between CMECAT and the CMECAT Configurator software. Do not use the registers in this area in PLC programs.

4.2 SDO task data area

The range is 64 registers from D3830 to D3893. SDO tasks planned by the CMECAT Configurator are mapped to the corresponding read and write registers from this area, so users can easily perform SDO operations by reading and writing to the corresponding registers.

4.3 Process data area

A total of 2048 registers ranging from R1000 to R3047 are assigned automatically by the CMECAT Configurator software according to the actual PDO mapping. PDOs are used to exchange data with other nodes of the network through this register area. Registers that are not used for PDO in this area can be used for other purpose.

Table 2 Process data area

Item	Register
Process data in (TPDO)	R1000 ~ R2023
Process data out (RPDO)	R2024 ~ R3047

4.4 Module status area

Table 3 Module status area

Register	Function	
R17	Process data register count. This value is automatically set according to the configuration and is not recommended for modification.	
D3800~D3813	EtherCAT network status	
	D3800	EtherCAT TX count (higher word)

	D3801	EtherCAT TX count (lower word)
	D3802	EtherCAT RX count (higher word)
	D3803	EtherCAT RX count (lower word)
	D3804	EtherCAT ERR count (higher word)
	D3805	EtherCAT ERR count (lower word)
	D3806	Cycle time
	D3807	Slave count
	D3808	Higher byte: master status Lower byte: slave 1 status
	D3809	Higher byte: slave 2 status Lower byte: slave 3 status
	D3810	Higher byte: slave 4 status Lower byte: slave 5 status
	D3811	Higher byte: slave 6 status Lower byte: slave 7 status
	D3812	Higher byte: slave 8 status Lower byte: slave 9 status
	D3813	Link status
D3896~D3897	SDO task status	
	BIT0 ~ 31 represent status of the 32 SDO tasks 0: OK 1: Error	

4.5 PLC block ladder reserved registers

Table 4 PLC block ladder reserved registers

Register	Description
D3000~D3007	Internal use
D3100~D3107	Internal use
M1000~M1002	Internal use
M1006~M1007	Internal use
T200~T201	Internal use

M1003	Internal use
M1004	Initialize from slave eeprom, then start network
M1005	Initialize from flash memory, then start network

5. LED Indicators

RUN LED (green) and ERR LED (red) operates as follow:

Table 5 RUN led modes

Indicator State	Operation State
double flash	INIT
single flash	PRE-OPERATIONAL
blinking	SAFE-OPERATIONAL
flickering	OPERATIONAL

Table 6 ERR led modes

Indicator State	Error State
off	No error
single flash	Error packet count: 1~256
on	Error packet count: > 256
double flash	ESI file configuration error
triple flash	Flash memory configuration error
4 flashes	Other error

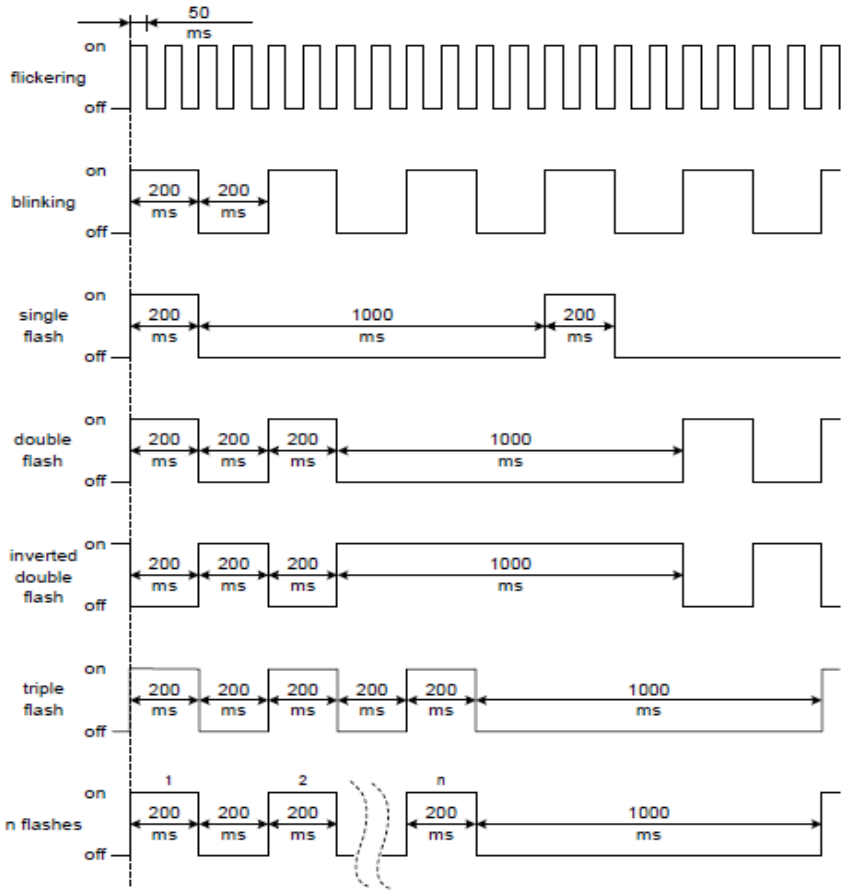

Figure 3 Indicator status and flash rate

6. CMECAT Configurator Software

This software has the following features:

- The establishment and modification of CMECAT module configuration. The configuration can be saved as a file for ease of copy.
- The SDO task service which reads or writes control objects in a single slave device by simply accessing PLC registers makes performing SDO operations a breeze.
- Firmware update of CMECAT through PLC serial port.

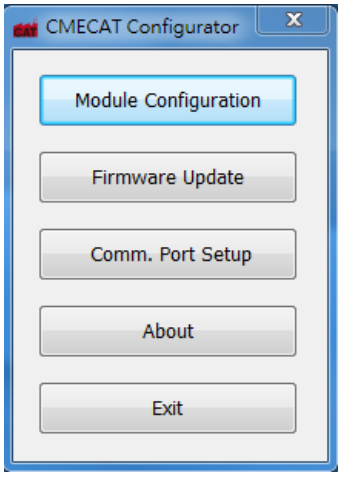

Figure 4 CMECAT Configurator main page

Table 7 Main page description

Item	Description
Module Configuration	EtherCAT master configuration
Firmware Update	Firmware update
Comm. Port Setup	PC serial port setting
About	Software information
Exit	End the application

6.1 PLC connection

The software must be connected to the PLC through serial port to perform online operation. After the communication line is connected, press the *Comm. Port Setup* button to setup the PC serial port. The operation screen is as shown below.

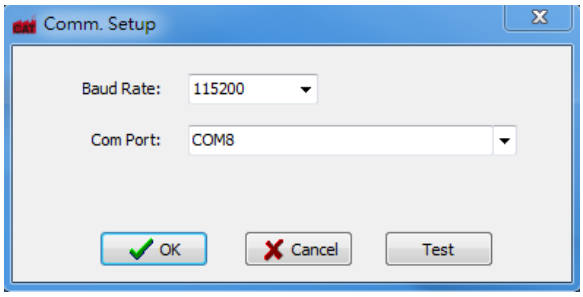

Figure 5 Communication port setup

After the connection is set successfully, press *Test* to confirm that the settings are correct, as shown in the following figure.

Figure 6 Serial port test OK

6.2 Configuration setup

Click on *Module Configuration* automatically obtains CMECAT module status. If the module has been initialized, it will jump to the master page directly; if the module has not been initialized, the following window will pop up. There are two options here:

1. Initialize CMECAT module
2. Fatek configuration file offline viewer

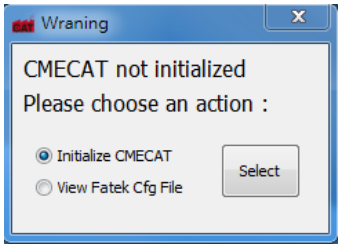

Figure 7 Select initial action

6.2.1 Module initialization

If users choose to initialize the CMECAT module, here are four ways to choose from, as shown below.

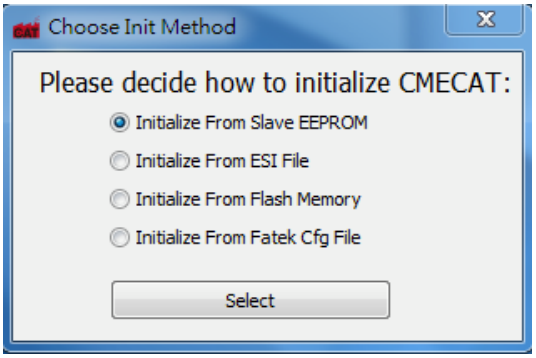

Figure 8 Select initialization method

6.2.1.1 Initialize from slave EEPROM

The slave device's basic set values are stored in the EEPROM, and the CMECAT module can directly query and retrieve the set values, thereby initializing the CMECAT module.

6.2.1.2 Initialize from ESI file

The ESI (EtherCAT Slave Information) file is an official definition file defined by the ETG (EtherCAT Technology Group). It can be loaded into the CMECAT Configurator to initialize CMECAT module.

6.2.1.3 Initialize from flash memory

CMECAT can save the current configuration to the internal flash memory. In the future, the module can directly access the settings and initialize itself.

6.2.1.4 Initialize from Fatek configuration file

The purpose of Fatek configuration file is similar to the idea of an ESI file but for a Fatek EtherCAT master module. The information of the CMECAT service such as SDO task is also included. Users can use the CMECAT Configurator to load the content and write it into CMECAT.

6.2.2 EtherCAT master page

After the CMECAT module initialization is completed, the master page is as follows.

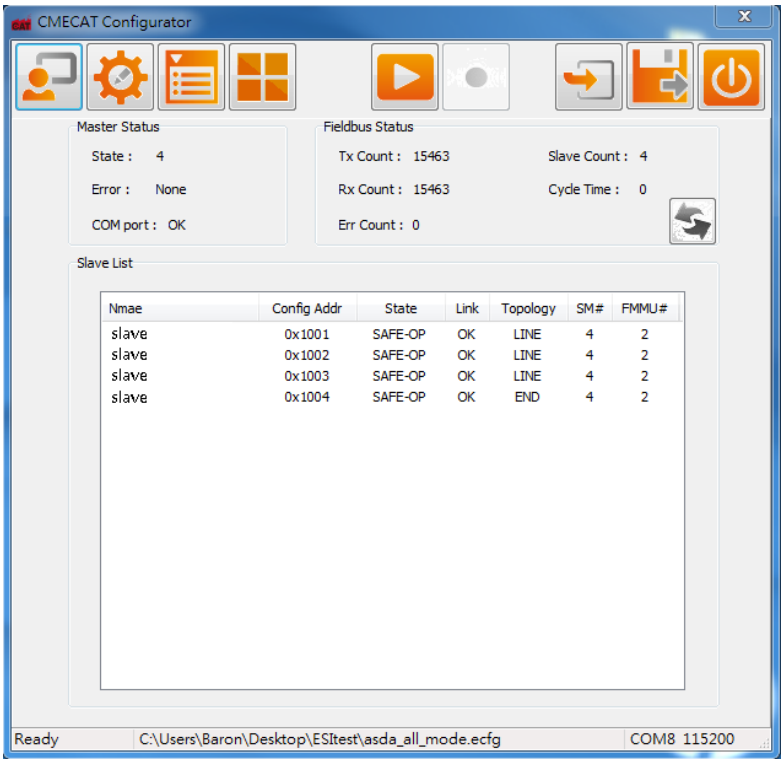

Figure 9 EtherCAT master page

The description of each icon is as follows.

Table 8 Master page description

Icon	Description
	Check bus status
	View and edit process data
	View mapping between process data and PLC registers
	View and edit SDO task data
	Start EtherCAT network
	Stop EtherCAT network
	Save current configuration to internal flash
	Save current configuration to file
	Reset and initialize module

6.2.2.1 EtherCAT bus status

Click to display the current status of the master station, bus status and list of slave devices, as shown below.

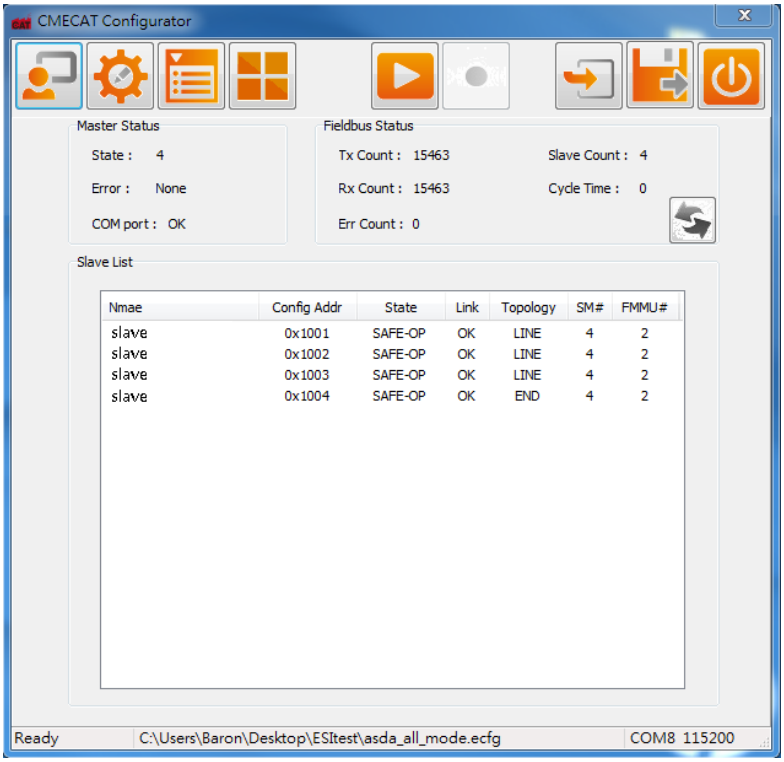

Figure 10 EtherCAT bus status

Table 9 EtherCAT bus status description

Group	Item	Description
Master Status	Status	Master status 8 : operational 4 : safe-operational 2 : pre-operational
	Error	Master error, show None if no error
	COM port	COM port status, show OK if no error
Fieldbus Status (press to refresh)	Tx Count	Tx packet count
	Rx Count	Rx packet count
	Err Count	Err packet count
	Slave Ciunt	Slave device count on bus
	Cycle Time	Cycle time
Slave List	Name	Slave name

	Config Addr	Configured address of slave device
	State	Slave device state
	Link	Link state
	Topology	Link topology LINE: intermediate device END: end device
	SM #	SyncManager count in slave device
	FMMU #	FMMU count in slave device

The information on this page is for review only and cannot be edited.

6.2.2.2 Process data mapping

Click on to display the current status of each station's Process Data mapping, users can freely modify the mapping content, as shown below.

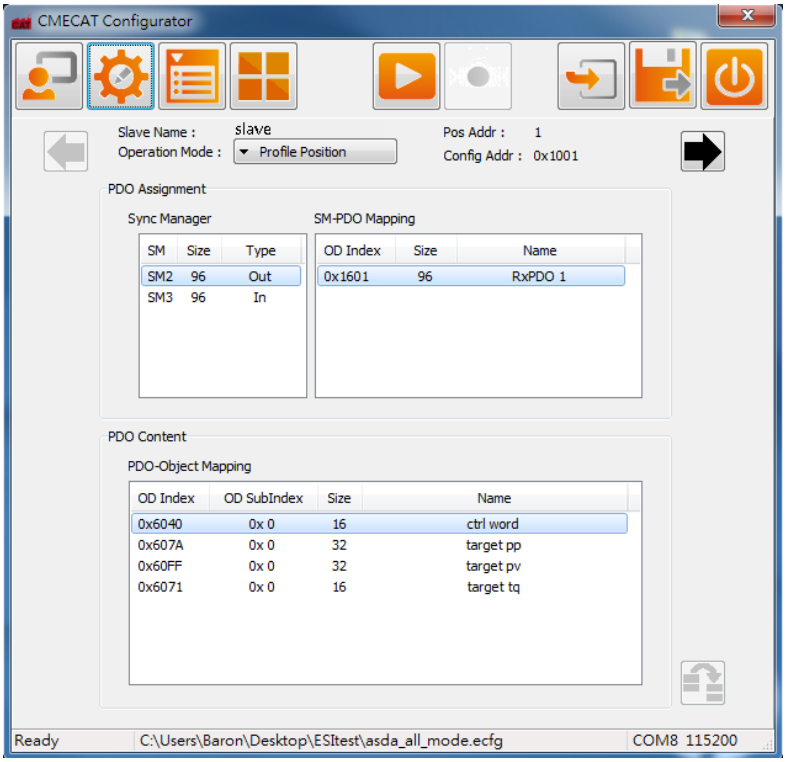

Figure 11 Process data mapping

Table 10 Process data page description

Group	Item	Description
Current Slave (press and to switch slave devices)	Slave Name	Slave device name
	Operation Mode	Drop-down menu to set the current operation mode (pp, pv, tq, etc)
	Pos Addr	Position address of slave device
	Config Addr	Configured address of slave device
PDO Assignment (Directly click on the item to view)	Sync Manager	The current SyncManager configuration status of the slave station, read only.
	SM-PDO Mapping	The configuration status of all PDOs under a SyncManager, can be modified, press to make effective.
PDO Content (Directly click on the item to view)	PDO-Object Mapping	The configuration status of all objects under a PDO, can be modified, press to make effective.

Right click on any item or blank space to open the editing options, there are five ways: add, delete, modify, move up, move down.

6.2.2.2.1 Edit SM-PDO Mapping

To add a PDO under the SyncManager, right-click on the blank to open the menu. Only the *Add* option allowed.

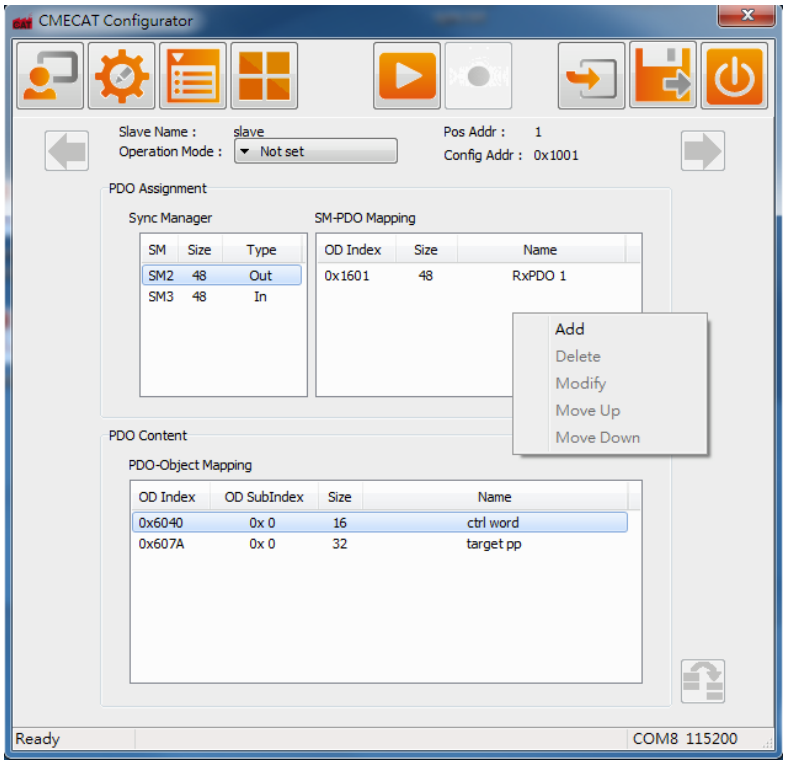

Figure 12 Add PDO

After selecting *Add*, the editing window will pop up. After the editing is completed, click *OK*. Remember to click again to have the new value take effect.

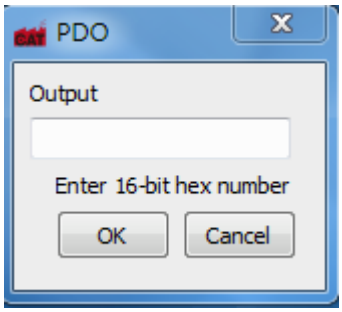

Figure 13 Input new PDO

To delete, modify, move up, and move down PDO, first select the item and then right click to open the menu.

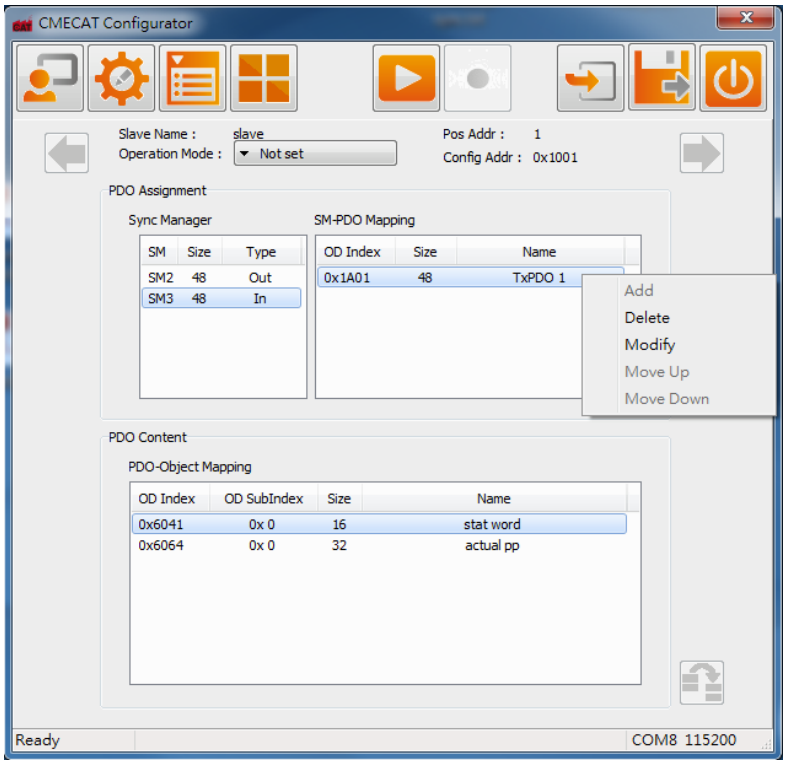

Figure 14 Delete, modify and move PDO

If select *Modify*, an edit window will pop up. Each field displays the current setting value. After the editing is completed, click OK. Remember to click again to make the new value take effect.

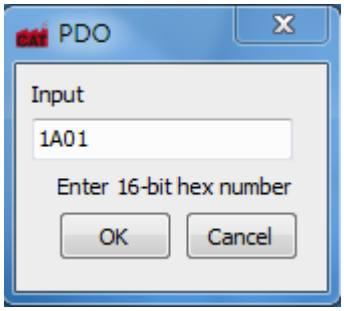

Figure 15 Input PDO content

6.2.2.2.2 Edit PDO-Object Mapping

To add an object under the PDO, right-click on the blank to open the menu. Only the *Add* option allowed.

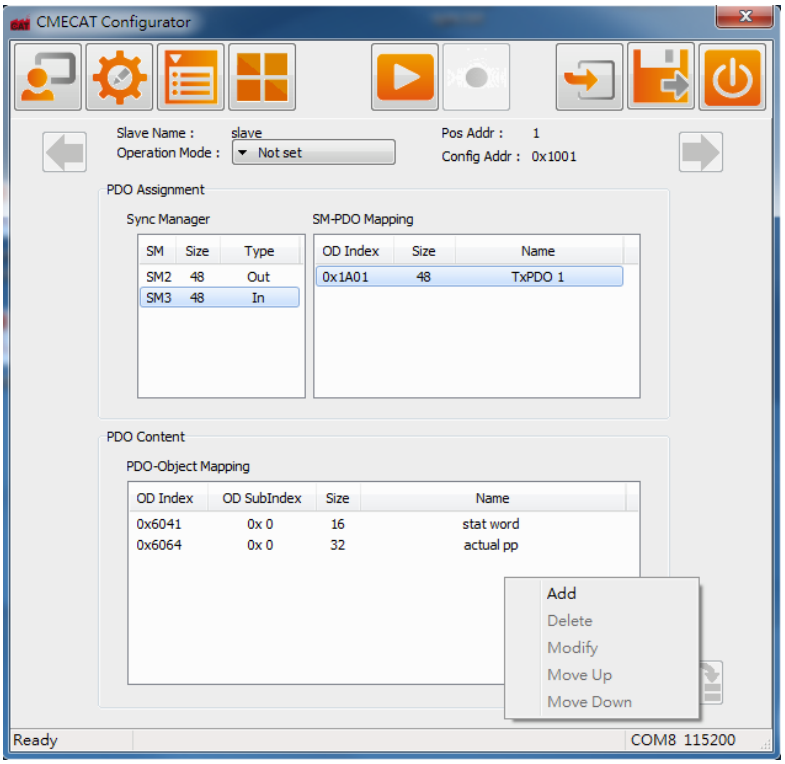

Figure 16 Add object

After selecting *Add*, the editing window will pop up. After the editing is completed, click *OK*. Remember to click again to have the new value take effect.

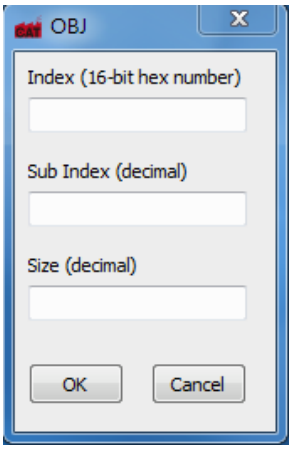

Figure 17 Input new object

To delete, modify, move up, and move down object, first select the item and then right click to open the menu.

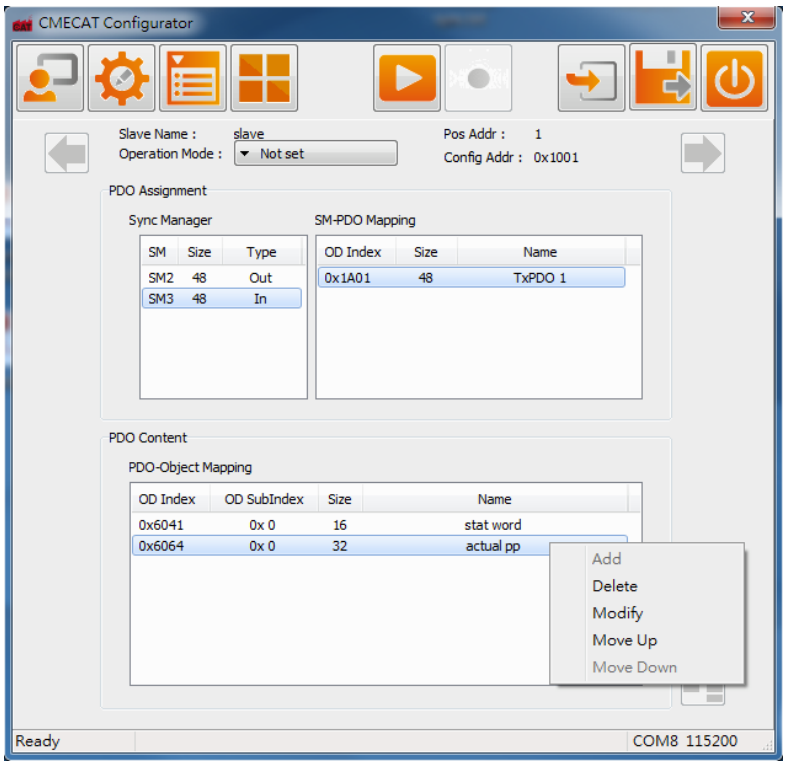

Figure 18 Delete, modify and move object

If select *Modify*, an edit window will pop up. Each field displays the current setting value. After the editing is completed, click OK. Remember to click again to make the new value take effect.

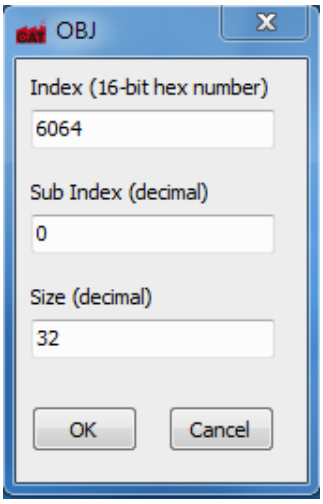

Figure 19 Input object content

6.2.2.3 PLC register mapping

Click to display the mapping of the control objects to the PLC registers. This is generated by CMECAT automatically. Users can write ladder programs according to its contents. Reading and writing PLC registers is equivalent to accessing the control objects of the slaves. The information on this page is read-only.

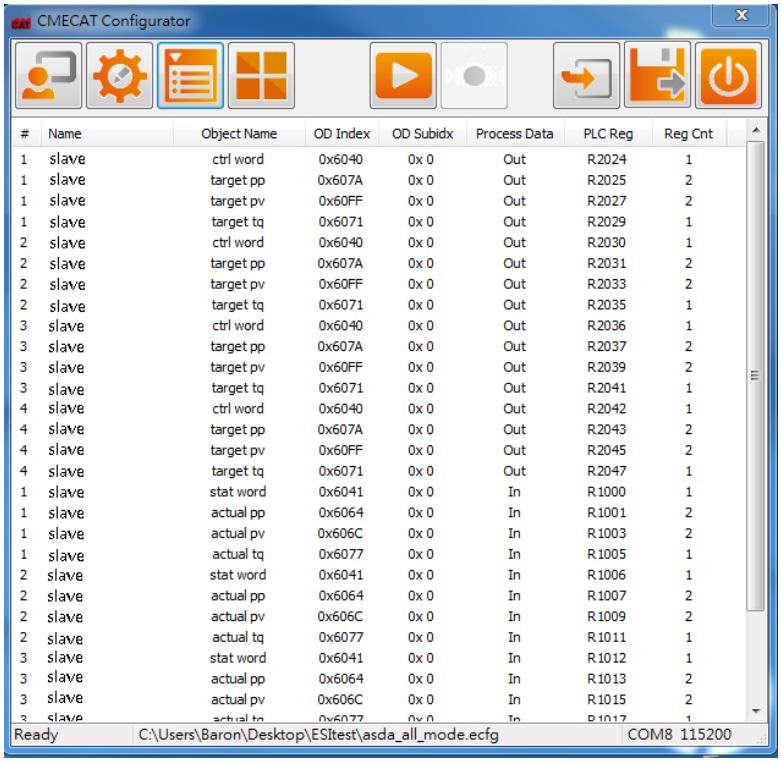

Figure 20 PLC register map

Table 11 PLC register map description

Group	Item	Description
PLC Register Mapping	#	Slave number
	Name	Slave device name
	Object Name	Object name
	OD Index	Object's index
	OD Subidx	Object's sub index
	Process Data	Input or output
	PLC Reg	Corresponding PLC register
	Reg Cnt	count of corresponding PLC register

6.2.2.4 SDO task settings

Click to display the current SDO task settings, so that SDO operations can be completed by accessing the PLC register. The CMECAT module supports 32 SDO tasks. As shown below.

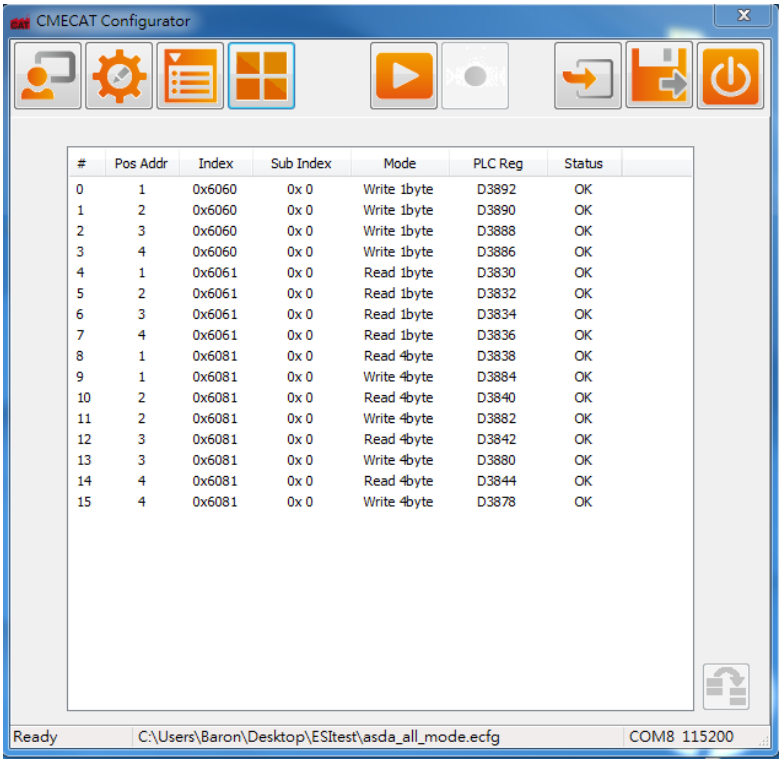

Figure 21 SDO task

Table 12 SDO task description

Group	Item	Description
SDO Task	#	SDO task number
	Pos Addr	Slave position address
	Index	Object's index
	Sub Index	Object's sub index
	Mode	Input or output, data size
	PLC Reg	Corresponding PLC register
	Status	SDO task status

6.2.2.4.1 Edit SDO task data

To add a SDO task, right-click on the blank to open the menu. Only the *Add* option allowed.

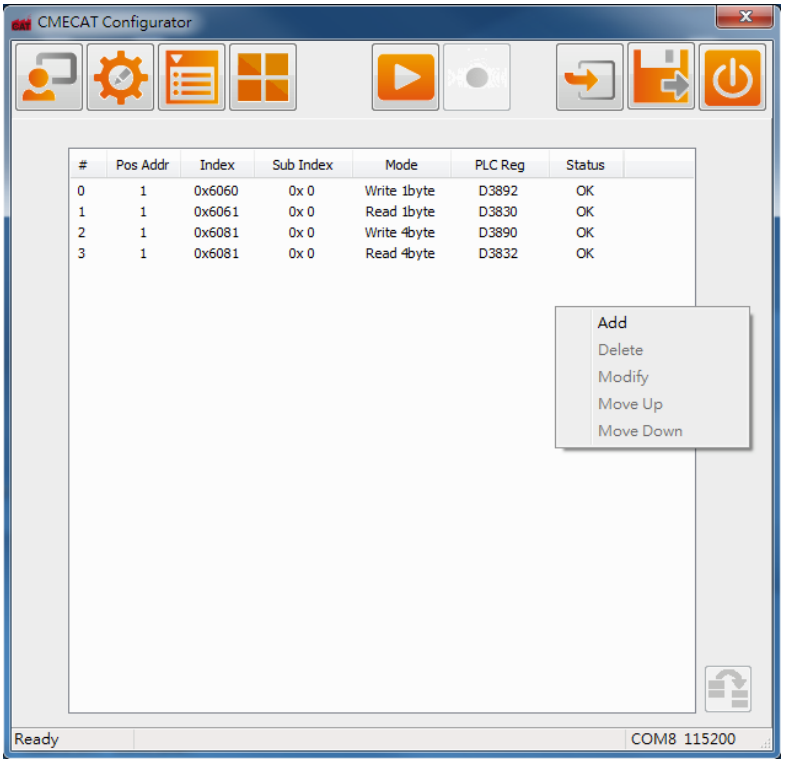

Figure 22 Add SDO task

After selecting *Add*, the editing window will pop up. After the editing is completed, click *OK*. Remember to click again to have the new value take effect.

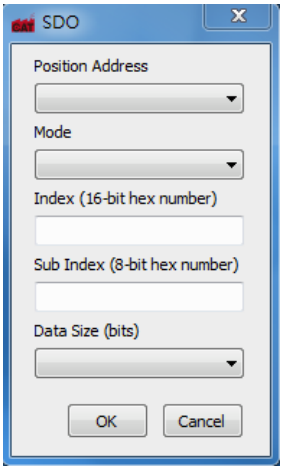

Figure 23 Input new SDO task

To delete, modify, move up, and move down PDO, first select the item and then right click to open the menu.

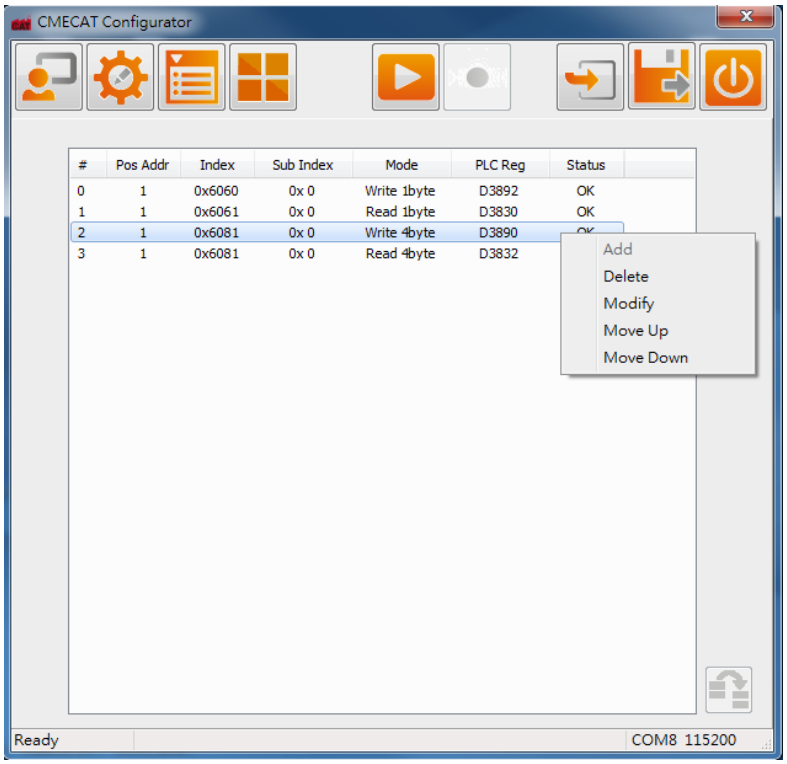

Figure 24 Delete, modify and move SDO task

If select *Modify*, an edit window will pop up. Each field displays the current setting value. After the editing is completed, click OK. Remember to click again to make the new value take effect.

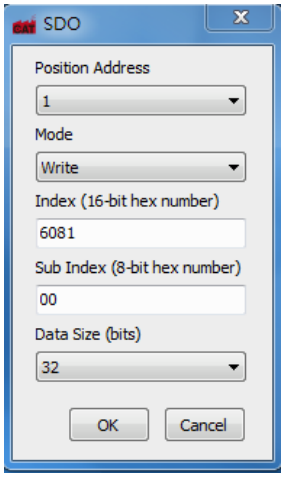

Figure 25 Input SDO task content

For more information on how to manipulate SDO operations in a ladder program, please refer to the operation manual.

6.2.2.5 Start / stop EtherCAT network

Click or to switch all slave devices to operational state or pre-operational state。

6.2.2.6 Save current configurations

Users can save all the internal settings of the current CMECAT module. There are two options: Click to store in the flash memory in the CMECAT, or click to save as the Fatek configuration file.

6.2.2.7 Reset CMECAT Module

Click to clear the internal settings of the CMECAT module. The CMECAT Configurator software will guide the user to reinitialize the module。

6.3 Firmware update

Click the *Firmware Update* button to enter the firmware update operation screen. *File Name* is the firmware file to be updated, as shown in the following figure.

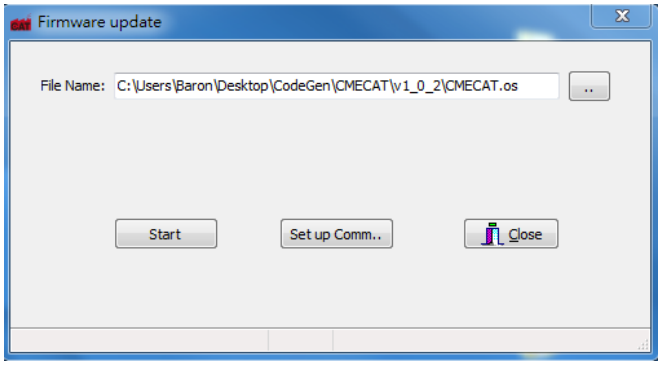

Figure 26 Firmware update

6.3.1 Select firmware image file

Click to open the file selection window and press OK to display the following screen. The firmware version information in the corresponding file will be displayed on the screen.

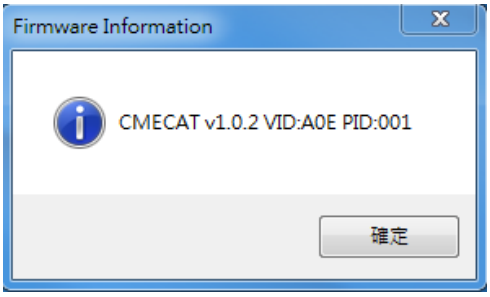

Figure 27 Firmware information

6.3.2 Start firmware update

Click *Start* to start firmware update.

6.4 End application

Click *Exit* to end CMECAT Configurator software.