



# FBs-CMECAT

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Operation Manual

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EtherCAT Master Communication Module

Version 1.1

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Version	Date	Author	Description
V1.0	2018/03/20	Leaigo Chan	Draft
V1.1	2018/03/21	Leaigo Chan	More explanation on module

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## 1. Environmental Configuration

This example uses FBs PLC with CMECAT module to control a servo drive and motor. The basic configuration is as follows.



Figure 1 Environmental configuration

After the CMECAT module starts up, it automatically detects port3 and port4 of PLC and set Baud to 307200 bps. After the above actions are completed, CMECAT's Run LED switches to Two-Flash mode.

## 2. Use Steps

The steps for initializing the module are shown below. Users can choose to use CMECAT Configurator or through the ladder program. CMECAT Configurator supports four initialization methods. The “init from slave” and “init from flash” methods have been incorporated into a block ladder and therefore can be performed by switching on M1004 or M1005 in the program to achieve the same effect. This is especially useful when use of computer is not considered. Relevant PLC register meanings are described in Table 3.

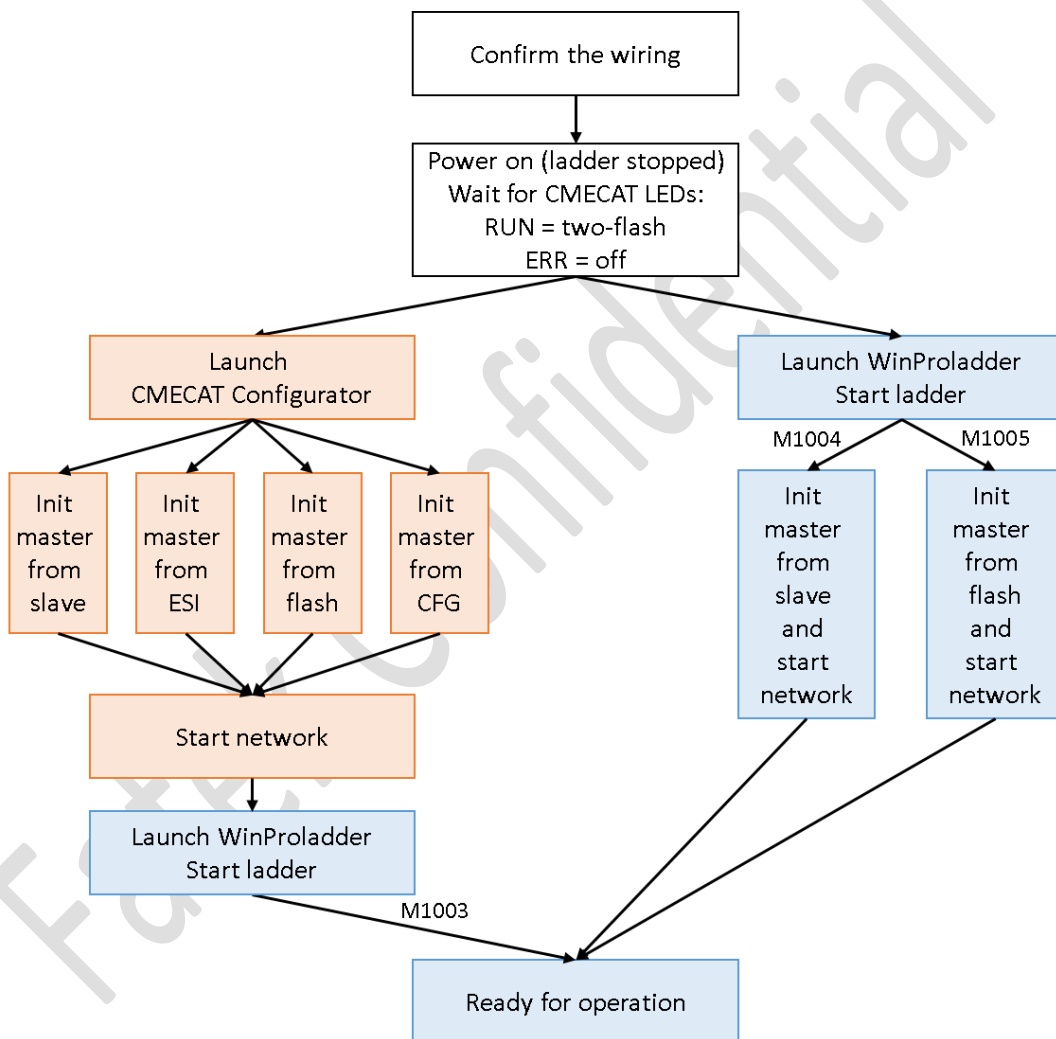


Figure 2 Module initialization flow

In the figure,  represents CMECAT Configurator operations, and  represents WinProladder operations.

Control the servo motor according to the following steps. The explanations of the various parts of the program can be found in the following chapters.

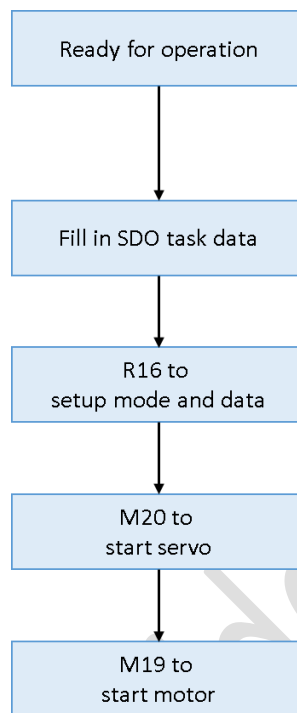


Figure 3 Servo drive control flow

All  in the figure represent WinProLadder operations.



### 3. Module Initialization

Use CMECAT Configurator to load a Fatek configuration file.

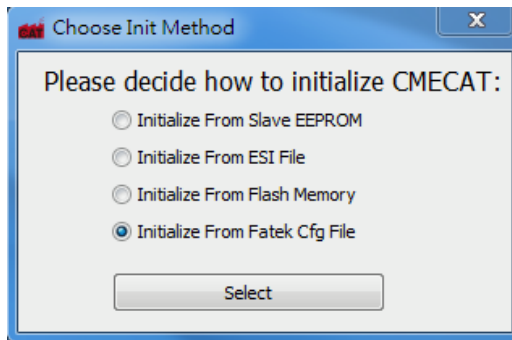


Figure 4 Choose initialization method

After the initialization is complete, the master page is as follows. Users can confirm the following points:

1. Only one slave device (servo drive) in the EtherCAT network
2. The servo drive is in SAFE-OP state
3. Tx packet count = Rx packet count, error packet count = 0

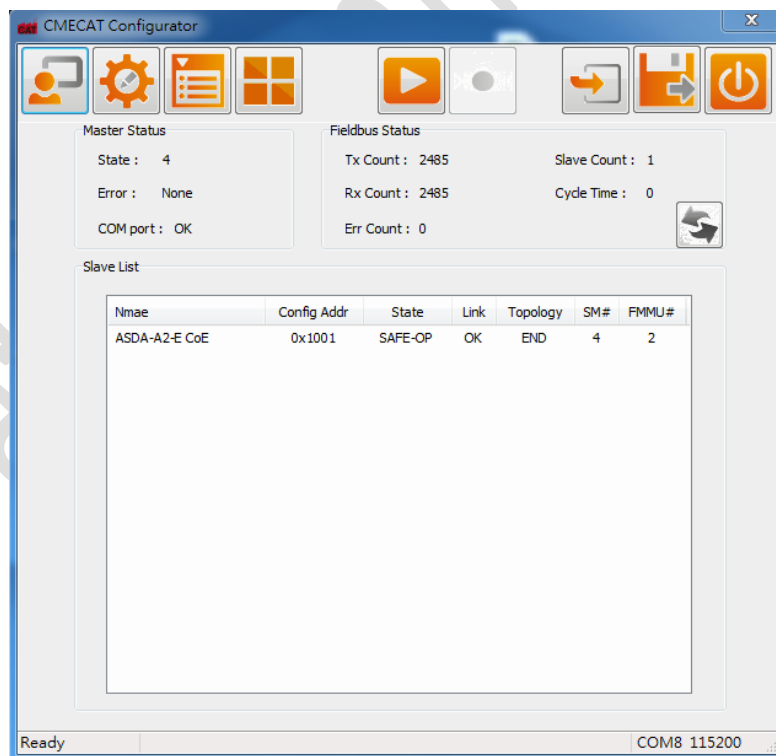



Figure 5 Master page - bus status

The servo drive provides several control objects. The CMECAT can access these

objects for control purposes. According to the EtherCAT protocol, the control objects are hierarchically managed and can be viewed on the  page.

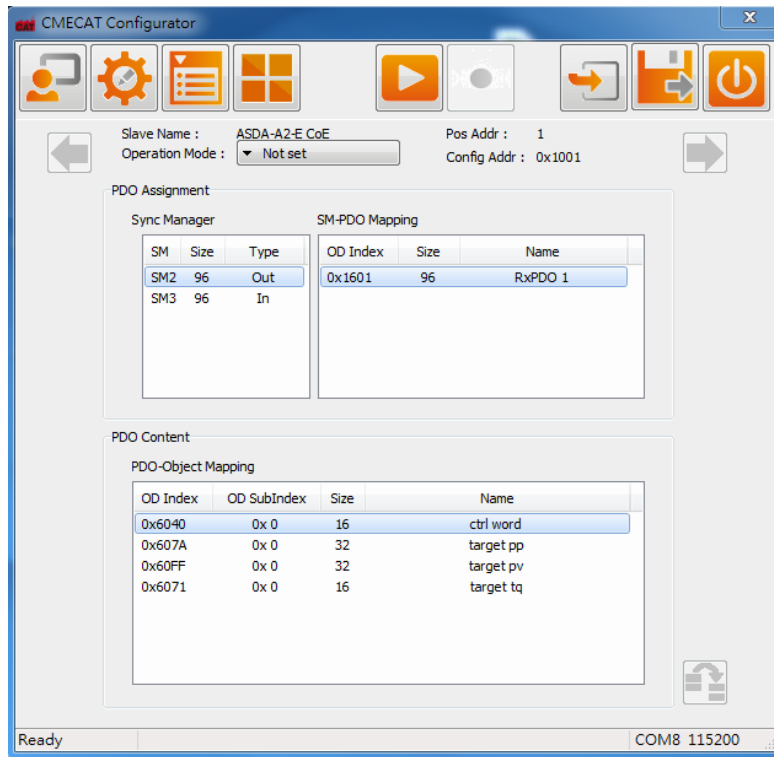


Figure 6 Master page - control objects (output)

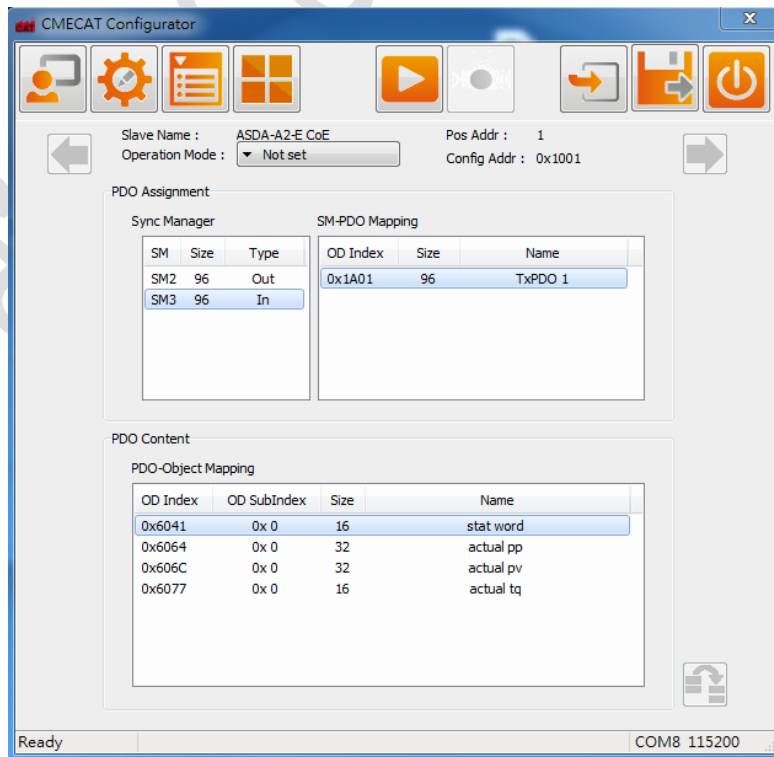


Figure 7 Master page - control objects (input)

Users can see the hierarchical structure of the control objects in the servo drive. One RPDO and one TPDO are used under Sync Manager 2 and Sync Manager 3, and 4 control objects are mapped to each PDO. In addition to the ctrlword, the output section also controls the position, speed, and torque. The input is the statword and the object that returns the current position, speed and torque. Editing is allowed in this page.

The servo drive provides a control object to switch the operation mode. The CMECAT Configurator lists all the modes supported by it. Users can select the mode to switch to, as shown below.

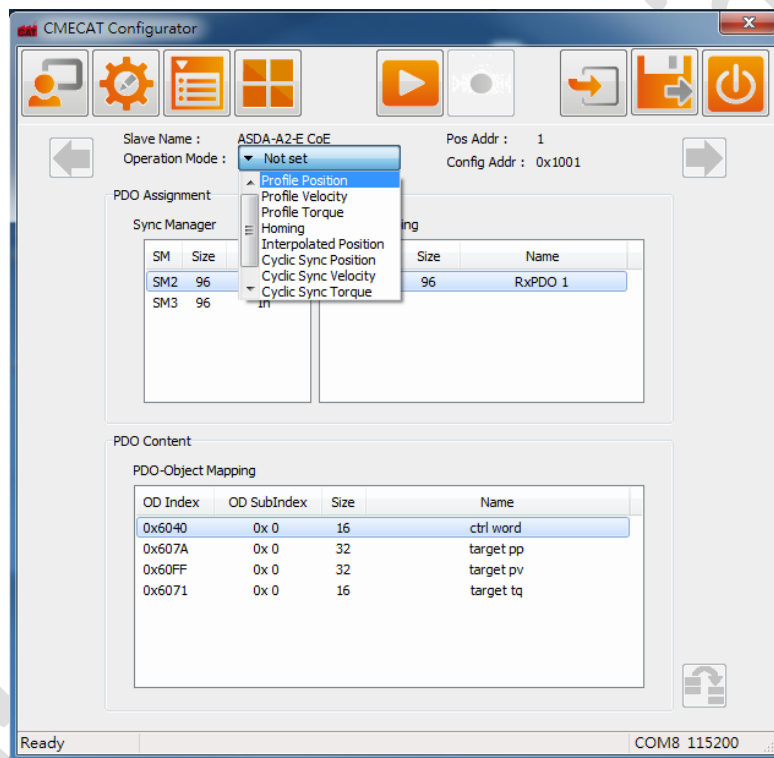


Figure 8 Master page - set operation mode


CMECAT automatically maps the control objects to the PLC registers. This part cannot be modified. It can only be viewed on the  page.

Table 1 Control objects

Sync Manager	PDO	Object name	Index : sub index	Mapped PLC register
SM2 (output)	RPDO1	Control word	0x6040 : 0x00	R2024
		Target position	0x607A : 0x00	R2025 - R2026
		Target velocity	0x60FF : 0x00	R2027 - R2028

		Target torque	0x6071 : 0x00	R2029
SM3 (input)	TPDO1	Status word	0x6041 : 0x00	R1000
		Actual position	0x6064 : 0x00	R1001 - R1002
		Actual velocity	0x606C : 0x00	R1003 - R1004
		Actual torque	0x6077 : 0x00	R1005

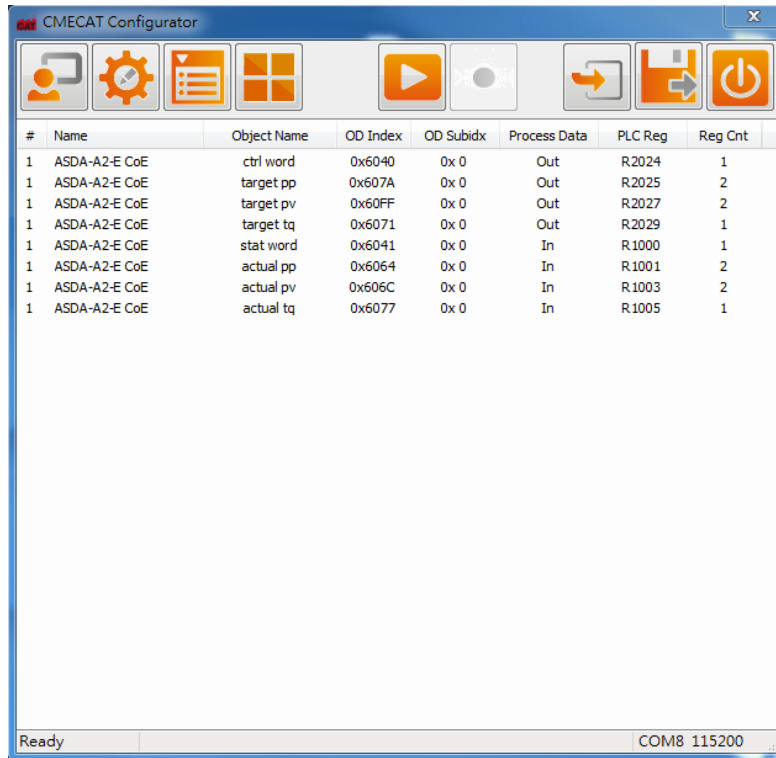


Figure 9 Master page - PLC register map

Finally, confirm the setting of SDO task. This example maps the current servo drive operating mode and speed in position control mode to the PLC register. This part is also automatically assigned by the CMECAT module.

Table 2 SDO tasks

Task#	Slave#	Object name	Index : sub index	Mapped PLC register	Mode
0	1	Mode of operation	0x6060 : 0x00	D3892 - D3893	write
1	1	Mode of operation display	0x6061 : 0x00	D3830 - D3831	read
2	1	Profile velocity	0x6081 : 0x00	D3890 - D3891	write
3	1	Profile velocity	0x6081 : 0x00	D3832 - D3833	read

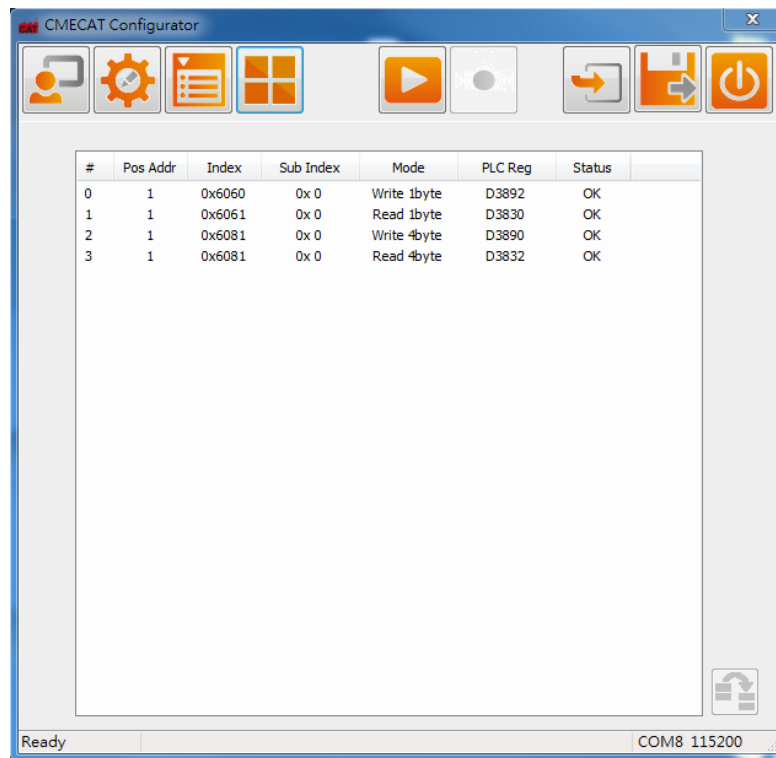



Figure 10 Master page - SDO task

After everything is confirmed, press  to start the EtherCAT network.

The current settings can be saved to CMECAT internal flash memory (by pressing ) , and can be accessed directly (switch on M1005 in ladder program) without using the CMECAT Configurator.

#### 4. Example program

This program controls one servo drive using three controlling mode: profile position (PP), profile velocity (PV), and profile torque (TQ) modes.

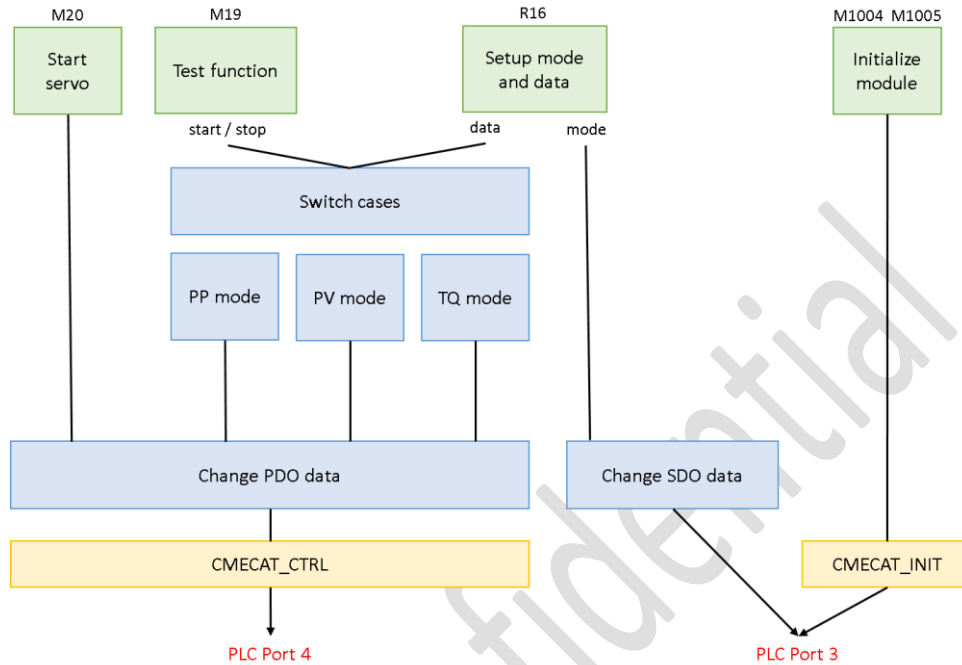


Figure 11 Example program

The following table summarizes the PLC registers and relays used by this sample program.

Table 3 Reserved registers and relays

Block ladder	
D3000 - D3007	Clink SR
D3100 - D3107	Clink WR
M1000 - M1002	Clink status
M1003	Clink start / stop
M1004	Initialize master from slave memory, start network
M1005	Initialize master from flash memory, start network
M1006 - M1007	Internal use
T200 - T201	Internal use
R17	Internal use
Ladder program	
M1	Change ctrlword

M2	Change target position
M3	Change target velocity
M4	Change target torque
M5	Change operation mode
M19	Start / stop test
M20	Start servo
R16	User set operation mode
M101, M103, M104	Internal use
R500 - R504	Internal use
R510 - R519	Internal use
M11 - M18, M21, M22, M30 - M35, M40 - M43, M50, M60, M120 - M122	Internal use
T112, T115, T117, T120 - T122, T142	Internal use
C0	Internal use
R5	Internal use

Here are the important parts of the program.

#### 4.1 Block ladder

Use of CMECAT module needs coincide with two block ladders (CMECAT\_INIT and CMECAT\_CTRL), which perform necessary communication details between the module and the PLC. The ladder program must add these two lines to allow CMECAT to execute correctly.

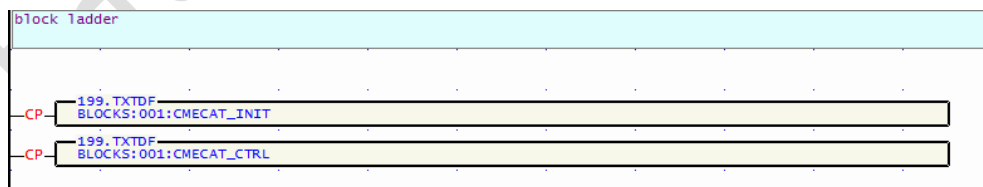


Figure 12 Ladder program - block ladder

## 4.2 Setup mode and data

Use R16 to switch operating modes. Supported modes are shown in the table below.

Table 4 Supported operation modes

R16 value	Operation mode
1	Profile position mode
3	Profile velocity mode
4	Profile torque mode

Subsequent programs use M101, M103, and M104 to indicate which mode the servo drive is in.

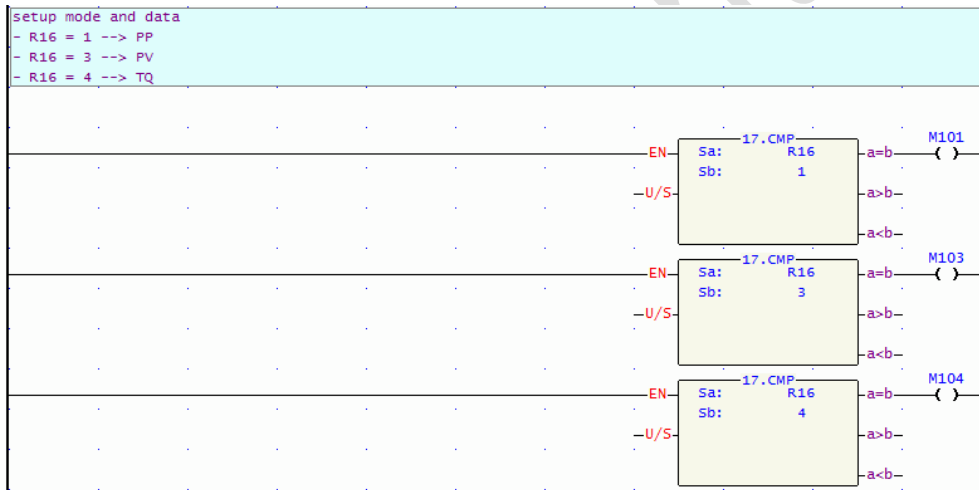


Figure 13 Ladder program - switch operation mode

Depending on the current operating mode, fill in the corresponding data for the servo drive to registers R503, R504 and R510 - R519. Please refer to section 4.5 and 4.6 for more information.

## 4.3 Change PDO data

Register R500-R502 are the set value currently sent to the servo drive. In this program, the value is updated to the corresponding register of each control object (R2024 represents ctrlword, R2025-R2026 represent target position, R2027- R2028 represent target speed and R2029 represent target torque). The CMECAT module sends the set value periodically.



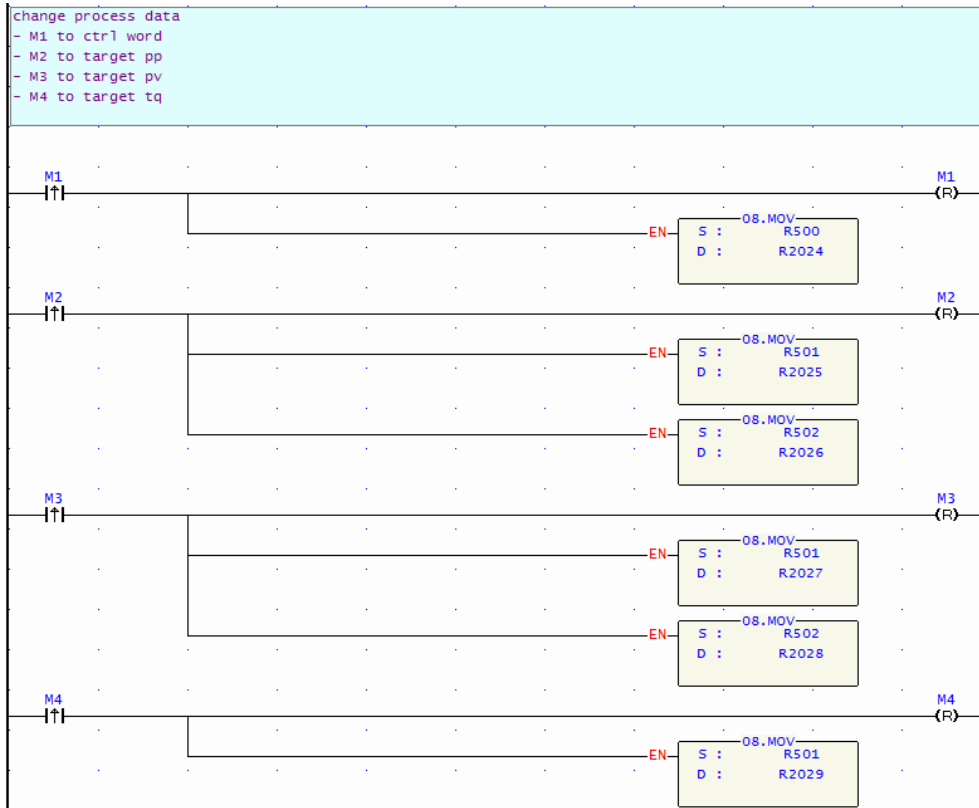


Figure 14 Ladder program - set PDO data

#### 4.4 Change SDO data

In this example, the servo drive operation mode has been mapped to D3892 - D3893. The operating mode setting R16 is updated to D3892 - D3893 and the CMECAT module is informed to send the SDO write command to servo drive.

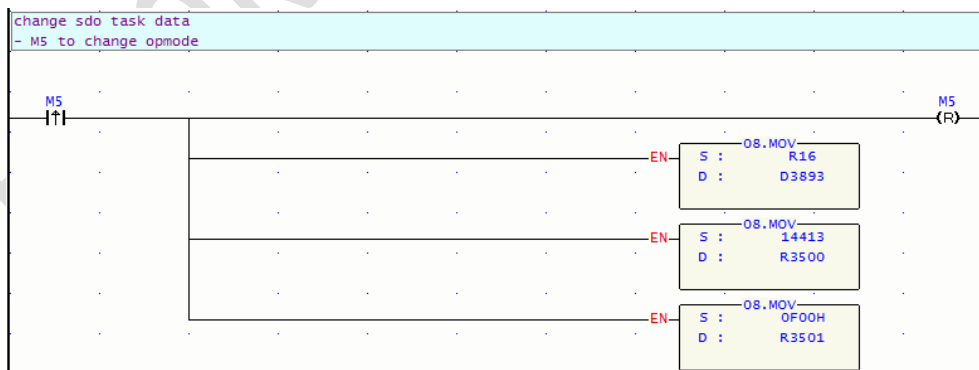


Figure 15 Ladder program - set SDO data

### 4.5 Start servo

The servo drive must be switched to the operating state before it can control the motor. The figure below is the state machine.

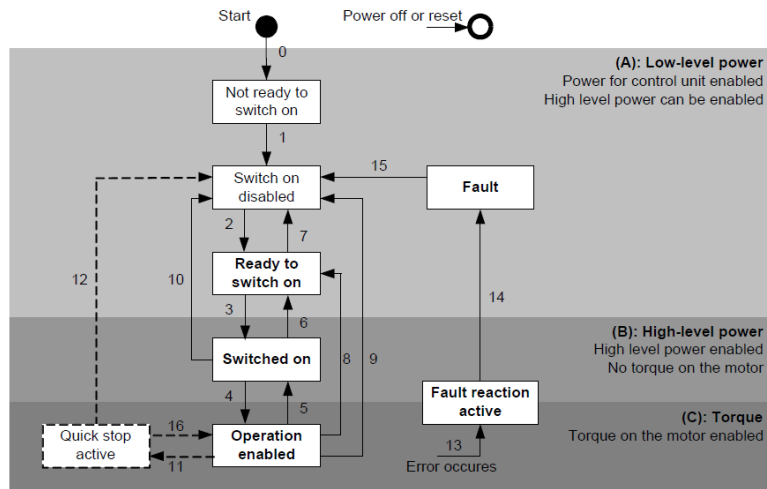


Figure 16 State machine

The example program sends a series of control values to the servo drive's control object (ctrlword) according to the specification that switches it to the operating state. The content of the control value differs depending on the operating mode (profile position, profile velocity, or profile torque).

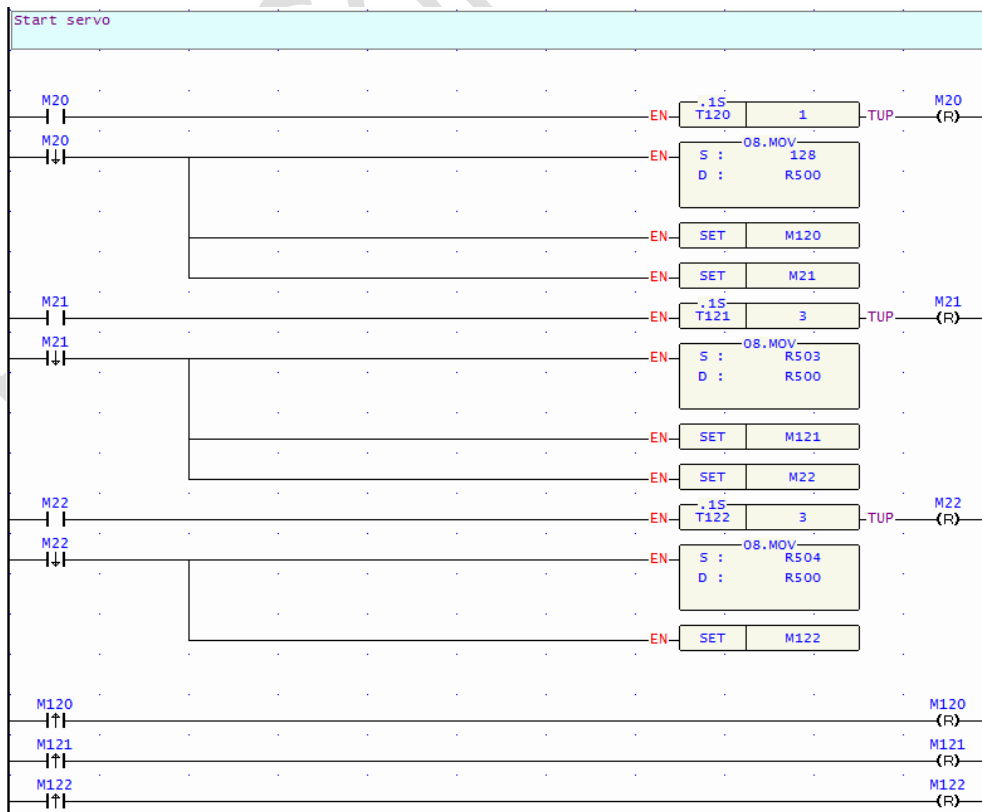


Figure 17 Ladder program - start servo

### 4.6 Run test function

The sample program sends different set values to the servo drive in order where the counter C0 (value from 0 to 5) controls the current set value. At the meantime, the servo driver repeatedly executes the predefined five different command values (R510 - R519).

After a command is sent, the sample program checks the servo drive control objects (R1000 stands for status, R1001 - R1002 for the current position, R1003 - R1004 for the current speed, R1005 for the current torque). After confirming that the request is made, the next command is updated and sent.

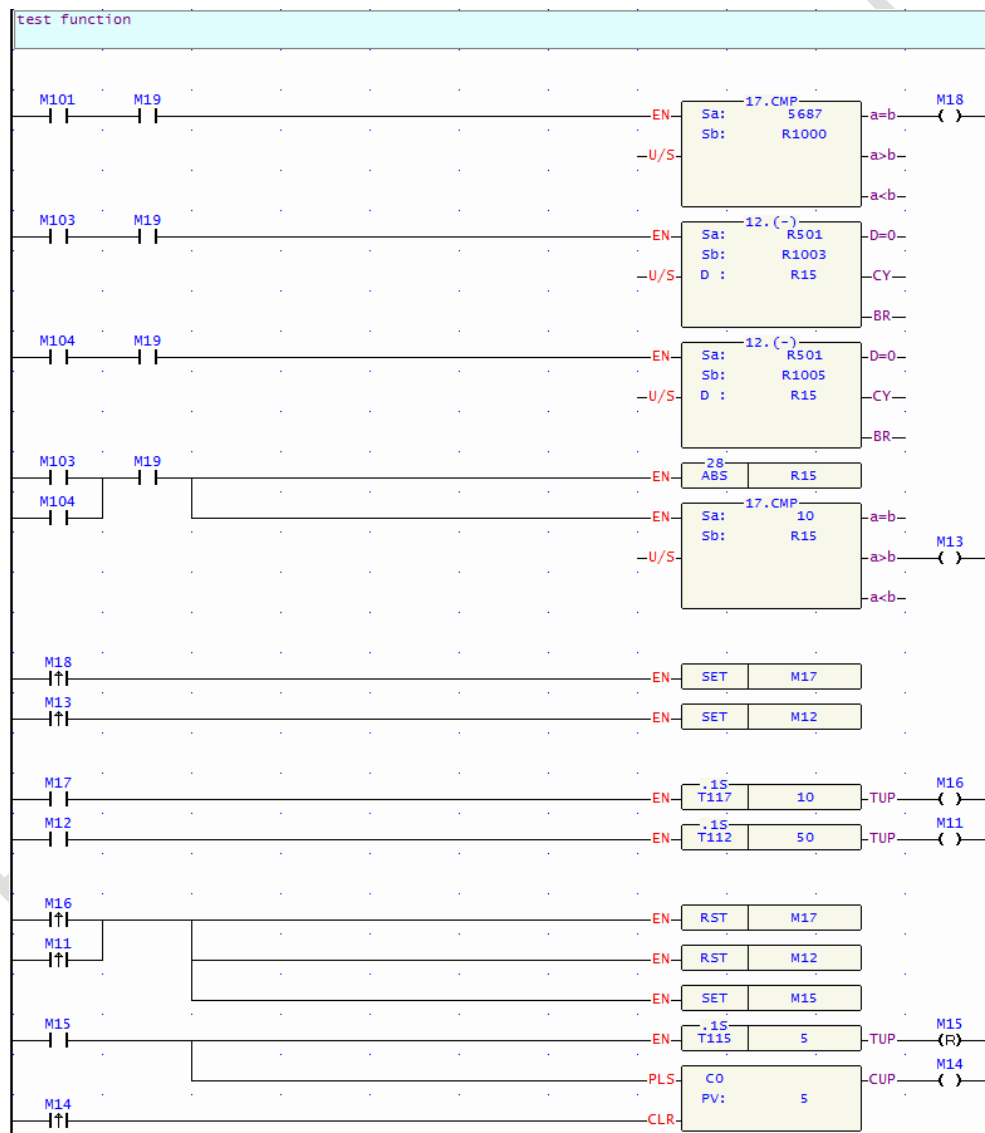


Figure 18 Ladder program - run test function