

## MD800

# EtherCAT Starting Guide



EtherCAT®

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## 1 GENERAL DATA

Date: 09.11.2021

Hardware: MD800, SI-ECAT card

Software: InoDriverShop for AC drives 3.6.1.16

Info: MD800 EtherCAT communication procedure

## 2 PURPOSE OF THIS DOCUMENT

The purpose of this document is to facilitate the commissioning of EtherCAT communications on the MD800 drives. To perform this procedure, an MD800 and an optional SI-ECAT communications card are required.

## 3 OVERVIEW

Thank you for using Inovance's MD800 series AC drives and SI-ECAT communication expansion card.

The SI-ECAT card is an EtherCAT fieldbus adapter card, which can be used in the ultra-high speed I/O network. The protocol is applicable on the I/O layer.

This card features high efficiency, flexible topology, and easy operation. It is installed in the MD800 series AC drive to increase the communication efficiency and implement the AC drive networking function, which enables the AC drive to be a slave controlled by the field bus master station.

SI-ECAT accepts the fieldbus master station control. EtherCAT communication supports a minimum synchronization cycle of 500μs. The internal bus between SI-ECAT, rectifier and inverter units have a communication cycle of 40ms.

**NOTE** The SI-ECAT supports the **CiA402 Velocity and Cyclic Synchronous Velocity (CSV)** modes which are suitable for the MD800 open loop (sensorless) operation. MD800 does not support encoder feedback.

This manual requires that the corresponding SI-ECAT card software version is 1.08 or above (after the card is installed and powered on, the function code can be checked in the rectifier FD-91), the associated device description XML file is named "MD800\_9Axis\_EtherCAT\_XML\_Vn.nn.xml" (n.nn is the version number, use version above V0.16).

CiA402 Velocity and Cyclic Synchronous Velocity (CSV) modes require the below software version:

- Rectifier software version:  
U05.00 and above (checked by parameter: F0-02 = 05.00)
- Inverter software version:  
U80.03 and above (checked by parameter: F7-10 = 80.03)
- SI-ECAT card:  
V01.15 and above (checked by rectifier parameter: FD-91 = 01.15)

Before using the product, read this user guide thoroughly.

## 4 INSTALLING THE SI-ECAT CARD

The SI-ECAT card is designed to be used as an expansion card embedded in the MD800 series drive. The SI-ECAT expansion card is located on the rectifier module.



Please turn off the inverter power supply before installation and wait for about 10 minutes. After that, the inverter charging indicator light is completely extinguished before installation.

After the SI-ECAT card is inserted into the inverter, please check whether it is securely inserted to prevent the signal socket between the boards from being damaged by the pulling force of the external signal cable.

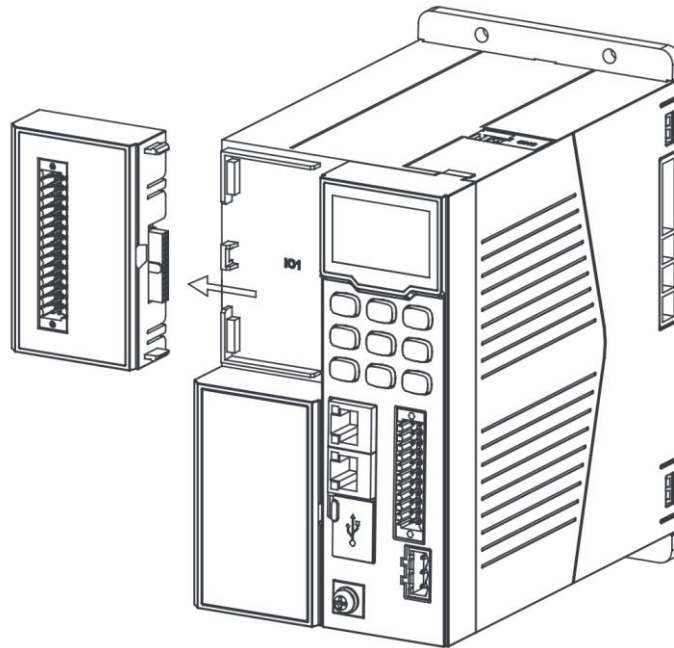
Before replacement, make sure that the network cable has been removed from the terminal of the expansion card.

### 1. Disassembly

- Insert a flat-blade screwdriver into the groove of the expansion card, and pry out the expansion card to the left with proper force.

### 2. Installation

- Please install it in the reverse order of the above disassembly process.



## 4.1 HARDWARE LAYOUT

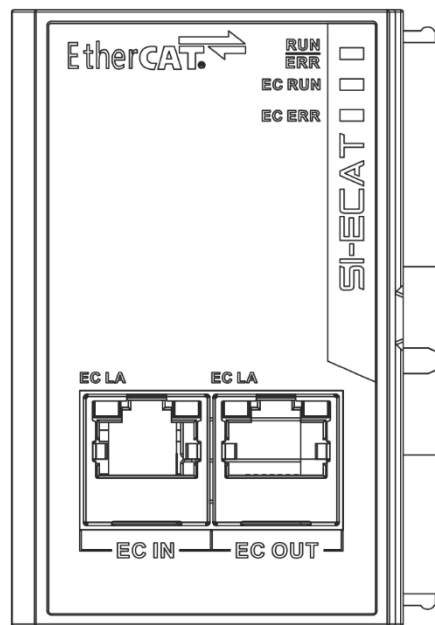


Figure 1 - SI-ECAT card terminal distribution

The SI-ECAT card uses a standard Ethernet RJ45 socket, which is connected to the EtherCAT master station, and its pin signal definition is the same as that of the standard Ethernet

The pins of the network are the same, cross-wire and straight-wire are both possible.

SI-ECAT card terminal function description:

Terminal symbol	Terminal name	Description
EC IN	Input port	After installation, EC IN is on the left and EC OUT is on the right when facing to the RJ45 interface. The two interfaces must be connected correctly. The Cat5e shielded twisted pair (STP) network cable must be used for ensuring stability. To improve the anti-interference capability of communication, it is recommended to install it in the expansion card slot 2.
EC OUT	Output port	

SI-ECAT card indicator description:

Indicator light	Status description	Approach
RUN/ERR	The green light is always on	The communication is normal
	The red light is always on	SI-ECAT card and node communication timeout
	Red light flashes slowly	SI-ECAT card and rectifier communication timeout
	Red light flashes quickly	SI-ECAT card failure

EC RUN	Green light off	EtherCAT state machine status: INIT=initialization	None
	Green light flashes quickly	EtherCAT state machine status: PREOP=Pre-operation	None
	Green light flashes slowly	EtherCAT state machine status: SAFEOP=safe operation	None
	Steady green	EtherCAT state machine state: OP=run	None
EC ERR	Red light off	EtherCAT communication is trouble-free	None
	Red light is always on	EtherCAT communication is faulty	Check the fault code displayed on the rectifier panel
EC LA	Yellow light off	Nothing with the previous EtherCAT device connection	None
	Yellow light is always on	Already connected with the previous EtherCAT device connection	None
	Green light off	No data interaction on the network port	None
	Flashing green	Data exchange through the network port	None

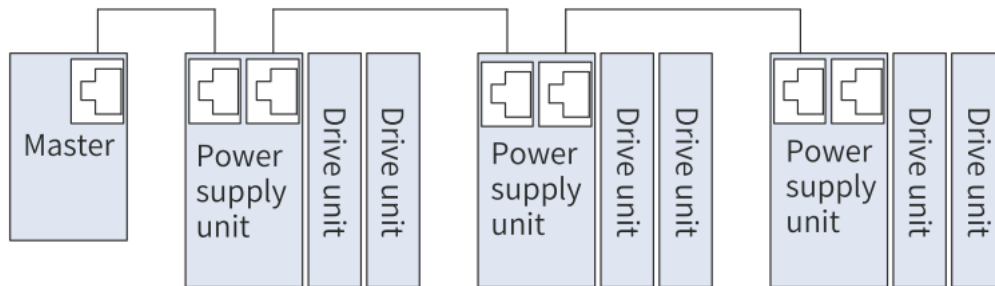


## 4.2 NETWORK TOPOLOGY

The AC drive supports EtherCAT bus. It adopts the standard RJ45 network port and standard connector. The Cat 5e shielded twisted pair cable with iron shell injection molding must be used to connect with the Ethernet master station properly. With relevant communication setting, the communication with the EtherCAT master station can be realized, thus realizing the networking function of the AC drive.

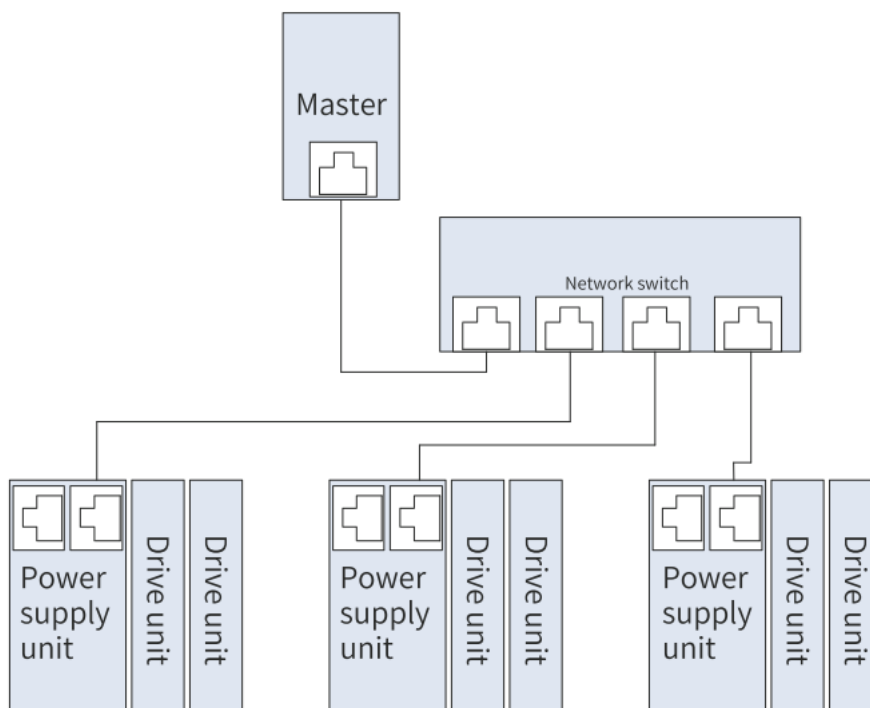
The topological structures supported by EtherCAT include bus, star, and tree topologies. Various networking can be realized by using switches correctly.

Bus topology:



Star topology:

**NOTE** For this type of topology it is necessary to use a special switch such as the Inovance's GR10-EC-6SW 6-Port EtherCAT Branch Module.



## 5 QUICK START COMMISSIONING

After installing the SI-ECAT card on the MD800 series AC drive, complete configuration to enable the communication between them.

The following parameters must be set to enable normal communication between the SI-ECAT card and MD800 series AC drive and connect the SI-ECAT card to the EtherCAT fieldbus network.

The table also shows the basic configuration of the single axis motor map and the different autotune modes. For a more detailed description of the autotune process, consult the MD800 commissioning manual.

Parameter	Description	Setting Range	Value
<b>Rectifier communication</b>			
FD-10	Communication protocol selection	1 : CANopen 2 : CANlink 3 : Optional communications card	3
<b>Inverter communication</b>			
F0-02	Command source selection	0: External LCD panel/Commissioning software 1: Terminal I/O control 2: Communication control	2
F0-03	Main frequency source X selection	0: Digital setting (initial value F0-08 can be modified by terminal UP/DOWN, non-retentive at power failure) 1: Digital setting (initial value F0-08 can be modified by terminal UP/DOWN, retentive at power failure) 2: AI1 3: AI2 4: (Reserved) 5: Pulse reference (DIO1) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication setting 10: Synchronization control	9
<b>Inverter motor configuration</b>			
F0-01	1st motor control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC) 2: Voltage/Frequency control (V/F control)	1
F0-10	Maximum frequency	5.00 to 590.00 Hz	50Hz
F1-00	Motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Synchronous motor	1
F1-01	Rated motor power	0.1 to 1000.0 kW	0.55kW
F1-02	Rated motor voltage	1 to 2000 V	380V
F1-03	Rated motor current	0.01 A to 655.35 A (drive power ≤ 55 kW) 0.1 A to 6553.5 A (drive power > 55 kW)	1.3A
F1-04	Rated motor frequency	0.01 Hz to maximum frequency (F0-10)	50Hz

F1-05	Rated motor rotation speed	1 RPM to 65535 RPM	3000RPM
F1-37	Autotuning	Dynamic no-load auto-tuning F1-37 (Auto-tuning selection): 0: No operation 1: Asynchronous motor static auto-tuning 2: Asynchronous motor complete auto-tuning 3: Asynchronous motor with-load complete auto-tuning 4: Reserved 11: Synchronous motor no-load partial auto-tuning (back EMF exclusive) 12: Synchronous motor dynamic no-load auto-tuning 13: Synchronous motor complete static auto-tuning 14: Reserved	2

## 5.1 TARGET FREQUENCY MODE

By default, when inserting the XML file that describes the MD800 drive, the following PDOs are added in the EtherCAT master configuration:

Data received from the EtherCAT master in the inverter:

RPDO	EtherCAT address	Inverter Parameter	Description
RPDO1	Index: 2073 SubIndex: 12 Data type: UINT	U3-17	<b>Inverter command word</b> (command source needs to be set to communication F0-02=2) 0: Stop according to the stop mode F6-10 1: Forward running 2: Reverse operation 3: Forward jog 4: Reverse jog 5: Free stop 6: Decelerate to stop 7: Fault reset
RPDO2	Index: 2073 SubIndex: 11 Data type: UINT	U3-16	<b>Inverter target frequency</b> (the frequency source needs to be set to communication, ie F0-03=9) The function code F8-64 can be used to set whether the writing unit is Hz or rpm. If F8-64 is set to 0, the unit is Hz. The decimal point is the same as F0-22, such as: write ten The hexadecimal number is 1000, F0-22=2, that is, the frequency setting is 10.00Hz. If F8-64 is set to 1, the writing unit is rpm. Such as: write the decimal number 1000, that is, the speed is given It is 1000rpm.

Data transmitted from the inverter to the EtherCAT master:

TPDO	EtherCAT address	Inverter Parameter	Description
TPDO1	Index: 2070 SubIndex: 45 Data type: UINT	U0-00	<b>Inverter running status information</b> The operating status information of the inverter is defined by bits, as follows: Bit0: 0 inverter stops, 1 inverter runs Bit1: 0 forward running, 1 reverse running Bit2: 0 no fault, 1 inverter fault

			Bit3: 0 running frequency is not up to standard, 1 running frequency is reached
TPDO2	Index: 2070 SubIndex: 1 Data type: UINT	U0-68	<b>Inverter operating frequency</b> (unit: 0.01Hz) Returns the actual operating frequency of the current inverter, the returned data value is 16bit unsigned data

## 5.2 CIA402 VELOCITY MODE

With this mode it can define the speed and acceleration ramps through the objects of the CiA402.

The following table shows the necessary settings to work with the speed mode of the CiA402 standard. The configuration is for a motor with these characteristics:

- Max speed 1500 RPM
- Acceleration from 0 to 1500 RPM in 2.5 seconds
- Deceleration from 1500 to 0 RPM in 5 seconds

Index (hex)	Sub-index (hex)	Drive Parameter	Name	Unit	Value
		FD-11	CANopen402 protocol		1 [Enabled]
		F0-19	Acceleration/Deceleration time unit		1 [0.1s]
		F0-25	Acceleration/Deceleration time base frequency		0 [F0-10 (maximum frequency)]
		F8-64	7310H address data unit		1 [Speed (rpm)]
6060	00		Modes of operation	-	2 [velocity mode]
6042	00		vl target velocity	RPM	
606C	00		Velocity actual value	RPM	
6077	00		Torque actual value	%	
6046	01	F0-14	vl velocity min amount		0
	02	F0-10	vl velocity max amount	RPM	1500
6048	01	F0-17	vl velocity acceleration. Delta Speed	0.1 RPM	15000
	02		vl velocity acceleration. Delta Time	0.1s	25
6049	01	F0-18	vl velocity acceleration. Delta Speed	0.1 RPM	15000
	02		vl velocity acceleration. Delta Time	0.1s	50

**NOTE** See section 6.4.1 for more information on this mode.

## 5.3 CIA402 CYCLIC SYNCHRONOUS MODE (CSV)

In this mode of operation, the host controller gives the target speed in 60FFh to the MD800 drive using PDOs configuration. Speed control and torque control are performed by the drive.

The following table shows the necessary settings to work with the Cyclic Synchronous Mode of the CiA402 standard.

Index (hex)	Sub-index (hex)	Drive Parameter	Name	Unit	Value
		FD-11	CANopen402 protocol		1 [Enabled]
		F8-64	7310H address data unit		1 [Speed (rpm)]
6060	00		Modes of operation	-	9 [Cyclic Synchronous Mode]
60FF	00		Target velocity	RPM	
606C	00		Velocity actual value	RPM	
6077	00		Torque actual value	%	

**NOTE** See section 6.4.2 for more information on this mode.

## 6 PARAMETERS: DEFINITION, STORAGE, AND ACCESS

### 6.1 INTRODUCTION TO PARAMETERS

Drive structures its parameters into two main categories: basic function parameters, and monitoring function parameters. Each category is divided in different groups, and each group contains multiple parameters with a related functionality.

Rectifier parameters:

MD800 rectifier			
Basic function parameters	Group F	RW	F0, F1, F4, F5, F7, FA, FD, FF, FP
	Group A	RW	A0, A1, A3, AC, AE, AF
Monitoring function parameters	Status data	RO	U0,U2,U3,U4

Inverter parameters:

MD800 inverter			
Basic function parameters	Group F	RW	F0, F1, F2, F3, F4, F5, F6, F7, F8, F9, FA, FB, FC, FD, FE, FF, FP
	Group A	RW	A0, A1, A3, A5, A6, A9, AC, AD, AE, AF
Monitoring function parameters	Status data	RO	U0,U4,U5
	Communication control parameters	WO	U3

To access to a parameter, you must indicate the group to which it belongs, and the ID of the parameter. See the sample below:

Group Description	Group number	Parameter ID	Parameter Name
F0 - Basic Power Supply Unit	F0	16	F0-16
AF - Process Data Address Mapping	AF	00	AF-00
U0 - Monitoring Parameters	U0	35	U0-35

### 6.2 MEMORY AREAS AND COMMUNICATION ADDRESSES

Drive has RAM and EEPROM memory. All parameters are placed in both areas in the drive: RAM memory, and EEPROM memory when the drive is power-off.

Parameter communication addresses must be used to perform a read-write and other operations of MD800. Each parameter has its own EEPROM communication address to be accessed.

Furthermore, in the case of Basic Function Parameters, to avoid an intensive use of the drive's EEPROM memory, also they can be accessed to the RAM memory using a particular communication address.

#### 6.2.1 EEPROM MEMORY ACCESS

The communication address to access to the EEPROM memory of the parameter, is represented in hexadecimal format.

Following the same way as the parameter name, the communication address is made up of two parts:

- The two most significant digits that represent the group to which the parameter belongs
- And the two least significant digits that represent the ID of the parameter

In the case of groups U0 through U5, the group name is represented by 70 through 75, respectively.

Below, in the table, the addresses of all the drive parameters are represented.

Group number	Parameter IDs	EEPROM Address
F0~FE	00~FF	0xF000~0xFEFF
A0~AF	00~FF	0xA000~0xAEFF
U0~U5	00~FF	0x7000~0x75FF

## 6.2.2 RAM MEMORY ACCESS

Only Basic Function Parameters, that is group parameters F0 to FE, and A0 to AF, can be accessed through their RAM communication address.

The communication address to access to the RAM memory of the parameter, is represented in hexadecimal format.

The RAM memory address is based in the EEPROM memory address, but changing the most significant digit for another value. See the correspondence below:

Parameter group number	EEPROM address	RAM address
F0~FE	0xF000~0xFEFF	0x0000~0x0EFF
A0~AF	0xA000~0xAFFF	0x4000~0x4CFF
U0	0x7000~0x70FF	-
U3	0x7300 ~ 0x73ff	-
U4	0x7400 ~ 0x74ff	-
U5	0x7500 ~ 0x75ff	-

## 6.3 ETHERCAT COMMUNICATION

### 6.3.1 ETHERCAT COMMUNICATION ADDRESS

Each MD800 parameter has an EtherCAT communication address associated with it, within the object dictionary. This address allows external communication with that parameter via EtherCAT fieldbus. All addresses in the object dictionary are made up of two parts:

- Object Dictionary Index – Related with the module type and the parameter group
- Object Dictionary Sub-Index – Related with the parameter ID

Each MD800 can control up to 8 Axes plus the rectifier. It is simple to determine the relation between any MD800 parameter and the communication address by this method:

Module type	Mapping relations
Rectifier	Object Dictionary Index = <b>0x2100</b> + Parameter Group Object Dictionary Sub-Index = 0x1 + Parameter ID
Inverter	Object Dictionary Index = <b>0x2000</b> + Group Number + ( Axis Number – 0x1 ) * 0x800 ) Object Dictionary Sub-Index = 0x1 + Parameter ID

For example:

For axis 2 parameter F0-03 (Main frequency source X selection) and communication address 0xF003, the corresponding object dictionary index and sub-index are 0x28F0 and 0x04, respectively.

### 6.3.2 PDO AREA DATA

The PDO data is used for the master station to read and write Drive data in real time and perform periodic data exchange. Data communication addresses are directly configured by the Drive. It mainly includes:

1. Real-time setting of Drive control command and target frequency
2. Real-time reading of Drive current state and running frequency
3. Function parameter and monitor data real-time exchange between Drive and EtherCAT master station

There are two types of PDO data:

- **RPDO or RxPDO.** These PDOs contain data received from the Master
- **TPDO or TxPDO.** These PDOs contain data transmitted by MD800

MD800 is a multi-axis device, therefore, it provides to the communications master with an independent set of PDOs for each of its devices. A maximum of 16 RPDOs and 16 TPDOs can be configured for each device.



The tables below indicate the base address for the PDOs of each element of the MD800.

RECTIFIER		
Data PDO area transmitted by RECTIFIER (1A10h)		
Bus Voltage	Module Temperature	Real-Time reading of rectifier parameters
TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 1					
PDO area received from Master (1601h)			PDO area transmitted by AXIS 1 (1A01h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 2					
PDO area received from Master (1602h)			PDO area transmitted by AXIS 2 (1A02h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 3					
PDO area received from Master (1603h)			PDO area transmitted by AXIS 3 (1A03h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 4					
PDO area received from Master (1604h)			PDO area transmitted by AXIS 4 (1A04h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 5					
PDO area received from Master (1605h)			PDO area transmitted by AXIS 5 (1A05h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 6					
PDO area received from Master (1606h)			PDO area transmitted by AXIS 6 (1A06h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 7					
PDO area received from Master (1607h)			PDO area transmitted by AXIS 7 (1A07h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

AXIS 8					
PDO area received from Master (1608h)			PDO area transmitted by AXIS 8 (1A08h)		
Fixed RPDO		Variable RPDO			
Command	Target Frequency	Function parameters	Status	Operating Frequency	Function parameters
RPDO1	RPDO2	RPDO3 ~ RPDO16	TPDO1	TPDO2	TPDO3 ~ TPDO16

By default, when inserting the XML file that describes the MD800 drive, the following PDOs are added in the EtherCAT master configuration: RPDO1, RPDO2, TPDO1, TPDO2.

### 6.3.2.1 RPDO – DESCRIPTION OF DATA RECEIVED FROM MASTER

Each of the devices of the MD800 receives information from the EtherCAT master in its own RPDO area. This area is described below:

RPDO	EtherCAT address	Inverter Parameter	Data Type	Description
RPDO1	<b>Index:</b> 0x2073  <b>SubIndex:</b> 0x12	U3-17	UINT	<b>Inverter command word</b> (command source needs to be set to communication F0-02=2)  0: Stop according to the stop mode F6-10 1: Forward running 2: Reverse operation 3: Forward jog 4: Reverse jog 5: Free stop 6: Decelerate to stop 7: Fault reset
RPDO2	<b>Index:</b> 0x2073  <b>SubIndex:</b> 0x11	U3-16	UINT	<b>Inverter target frequency</b> (the frequency source needs to be set to communication, ie F0-03=9)  The function code F8-64 can be used to set whether the writing unit is Hz or rpm. If F8-64 is set to 0, the unit is Hz. The decimal point is the same as F0-22, such as: write ten The hexadecimal number is 1000, F0-22=2, that is, the frequency setting is 10.00Hz. If F8-64 is set to 1, the writing unit is rpm. Such as: write the decimal number 1000, that is, the speed is given It is 1000rpm.

## 6.3.2.2 TPDO – DESCRIPTION OF DATA TRANSMITTED FROM MD800

Each of the devices of the MD800 transmit information to the EtherCAT master in its own TPDO area. This area is described below:

TPDO	EtherCAT address	Inverter Parameter	Data Type	Description
TPDO1	<b>Index:</b> 0x2070  <b>SubIndex:</b> 0x45	U0-00	UINT	<b>Inverter running status information.</b> The operating status information of the inverter is defined by bits, as follows:  Bit0: 0 inverter stops, 1 inverter runs Bit1: 0 forward running, 1 reverse running Bit2: 0 no fault, 1 inverter fault Bit3: 0 running frequency is not up to standard, 1 running frequency is reached
TPDO2	<b>Index:</b> 0x2070  <b>SubIndex:</b> 0x1	U0-68	UINT	<b>Inverter operating frequency</b> (unit: 0.01Hz) Returns the actual operating frequency of the current inverter, the returned data value is 16bit unsigned data

## 6.3.3 SDO MAILBOX DATA

EtherCAT SDO is used to transmit asynchronous data, such as communication, configuration and servo drive running parameter configuration. The EtherCAT CoE service types include:

- Critical event message
- SDO request
- SDO response
- TxPDO
- RxPDO
- Remote TxPDO transmit request
- Remote RxPDO sending request
- SDO information

Currently, the AC drive supports SDO requests and responses. For details about SDO-related parameters, see the MD800 user guides.

## 6.3.4 RELATED PARAMETERS

The following table shows the rectifier parameters related to the SI-ECAT board.

Function code	Name	Setting Range	Setting Value	Meaning
FD-10	Communication protocol selection	1: CANopen 2: CANlink 3: Optional communications card	3	Set to 1, for CANopen communication. Set to 2, for CANlink communication. Set to 3, which is the communication card mode. (SI-ECAT mode)
FD-50	Missing station start function	0: Disable 1: Enable	0	It can also be operated when the mapping relationship is configured without this station Row.
FD-70	EtherCAT slave name	0-65535	0	Displays the station number assigned to the slave by the master during EtherCAT communication.
FD-71	EtherCAT slave alias	0-65535	0	Assigns a station number to the slave during EtherCAT communication in case of a master unable to assign the slave station number automatically. FD-71 = 0: The master assigns the station number automatically. FD-71 $\neq$ 0: Use the set station number, with the one assigned by the master deactivated.
FD-72	Number of SYNC interrupts allowed by EtherCAT	0-30	10	Defines the maximum number of master signal loss events allowed by the slave.
FD-73	EtherCAT-Port0 terminal	0-65535	0	
FD-74	EtherCAT-Port1 terminal	0-65535	0	
FD-75	EtherCAT port 0/1 Data forwarding error	0-65535	0	
FD-76	EtherCAT processing unit And PDI error	0-65535	0	If data exchange error occurs between ESC and internal MCU, keep the setpoint to 0. If the counting value increases, the internal anti-interference performance of the board is abnormal.
FD-77	Port 0/1 lost counter	0-65535	0	If data link loss is detected by the ESC port, the counting value of the corresponding link loss counter increases. Such scenario may be caused by poor contact or damaged cables.
FD-78	SYNC mode setting	0-65535	0	0~1 0 Used to check for setting failure (loss of synchronization) Testing mechanism
FD-79	EtherCAT synchronization	0-1	0	

	error Monitoring mode settings			
FD-80	EtherCAT synchronization frame loss Lost times	0-65535	0	
FD-81	EtherCAT state machine and PHYLink status	0-65535	0	
FD-82	EtherCAT - AL fault code	0: no error 1~0xFFFF: Error status code	0	Error status code
FD-83	EtherCAT XML file version	0.00-655.35	0.00	
FD-84	FPGA software version	0-65535	0	
FD-86	EtherCAT EEPROM read time	0-65535	0	
FD-87	EtherCAT DC gain parameter	0-65535	0	
FD-88	EtherCAT DC acceleration Limit value	0-65535	0	
FD-89	EtherCAT DC speed Limit value	0-65535	0	
FD-90	EtherCAT DC integration coefficient	0.00-655.35	0.00	
FD-91	Communication card version	0.00-655.35	0.00	Communication expansion card software version number.

## 6.4 CIA402 PROTOCOL

The SI-ECAT only supports the CIA402 PV and CSV profiles. Although these two profiles are open loop since the MD800 does not support speed feedback.

### 6.4.1 VELOCITY MODE

In this mode of operation, the host controller gives the target speed, acceleration, and deceleration to the MD800 drive. Speed control and torque control are performed by the drive.

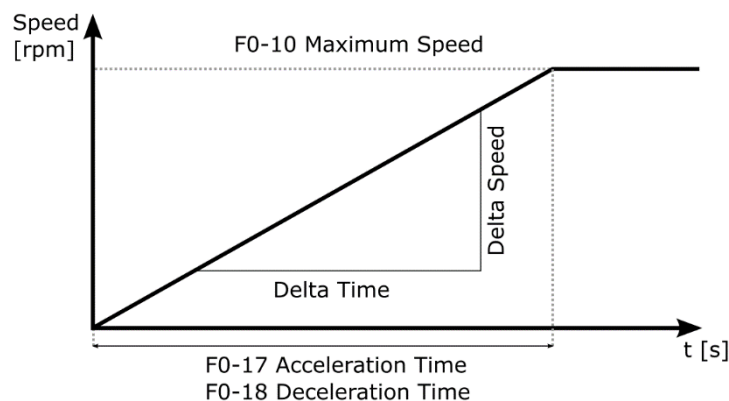
The below table shows the PV profile related objects:

Index (hex)	Sub-index (hex)	Drive Parameter	Name	Access	Data Type	Unit	Value Range
6040	00		Control word	RW	Uint16	-	0~65535
6041	00		Status word	RO	Uint16	-	0~65535
6060	00		Modes of operation	RW	Int8	-	0~9
6061	00		Modes of operation display	RO	Int8	-	0~9
6042	00		vl target velocity	RW	Int16	Hz/RPM	-32768~32767
606C	00		Velocity actual value	RO	Int32		$-2^{31} \sim (2^{31}-1)$
6077	00		Torque actual value	RO			
6046	01	F0-14	vl velocity min amount	RW	Uint32		$2^{32}-1$
	02	F0-10	vl velocity max amount	RW	Uint32		$2^{32}-1$
6048	01	F0-17	vl velocity acceleration. Delta Speed	RW	Uint32		$2^{32}-1$
	02		vl velocity acceleration. Delta Time	RW	Uint16		0~65535
6049	01	F0-18	vl velocity acceleration. Delta Speed	RW	Uint32		$2^{32}-1$
	02		vl velocity acceleration. Delta Time	RW	Uint16		0~65535

With this mode, the acceleration and deceleration ramps are defined to perform the speed profile.

$$F0 - 17 \text{ Acceleration Time} = \frac{F0 - 10 \text{ Maximum Speed}}{\text{Acc. Delta Speed}} \times \text{Acc. Delta Time}$$

$$F0 - 18 \text{ Deceleration Time} = \frac{F0 - 10 \text{ Maximum Speed}}{\text{Dec. Delta Speed}} \times \text{Dec. Delta Time}$$



## 6.4.2 CYCLIC SYNCHRONOUS VELOCITY MODE (CSV)

In this mode of operation, the host controller gives the target speed in 60FFh to the MD800 drive using PDOs configuration. Speed control and torque control are performed by the drive.

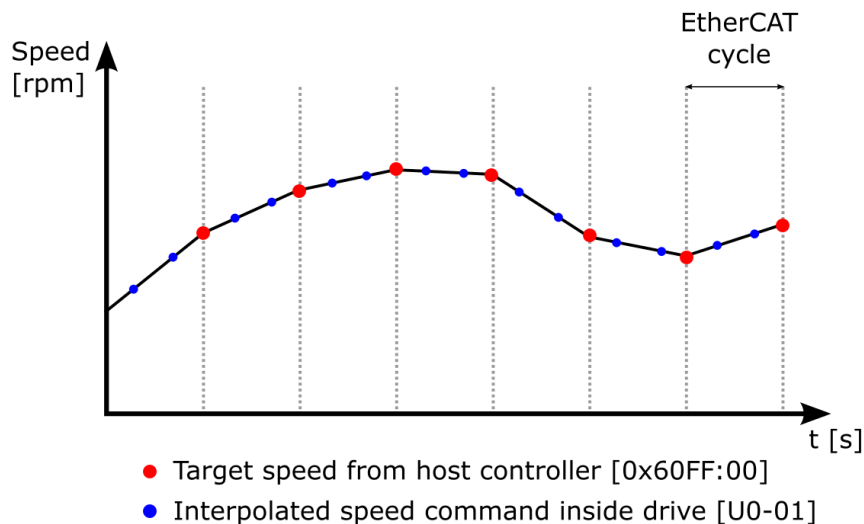
The below table shows the CSV profile related objects:

Index (hex)	Sub-index (hex)	Drive Parameter	Name	Access	Data Type	Unit	Value Range
6040	00		Control word	RW	UInt16	-	0~65535
6041	00		Status word	RO	UInt16	-	0~65535
6060	00		Modes of operation	RW	Int8	-	0~9
6061	00		Modes of operation display	RO	Int8	-	0~9
60FF	00		Target velocity	RW	Int32	RPM	$-2^{31} \sim (2^{31}-1)$
60B1	00		Velocity Offset	RO	Int32	RPM	$-2^{31} \sim (2^{31}-1)$
607E	00		Polarity	RO	UInt8	-	0~255
606C	00		Velocity actual value	RO	Int32		$-2^{31} \sim (2^{31}-1)$
6077	00		Torque actual value	RO	Int16	unit: 0.1%	-32768~32767

In this mode the host controller sends a speed command every EtherCAT cycle. The MD800 drive takes care of interpolating the necessary points between each EtherCAT cycle to create a final speed command.

The MD800 is an open loop drive, therefore the final speed of the motor has a small error because the drive has no feedback.

The following image shows how the MD800 interpolates the final speed from the command received from the host controller:



## 6.4.3 CIA402 OBJECT DICTIONARY

This section describes the CiA402 objects implemented in the inverter firmware.

### 6.4.3.1 MONITORING PARAMETERS

The following section describes the U4 menu parameters that show the values of some of the CiA402 standard objects.

Function code	CiA402 Object Dictionary	Setting Range	Meaning
U4-00	0x6502 (high byte)		Supported drive modes
U4-01	0x6502 (low byte)		
U4-02	0x603F	0~65535	Fault code
U4-03	0x6040	0~65535	Control Word
U4-04	0x6041	0~65535	Status Word
U4-05	0x6042	-32768 ~ 32767 rpm	vl target velocity
U4-06	0x6043	-32768 ~ 32767 rpm	vl velocity demand
U4-07	0x6044	-32768 ~ 32767 rpm	vl velocity actual value
U4-08	0x6046-01 (high byte)	0~65535	vl velocity min amount
U4-09	0x6046-01 (low byte)	0~65535	
U4-10	0x6046-02 (high byte)	0~65535	vl velocity max amount
U4-11	0x6046-02 (low byte)	0~65535	
U4-12	0x6048-01 (high byte)	1~65535 (unit: RPM)	vl velocity acceleration. Delta speed
U4-13	0x6048-01 (low byte)		
U4-14	0x6048-02	0~65536 (unit: s)	vl velocity acceleration. Delta time
U4-15	0x6049-01 (high byte)	1~65535 (unit: RPM)	vl velocity deceleration. Delta speed
U4-16	0x6049-01 (low byte)		
U4-17	0x6049-02	0~65536 (unit: s)	vl velocity deceleration. Delta time
U4-18	0x605A	0~2	Quick stop option code
U4-19	0x605B	0~1	Shutdown option code
U4-20	0x605C	0~1	Disable operation option code
U4-22	0x605E	0~65535	Fault reaction option code
U4-23	0x6060	0~65535	Mode of operation
U4-24	0x6061	0~65535	Mode of operation display
U4-36	606C (high byte)	$-2^{31} \sim (2^{31}-1)$ RPM	Velocity actual value
U4-37	606C (low byte)		
U4-43	6077	Unit: 0.1%	Torque actual value
U4-52	607E	0~255	Polarity: Bit6 sets the target speed limit to 0, and the target speed is (60ff + 60b1); Set to 1, target speed is - (60ff + 60b1)
U4-79	60B1 (high byte)	$-2^{31} \sim (2^{31}-1)$ RPM	Velocity offset
U4-80	60B1 (low byte)		
U4-95	60FF (high byte)	$-2^{31} \sim (2^{31}-1)$ RPM	Target velocity
U4-96	60FF (low byte)		



## 6.4.3.2 OBJECT DICTIONARY

This section describes the CiA402 objects implemented in the inverter firmware. The inverter only supports the PV and CSV profiles of the CiA402 standard. Therefore, only the objects related to these two profiles are implemented.

Indexes	name	Error Code			Setting effective	-	data structure	VAR	data type	Uint16
	603Fh	Accessibility	RO	Can It map	TPDO	Correlation mode	ALL	Data range	0~65535	factory setting

The indication of fault code does not comply with the requirements of DS402. The read fault code is the fault code defined by the manufacturer. The upper 8 bits are the main fault code and the lower 8 bits are the fault subcode. For specific meaning, please refer to the Manual of MD800.

Indexes 6040h	name	Control word	Setting effective	Operation setting	data structure	VAR	data type	Uint16		
	Accessibility	RW	Can It map	RPDO	Correlation mode	ALL	Data range	0~65535	factory setting	0

Control command:

Bit	name		describe
0	The inverter can operate	Switch on	1-Valid 0 - invalid
1	Turn on the main circuit	Enable voltage	1-Valid 0 - invalid
2	fast stop	Quick stop	0-Valid 1 - invalid
3	Inverter operation	Enable operation	1-Valid 0 - invalid
4~6	Operation mode related	Operation mode specific	Related to operation mode

7	Fault reset	Fault reset	Fault reset, the rising edge is valid and remains 1 invalid
8	Undefined	Reserved	Undefined
9	Operation mode related	Operation mode specific	Close first with operation mode
10	retain	Reserved	Undefined
11~15	Manufacturer defined	Manufacturer-specific	Manufacturer defined

Bit8 ~ 15 has no function defined at present.

Indexes 6041h	name	Status word Status word	Setting effective	-	data structure	VAR	data type	Uint16		
	Accessibility	RO	Can It map	TPDO	Correlation mode	ALL	Data range	0~65535	factory setting	0

Feedback inverter status:

Bit	name		describe
0	Inverter ready	Ready to switch on	1-Valid 0 - invalid
1	The inverter can operate	Switch on	1-Valid 0 - invalid
2	Inverter operation	Operation enabled	1-Valid 0 - invalid
3	fault	Fault	1-Valid 0 - invalid
4	The main circuit is electrically connected	Voltage enabled	1-Valid 0 - invalid

5	fast stop	Quick stop	0-Valid 1 - invalid
6	Servo not running	Switch on disabled	1-Valid 0 - invalid
7	Undefined		
8	Manufacturer defined	Manufacturer-specific	
9	Remote control	Remote	1-Control word valid 0 - invalid
10	Target arrival	Target reach	1-Valid 0 - invalid
11~15	Undefined		

Value (binary)	describe
Xxxx xxxx x0xx 0000	Not ready (Not ready to switch on)
Xxxx xxxx x1xx 0000	Start failed (switch on disabled)
Xxxx xxxx x01x 0001	Ready (Ready to switch on)
Xxxx xxxx x01x 0011	Start (Switch on)
Xxxx xxxx x01x 0111	Operation enabled
Xxxx xxxx x00x 0111	Quick stop active
Xxxx xxxx x0xx 1111	Fault reaction active
Xxxx xxxx x0xx 1000	Fault

Indexes	name	Target speed vl target velocity			Setting effective	Operation setting	data structure	VAR	data type	int16
	Accessiblity	RO	Can It	RPDO	Correlation mode	vl	Data range	32768~32767	factor y	0

		map				setting	
<p>(1) The unit of target speed shall be determined according to F8-64: 0 (Hz) 1 (RPM)</p> <p>(2) When the unit is Hz, the correlation (F0-22) needs to be set according to the unit of frequency. If F0-22 = 2, the frequency resolution is 0.01Hz. Assuming that the target frequency needs to be set to 10.00hz, the communication needs to write 1000; If F0-22 = 1, the frequency resolution is 0.1Hz. Assuming that the target frequency needs to be set to 10.0hz, the communication needs to write 100.</p> <p>(3) When the unit is rpm, the maximum speed only supports - 32768rpm ~ 32767rpm. If it exceeds this range, please use Hz bit unit to support higher speed setting.</p>							

Indexes	name	Speed setting vl velocity demand			Setting effective		data structure	VAR	data type	int16
	Accessability	RO	Can It map	RPDO	Correlation mode	vl	Data range	-32768~32767	factory setting	0
<p>(1) Speed setting, speed setting through ramp generator.</p> <p>(2) The speed display unit is consistent with the description of 6042h.</p>										

Indexes	name	Target speed vl velocity actual value			Setting effective		data structure	VAR	data type	int16
	Accessability	RO	Can It map	TPDO	Correlation mode	vl	Data range	- 32768~32767	factory setting	0
<p>(1) The actual operating speed of inverter, if VF control, represents the synchronization frequency; In the case of SVC control, the speed is estimated according to the motor mathematical model.</p> <p>(2) The speed display unit is consistent with the description of 6042h.</p>										

Indexes	name	Min / max speed	Setting effective		data structure	ARR	data type	Uint32
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6046h		vI velocity min max amount								
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	OD data range	factory setting	Od default
(1) The minimum or maximum speed at which the inverter operates.										

Subindex 0h	name	Number of minimum / maximum speed sub indexes			Setting effective	-	data structure	-	data type	Uint8
	Accessibility	RO	Can It map	NO	Correlation mode	vI	Data range	-	factory setting	2

Subindex 1h	name	Minimum speed vI velocity min amount			Setting effective	-	data structure	VAR	data type	Uint32
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	0~65535	factory setting	0
(1) The minimum allowable speed of the inverter, in RPM. The actual set value can be seen by querying f0-14, and the unit of f0-14 is Hz										

Subindex 2h	name	Maximum speed vI velocity max amount			Setting effective		data structure	VAR	data type	Uint32
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	0~65535	factory setting	1500
(1) The maximum allowable speed of the inverter, in RPM, is limited by the maximum frequency (F0-10).										

Indexes 6048h	name	Acceleration settings vI velocity acceleration			Setting effective		data structure	ARR	data type	Uint32
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	OD data range	factory setting	Od default
(1) Set the acceleration time of the inverter										

Subindex 0h	name	Number of accelerated sub indexes			Setting effective	-	data structure	-	data type	Uint8
	Accessibility	RO	Can It map	NO	Correlation mode	vI	Data range	-	factory setting	2

Subindex 1h	name	Speed variation Delta speed			Setting effective	-	data structure	VAR	data type	Uint32
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	1 ~ 65535 (unit: RPM)	factory setting	1500
(1) Confirm that F0-25 = 0. If other values are set, the acceleration time will be calculated incorrectly.										

Subindex 2h	name	Time variation Delta time			Setting effective		data structure	VAR	data type	Uint16
	Accessibility	RW	Can It map	RPDO	Correlation mode	vI	Data range	0 ~ 65536 (unit: s)	factory setting	20
(1) F0-19 needs to set 1 or 2. If 0 is set, the calculation of acceleration and deceleration time will be inaccurate due to calculation error.										

Indexes 6049h	name	Deceleration setting vl velocity deceleration	Setting effective		data structure	AR R	data type	Uint32		
	Accessibility	RW	Can It map	RPDO	Correlation mode	vl	Data range	OD data range	factory setting	Od default

Subindex 0h	name	Number of decelerator indexes			Setting effective	-	data structure	-	data type	Uint8
	Accessibility	RO	Can It map	NO	Correlation mode	vl	Data range	-	factory setting	2

Subindex 1h	name	Speed variation Delta speed			Setting effective	-	data structure	VAR	data type	Uint32
	Accessibility	RW	Can It map	RPDO	Correlation mode	vl	Data range	1~65535	factory setting	1500
(1) Confirm that f0-25 = 0. If other values are set, the deceleration time will be calculated incorrectly.										

Subindex 2h	name	Time variation Delta time			Setting effective		data structure	VAR	data type	Uint16

	Accessibility	RW	Can It map	RPDO	Correlation mode	vl	Data range	0~65535	factory setting	20
(1) F0-19 needs to set 1 or 2. If 0 is set, the calculation of acceleration and deceleration time will be inaccurate due to calculation error.										

Indexes 605Ah	name	Fast shutdown mode selection  Quick stop option code			Setting effective		data structure	VAR	data type	Int16
	Accessibility	RW	Can It map	NO	Correlation mode	ALL	Data range	0~2	factory setting	1

(1) Setpoint definition

Set value	Shutdown mode
0	Coast to stop
1	Deceleration stop: the deceleration time is f0-18, i.e. the set time of 6049h in VL mode
2	For emergency stop, the deceleration time is the time set by f8-60

Indexes 605Bh	name	Stop mode selection  Shut down option code			Setting effective		data structure	VAR	data type	Int16
	Accessibility	RW	Can It map	NO	Correlation mode	ALL	Data range	0~1	factory setting	1



## (1) Setpoint definition

Set value	Shutdown mode
0	Coast to stop
1	Deceleration stop: the deceleration time is f0-18, i.e. the set time of 6049h in VL mode

Indexes 605Ch	name	Off enable shutdown mode selection Disable operation option code			Setting effective		data structure	VAR	data type	Int16
	Accessibility	RW	Can It map	NO	Correlation mode	ALL	Data range	0~1	factory setting	1

## (1) Setpoint definition

Set value	Shutdown mode
0	Coast to stop
1	Deceleration stop: the deceleration time is f0-18, i.e. the set time of 6049h in VL mode

Indexes	name	Fault shutdown mode selection	Setting effective		data structure	VAR	data type	Int16
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605Eh		Disable operation option code								
	Accessibility	RW	Can It map	NO	Correlation mode	ALL	Data range	0	factory setting	0
(1) The current value supports 0, coast to stop										

Indexes 6060h	name	Mode selection setting Mode of operation	Setting effective		data structure	VAR	data type	Int8		
	Accessibility	RW	Can It map	RPDO	Correlation mode	ALL	Data range	0~9	factory setting	2

(1) Setpoint definition

Set value	Operation mode
0	NA
1	NA
2	(speed mode) VL
3	NA
4	NA
5	NA
6	NA
7	NA
8	NA
9	(periodic synchronous speed mode) CSV

--

Indexes 6061h	name	Current mode selection Mode of operation display	Setting effective	-	data structure	VAR	data type	Int8		
	Accessibility	RO	Can It map	RPDO	Correlation mode	ALL	Data range	0~9	factory setting	9

## (1) Setpoint definition

Set value	Operation mode
0	NA
1	NA
2	(speed mode) VL
3	NA
4	NA
5	NA
6	NA
7	NA
8	NA
9	(periodic synchronous speed mode) CSV

Indexes 606Ch	name	Speed feedback Velocity actual value			Setting effective	-	data structure	VAR	data type	Int32
	Accessibility	RO	Can It map	TPDO	Correlation mode	CSV	Data range	-231~ (231-1)	factory setting	-
(1) Actual operation speed of inverter										

Indexes 6077h	name	Actual torque Torque actual value			Setting effective	-	data structure	VAR	data type	Int16
	Accessibility	RO	Can It map	TPDO	Correlation mode	ALL	Data range	(unit: 0.1%)	factory setting	-
(1) The unit is based on the rated torque of the motor										

Indexes 607Eh	name	Command polarity Polarity			Setting effective	-	data structure	VAR	data type	UInt8
	Accessibility	RO	Can It map	TPDO	Correlation mode	CSV	Data range	0~255	factory setting	0
(1) Bit6 sets the target speed limit to 0, and the target speed is (60ff + 60b1);Set to 1, target speed is - (60ff + 60b1)										

Indexes 60B1h	name	Speed offset Velocity Offset	Setting effective	-	data structure	VAR	data type	Int32		
	Accessibility	RO	Can It map	TPDO	Correlation mode	CSV	Data range	-231 ~ (231-1)	factory setting	0

Indexes 60FFh	name	Target speed  Target velocity	Setting effective	-	data structure	VAR	data type	Int32		
	Accessibility	RW	Can It map	YES	Correlation mode	CSV	Data range	-231 ~ (231-1) unit: (RPM)	factory setting	0

Indexes 6502h	name	Support mode Supported drive modes			Setting effective	-	data structure	VAR	data type	Uint32
	Accessibility	RO	Can It map	RO	Correlation mode	ALL	Data range	0~232	factory setting	0x00000102

bit	Operation mode
0	NA
1	VL support
2	NA
3	NA
4	NA

5	NA
6	NA
7	NA
8	CSV support
9~31	retain

Indexes 20FDh	name	Distribution group parameters	Setting effective	-	data structure	ARR	data type	Uint16	
	Accessibility	RW	Can It map	NO	Correlation mode	ALL	Data range	factory setting	0

Subindex 8h	name	Does the object dictionary support power down saving			Setting effective	-	data structure	VAR	data type	Uint16
	Accessibility	RW	Can It map	RPDO	Correlation mode	ALL	Data range	0~1	factory setting	0

(1) Fd-07 control object dictionary can modify whether to save after power failure through SDO, set "0" to not save after power failure, and set "1" to save after power failure.

(2) For some objects only, please refer to the following table:

Object dictionary	Support SDO power down saving
603F	I won't support it
6040	It doesn't support

6041	It doesn't support
6042	It doesn't support
6043	It doesn't support
6044	It doesn't support
6046-0	It doesn't support
6046-1	support
6046-2	support
6048-0	It doesn't support
6048-1	support
6048-2	support
6049-0	It doesn't support
6049-1	support
6049-2	support
605A	support
605B	support
605C	support
605E	support
6060	support
6061	It doesn't support
606C	It doesn't support
6077	It doesn't support
607E	support
60B1	It doesn't support

	60FF	It doesn't support
--	------	--------------------

Subindex	name	Support 402 mode			Setting effective	-	data structure	VAR	data type	Uint16
Ch	Accessibility	RW	Can it map	RPDO	Correlation mode	ALL	Data range	0~1	factory setting	0
(1) Set "0" to work in non 402 mode and "1" to work in 402 mode.										



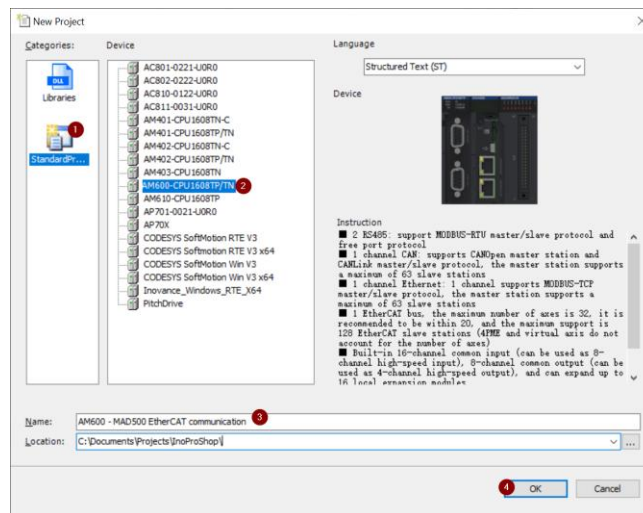
## 7 PROJECT EXAMPLES

### 7.1 INOPROSHOP PROJECT (INOVANCE'S AM/AC SERIES CONTROLLERS)

The AM600 master station is used as an example to describe how to use the SI-ECAT card with the master station.

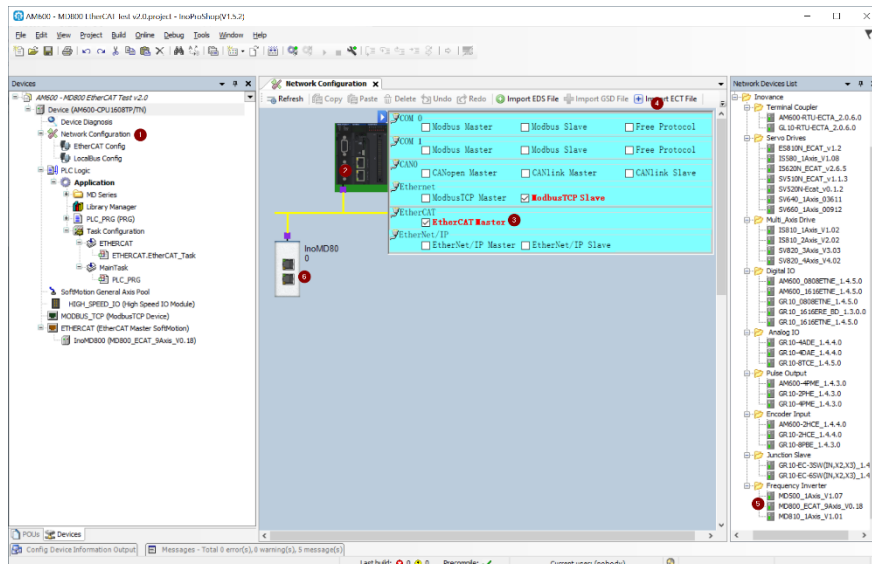
1) Start the software and create an AM600 project.

Select AM600-CPU1608TP, as shown in the following figure.



2) Add the MD500 AC drive slave station.

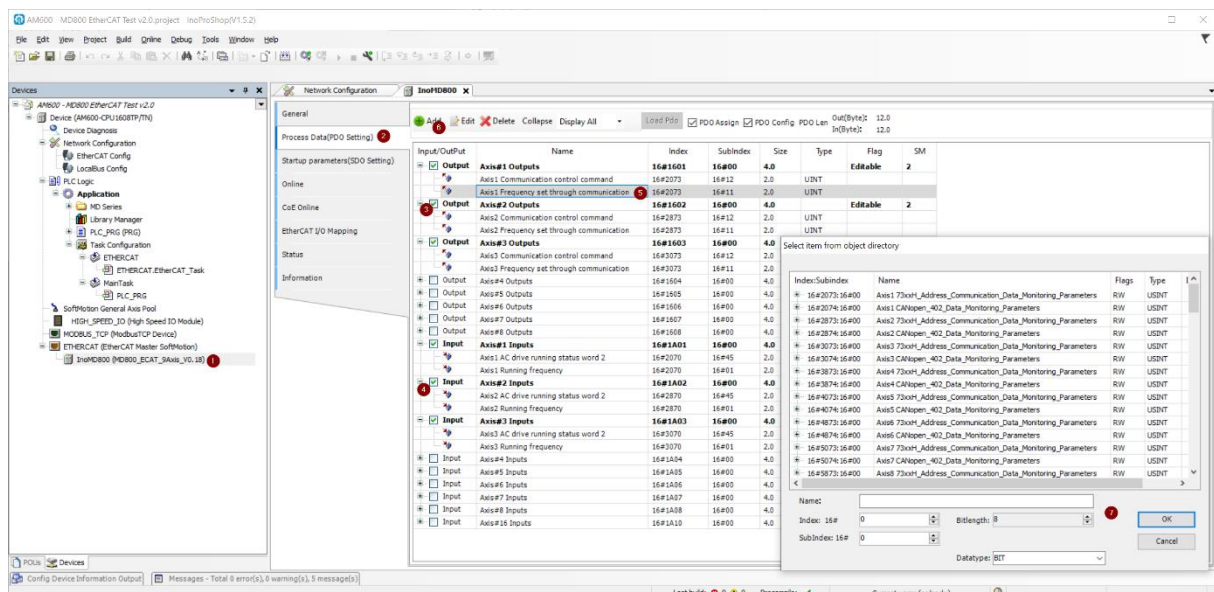
1. Open the network configuration.
2. Select CPU.
3. Enable EtherCAT Master.
4. Import the EtherCAT configuration file of MD500. If any configuration file of other version exists, delete the existing configuration file before importing a new one.
5. Drag the device in the network device list.
6. Add the AC drive slave station, as shown in the following figure.



### 3) Configure PDO parameters.

1. Select EtherCAT Slave.
2. Open PDO Setting tab.
3. Enable Input/Output PDOs related to each axis. The MD800 can handle up to 8 axes.
4. Select Input/Output PDOs.
5. Click on Add button.
6. Select the required PDO and add to PDO settings list.

Control Command and Inverter State of the RPDO cannot be changed and they must be set as the first items. Otherwise, the running will be abnormal.



## 7.2 BECKHOFF'S CONTROLLER

Beckhoff's TwinCAT master station is used as an example to describe the configuration of the SI-ECAT card.

**NOTE:** The 100M Ethernet network adapter with Intel chip must be used. Other network adapters may not support EtherCAT.

1. Install TwinCAT.

Windows XP system: **tcats\_2110\_2230** is recommended.

Windows 7 32-bit system: **tcats\_2110\_2248** is recommended.

2. Copy the EtherCAT configuration file (MD800\_9Axis\_V0.18.xml) of MD800 to the

TwinCAT installation directory.

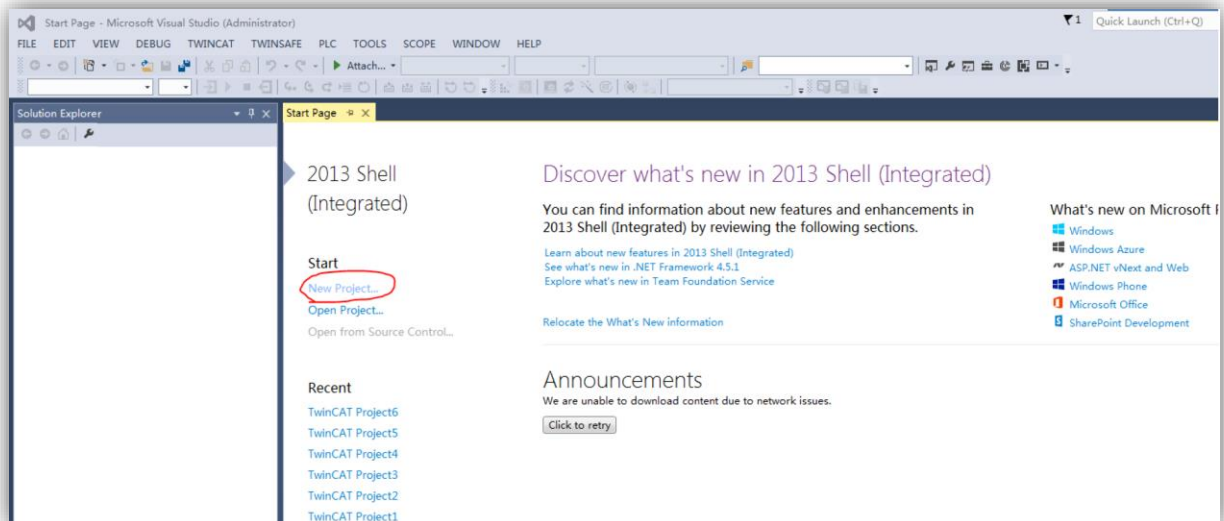
TwinCAT2 directory: **TwinCAT\IO\EtherCAT**

TwinCAT3 directory: **TwinCAT\3.1\config\IO\EtherCAT**

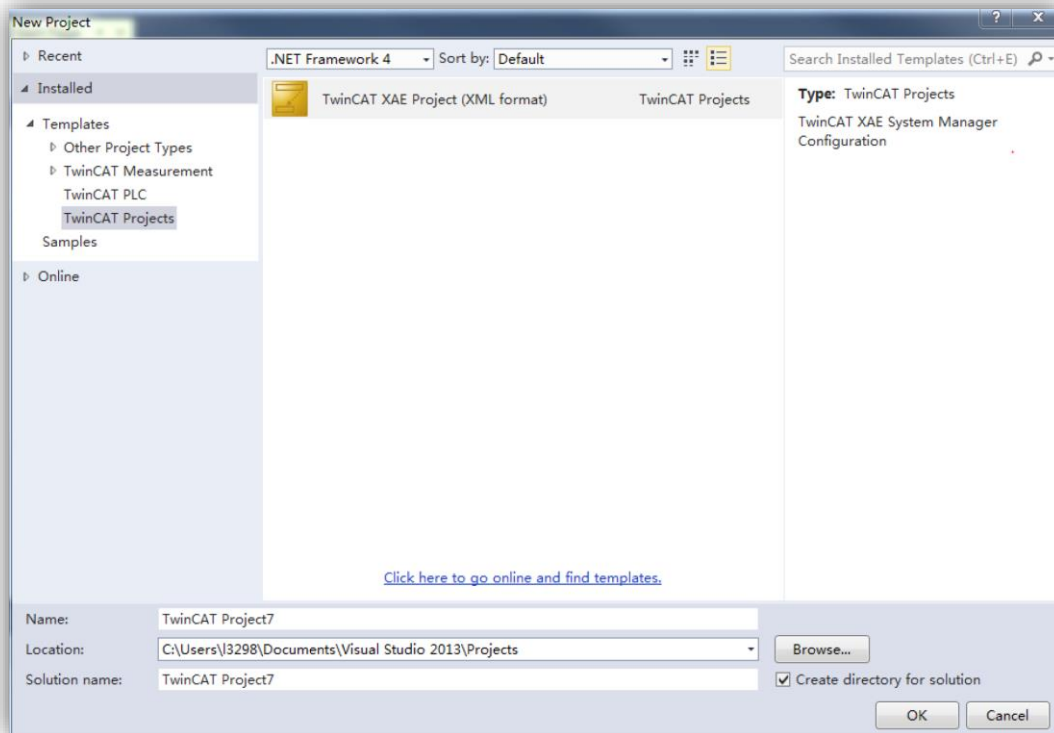
TwinCAT3 is used as an example in the following section. The operation steps for TwinCAT2 are similar.

3. Start TwinCAT.

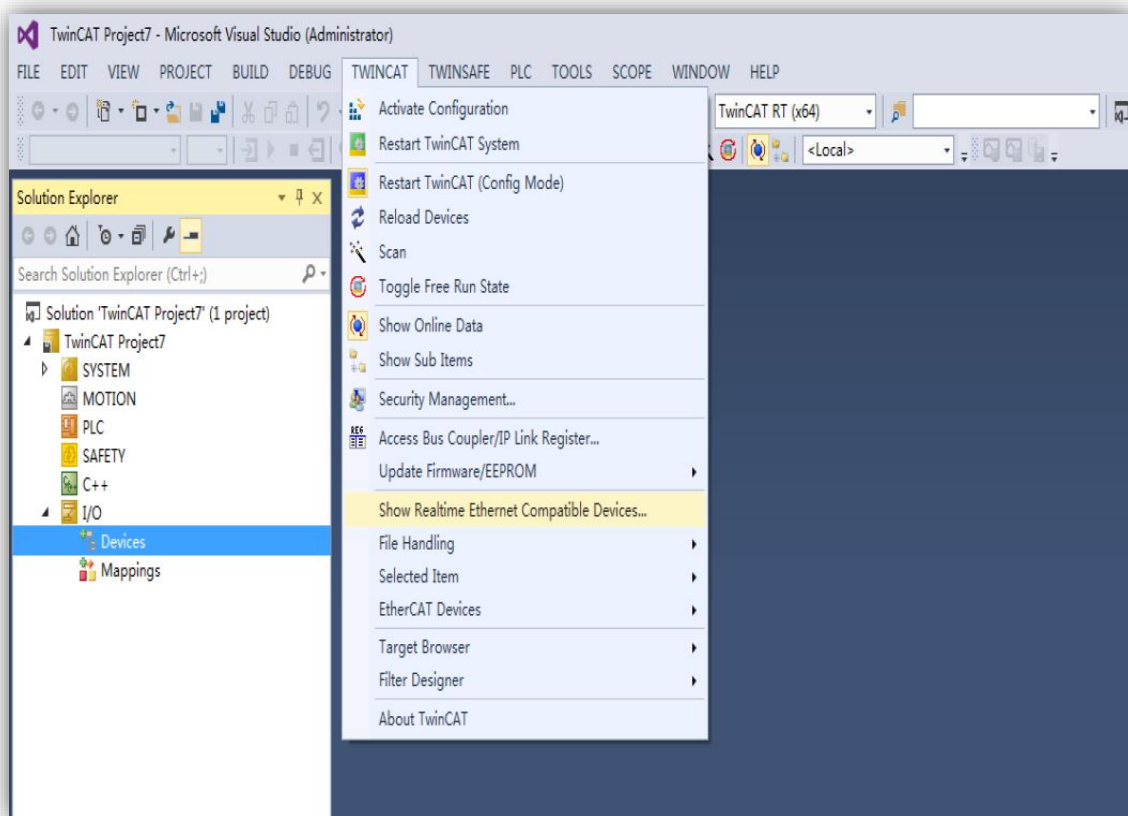
Click **New Project** to create a project.



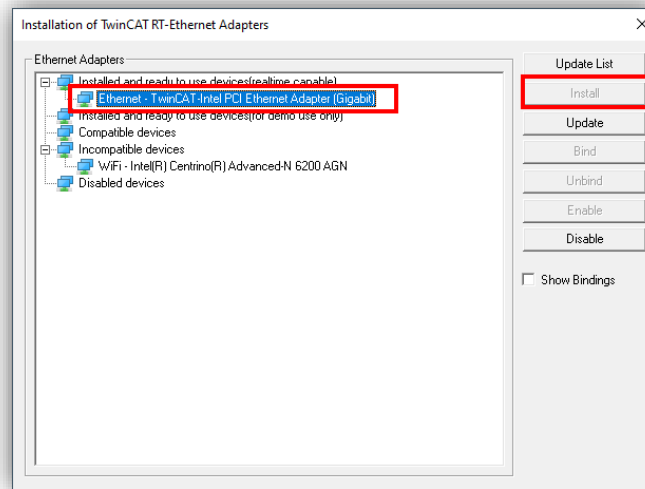
Select TwinCAT XAE Project and click **OK**.



4. Install the TwinCAT network adapter driver.

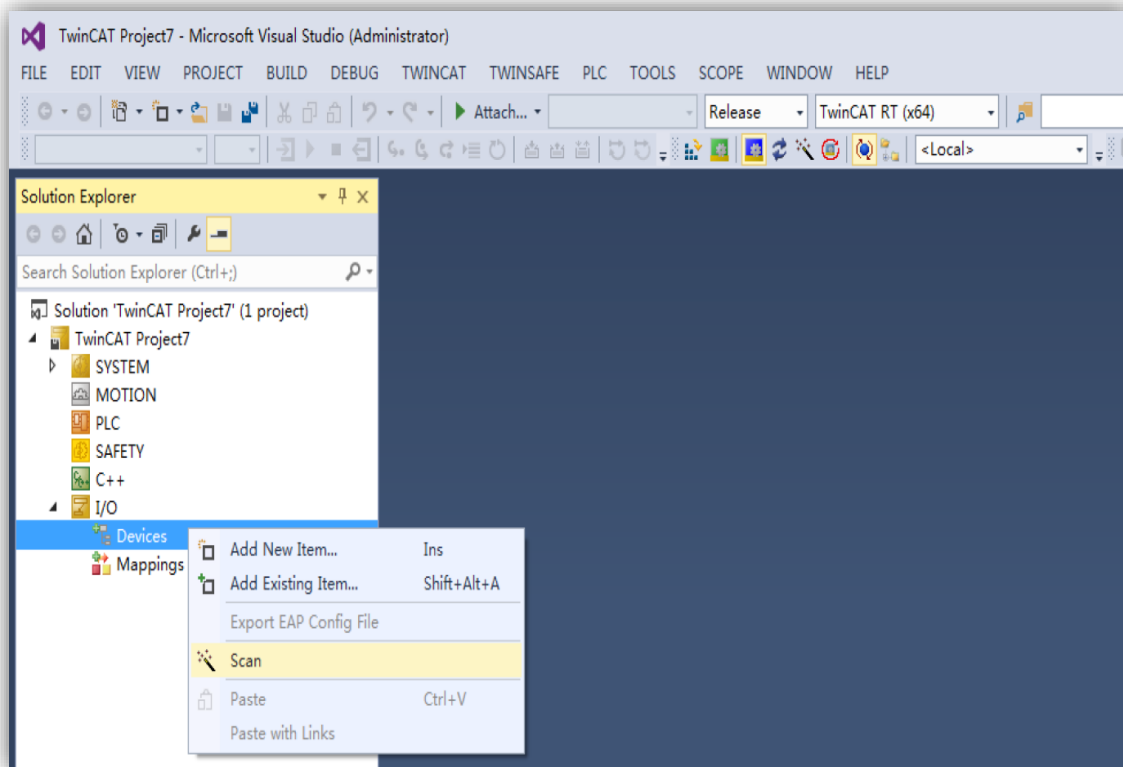


Choose **TWINCAT > Show Real Time Ethernet Compatible Devices....** In the displayed dialog box, select the local network adapter in **Incompatible devices**, and click **Install**. After installation, the installed network adapter is displayed in **Installed and ready to use devices**.

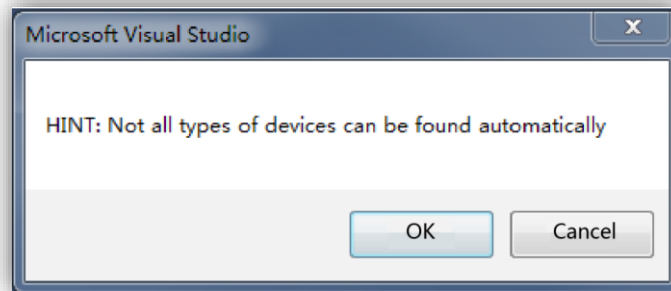


## 5. Search for devices.

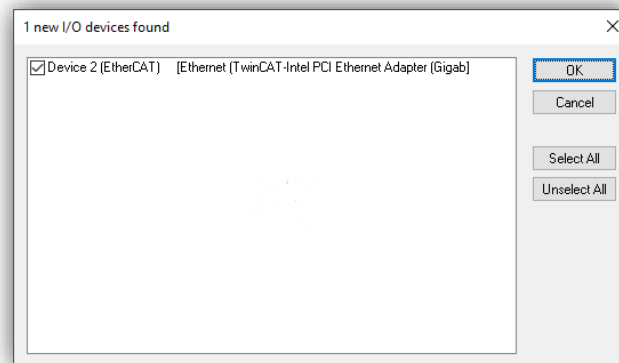
Create a project, right-click **Device**, and then click **Scan** to search for devices, as shown in the following figure.



The following message appears. Click **OK**.



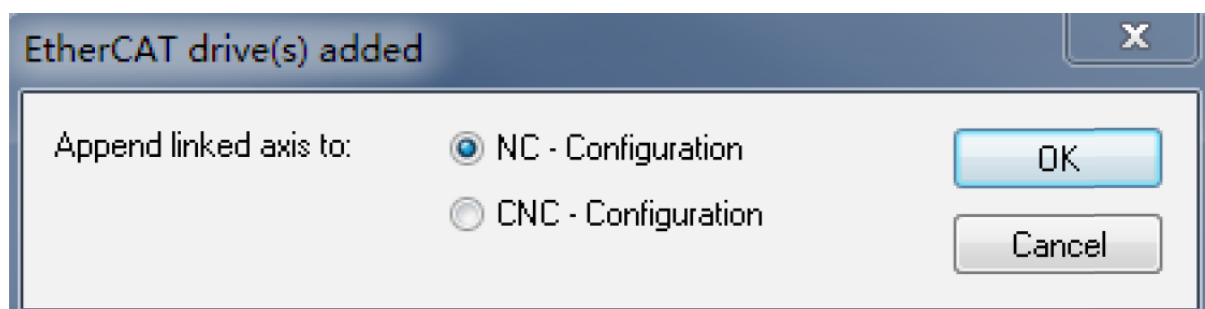
Select EtherCAT device and click **OK**.



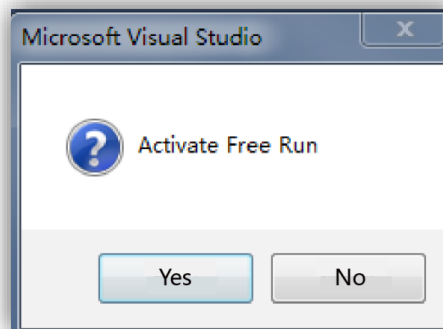
Click **Yes**.



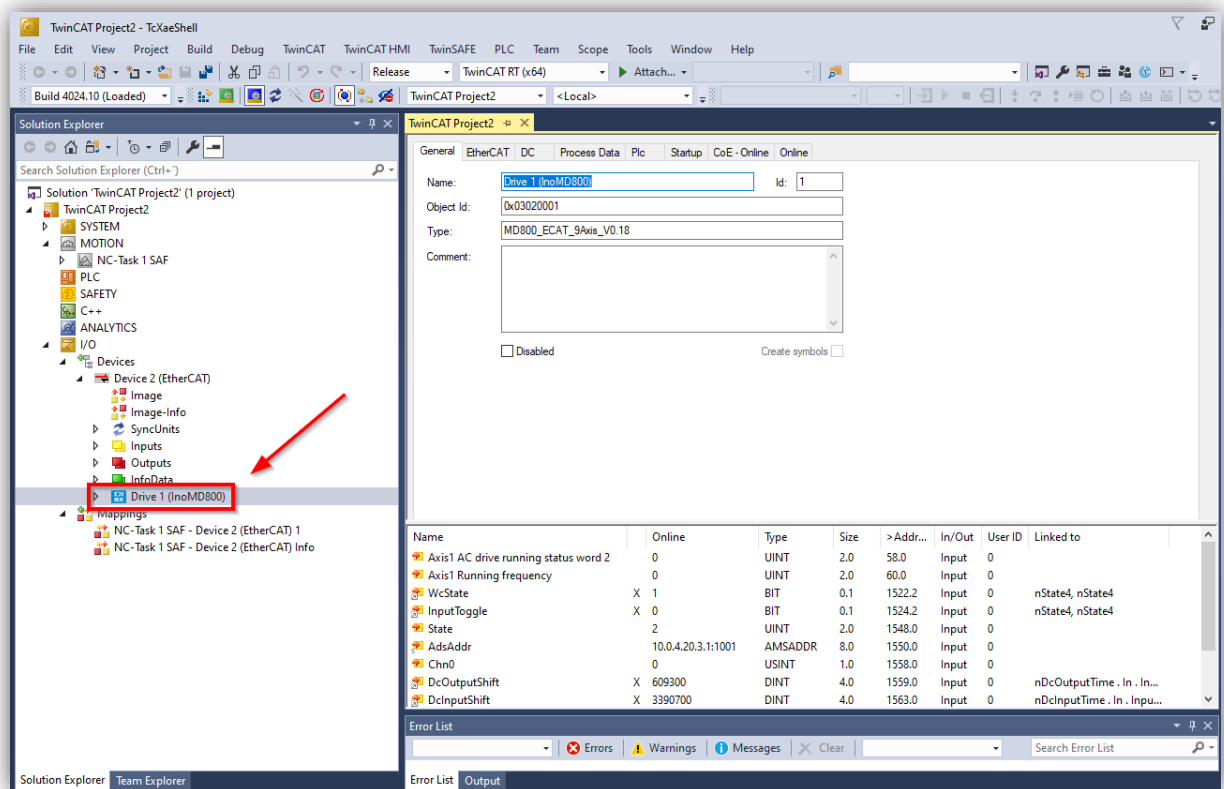
Select NC configuration and click **OK**.



Click **No**.



Now the equipment search is complete, as shown in the following figure:





## 7.2.1 CONFIGURE PDO PARAMETERS.

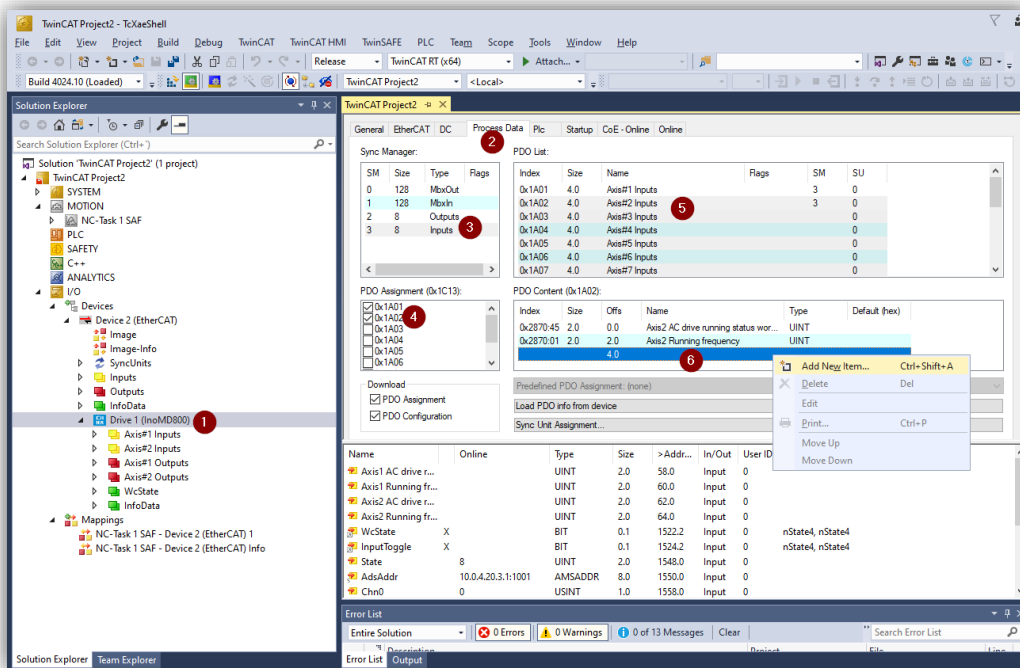
---

### **Configure TPDO.**

- 1) Open drive configuration
- 2) Open “Process Data” tab
- 3) Select “Inputs”
- 4) Select 0x1A01, 0x1A02, 0x1A03, etc. to enable axis 1, axis 2, axis 3, etc. PDO inputs.
- 5) Select the corresponding index to configure the PDOs
- 6) The first two items are set to TPDO by default and cannot be changed. Right click at the position indicated by step 6 in the following figure to add the TPDO mapping as required.

Each drive or the rectifier has a specific index:

- 0x1A01 Drive 1
- 0x1A02 Drive 2
- 0x1A03 Drive 3
- 0x1A04 Drive 4
- 0x1A05 Drive 5
- 0x1A06 Drive 6
- 0x1A07 Drive 7
- 0x1A08 Drive 8
- 0x1A10 Rectifier

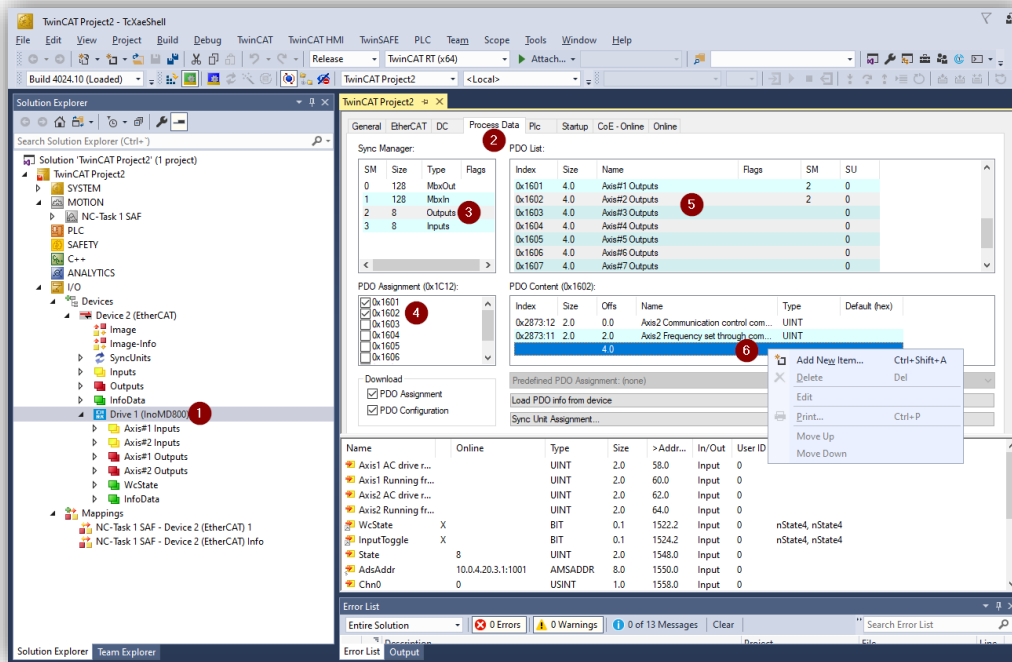


## Configure RPDO.

- 7) Open drive configuration
- 8) Open “Process Data” tab
- 9) Select “Outputs”
- 10) Select 0x1601, 0x1602, 0x1603, etc. to enable axis 1, axis 2, axis 3, etc. PDO outputs.
- 11) Select the corresponding index to configure the PDOs
- 12) The first two items are set to RPDO by default and cannot be changed. Right click at the position indicated by step 6 in the following figure to add the RPDO mapping as required.

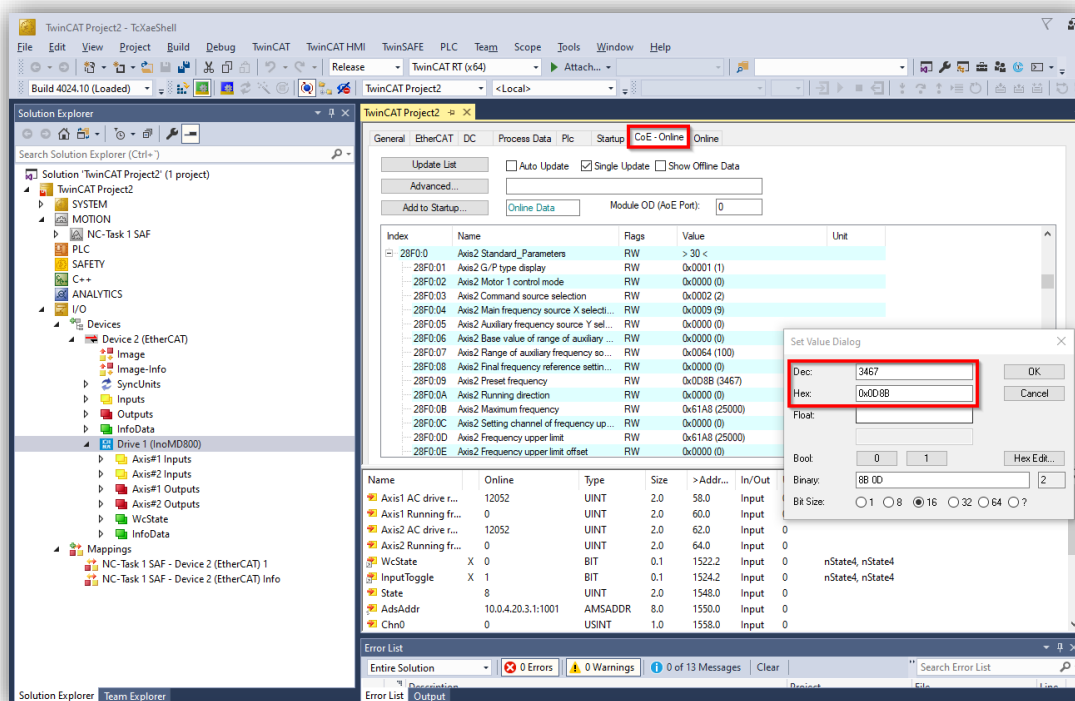
Each drive has a specific index:

- 0x1601 Drive 1
- 0x1602 Drive 2
- 0x1603 Drive 3
- 0x1604 Drive 4
- 0x1605 Drive 5
- 0x1606 Drive 6
- 0x1607 Drive 7
- 0x1608 Drive 8




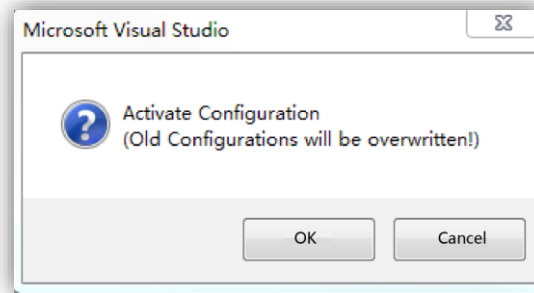
## 2. View the SDO data list.

After the OP state is activated, you can view real-time data in the SDO data list or double-click the object dictionary to modify the SDO data.

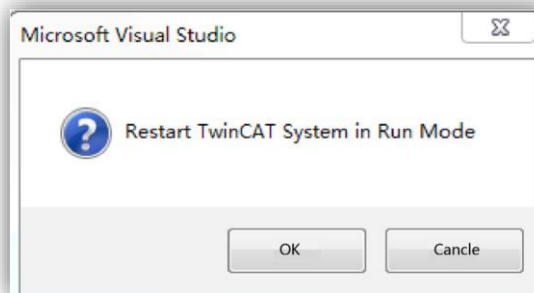


## 3. Activate the configuration and switch over to the running mode.

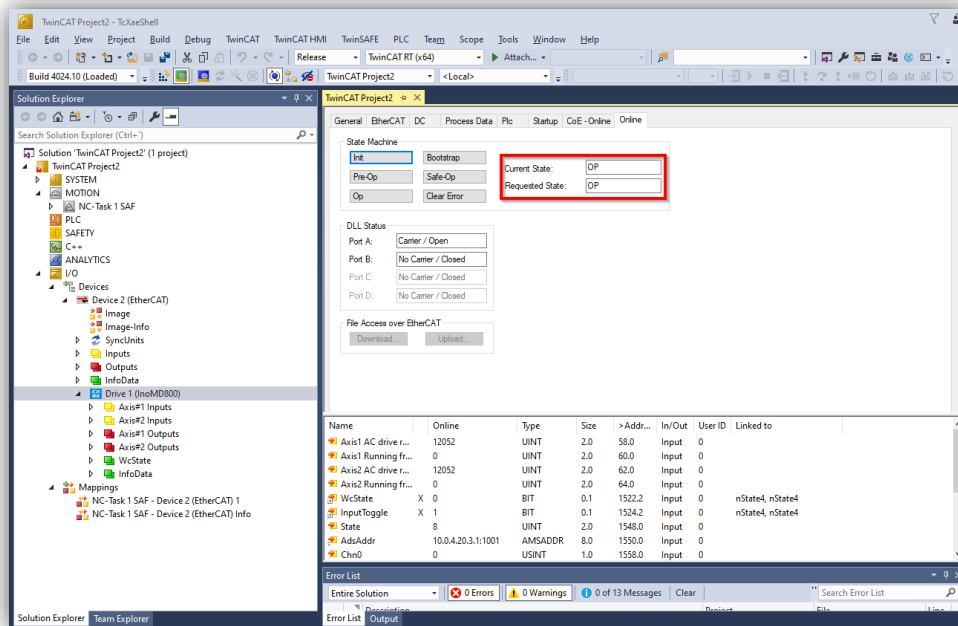
Click . The following dialog box is displayed.



Click **OK**.

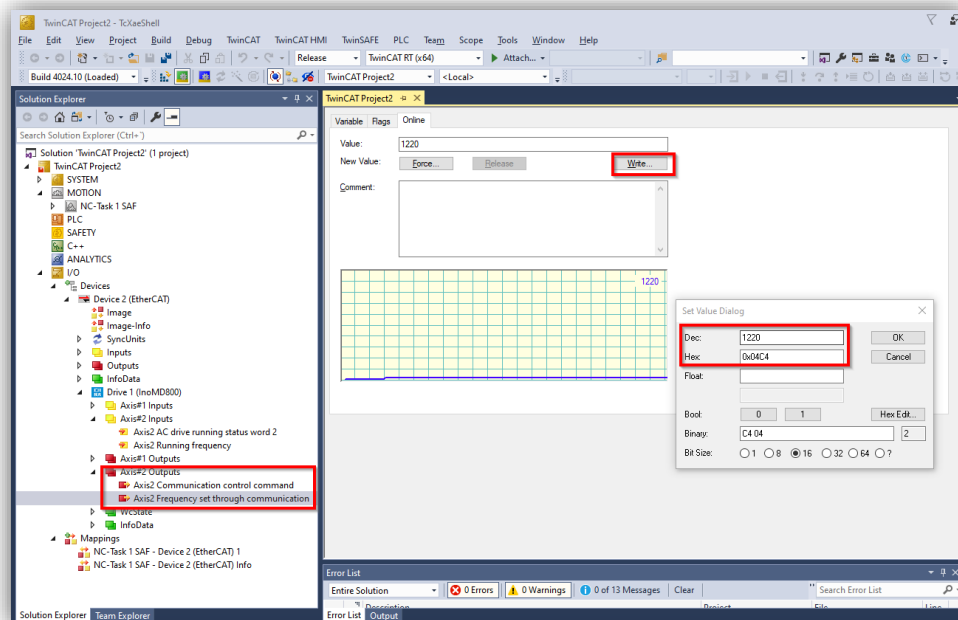


Click OK to enter the OP state.



#### 4. Control the AC drive through PDO.

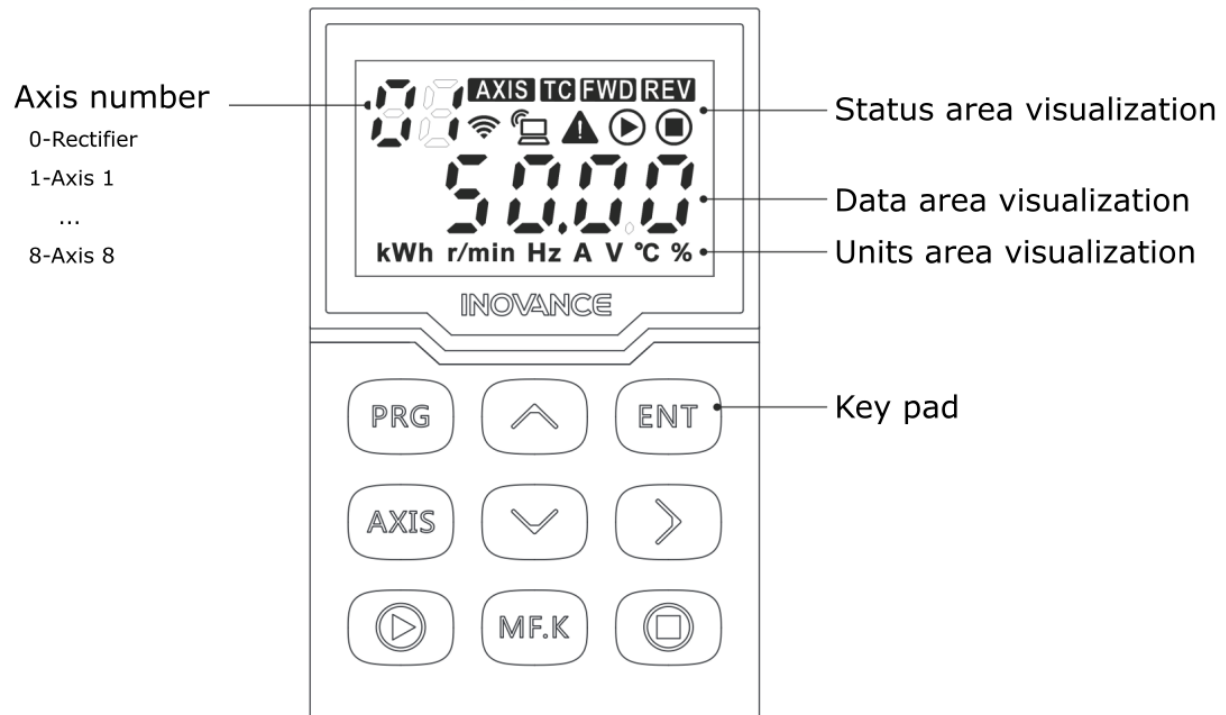
Write corresponding values through the configured RPDO to control the AC drive.



## 8 MD800 BRIEF DESCRIPTION



### 8.1 KEYPAD

The LED operation panel can display operating status, parameter settings, fault information, etc. The below image shows the operation panel distribution:



Key description:

Button	Name	Function
	Programming key	Return to the previous screen; Enter the first level menu.
	Enter	Go to the next screen; Confirmation of mode, parameter and set value.
	Multi-axis switch key	To switch between multiple axes, rectifier is selected by default.
	Increment key	Change (increase) the parameter number and set value.
	Decrement key	Change (decrease) the parameter number and set value.
	Shift key	Shift left to select display parameters. The digits that need to be changed when setting parameter numbers and values are shifted to the left.
	Multi-function selection key	According to the set value of F7-01, switch between the selected functions.

	Run key	In the start-stop control mode of the operation panel, it is used for running operation.
	Stop command / fault reset	In the running state, it is used to stop the running operation. In the fault alarm state, it is used to reset operation.

## 8.2 INVERTER MODULE LEDS

**Table 1 - Description of Inverter Module Indicators**

Indicator symbol	Indicator name	Status description
PWR (yellow)	Power Indicator	Steady on: The device is in the power-on state. Off: The device is powered off
RUN (green)	Running lights	Steady on: The device is in operation. Off: The device is in a stopped state. Flashing: operated by rectifier keyboard
ERR (red)	Alarm indicator	Steady on: The device is malfunctioning. Off: The device is normal. Flashing: The device has an alarm

## 8.3 RECTIFIER MODULE DISPLAY







### Keypad Data Display

- Axis number




Two-digit digital tube display, 0 means rectifier module, 1~8 means inverter module.

- Status display area

**Table 2 - Status icon description**

Icon	Name	Function description	Status description
	Axis (AXIS)	Multi-axis switch key	—
	Torque control (TC)	Torque control mode	Steady on: the device is in torque control mode Blinking: the device is in the state of autotuning
	Forward (FWD)	Forward running	—
	Reverse (REV)	Reverse running	—
	Wi-Fi	Wi-Fi connection mode	—
	Remotely	Remote connection mode	Steady on: The command source is selected as the terminal control channel Blinking: The command source is selected as the communication control channel



	Alert	Alarm status	Steady on: The device is malfunctioning Flashing: The device has an alarm
	Run	Operating status	—
	Stop	Stop status	—

- Data display area


There are a total of 5 LED data displays on the operation panel, which can display the set frequency, output frequency, various monitoring data, and alarm codes.



- Unit display area

Unit	Description
kWh	Energy unit
r/min	Speed unit
Hz	Frequency unit
A	Current unit
V	Voltage unit
°C	Temperature unit
%	Percentage

## 8.3.1 RELATED PARAMETERS

Parameter	Parameter name	Default Value	Setting Range	Description
F7-01	MF.K key function selection	0	0: MF.K is invalid 1: Switch between terminal command channel or communication command 2: Forward and reverse switching 3: Forward jog 4: Reverse jog	The MF.K key on the operation panel is a multi-function key, and the MF.K key is set by this parameter Function: 0: MF.K is invalid This key has no function. 1: Switch between terminal command channel or communication command F0-02 is set to 0 (operation panel), there is no effect after pressing the MF.K key F0-02 Set to 1 (terminal), through the MF.K key can be realized between the terminal and the operation panel Switch; F0-02 is set to 2 (communication), through the MF.K key can realize the communication and

				<p>Switch between operation panels.</p> <p>2: Forward and reverse switching Switch the direction of frequency command by MF.K key. This function is only available when the command source is running. It is valid when the command is the operation panel.</p> <p>3: Forward jog Realize forward jog (FJOG) by MF.K key. This function is only available in the command source. It is valid when the line command is the operation panel.</p> <p>4: Reverse jog Reverse jog (RJOG) is realized by MF.K key. This function only runs at the command source. It is valid when the command is an operation panel.</p>
F7-02	STOP key function	0	<p>0: Only in keyboard operation mode: STOP/RES</p> <p>1: In any operation mode, the STOP/RES key stops</p>	<p>The STOP button on the operation panel is the stop/reset button, set STOP behavior by this parameter. The function of the key.</p> <p>0: Only in the keyboard operation mode, the stop function of the STOP key is valid.</p> <p>Only in the keyboard operation mode, the stop reset function of the STOP key is valid.</p> <p>1: In any operation mode, the stop function of the STOP key is valid.</p> <p>In any operation mode, the stop reset function of the STOP key is valid.</p>
F7-03	Display parameter 1	31	<p>BIT00: Operating frequency (Hz)</p> <p>BIT01: Setting frequency (Hz)</p> <p>BIT02: Bus voltage (V)</p> <p>BIT03: Output voltage (V)</p> <p>BIT04: Output current (A)</p> <p>BIT05: output power (kW)</p> <p>BIT06: Output torque (%)</p> <p>BIT07: DI input status</p> <p>BIT08: DO output status</p> <p>BIT09: AI1 voltage (V)</p> <p>BIT10: AI2 voltage (V)</p>	<p>If you need to display the following parameters during operation, set their corresponding positions to 1. Set this binary number to hexadecimal and set it in F7-03.</p> <p>Pressing the shift key  the configured parameters can be displayed</p>

			BIT11: AI3 voltage (V) BIT12: count value BIT13: length value BIT14: Load speed display BIT15: PID setting	
F7-04	Display parameter 2	0	BIT00: PID feedback BIT01: PLC stage BIT02: reserved BIT03: Operating frequency 2 (Hz) BIT04: Remaining running time BIT05: reserved BIT06: reserved BIT07: reserved BIT08: Linear speed BIT09: Current power-on time (Min) BIT10: current running time (Min) BIT11: reserved BIT12: Communication setting value BIT13: reserved BIT14: Main frequency X display BIT15: auxiliary frequency Y display	If you need to display the following parameters during operation, set their corresponding positions to 1. Set this binary number to hexadecimal and set it in F7-04.  Pressing the shift key  the configured parameters can be displayed
F7-05	Stop display parameters	51	BIT00: set frequency (Hz) BIT01: bus voltage (V) BIT02: DI input status BIT03: DO output status BIT04: AI1 voltage (V) BIT05: AI2 voltage (V) BIT06: AI3 voltage (V) BIT07: Count value BIT08: length value BIT09: PLC stage BIT10: Load speed display BIT11: PID setting BIT12: reserved	If you need to display the following parameters during stop state, set their corresponding positions to 1, Convert this binary number to hexadecimal and set it in F7-05.  Pressing the shift key  the configured parameters can be displayed
FP-01	Parameter initialization	1	0: No operation 1: Restore factory parameter mode 1 2: Clear record information 4: Backup user current parameters	Set the corresponding actions when the inverter performs parameter initialization. 0: No operation The inverter does not perform any operation. 1: Restore factory parameter mode 1

			<p>501: Restore user backup parameters</p>	<p>Most of the inverter function parameters are restored to the factory parameters, but the motor parameters</p> <p>Maximum frequency (F0-10), frequency command decimal point (F0-22), fault record Information, cumulative running time (F7-09), cumulative power-on time (F7-12),</p> <p>The cumulative power generation (F7-13) and cumulative power consumption (F7-14) will not recover.</p> <p>2: Clear record information</p> <p>Clear the inverter fault record information, accumulated running time (F7-09), accumulated up Electricity time (F7-12), cumulative power generation (F7-13), cumulative power consumption (F7-14).</p> <p>4: Backup user current parameters</p> <p>Back up the parameter settings set by the current user.</p> <p>501: Restore user backup parameters</p> <p>Restore the parameter setting value backed up by setting FP-01 to 4.</p>
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## 8.4 DIGITAL I/O CONFIGURATION

### 8.4.1 DRIVES DIGITAL I/O CONFIGURATION

Function code	Name	Setting Range	Meaning
F4-00	DI1 hardware source selection	0: no choice 1: Rectifier-DI1 2: Rectifier-DI2 3: Rectifier-DI3 4: Rectifier-DI4 5: Rectifier-DIO1 6: Rectifier-DIO2 7: Rectifier-DIO3 8: Rectifier-DIO4 101: Expansion card 1-DI1 102: Expansion card 1-DI2 103: Expansion card 1-DI3 104: Expansion card 1-DI4 105: Expansion card 1-DI5 106: Expansion card 1-DI6 107: Expansion card 1-DI7 108: Expansion card 1-DI8 201: Expansion card 2-DI1 202: Expansion card 2-DI2 203: Expansion card 2-DI3 204: Expansion card 2-DI4 205: Expansion card 2-DI5 206: Expansion card 2-DI6 207: Expansion card 2-DI7 208: Expansion card 2-DI8	Select the source of the input terminal.
F4-01	DI1 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-02	DI2 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-03	DI2 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-04	DI3 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-05	DI3 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-06	DI4 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-07	DI4 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-08	DI5 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-09	DI5 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-10	DI6 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.

F4-11	DI6 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-12	DI7 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-13	DI7 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-14	DI8 hardware source selection	See function code F4-00 setting range	Select the source of the input terminal.
F4-15	DI8 terminal function selection	0-63. See table below	Select the function of the input terminal.
F4-17	Terminal command mode	<p>0: Two-wire type 1 Two-wire mode 1, access to 2 DI terminals, one is used to control the start and stop of the inverter in forward rotation, and the other is used to control the start and stop of the reverse rotation.</p> <p>1: Two-wire type 2 Two-wire mode 2, access 2 DI terminals, one is used to control the start and stop of the inverter, and the other is used to control the running direction.</p> <p>2: Three-wire 1 Three-wire mode 1, access 3 DI terminals, one is used to control the start and stop of the inverter, and the other 2 are used to control the running direction.</p> <p>3: Three-wire 2 Three-wire mode 2, access 3 DI terminals, one is used to control the start of the inverter, one is used to control the stop, and the other one is used to control the running side to.</p>	There are four different ways to control the operation of the inverter through external terminals.
F4-18	Terminal UP/DOWN change rate	0.001Hz/s~65.535Hz/s	The rate of change when adjusting the frequency through the terminal UP or DOWN When DI terminal function selection is set to terminal UP or terminal DOWN, this parameter needs to be set (the value of F4-01~F4-15 is 6 or 7).
F4-19	DI1 delay time	0.0s~3600.0s	When the state of the digital input terminal DI changes, the inverter delay time for the change. Currently only DI1, DI2, DI3 have set delay
F4-20	DI2 delay time	0.0s~3600.0s	When the state of the digital input terminal DI changes, the inverter

			delay time for the change. Currently only DI1, DI2, DI3 have set delay
F4-21	DI3 delay time	0.0s~3600.0s	When the state of the digital input terminal DI changes, the inverter delay time for the change. Currently only DI1, DI2, DI3 have set delay
F4-22	DI input terminal valid state setting 1	Ones place: 0: High level active 1: active low Ten: 0: High level active 1: active low hundreds: 0: High level active 1: active low Thousands: 0: High level active 1: active low Ten thousand: 0: High level active 1: active low	Set the effective mode of DI1~DI5 terminal through the ones place, tens place, hundreds place, thousands place and ten thousand place of this parameter. 0: high level active DI terminals (DI1~DI5) are valid when connected to COM, and invalid when disconnected from COM. 1: Active low DI terminals (DI1~DI5) are invalid when connected to COM, and valid when disconnected from COM.
F4-23	DI input terminal valid state setting 2	Ones place: 0: High level active 1: active low Ten: 0: High level active 1: active low hundreds: 0: High level active 1: active low Thousands: 0: reserved Ten thousand: 0: reserved	Set the effective mode of DI1~DI8 terminal through the ones place, tens place, hundreds place, thousands place and ten thousand place of this parameter. 0: high level active DI terminals (DI6~DI8) are valid when connected to COM, and invalid when disconnected from COM. 1: Active low DI terminals (DI6~DI8) are invalid when connected to COM, and valid when disconnected from COM.
F4-25	AI1 hardware source selection	0: no choice 1: Rectifier AI1 2: Rectifier AI2 101: Expansion card 1 AI1 102: Expansion card 1 AI2 201: Expansion card 2 AI1 202: Expansion card 2 AI2	Select the source of the analog quantity/temperature input.
F4-27	AI2 hardware source selection	0: no choice 1: Rectifier AI1 2: Rectifier AI2 101: Expansion card 1 AI1 102: Expansion card 1 AI2 201: Expansion card 2 AI1 202: Expansion card 2 AI2	Select the source of the analog quantity/temperature input.
F4-29	AI3 hardware source selection	0: no choice 1: Rectifier AI1 2: Rectifier AI2 101: Expansion card 1 AI1 102: Expansion card 1 AI2 201: Expansion card 2 AI1	Select the source of the analog quantity/temperature input.

		202: Expansion card 2 AI2	
F4-31	AI curve 1 minimum input	-10.00V~10.00V	<p>When the main frequency is set through the analog input, the AI terminal is used as the frequency source setting, and 5 different AI curves can be selected for each AI terminal.</p> <p>AI curve is the relationship between the analog input voltage (or analog input current) and the percentage relative to the maximum frequency (F0-10). AI song</p> <p>The x-axis of the line represents the analog input voltage (or analog input current), and the y-axis represents the set value corresponding to the analog input, that is, the relative maximum frequency (F0-10) percentage.</p> <p>There are 5 types of AI curves, among which curve 1, curve 2, and curve 3 are all 2-point curves, and the relevant parameters are F4-31~F4-42; curve 4 and curve 5 are both It is a 4-point curve, and the relevant parameters are A6-00 ~ A6-15.</p> <p>There are 2 points on AI curve 1~3, namely the minimum input point and the maximum input point. F4-31 corresponds to the x-axis of the minimum input point of AI curve 1, that is, the minimum modulus Analog input voltage (or minimum analog input current).</p>
F4-32	AI curve 1 minimum input corresponding setting	-100.0%~100.0%	The y-axis corresponding to the minimum input point of AI curve 1, that is, the set value corresponding to the minimum analog input.
F4-33	AI curve 1 maximum input	-10.00V~10.00V	The x axis corresponding to the maximum input point of AI curve 1, that is, the maximum analog input voltage (or the maximum analog input current).
F4-34	AI curve 1 maximum input corresponding setting	-100.0%~100.0%	The y-axis corresponding to the maximum input point of AI curve 1, that is, the set value corresponding to the maximum analog input.
F4-35	AI curve 2 minimum input	-10.00V~10.00V	The x axis corresponding to the minimum input point of AI curve 2 is the minimum analog input voltage (or minimum analog input current).
F4-36	AI curve 2 minimum input	-100.0%~100.0%	The y-axis corresponding to the minimum input point of AI curve 2 is



	corresponding setting		the set value corresponding to the minimum analog input.
F4-37	AI curve 2 maximum input	-10.00V~10.00V	The x axis corresponding to the maximum input point of AI curve 2, that is, the maximum analog input voltage (or the maximum analog input current).
F4-38	AI curve 2 maximum input corresponding setting	-100.0%~100.0%	The y-axis corresponding to the maximum input point of AI curve 2 is the set value corresponding to the maximum analog input.
F4-39	AI curve 3 minimum input	-10.00V~10.00V	The x axis corresponding to the minimum input point of AI curve 3 is the minimum analog input voltage (or minimum analog input current).
F4-40	AI curve 3 minimum input corresponding setting	-100.0%~100.0%	The y-axis corresponding to the minimum input point of AI curve 3 is the set value corresponding to the minimum analog input.
F4-41	AI curve 3 maximum input	-10.00V~10.00V	The x axis corresponding to the maximum input point of AI curve 3, that is, the maximum analog input voltage (or the maximum analog input current).
F4-42	AI curve 3 maximum input corresponding setting	-100.0%~100.0%	The y-axis corresponding to the maximum input point of AI curve 3 is the set value corresponding to the maximum analog input.
F4-48	AI curve selection	<p>Ones place:</p> <p>1: Curve 1 (2 points)</p> <p>2: Curve 2 (2 points)</p> <p>3: Curve 3 (2 points)</p> <p>4: Curve 4 (4 points)</p> <p>5: Curve 5 (4 points)</p> <p>Ten:</p> <p>1: Curve 1 (2 points)</p> <p>2: Curve 2 (2 points)</p> <p>3: Curve 3 (2 points)</p> <p>4: Curve 4 (4 points)</p> <p>5: Curve 5 (4 points)</p> <p>hundreds:</p> <p>1: Curve 1 (2 points)</p> <p>2: Curve 2 (2 points)</p> <p>3: Curve 3 (2 points)</p> <p>4: Curve 4 (4 points)</p> <p>5: Curve 5 (4 points)</p>	<p>Set the curve corresponding to AI1~AI3 through the ones, tens, and hundreds of this parameter, and each AI can select any AI curve.</p> <p>1: Curve 1 (2 points) Two-point curve, the corresponding relationship between voltage and frequency is set by F4-31~F4-34.</p> <p>2: Curve 2 (2 points) Two-point curve, the corresponding relationship between voltage and frequency is set by F4-35~F4-38.</p> <p>3: Curve 3 (2 points) Two-point curve, the corresponding relationship between voltage and frequency is set by F4-39~F4-42.</p> <p>4: Curve 4 (4 points) 4-point curve, the corresponding relationship between voltage and frequency is set by A6-00~A6-07.</p> <p>5: Curve 5 (4 points) 4-point curve, the corresponding relationship between voltage and frequency is set by A6-08~A6-15.</p>

F4-49	AI is lower than the minimum input setting selection	<p>Ones place: 0: Corresponding to the minimum input setting 1:0.0%</p> <p>Ten: 0: Corresponding to the minimum input setting 1:0.0%</p> <p>hundreds: 0: Corresponding to the minimum input setting 1:0.0%</p>	<p>Set the processing mode that AI1~AI3 are lower than the minimum input setting through the ones place, tens place and hundreds place of this parameter.</p> <p>0: Corresponding to the minimum input setting When the input AI is lower than the minimum setting value, the frequency corresponding relationship is the minimum input setting.</p> <p>1:0.0% When the input AI is lower than the minimum setting value, the frequency corresponding relationship is 0.0%.</p>
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DI Function code	Description
1	<p><b>Forward run (FWD) or run command</b></p> <p>When two-wire type 1 (F4-17=0), it is forward running; when two-wire type 2 (F4-17=1), it is running command.</p>
2	<p><b>Reverse running (REV) or forward and reverse running direction</b></p> <p>Three-wire type 1 (F4-17=2) is reverse running; two-wire type 2 (F4-17=3) is forward and reverse running direction.</p>
3	<p><b>Three-wire operation control</b></p> <p>Make sure that the inverter operation mode is three-wire control mode. If you want to set the run command through the terminal, set the parameter F4-17 (terminal command mode) to 2 (Three-wire type 1) or 3 (Three-wire type 2), the terminal function should be set to this function.</p>
4	<p><b>Forward jog (FJOG)</b></p> <p>The operation mode of the inverter is forward jog operation. Description of jog running frequency and jog acceleration/deceleration time parameters F8-00, F8-01, F8-02.</p>
5	<p><b>Reverse Jog (RJOG)</b></p> <p>The operation mode of the inverter is reverse jog operation. Description of jog running frequency and jog acceleration/deceleration time parameters F8-00, F8-01, F8-02.</p>
6	<p><b>Terminal UP</b></p> <p>When the frequency is given through the terminal, it is an increasing command to modify the frequency. The effective terminal is equivalent to being pressed all the time.</p>
7	<p><b>Terminal DOWN</b></p> <p>When the frequency is given through the terminal, it is the decrement command to modify the frequency. The effective terminal is equivalent to keep pressing</p>
8	<p><b>UP/DOWN setting clear (terminal, keyboard)</b></p> <p>When the main frequency is set through the panel, the terminal selects this function to clear the</p>
9	<p><b>Fault reset (RESET)</b></p> <p>Reset the fault of the inverter. Use this function to realize remote fault reset.</p>
10	<p><b>External fault normally open input</b></p> <p>When the external signal is sent to the inverter, the inverter reports fault E15.01.</p>
11	<p><b>External fault normally closed input</b></p> <p>When the external signal is sent to the inverter, the inverter reports fault E15.02.</p>
12	<b>User-defined fault 1</b>

	When the inverter alarms E27.00, the inverter will process according to the set value of F9-51 (fault protection action selection).
13	<b>User-defined fault 2</b> When the inverter alarms E28.00, the inverter will process according to the set value of F9-51 (fault protection action selection).
14-17	<b>Multi-segment command terminal 1~4</b> Through 16 states of these four terminals, 16 speeds or 16 other commands can be set.
18-19	<b>Acceleration/deceleration selection terminal 1~2</b> Through the 4 states of the two terminals, 4 kinds of acceleration and deceleration time can be selected.
20	<b>Prohibition of acceleration and deceleration</b> The inverter maintains the current running frequency (except for the stop command), and is not affected by changes in the external input frequency.
21	<b>Command source switching terminal 1</b> When the run command is set through the terminal (F0-02=1), the terminal selects this function to switch between terminal control and keyboard control; When setting the running command (F0-02=2), the terminal selects this function to switch between communication control and keyboard control.
22	<b>Command source switching terminal 2</b> It is used to switch between the terminal and the communication setting operation command. If the terminal is used to control the running command, the system will switch off when the terminal of this function is selected. Change to communication control; if the communication control operation command is used, the system will switch to terminal control when the terminal that selects this function is valid.
23	<b>Frequency command switching</b> Used to switch between different frequency command input methods. According to the setting of F0-07 (frequency command superposition selection), the Switch.
24	<b>Frequency source X and preset frequency switch</b> The main frequency is switched to the preset frequency (F0-08).
25	<b>Frequency source Y and preset frequency switch</b> The auxiliary frequency is switched to the preset frequency (F0-08).
26	<b>Frequency modification enable</b> If the terminal is valid, it is allowed to modify the frequency; if the terminal is invalid, it is forbidden to modify the frequency.
27	<b>Counter input</b> In the counting technology function, the terminal selects this function to input counting pulse.
28	<b>Counter reset</b> In the counting technology function, the terminal selects this function to clear the counter status.
29	<b>Length count input</b> In the fixed-length technology function, the terminal selects this function to input the length count.
30	<b>Length reset</b> Use this terminal function in the fixed-length technology function to clear the length.
31	<b>PID pause</b> PID is temporarily invalid, the inverter maintains the current output frequency and no longer performs PID adjustment of the frequency source.
32	<b>PID integration suspended</b> The integral adjustment function of PID is suspended, but the proportional adjustment and differential adjustment functions of PID are still valid.

33	<b>PID parameter switch</b>
	When the PID parameter switching condition selection (FA-18) is set to 1 (switched by the terminal) and the terminal is invalid, the PID parameter uses FA-05~FA-07; When the sub is valid, FA-15~FA-17 are used.
34	<b>The direction of PID action is reversed</b>
	PID action direction is opposite to the direction set by FA-03 (PID action direction).
35	<b>Torque control prohibited</b>
	In the torque control mode, the torque control is switched to the speed control. After the terminal is invalid, it returns to the torque control mode.
36	<b>Speed control/torque control switch</b>
	The inverter switches between torque control and speed control modes. A0-00 (speed/torque control mode) is set to 0, when the terminal is valid, the control mode is torque mode; when the terminal is invalid, the control mode is speed mode formula. A0-00 (speed/torque control mode) is set to 1, when the terminal is valid, the control mode is speed mode; when the terminal is invalid, the control mode is torque mode formula.
38	<b>Speed tracking start</b>
	When DI is valid, speed tracking starts.
39	<b>Immediate DC braking</b>
	The inverter directly switches to the DC braking state.
40	<b>Deceleration DC braking</b>
	The inverter decelerates to the start frequency of stop DC braking (F6-11), and then enters the DC braking state.
41	<b>External parking terminal 1</b>
	When "running command selection" is the operation panel (F0-02=0), the inverter will stop.
42	<b>42: External parking terminal 2</b>
	In any running command mode (panel control, terminal control, communication control), the inverter decelerates to stop. At this time, the deceleration time is fixed at deceleration time Room 4 (F8-08).
43	<b>Running pause</b>
	The inverter decelerates to stop. When the terminal is valid, all operating parameters are memorized (such as PLC parameters, swing frequency parameters, PID parameters). After the terminal is invalid, The inverter restores the previously memorized operating state.
44	<b>Free parking</b>
	The inverter stops and the motor stops according to inertia.
45	<b>Emergency stop</b>
	When the system is in an emergency state, the inverter will decelerate according to the emergency stop deceleration time of terminal F8-59. When the emergency stop deceleration time of V/f mode is 0s, follow the minimum unit Time to decelerate. The input terminal does not need to be in the closed state continuously, even if the time in the closed state is only an instant, it will be stopped urgently. only. Different from the general deceleration time, the emergency stop input terminal is disconnected after the emergency stop deceleration time, if the inverter terminal runs signal at this time If it is still in the closed state, the inverter will not start. The inverter will restart only after disconnecting the running terminal first and then inputting the terminal running command again.
46	<b>Motor selection terminal</b>
	Select the motor parameters. When the terminal is valid, select motor 2; when the terminal is invalid, select motor 1.

47	<b>This running time is cleared</b>
	<p>The running time of the inverter is cleared to zero.</p> <p>If the current running time is less than the set value (greater than 0) of F8-57 (this running arrival time), the terminal is valid during this process, and the current running counts Time is cleared.</p> <p>If the current running time is greater than the set value of F8-57 (greater than 0), the terminal is valid at this time, and the current running time will not be cleared.</p>
48	<b>Two-wire/three-wire switch</b>
	<p>Used to switch between two-wire and three-wire control.</p> <p>If F4-17 is set to 0 (two-wire type 1), when the terminal of this function is valid, switch to three-wire type 1.</p> <p>If F4-17 is set to 1 (two-wire type 2), when the terminal of this function is valid, switch to three-wire type 2.</p> <p>If F4-17 is set to 2 (three-wire type 1), when the terminal of this function is valid, switch to two-wire type 1.</p> <p>If F4-17 is set to 3 (three-wire type 2), when the terminal of this function is valid, switch to two-wire type 2.</p>
49	<b>PLC status reset</b>
	Restore the inverter to the initial state of the simple PLC.
50	<b>Swing frequency pause</b>
	In the swing frequency technology function, the terminal selects this function to pause the swing frequency function (the inverter outputs at the center frequency).
54-63	<b>reserved</b>

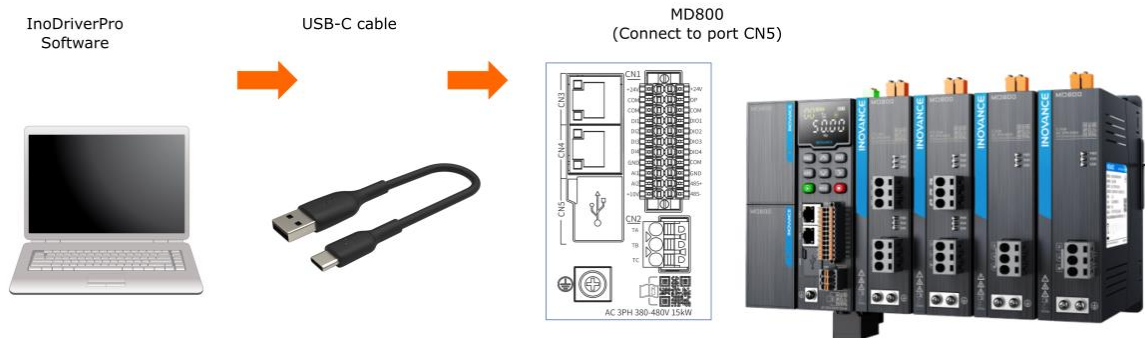
## 9 PC TOOLS

This section explains the different tools available for diagnosis, monitoring and updating. It is divided into two main sections: communication with the InoDriverShop diagnostic and monitoring software and firmware update.

### 9.1 INODRIVERSHOP

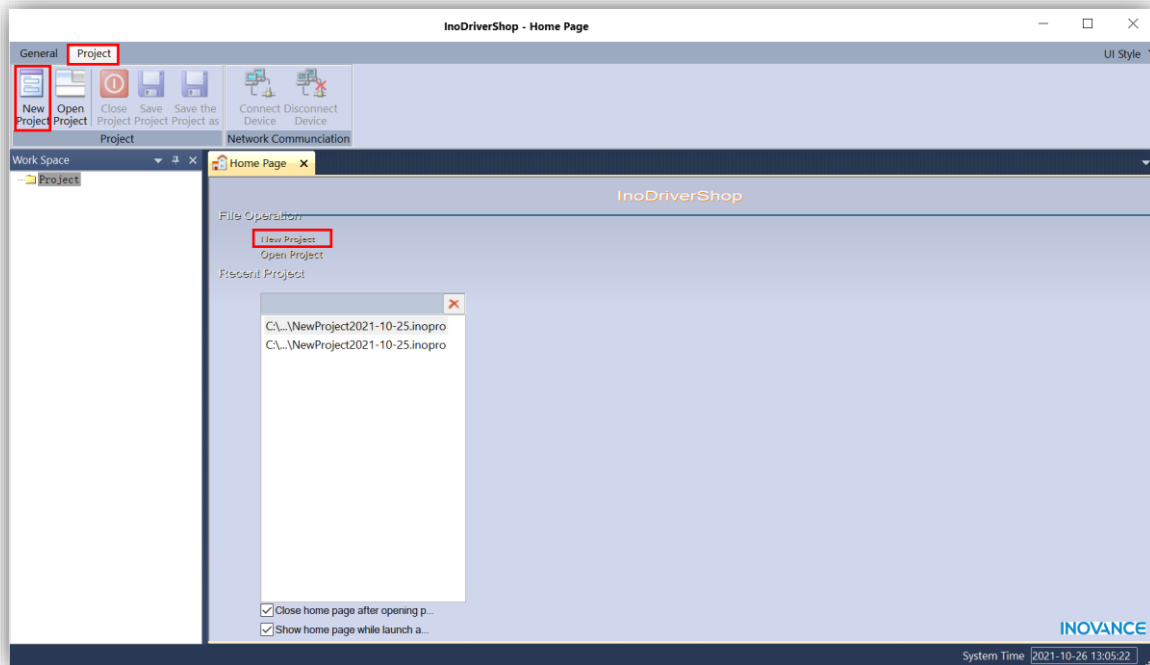
InoDriverShop is the software for windows platforms that allows diagnosis and monitoring of MD800 drives.

Only a standard USB-C cable is needed to connect to the sMD800 drives.

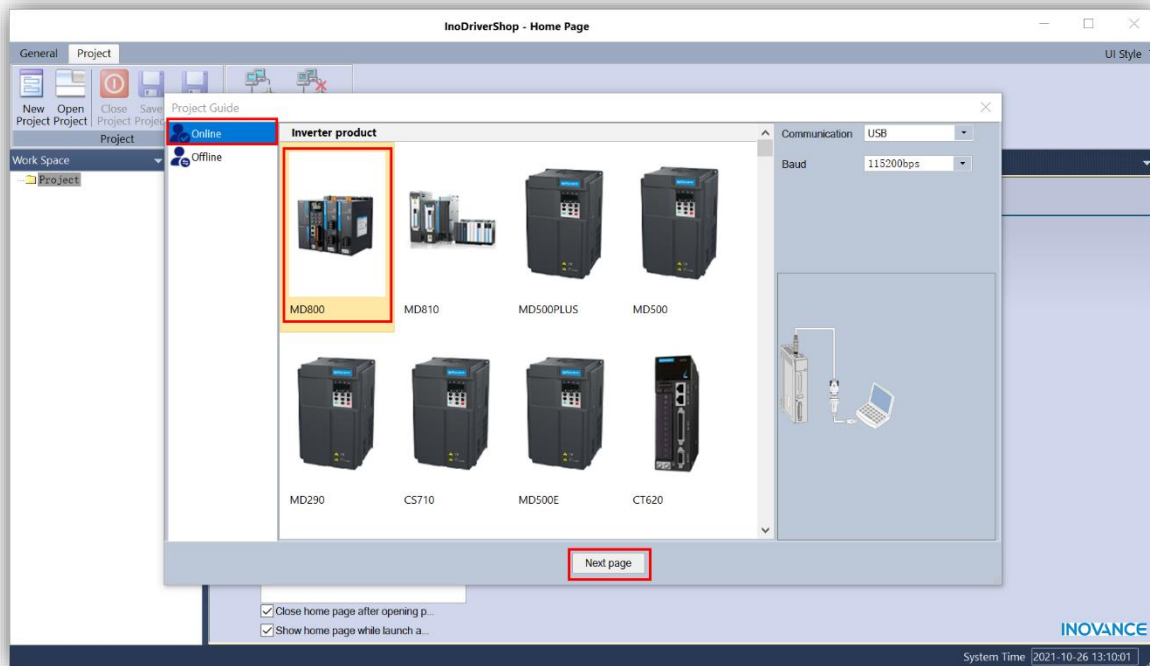


Follow the below procedure to connect InoDriverShop to the MD800 drive:

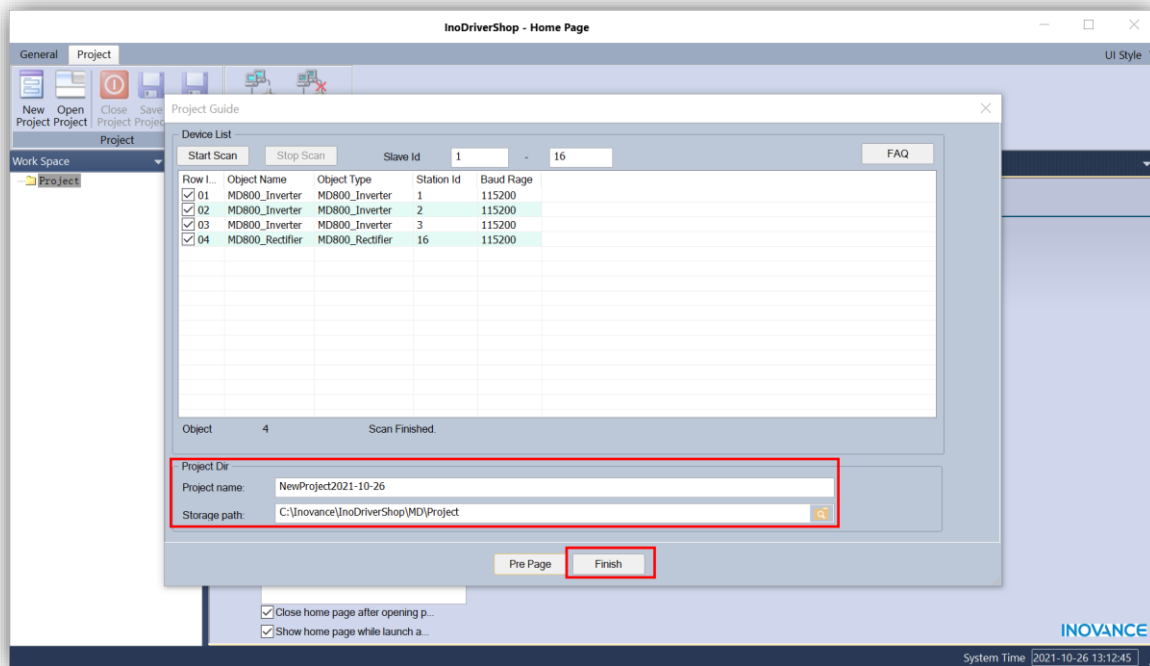
1. Open the InoDriverShop and click in the “new project” button.



2. Select "Online", the MD800 drive, and click on the "next" button

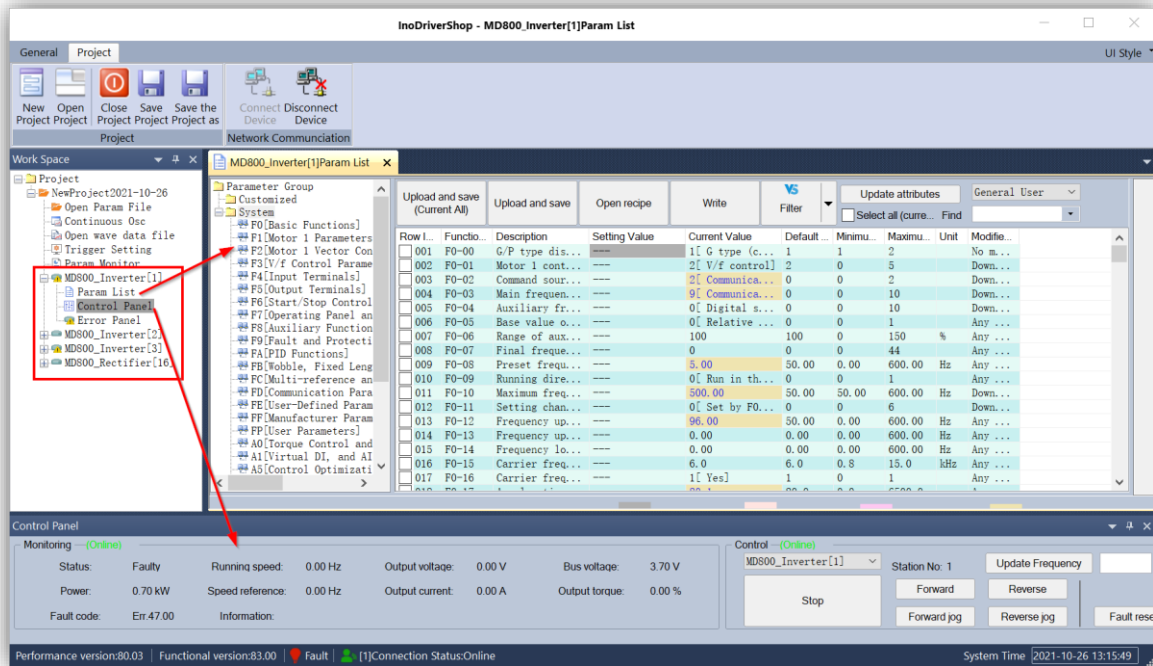


3. The software will detect the connected modules and shows a list. The software detects the different modules and displays them in a list. Select the location where you want to save the project and click on the "Finish" button.





- The detected modules are shown in the project tree from where you can access the list of parameters or the control panel of each module.





## 9.2 MD800 FIRMWARE UPDATE

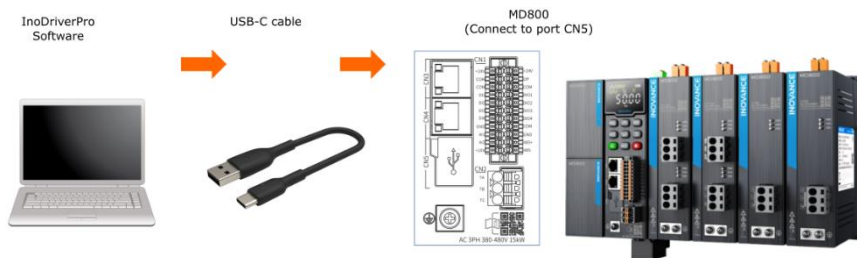
In some cases it is necessary to update the firmware of the rectifier, the inverters or the optional communication modules. This section explains the procedure and the different methods to carry out this task.

The following table shows the parameters that indicate the firmware version of each module:

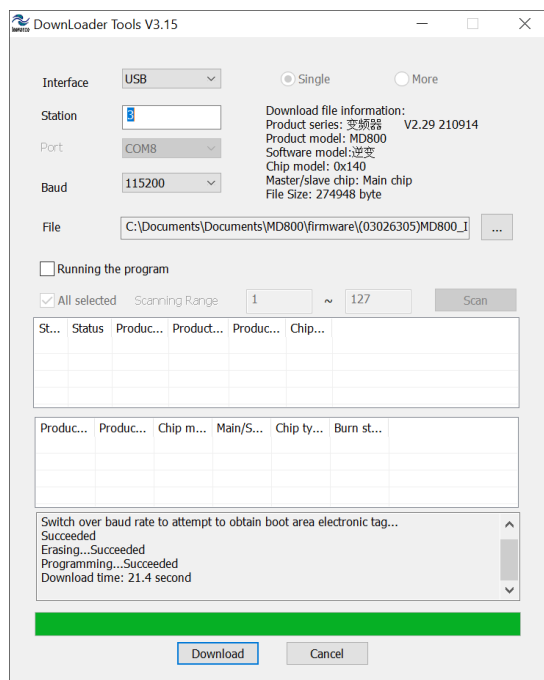
Parameter	Parameter description
<b>Rectifier</b>	
<b>F0-02</b>	Rectifier software version
<b>FD-91</b>	Optional communication card firmware version
<b>Inverter</b>	
<b>F7-10</b>	Performance software version
<b>F7-11</b>	Function software version

## 9.2.1 USING INOLOADER SOFTWARE

To update the firmware with the InoLoader software it is necessary a USB-C cable, and a computer to run the software.



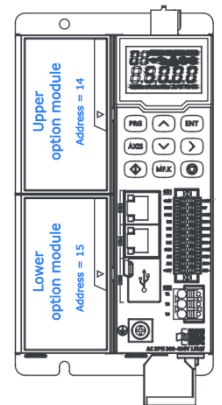
Connect the USB-C cable to the laptop and the MD800 and follow the below procedure:



Start the InoLoader software and select the USB interface as the communication port.

Set the Station number:

- Rectifier = 16
- Axis 1 = 1
- Axis 2 = 2
- ....
- Axis 8 = 8
- Upper option module = 14
- Lower option module = 15



Select the firmware file and click on the download button to download it to the device.

## 9.2.2 USING SOP-20 KEYPAD

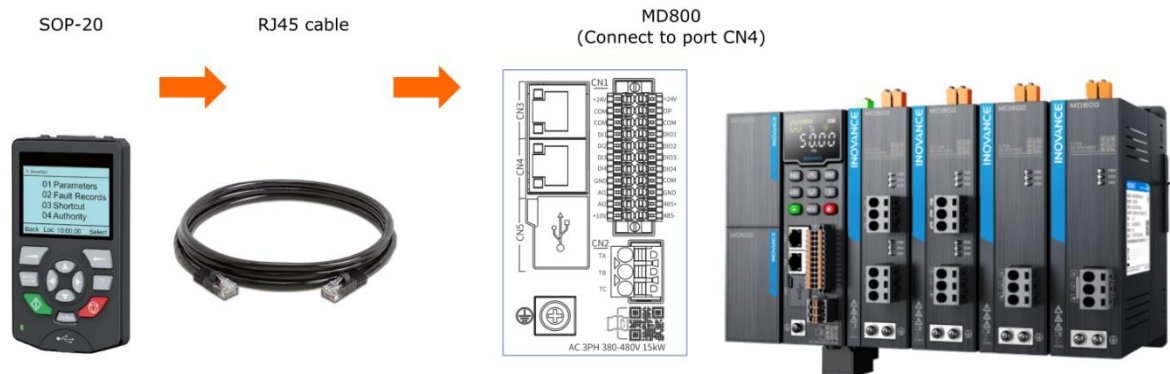


SOP-20

SOP-20 could be used to update the MD800 firmware. The SOP-20 is the remote keyboard that allows access to the parameterization of the MD800 in a simpler way and offers a series of tools that facilitate the start-up of the drive.

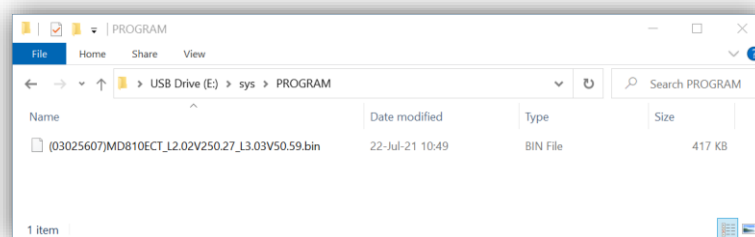
One of the functions of the SOP-20 is to update the MD800 firmware.

To update the firmware with the SOP-20 keypad it is necessary a USB Mini b and RJ45 cable. The USB cable is for copy the firmware file to the SOP-20 memory. The RJ45 cable is for communicate SOP-20 with the MD800 drive port.

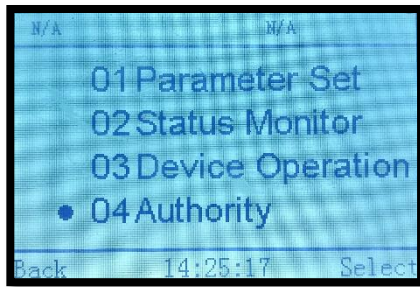


To update the firmware, follow these steps:

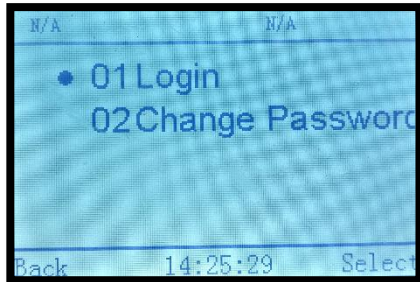
- The first step is to copy the firmware file onto the SOP-20's SD card.
  - Connect the SOP-20 to the USB port of a computer and activate the "USB Disk" mode of the SOP-20. A new drive will appear on the computer.
  - Copy the firmware file to this path "X:\SYS\PROGRAM"



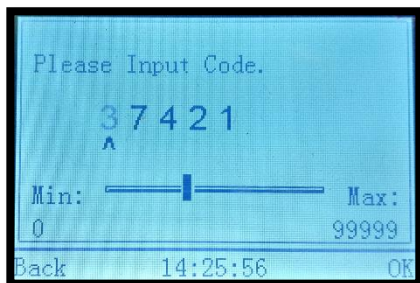
- Disconnect the SOP-20 from laptop
- Connect the SOP-20 to the RJ45B port of the MD800. The SOP-20 turns on and shows an initial screen. Press the button "Menu" and the below screen appears:
-



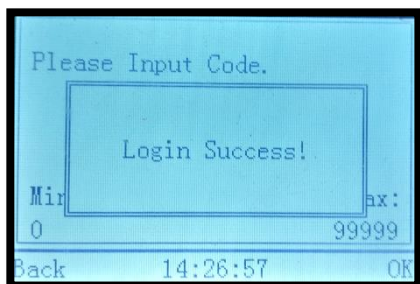
Select Authority



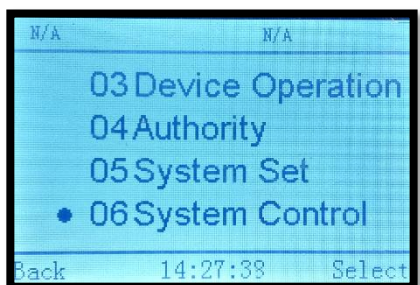
Select Login



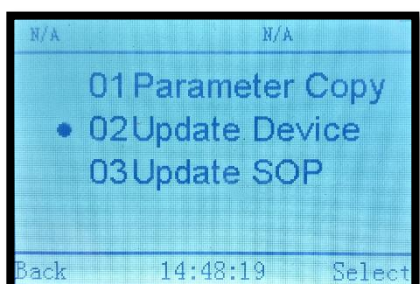
Enter administrator password: 37421



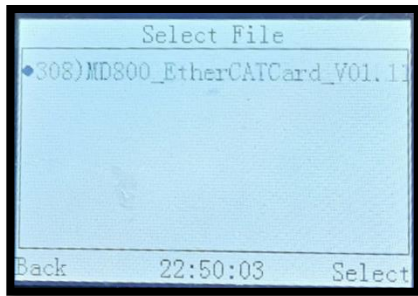
Click button back to return to main menu



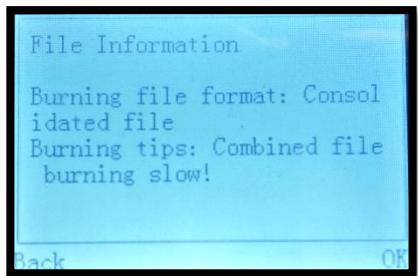
Select "System control"



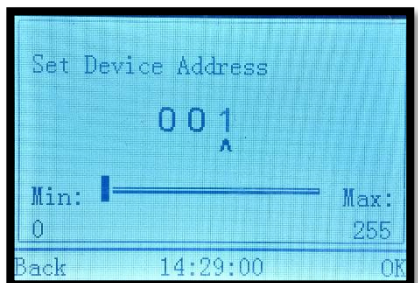
Select "Update Device"



Select firmware file

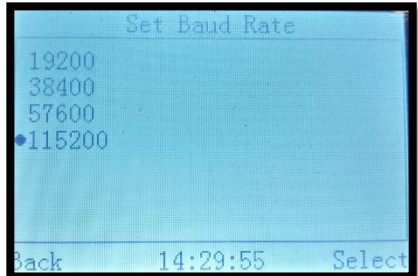
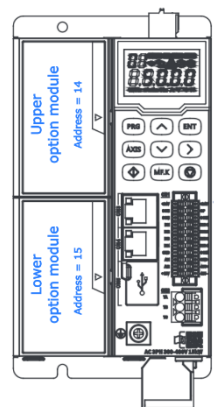


Click OK

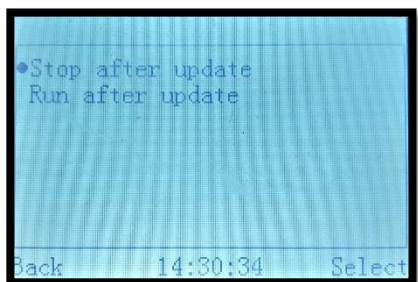


Select device address:

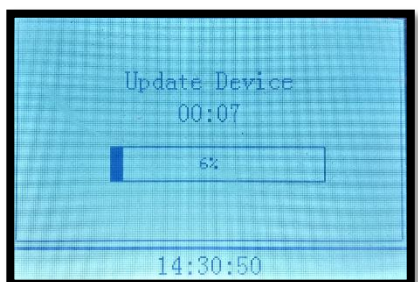
- Rectifier = 16
- Axis 1 = 1
- Axis 2 = 2
- ....
- Axis 8 = 8
- Upper option module = 14
- Lower option module = 15



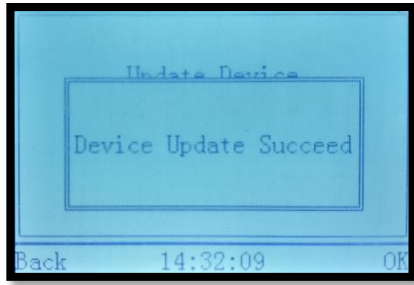
Select baud rate (parameter **FD-00 Modbus baud rate**) and click OK



Select option "Stop after update"



Update starts...



If the process finish without any problem this message appears

## 10 NOTES

If FD-10 <> 3 the RUN/ERR led flashes quickly and the rectifier gets the trip E16.77. Change the parameter FD-10 to 3 to stablish communication between the optional card and the rectifier.