

## ET01 technical specification

Thank you for using the EtherCAT products.

Our company ET01 needs to be used with our company Inverters, push the expansion card along the bottom rail into the bottom of the CU. It communicates with bus master station through EtherCAT communication protocol.

### 1. EtherCAT Cables

- Cable Type



Please use Category 5e shielding 100M cable.

- Signal define

Pin Number	Signal	Terminal	Description
1	TD+	TD+	Transmit +
2	TD-	TD-	Transmit -
3	RD+	RD+	Receive +
4	--	--	--
5	--	--	--
6	RD-	RD-	Receive -
7	--	--	--
8	SHIELD		Shielded GND

## 2. Status indicator and connector description

<p>ETHERCAT ET01</p> <p>ERROR → Индикатор состояния STATUS → Индикатор работы POWER → Индикатор питания</p> <p>OUT IN</p>		
Светодиод	Состояние	Описание
ERROR (Красный)	Горит	Таймаут сторожевого таймера
	Мигает	Сбой связи ET01 с модулей управления
	Не горит	Связь в норме
STATUS (Зеленый)	Горит	ET01 в состоянии Op
	Мигает	ET01 в состоянии Pre-Op
	Одиночное мигание	ET01 в состоянии Safe-Op
	Не горит	Ошибка
POWER (Зеленый)	Горит	Питание в норме
	Не горит	Питание некорректно или отсутствует
Connector	Label	Description
EtherCAT communication connector	IN	EtherCAT input port
	OUT	EtherCAT output port

## 3. Communication Specification

Type	Specification
Communication connector	RJ45◇2
Physical layer	100BASE-TX
Cable Type	Category 5e shielding 100M
Network topology	Line connection
Communication	EtherCAT
SyncManager	SM0: mailbox output SM1: mailbox input SM2: process data output SM3: process data input
FMMU (Fieldbus Memory Management Units)	FMMU0: process data output area FMMU1: process data input area FMMU2: mailbox status area
Synchronization mode	Sync manager mode Free run mode
Device profile	CoE: CANopen over EtherCAT
Communication object	SDO: Service Data Object PDO: Process Data Object

## 4. ET01 features

Type	Specification
PDO Max	2 (Only "Inputs" and "Outputs")
SDO minimum response time	4ms (10ms - рекомендуемое значение)
PDO minimum response time	2ms (4ms - рекомендуемое значение)
TxPDO "Inputs" length	4~20 bytes
RxPDO "Outputs" length	4~20 bytes

### 4.1 PDO mapping

The following tables show the default PDO mapping configuration of AD800 inverter for data exchange. This is also defined in the XML file of the EtherCAT Slave.

RxPDO (0x1610)	ControlWord (0x2001)	Set_Value (0x2002)
TxPDO (0x1A10)	Status_Word_P9-01 (0x3385)	Outputs_Frequency_P9-07 (0x338B)

These default object of the PDOs cannot be modified, deleted, or reordered.

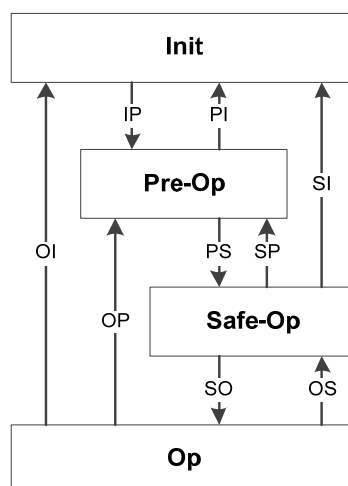
### 4.2 Control words correspondence table

Bit field	Description
Bit 7~0 (run/stop control etc.)	0x00: No function 0x01: Run Forward 0x02: Run Reverse 0x03: Jog 0x04: Jog reverse 0x05: Deceleration Stop 0x06: Coast Stop 0x07: Reset 0x08: clear all run/stop commands from communication
Bit 11~8 (Preset value select)	0000B: P0-30(Preset Value 0) 0001B: P0-31(Preset Value1) ... 1111B: P0-45(Preset Value 15)
Bit 13~12 (Ramp time select)	00B: Ramp 1 01B: Ramp 2 10B: Ramp 3 11B: Ramp 4
Bit 14	Reserve
Bit 15	1B: Enable Bit8~13 function 0B: Disable Bit8~13 function

### 4.3 Status words correspondence table

Bit	0	1
0	Control not ready	Control ready
1	Control not ready	Control ready
2	Inertial stop	Run
3	Fault-free	Fault tripping
4	Fault-free	The fault is not tripped
5	Reserve	Reserve
6	Fault-free	Fault tripping
7	No warnings	Warning
8	Frequency out of range	Frequency in the range
9	Manual mode	Remote control
10	Reserve	Reserve
11	Stop	Run
12	Forward running	Reverse running
13	Within the voltage range	Over voltage limit
14	Reserve	Reserve
15	No overheat warning	Overheat warning

## 5. EtherCAT state machine



EtherCAT communication states

State	Description
Init (Initialization)	The inverter successfully completes the initialization after being powered on without errors occurring. The packets cannot yet be transmitted in this stage.
Pre-Op (Pre-Operational)	Data can be exchanged with SDOs. If an alarm occurs in the inverter, an emergency message is sent to notify the controller.
Safe-Op (Safe-Operational)	The inverter can use SDO and TxPDO data packets to exchange data with the controller.
Op (Operational)	All data exchanges including SDOs and PDOs (TxPDO and RxPDO) are allowed.

State Transition	Description
IP	<ul style="list-style-type: none"> <li>The master defines the slave address as well as the SyncManager 0 and 1 (SM0 and SM1) registers and establishes the mailbox communication.</li> <li>The master issues the command to have the slave switched to Pre-Operational state.</li> </ul>
PS	<ul style="list-style-type: none"> <li>The master uses the SDOs to set the PDO mapping related parameters.</li> <li>The master defines the FMMU as well as the SyncManager 2 and 3 (SM2 and SM3) registers, and the slave continues to transmit the PDO (TxPDO) packets to the master.</li> <li>The master issues the command to have the slave switched to Safe-Operational state.</li> </ul>
SO	<ul style="list-style-type: none"> <li>The master starts transmitting PDOs (RxPDOs).</li> <li>The distributed clock synchronization process between the master and slave is started.</li> </ul>
PI, SI, OI	<ul style="list-style-type: none"> <li>The slave disables all communication functions, including transmission of the SDOs and PDOs.</li> <li>The slave switches to the Init state.</li> </ul>
SP, OP	<ul style="list-style-type: none"> <li>The slave disables the PDO function.</li> <li>The slave switches to the Pre-Operational state.</li> </ul>
OS	<ul style="list-style-type: none"> <li>The master stops transmitting PDOs (RxPDOs).</li> <li>The slave switches to the Safe-Operational state.</li> </ul>

## 6. Object Dictionary

### 6.1 Overview of object group 1000h

Index	Object Type	Name	Data Type	Read/Write
1610h	Record	Outputs(Receive PDO mapping)	PDOMAPPING	RW
1A10h	Record	Inputs(Transmit PDO mapping)	PDOMAPPING	RW

### 6.2 3000-5FFF inverter object area

The area 3000h to 5FFFh holds the indexes for accessing the inverter parameters. All parameters in the inverter are linked to indexes in this area. The first index available is index 3001h. This index is linked to the inverter's parameter 1. The rest of the EtherCAT index follows the same rule, where the inverter's parameter number plus 3000h gives the EtherCAT index. For example, the reading the output current in parameter P9-08, is calculated by 3000h + parameter number in hex number = 3000h + 38Ch = index 338Ch. A few indexes and their mapping are shown below.

Index	Object Type	Name	Type	Read/Write
3001h	VAR	Control Mode P0-01	UNSIGNED16	RW
3002h	VAR	Motor Control Principle P0-02	UNSIGNED16	RW

.....				
3812h	VAR	wake up detection time P20-66	UNSIGNED16	RW

Please refer to the inverter manual for the definition of inverter parameters.

The Communication data is expressed by hexadecimal in actual application and there is no radix point in hexadecimal. For example, if you want to set P5-08 = 61.5, 61.5 can be magnified by 10 times into 615. So hex 0x0267 (615) can be used to express 61.5.

A non-integer can be timed by a multiple to get an integer and the integer can be called communication ratio values.

The communication ratio values are referred to the radix point of the setting range of default value in the functional parameter list. If there are radix point n, then the communication ratio value m is  $10^n$ .