ETHERCAT 卡操作手册

Operation Guide of ETHERCAT-ET01

操作手册（中文）

感谢您使用本公司 ETHERCAT-ET01 卡产品，在产品使用前，请认真阅读本指南.

Operation Guide （ENGLISH）

Thank you for using the our company ETHERCAT-ET01 products. Please read this guide carefully before using the products.

目录

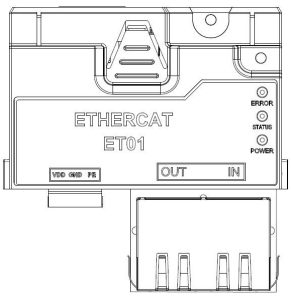
CONTENTS

中文

1. 概述

首先感谢您使用本公司变频器，并选用本公司 EtherCAT 现场总线扩展卡，以下简称 ET01 卡。

ET01 卡是 EtherCAT 现场总线适配卡。该卡安装在本公司变频器上，提高通讯效率，便于实现变频器组网功能，变频器作为从站接受现主站的控制。ET01 适用于本系列全功率段产品



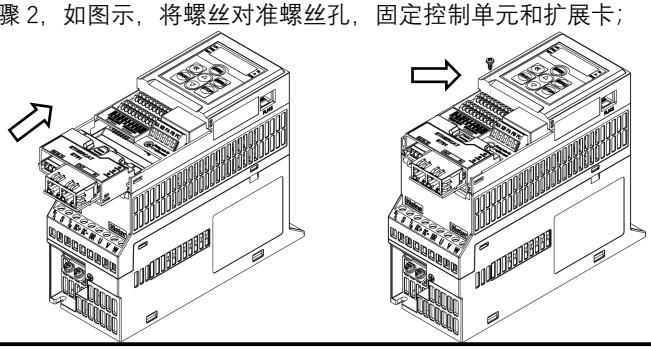
功能特点：

- 总线通信速率达到 100Mbit/s，通讯周期短；
- ET01 直接安装在控制单元的扩展卡插槽上，安装方便。

2. ETHERCAT-ET01 卡安装说明

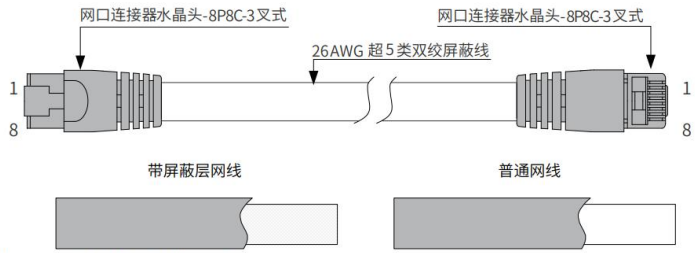
安装步骤：

- 检查扩展卡附件包中包含：ETHERCAT-ET01 卡、可插拔端子*1、螺丝*1、说明书；
- 如下图示安装扩展卡：
  步骤 1，将扩展卡沿着底部导轨推进控制单元底部，扩展卡的端子与控制单元端子对插到底，两个螺丝孔对齐；
  步骤 2，如图示，将螺丝对准螺丝孔，固定控制单元和扩展卡；



3. EHERCAT 线缆选型

3.1. 网络线缆制作

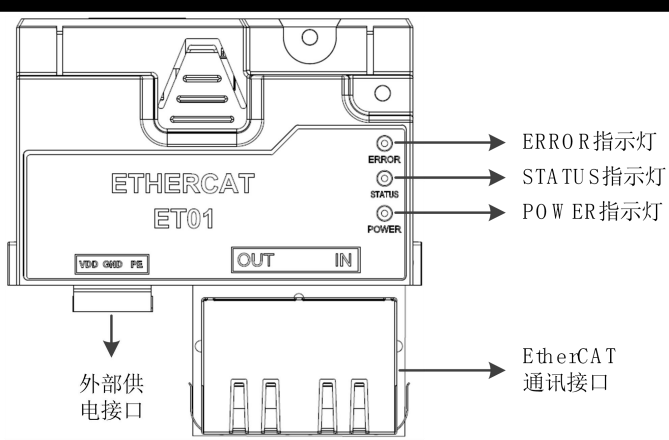


＊ 请使用超5 类屏蔽双绞线，带铁壳注塑线。

3.2. 信号引线分配

引脚	信号	信号方向	信号描述
1	TD+	输出	数据传输 +
2	TD-	输出	数据传输 -
3	RD+	输入	数据接收 +
4	--	--	不使用
5	--	--	不使用
6	RD-	输入	数据接收 -
7	--	--	不使用
8	SHIELD		屏蔽地

4. 状态指示灯和接口说明



指示灯	颜色	状态说明
ERROR	红灯常亮	总线网络通讯失败
	红灯闪烁	ET01 扩展卡与控制单元通讯失败
	红灯灭	ET01 扩展卡无异常
STATUS	绿灯常亮	总线网络通讯正常
	绿灯闪烁	ET01 扩展卡处于 Pro-OP 状态
	绿灯灭	总线网络通讯失败
POWER	绿灯常亮	ET01 电源正常
	绿灯灭	ET01 电源异常或者未上电
接口	**端子或信号**	**说明**
ETHERCAT 通讯接口	IN	EtherCAT 输入口
	OUT	EtherCAT 输出口
外部供电接口	VDD	外部 24V 供电，24V+/5%; 当变频器断电时可由该端口供电,保证 ET01 不掉站;
	GND	电源地
	PE	大地

5. ETHERCAT 通讯描述

5.1. 通讯参数

项目	规格
通讯连接器	RJ45 × 2
物理层	100BASE-TX
传输媒介	超五类双绞屏蔽线
拓扑结构	线性拓扑结构
通讯协议	EtherCAT
同步模式	同步管理器（Sync manager）模式 自由运行（Free run)模式
设备行规	CoE：CANopen over EtherCAT
通讯对象	SDO：服务数据对象 PDO：过程数据对象

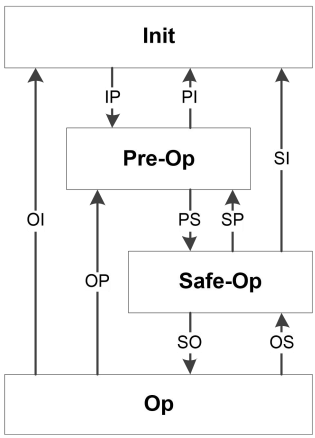
5.2. ET01 特性

项目	规格
PDO 最大数量	2（只有"Inputs"和"Outputs"）
SDO 最快响应时间	10 毫秒
PDO 最快响应时间	10 毫秒
TxPDO "Inputs" 长度	4~20 字节
RxPDO "Outputs" 长度	4~20 字节

5.3. 状态机

EtherCAT 状态机用于描述从站应用的状态和状态改变。状态改变请求通常由主站发起，从站响应。

具体状态跳转方式如下图:



5.4. 默认 PDO 映射

PDO 映射是表示对象字典到 PDOs 应用对象（实时过程数据/变频器参数）的映射关系，对象字典内的索引 0x1A10 和 0x1610 分别存储 Inputs 和 Outputs 的映射表。

下表为 ET01 默认的 PDO 映射，其同时定义于 ET01 的 XML 文件内。

Inputs				
	索引	大小	名称	变频器参数
Inputs (0x1A10)	0x3385	2	Status_Word_P9-01	P9-01
	0x338B	2	Outputs_Frequency_P9-07	P9-07
Outputs				
	索引	大小	名称	变频器参数
Outputs (0x1610)	0x2001	2	ControlWord	无
	0x2002	2	Set_Value	无

主站可以在 Inputs 和 Outputs 默认映射之后新增应用对象。Inputs 和 Outputs 分别可以最多新增 8 个应用对象，即 Inputs 和 Outputs 分别最多可以有 10 个应用对象。

Inputs 只能添加变频器的只读参数，Outputs 只能添加变频器的非只读参数。

5.5. 控制字和状态字介绍

协议控制字说明

Bit 位	说明
Bit7~0（启停控制等）	0x00：无功能（保持原状态不变） 0x01：正转运行 0x02：反转运行 0x03：点动正转运行 0x04：点动反转运行 0x05：停止 0x06：自由停车 0x07：故障复位 0x08：清除命令（清除所有运行及停止指令）
Bit11~8(多段速选择)	0000B：P0-30（预置设定值 0） 0001B：P0-31（预置设定值 1） 1111B：P0-45（预置设定值 15）
Bit13~12（加减速时间选择）	00B：加减速 1　　01B：加减速 2 10B：加减速 3　　11B：加减速 4
Bit14	保留
Bit15	1B 使能 Bit8~13　　0B 禁能 Bit8~13

协议状态字说明 - P9-02 状态字对应表

Bit 位	**0**	**1**
bit0	控制未就绪	控制就绪
bit1	控制未就绪	控制就绪
bit2	惯性停止	运行
bit3	无故障	故障跳脱
bit4	无故障	故障未跳脱
bit5	保留	保留
bit6	无故障	故障跳脱
bit7	无警告	警告
bit8	不按参考值运行	按参考值运行
bit9	本地模式	远程模式
bit10	频率不在范围	频率在范围内
bit11	停止	运行
bit12	正转	反转）
bit13	在电压范围内	超出电压限制
bit14	保留	保留
bit15	无过热警告	过热警告

6. XML 文件配置

EtherCAT 从站信息描述文件（*.XML），提供了 ET01 的通讯和配置信息。用户需要导入该文件至主站配置工具，才可以对 ET01 设备进行组态。ET01 配套的 XML 文件请联系厂家获取。

7. 对象字典

7.1. OD 1000h 通信群组

索引	对象类型	名称	数据类型	属性
1610h	Record	Outputs(接收 PDO 映射)	PDOMAPPING	RW
1A10h	Record	Inputs(发送 PDO 映射)	PDOMAPPING	RW

7.2. OD 2001h-2002h 变频器控制对象区

2001h 和 2002h 为变频器的控制访问区域，其中 2001h 为控制字，2002h 为设定值。控制字定义见第 5.4 章节。设定值单位为 0.1Hz。Outputs 中默认为这两个对象。

7.3. OD 3000h-5FFFh 变频器参数对象区

3000h 到 5FFFh 为变频器参数访问区域。变频器的所有参数都映射到该区域。第一个可用索引为 3001h，其对应变频器的 P0-01 参数。变频器参数号与 EtherCAT 应用对象索引的映射关系为：索引=3000h+变频器参数号。例如变频器的 P9-08 参数，其对应的应用对象索引=3000h+38Ch=338Ch。下表列举了部分变频器参数的应用对象。

索引	对象类型	名称	数据类型	属性
3001h	VAR	运行模式 P0-01	UNSIGNED16	RW
3002h	VAR	控制模式 P0-02	UNSIGNED16	RW
.....				
3812h	VAR	唤醒检测时间 P20-66	UNSIGNED16	RW

变频器参数的定义和描述请查阅变频器说明书或联系厂家。

8. 故障描述与处理

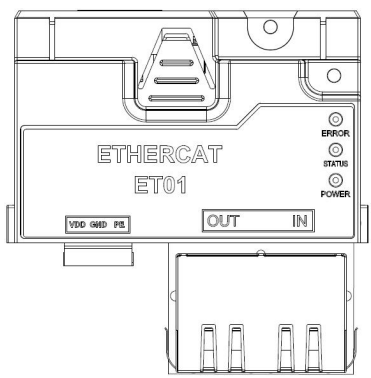
类型	ERROR	STATUS	现象描述	对应处理措施
1	亮	X	总线通讯异常	1. 检查 ET01 与主站通讯连接是否正常；
类型	ERROR	STATUS	现象描述	对应处理措施
2	闪	X	ET01 与控制单元通讯不上	1. 检查 ET01 与控制单元对插是否到位； 2. 检查控制单元 pin 针是否弯曲； 3. 更换扩展卡或联系厂家；

ENGLISH

1. Summary

First of all, thank you for using our company's frequency inverter and selecting our company's EtherCAT fieldbus option card, hereinafter referred to as the ET01 card.

The ET01 card is an EtherCAT fieldbus adapter card. This card is installed on our company's frequency inverter to enhance communication efficiency and facilitate the realization of inverter networking functions, where the inverter acts as a slave to receive control commands from the master station. The ET01 is applicable to the entire power range of our product series.



Specifications of functions:

- The bus communication speed reaches 100 Mbit/s, with a short communication cycle.
- ET01 is directly installed in the expansion card slot of the control unit, making installation convenient.

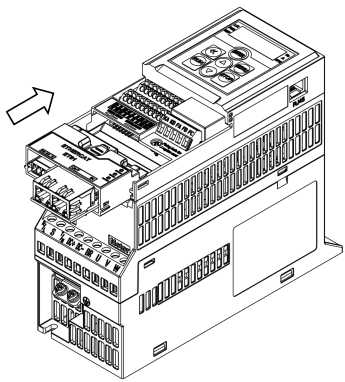
2. ETHERCAT-ET01 Card Installation Instructions

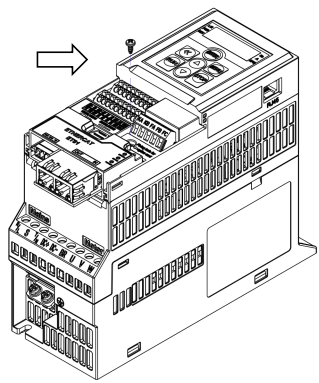
Installation steps:

- Check the option card accessory package contains: ETHERCAT-ET01 card, pluggable terminal *1, screw *1, manual;
- Install the option card as shown below:

Step 1: Slide the option card along the bottom guide rail to the bottom of the control unit. Insert the terminals of the option card into the corresponding terminals of the control unit until they are fully seated, aligning the two screw holes.

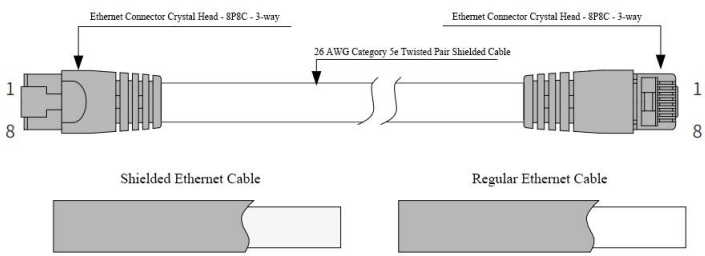
Step 2: As shown in the diagram, align the screws with the screw holes and secure the control unit and option card.





3. ETHERCAT Cable Selection

Cable Assembly:

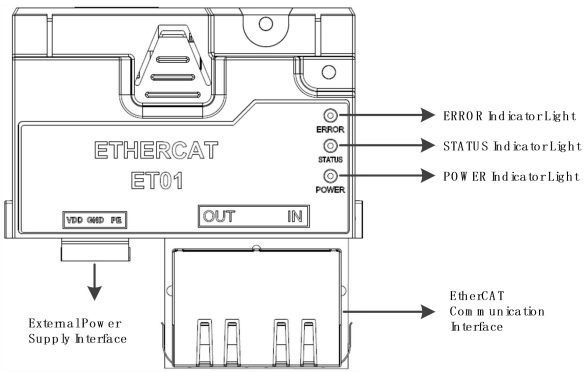


✳ Please Use Category 5e Shielded Twisted Pair Cable with Metal-Clad Injection Molding.

- Please use Category 5e shielded twisted pair cable with iron-shielded injection molding.
- Signal Wire Allocation

Pin	Signal	Signal Direction	Signal Description
1	TD+	Output	Data Transfer+
2	TD-	Output	Data Transfer -
3	RD+	Input	Data Receive +
4	--	--	Not Used
5	--	--	Not Used
6	RD-	Input	Data Receive -
7	--	--	Not Used
8	SHIELD		Shield Ground

4. Status Indicator Lights and Interface Explanation



Status light	Color	Description
ERROR	Red light always on	Fieldbus Communication Failure
	Red light blinking	Communication Failure Between ET01 Card and Control Unit
	Red light off	ET01 Card is Normal
STATUS	Green light always on	Bus Network Communication Normal
	Green light blinking	ET01 Card is in Pro-OP State
	Green light off	Fieldbus Communication Failure
POWER	Green light always on	ET01 Power Supply Normal
	Green light off	ET01 Power Supply Abnormal or Not Powered
Interface	**Terminal or Signal**	**Description**
ETHERCATCommunication Interface	IN	EtherCAT Input Port
	OUT	EtherCAT Output Port
External Power Supply Interface	VDD	External 24V Power Supply, 24V+ with ±5; When the inverter loses power, this port can provide power to ensure the ET01 does not lose connection
	GND	Power Ground
	PE	Protective Earthing

5. ETHERCAT Communication Description

5.1. Communication Parameter

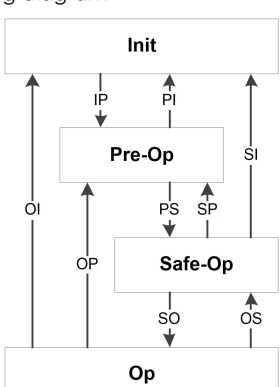
Type	Specifications
Communication Connector	RJ45 × 2
Physical Layer	100BASE-TX
Transmission Medium	Category 5e Shielded Twisted Pair Cable
Topology	Linear Topology
Communication Protocol	EtherCAT
Synchronization Mode	Sync Manager Mode Free Run Mode
Device Profiles	CoE: CANopen over EtherCAT
Communication Objects	SDO: Service Data Object PDO: Process Data Object

5.2. ET01 Features:

Item	Specifications
Maximum Number of PDOs	2 (Only 'Inputs' and 'Outputs')
Fastest SDO Response Time	10 millisecond
Fastest PDO Response Time	10 millisecond
TxPDO 'Inputs' Length	4~20 bytes
RxPDO 'Outputs' Length	4~20 bytes

5.3. State Machine

The EtherCAT state machine is used to describe the states and state transitions of a slave application. State transition requests are typically initiated by the master and responded to by the slave. The specific state transition process is illustrated in the following diagram:



5.4. Default PDO Mapping

PDO mapping designs the mapping relation between the object dictionary to PDOs application objects (real-time process data / inverter parameters). Indexes 0x1A10 and 0x1610 within the Object Dictionary store the mapping tables for Inputs and Outputs respectively. The following table illustrates the default PDO mapping for ET01, also defined in the ET01's XML file.

Inputs

	Index	Size	Name	Inverter Parameters
Inputs (0x1A10)	0x3385	2	Status_Word_P9-01	P9-01
	0x338B	2	Outputs_Frequency_P9-07	P9-07

Outputs

	Index	Size	Name	Inverter Parameters
Outputs (0x1610)	0x2001	2	ControlWord	/
	0x2002	2	Set_Value	/

The master station can add new application objects after the default mapping of Inputs and Outputs. Up to 8 application objects can be added to both Inputs and Outputs, allowing a maximum of 10 application objects for each. Only read-only parameters of the inverter can be added to Inputs, while non-read-only parameters of the inverter can be added to Outputs.

5.5. Introduction to Control Words and Status Words

Control Word Explanation

Bit	Explanation
Bit7~0 (Run/Stop Control, etc.)	0x00: No function (Maintain the current state) 0x01: Run Forward 0x02: Reverse 0x03: Jog 0x04: Jog reverse 0x05: Stop 0x06: Coast 0x07: Reset 0x08: Clear command (Clear all run and stop commands)

Bit	Explanation
Bit11~8 (Preset value select)	0000B: P0-30 (Preset Value 0) 0001B: P0-31 (Preset Value 1) ... 1111B: P0-45 (Preset Value 15)
Bit13~12(Ramp time select)	00B: Ramp 1 01B: Ramp 2 10B: Ramp 3 11B: Ramp 4
Bit14	Reserved
Bit15	1B: Enable Bit8~13 function 0B: Disable Bit8~13 function

Status Word Explanation - P9-02 Status Word Correspondence Table

Bit	0	1
bit0	Control Not Ready	Control Ready
bit1	Control Not Ready	Control Ready
bit2	Inertia Stop	Running
bit3	No Fault	Fault Trip
bit4	No Fault	Fault Not Tripped
bit5	Reserved	Reserved
bit6	No Fault	Fault Trip
bit7	No Warning	Warning
bit8	Not Running at Reference Value	Running at Reference Value
bit9	Local Mode	Remote Mode
bit10	Frequency Out of Range	Within Frequency Range
bit11	Stop	Running
bit12	Forward	Reverse
bit13	Within Voltage Range	Beyond Voltage Limit
bit14	Reserved	Reserved
bit15	No Overheat Warning	Overheat Warning

6. XML File Configuration

The EtherCAT Slave Information Description File (*.XML) provides communication and configuration information for ET01. Users need to import this file into the master station configuration tool in order to configure the ET01 device. Please contact the manufacturer to obtain the XML file that matches the ET01.

7. Object Dictionary

7.1. OD 1000h Communication Group

Index	Object Type	Name	Data Type	Attribute
1610h	Record	Outputs (Receive PDO Mapping)	PDOMAPPING	RW
1A10h	Record	Inputs (Transmit PDO Mapping)	PDOMAPPING	RW

7.2. OD 2001h-2002h Inverter Control Object Area

2001h and 2002h are the control access areas for the inverter, where 2001h represents the Control Word and 2002h represents the Set Value. The definition of the Control Word can be found in Chapter 5.4. The Set Value is in units of 0.1Hz. These two objects are present by default in Outputs.

7.3. OD 3000h-5FFFh Inverter Parameter Object Area

The area from 3000h to 5FFFh is designated for the inverter parameter access. All parameters of the inverter are mapped to this area. The first available index is 3001h, corresponding to the inverter's P0-01 parameter. The mapping relationship between inverter parameter numbers and EtherCAT application object indexes is: Index = 3000h + Inverter Parameter Number. For example, for the inverter's P9-08 parameter, its corresponding application object index is = 3000h + 38Ch = 338Ch. The following table lists some application objects for inverter parameters.

Index	Object Type	Name	Data Type	Access
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

The definition and description of inverter parameters can be found in the inverter's user manual or by contacting the manufacturer.

8. Fault Description and Handling

Type	Error	Status	Symptom Description	Corresponding Remedial Measures
1	On	X	Fieldbus Communication Abnormality	1. Check if the communication connection between ET01 and the master station is normal
2	Off	X	Communication Failure Between ET01 and Control Unit	1. Verify if the ET01 is properly inserted into the control unit 2. Inspect if any pins in the control unit are bent 3. Replace the expansion card or contact the manufacturer

■ Innovate for more | win forever

■ Industry intelligence | Energy saving | Green power

Quanzhou Factory

Address:3# Zixin Road, Jiangnan Hi-Tech Industrial Park, Quanzhou, Fujian, China

Tel：0595-24678267 Fax：0595-24678203

Service Network

Website：www.savch.net

Qualification

Received ISO9001 and CE recognition

Version : V1.0 2024-11-22