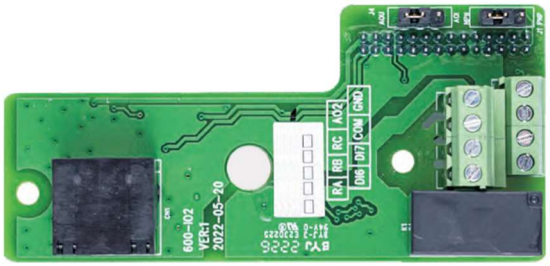
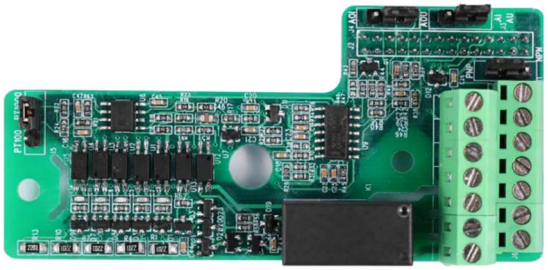
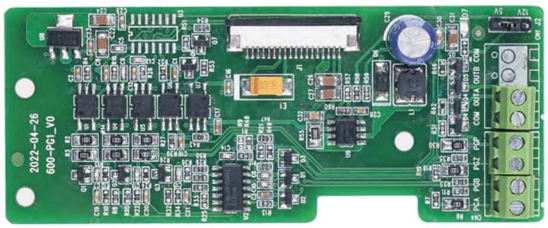
CHEMPLEX
Hajtóművek szakértői támogatással







driveEU
TECHNOLOGY

KD600

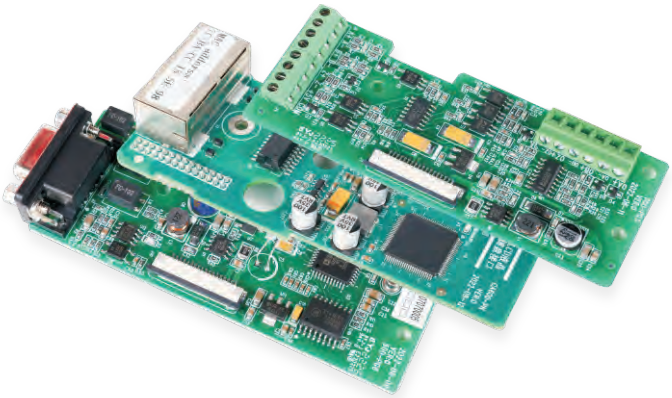
Frequency converter expansion card

User Manual

Preface

Introduction of data

This document describes the information about the communication expansion card, encoder expansion card, and IO expansion card commonly used in our common frequency converter, including the installation size, electrical specifications, interface layout, and terminal definition of the expansion card.



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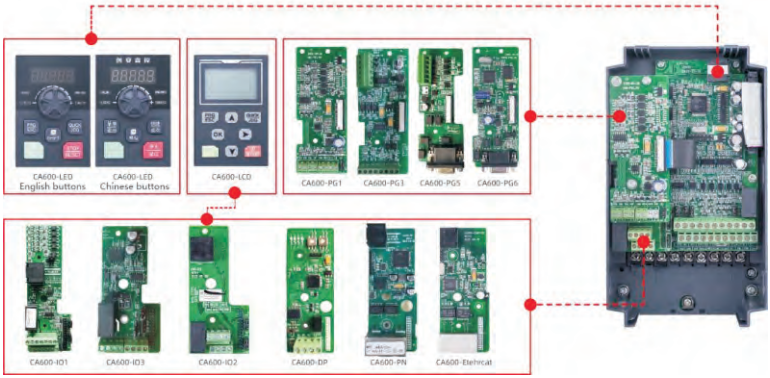
Quick selection List



Plastic shell chassis

Sheet metal chassis

Installation and function description of expansion card

Installation of expansion card

Inverter is equipped with 3 I/O expansion cards, 4 field bus cards (Profi-bus-DP, CANopen, Profinet, EtherCAT) and 4 kinds of PG cards. The installation positions are shown in the following figure. The cover plate needs to be removed during installation (refer to the following figure for installation).

Expansion diagram for
4T011GB/15PB and above models

Schematic diagram of 4.0KW-9.0KW expansion method
2.2KW and below models currently have no expansion function

Installation diagram of 4.0KW-9.0KW
expansion interface

Installation diagram of
11KW and above models

Chapter 1 I/O expansion card

1.1 IO1 Expansion Card Product Introduction

The IO1 expansion card is an I/O expansion card designed for use with series frequency converters. It can expand 5 channels of DI, 1 channel of AI3, 1 channel of DO, 1 channel of AO, and 1 channel of relay output, as well as 1 channel of temperature detection.

1.1.1 Appearance and layout

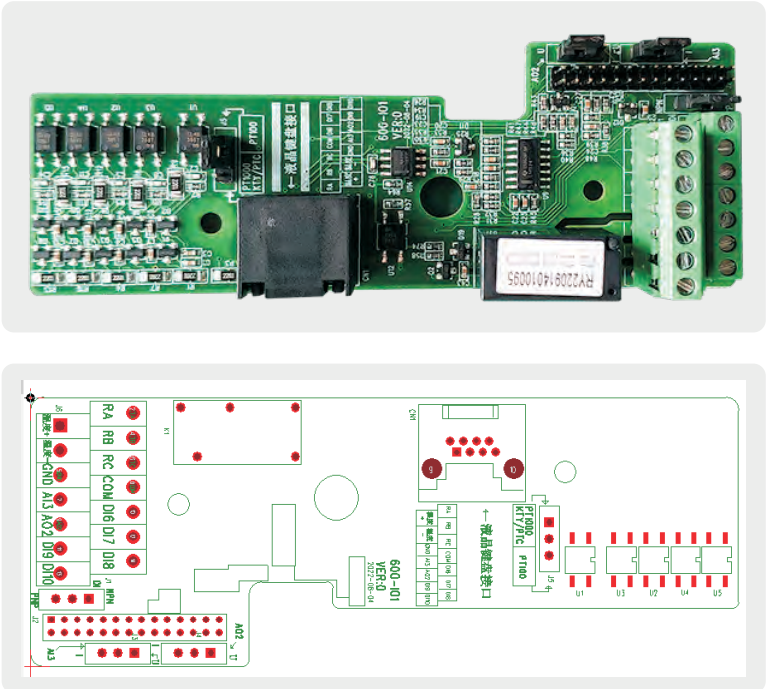
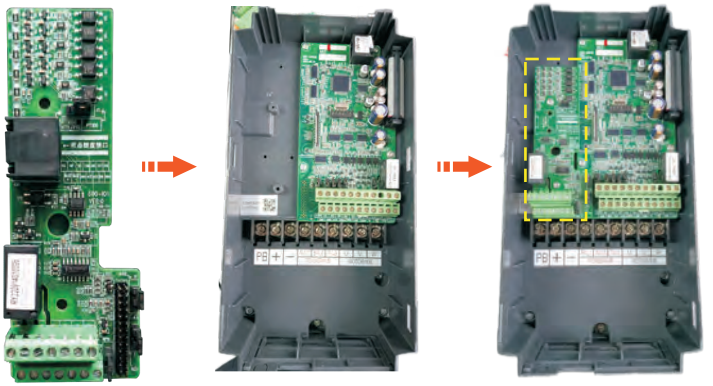


Figure 1-1 I/O Expansion Card 1 Appearance and Layout

1.1.2 Installation diagram

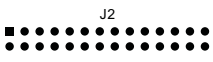
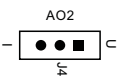
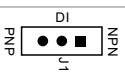
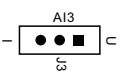


1.1.3 Interface layout description and parameter settings

Terminal identity	Terminal name	Function Description	Function Code	Content	Notes
RA-RB	Normally closed terminal	Contact driving capability: AC250V, 3A, COS Φ= 0.4. DC 30V, 1A	P6.01	Control board relay RELAY2 output (RA/RB/RC) selection	U1-07 monitoring status
RA-RC	Normally open terminal				
DI6~DI9	DI6-COM ~DI9-COM	1. Optocoupler isolation, compatible with bipolar input (when PNP input, connect the+24V power supply to the motherboard+24V) 2. Input impedance: 4.4kΩ 3. Voltage range during level input: 9-30V	P5-05	DI6 terminal function	U1-06 monitors whether the DI terminal is connected
			P5-06	DI7 terminal function	
			P5-07	DI8 terminal function	
			P5-08	DI9 terminal function	
AO2-GND	Analog output	1. Specification of output voltage: 0V~10V 2. Specification of output current: 0mA~20mA 3. Output current with impedance specifications: 0Ω~500Ω	P6-17	AO2 output lower limit	Monitoring U1-38 value=AO2
			P6-18	Lower limit corresponds to AO2 output	
			P6-19	AO2 output upper limit	
			P6-20	Upper limit corresponds to AO2 output	

Terminal identity	Terminal name	Function Description	Function Code	Content	Notes
TEMP-P TEMP-N	Temperature+ Temperature-	PT100, Pt1000 Temperature sensor, PTC, KTY type temperature sensor (selected through jumper J5)	P9-38	Temperature sensor type selection	
			U1-50	Motor temperature (sensor temperature)	
AI3-GND	Analog input terminal Ai3	Input voltage range: 0-10V (input impedance: 30k Ω); Input current range: 0-20mA (input impedance: 500 Ω)	Ai3 is a non-standard software and does not have this feature in general use		
COM	+24V power supply common terminal	+24V power supply common terminal			

1.1.4 Selection terminal description

Terminal identity	The name of the terminal	Functional specifications	Terminal distribution
J2	Main board connection	28 pin connection to the main control board	
J4	Ao2 output type setting jumper	Short cap short circuiting U: voltage type output Short cap short circuit I: current type output	
J1	NPN/PNP input DI selection type jumper	DI6-DI10 input type selection. NPN type, PNP type	
J3	Ai3 Analog Input Type Setting Jumper	Short cap short circuiting U: voltage type Short cap short circuit I: current type	

1.2 IO2 Expansion Card Product Introduction

The IO2 expansion card is an I/O expansion card designed for use with series frequency converters, capable of expanding 2 DI, 1 AO, and 1 relay output.

1.2.1 Appearance and layout

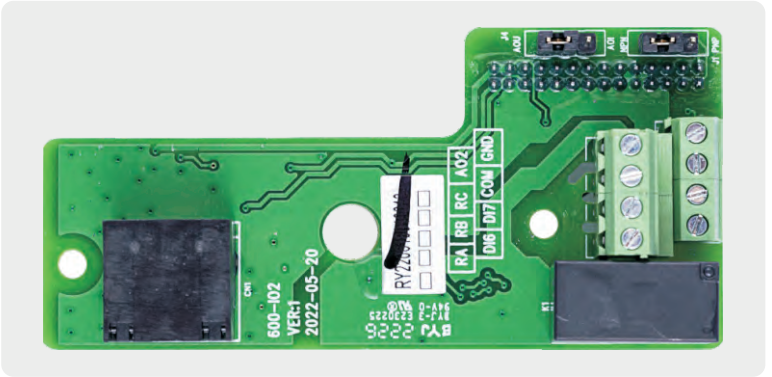
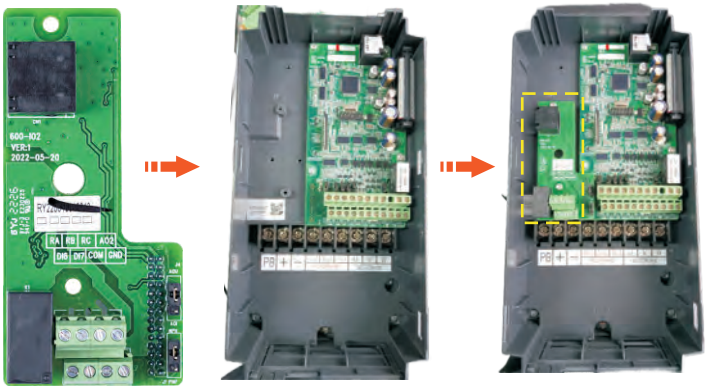


Figure 1-2 Appearance and layout diagram of I/O2 expansion card

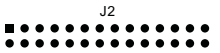
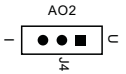
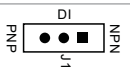
1.2.2 Installation diagram



1.2.3 Interface layout description and parameter settings

Terminal identity	Terminal name	Function Description	Function Code	Content	Notes
RA-RB	Normally closed terminal	Contact driving capability: AC250V, 3A, COS Φ= 0.4. DC 30V, 1A	P6.01	Control board relay RELAY2 output (RA/RB/RC) selection	U1-07 monitoring status
RA-RC	Normally open terminal				
DI6~DI7	DI6-COM ~DI7-COM	1. Optocoupler isolation, compatible with bipolar input (when PNP input, connect the+24V power supply to the motherboard+24V) 2. Input impedance: 4.4kΩ 3. Voltage range during level input: 9-30V	P5-05	DI6 terminal function	U1-06 monitors whether the DI terminal is connected
			P5-06	DI7 terminal function	
COM	+24V power supply common terminal	+24V power supply common terminal			

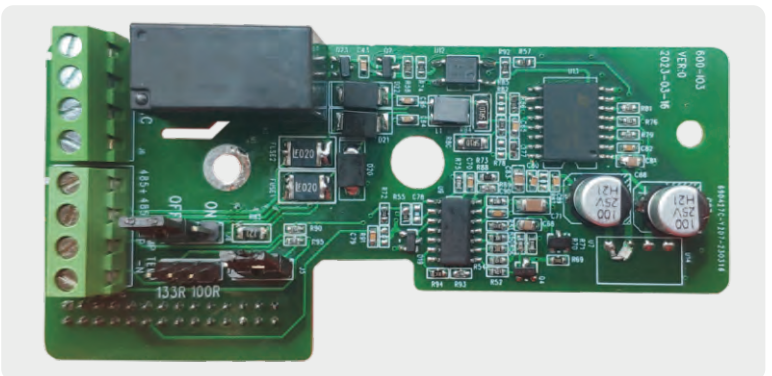
1.2.4 Selection terminal description

Terminal identity	The name of the terminal	Functional specifications	Terminal distribution
J2	Main board connection	28 pin connection to the main control board	
J4	Ao2 output type setting jumper	Short cap short circuiting U: voltage type output Short cap short circuit I: current type output	
J1	NPN/PNP input DI selection type jumper	DI6-DI10 input type selection. NPN type, PNP type	

1.3 IO3 Expansion Card Product Introduction

The IO3 expansion card is an I/O expansion card designed for use with a series of frequency converters. It mainly serves as a 485 communication anti-interference isolation expansion card, with one relay output, one 485 communication port, and one temperature channel.

1.3.1 Appearance and layout



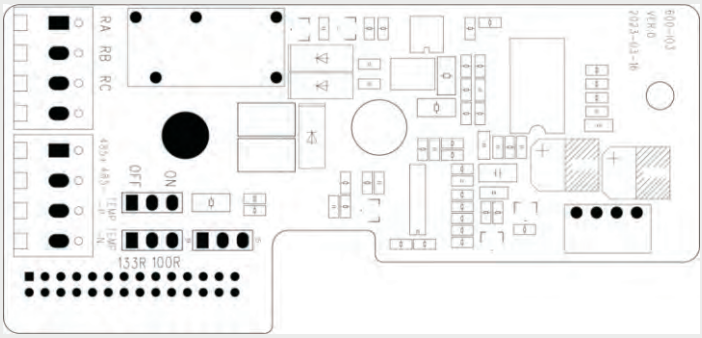
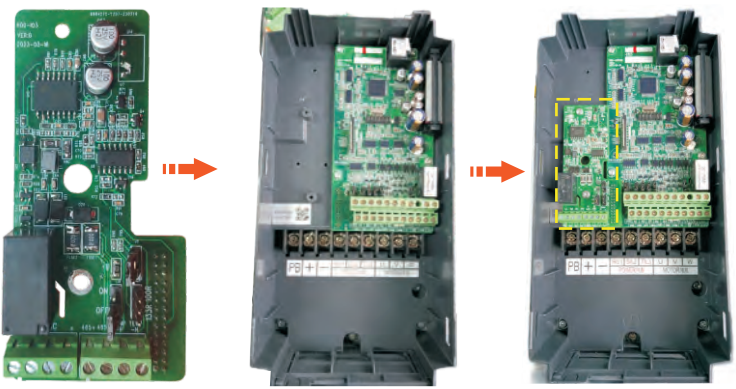


Figure 1-3 Appearance and layout diagram of I/O3 expansion card

1.3.2 Installation diagram



1.3.3 Interface layout description and parameter settings

Terminal identity	Terminal name	Function Description	Function Code	Content	Notes
RA-RB	Normally closed terminal	Contact driving capability: AC250V, 3A, COS Φ= 0.4. DC 30V, 1A	P6-01	Control board relay RELAY2 output (RA/RB/RC) selection	U1-07 monitoring status
RA-RC	Normally open terminal				
485+	ModBus 485+	Standard ModBus 485 communication protocol	P8-00	Baud rate setting	
			P8-01	Data format	
			P8-02	Mailing address	
			P8-03	Response time	
485-	ModBus 485-		P8-04	Communication timeout	
			P8-05	Communication format selection	
			P8-06	Backend software monitoring function	
TEMP-P TEMP-N	Temperature+ Temperature-	PT100, Pt1000 Temperature sensor, PTC, KTY type temperature sensor (selected through jumper J5)	P9-38	Temperature sensor type selection	
			U1-50	Motor temperature (sensor temperature)	
PE	Grounding	Grounding terminal			

Chapter 2 Communication expansion card

2.1 ProFinet communication card

2.1.1 Product Overview

The PN card is a Profinet fieldbus adapter card that complies with the internationally recognized Profinet Ethernet standard. This card is installed on the CA series frequency converter to improve communication efficiency and facilitate the networking function of the frequency converter, making the frequency converter a slave station of the fieldbus and receiving control from the fieldbus master station. PN card software version 1.00 or higher is required, and the supporting GSDML file name is "GSDML-V2.31-PNCard-2020220222. XML".

2.1.2 Appearance and Size

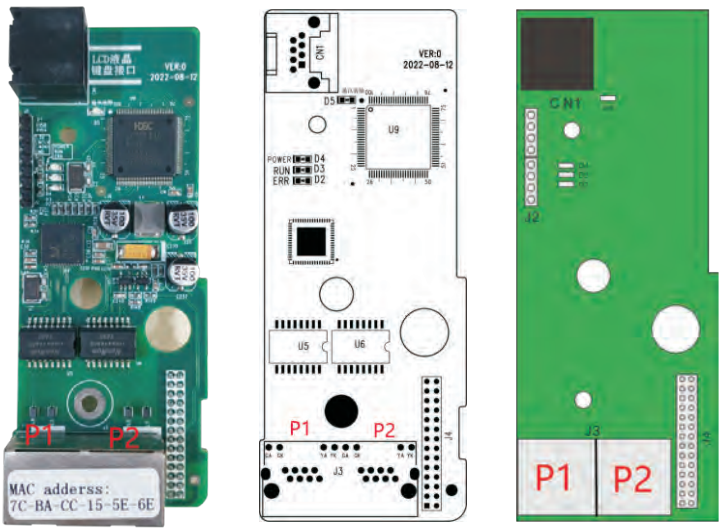
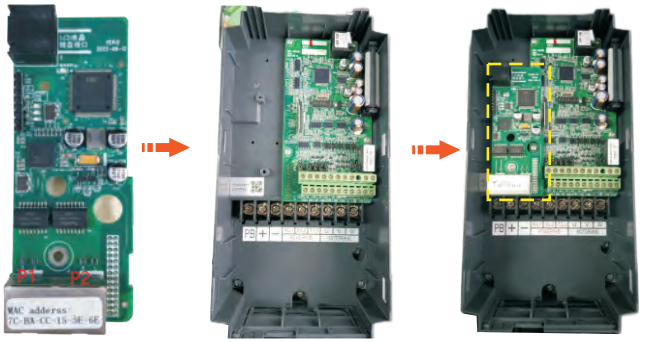


Figure 2-1 ProFinet Communication Card Appearance and Interface Layout

2.1.3 Installation diagram



2.1.4 Profinet topology

The topology structures supported by PROFINET include bus type, star type, tree type, etc. By utilizing switches reasonably, a variety of networking can be achieved.

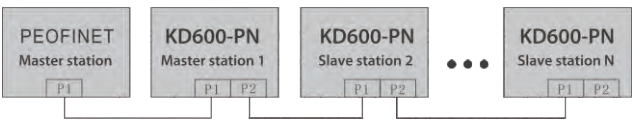


Figure 2-2 Bus type connection topology diagram

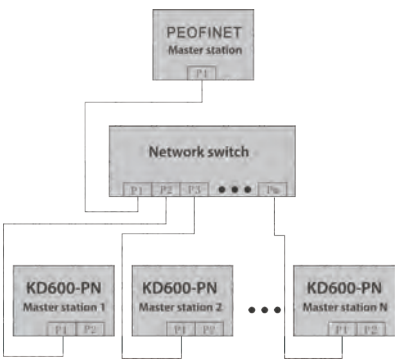


Figure 2-3 Star connection topology diagram

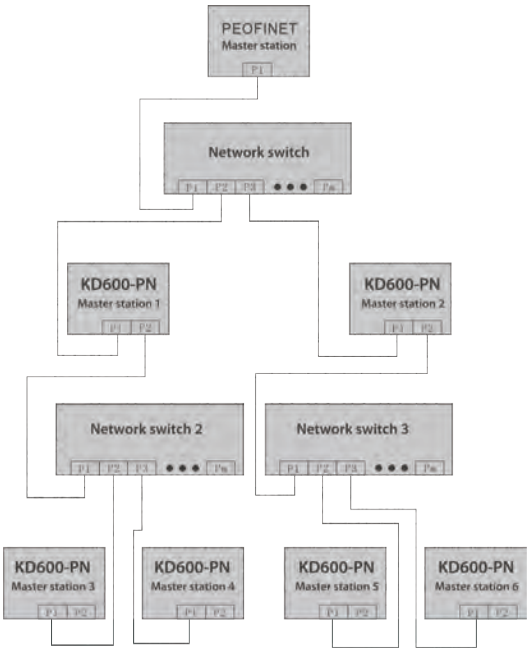


Figure 2-4 Tree connection topology diagram

2.1.5 Hardware Description of PN Card

2.1.5.1 Indicator description

Indicator light position number	Indicator light function	Indicator light status	Description of indicator light status	Solution
D2	PROFINET fault indicator light (red)	OFF state	Normal	N/A
		Red always bright	Communication failure	Please contact technical support
D3	PROFINET communication indicator light (green)	Green always on	Contro) selection	N/A
		OFF state	Lost communication with drive	Set P8-11 to 1 and check if the AC drive supports PN cards

Indicator light position number	Indicator light function	Indicator light status	Description of indicator light status	Solution
D4	Power indicator light (green)	Green always on	Normal	N/A
		OFF state	The communication board is not powered on	Check if the J4 connector is connected properly and if the frequency converter is powered on
D5	Frequency converter communication indicator light (green)	Green always on	Normal	N/A
		OFF state	ESC internal malfunction	Please contact technical support

2.1.5.2 Terminal Description

Identification	Terminal name	Function description	Function description
J3	Dual port connector	PEIFINET interface P1	Standard Ethernet RJ45 socket, no direction, J3 PN card and PN card (PLC) connection communication
		PEIFINET interface P2	
J4	28 pin plug	Connected to the frequency converter motherboard	Connect the LCD keyboard network cable interface

2.1.5.3 Debugging parameter

Function code	Name	Description (setting range)	Factory Default	Change
P0-04	Run command source	0: Operation panel running command channel (LED off) 1: Terminal command channel (LED on) 2: Communication command channel (LED flashes)	2	Running command issued by communication
P0-06	Main frequency source X selection	0: Up/Down modification frequency, no memory after shutdown 1: Up/Down modification frequency power-off memory 2: AI1 3: AI2 4: Multi-speed 5: Simple PLC 6: PID	7	The given target frequency is communicated

Function code	Name	Description (setting range)	Factory Default	Change
		7: Communication given 8: PULSE pulse setting 9: Up/Down modifies the frequency, and the memory is stopped when the power is turned off.		
P8-11	Serial communication protocol	0: Modbus protocol 1: Communication Card Bridge Protocol	1	Select special item communication card for communication

2.1.6 Data transmission format

According to the ProfiDrive (variable speed transmission) protocol, the use type is divided into five types: PPO1, PPO2, PPO3, PPO4 and PPO5.

Data type	Supported features
PP01	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read
PP02	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ The four function parameters are written periodically ➢ The four function parameters are periodically read
PP03	➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read
PP04	➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ The four function parameters are written periodically ➢ The four function parameters are periodically read
PP05	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ 10 function parameters are written periodically ➢ 10 function parameters are periodically read

2.1.6.1 PPO type description

The data block contained in the PPO type data format is divided into two regions, nam-ely the PKW region (parameter region) and the PZD region (procedure data region). The type data format is shown in the following figure.

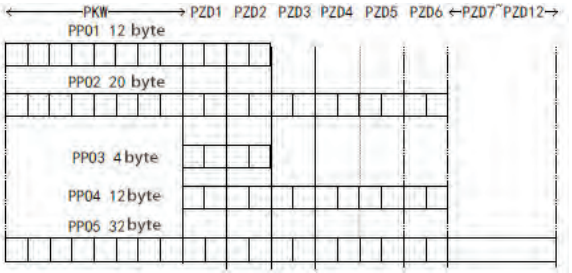


Figure 2-5 PPO type data format

2.1.6.2 PKW data description

PKW data mainly realizes the master station to read and write a single parameter of the frequency converter, and the communication address of the frequency converter parameter is directly given by the communication data. The functions achieved are as follows:

a) Frequency converter function parameter reading;

b) Change of inverter function parameters;

Data format:

PKW data contains three groups of array areas, namely PKE, IND,PWE, where PKE data byte length is 2 bytes IND is 2 bytes,PWE,PWE is 4 bytes.

The data format is shown in the following table:

The master station sends data PKW							
Operation command	Parameter address		Reserve			Write operation: Parameter value Read operation: empty	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
Communication card response data PKW							
Operation command	Parameter address		Reserve			Success: Return value Failed: Error message	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE

The master station sends data PKW description		Supported features
PKE	High 4 bits: command code 0: No request 1: Read the parameter data 2: Change the parameter data (The above command code is decimal data) Lower 4 bits: reserved Low 8 bits: indicates the high level of the parameter address	High 4 bits: response code 0: No request 1: The parameters are correctly operated 7: cannot be executed Low 8 bits: indicates the high level of the parameter address
IND	High 8 bits: indicates the low part of the parameter address Lower 8 bits: reserved	High 8 bits: indicates the low part of the parameter address Lower 8 bits: reserved
PWE	High 16 bits: reserved Lower 16 bits: not used during the read request. Indicates the parameter value when the request is written	When the request succeeds: Parameter value When the request fails: Error code (consistent with standard MODBUS) 1: indicates an illegal command 2: indicates the illegal address 3: indicates illegal data 4: Other errors

2.1.7 Application example

The PKW area of the sent data and the PKW area of the response data of the frequency converter read by the master station are shown in the figure below.

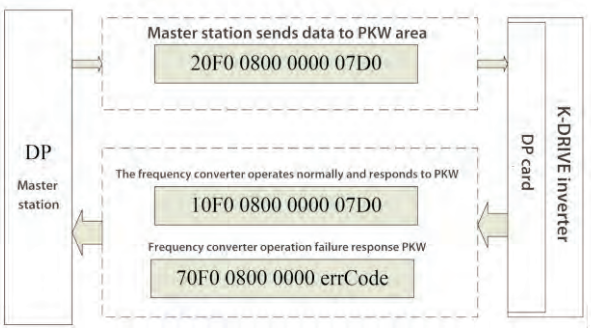


Figure 2-6 Example of master station reading frequency converter parameters and sending PKW data

2.1.8 PZD area data description

The data in PZD area can change and read the data from the main station to the inverter in real time and periodically interact with the data. The communication address of the data is directly configured by the frequency converter. It mainly contains the following contents:

- Frequency converter control command, target frequency set in real time;
- Real-time reading of the current status and operating frequency of the inverter;
- Real-time interaction of functional parameters and monitoring parameter data between frequency converter and PROFINET master station.

The PZD process data mainly completes the periodic data exchange between the main station and the frequency converter. The interaction data is shown in Table:

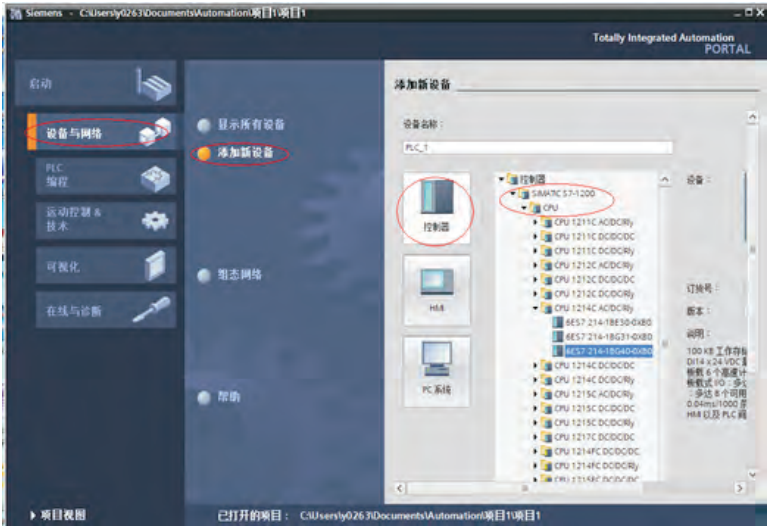
PZD area for sending data from the main station			Frequency converter response data PZD area		
PZD1	PZD2	PZD3~PZD12	PZD1	PZD2	PZD3~PZD12
Control Word (U3-17)	Frequency setting (U3-16)	Real time modification of frequency converter functional parameters	Status Word (U0-39)	Operating frequency (U0-00)	Real time reading of frequency converter functional parameters

Main station sends data PZD description		Frequency converter response data PZD area
PZD1	Frequency converter command word (command source needs to be set to communication, i.e. P0-02=2) 0001: Forward running 0002: Reverse operation 0003: Forward jog 0004: Reverse jog 0005: Free shutdown 0006: Deceleration shutdown 0007: Fault reset 0008: Fault reset (can only be reset in communication control mode)	Frequency converter operation status signal interest 0001: Forward running 0002: Reverse operation 0003: Shutdown
PZD2	The target frequency of the AC drive (frequency source set to "communication") is within the range of reverse frequency upper limit (negative value) to forward frequency upper limit (including decimal point, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the given target frequency exceeds this range, the AC drive operates at that frequency upper limit. For example, if the frequency limit is set to 50.00 Hz and set to 6000, the AC drive will run forward at a frequency of 50.00 Hz. If the frequency limit is set to 50.00 Hz and the communication is set to -6000, the AC drive will operate in reverse at a frequency of 50.00 Hz.	Frequency of frequency converter operation (unit: 0.01Hz) Returns the actual operating frequency of the current frequency converter, with a data value of sixteen signed digits

Main station sends data PZD description		Frequency converter response data PZD area
PZD3~ PZD12	Real time change of function parameter values without writing to EEPROM	Real time reading of functional parameters

2.1.9 Configuring Slaves with S7-1200 in TIA Portal

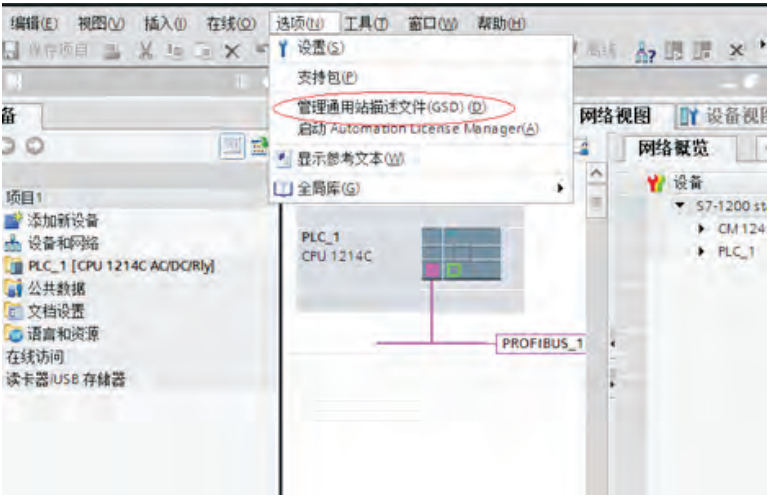
2.1.9.1 Open TIA Portal V13, create a new project, and add the S7-1200 main station according to the actual situation.

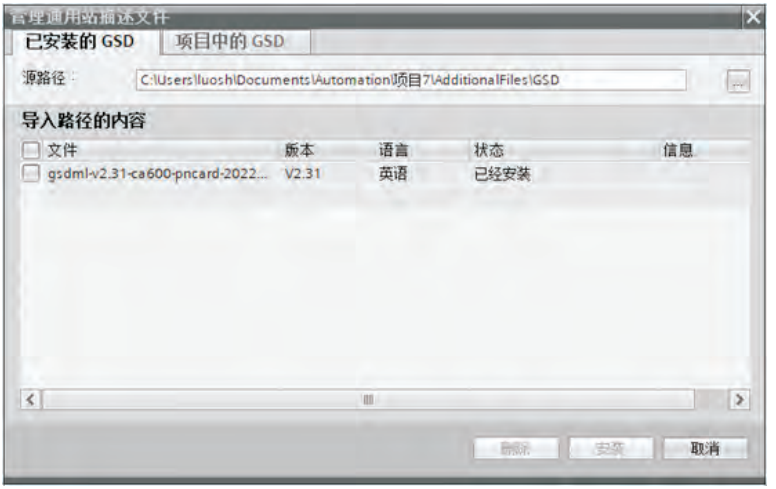


After adding Siemens PLC, switch to the "Project View".

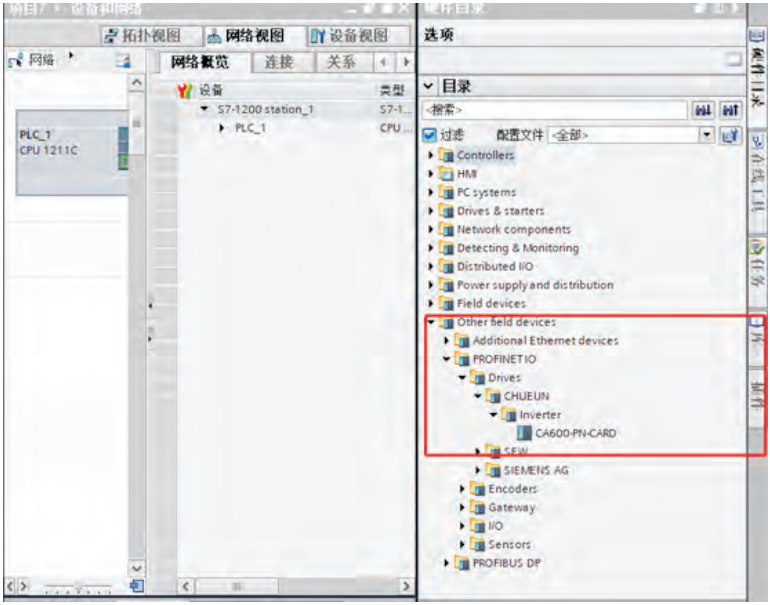
2.1.9.2 Install GSD file (this step can be ignored if GSD is already installed)

The uninstalled GSD file will display "Not Installed". After checking, select "Install" and wait for the installation to complete (it is recommended that the installation path does not contain Chinese, otherwise an error may occur).


编辑(E) 视图(V) 插入(I) 在线(O) 选项(N) 工具(T) 窗口(W) 帮助(H)
设置(S)
支持包(P)
管理通用站描述文件(GSD)(D)
启动 Automation License Manager(A)
显示参考文本(W)
全局库(G)
网络视图
设备视图
网络概览
设备
项目1
添加新设备
设备和网络
PLC_1 [CPU 1214C AC/DC/Rly]
公共数据
文档设置
语言和资源
在线访问
读卡器/USB 存储器
PLC_1
CPU 1214C
PROFIBUS_1

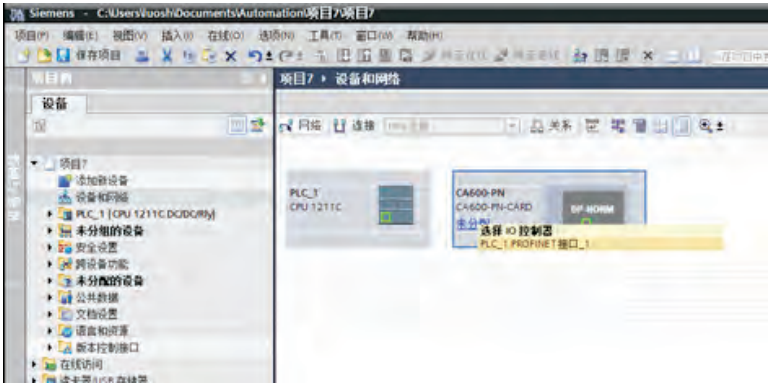

管理通用站描述文件
已安装的 GSD
项目中的 GSD
源路径：
C:\Users\luoshi\Documents\Automation\项目7\AdditionalFiles\GSD
导入路径的内容
文件
版本
语言
状态
信息
gsdml-v2.31-ca600-pncard-2022...
V2.31
英语
已经安装
删除
安装
取消

When the "Successfully Installed" interface appears, it indicates that you have clicked to close. After installing GSD, PORTAL will automatically close the configuration interface and complete the installation. You can find the device corresponding to the P_PN in the hardware device tree, as shown in the following figure:



2.1.9.3 Configure network

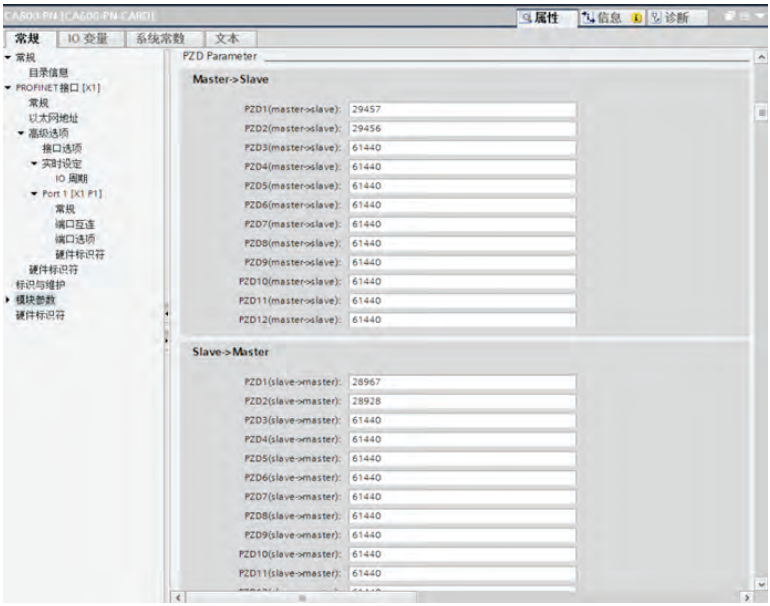
(1) Double click or drag PN CARD from the "Hardware Directory" to the "Network View" of "Devices and Networks", click "Unassigned" on the slave station, and connect to the network of the Profinet corresponding to the PLC:



(2) Double click the _ PN icon to enter the configuration module, select the appropriate PPO type in the "Hardware Directory", pay attention to the addresses assigned to each segment, as shown in the figure below. Mark the corresponding PKW addresses in the marked section. If the selected PPO does not have a PKW, the column will be blank.

2.1.9.4 Set PZD mapping

Switch back to the "Network View" and click on "Device Specific Parameters" to set the mapping for PZD3->PZD12. Note that the PZD mapping for PLC read and write slave stations is set separately and does not interfere with each other. The specific setting method can refer to the introduction in this section of STEP7.



Among them, PZDx (master -->slave) represents the corresponding address written by the master station to the slave station, and PZDx (slave -->master) represents the corresponding address read by the master station to the slave station. The PZD range that can be set is PZD3~PZD12 (depending on the selected message type), and the display format is decimal. That is, if you want to set PZD3 (master -->slave) to P0-12, you need to fill in 61452 in the numerical value of this line.

The default value for all PZDs is P0-00 (corresponding to decimal 61440), and unused PZDs can be retained without modification. Each slave station needs to set up its own PZD mapping relationship according to the requirements (if the mapping relationship is the same for each slave station, you can select an already set slave station, press CTRL+C, and then select the Profinet bus in the configuration and press CTRL +V to directly modify the device name and IP address).

Switch back to the "Network View". If more sites need to be added, repeat the above work. If the configuration is the same, you can directly select the secondary site and copy it, then modify the IP address and device name (note: the device name must be inconsistent).

Configure module communication address：

2.2 Profibus-DP communication card

2.2.1 Product Overview

DP is a Profibus DP fieldbus adapter card that complies with the internationally recognized Profibus fieldbus standards. The card is installed on a series of frequency converters, improving communication efficiency and facilitating the networking function of the frequency converter. It makes the frequency converter a slave station of the fieldbus and accepts control from the fieldbus master station. This DP expansion card can achieve Profibus DP communication.

This manual requires the corresponding DP card software version to be 1.00 or higher, and the supporting GSDML file name is "WSDP. gsd".

Communication object:

Types of	Profbus-DP
Diagnostic support	Support
DPV1 support	Support
PPO4 support	Support
PPO type selection	Siemens backend settings
PZD mapping address	Siemens backend settings
Station number setting dialing	Set 1-125
Main station drop	Expansion card actively informs frequency converter
Communication speed between card and frequency converter	Fixed rate
Slave station failure	Expansion card actively informs the main station
CAN communication support	Not supported

2.2.2 Appearance and Size

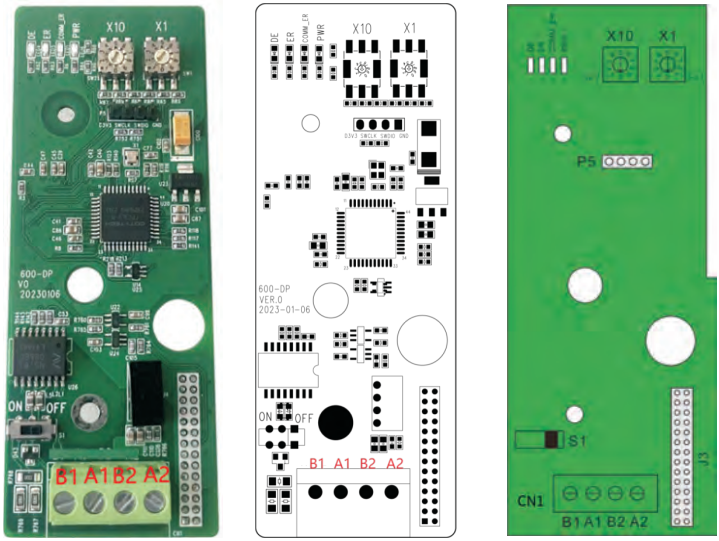
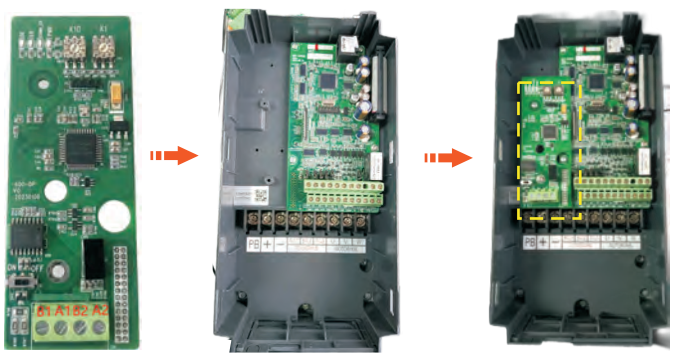


Figure 2-7 Profibus-DP Communication Card Appearance and Interface Layout

2.2.3 Installation diagram



2.2.4 Profibus connection topology

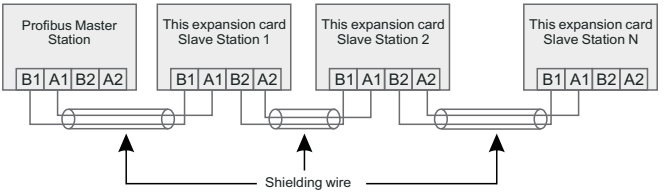


Figure 2-8 Schematic diagram of the connection between this DP expansion card and the Profibus master station

2.2.5 Hardware Description of DP Card

2.2.5.1 Indicator description

Indicator light position number	Indicator light function	Indicator light status	Description of indicator light status	Solution
DE	Profibus-DP Communication Indicator (Green)	Steady green	DP normal	N/A
		OFF state	Communication with the drive is disconnected	Set P8-11 to 1 and check that the AC drive supports DP cards.
ER	Profibus-DP Fault indicator (Red)	Steady red	Communication failure	Contact technical support.
		OFF state	Normal	N/A
COMM_ER	Frequency converter communication light (green)	Steady green	Communication board is not powered on	Check whether the J3 connector is properly connected and whether the inverter is powered on.
		OFF state	Normal	N/A
PWR	Power indicator (Green)	Steady green	Normal	N/A
		OFF state	ESC internal fault	Contact technical support.

2.2.5.2 Terminal Description

Identification	Terminal name	Function description	Function description
B1 A1 B2 A2	DP communication interface	PROFIBUS differential signal AB	B1 A1 input interface, B2 A2 output interface
J3	28-bit pin insertion	Connect to the frequency converter motherboard	

Identification	Terminal name	Function description	Function description
X10 X1	Set the address of the slave station	Profibus station number setting	X10 is the address tens place and X1 is the ones place
S1	Terminal resistance dip switch	Profibus terminal resistance	When the DP expansion card is the last station in the Profibus network, the terminal resistance switch ON the expansion card is ON. When the DP expansion card is an intermediate station in the Profibus network, the terminal resistance switch on the expansion card is in the OFF position.

For the S1 DIP switch, the resistance of the terminal must match that of the Profibus bus at the beginning and end. After the DIP switch is correctly connected to the terminal resistance, the test resistance between A1 and B1 should be about 110 ohms when the power is off. The DP connectors of the devices at both ends of the Profibus network must connect the communication cables to channels A1/B1; otherwise, terminal resistors cannot be connected. If the terminal resistance is not connected or less connected, the communication quality will be affected, resulting in unstable communication.

2.2.6 Transmission distance

According to the different baud rate Settings of the master station, the length of the communication wire between the DP expansion card and the Profibus master station is also required, and the length of the communication data wire must be strictly limited in accordance with SIEMENS. Baud rate and wire length requirements are shown in the table below.

Transmission rate Kbps	Cable Type A Maximum Length (m)	Cable Type B Maximum Length (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	100
3000	100	Nonsupport
6000	100	
12000	100	

Cable technical specifications are shown in the following table.

Cable parameter	Type A	Type B
Impedance	135Ω~165Ω (f=3~20MHz)	100Ω~130Ω (f>100kHz)
Capacitance	<30pF/m	<60pF/m
Resistance	<110Ω/km	Unspecified
Conductor cross-sectional area	≥0.34mm^2	≥0.22mm^2

2.2.7 Debugging parameter

Function code	Name	Description (setting range)	Factory Default	Change
P0-04	Run command source	0: Operation panel running command channel (LED off) 1: Terminal command channel (LED on) 2: Communication command channel (LED flashes)	2	Running command issued by communication
P0-06	Main frequency source X selection	0: Up/Down frequency modification, shutdown not remembered 1: Up/Down Modify Frequency Power Failure Memory 2: Ai1 3: Ai2 4: Multi stage speed 5: Simple PLC 6: PID 7: Communication given 8: PULSE pulse setting 9: Up/Down modification frequency, shutdown memory, power-off memory, no memory	7	The given target frequency is communicated
P8-11	Serial communication protocol	0: Modbus protocol 1: Communication Card Bridge Protocol	1	Select special item communication card for communication

2.2.8 Data transmission format

Profibus DP data format

According to the ProfiDrive protocol, the usage types are divided into five types: PPO1, PPO2, PPO3, PPO4, and PPO5. The functions that each data format can accomplish are shown in the table below:

Data type	Supported features
PP01	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read
PP02	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ The four function parameters are written periodically ➢ The four function parameters are periodically read
PP03	➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read
PP04	➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ The four function parameters are written periodically ➢ The four function parameters are periodically read
PP05	➢ Single-function parameter operations ➢ Inverter command and frequency setting ➢ Frequency converter status, running frequency read ➢ 10 function parameters are written periodically ➢ 10 function parameters are periodically read

PPO type description

The data blocks contained in the PPO type data format are divided into two areas, namely the PKW area (parameter area) and the PZD area (process data area). The type data format is shown in the following figure:

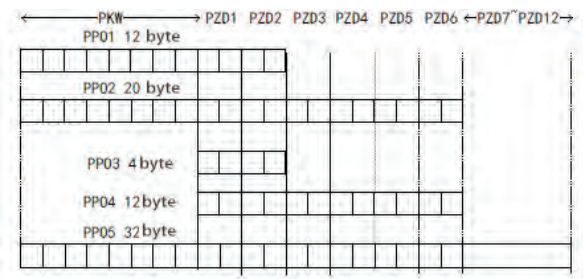


Figure 2-9 PPO type data format

2.2.8.1 PKW data description

PKW data mainly realizes the master station to read and write a single parameter of the frequency converter, and the communication address of the frequency converter parameter is directly given by the communication data. The functions achieved are as follows:

a) Frequency converter function parameter reading;

b) Change of inverter function parameters;

Data format:

PKW data contains three groups of array areas, namely PKE, IND,PWE, where PKE data byte length is 2 bytes IND is 2 bytes,PWE,PWE is 4 bytes.

The data format is shown in the following table:

The master station sends data PKW							
Operation command	Parameter address		Reserve			Write operation: Parameter value Read operation: empty	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
Communication card response data PKW							
Operation command	Parameter address		Reserve			Success: Return value Failed: Error message	
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE

The master station sends data PKW description		Supported features
PKE	High 4 bits: command code 0: No request 1: Read the parameter data 2: Change the parameter data (The above command code is decimal data) Lower 4 bits: reserved Low 8 bits: indicates the high level of the parameter address	High 4 bits: response code 0: No request 1: The parameters are correctly operated 7: cannot be executed Low 8 bits: indicates the high level of the parameter address
IND	High 8 bits: indicates the low part of the parameter address Lower 8 bits: reserved	High 8 bits: indicates the low part of the parameter address Lower 8 bits: reserved
PWE	High 16 bits: reserved Lower 16 bits: not used during the read request. Indicates the parameter value when the request is written	When the request succeeds: Parameter value When the request fails: Error code (consistent with standard MODBUS) 1: indicates an illegal command 2: indicates the illegal address 3: indicates illegal data 4: Other errors

2.2.9 Application example

The PKW area of the sent data and the PKW area of the response data of the frequency converter read by the master station are shown in the figure below.

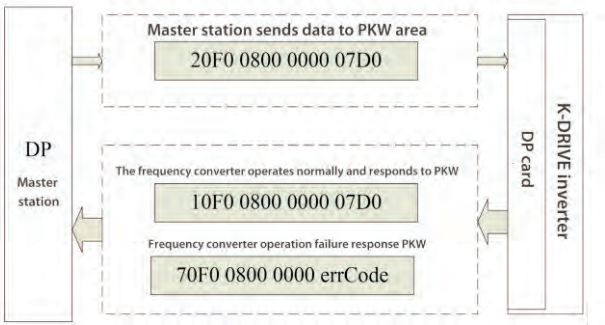


Figure 2-10 Example of master station reading frequency converter parameters and sending PKW data

2.2.10 PZD area data description

The data in PZD area can change and read the data from the main station to the inverter in real time and periodically interact with the data. The communication address of the data is directly configured by the frequency converter. It mainly contains the following contents:

- Frequency converter control command, target frequency set in real time;
- Real-time reading of the current status and operating frequency of the inverter;
- Real-time interaction of functional parameters and monitoring parameter data between frequency converter and Profibus-DP master station.

The PZD process data mainly completes the periodic data exchange between the main station and the frequency converter. The interaction data is shown in Table:

PZD area for sending data from the main station			Frequency converter response data PZD area		
PZD1	PZD2	PZD3~PZD12	PZD1	PZD2	PZD3~PZD12
Control Word (U3-17)	Frequency setting (U3-16)	Real time modification of frequency converter functional parameters	Status Word (U0-39)	Operating frequency (U0-00)	Real time reading of frequency converter functional parameters

Main station sends data PZD description		Frequency converter response data PZD area
PZD1	Frequency converter command word (command source needs to be set to communication, i.e. P0-02=2) 0001: Forward running 0002: Reverse operation 0003: Forward jog 0004: Reverse jog 0005: Free shutdown 0006: Deceleration shutdown 0007: Fault reset 0008: Fault reset (can only be reset in communication control mode)	Frequency converter operation status signal interest 0001: Forward running 0002: Reverse operation 0003: Shutdown
PZD2	The target frequency of the AC drive (frequency source set to "communication") is within the range of reverse frequency upper limit (negative value) to forward frequency upper limit (including decimal point, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the given target frequency exceeds this range, the AC drive operates at that frequency upper limit. For example, if the frequency limit is set to 50.00 Hz and set to 6000, the AC drive will run forward at a frequency of 50.00 Hz. If the frequency limit is set to 50.00 Hz and the communication is set to -6000, the AC drive will operate in reverse at a frequency of 50.00 Hz.	Frequency of frequency converter operation (unit: 0.01Hz) Returns the actual operating frequency of the current frequency converter, with a data value of sixteen signed digits
PZD3~ PZD12	Real time change of function parameter values without writing to EEPROM	Real time reading of functional parameters

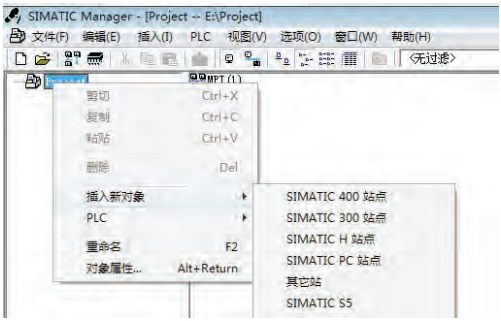
2.2.11 Communication configuration

2.2.11.1 Configure slave stations with S7-300 master stations in STEP7 V5.4

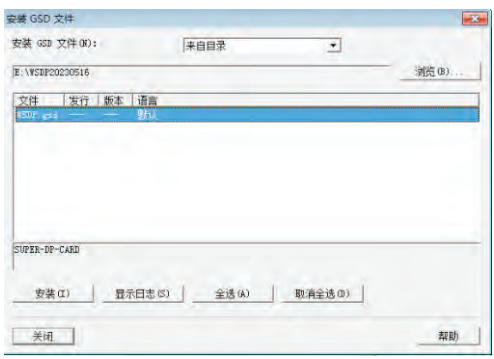
When using the Profibus master station, it is necessary to first configure the GSD file of the slave station to add the corresponding slave station equipment to the master station's system. If it already exists, the second step can be ignored. GSD files can be requested from the manufacturer.

The specific operation is as follows:

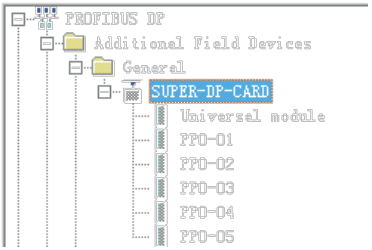
1. Install the GSDML file. If GSDML has not been installed before, installation is still required here. Select "Manage General Station Description Files (GSD)" in the "Options" section.



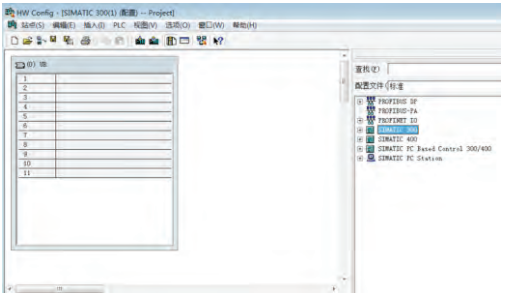
2. Double click on the hardware icon to enter HW config configuration, and add WSDP in the HW config configuration screen GSD file, the operation is as follows (note: GSD file should not be stored in the Chinese path, otherwise Step7 may not recognize it):



Click Install, and after installation is completed, the Profibus-DP module for SUPER-DP-CARD will exist, as shown in the following figure.



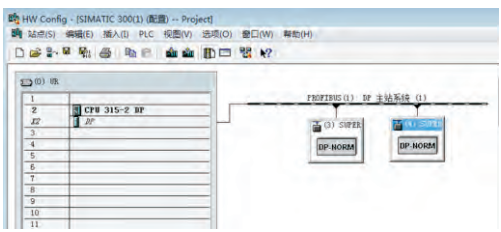
Note: If any master or slave station already exists on the HW config interface, the current interface needs to be closed when importing GSD. Click on the part marked by the red circle as shown in the following figure.



You can choose to save the original project. If a warning pops up during the process that system data cannot be created, please select "OK". After closing the current configuration interface, you can follow the previous steps to install the GSD file. After installation is complete, please select "Open", as shown in the following figure.

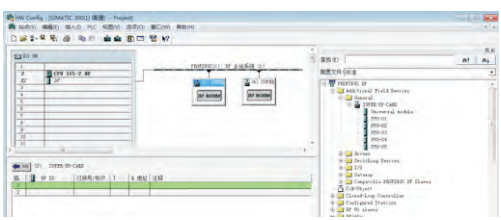
Select the previously closed configuration and click "Confirm" to open the original configuration.

The actual hardware system of the configuration system is shown in the following figure.



In the above figure, Station 4 is SUPER-DP for comparison purposes only, without detailed explanation. SUPER-DP and this DP expansion card can coexist simultaneously in the same network.

2.2.11.2 Configure the data characteristics of the slave station

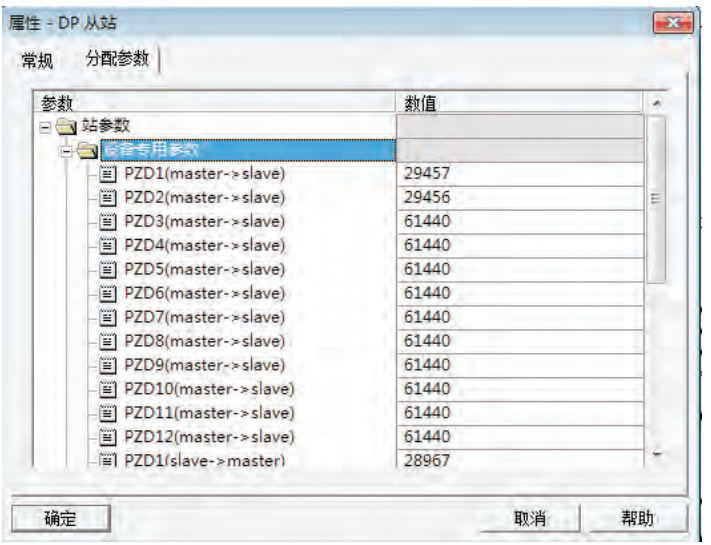


After adding the PPO type, you can see the address assigned by the PLC to the station, as shown in the figure. Slot 1 marked in the figure corresponds to the PKW address, with a total of 8 bytes, and slot 2 corresponds to the PZD address, with a total of 12 bytes.

If the selected PPO type does not have a PKW area, the I address and Q address corresponding to slot 1 are empty.

2) Set PZD mapping

PZD1 and PZD2 are fixed configurations, and users do not need to modify them. PZD3~PZD12 are user-defined periodic data interactions, which are set in the hardware configuration. Double click on the SUPER-DP icon in the hardware system (HW Configuration), open "Device specific parameters", and set the corresponding parameter address according to actual usage.



Among them, PZDx (master -->slave) represents the corresponding address written by the master station to the slave station, and PZDx (slave -->master) represents the corresponding address read by the master station to the slave station. The PZD range that can be set is PZD3~PZD12, and the display format is decimal. That is, if you want to set PZD3 (master -->slave) to P0-12, you need to fill in 61452 in the value of this line.

The default value for all PZDs is P0-00 (corresponding to decimal 61440), and unused PZDs can be retained without modification. Each slave station needs to set up its own PZD mapping relationship according to the requirements (if the mapping relationship is the same for each slave station, you can select an already set slave station, press CTRL+C, and then select the Profibus DP bus in the configuration and press CTRL+V to directly modify the station number).

All the above operations have completed the operation of the Profibus slave station. By writing the corresponding program in S7-300, the frequency converter can be controlled.

3) Operate the cycle reading and writing of the frequency converter slave station

Taking the address allocation in the following figure as an example, the PLC is S7 315-2DP.

1. Directly use the MOVE command, as shown in the figure below, to start the frequency converter to rotate forward with a target frequency of 15Hz (at this time, F0-02=2, F0-06=7).

Similarly, the same applies to other data writes, and the read data can also be passed from the PIW register to the regular Q, I, L, M, D registers through the MOVE instruction, and then parsed.

2.3 Ethercat communication card

2.3.1 Product Overview

EtherCAT expansion card (hereinafter referred to as EA card). The EA card is an EtherCAT fieldbus adapter card that can be used for ultra-high speed I/O networks. This protocol is applicable to the I/O layer. This card has high efficiency, flexible topology, and is easy to operate. It is installed in the CA series AC drive to increase communication efficiency and achieve AC drive networking function. The AC drive is controlled by the fieldbus master station. EA cards can be used for CA series AC drives, such as. The EA card software version required in this user guide is 1.00 or higher (parameters on the AC drive after the card is installed and powered on). The corresponding XML file is ENC.xml.

2.3.2 Appearance and Size

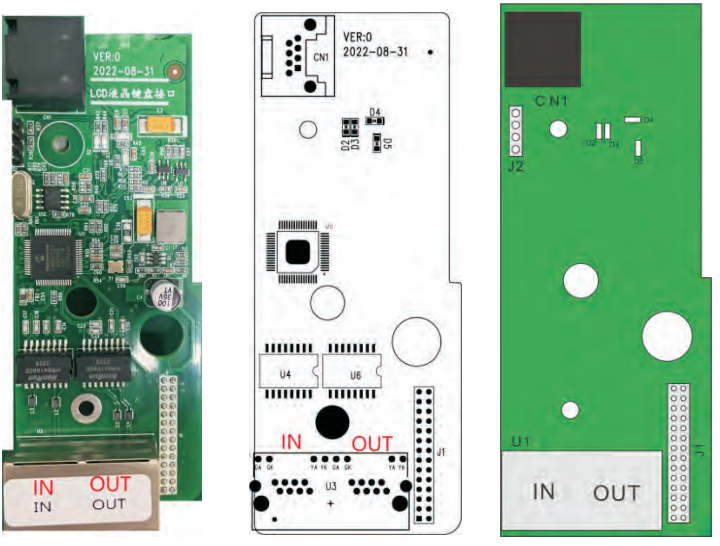
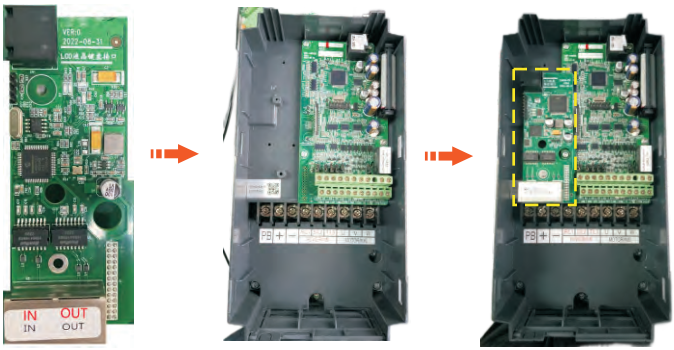


Figure 2-11 Ethercat communication card Card Appearance and Interface Layout

2.3.3 Installation diagram



2.3.4 EtherCAT topology

TheCAT supports various topology structures, including star, bus, and tree topologies, as well as their combinations. This makes device connections and wiring flexible and convenient. This diagram shows the bus topology.

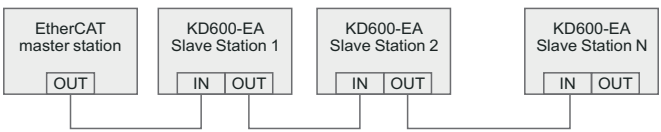


Figure 2-12 Bus topology

The EtherCAT communication expansion card (SI-ECAT) uses a standard Ethernet RJ45 socket and is connected to the EtherCAT master station. Its pin signal definition is consistent with the standard Ethernet pins, and it can be connected with both cross and straight lines.

2.3.5 Hardware Description of EtherCAT Card

2.3.5.1 Indicator description

Indicator light position number	Indicator light function	Indicator light status	Description of indicator light status	Solution
D2	Ethercat Op status indicator light (green)	Green always on	Working in OP state	N/A
		Green flashing	Working/Safe Mode in PREOP	Check the configuration. Check if the AC drive supports EA cards and if F8-11 is set to 1.
		OFF state	Disconnect or work in initial mode	Check if the network port is connected correctly
D3	Frequency converter communication indicator light (green)	Green always on	Normal	Check if the main station and network ports are connected correctly
		OFF state	Lost communication with drive	N/A
D4	Power indicator light (green)	Green always on	Normal	Set P8-11 to 1 and check if the AC drive supports EA cards
		OFF state	The communication board is not powered on	Check if the J1 connector is connected properly and if the frequency converter is powered on
D5	Ethercat fault indicator light (red)	Red always bright	ESC internal malfunction	Please contact technical support
		OFF state	Normal	N/A

2.3.5.2 Terminal Description

Identification	Terminal name	Function description	Function description
U3	Dual port connector	ECAT IN	Used to communicate with the master station (or previous slave station) and the next slave station (if present). ECAT IN is used for input, and ECAT OUT is used for output.
		ECAT OUT	
J1	28 pin plug	Connected to the frequency converter motherboard	

2.3.6 Debugging parameter

Function code	Name	Description (setting range)	Factory Default	Change
P0-04	Run command source	0: Operation panel running command channel (LED off) 1: Terminal command channel (LED on) 2: Communication command channel (LED flashes)	2	Running command issued by communication
P0-06	Main frequency source X selection	0: Up/Down modification frequency, no memory after shutdown 1: Up/Down modification frequency power-off memory 2: AI1 3: AI2 4: Multi-speed 5: Simple PLC 6: PID 7: Communication given 8: PULSE pulse setting 9: Up/Down modifies the frequency, and the memory is stopped when the power is turned off.	7	The given target frequency is communicated
P8-11	Serial communicati on protocol	0: Modbus protocol 1: Communication Card Bridge Protocol	1	Select special item communication card for communication

2.3.7 Parameters related to communication control

Name	Description (setting range)	Index	Sub-index
Written Freq	Communication setting frequency: 0Hz ~ P0-14 (minimum unit: 0.01Hz)	16#2073	16#01
Control command	0001: Forward running 0002: Reverse operation 0003: positive inching 0004: Reverse inching 0005: Free stop 0006: Deceleration shutdown)	16#2073	16#02

Name	Description (setting range)	Index	Sub-index
Control command	0007: Fault reset 0008: Fault reset (only in -control mode)	16#2073	16#02
DO	BIT0: RELAY1 output control BIT1: DO1 output control BIT2: RELAY2 output control	16#2073	16#03
A01	0 ~ 7FFF means 0% ~ 100%	16#2073	16#04
A02	0 ~ 7FFF means 0% ~ 100%	16#2073	16#05

AC drive parameters (common)

Function code	Name	Description (setting range)	Index	Sub-index
P0-14	Maximum output frequency	When P0-20=1, the adjustable range is 50.0Hz ~ 1200.0Hz; When P0-20=2, the adjustable range is 50.00Hz ~ 600.00Hz;	16#20F0	16#0A
P0-21	Acceleration and deceleration time unit	0: 1 second 1: 0.1 seconds 2: 0.01 seconds	16#20F0	16#13
P0-23	Acceleration time 1	0s ~ 30000s(P0-21=0) 0.0s ~ 3000.0s(P0-21=1) 0.00s ~ 300.00s(P0-21=2)	16#20F0	16#11
P0-24	Deceleration time 1	0s ~ 30000s(P0-21=0) 0.0s ~ 3000.0s(P0-21=1) 0.00s ~ 300.00s(P0-21=2)	16#20F0	16#12
P7-00	Jog running frequency	0.00Hz ~ Maximum frequency	16#20F7	16#01
P7-01	Jog acceleration time	0.0s ~ 3000.0s	16#20F7	16#02
P7-02	Jog deceleration time	0.0s ~ 3000.0s	16#20F7	16#03
PD-01	Torque digital given	-200.0% ~ 200.0%	16#20FD	16#03
PD-03	Torque control positive direction maximum frequency	0.00Hz ~ Maximum frequency (P0-14)	16#20FD	16#04
PD-04	Torque control reverse direction maximum frequency	0.00Hz ~ Maximum frequency (P0-14)	16#20FD	16#05

Function code	Name	Description (setting range)	Index	Sub-index
U1-05	Output power (KW)	---	16#2070	16#06
U1-06	DI input status, hexadecimal number	---	16#2070	16#07
U1-07	DO output status, hexadecimal number	--	16#2070	16#08

2.3.8 The description of communication drive parameter indicators is as follows:

Each object in the dictionary should be uniquely addressed by using indexes and subindexes.

Index: This field (hexadecimal) specifies that objects of the same type are in the dictionary.

"Sub index": This field specifies the overall arrangement of offsets for each object in the same index in hexadecimal

The mapping between communication driver parameters and object dictionaries is as follows:

Object dictionary index=0x2000+parameter group number

Object dictionary subindex=hexadecimal+1 offset in parameter group

By default, when using an EA card, the written PDO1 and PDO2 are mapped to U3-17 and U3-16. Therefore, the first item of RPDO must be U3-17; Otherwise, the operation will be abnormal. In addition, if the eight high bits of U3-17 are written with any non-zero values, the AC driver will report a communication failure (Err16).

2.3.9 Communication settings between EA card and EtherCAT host

After enabling communication between the EA card and the AC drive, connect the EtherCAT master station and correctly enable the networking function between the EA card, EtherCAT master station, and the AC drive.

2.3.10 EtherCAT communication protocol

In DC mode, the DC synchronization mode cycle must be at least 1 ms, but less than 100 ms. Otherwise, EtherCAT communication failure will occur.

■ **PDO Data Description**

PDO data is used by the main station to modify and read communication driven data in real-time, and to perform regular data exchange. The data communication address is driven by communication. Mainly including:

a) Real time setting of communication driven control commands and target frequencies ;

b) Real time reading of AC drive current status and operating frequency ;

c) The functional parameters and monitoring data are used for regular data exchange between the AC driver and EtherCAT master station PDO process data, as shown in the table below.

Primary sending PDO (0x1600)		
Fixed RPDO		Variable RPDO
AC drive target frequency	AC drive command	Modify the functional parameters of the frequency converter
RPDO1	RPDO2	RPDO3 to RPDO10
Corresponding AC drive data PDO (0x1A00)		
AC drive status	AC drive operating frequency	Read the functional parameters of the AC drive
TPDO1	TPDO2	TPDO3 to TPDO10

Note: Up to 10 RPDOs and 10 TPDOs can be configured.

■ **Data sent by master station**

Primary sending RPDO	
RPDO1	The AC drive target frequency (the frequency source is set as "communication") is within the range from the upper limit of the reverse frequency (negative value) to the upper limit of the forward frequency (including the decimal point, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the given target frequency exceeds the range, the AC drive operates at the upper limit of the frequency. For example, if the upper frequency limit is set to 50.00 Hz and set to 6000, the AC drive will operate in the forward direction at 50.00 Hz. If the upper frequency limit is set to 50.00 Hz and the communication is set to - 6000, the AC drive will operate in reverse at 50.00 Hz.

Primary sending RPDO	
RPDO2	AC drive command word (command source is set to "communication")
	0001: Forward running 0002: Reverse operation 0003: positive inching 0004: Reverse inching 0005: Free stop 0006: Deceleration shutdown 0007: Fault reset 0008: Fault reset (only in communication control mode)
RPDO3 TO RPDO10	Real time modification of function parameter values (Group F and Group A) without writing into EEPROM (electronic read-only memory)

■ **Communication driven response data**

Corresponding AC drive data TPDO	
TPDO1	Operation status of AC drive
	0001: Forward running 0002: Reverse operation 0003: Shutdown
TPDO2	Operating frequency (unit: 0.01Hz)
	Returns the current AC drive operating frequency. The returned data is 16 bit signed and the received data is 16 bit unsigned data. Variables must be mapped to 16 bit signed data.
TPDO3 TO TPDO10	Read function parameter values (Group F and Group A) and monitor parameter values (Group U)

For more information about PDO definitions for other AC drives, see the appropriate AC drive user guide.

■ **Service Data Object (SDO)**

EtherCAT SDO is used to transmit acyclic data, such as communication parameter configuration and servo driver operation parameter configuration. EtherCAT CoE service types, including:

1) Key event messages

2) SDO request

3) SDO response

4) TxPDO

5) RxPDO
6) Remote TxPDO sends request
7) Remote RxPDO sends request
8) SDO information
Currently, AC drives support SDO requests and responses. For detailed SDO parameters, see the KD600 User Guide.

Using EA cards with Beckhoff controllers

Taking Beckhoff's TwinCAT main station as an example, describe the MD500-ECAT card.

Note:

2.3.10 A 100M Ethernet adapter with an Intel chip must be used. Other network adapters may not support EtherCAT.

1) Install TwinCAT.

Windows XP system: It is recommended to use tcat_2110_2230.

Windows 7 32-bit system: It is recommended to use tcat_2110_2248.

2) Copy the EtherCAT configuration file (ENC.xml) to the TwinCAT installation directory.

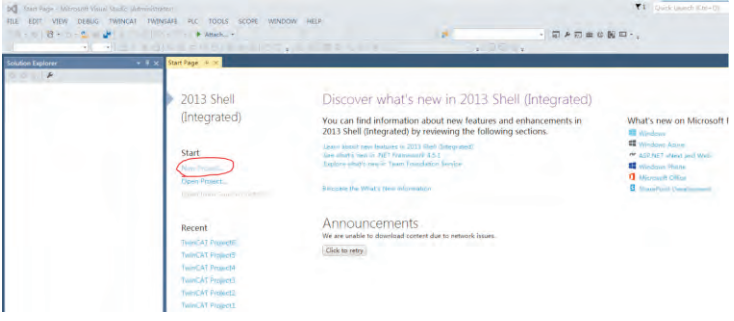
TwinCAT2 directory: TwinCAT \ IO \ EtherCAT

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

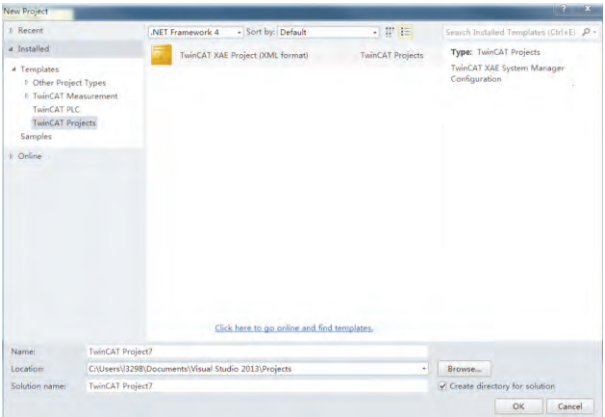
TwinCAT3 will be used as an example in the next section. The operation steps of TwinCAT2 are similar.

3) Start TwinCAT.

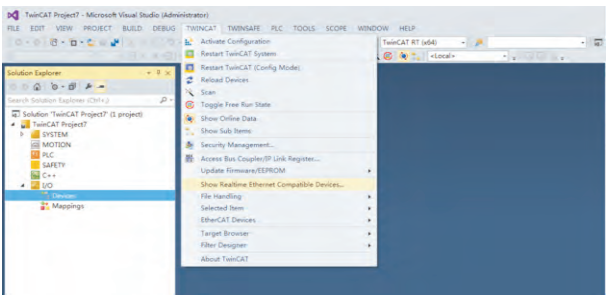
Click "New Project" to create the project.



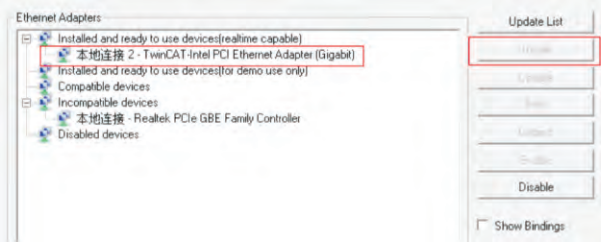
Click "OK"



4) Install the TwinCAT network adapter driver.

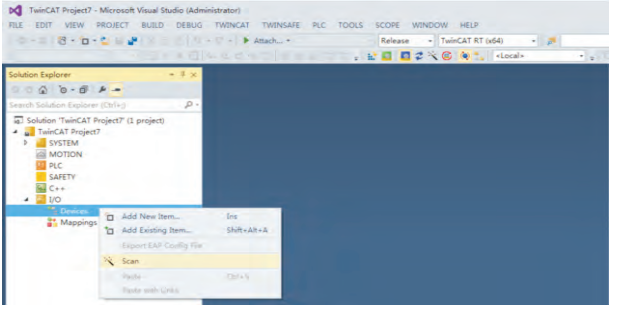


Select TWINCAT>Show Real Time Ethernet Compatible Devices. In the displayed dialog box, select the local network adapter from the incompatible devices, and then click Install. When installed later, the installed network adapter is displayed in "Devices Installed and Ready for Use".

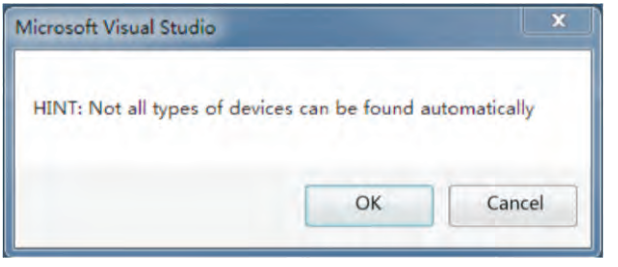


5) Search for devices. Create a project, right-click on the device, and then click Scan to search for devices, such as

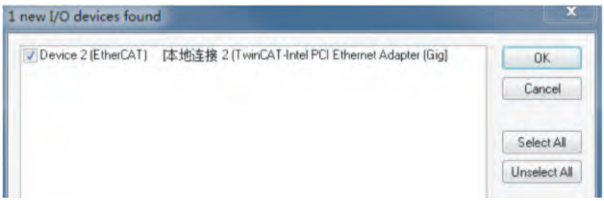
As shown in the following figure.



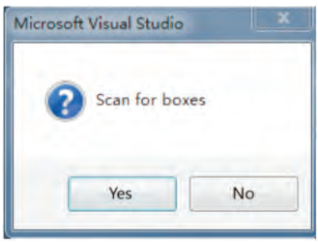
Click "OK"



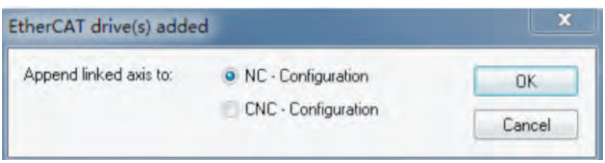
Click "OK"



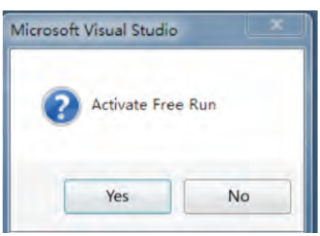
Click "Yes"

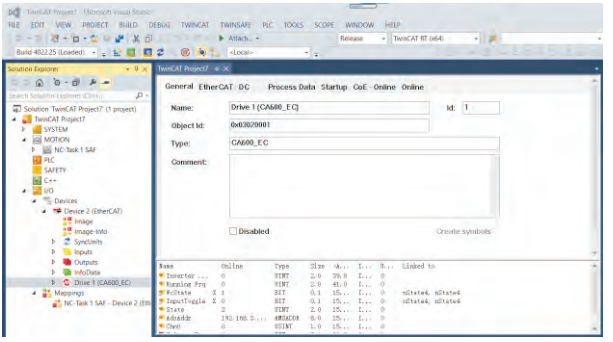


Click "OK"



Click "No", and the device search is completed, as shown in the following figure:

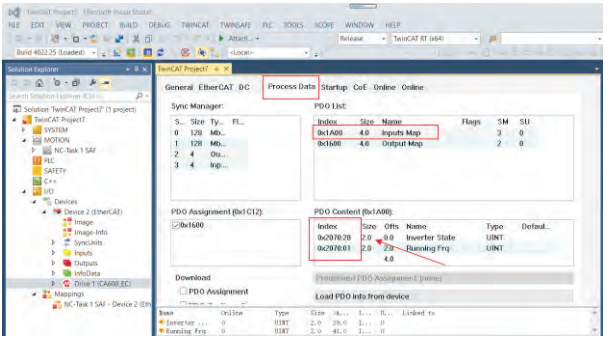




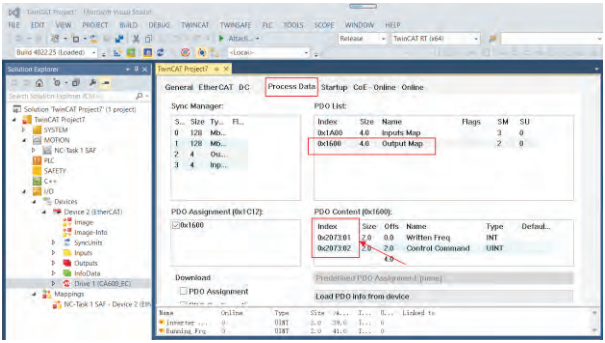
6) Configure PDO parameters.

1. Configure TPDO.

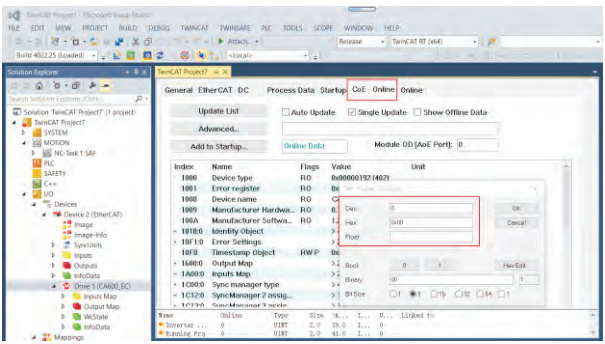
Select 0x1A00 when configuring TPDO. The first two items are set to TPDO by default and cannot be changed. Right click on the location indicated by the red arrow in the following image to add TPDO mapping as needed.



2. Configure RPDO. Select 0x1600 when configuring RPDO. The first two items are set to RPDO by default and cannot be changed. Right click on the location indicated by the red arrow in the following image to add RPDO mapping as needed.

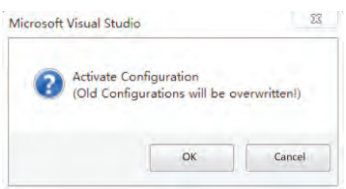


3. View the SDO data list. After the OP status is activated, you can view real-time data in the SDO data list or double-click the object dictionary to modify SDO data.

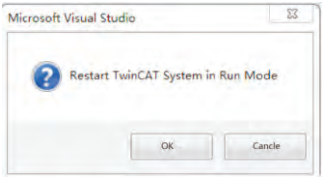


4. Activate the configuration and switch to running mode.

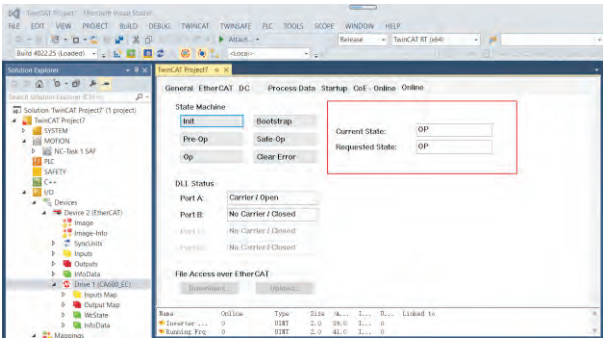
Clicking  will display the following dialog box.



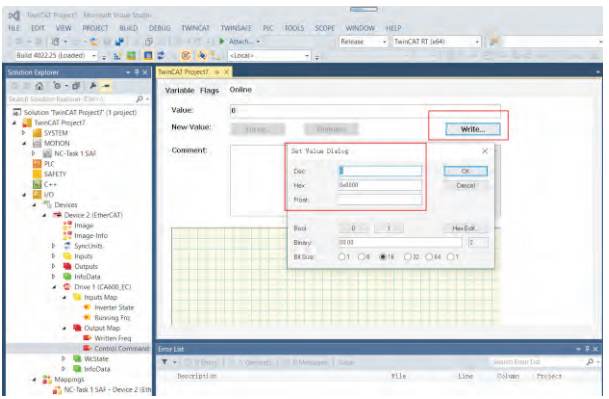
Click "OK"



Click "OK" to enter OP status



5. Control communication drive through PDO. Write the corresponding value through the configured RPDO to control the AC drive.



2.3.11 Troubleshooting

The following table describes the possible faults and AC drivers that may occur during the use of EA cards.

Fault name	Possible cause	Solution
Communication failure between EA card and AC drive	1. Ac drives do not support EtherCAT communication. 2. The communication configuration of the EA card is incorrect. 3. The EA card hardware is faulty	1. Check whether the AC drive supports EtherCAT communication. 2. Set EtherCAT communication parameters correctly. 3. Replace the EA card.

When the slave node is faulty, you can replace the EA card (only the faulty EA card) without configuring the device again.

2.3.12 Prerequisites for Replacing an EA Card Directly:

1. Ensure that cables are connected in the same sequence before and after the EA card is replaced.

2. The internal XML file version of the original EA card and the new EA card must be the same.

3. If a workstation alias is configured for the original EA card, the device must be the same as the original device.

2.4 CANOPEN communication card

2.4.1 Product Overview

The CANOPEN fieldbus communication card is used as a dedicated expansion card for CAN communication networks in series frequency converters, allowing the frequency converter to connect to a high-speed CAN communication network and achieve fieldbus control.

The CAN bus interface fully complies with the ISO/DIS11898 standard, achieving CAN communication between multiple frequency converters. The CANOPEN card wiring port adopts terminal wiring.

2.4.2 Appearance and Size

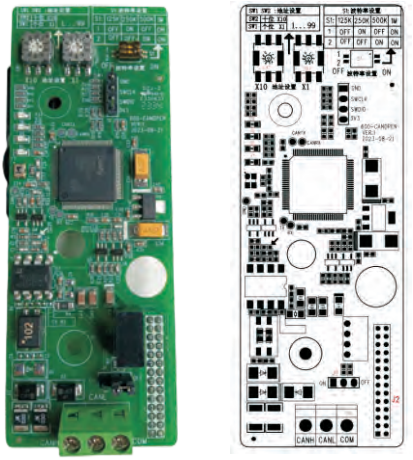
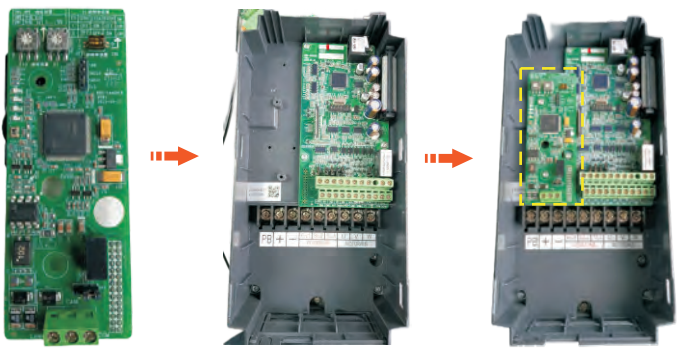
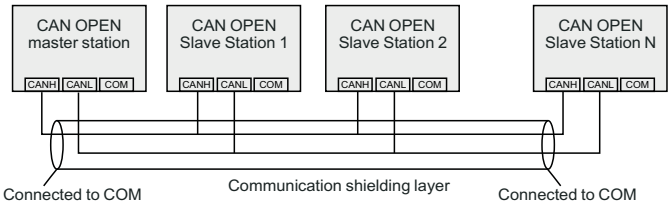


Figure 2-13 Layout diagram of CAN communication card

2.4.3 Installation diagram



2.4.4 CAN bus topology:



2.4.5 Hardware Description

2.4.5.1 Indicator description

Indicator light position number	Indicator light function	Indicator light status	Description of indicator light status	Solution
D5	Ethercat Op status indicator light (green)	Green always on	Working in OP state	N/A
		Green flashing	Pre operation or stop status	The CAN communication layer is in an operational or stopped state
D6	Error indication (green)	OFF state	Normal	N/A
		Green flashing (running light is constantly dim)	Initialization status	Unprepared bootups were not successfully sent.
		Flashing (running light flashing or constantly on)	Bus error	Device CAN frame sending failed
D7	Ethercat fault indicator light (red)	Red always bright	ESC internal malfunction	Please contact technical support
		OFF state	Normal	N/A
D8	Power indicator light (green)	Green always on	Normal	N/A
		OFF state	The communication board is not powered on	Check if the J1 connector is connected properly and if the frequency converter is powered on

2.4.5.2 Terminal Description

<table>
<tr><th>Identification</th><th>Terminal name</th><th colspan="6">Instructions</th><th>Function description</th></tr>
<tr><td rowspan="3">CN1</td><td>CANH</td><td colspan="6">CAN bus interface</td><td>Connect to the positive terminal of CAN bus</td></tr>
<tr><td>CANL</td><td colspan="6">CAN bus interface</td><td>Connect to the negative terminal of CAN bus</td></tr>
<tr><td>COM</td><td colspan="6">CAN bus interface</td><td>Connect to the shielding layer of CAN communication line</td></tr>
<tr><td>J2</td><td>28-bit pin insertion</td><td colspan="6">Connect to the frequency converter motherboard</td><td></td></tr>
<tr><td>SW1 SW2</td><td>Set the address of the slave station</td><td colspan="6">CAN OPEN the mailing address Settings</td><td>Sw1 is the address bits, SW2 is the address tens</td></tr>
<tr><td rowspan="4">S1</td><td rowspan="4">Baud rate setting (1 pin, 2 pin)</td><td rowspan="4">The combination switch sets the baud rate</td><td colspan="5">S1 Baud rate Setting</td></tr>
<tr><td>S1</td><td>125K</td><td>250K</td><td>500K</td><td>1M</td></tr>
<tr><td>1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td rowspan="2">J1</td><td rowspan="2">Communication jumper</td><td colspan="6" rowspan="2">Communication terminal resistance selection</td><td>The jumper cap connects to the terminal resistor at the ON end</td></tr>
<tr><td>The jumper cap is not connected to the terminal resistor at the OFF end (factory Settings)</td></tr>
</table>

2.4.6 Debugging parameter

Function code	Name	Description (setting range)
P0-04	Command source selection	0: Keyboard command channel 1: Terminal command channel 2: Communication command channel
P0-06	Frequency source selection	7: Communication given
P8-11	Communication type selection	0:485 communication 1: Expansion card communication (CAN/DP)

2.4.7 CAN transmission distance

The transmission distance of CANopen bus is directly related to baud rate and communication cable. The maximum bus line length is related to baud rate as shown in the table:

Baud rate	125K	250K	500K	1M
Bus length (M)	250M	125M	80M	30M

2.4.8 CANopen Protocol description

Support the Node Guard protocol, which can be used by the master station to query device status. Support the Heartbeat protocol, and report the current status to the master station when the slave station is located. SDO only supports the accelerated transmission mechanism, with 1 function code and 2 bytes each transmission supporting 3 TPdos and 3 RPdos. Support for emergency targets;

Communication object COBID

CANOPEN provides a variety of communication objects, each communication object has different characteristics (refer to CANOPEN standard protocol), can be used according to different applications. The expansion card uses the predefined COB-ID. The specific rules are as follows:

1. NMT object :0x000
2. SYNC object :0x080
3. SDO objects

   Send SD0-0x600+Node-Id

   Receives SD0-0x580+Node-Id

4. PDO object:

   RPDO1-0x200+Node-Id

   RPDO2-0x300+Node-Id

   RPDO3-0x400+Node-Id

   TPDO1--0x180+Node-Id

   TPDO2-0x280+Node-Id

   TPDO3-0x380+Node-Id

2.4.9 Frequency converter parameter operation

1 Frequency converter parameter mapping

Frequency converter parameter address

Frequency converter parameter addresses are divided into functional code parameter addresses and non-functional code parameter addresses. For details, please refer to the MODBUS Communication Protocol chapter - Function code parameter address marking rules in KD600 Series High-performance Vector Frequency Converter User Manual.

Mapping specification

The frequency converter function code set is mapped to the range 0x2000 to 0x20FF of the CANopen object dictionary. The function code number is added by 1 to the function code number of the subindex of the mapping object dictionary. The function code of the frequency converter is P0-04, the main index number of the mapping object dictionary is 0x20F0, and the sub-index number is 0x05.

Function codes are divided into three groups: P0 to PF, A0 to AF, and UO to UF.

When the function code is read, the mapping address corresponds to the following:

Function code group	CANopen index
P0~PF	0x20F0~0x20FF
A0~AF	0x20A0~0x20AF
U0~UF	0x2070~0x207F

When writing EEPROM operations, the corresponding mapping address is as follows:

Function code group	CANopen index
P0~PF	0x20F0~0x20FF
A0~AF	0x20A0~0x20AF

When writing to RAM, the mapping address corresponds to the following:

Function code group	CANopen index
P0~PF	0x2000~0x200F
A0~AF	0x2040~0x204F

Taking function code P0-23 (acceleration time) as an example, when reading the P0-23 function code value, its object dictionary index number is 0x20F0 and sub index number is 0x18; When writing the P0-23 function code value and EEPROM, its object dictionary index is 0x20F0 and sub index is 0x18;

When writing the P0-23 function code value and only writing to RAM, its object dictionary index number is 0x2000 and sub index number is 0x18;

The motor tuning function does not allow changing functional parameters through communication. The frequency converter function code is stored in EEPROM and can be read repeatedly, but do not repeatedly rewrite it. When programming, pay attention to rewriting instructions for function codes, and do not drive the PLC program unconditionally to cause cyclic communication writing operations, in order to avoid damaging the memory of the frequency converter.

2. SDO read and write operations

The frequency converter uses CANopen Service Data Object (SDO) to read and operate on the frequency converter. The main station sends data in the format shown in the table:

CAN	CANopen data	illustrate
11 digit ID	0x600+Node ID	Node ID device address dialing settings
RTR	0	Remote frame flag "0"
DATA0	Command code (0x40)	0x40 read command
DATA1	Index low byte	Function code group (P0 group “0xF0")
DATA2	Index high byte	Mapping address
DATA3	Subindex	Function code number+1 ("0x03")
DATA4	Data 1	Keep '0'
DATA5	Data 2	Keep '0'
DATA6	Data 3	Keep '0'
DATA7	Data 4	Keep '0'

Return:

CAN	CANopen data	illustrate
DATA0	Command code return	Correct '0x4B' Error '0x80'
DATA1	Index low byte	Function code group (P0 group "0xF0")
DATA2	Index high byte	Mapping address
DATA3	Subindex	Function code number+1 ("0x03")
DATA4	Data 1	Data low byte

CAN	CANopen data	illustrate
DATA5	Data 2	Data high byte
DATA6	Data 3	Correct: "0" Error: SDO operation failed error code
DATA7	Data 4	

3. SDO write frequency converter operation

Using CANopen Service Data Object (SDO) to write operations to the frequency converter, the main station sends data in the format shown in the table.

CAN	CANopen data	illustrate
11 digit ID	0x600+Node ID	Node ID device address dialing settings
RTR	0	Remote frame flag "0"
DATA0	Command code	0x2B
DATA1	Index low byte	Function code group (P0 group “0xF0")
DATA2	Index high byte	Mapping address
DATA3	Subindex	Function code number+1 ("0x03")
DATA4	Data 1	Data low byte
DATA5	Data 2	Data high byte
DATA6	Data 3	Keep '0'
DATA7	Data 4	Keep '0'

Write the response data of the frequency converter SDO slave station as shown in the table below. The command code for successful operation returns a value of "0x60", with the index unchanged. Data 4, 5, 6, and 7 return "0". The command code for failed operation is "0x80", with the index unchanged. Data 4, 5, 6, and 7 return SDO failure error codes.

Return:

CAN	CANopen data	illustrate
11 digit ID	0x580+Node ID	Node ID device address dialing settings
RTR	0	Remote frame flag "0"
DATA0	Command code (0x40)	Correct '0x60' failed '0x80
DATA1	Index low byte	Function code group (P0 group "0xF0")

CAN	CANopen data	illustrate
DATA2	Index high byte	Mapping address
DATA3	Subindex	Function code number+1 ("0x03")
DATA4	Data 1	Correct: "0" Error: SDO operation failed error code
DATA5	Data 2	
DATA6	Data 3	
DATA7	Data 4	

The main communication control related function codes are shown in the table below. The main index address is 0x2073. For other function codes, please refer to the user manual.

Name	CANopen subindex	Setting Range	
Frequency setting	0x11	0~maximum frequency, 0.01Hz	
Control command	0x12	0001: Forward running 0002: Reverse operation 0003: Forward jog 0004: Reverse jog	0005: Free shutdown 0006: Deceleration shutdown 0007: Fault reset
DO control	0x13	BIT0: DO1 output control BIT1: DO2 output control BIT2: RELY1 output control BIT3: RELY2 output control BIT4: FMR output control	
AO1 control	0x14	0~7FFF represents 0%~100%	
AO2 control	0x15	0~7FFF represents 0%~100%	
FM control	0x16	0~7FFF represents 0%~100%	

2.4.9 Communication monitoring function code

Function code	Name	Unit	CANopen subindex
U1-00	Operating frequency (Hz)	0.01Hz	0x01
U1-01	Set frequency (Hz)	0.01Hz	0x02
U1-02	Bus voltage (V)	0.1V	0x03
U1-03	Output voltage (V)	1V	0x04
U1-04	Output current (A)	0.1A	0x05

Function code	Name	Unit	CANopen subindex
U1-05	Output power (KW)	0.1kW	0x06
U1-06	DI input status, hexadecimal number	1	0x07
U1-07	DO output status, hexadecimal number	1	0x08
U1-08	Ai1 corrected voltage	0.01V	0x09
U1-09	Voltage after AI2 correction	0.01V	0x0A
U1-10	PID set value, PID set value (percentage) * PA-05	1	0x0B
U1-11	PID feedback, PID feedback value (percentage) * PA-05	1	0x0C
U1-12	Counting value	1	0x0D
U1-13	Length value	1	0x0E
U1-14	motor speed	rpm	0x0F
U1-15	During the PLC stage, when running at multiple speeds, the current segment is located	1	0x10
U1-16	PULSE pulse input frequency	0.01kHz	0x11
U1-17	Feedback speed, actual operating frequency of the motor	0.1Hz	0x12
U1-18	P7-38 Remaining time of timed time	0.1Min	0x13
U1-19	Voltage before AI1 calibration	0.001V	0x14
U1-20	Voltage before AI2 calibration	0.001V	0x15
U1-21	Di5 high-speed pulse sampling line speed, refer to P7-71 for use	1m/min	0x16
U1-22	Load speed display (set load speed during shutdown), refer to P7-31 for use	Custom	0x17
U1-23	Time of power on this time	1Min	0x18

Chapter 3 Encoder expansion card product information

Encoder card wiring requirements:

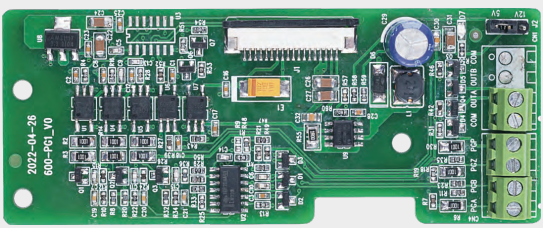
- The cable of encoder card must be routed separately from the power cable, and it is strictly prohibited to route in parallel at a short distance.
- Please use shielded cable for routing encoder card. The shielding layer is connected to PE terminal at the side close to the controller (only one end can be grounded to avoid interference).
- The encoder card must be routed through the tube separately, and the metal tube shell must be reliably grounded.

3.1 Open collector ABZ encoder card (PG1)

3.1.1 Product Overview

ABZ open collector signal input, with 1:1 frequency split open collector signal output encoder card.

3.1.2 Appearance and Size



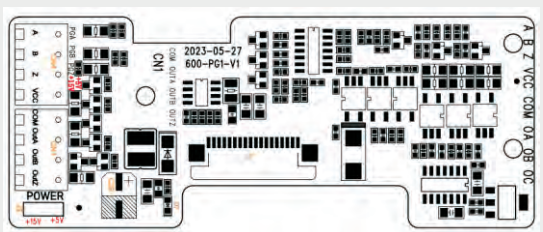
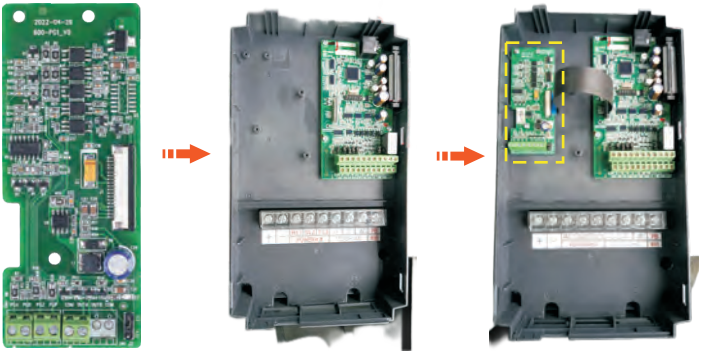
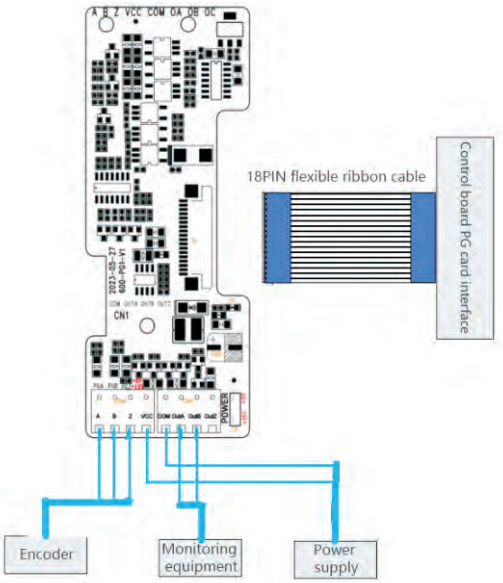


Figure 3-1 Appearance diagram of PG1 collector open circuit ABZ encoder card

3.1.3 Installation diagram



3.1.4 Topology Map



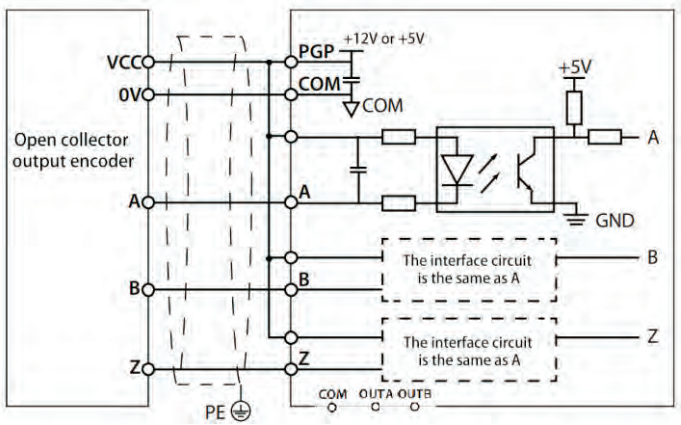
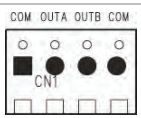
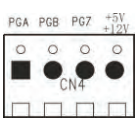


Figure 3-2 Open collector ABZ encoder card wiring diagram

3.1.5 Terminal Description

Terminal identity	The name of the terminal	Functional specifications	Terminal distribution
J1	Control signal connection port	Connect the mainboard encoder port	
CN1	PGA,PGB,PGZ: ABZ signal input port of the encoder	The encoder A	
	PGP(+5V,+12V)+12V or +5V power output	Select +12V or +5V through the J2 jumper	
CN4	COM	Grounding	
	OUTA	Frequency division output A signal, NPN OC output	
	OUTB	Frequency division output B signal, NPN type OC output	

3.1.6 Parameter settings: Electrical PG1 card debugging guide

Function code	Name	Description (setting range)	Factory Default	Change
P0-14	Maximum output frequency	When P0-20=1, the adjustable range is 50.0Hz to 1200.0Hz; When P0-20=2, the adjustable range is 50.00Hz to 600.00Hz;	50.00Hz	Set according to motor parameters
P0-16	Upper limit frequency	Lower frequency P0-18 to maximum frequency P0-14	50.00Hz	Set according to motor parameters
P4-01	Rated power of motor	0.1KW~1000.0KW	Model determination	
P4-02	Rated voltage of motor	1V~1500V	380V	
P4-04	Motor rated current	0.1A~6000A	Model determination	
P4-05	Rated frequency of motor	0.01HZ~P0-14	50.00Hz	
P4-06	Rated motor speed	1rpm~60000 rpm	P4-01 OK	
P4-20	Antipoint electromotive force	1V~65535V	Model determination	For permanent magnet synchronous motors
P4-28	Encoder pulse count	1~65535	1024	
P4-30	Encoder type	0: ABZ encoder	0	
		1: UVW encoder		
		2: Provincial line encoder		
		3: Rotary encoder		
		4: Sine cosine encoder		

3.1.7 Debugging steps

1. Set parameters P4-00=1 static self-learning, P4-00=2 dynamic self-learning;

2. Set parameter P0-03=3 (select 13 for permanent magnet synchronous motors);

3. Run slowly to check the feedback speed of U1-46 encoder, which corresponds to a positive frequency and is normal. If it is negative, debug P4-29 and select encoder phase sequence.

3.2 Differential input ABZ encoder card (PG3)

3.2.1 Appearance and Size

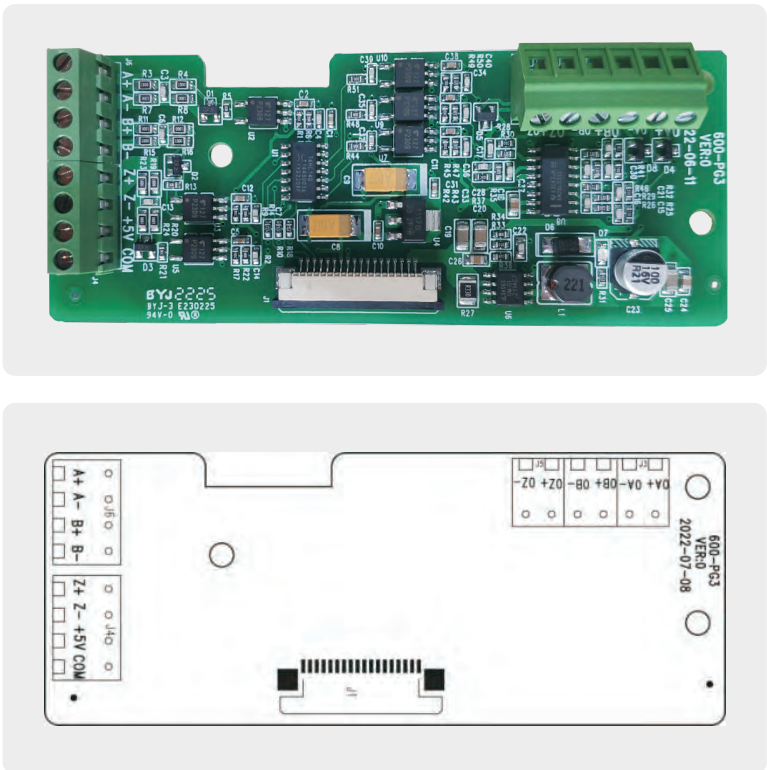
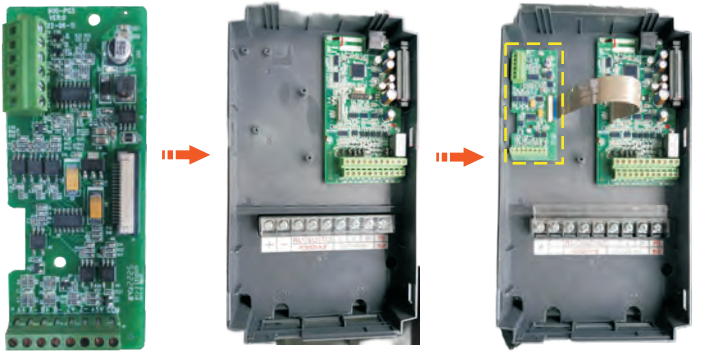
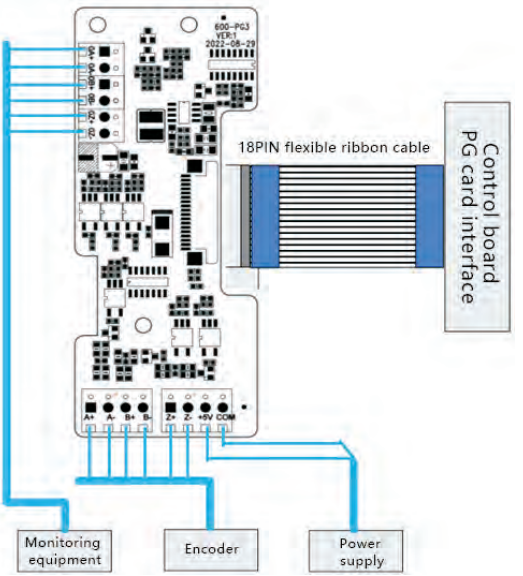


Figure 3-3 Appearance diagram of PG3 differential input ABZ encoder card

3.2.2 Installation diagram



3.2.3 Topology Map



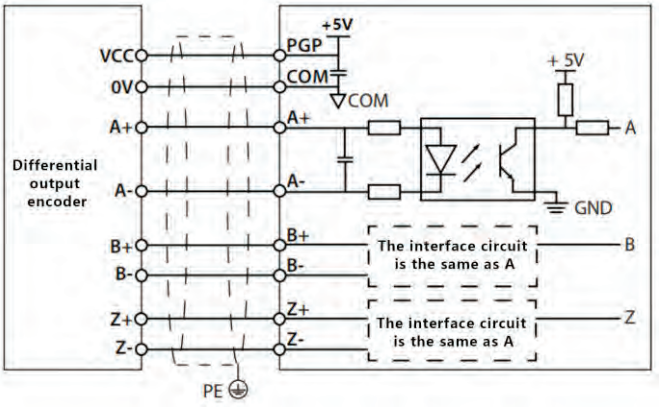
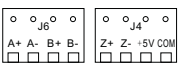
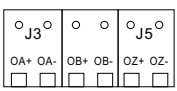


Figure 3-4 Differential output ABZ encoder card wiring diagram

3.2.4 Terminal Description

Terminal identity	The name of the terminal	Functional specifications	Terminal distribution
J1	Control the signal line	Connect the motherboard encoder interface	
J6/J4	A+,A-	Encoder A+/A - Signal	
	+5V,COM	+5V power output	
	B+,B-	Encoder B+/B - Signal	
	Z+,Z-	Encoder Z+/Z - signal	
J3/J5	OA+,OA-	Frequency division output differential A signal	
	OB+,OB-	Frequency division output differential B signal	
	OZ+,OZ-	Frequency division output differential Z signal	

3.2.5 Parameter settings: Electrical PG3 card debugging guide

Function code	Name	Description (setting range)	Factory Default	Change
P0-14	Maximum output frequency	When P0-20=1, the adjustable range is 50.0Hz to 1200.0Hz; When P0-20=2, the adjustable range is 50.00Hz to 600.00Hz;	50.00Hz	Set according to motor parameters
P0-16	Upper limit frequency	Lower frequency P0-18 to maximum frequency P0-14	50.00Hz	Set according to motor parameters
P4-01	Rated power of motor	0.1KW~1000.0KW	Model determination	
P4-02	Rated voltage of motor	1V~1500V	380V	
P4-04	Motor rated current	0.1A~6000A	Model determination	
P4-05	Rated frequency of motor	0.01HZ~P0-14	50.00Hz	
P4-06	Rated motor speed	1rpm~60000 rpm	P4-01 OK	
P4-20	Antipoint electromotive force	1V~65535V	Model determination	For permanent magnet synchronous motors
P4-28	Encoder pulse count	1~65535	1024	
P4-30	Encoder type	0: ABZ encoder	0	
		1: UVW encoder		
		2: Provincial line encoder		
		3: Rotary encoder		
		4: Sine cosine encoder		

3.2.6 Debugging steps

1. Set parameters P4-00=1 static self-learning, P4-00=2 dynamic self-learning;

2. Set parameter P0-03=3 (select 13 for permanent magnet synchronous motors);

3. Run slowly to check the feedback speed of U1-46 encoder, which corresponds to a positive frequency and is normal. If it is negative, debug P4-29 and select encoder phase sequence.

3.3 Sine cosine encoder interface card (PG5)

3.3.1 Product Overview

PG5 is a sine and cosine encoder card with frequency division output.

3.3.2 Appearance and Size

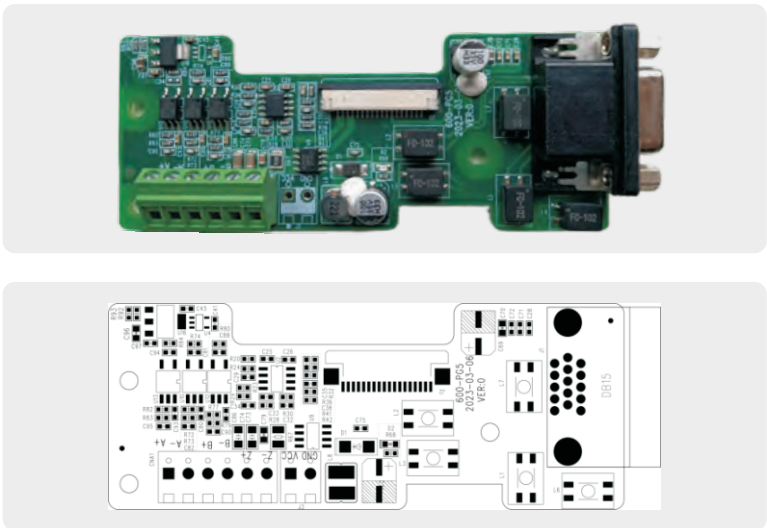
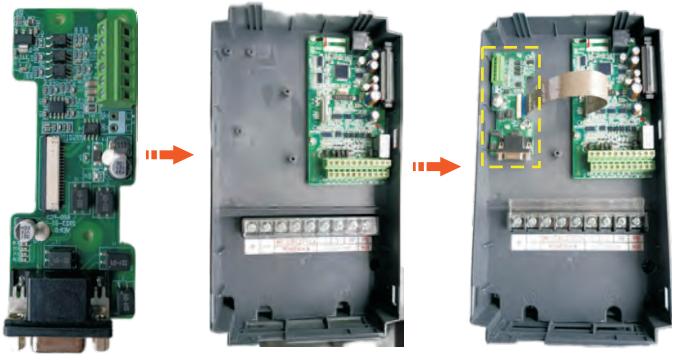
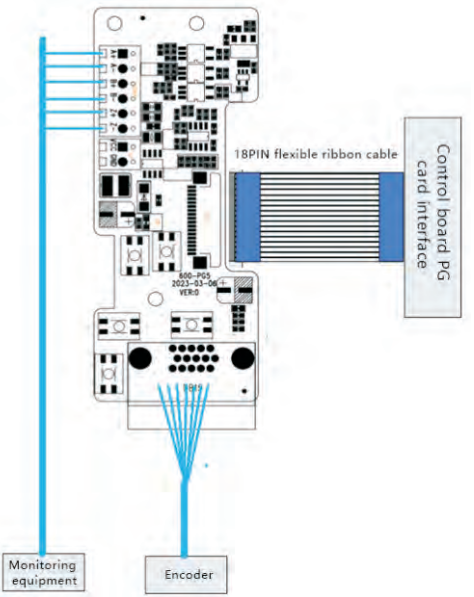


Figure 3-5 Appearance diagram of PG5 sine cosine encoder interface card

3.3.3 Installation diagram



3.3.4 Topology Map

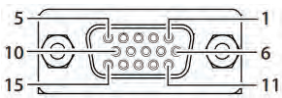


3.3.5 Terminal Description

Terminal		Signal description	Describe
½	A+/A-	Encoder differential signal A+/A-	OA+, OA - Frequency division output differential A signal
3/4	B+/B-	Encoder differential signal B+/B-	OB+, OB - frequency division output differential B signal
5/6	Z+/Z-	Encoder differential signal Z+/Z-	OZ+, OZ - Frequency division output differential Z signal
7	VCC	+5V power supply	No need to connect
9	GND	Power supply ground	

3.3.6 Encoder card wiring

It is recommended to use the Heidelberg ERN1387 encoder. The double row socket of 1387 corresponds to the DB15 terminal block as shown in the table:

1387 double row socket		DB15 terminal block	
			
5a	B-	1	B-
4b	R+(Z+)	3	R+
4a	R-(Z-)	4	R-
6b	A+	5	A+
2a	A-	6	A-
3a+5b	0V	7	PGGND
3B	B+	8	B+
7b+1b	+5V	9	PGVCC
7b	C+(SIN-)	10	C+
1a	C-(SIN+)	11	C-
2b	D+(COS+)	12	D+
6a	D-(COS-)	13	D-

3.3.7 Parameter settings: Electrical PG5 card debugging guide

Function code	Name	Description (setting range)	Factory Default	Change
P0-14	Maximum output frequency	When P0-20=1, the adjustable range is 50.0Hz to 1200.0Hz; When P0-20=2, the adjustable range is 50.00Hz to 600.00Hz;	50.00Hz	Set according to motor parameters
P0-16	Upper limit frequency	Lower frequency P0-18 to maximum frequency P0-14	50.00Hz	Set according to motor parameters
P4-01	Rated power of motor	0.1KW~1000.0KW	Model determination	
P4-02	Rated voltage of motor	1V~1500V	380V	
P4-04	Motor rated current	0.1A~6000A	Model determination	
P4-05	Rated frequency of motor	0.01HZ~P0-14	50.00Hz	
P4-06	Rated motor speed	1rpm~60000 rpm	P4-01 OK	
P4-20	Antipoint electromotive force	1V~65535V	Model determination	For permanent magnet synchronous motors
P4-30	Encoder type	0: ABZ encoder	4	
		1: UVW encoder		
		2: Provincial line encoder		
		3: Rotary encoder		
		4: Sine cosine encoder		
P4-31	Number of rotating transformer poles	1 ~ 65535	1	
P4-32	Encoder mounting Angle			

3.3.8 Debugging steps

1. Set P4-00=1 Static self-learning and P4-00=2 dynamic self-learning.

2. Set parameter P0-03=3 (select 13 for permanent magnet synchronous motor);

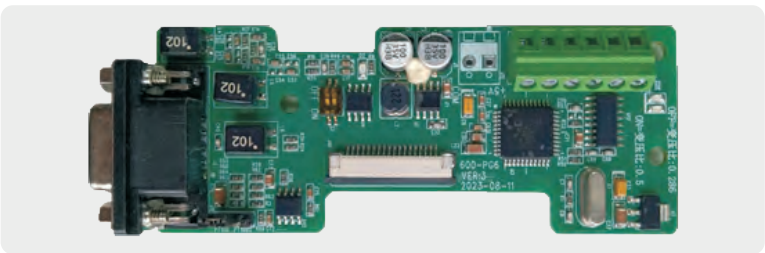
3. Click the operation to check the feedback speed of the U1-46 encoder. The frequency corresponds to the positive value and is normal. If the value is negative, debug P4-29 and select encoder phase sequence.

3.4 Rotary Transformer Interface Card (PG6)

3.4.1 Product Overview

PG6 is a rotary transformer encoder interface card.

3.4.2 Appearance and Size



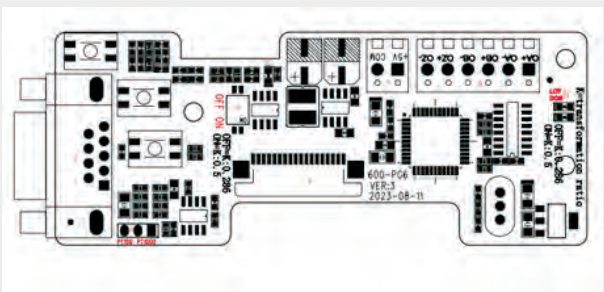
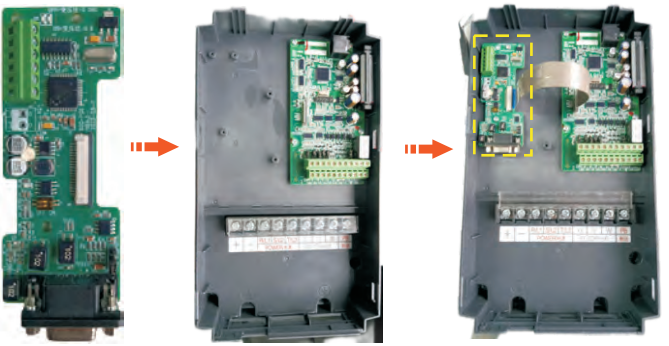
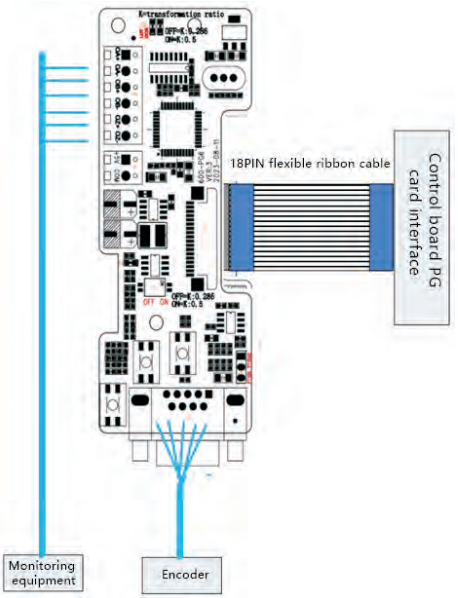


Figure 3-6 PG6 Rotary transformer interface card appearance

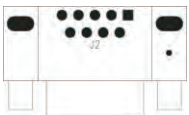
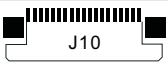
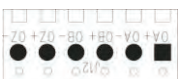
3.4.3 Installation diagram



3.4.4 Topology Map

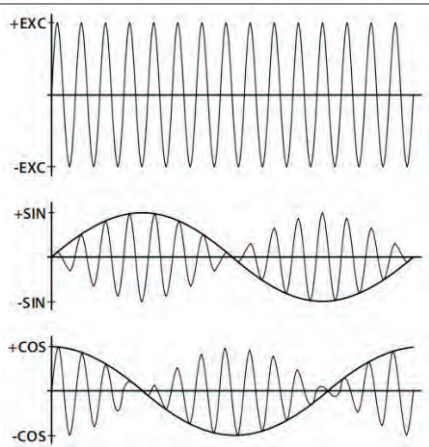


Function Description of Rotary Transformer Interface Card Terminals

Terminal identity	The name of the terminal	Functional specifications	Terminal distribution
J1	+5V,COM	+5V power supply	
J2	EXC-,EXC+	Encoder excitation output signal, 4Vrms/10kHz sinusoidal signal	
	SIN+,SIN-	Encoder feedback input signal, 2Vrms/10kHz forward rotation, SIN signal is 90° ahead of COS signal When reversed, the COS signal is 90° ahead of the SIN signal	
	COS+,COS-		
	PTCP	Motor temperature detection: PT100,PT1000,KTY,PTC, etc	
	PTCN		
J10	Control signal cable interface	Connect the motherboard encoder interface	
J12	OA+,OA-	1:1, A B Z differential signal output (0-500KHZ)	
	OB+,OB-		
	OZ+,OZ-		

EXC/SIN/COS signal description

The excitation signal (EXC) and feedback signal (SIN/COS) waveform of the rotary transformer encoder card are shown in the figure on the right.



3.4.5 Rotary encoder wiring:

The encoder line	DB9 pin number	1	2	3	4	5	9	7	8	Metal case
	Line color	red	black	orange	purple	blue	green	gray	white	Yellow and green heat shrink tubing
	Define	EXC+	EXC-	SIN+	SIN-	COS+	COS-	PTC-M	PTC-N	Ground (imported)
		twisted-pair		twisted-pair		twisted-pair		twisted-pair		Answer the shield
	External lead (with definition label)							gray	white	

3.4.6 Parameter settings: Electrical PG5 card debugging guide

Function code	Name	Description (setting range)	Factory Default	Change
P0-14	Maximum output frequency	When P0-20=1, the adjustable range is 50.0Hz to 1200.0Hz; When P0-20=2, the adjustable range is 50.00Hz to 600.00Hz;	50.00Hz	Set according to motor parameters
P0-16	Upper limit frequency	Lower frequency P0-18 to maximum frequency P0-14	50.00Hz	Set according to motor parameters
P4-01	Rated power of motor	0.1KW~1000.0KW	Model determination	
P4-02	Rated voltage of motor	1V~1500V	380V	
P4-04	Motor rated current	0.1A~6000A	Model determination	
P4-05	Rated frequency of motor	0.01HZ~P0-14	50.00Hz	
P4-06	Rated motor speed	1rpm~60000 rpm	P4-01 OK	
P4-20	Antipoint electromotive force	1V~65535V	Model determination	For permanent magnet synchronous motors
P4-30	Encoder type	0: ABZ encoder 1: UVW encoder 2: Provincial line encoder 3: Rotary encoder 4: Sine cosine encoder	3	
P4-31	Number of rotating transformer poles	1 ~ 65535	1	
P4-32	Encoder mounting Angle			