EM760 Profinet Communication Card User Manual

1. Wiring

Profinet communication card include linear, tree, and star. Different networking can be achieved by using switches.

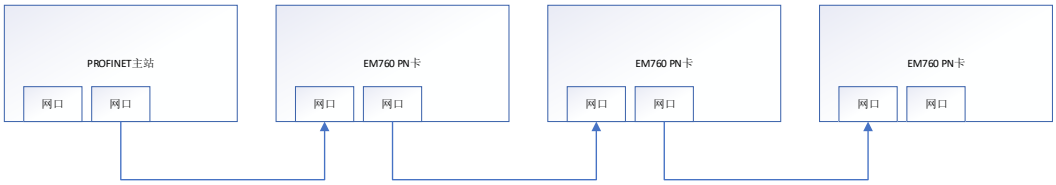


Figure 1.1 Linear topology

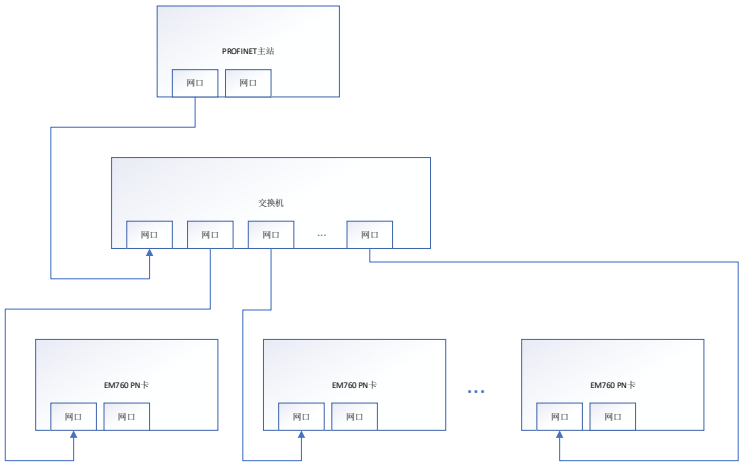


Figure 1.2 Star topology

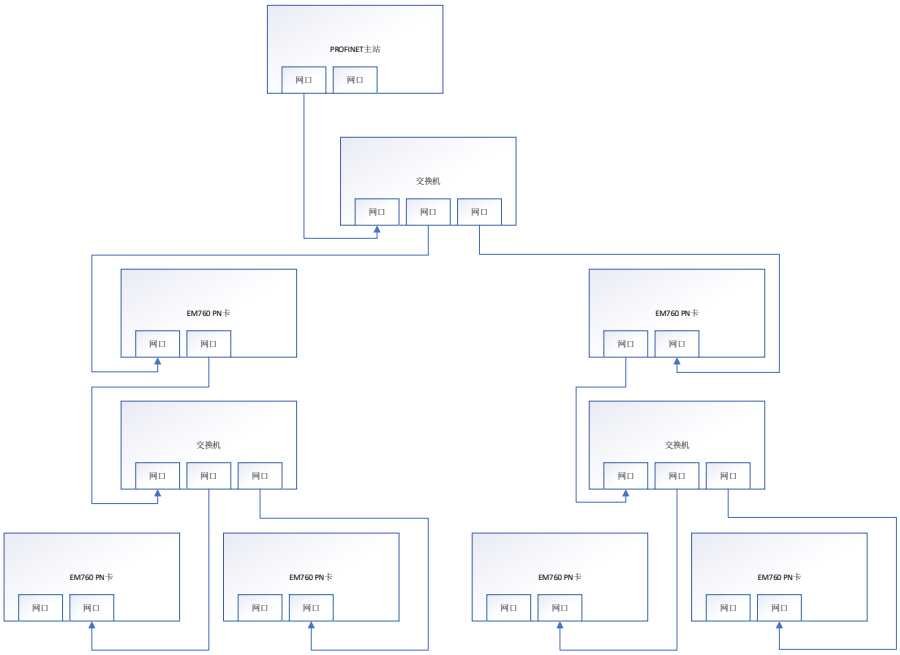


Figure 1.3 Tree topology

2. Communication card related function codes

The inverter is connected to the Profinet communication card, the inverter communication parameters must be set. After the communication parameters are set, the Profinet master station can start and stop the inverter.

parameter	Parameter name	Parameter Value	Meaning
F00.02	Command source selection	2	The operation command is controlled by the communication card
F00.04	Main frequency source selection	7	Frequency setting is direct communication setting
F00.36	Communication control start and stop channel selection	1	Profinet control
F00.37	Communication given channel selection	1	Profinet channel given
F10.51	Process data address setting method	1	0:Keyboard configuration 1:Master station configuration
F10.65	PN card IP address setting method	0	0: Master configuration 1:Keyboard configuration

3. Profinet communication protocol

3.1 Data transmission format

According to different requirements, the Profinet communication card can select PZD data formats of different lengths for periodic data interaction. The functions supported by each data format are shown in the following table:

Data Types	Data length	Support functions
Standard message 1	P ZD 2/2	Inverter control word, frequency setting Inverter status word, real-time output frequency
Standard message 2	P ZD 4/4	Inverter control word, frequency setting 2 function parameters are written periodically Inverter status word, real-time output frequency 2 function parameters are read periodically
Standard message 3	P ZD 6/6	Inverter control word, frequency setting 4 function parameters are written periodically Inverter status word, real-time output frequency 4 function parameters are read periodically

Standard message 4	P ZD 8/8	Inverter control word, frequency setting 6 function parameters are written periodically Inverter status word, real-time output frequency 6 function parameters are read periodically
Standard message 5	P ZD 10/10	Inverter control word, frequency setting 8 function parameters are written periodically Inverter status word, real-time output frequency 8 function parameters are read periodically
Standard message 6	P ZD 12/12	Inverter control word, frequency setting 10 function parameters are written periodically Inverter status word, real-time output frequency 10 function parameters are read periodically
Standard message 7	P ZD 14/14	Inverter control word, frequency setting 12 function parameters are written periodically Inverter status word, real-time output frequency 12 function parameters are read periodically
Standard message 8	P ZD 16/16	Inverter control word, frequency setting 14 function parameters are written periodically Inverter status word, real-time output frequency 14 function parameters are read periodically

3.2 PZD data area

The PZD area realizes real-time data interaction between the master station and the inverter, and mainly includes the following data:

(1) Inverter control word and frequency setting.

(2) Read the inverter status word and operating frequency.

(3) Real-time interaction of other data between the master station and the inverter.

PZD data is divided into PZD write area and PZD output area.

P ZD write area			P ZD output area		
The first data (inverter control word)	The second data (frequency given by the inverter)	The 3rd data to the 16th data (the data corresponds to F 10.18~10.31 . When the data is configured, the address is displayed in decimal)	The first data (inverter status word)	The second data (inverter operating frequency)	The 3rd data to the 16th data (the data corresponds to F 10.33~F10.46, when the data is configured, the address is displayed in decimal)

The PZD write area is the data that the PLC writes into the inverter. The first data defaults to the inverter control word (7000H), the second data defaults to the

inverter given frequency value (7015H), and the other data are configured by the user.

PZD write area	
PZD1	The inverter control word (F00.02 is set to 2) uses the 7000H control word of the MODBUS RTU protocol : 0001 H: Forward operation 000 2H: Reverse operation 000 3H: Forward jog 000 4H: Reverse jog 000 5H: deceleration and stop 000 6H: Rapid stop 000 7H: Free stop 000 8H: Fault reset
PZD2	Frequency setting, the default configuration is 7015H (F00.04 is set to 7)
PZD3~PZD16	Function codes that can be changed in real time, not written into EEPROM, corresponding to F 10.18~10.31 (when data is configured, the address is displayed in decimal)

The PZD output area is the data that the PLC reads from the inverter. The first data defaults to the inverter status word, the second data defaults to the inverter operating frequency value, and the other data are configured by the user.

PZD output area	
PZD1	The inverter status word uses the 7200H status word of the MODBUS RTU protocol : Bit 7~0 represents the operating status 0 0 H : Parameter setting 01H: Slave running 02H: JOG operation 03H: Self-learning operation 04H: Slave machine stops 05H: JOG parking 06H: Fault status 07H: Factory self-inspection Bit 15~8 represents the fault code, 00H represents no fault
PZD2	Real-time output frequency, the default configuration is F 18.00
PZD3~PZD16	Function codes that can be read in real time, corresponding to F 10.33~F10.46 (when data is configured, the address is displayed in decimal)

Different message types support different data lengths. For example, in standard message 1, the PZD write area and PZD output area each have 2 data, including the inverter control word, given frequency, inverter status word, and operating frequency; in standard message 2, the PZD write area and PZD output area each have 4 data, in addition to the control word, given frequency, status word, and operating frequency, it can support the periodic reading and writing of 2 function codes; and so on, in standard message 8, the PZD write area and PZD output area each have 16 data,

which can support the periodic reading and writing of 14 function codes.

4. Project Configuration

Project configuration is completed in the TIA Portal software without connecting to the PLC and PN card.

4.1 Create a new project

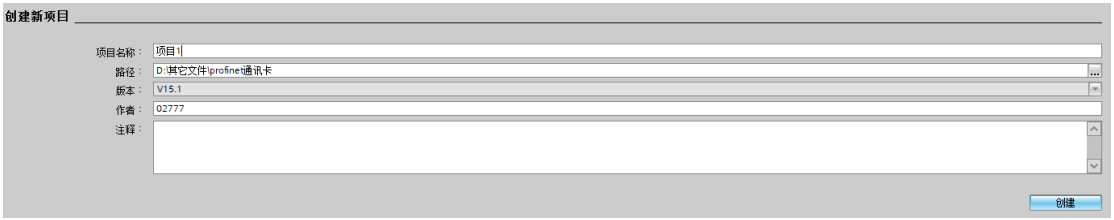
Open TIA Portal V15.1 and click "Create New Project", as shown in Figure 4.1. In the pop-up " Create New Project " dialog box, fill in the project content:

(1) Project name;

(3) Select the save path for the project;

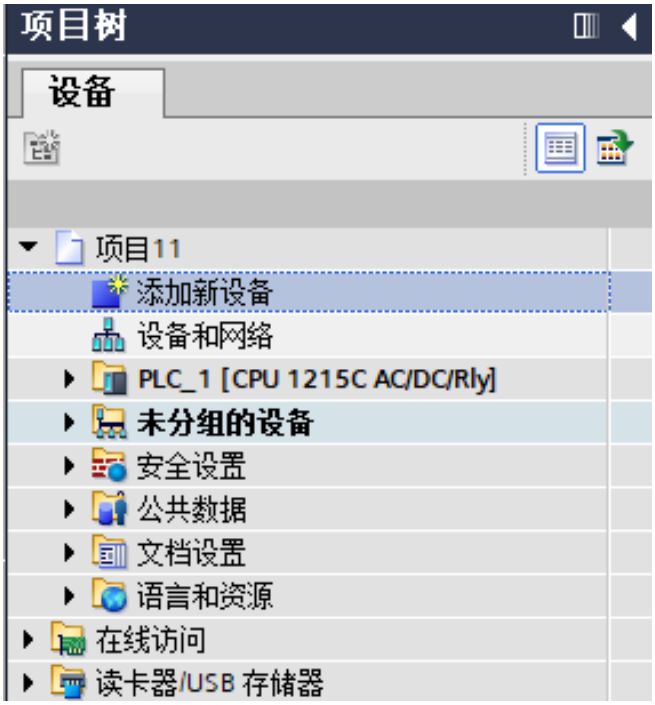
(4) Click "Create" in the lower right corner to enter the project development environment page;

(5) Click "Open Project View".



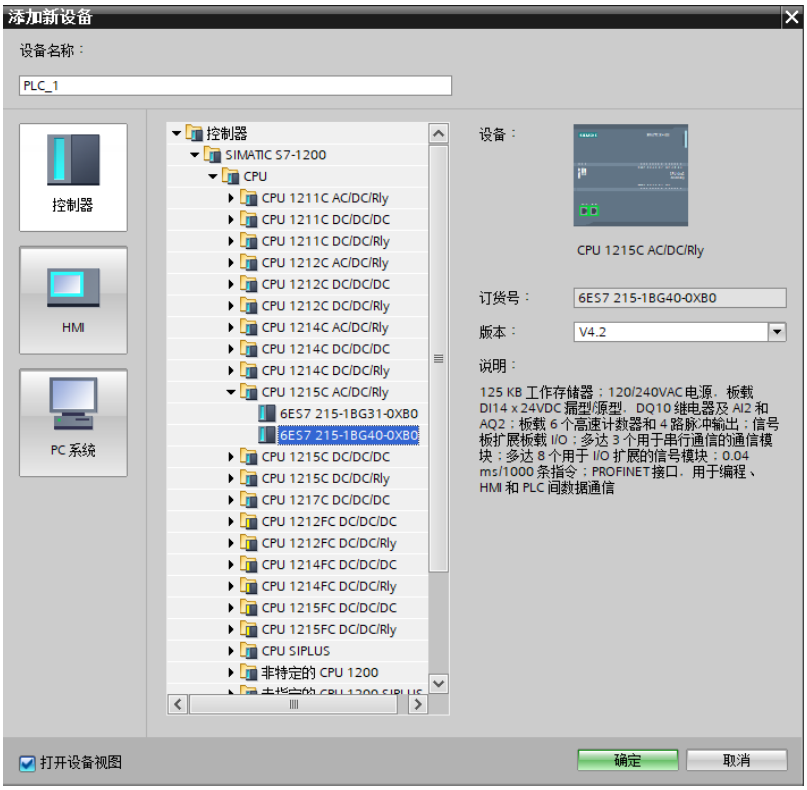
4.2 Create the master site

(1) In the project structure directory, double-click "Add New Device".



(2) In the pop-up "Add New Device" dialog box, select the PLC model and version, and click the "OK" button to complete the establishment of the master

station.

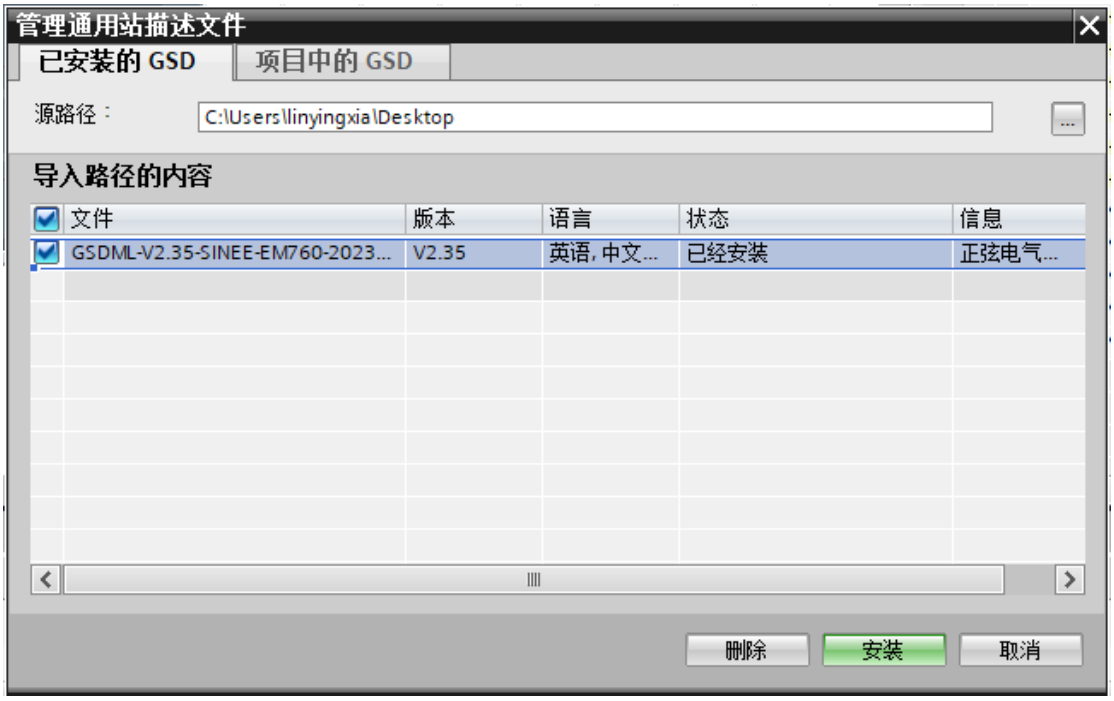


4.3 Install GSDML file

(1) At the top of the TIA Portal page, click "Options", then "Manage General Station Description File (GSD)".

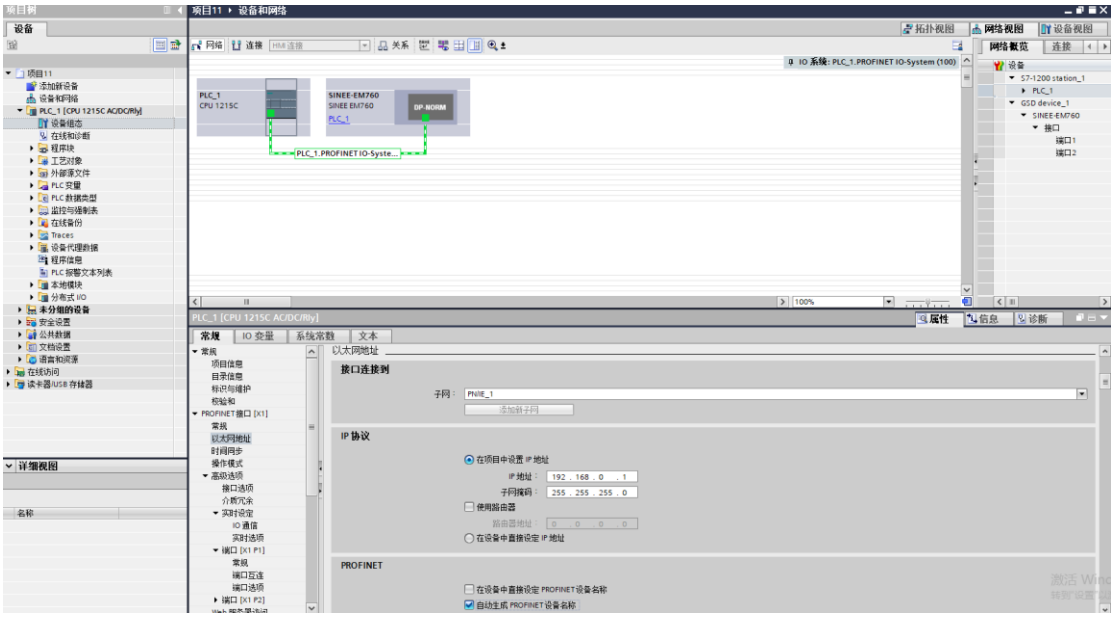


(2) Select the path where the GSDML file is stored (Note: GSD files should not be stored in a Chinese path, otherwise an error may occur), then select the GSD file and click "Install".

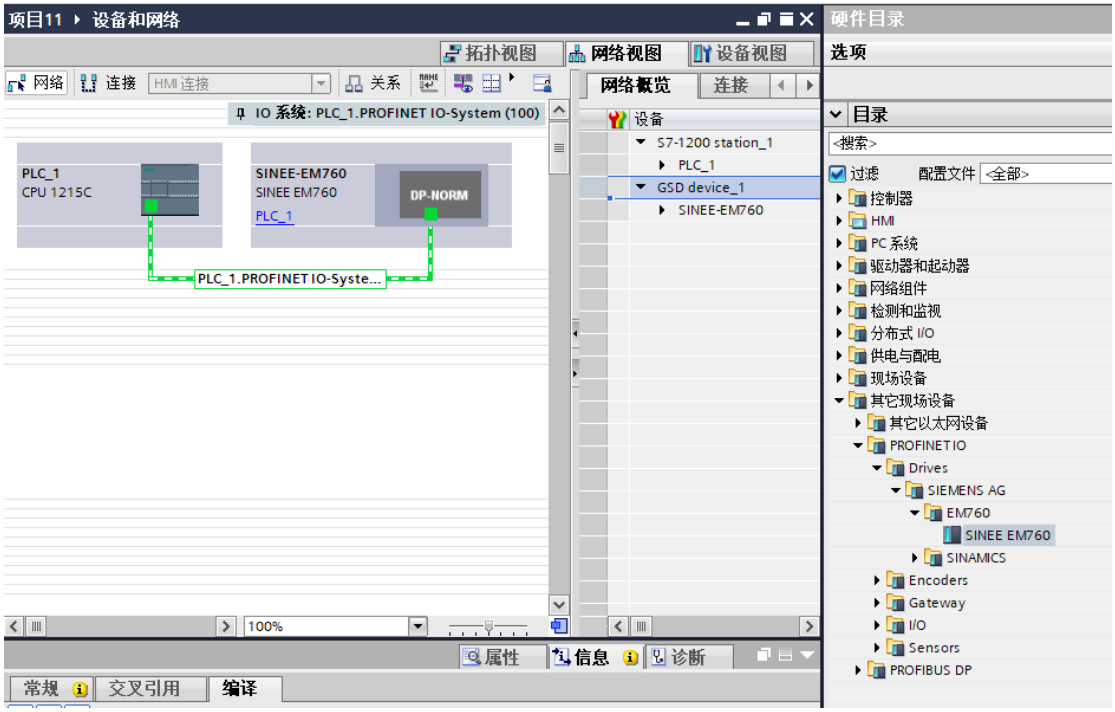


4.4 Slave Configuration

(1) In the list on the left, click "PLC_1 " and "Device Configuration" in turn. After selecting the PLC, set the PLC's IP address and subnet mask in the property interface below, and click "Add New Subnet".



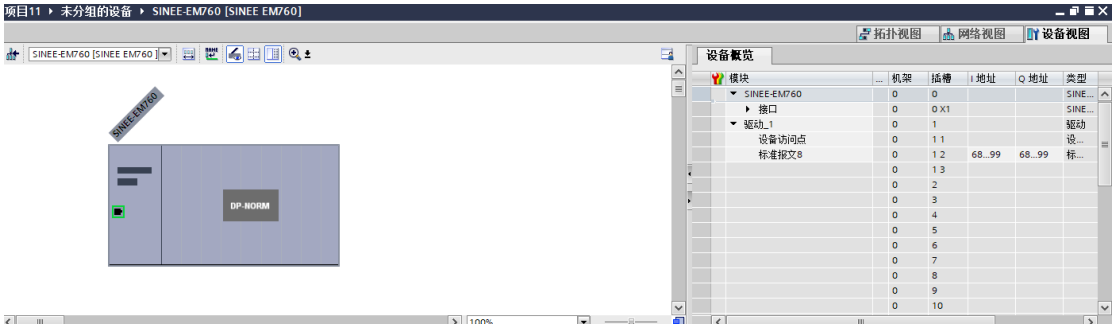
(2) Click "Hardware Catalog", "Other Field Devices", "PROFINET IO", "Drives", "SIEMENS AG", "EM760" on the right, and then double-click "SINEE EM760" to add EM760 to the network view.



(3) Click “Unassigned” and select the master system to which the EM760 slave needs to connect.



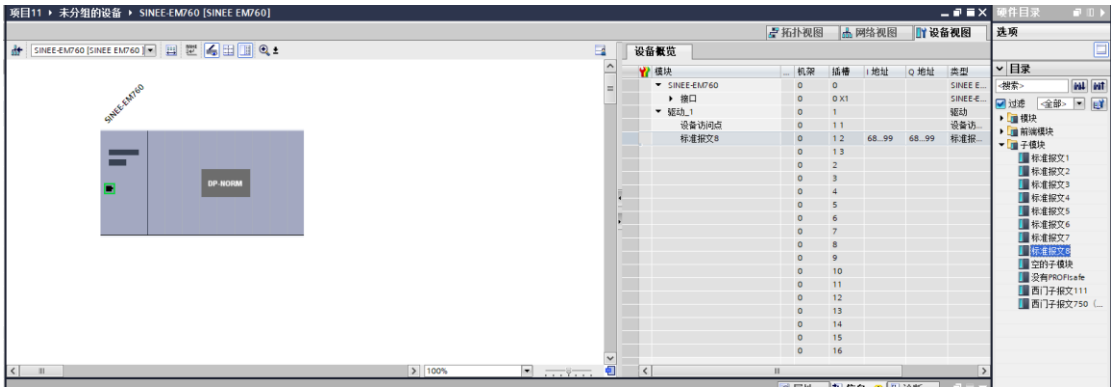
(4) Select the EM760 slave station , switch to "Device View", click "Properties", "General", "PROFINET Interface [X1]", "Ethernet Address" in sequence, and then set the IP address of the device .



In the above interface, uncheck "Automatically generate PROFINET device name" and enter the device name you want to set after "PROFINET device name" (you can also keep it checked to let the system automatically generate the name).



(6) Select the EM760 slave station, switch to the device view, click "Hardware Catalog" and "Submodule" on the right, and then double-click the message to be added. (The difference between standard messages 1 to 8 is the number of PZD data. Select the appropriate message type according to the number of function codes that need to be read and written in real time)



The difference between standard telegrams 1 to 8 is the number of PZD data. The number of data transmitted in a standard telegram 1 cycle is the largest.

4.5 PZD Configuration

PZD1 and PZD2 are default configurations and cannot be modified in the configuration. PZD3~PZD16 are user-defined data, and the user can configure the periodic interactive data. The configurable PZD range is related to the selected message type. If standard message 8 is selected, the configurable PZD range is PZD3~PZD16. The configured address is decimal. For example, if the function code F18.00 has a hexadecimal address of 1200H, which is converted to decimal 4608. The address corresponding to F18.00 is 4608. During use, unused PZDs do not need to be modified and retain the default values.

There are two methods for PZD configuration, one is keyboard configuration and the other is master station configuration.

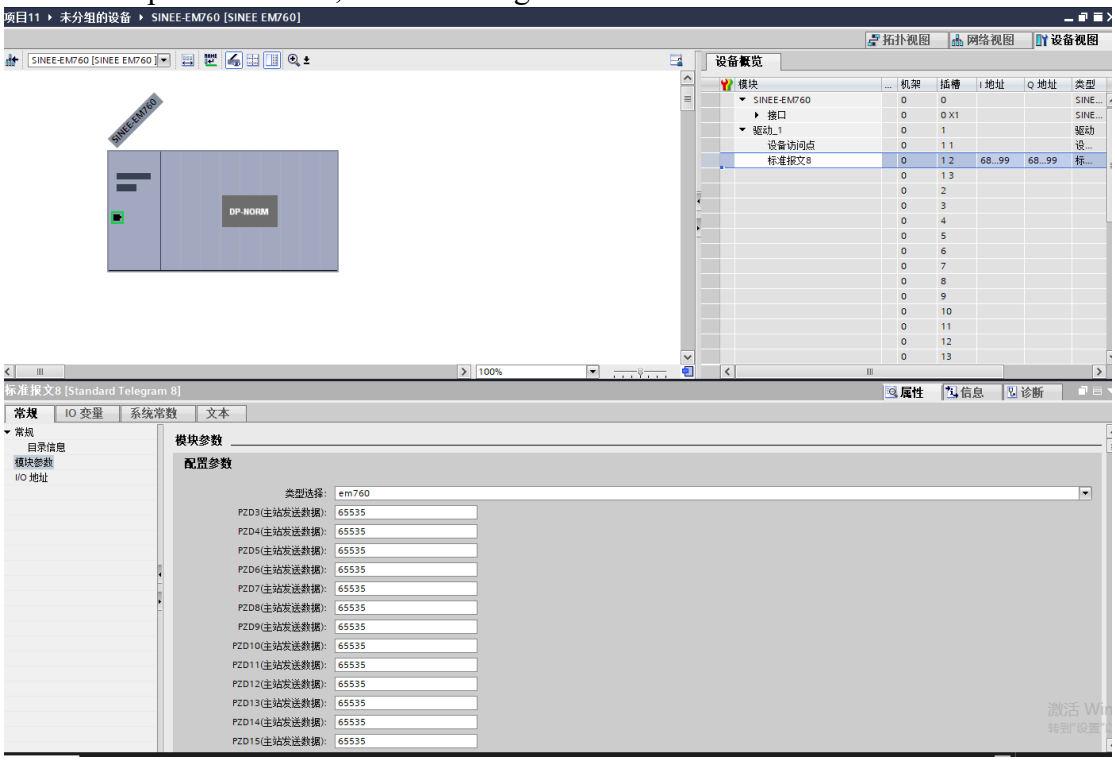
(1) When F10.51=0, it is keyboard configuration.

By modifying F 10.18~10.31 on the keyboard, you can configure the data address of the PZD write area. If F10.18 is changed to 14 (F00.14), the data corresponding to the write area PZD3 is the acceleration time. By modifying the value of the write area PZD3, you can modify the acceleration time of the inverter.

The data address of the PZD output area can be configured by modifying F 10.33~F10.46 through the keyboard . If F10.33 is changed to 4614 (F18.06), the data corresponding to the output area PZD3 is the output current. By reading the value of the output area PZD3, the output current of the inverter can be obtained.

(2) When F10.51=1, it is configured as the master station. (Recommended method)

Select the corresponding message, click "Properties", "General", "Module Parameters" in turn, and configure the PZD3~PZD16 data address, where the master station sends data corresponding to the PZD write area data, and the inverter response data corresponds to the PZD output area data. For example: modify PZD3 (master station sends data) to 15, then the data corresponding to the write area PZD3 is the deceleration time. By modifying the value of the write area PZD3, the deceleration time of the inverter can be modified. Modify PZD3 (inverter response data) to 4617, then the data corresponding to the output area PZD3 is the bus voltage. By reading the value of the output area PZD3, the bus voltage of the inverter can be obtained.



4.6 Network Configuration

Switch to "Network View". If you need to add more slaves, repeat steps 4.3 and 4.4. If the slave configurations are the same, you can directly select the slave and copy it, and then modify the IP address and device name (in networking, the IP address and device name of each slave need to be different).

5. Communication Configuration

5.1 IP address and device name

using the communication card for the first time , you need to set the IP address and device name. Note that the IP address and device name you set must be consistent with the IP address and device name configured in Section 4.3.

(1) There are two ways to configure the IP address of the PN card, one is the master station configuration, the other is the keyboard configuration.

When F10.65=0, it is the master station configuration method. Click "Online Access" in the list on the left, find the network card corresponding to the local computer, double-click "Update Accessible Devices", wait for a while, and all the devices scanned in the network will be displayed in the drop-down list.

Among all the displayed devices, select the EM760 slave station , double-click "Online and Diagnosis" to enter the online debugging state. Then click "Assign IP Address " to assign an IP address to the PN communication card.



When F10.65=1, it is the keyboard configuration method. By modifying the values of F10.66~F10.69 (the default values of F10.66~F10.69 are 192, 168, 0, 2), the IP address of the PN communication card can be modified, and the modified IP address will take effect after powering on again.

Note: F10.65 defaults to 0. In general, the IP address is configured using the master station. The IP address of the current PN card can be viewed through F10.66~F10.69.

(2) The device name of the PN card can only be configured by the master station.

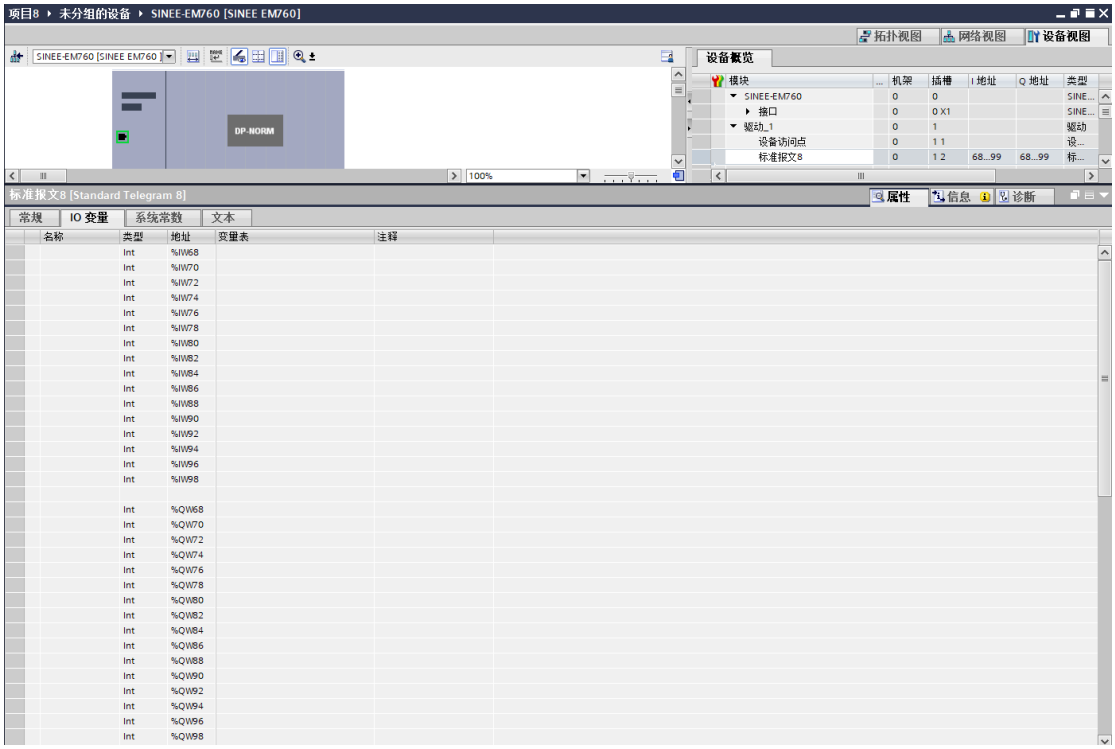
Click "Online Access" in the list on the left, find the network card corresponding to the local computer, double-click "Update Accessible Devices", wait for a while, and all devices scanned in the network will be displayed in the drop-down list.

Among all the displayed devices, select the EM760 slave station , double-click "Online and Diagnosis" to enter the online debugging state. Then click "Assign Device Name " to assign a device name to the PN communication card.

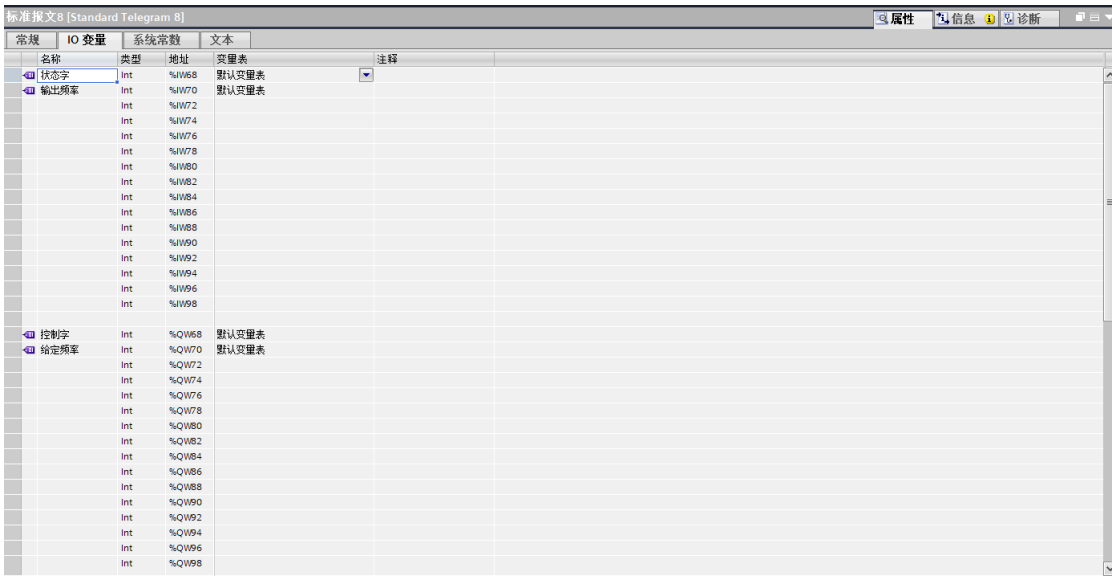


5.2 PZD data

(1) The PZD data area realizes real-time data exchange between the PLC master station and the inverter slave station. You can select different lengths of PZD transmission formats for data exchange as needed. As shown in the figure below, after double-clicking "Standard Message 8" in the submodule, the TIA Portal software will automatically assign the I address and Q address. The Q address is the address of the write area PZD, and the I address is the address of the output area PZD.



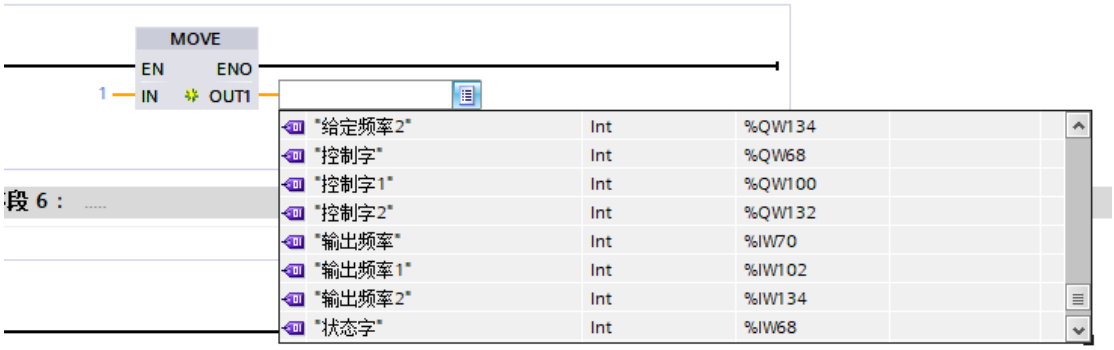
(2) Click "Properties" and "IO Variables" to see all Q addresses and I addresses. Among them, addresses %QW68~%QW99 correspond to write areas PZD1~PZD16 respectively, and addresses %IW68~%IW99 correspond to output areas PZD1~PZD16 respectively. By entering the variable name in the "Name" column, you can create the variables corresponding to PZD1~PZD16, as shown in the figure below.



(3) Find "Instructions" in the directory column on the right side of the TIA Portal page . The MOVE instruction is under the "Move Operation" directory. Enter the "Program Blocks" directory on the left side and double- click the main function module " Main[OB1] ". Add MOVE instructions as needed to write and read data.



(4) If you want to write data to the inverter, you can add the variable to be written on the OUT side of the MOVE instruction (the variable corresponding to the %QW address, which is also the variable corresponding to the write area PZD, set in Section 2). By modifying the value on the IN side, you can modify the corresponding PZD value.



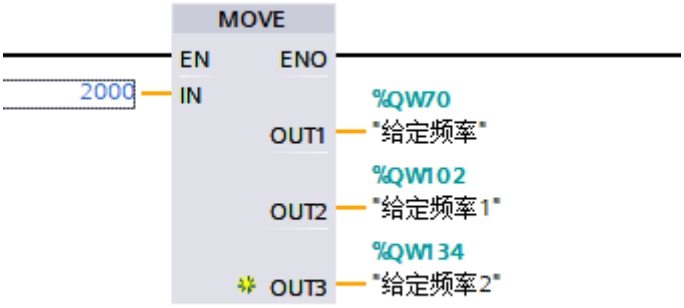
As shown in the figure, use the MOVE instruction to write 1 to the control word, and the inverter will run forward.



As shown in the figure, use the MOVE instruction to write 5 into the control word, and the inverter decelerates and stops.



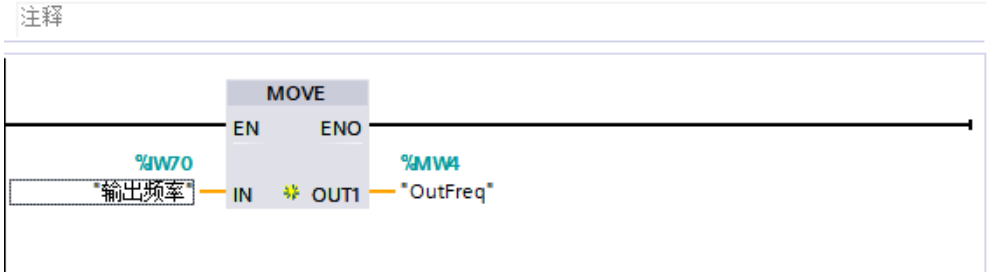
As shown in the figure, use the MOVE instruction to write 2000 to the given frequency, and the given frequency of the inverter is set to 20.00Hz.



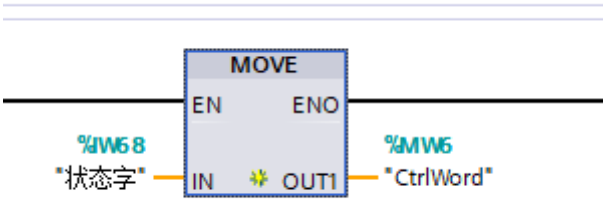
(5) If you want to read the data in the inverter, you can add the variable to be read on the IN side of the MOVE instruction (the variable corresponding to the %IW address, which is also the variable corresponding to the output area PZD, set in Section 2). By reading the value of the variable on the OUT side, you can get the corresponding PZD value.



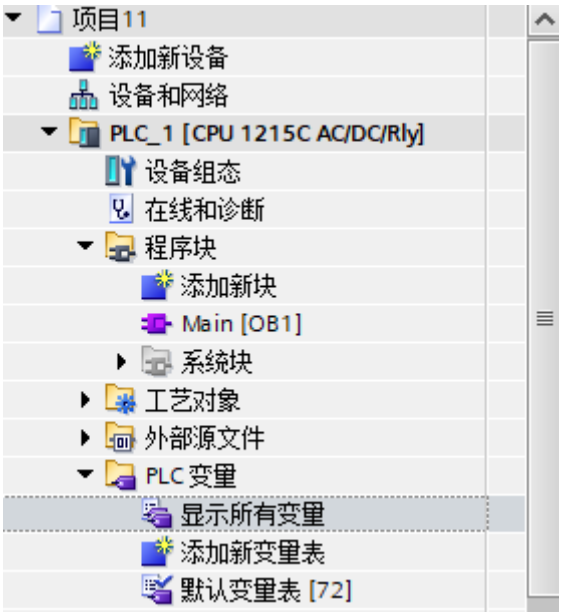
As shown in the figure, by reading the value of the OutFreq variable, the output frequency of the inverter can be obtained.



As shown in the figure, by reading the value of the CtrlWord variable, you can get the status word of the inverter.



(6) Click "PLC variables" in the list on the left, and then double-click "Show all variables". All PLC variables will be displayed.



Press the monitor button to monitor all PLC variables.



5.3 Non-periodic data

(1) Parameter address mapping

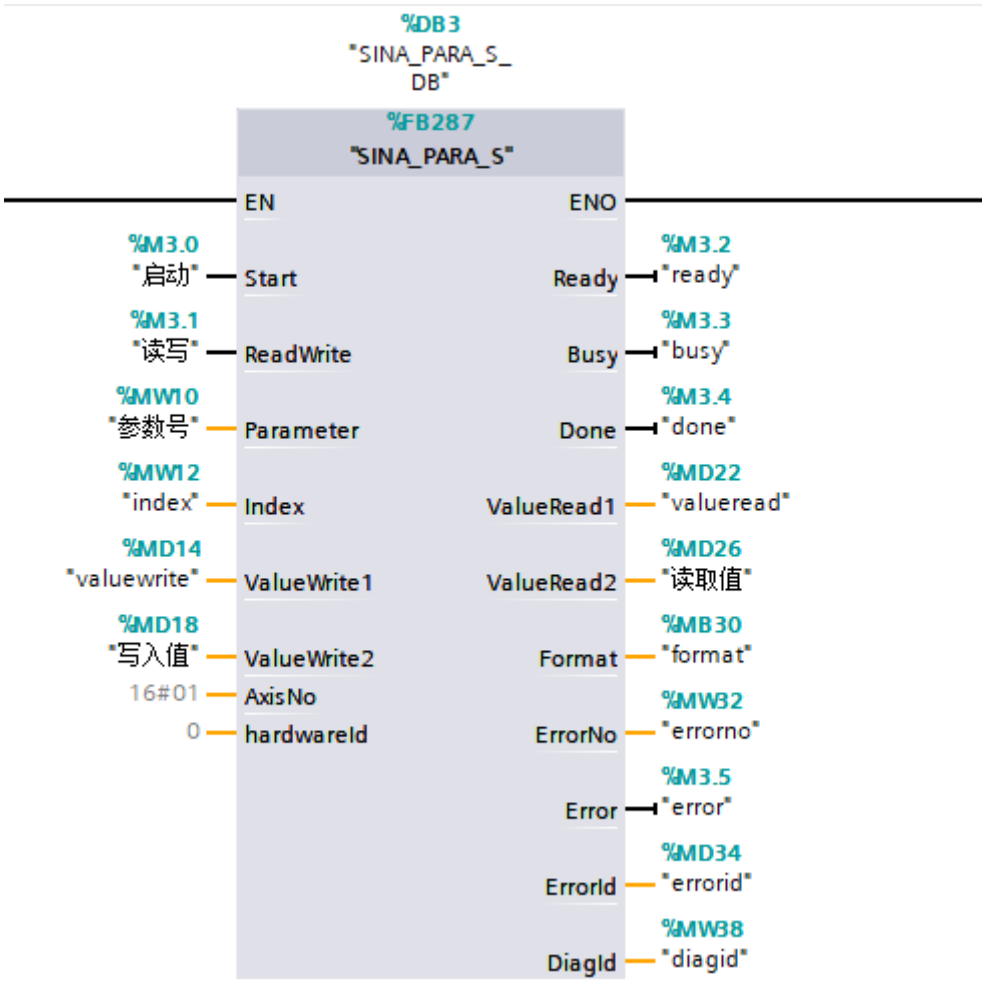
The parameter number range of the inverter function code mapping is 0x2000~0x8363. The corresponding rules between function code and parameter number are as follows:

Function code	Hexadecimal function code address	Parameter number
FXX.XX	0xaaaa	0xaaaa+0x2000

For example, the function code address of F18.14 is the hexadecimal number 18 shifted left by 8 bits plus the hexadecimal number 14, that is, 0x120E. The corresponding parameter number is 0x2000 + 0x120E = 0x320E.

(2) FB287 parameter reading and writing module

The non-periodic parameter read and write function uses the FB287 module, and each time a function code is read and written. The module interfaces involved in the read and write function code are Start, ReadWrite , Parameter, ValueWrite2 , Hardwareld , ValueRead2 , and Error. When the FB287 module sends data , it is in trigger mode, that is, Start is set from 0 to 1 to send data once, so before the next transmission, Start must be set from 1 to 0, and then set from 0 to 1 to start a transmission.



enter:

Start: triggers sending data;

ReadWrite : read and write commands, 0 is read, 1 is write;

Parameter: parameter number;

ValueWrite2: parameter write value;

Output:

ValueRead2: parameter read value;

Error: parameter specification flag, which becomes TRUE when the written value exceeds the limit.

(3) Non-periodic parameter reading and writing examples

Example 1: Read inverter deceleration time 1:

① The parameter number corresponding to function code F00.15 is 0x200F, and Parameter (parameter number) is assigned 0x200F;

② Set ReadWrite (read/write) to 0 (FALSE);

③Trigger Start twice;

④ From ValueRead2 (read value), you can see the value of the read function code.

Example 2: Write inverter acceleration time 1:

① The parameter number corresponding to function code F00.14 is 0x200E,

and the value of Parameter (parameter number) is assigned 0x200E;

② Set ReadWrite (read/write) to 1 (TRUE);

③ Assign 800 to ValueWrite2 (write value) (Error will be set to TRUE if the write value exceeds the limit);

④ Click to trigger Start once;

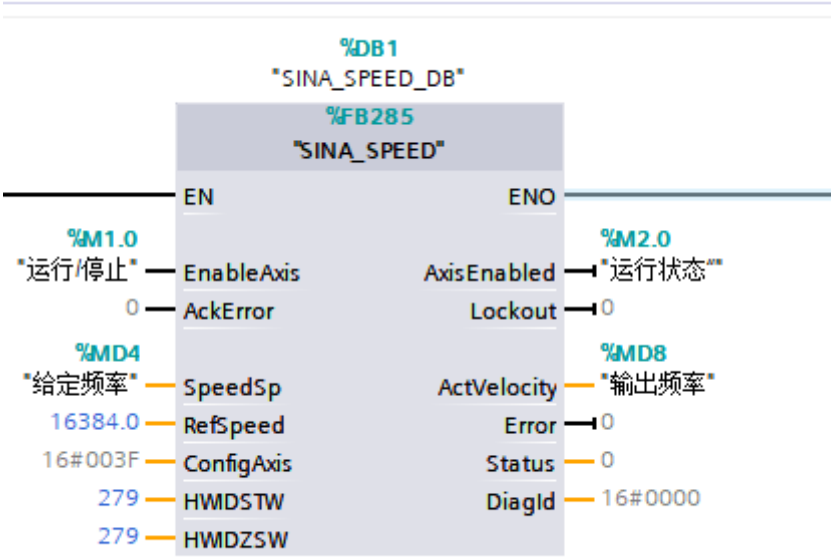
⑤ The value of F00.14 changes to 8.00.

5.4 Siemens Standard Message

(1) The communication card is compatible with Siemens standard message No. 1. Select "Siemens standard message" in "Submodule". The communication card also supports 750 auxiliary messages. Select "Siemens standard message" in "Submodule" to achieve 10 data cycle interaction, corresponding to F10.18~F10.27 and F10.33~F10.42.

	西门子标准报文	0	1 2	68...71	68...71
	西门子报文750（辅助...	0	1 3	72...91	72...91

(2) FB285 start-stop control module (only used when Siemens standard message is selected)



enter:

EnableAxis : Enable operation, TRUE means running, FALSE means stopping;

AckError : TRUE for fault reset, needs to be changed back to FALSE after reset;

SpeedSp : speed (frequency) given;

RefSpeed : fixed value 16384.0;

Output:

AxisEnabled :: Enabled state, when it is TRUE, it means the inverter is running;

Error: Fault status, when it is TRUE, it means the inverter is faulty;

ActVelocity : Actual operating speed (frequency).

(3) Start-Stop Module Example

Example 1: The inverter runs at 20.00Hz:

① Change the value of SpeedSp to 2000;

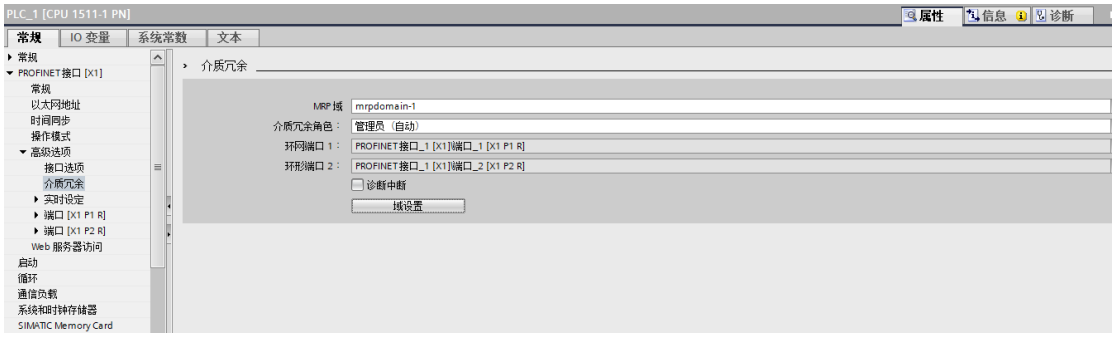
② Set EnableAxis to 1 (TRUE);

③ from ActVelocity .

5.5 Media Redundancy

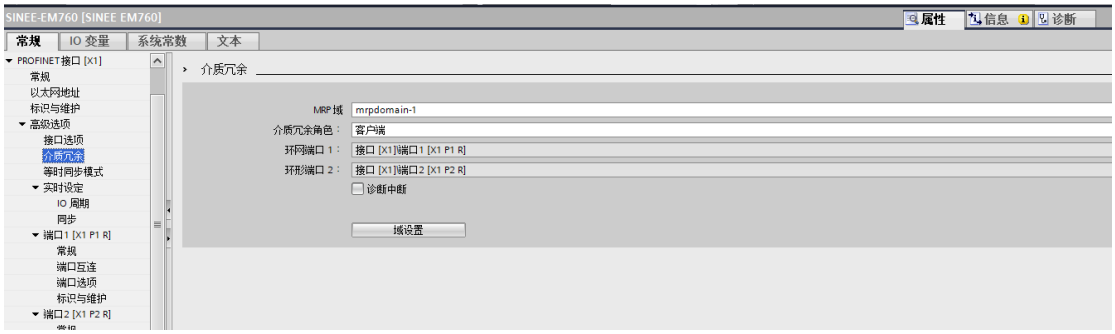
(1) Configuring the MRP Manager

Select the PLC and enter the device view. In the properties interface, click "PROFINET interface [X1]", "Advanced options", "Media redundancy" in sequence, and select "Manager (automatic)" from the drop-down list in "Media redundancy role ".



(2) Configuring the MRP client

Select the EM760 slave station and enter the device view. In the properties interface , click "PROFINET interface [X1]", "Advanced options", "Media redundancy" in sequence, and then select "Client" from the drop-down list in "Media redundancy role ".



(3) For a Profinet network configured with an MRP network , after a line in the ring network is disconnected, a handshake will be performed again after a few seconds . When there are two disconnections in the network, all nodes between the two disconnections cannot be connected normally even if the MRP function is configured .

5.6 Compile and run

(1) Save the configured network and set the computer's IP address to be in the same network segment as the PLC. Be careful not to set the same IP address as the

PLC and the IP addresses of each slave station. You can also select "Automatically assign IP address" after clicking "Download".

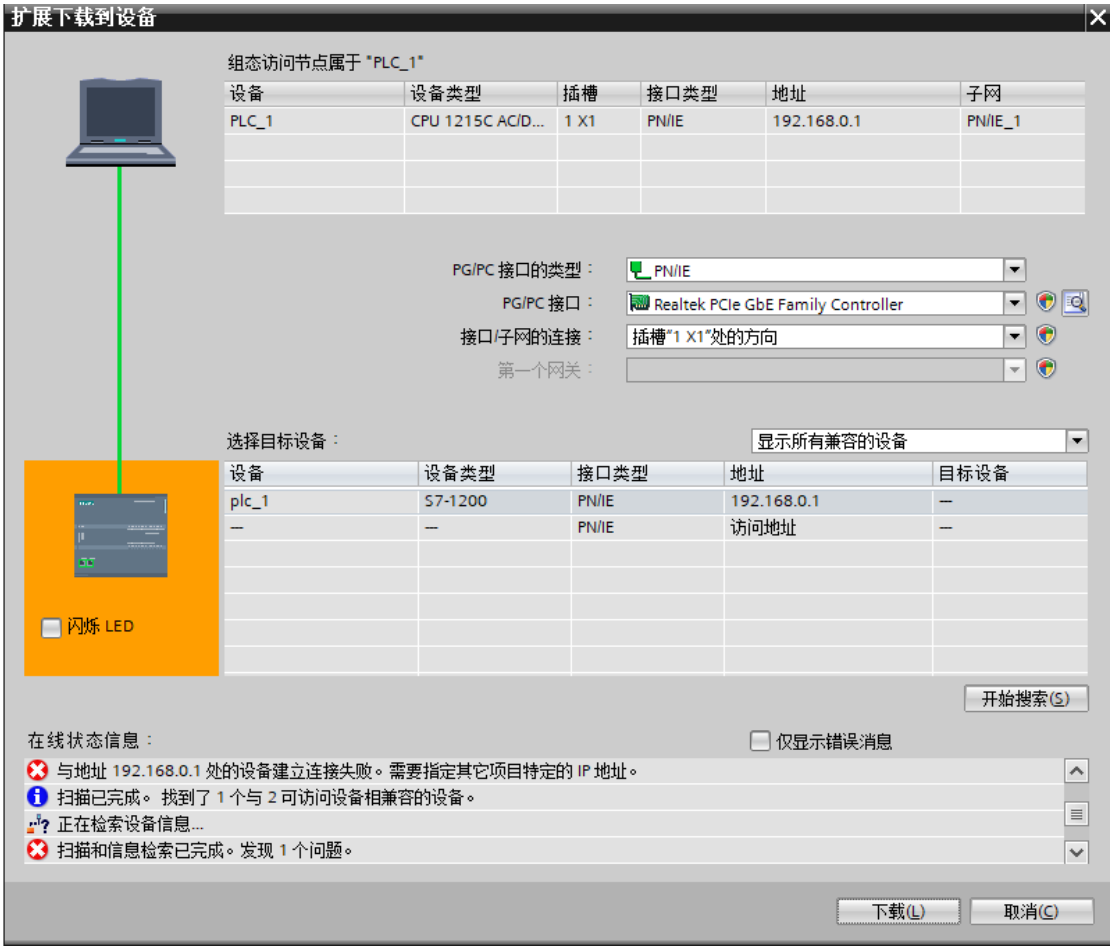
(2) Click the "Compile" button in the bar on the page to compile.



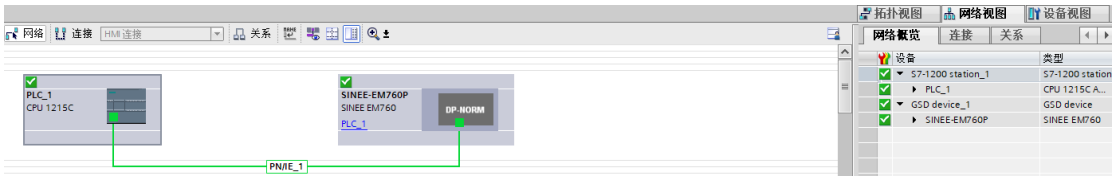
(3) After the compilation is successful, click the "Download to Device" button and a pop-up window will appear.



Select the interface, click the "Start Search" button, and after finding the PLC, click the "Download" button to download the program to the PLC. If there is an asynchrony, select "Continue in the event of an asynchrony".



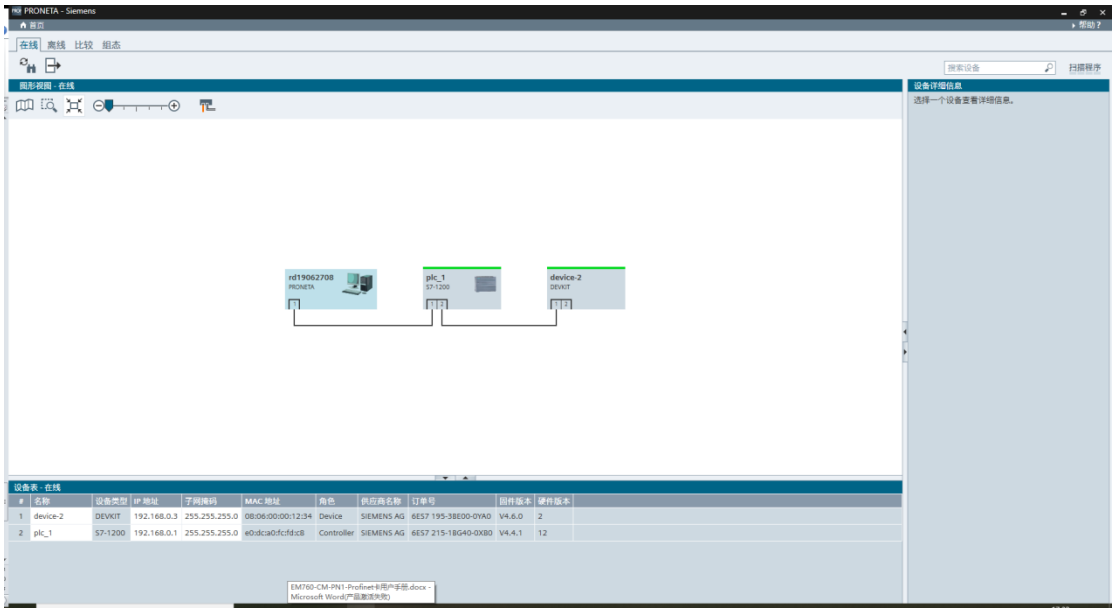
(4) After the program is successfully downloaded to the PLC, click "Go Online". If it is successfully online, a green check mark will appear, and then click "Start CPU" to start the PLC working.



6. Notes

7.1 Hardware Scan

After all hardware connections are completed, power on the inverter and PLC. Under normal circumstances, the PN card's wiring network port indicator light will flash and then stay on after a few seconds of power-on, which preliminarily indicates that the PN card communication connection is successful. Then open the network analyzer (Proneta.exe) to scan the hardware. If the PN card is recognized, the following screen will appear:



In the figure above, device-2 is the device name of the currently scanned PN card, and plc_1 is the PLC controller currently connected to the PN card, indicating that the hardware connection is normal. Use the network analyzer to set the device name and IP address of the PN card according to the PLC project file. The IP address of the PN card must be inconsistent with the IP address of the PLC.

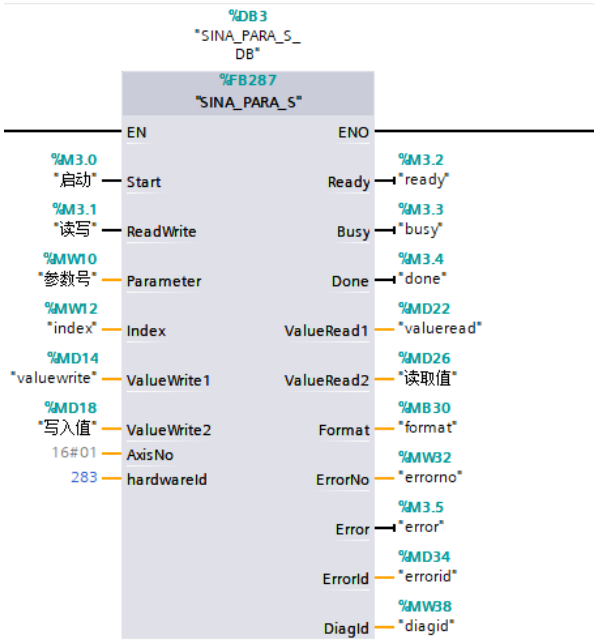
When using a network analyzer to set the IP address of a PN card, you can use a computer to directly connect to the PN card and modify the IP address. In the same configuration network, the device name, IP address, and MAC address of the PN cards cannot be the same.

7.2 Hardware Identifier

Both the FB287 parameter read/write module and the FB285 start/stop module require the hardware identifier of the corresponding device. Through the hardware identifier, one PLC can control multiple PN devices. The hardware identifier can be viewed in the system constants.



in hardwareId to control the PN device.



7.3 PN card communication disconnection fault

When PN communication is disconnected during inverter operation, the machine will report E16 communication fault. Check whether the wiring is disconnected. After troubleshooting, press STOP to reset and communication will resume normally.

7.4 Keyboard STOP emergency stop function

When the PN card controls the inverter, the keyboard STOP provides an emergency stop function. After STOP, F00.02 will automatically switch to keyboard control. If communication control needs to be restored, F00.02 must be switched to communication control.

7.5 Switching between the original PN card and the new PN card

(1) 750 messages

	I Address (Read)		Q address (write)	
	Original PN card	New PN Card	Original PN card	New PN Card
PZD1	Output torque	f/10.33	Given torque	f/10.18
PZD2	Output Current	f/10.34	\	f/10.19
PZD3	\	f/10.35	\	f/10.20
PZD4	f/11.01	f/10.36	f/11.11	f/10.21
PZD5	f/11.02	f/10.37	f/11.12	f/10.22
PZD6	f/11.03	f/10.38	f/11.13	f/10.23
PZD7	f/11.04	f/10.39	f/11.14	f/10.24
PZD8	f/11.05	f/10.40	f/11.15	f/10.25
PZD9	\	f/10.41	\	f/10.26
PZD10	\	f/10.42	\	f/10.27

the new PN card is 65535. When using, set the parameters in F10.18~F10.27 and

F10.33~F10.42 in sequence. Do not skip a function code and do not set it. The unused PZD in the middle must also be changed to 0. For example, the function code F18.00, the hexadecimal address is 1200H, which is converted to decimal 4608, and the corresponding address is 4608.

(2) Siemens standard message No. 1

New PN card F10.17 changed to 28693 (7015H communication given frequency), F10.32 changed to 4608 (F18.00 output frequency)