HV320-DP-V2
Profibus-DP Communication Card
User Manual

HNC Electric Limited

1. Overview

Thank you for using our HV320-V2 series AC drive and Profibus-DP expansion card (hereinafter referred to as HV320-DP-V2 card). HV320-DP-V2 card is a Profibus-DP fieldbus adapter card that complies with the internationally accepted Profibus fieldbus standard . This card is installed on the HV320-V2 series inverter to improve communication efficiency and facilitate the inverter networking function, making the inverter a slave station of the fieldbus and accepting the control of the fieldbus master station.

This manual requires that the corresponding HV320-DP-V2 card software version is 1.00 or above, and the matching GSD file name is "HV320-V2 DP.gsd".

Please read this user guide carefully before using this product.

Figure 1-1 Appearance of the HV320-DP-V2 card

2. 2. Installation and Setup

2.1 Installing the HV320-DP-V2 Card

The HV320-DP-V2 card is installed inside the HV320-V2 series AC drive. Before installation, disconnect the power supply of the AC drive and wait for about 10 minutes until the charging indicator on the AC drive lights up. Then, insert the HV320-DP-V2 card into the AC drive to avoid damage caused by the tension of the external signal cable on the inter-board signal socket.

Figure 2-3 shows the hardware layout of the HV320-DP-V2 card. The 2* 8P bent pin socket (P2) is used to connect the inverter . The HV320-DP-V2 card provides a DP communication interface for communication with the master station and the slave station.

For hardware details, see Table 2-1

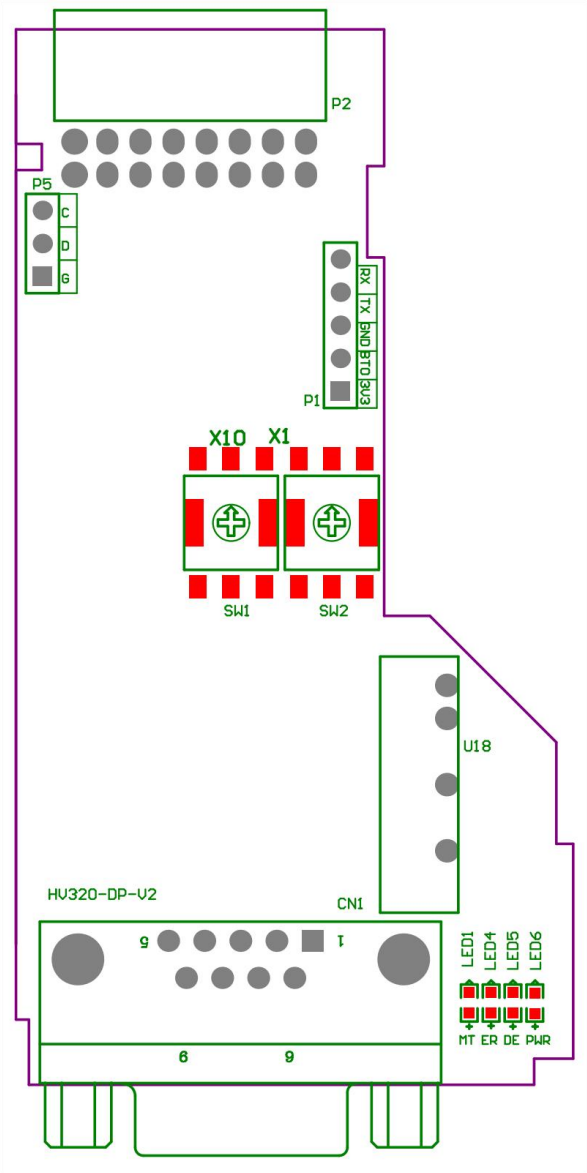


Figure 2-3 HV320-DP-V2 card (hardware)

Table 2-1 Hardware description of the HV320-DP-V2 card

Symbol	Hardware Name	Functional Description
P2	2* 8P bent pin socket	For connecting AC drives
CN1	Profibus communication connector (DB9 pin)	
SW1,SW2	Profibus station number setting	SW1=X10,SW2=X1
LED5	Profibus-DP communication indicator (DE) (green)	HV320-DP-V2 card, see Table 2-2.
LED4	Profibus-DP fault indicator (ER) (red)	
LED1	Inverter communication abnormality indicator (MT) (green)	
LED6	Power indicator (PWR) (green)	

Table 2-2 Specifications of the HV320-DP-V2 card

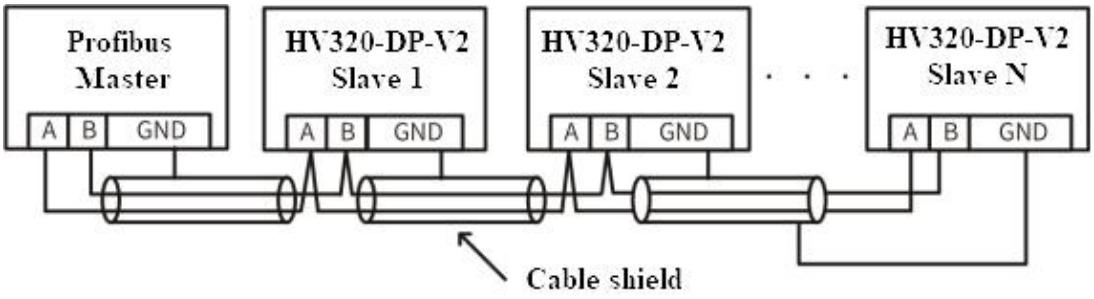
Indicator signal		Status description	Solution
LED5	Always green	DP normal	N/A
	OFF state	Communication with the drive is lost	Set P0-28 to 1 and check if the AC drive supports the HV320-DP-V2 card.

LED4	OFF state	normal	N/A
	Always red	communication fail	Please contact technical support.
LED1	OFF state	normal	N/A
	Always green	Communication with the inverter main control board is abnormal	Check whether the CN1 connector is connected normally and whether the inverter is powered on.
LED6	Always green	normal	N/A
	OFF state	ESC internal fault	Please contact technical support.

illustrate Note: For some products, the indicator light color may not match the number. The number shall prevail .

2.2 Profibus connection topology and transmission distance

The wiring diagram of this DP expansion card and Profibus master station is shown in the figure below.



Terminal matching resistors need to be connected at both ends of the Profibus bus. The dial code needs to be dialed according to the instructions on the wiring terminal. After the terminal resistors are correctly connected, the resistance between A1/B1 should be about 110Ω when the power is off. The communication cables on the DP connectors of the devices at both ends of the Profibus network need to be connected to the corresponding channels of A1/B1, otherwise the terminal resistors cannot be connected. Not connecting or connecting too little terminal resistors will affect the communication quality and cause unstable communication.

Depending on the different baud rate settings of the master station, the length of the communication wire between this DP expansion card and the Profibus master station is also required, and must strictly follow the limited communication data wire length of SIEMENS. The baud rate and wire length requirements are shown in the table below.

Transmission rate Kbps	Maximum length of cable type A (m)	Cable Type B Maximum Length (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	70
3000	100	not support
6000	100	
12000	100	

Cable specifications are shown in the table below.

Cable parameters	Type A	Type B
Impedance	135Ω~165Ω（f=3~20MHz）	100Ω~130Ω（f>100kHz）
Capacitance	<30pF/m	<60pF/m
Resistance	<110Ω/km	Not specified
Conductor cross-sectional area	≥0.34mm ^{2}	≥0.22mm2

3. Communication Configuration

3.1 Parameters

Communication configuration between HV320-DP-V2 card and HV320-V2 series inverter is established After installing HV320-DP-V2 card on HV320-V2 series AC drive, communication configuration is completed to realize communication between them.

■ Communication card settings for drives

The following parameters must be set to operate between the HV320-DP-V2 card and the HV320-V2 series AC drive and to connect the HV320-DP-V2 card to a Profibus-DP fieldbus network.

Function code	name	content	Settings	describe
P0-02	Run command source	0: Operation panel running command channel (LED off) 1: Terminal command channel (LED on) 2: Communication command channel (LED flashes)	2	Run command issued via communication
P0-03	Main frequency source X selection	0: Digital setting (preset frequency P0-08, UP/ DOWN can be modified, no memory is stored after power failure) 1: Digital setting (preset frequency P0-08, UP/ DOWN can be modified, power-off memory) 2: AI 1 3: AI2 4: AI 3 5: PULSE setting (DI 5) 6: Multi-segment instructions 7: Simple PLC 8: PID 9: Communication setting	9	Given a target frequency By communication
P0-28	Serial communication protocol	0: Modbus protocol 1: Communication card bridge protocol	1	Select special item communication card for communication

■ Communication control related function codes

Function code	Name	Predetermined area		Decimal address
U3-16	Frequency setting	-Maximum frequency~Maximum frequency 0.01Hz		29456
U3-17	control commands	0001: Forward operation 0002: Reverse operation 0003: Forward jog 0004: Reverse jog	0005: Free stop 0006: Deceleration and stop 0007: Fault reset	29457

Function code	Name	Predetermined area		Decimal address
U3-18	DO control	BIT 0: DO 1 output control BIT 1: DO 2 output control BIT 2: RELAY 1 lose Out of control BIT 3: RELAY 2 lose Out of control BIT 4: FMR output control	BIT 5: VDO 1 BIT 6: VDO 2 BIT 7: VDO 3 BIT 8: VDO 4 BIT 9: VDO 5	29458
U3-19	AO 1 control	0～7 FFF means 0 %～ 100%		29459
U3-20	AO 2 control	0～7 FFF means 0 %～ 100%		29460
U3-21	FMP Control	0～7 FFF means 0 %～ 100%		29461
U3-22	reserve	reserve		
U3-23	Speed control	Signed data, 1 rpm		29463

When using the HV320-DP-V2 card, the written PZD1 is mapped to U3-17 by default, and the PZD2 is mapped to U3-16 by default. If you find that the command or frequency cannot be written to the inverter normally, but PZD3~PZD12 can be written, and P0-02=2 and P0-03=9, then you can check on the inverter whether PE-00 is U3-17 and PE-01 is U3-16. If not, manually change them to the correct values.

■ **Communication monitoring related function codes**

Function code	Name	Unit	Decimal address
U 0-00	Operating frequency (Hz)	0.01 Hz	28672
U0-01	Set frequency (Hz)	0.01 Hz	28673
U0-02	Bus voltage (V)	0.1V	28674
U0-03	Output voltage(V)	1V	28675
U0-04	Output current(A)	0.01A	28676
U0-05	Output power (kW)	0.1kW	28677
U0-06	Output torque(%)	0.10%	28678
U0-07	DI input status	1	28679
U0-08	DO output status	1	28680
U0-09	AI 1 voltage (V)	0.01V	28681
U0-10	AI 2 voltage (V)	0.01V	28682
U0-11	AI 3 voltage (V)	0.01V	28683
U0-12	Count value	1	28684

U0-13	Length value	1	28685
U0-14	Load speed display	100.00%	2868600.00%
U0-15	PID Setting	1	28687
U0-16	PID Feedback	1	28688
U0-17	PLC stage	1	28689
U0-18	PULSE input pulse frequency (Hz)	0.01 kHz	28690
U0-19	Feedback speed (Hz)	0.01 Hz	28691
U0-20	Remaining running time	0.1Min	28692
U0-21	AI 1 voltage before correction	0.001V	2869300.00%
U0-22	AI 2 voltage before correction	0.001V	28694
U0-23	AI 3 voltage before correction	0.001V	28695
U0-24	Line speed	1m/ Min	28696
U0-25	Current power-on time	1 Min	28697
U0-26	Current running time	0.1 Min	28698
U0-27	PULSE input pulse frequency	1Hz	28699
U0-28	Communication setting value	0.01%	28700
U0-29	Encoder feedback speed	0.01 Hz	28701
U0-30	Main frequency X display	0.01 Hz	28702
U0-31	Auxiliary frequency Y display	0.01 Hz	28703
U0-32	View the value of any memory address	1	28704
U0-33	Synchronous machine rotor position	0.1°	2870500.00%
U0-34	Motor temperature value	1℃	2870600.00%
U0-35	Target torque(%)	0.10%	28707
U0-36	Resolver position	1	28708
U0-37	Power factor perspective	0.1°	28709
U0-38	ABZ position	1	28710
U0-39	VF separation target voltage	1V	28711
U0-40	VF separation output voltage	1V	28712
U0-41	DI input status intuitive display	1	28713
U0-42	DO input status intuitive display	1	28714
U0-43	DI input status intuitive display 1	1	28715
U0-44	DI input status intuitive display 2	1	28716
U0-45	accident details	1	28717
U0-58	Z signal counter	1	28730
U0-59	Setting frequency(%)	0.01%	28731
U0-60	Operating frequency(%)	0.01%	28732
U0-61	Inverter status	1	28733
U0-62	Current fault code	1	28734
U0-63	Operating frequency after droop control	0.01 Hz	38375
U0-64	Current Back EMF	0.1V	28736
U0-65	reserve	-	-

U0-66	Expansion card model	100: CANopen 200: Profibus - DP 300: CANlink 400: Profinet 500: EtherCAT	28738
U0-67	Expansion card version number	0.01	28739
U0-68	Inverter status	1	28740
U0-69	Operating frequency (Hz)	0.01 Hz	28741
U0-70	Motor speed	1 rpm	28742
U0-71	Output current	0.1A	28743

When using the HV320-DP-V2 card, the read PZD1 is mapped to U0-68 by default, and the PZD2 is mapped to U0-69 by default. If you find that the status or operating frequency cannot be read normally, but PZD3~PZD12 can be read, you can check whether PE-20 is U0-68 and PE-21 is U0-69 on the inverter. If not, please manually change it to the correct value.

3.2 Data transmission format

Profibus-DP Data Format

According to the ProfiDrive (variable speed transmission) protocol , the usage types are divided into five types: PPO1 , PPO2, PPO3, PPO4, and PPO5. The functions that can be completed by each data format are as follows:

Table 3-2 : PPO type description

Type of data	Supported Features
PPO1	● Single function parameter operation ● Inverter command, frequency setting ● Inverter status, operating frequency reading
PPO2	● Single function parameter operation ● Inverter command, frequency setting ● Inverter status, operating frequency reading ● 4 function parameters are written periodically ● 4 function parameters are read periodically
PPO3	● Inverter command, frequency setting ● Inverter status, operating frequency reading
PPO4	● Inverter command, frequency setting ● Inverter status, operating frequency reading ● 4 function parameters are written periodically ● 4 function parameters are read periodically
PPO5	● Single function parameter operation ● Inverter command, frequency setting ● Inverter status, operating frequency reading ● 10 function parameters are written periodically ● 10 function parameters are read periodically

PPO Type Description

The data block contained in the PPO type data format is 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 figure below

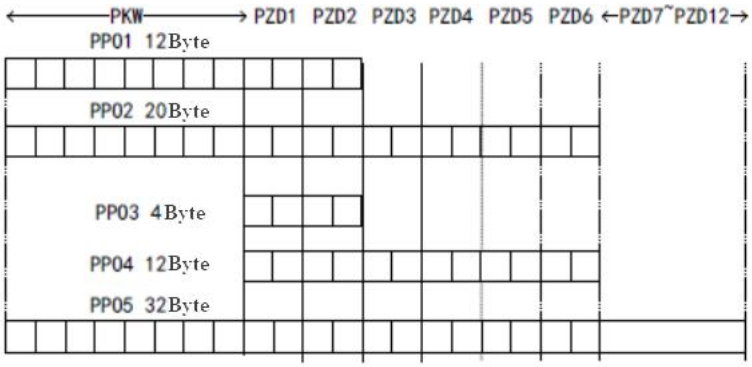


Figure 3-4 : PPO type data format

PKW Data Description

PKW data mainly realizes the master station's reading and writing operations on a single parameter of the inverter. The communication address of the inverter parameter is directly given by the communication data. The functions realized are as follows

a) Reading inverter function parameters

b) Change of inverter function parameters

Data Format

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

The data format is shown in the following table:

Table 3-3 : PKW data format

The master 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

Table 3-4 : PKW data description

Master sends data PKW description		**Inverter response data PKW description**
PKE	High 4 bits: command code 0: No request 1: Read parameter data 2: Change parameter data (The above command codes are decimal numbers according to) Lower 4 bits: reserved Lower 8 bits: parameter address high bits	High 4 bits: Response code 0: No request 1: Parameters are correct. 7: Unable to execute Lower 8 bits: parameter address high bits

IND	High 8 bits: parameter address low bits Lower 8 bits: reserved	High 8 bits: parameter address low bits Lower 8 bits: reserved
PWE	High 16 bits: reserved Lower 16 bits: not used for read requests; indicates parameter value for write requests	When the request is successful: parameter value When a request fails: Error code (same as standard MODBUS Consistent) 1: Illegal command 2: Illegal address 3: Illegal data 4: Other errors

Application examples:

The master station reads the inverter function parameter P0-08 sending data PKW area and the inverter response data PKW area as shown in the figure below

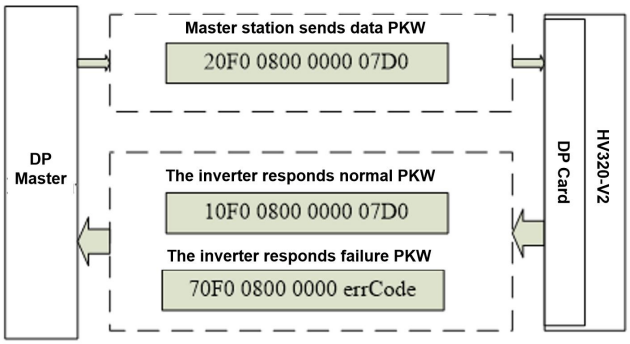


Figure 3-5 : Example of the master station reading inverter parameters and sending PKW data

PZD area data description

The data in the PZD area enables the master station to modify and read the inverter data in real time and exchange data periodically.

The frequency converter is directly configured. It mainly includes the following contents:

a) Inverter control command and target frequency are given in real time

b) Real-time reading of the inverter's current status and operating frequency

c) Real-time interaction of function parameters and monitoring parameter data between the inverter and the Profibus-DP master station

Note: "HV320DP.gsd" and later versions

The default mapping of PZD1 written is U3 -17 , and the default mapping of PZD2 is U3 -16 .

The default mapping of PZD1 is U 0-68 , and the default mapping of PZD2 is U 0-69 .

PZD process data mainly completes the periodic data interaction between the master station and the inverter. The interaction data is shown in Table **8 below** :

Table 3-5 Interaction data

Master sends data **PZD** area			Inverter response data **PZD** area		
PZD1	PZD2	PZD3~PZD12	PZD1	PZD2	PZD3~PZD12
Control Word (U3–17)	Frequency setting (U3–1 6)	Real-time change of inverter function parameters	Status word (U0–68)	Operating frequency (U0–69)	Real-time reading of inverter function parameters

Table 3-6

Master sends data **PZD** description		Inverter response data **PZD** area	
PZD1	Inverter command word (the command source needs to be set to communication, that is, P 0 - 02 = 2) 0001: Forward operation 0002: Reverse operation 0003: Forward jog 0004: Reverse jog 0005: Free stop 0006: Deceleration and stop 0007: Fault reset 0008: Fault reset (fault reset is only possible in communication control mode)	PZD1	Inverter operating status information interest 0001: Forward operation 0002: Reverse operation 0003: Shutdown
PZD2	The AC drive target frequency (frequency source is set to "communication") is in the range from the negative frequency upper limit (negative value) to the positive frequency upper limit (including the 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 the frequency upper limit. For example, if the Frequency High Limit setting is 50.00 Hz and the Comm Setting is 6000, the AC drive will run forward at 50.00 Hz. If the Frequency High Limit setting is 50.00 Hz and the Comm Setting is -6000, the AC drive will run reverse at 50.00 Hz.	PZD2	Inverter operating frequency (unit: 0.01Hz) Returns the actual operating frequency of the current inverter. The returned data value is a 16-bit signed data.
PZD3~ PZD12	Changing function parameter values in real time, do not write to EEPROM	PZD3~ PZD12	Function parameters real-time reading

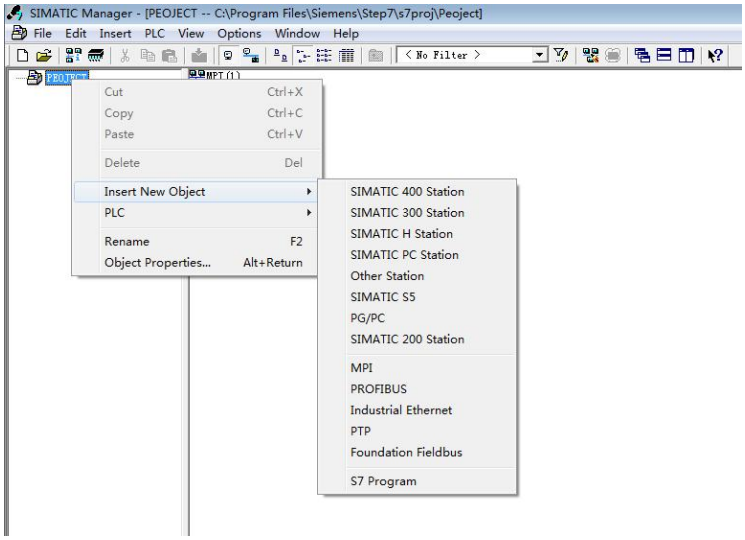
4 Communication Configuration in STEP7

1) In STEP7 V5.4, use the S7-300 master to configure the slave **.**

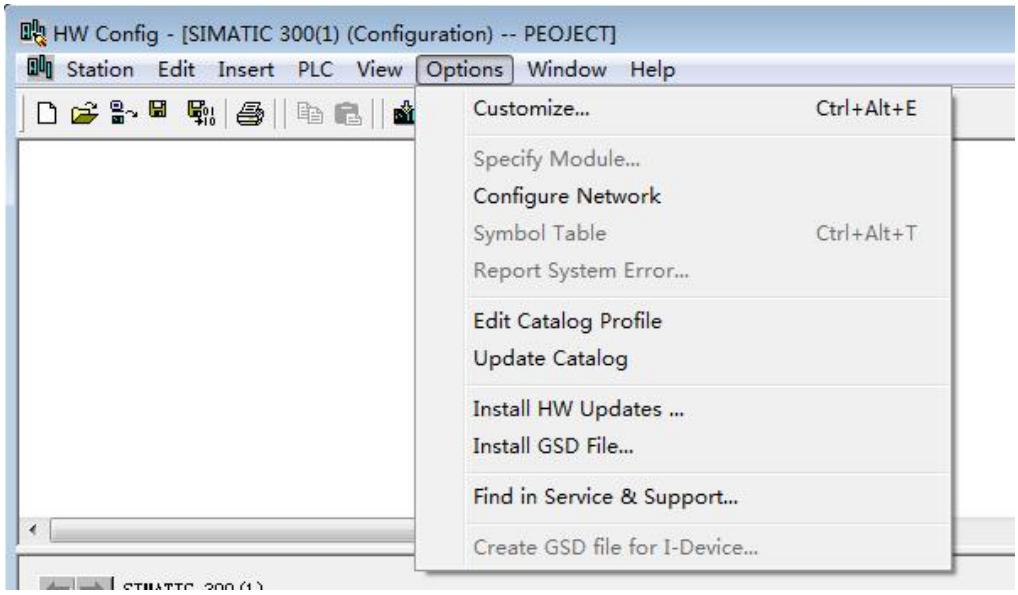
When using the Profibus master station, you must first configure the GSD file of the slave station to add the corresponding slave station device to the master station system. If it already exists, you can ignore the second step. The GSD file can be obtained from the manufacturer.

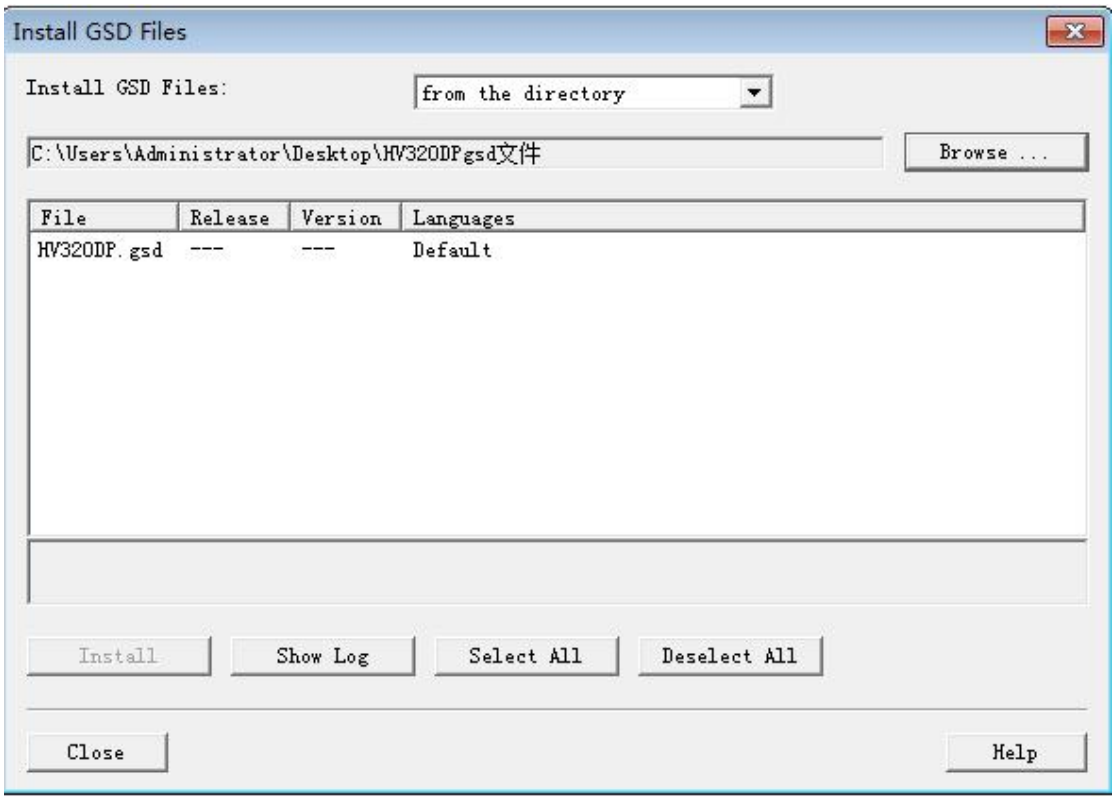
The specific operations are as follows:

1. Install GSDML file. If GSDML has not been installed, you need to install it here. Select "Manage General Station Description File (GSD)" in "Options".

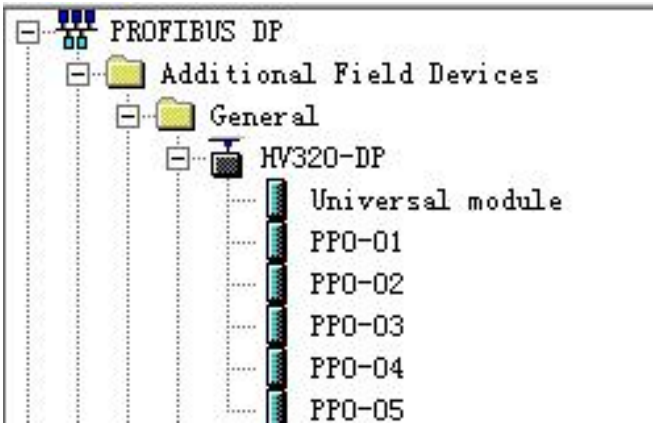


2. WSDP .GSD file in the HW config configuration screen . The operation is as follows (Note: The GSD file should not be stored in a Chinese path, otherwise Step 7 may not be recognized):

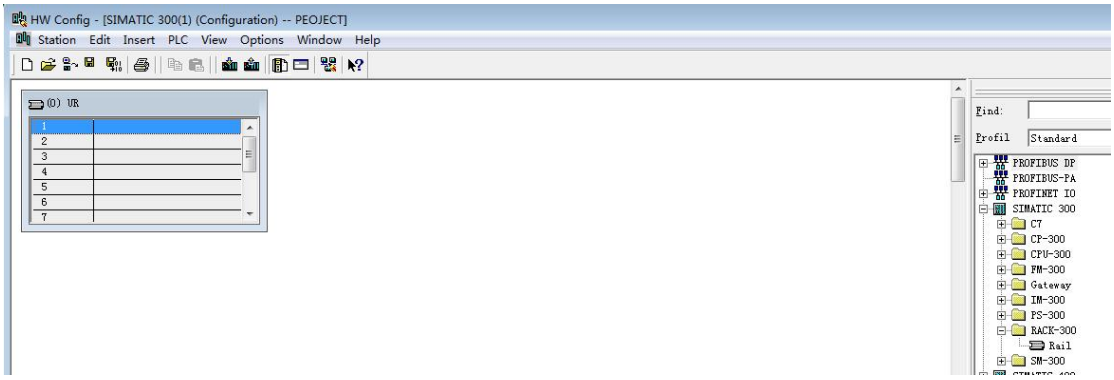




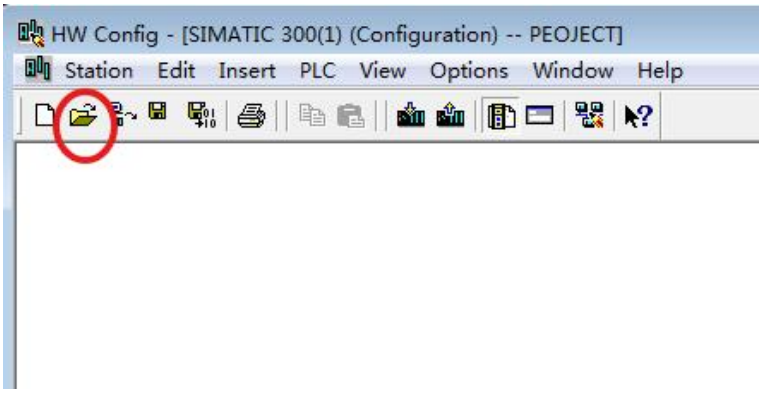
Click Install. After the installation is complete , the HV320-DP Profibus - DP module will exist, as shown in the figure below.



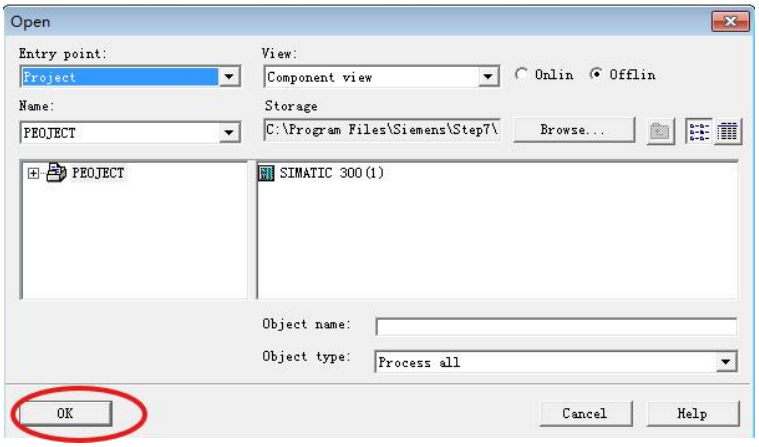
Note: If any master or slave already exists on the HW config interface, you need to close the current interface when importing GSD and click the part marked with a red circle as shown in the figure below.



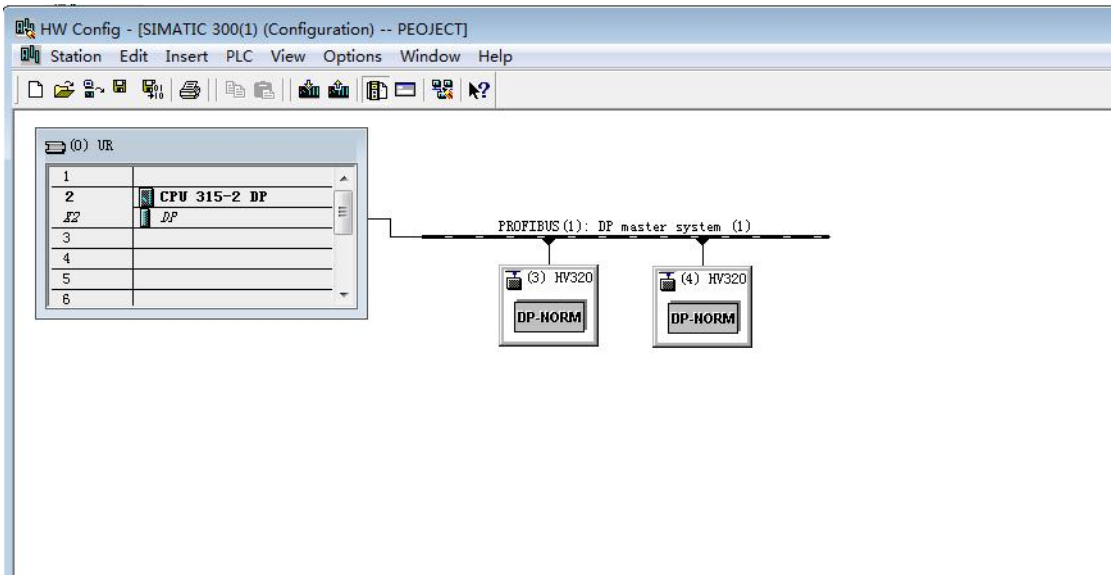
You can choose to save the original project. If a warning pops up during the process that the system data cannot be created, please select "OK". After closing the current configuration interface, you can install the GSD file according to the previous steps. After the installation is complete, please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



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

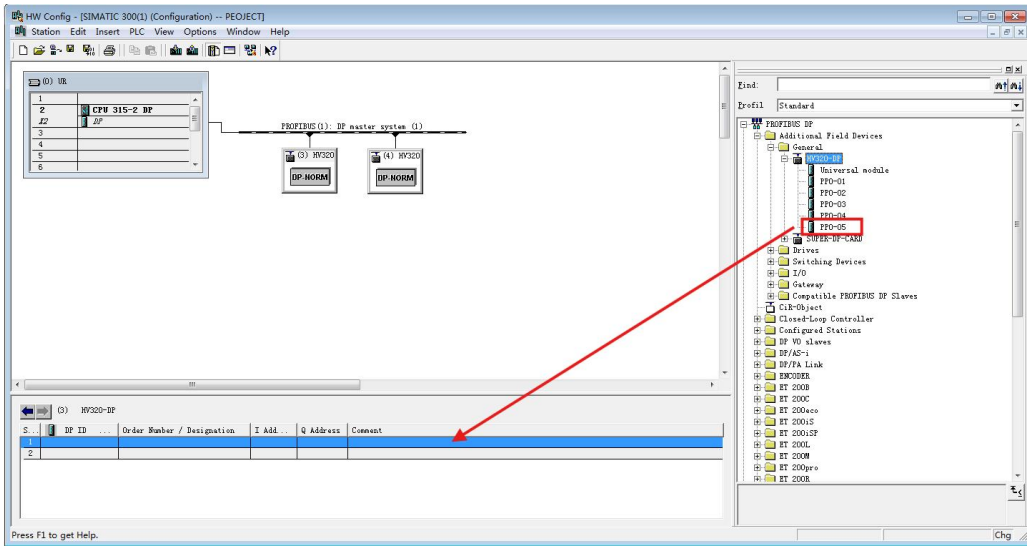


1. The actual hardware system of the configuration system is shown in the figure below.



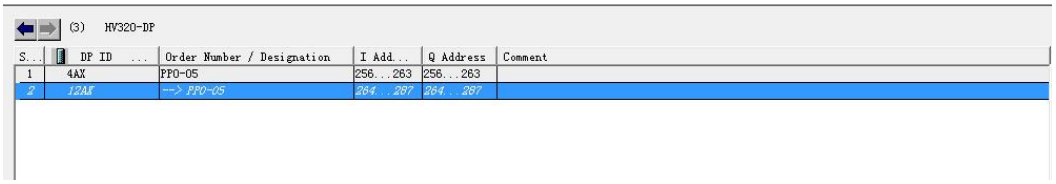
In the above figure, station 4 is HV320-DP , which is just for comparison and no detailed explanation is given. HV320-DP and this DP expansion card can coexist in the same network .

2. Configure the data characteristics of the slave



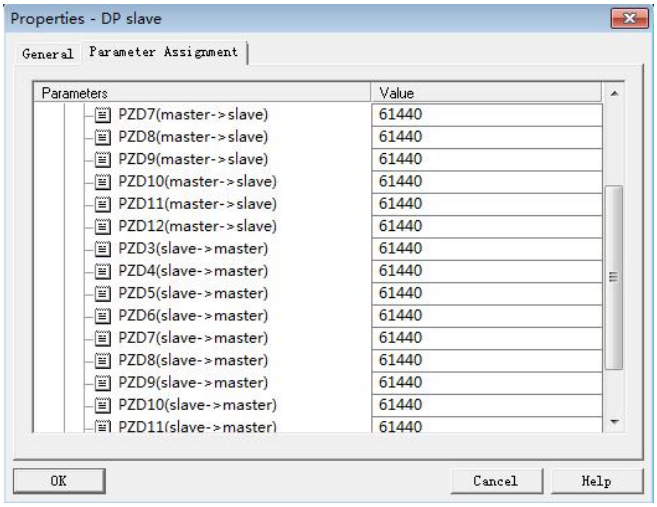
adding the PPO 5 type, you can see the address assigned by the PLC to the station, as shown in the figure below. The slot 1 marked in the figure corresponds to the PKW address, a total of 8 bytes, and slot 2 corresponds to the PZD address, a total of 12 bytes.

If the selected PPO type does not have a PKW area, the I address and Q address of slot 1 will be empty.



2) Setting PZD Mapping

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



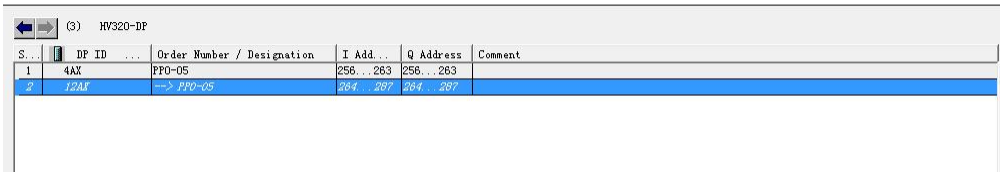
PZDx (master->slave) indicates the address that the master writes to the slave, and PZDx (slave->master) indicates the address that the master reads from the slave. The configurable PZD range is PZD3~PZD12, and the display format is decimal. That is, if you want to set PZD3 (master->slave) to P 0-12, you need to enter 61452 in the value of this row.

The default value of all PZDs of HV320-DP-V2 is P 0-00 (corresponding to 61440 in decimal). PZDs that are not used can be left unchanged and retain the default value. Each slave needs to set the PZD mapping relationship according to the requirements (if the mapping relationship of each slave is the same, you can select a slave that has been set, press CTRL+C, and then select the Profibus-DP bus in the configuration and press CTRL+V to directly change the station number).

All the above operations complete the operation of the Profibus slave. You can control the inverter by writing the corresponding program in S7-300.

3) Operate the cyclic reading and writing of the inverter slave

The following figure is used as an example to introduce the address allocation. The PLC is S7 315 - 2DP.



1. Directly use the MOVE instruction, as shown in the figure below, to start the inverter forward, with the target frequency being 15 Hz (at this time P0-02=2, P0-06=7).

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Similarly, the same operation is performed for other written data. The read data can also be transferred from the PIW register to the ordinary Q, I, L, M, D registers through the MOVE instruction, and then parsed.

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