ODOT Series Gateways

ODOT-DPM02 User Manual

Modbus-RTU to Profibus-DP Protocol Converter

Sichuan Odot Automation System Co., Ltd.

2015-12

Version information

Revision records：

Date	Version No.	Modify content	Author
2017-12-01	V2.0	Outlook、Data Zone	CCL

Ownership information

Without the consent of the copyright owner, the whole or part of this document may not be re issued in the form of paper or electronic document.

Disclaimer

This document is only to be used to assist readers to use products, the company does not use the information in this document due to loss or responsible for errors. Products described in this document and the text is constantly developing and perfecting. Sichuan ODOT Automation System Co., Ltd. has the right to amend this document without notifying the user.

Contents

1．Overview

1.1．Product function

ODOT-DPM02 Gateway is a protocol converter from Modbus-RTU to PROFIBUS-DP. It can realize the transformation between PROFIBUS-DP and Modbus-RTU. The devices (with RS485 interface and support Modbus - RTU protocol) can realize interconnect with PROFIBUS-DP fieldbus, by using this gateway. Such as: PLC, DCS, distributed I/O, frequency converter, motor start protection device, intelligent high and low voltage electrical appliances, power measuring device, the intelligent measuring equipment and instrument, etc.

1.2．The main technical parameters

1. Supported Modubs function code：01/02/03/04/05/06/15/16

2. Support Profibus-DP/V0 protocol

3. DP communication rate：9.6Kbps～12Mbps self-adaption

4. DP data area： Input max 244bytes

            Output max 244bytes

            Sum of Input and Output max 488bytes

5. DP slave station max slot：42

6. Modbus master station：Support

7. Modbus slave station：Support

8. Supported Modbus stations：31

9. Modbus baud rate：1200~115200bps optional

10. 8 data bits, None Parity, odd or even Parity, one or two stop bits

11. Power supply：9～36 VDC. electric current Max.50mA@24V

12. Working environment temperature：-40～85℃，relative humidity：5～95%（non-condensing）

13. Storage temperature：-55～125℃

14. Installation method：35mm Standard guide rail installation

15. Shape size：110*27.5*110(L*W*H,mm)

16. Protection grade：IP20

17. Product certification：CE

2. Hardware description

2.1. Product appearance

## 2.2. Indicators description

There are 4 LED status indicators in this gateway, the symbol definition and status description as shown in table 3.1

Table 3.1 LED indicators description

| Symbol	Definition	Status	Exolain
PW	Power indication	Red light ON*	Power supply on
		Red light OUT	Power supply off
DP	DP Network status indication	Red light always on	DP Bus communication error
		Red light shining	
		Red light off*	DPBus communication is normal
TX	Serial port send instruction	Green light shining*	Serial port sending datas
		Green light does not shining	Serial port does not send datas
RX	Serial port receive instruction	Green light shining*	Serial port receiving datas
		Green light does not shining	Serial port does not receive datas

Notice： *—The normal communication state of the ODOT-DPM02 gateway indicator.

2.3．Dail switch
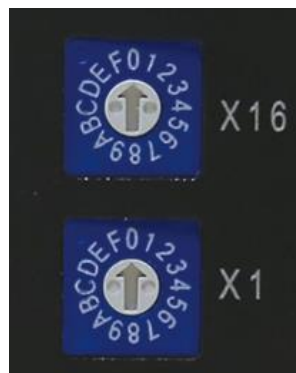
As shown in the Profibus-DP address set, the High position switch (X16) dail to 0, the low position switch (X1) dial to 3, indicating that the address of this module in the DP network is 0*16+3=3, Profibus-DP valid address range is 1-125.

2.4．PROFIBUS DP interface
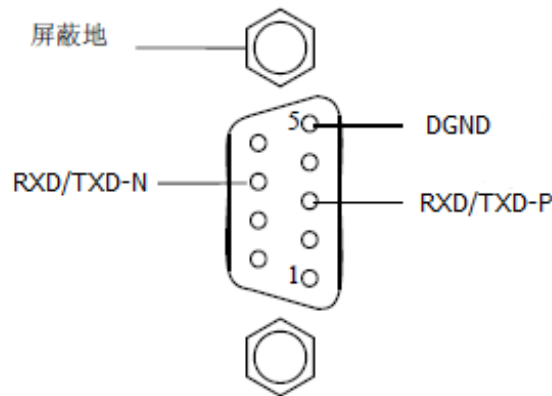
Profibus DPinterface use DB9 pore joint，The pin is defined as follows：

针脚号	RS-485	信号名称		含义
1		屏蔽	2)	屏蔽，保护地
2		M24V	2)	负 24V 输出电压
3	B/B'	RXD/TXD-P		接收/发送 数据－P
4		CNTR-P	2)	控制-P
5	C/C'	DGND		数据地
6		VP	1)	正电压
7		P 24V	2)	正 24V 输出电压
8	A/A'	RXD/TXD-N		接收／发送 数据-N
9		CNTR-N	2)	控制-N
1) 此信号仅在总线电缆端点的站需要				
2) 这些信号是可选的				

2.5．Terminal definition

Equipment wiring use 10 pin 3.81mm spacing plug-in terminals, RS485 interface terminal is defined as "Table 2" below.

Table3.2 terminal definition

SN	Terminal	Definition

| 1	R-	RS422 Receive negative
2	R+	RS422Receive positive
3	B-/T-	RS485negative/RS422send negative
4	A+/T+	RS485positive/RS422send positive
5	SGND	Series port ground
6	RX	RS232receive
7	TX	RS232send
8	PE	Grounding terminal
9	V-	24V Input negative
10	V+	24V Input positive

2.6．Installation size

3. Application topology of product

RS485 interface set to Modbus RTU Master model, Typical network topology diagram（as follows）
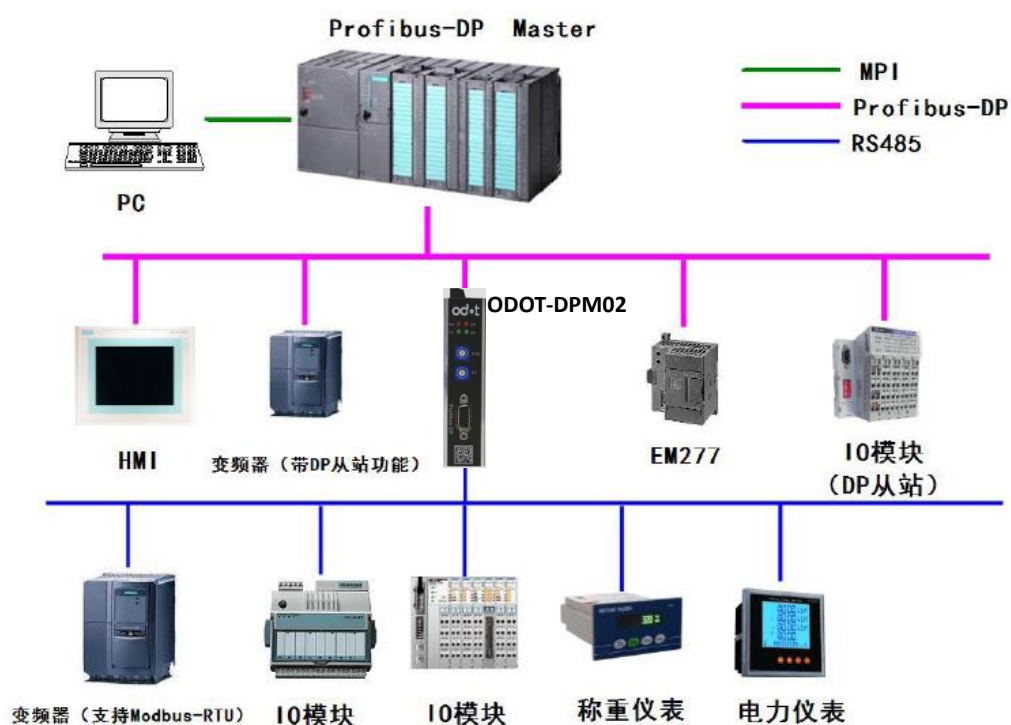
RS485 interface set to Modbus RTU Slave model, Typical network topology diagram (as follows)
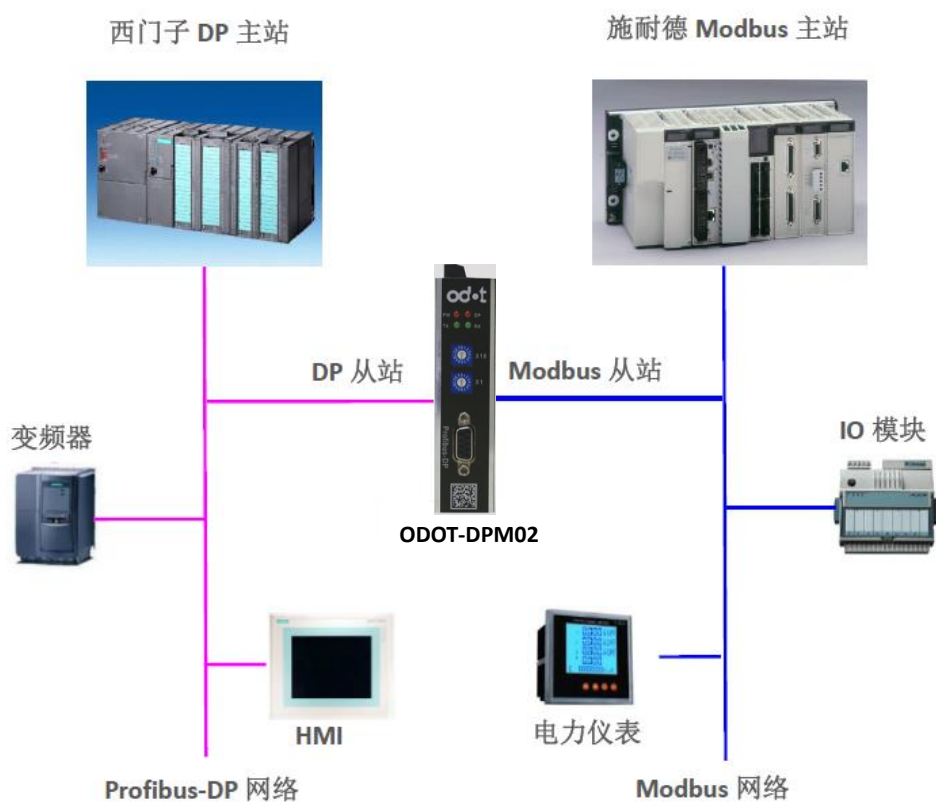
4. **Usage of this module in Siemens Step7**

## 4.1．**RS485 interface set to Modbus RTU Master model configuration**

1．Find the GSD files in the product disc, confirm that the folder contains the following files. If not, ask the supplier for it. And then copied the files to C:\Program Files\Siemens\Step7\S7DATA\GSD.

DPM02_V2.gsd   ODOT.bmp   ODOT_SF.bmp
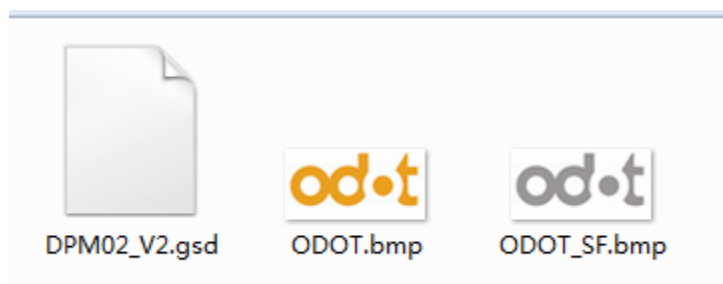
2．Open Step7 software, create a new project and name it as "TEST", no Chinese characters in the storage path.
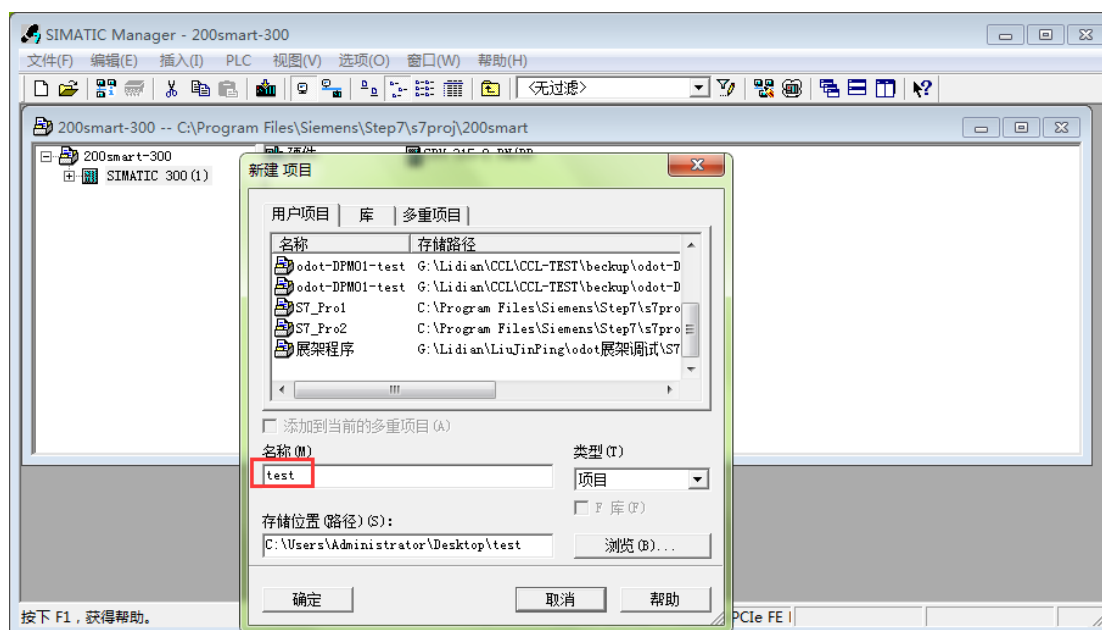
3．Right click on the project name, insert new object, select "SIMATIC 300", click the "SIMATIC 300", and then double-click the right of the "hardware", enter the hardware configuration interface.
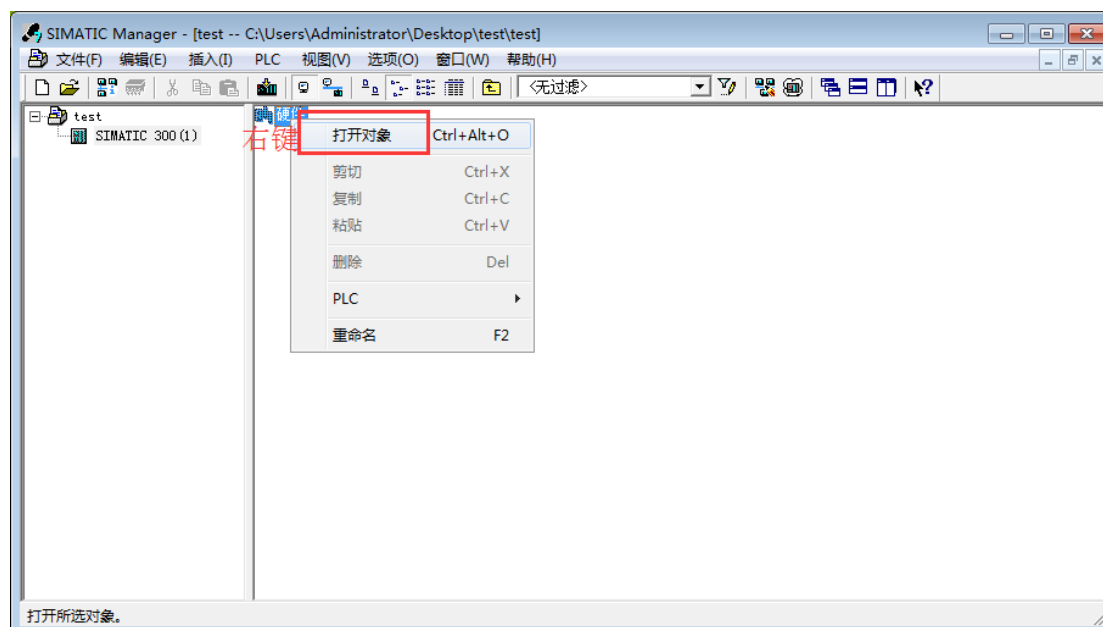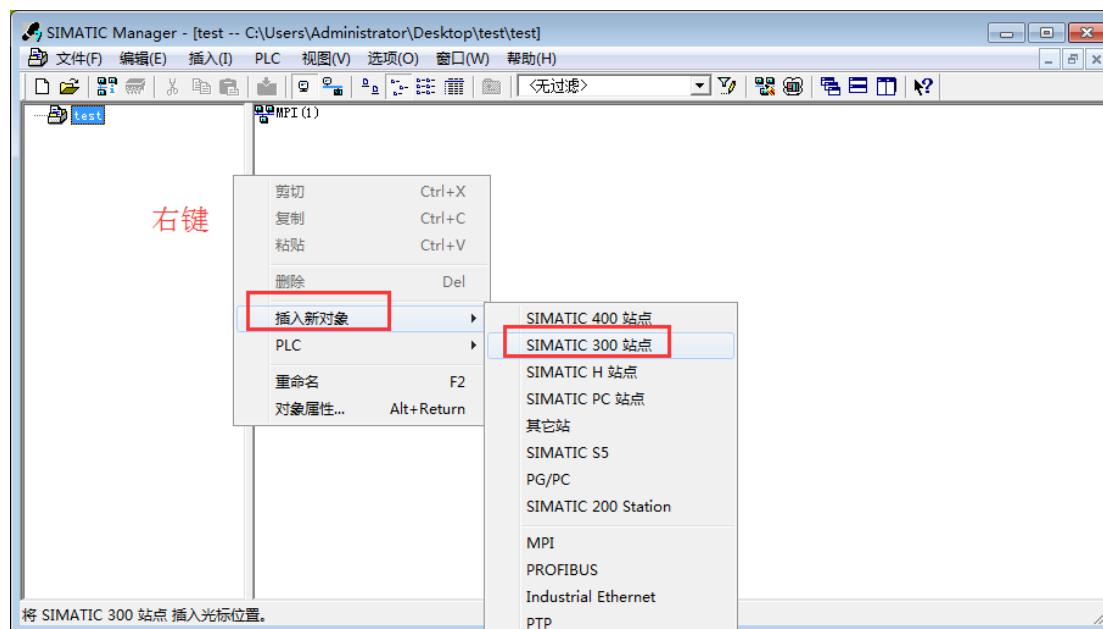
4．Before you can configure the hardware first click "Options", then click the "Install GSD files" in the pop-up box, click "Browse" and navigate to the directory where DPM02_V2.GSD, in this sample is:

C:\Users\Administrator\Desktop\ODOT-DPM02-GSD， In the "Install GSD Files" screen, click "Install" and then "Yes"
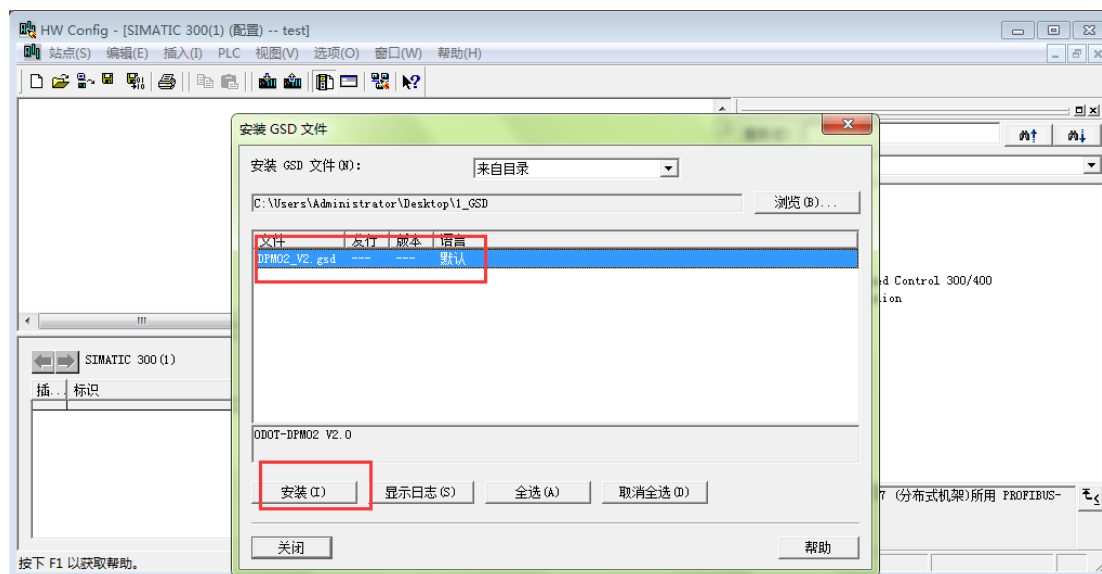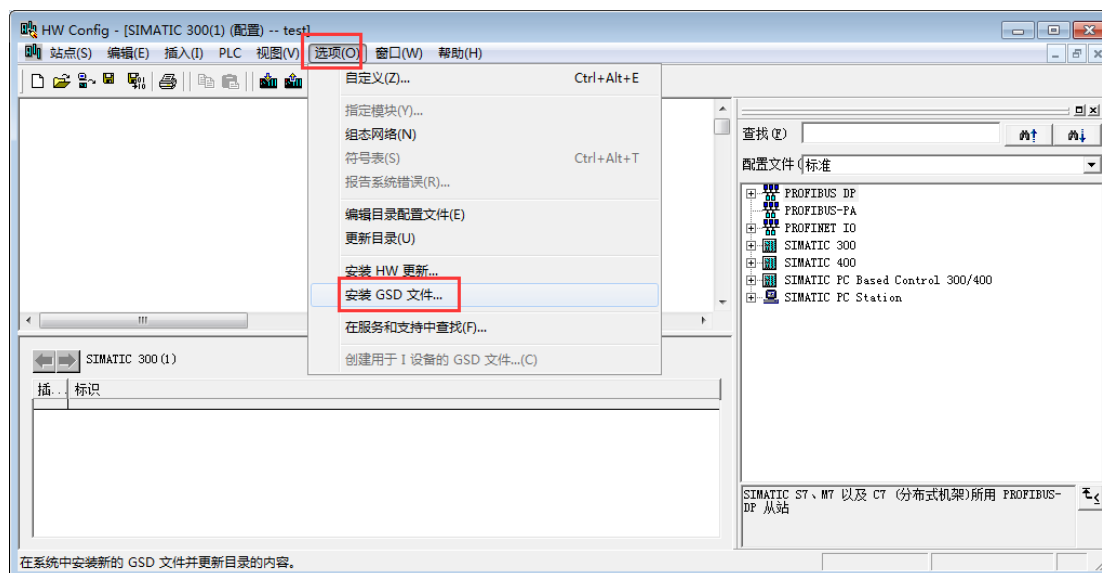
5．Click the toolbar "Options" and pull-down menu in the "update directory".
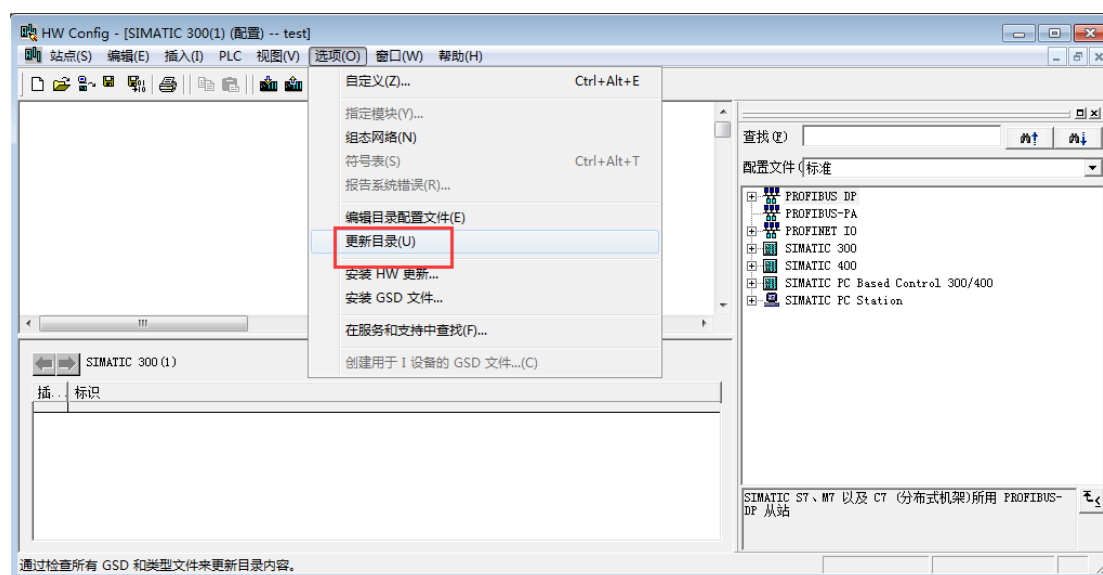
6．In the"PROFIBUS-DP"-"Additional Field Devices"-"Gateway" you can find the gateway device "ODOT-DPM02 V2.0".
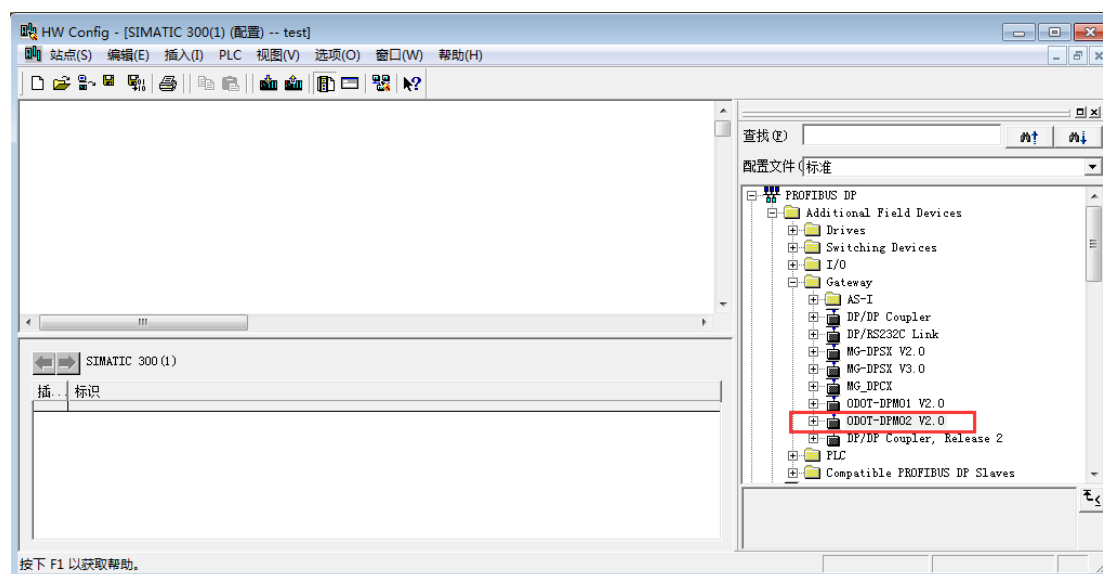
7．Start the configuration of thehardware, place the rail first, then put the power supply module and CPUModule in slot 1 and 2, right-click on the "X2 DP", add master station system.
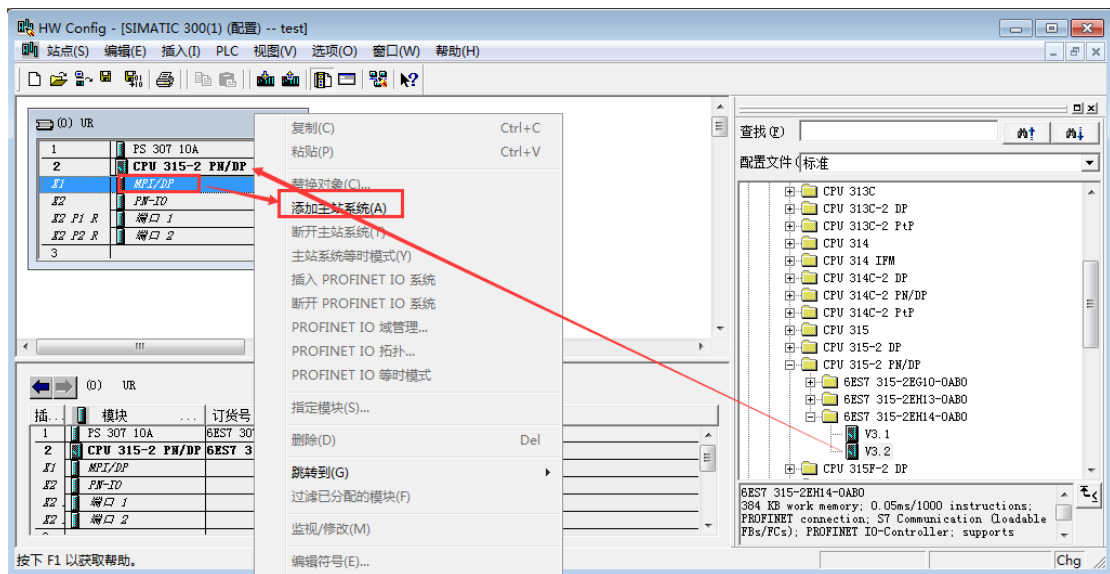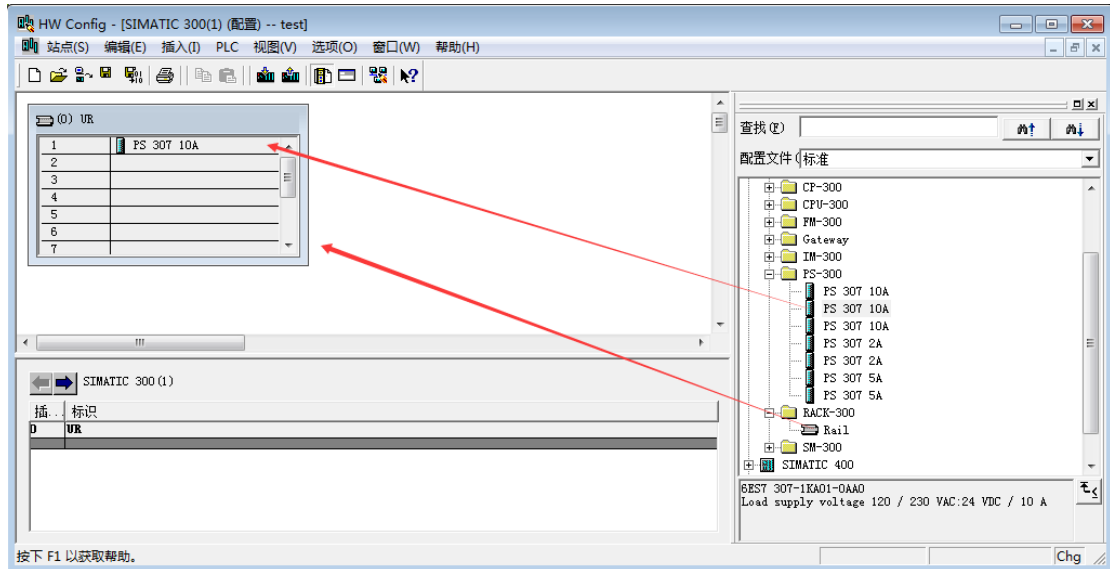
8．Drag ODOT-DPM02 V2.0 module to DP bus directly, then will appear the configuration page as follows:
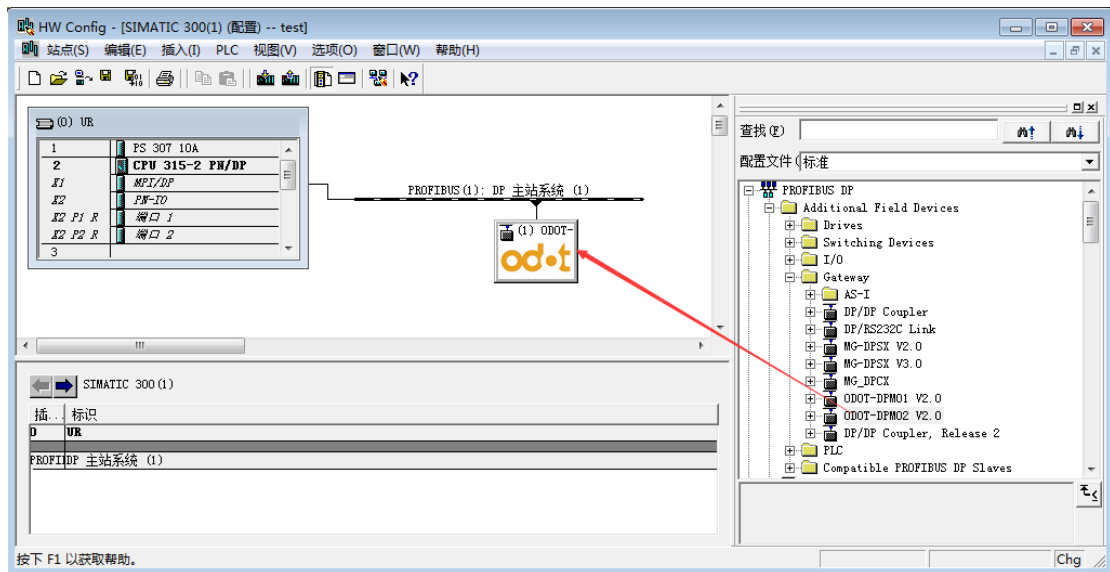
9．Double-click the Gateway icon, Set the gateway address in the DP bus, this address should be the same as the gateway dial switch set address of the ODOT-DPM02 V2.0, and then click "OK", complete adding the gateway.
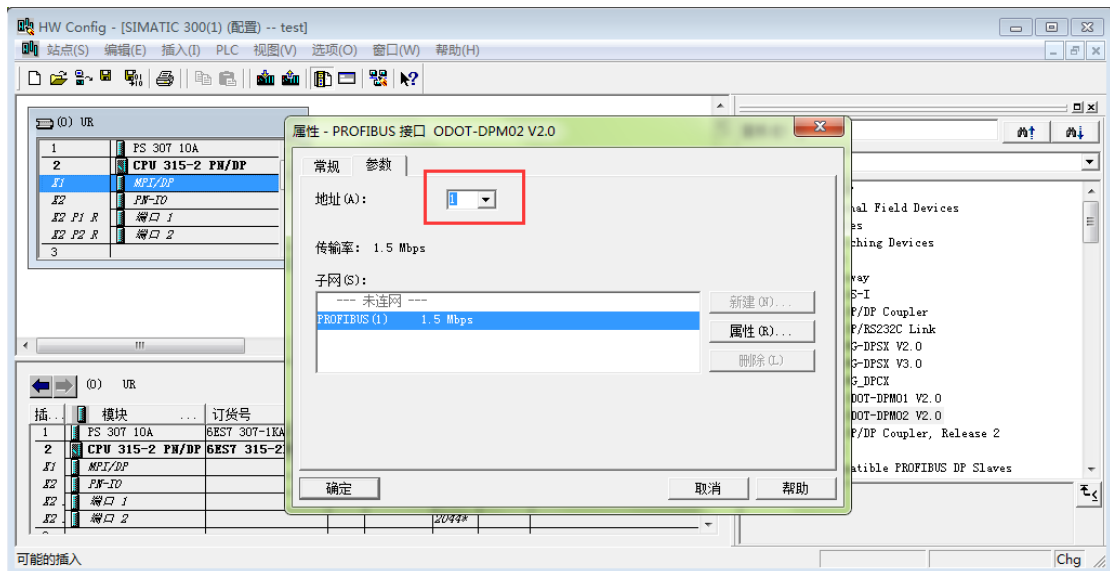
10．Double-click the Gateway icon, then appear the following configuration.

Then click the "Parameters Assignment ", to set the Modbus parameters of the gateway(must match with the user's RS485 device connected), after completing setup, click "OK" button, as follows:
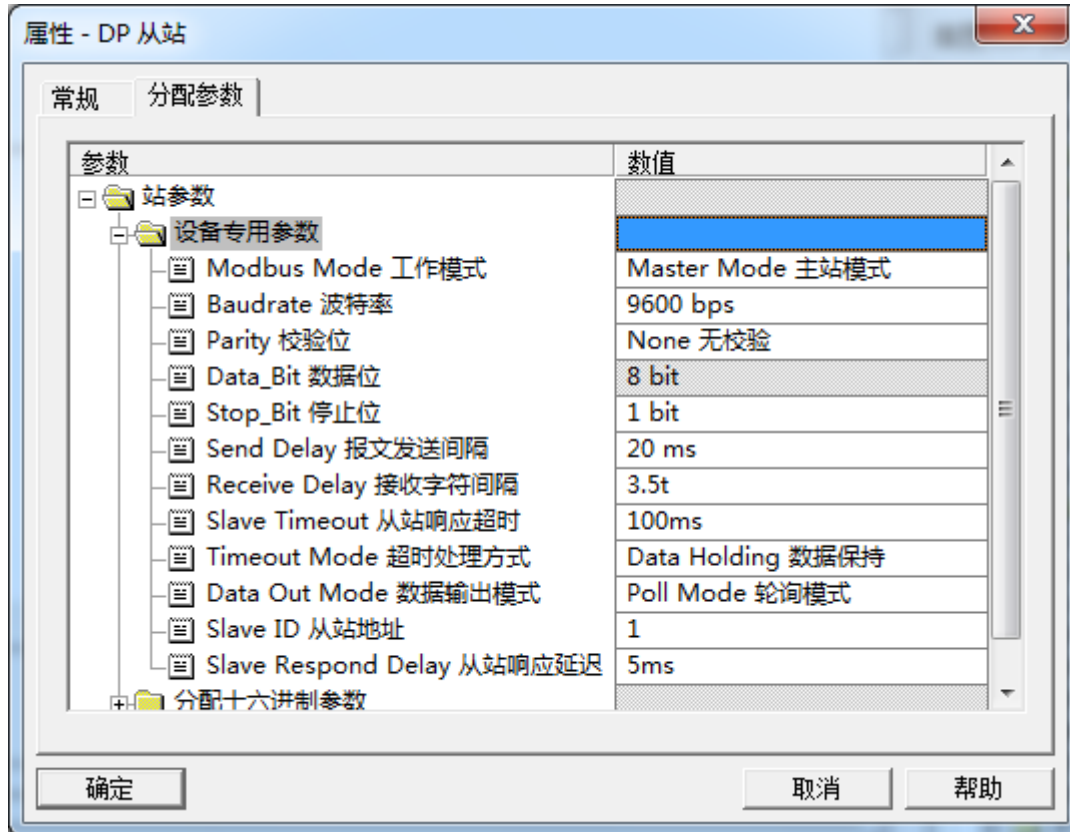
11. To set device-specific parameters.

Modbus Mode：

Master Mode

Baud rate：

Serial baud rate，Valid range:1200~115200bps，Default:9600bps.

Parity：

Selectable no-parity、Odd parity、Even parity，Default setting is No-parity.

Data_Bit：

Fixed to 8 bit data。

Stop_Bit：

1bit、2bit，Default setting is 1bit.

Send interval：

Modbus Send Interval(The interval from receiving respond from the slave

station to send the next command), valid range:0ms-5000ms, Default setting is 20ms.

Receive Interval：

Frame interval detection time for receiving messages，range 1.5t~200t, default setting is 3.5t（t : transmission time of the　single character, related with the baud rate）

Slave Timeout：

When master station has sent the command，until the slave station respond.10ms~5000ms optional，Default setting:100ms.

Timeout Processing：

When slave station has read the data with timeout，you can choose to "clear data" or "keep data". Default setting is "keep data" mode. This setting only works for Modbus-Read.

Data Out Mode：

You can choose "polling" mode or "event-triggered" mode. Modbus can send a command periodically under "polling mode". "Event-triggered" mode is sending a command only when output data has changed. Default setting is "polling" mode. This parameter only works for Modbus.

~~Slave ID：~~

Master model of this parameter is invalid.

~~Slave Respond Delay：~~

Master model of this parameter is invalid.

12. Modbus Master station mode data command configuration:

Modules start with M is master station module，can be used only under Modbus Master station mode.

Click the gateway icon and insert the required function block in the list below. Two diagnostic modules are inserted in the first two slots. According to the instructions of the IO module used in this example, using 04 functions to read the 8 continuous current input data of this IO module, we choose the function block in the next diagram box "Read 8 Word (3xxxx)".
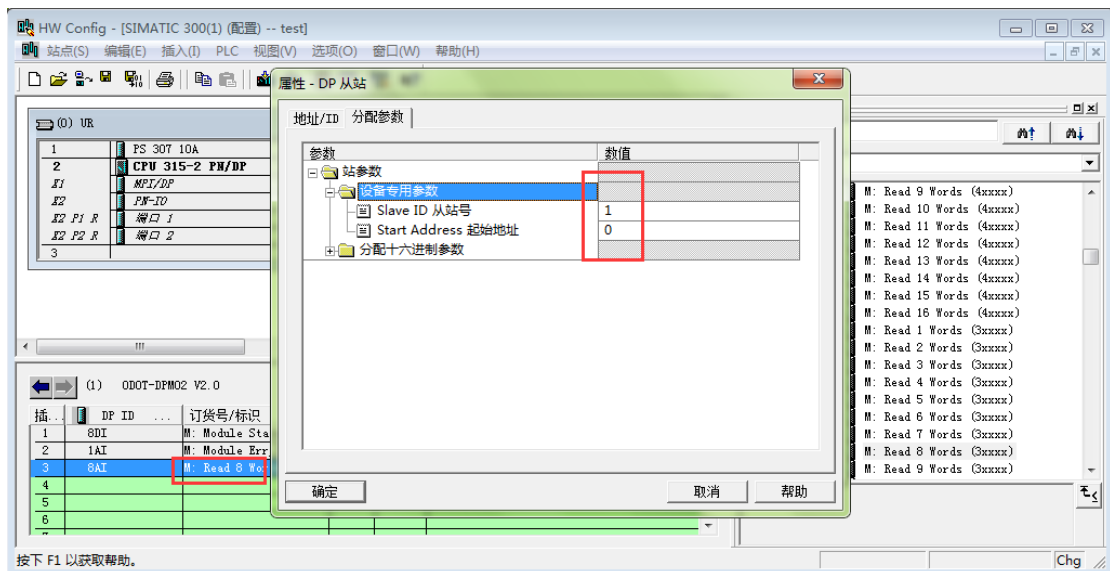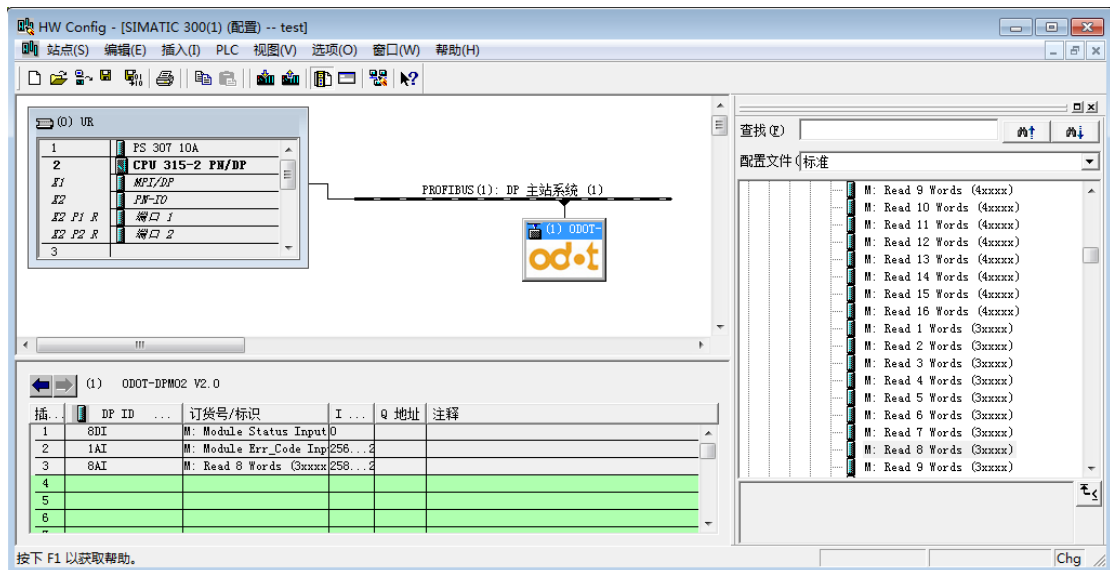
Double click the added function block "Read 8 Words (3xxxxx)" to configure its parameters. The "Slave ID slave station number" must be consistent with the Modbus address set by the corresponding slave station. The "start address" refers to the Modbus buffer start address that needs to be read. For example, the Modbus slave station used in this case is 1 input modules, and its Modbus address table is shown as below.

地址	缓存器名称	低限值	高限值	存取	说明
30001	韧体版本 模块型式	无	无	可读	高字节＝韧体版本 低字节 = 103
30002	电流输入 1	0	4095	可读	电流输入 12 Bits
30003	电流输入 2	0	4095	可读	"
30004	电流输入 3	0	4095	可读	"
30005	电流输入 4	0	4095	可读	"

This example reads the current input value of the 8 channels of the IO module, so the "0" of the "start address" is changed to "1". (Note: when the slave address code starts from 1, its address is encoded as an PLC address, and the "start address" subtracts the actual PLC address from the address table by 1. When the slave address code starts from 0, the "start address" is the actual coding address in the address table. For the PLC address in this case, the starting address is 2-1=1)

According to the actual situation, other data modules can be inserted in the rear slot.

13．Click "Save and Compile", if without error, use USB-MPI cable to connect the PC and CPU 315-2 DP.In the pop-up interface, click "OK" - "yes".
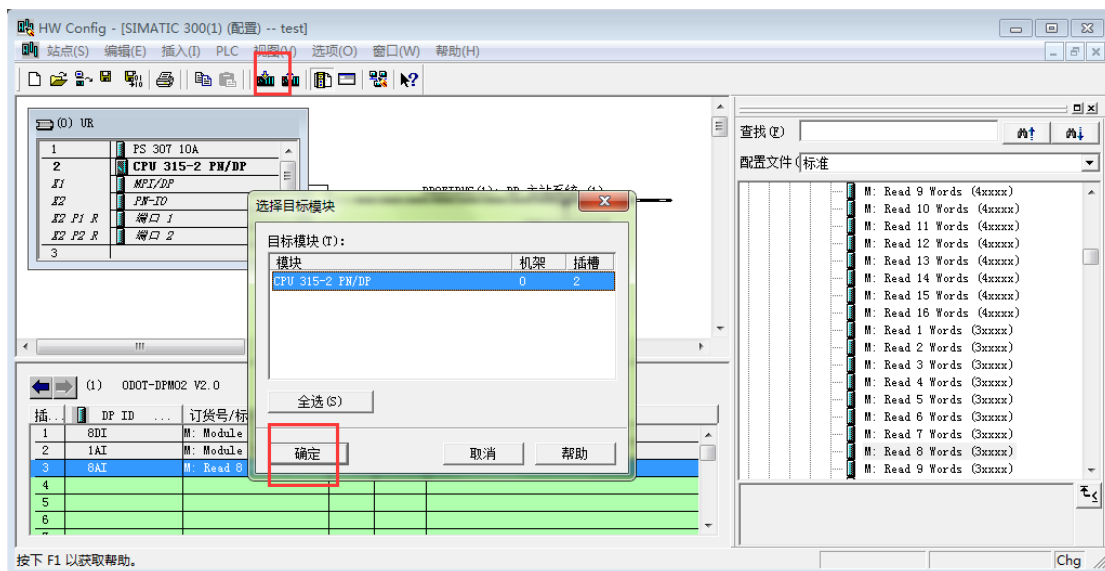
14．On 2 # Slot "8AI" module, right-click, and then click on the "Monitor / Modify" and in the pop-up panel, check the "monitoring," then you can read the value of each channel. The red box in the following figure is the readed value

in this case.
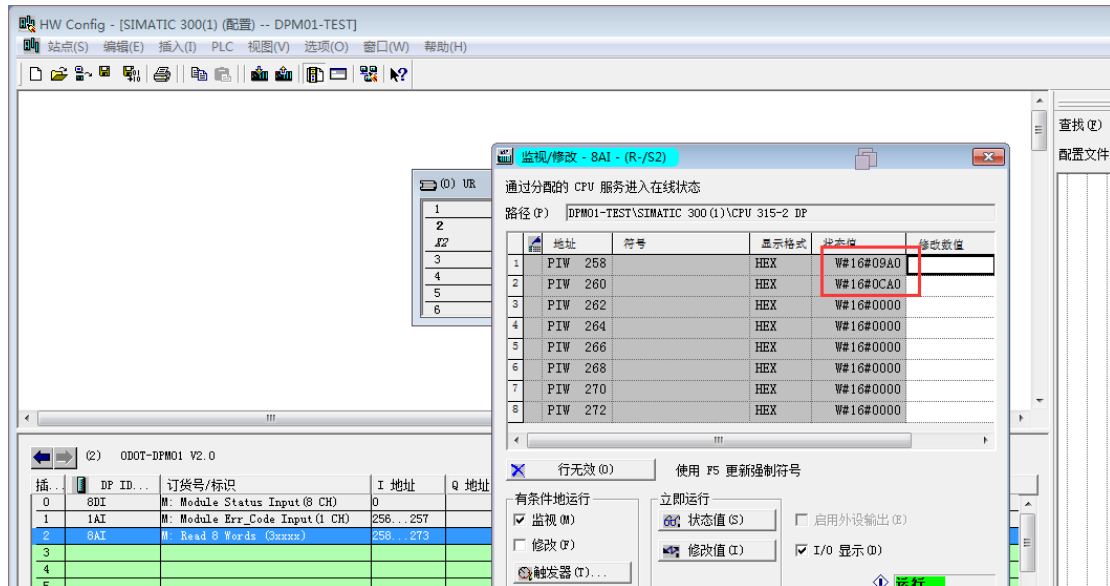
The image above is the usage of the AI module, the corresponding DI, DO, AO modules and other standard Modbus devices is similar to it.(Notice: I、Q address can be revised by yourself)

15．The master station's diagnosis module
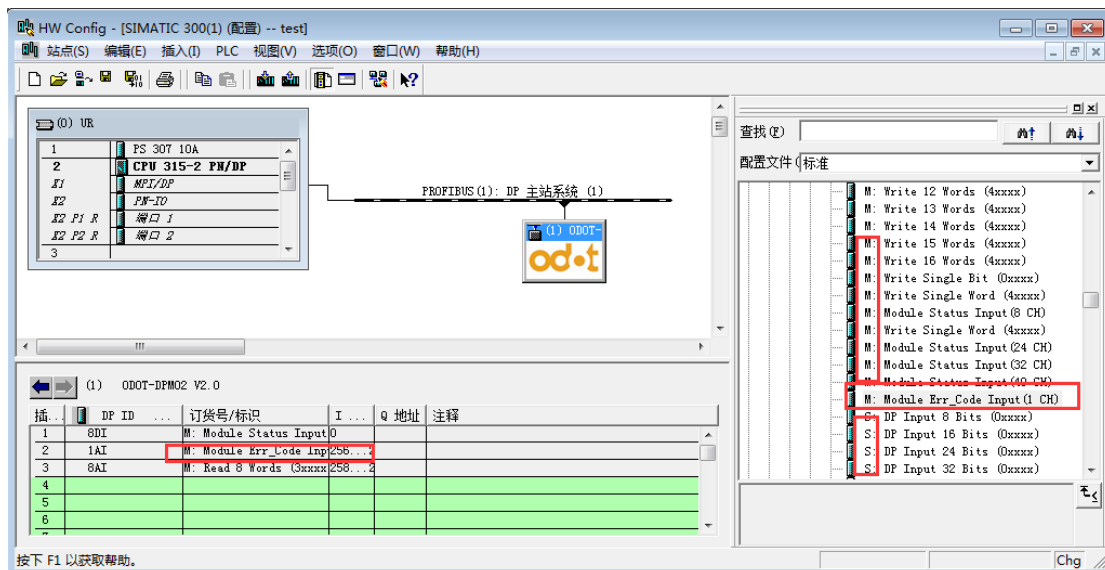
The master station's diagnosis module is optional module, the master station's

diagnosis module can only be used under the Modbus Master Mode. The master station's diagnosis Module is divided into two kinds: "Module Status Input" and "Module Err_Code Input. "state Module can only be inserted into slot 1, error code module can be inserted into slot 0 and slot 1, when the error code module was inserted into slot 1, slot 0 can only be inserted by the state module.
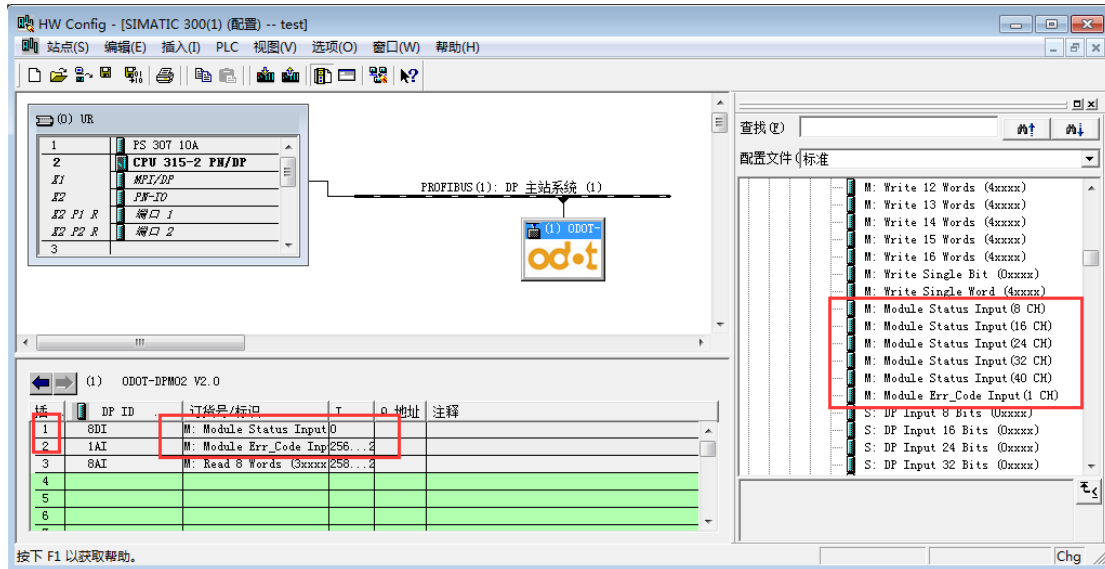
State module can monitor the working state of each data slot, when a certain data slot facing a failure, the state of the corresponding bit will be setted as 1, and will be automatically reset after recovery.

When data slot fault occurs, the error code module can display the exact error data slot number and a specific error code, user can judge the reason according to the error code, and then adopt corresponding adjustment. Detailed description please refer to "error code table".

Error code modules can only display one slot fault condition, when multiple slot failure occured at the same time, the error code module will display the lowest error slot's serial number.

Right-click on 0 and 1 slot, select "monitoring/modify", in the pop-up panels choose the "monitor", then it will display module status and error code.
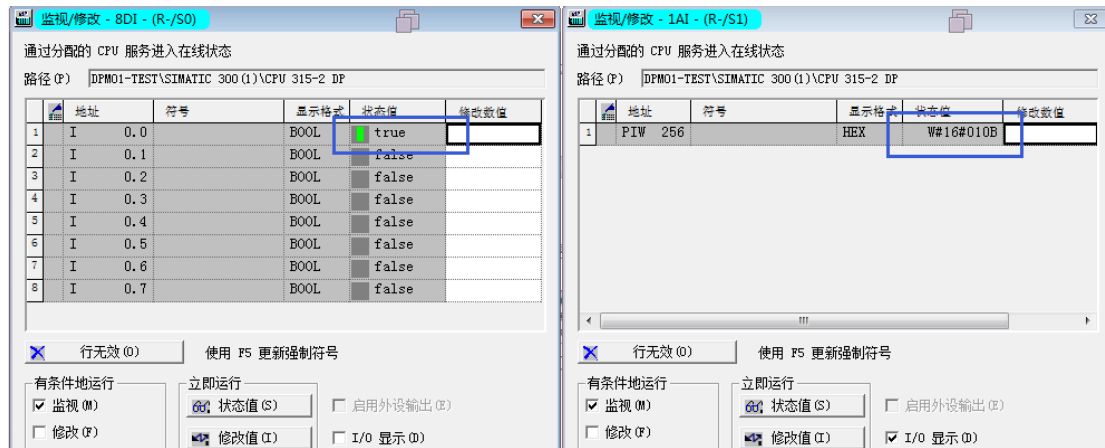
As shown above, when the data communication module facing a fault, the module state corresponding bit will be setted as 1. The error code of 0 x010B, 0 x01 indicates a problem with the first data slot, the 0 x0b fault indicate that the fault is "slave station response time out", error code in is showed as the following table.

<p align="center">Modbus Master station Error code table</p>

Error code	Fault description	Troubleshooting method
0x00	Slave station works normally	No
0x01	Illegal function code	Slave does not support the current function code, please read the slave manual to choose the function code module.
0x02	Illegal data address	Slave data beyond the address range, read to slave manual to revise the starting address or data length.
0x03	Illegal data value	Data length error, data length beyond the maximum allowed 125 (Word) or 2000 (Bit), modify the length

0x04	Slave device in fault	Check the slave device state
0x06	Slave device in busy	Check the slave device state
0x07	Parity fault	Check the parity, baud rate, stop bit, check the hardware connection status
0x09	CRC check fault	the slave response massage CRC calculation error, check the slave device
0x0B	Slave device response timeout	Increase the timeout, check the hardware connection status, check the communication parameters, such as baud rate
0x0E	The response message length error	Increase the space between the receiving character
0x0F	Write to slave device response errors	Check the hardware connection status

4.2．RS485 interface set to Modbus RTU Slave model configuration

1. Modbus slave model data address table

Data area	Valid address range
0 area（0XXXX）	0～1951
1 area（1XXXX）	0～1951
3 area（3XXXX）	0～121
4 area（4XXXX）	0～121

2→10 refer to 4.1(master model) 1→9.

11. Double click the gateway icon to show the following configuration
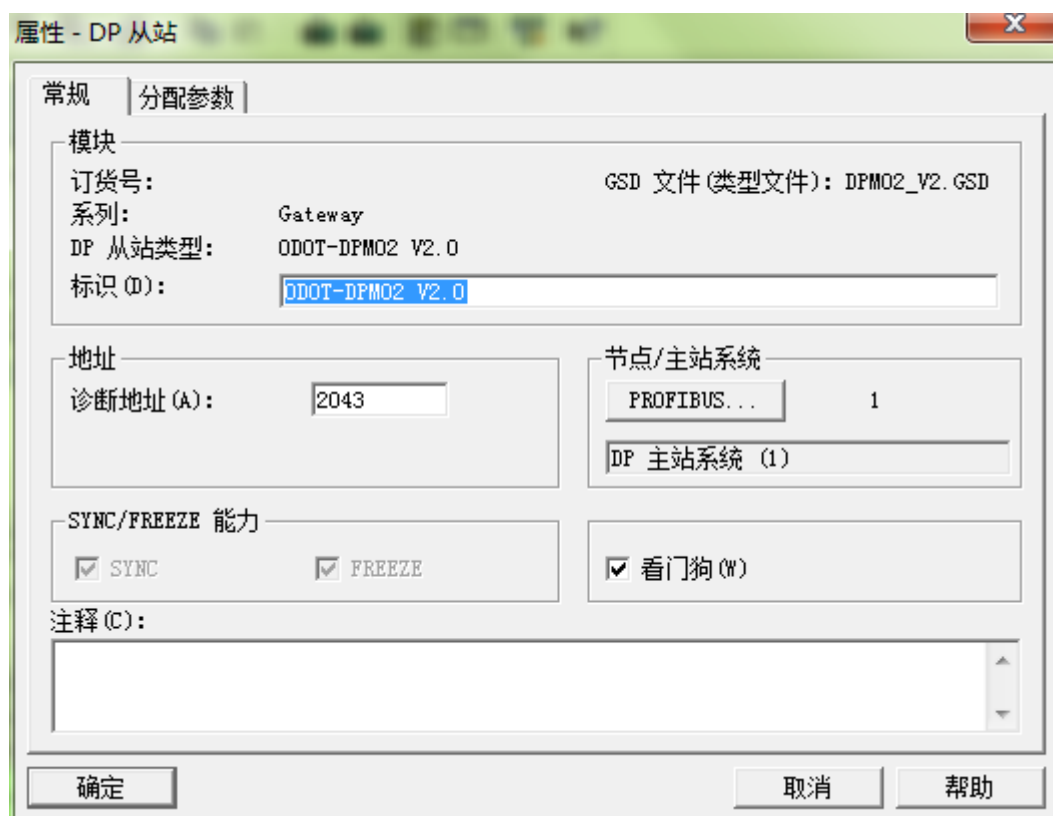
Then click "allocation parameter", set the Modbus parameter of the gateway (it must match the RS485 device connected by the user), and click the "confirm" button after the setting is completed, as following:
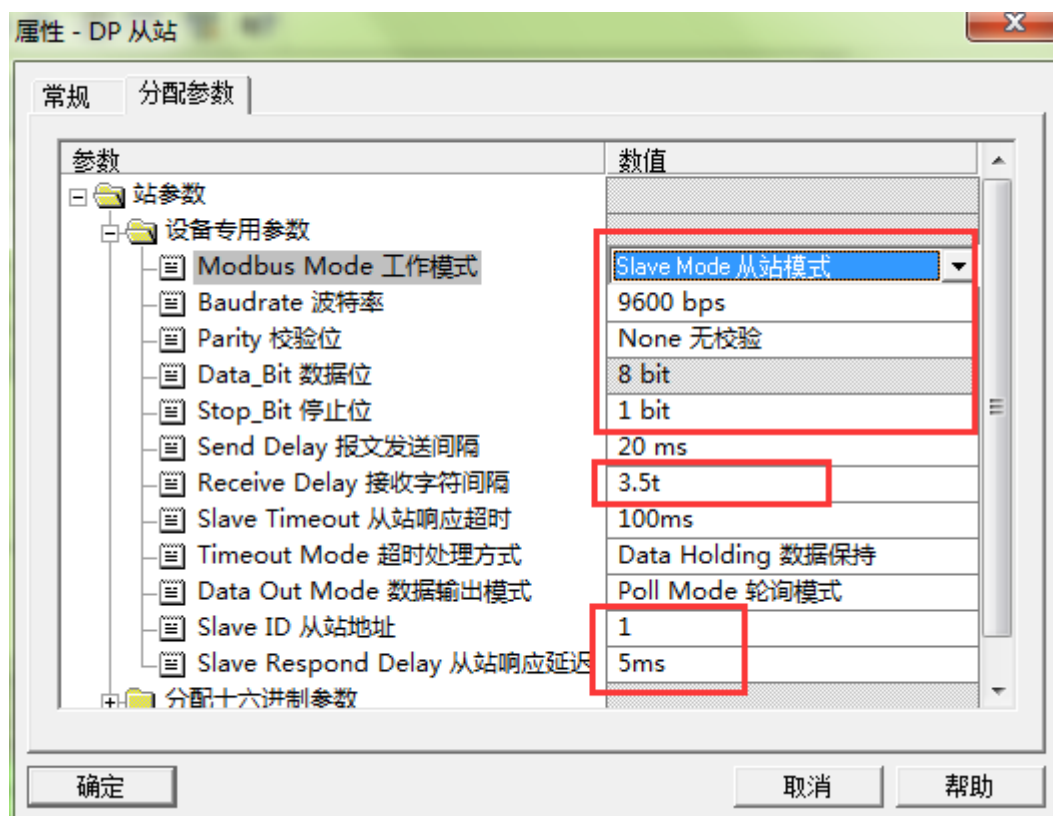
Modbus Mode：

Slave Mode

Baudrate：

Serial baud rate，Valid range:1200~115200bps，Default:9600bps.

Parity：

Selectable no-parity、Odd parity、Even parity，Default setting is No-parity

Data_Bit：

Fixed to 8 bit data

Stop_Bit：

1bit、2bit，Default setting is 1bit.

~~Send Interval：~~

This parameter slave model invalid

Receive Interval：

Frame interval detection time for receiving messages，range 1.5t~200t, default setting is 3.5t（t : transmission time of the single character, related with the baud rate）

~~Slave Response Timeout：~~

This parameter slave model invalid

~~Timeout Processing Method：~~

This parameter slave model invalid

~~Data Out Mode：~~

This parameter slave model invalid

Slave ID：

Slave ID number, valid range 1-247, default setting is 1

Slave Respond Delay：

Slave response delay time is the time from the slave station receives the requested message from the master station, then processes the data, to the message is returned. 0ms~2000ms optional, default is 5ms.

12. Modbus slave mode data command configuration

Start with S:is a slave module，can be used only under Modbus slave model.

Insert slave model module at number 0 slot, insert an input module "DP Input 8 Words (4xxxx)" in No. 1 slot, and fill in the starting address of the Modbus 4xxxx zone.
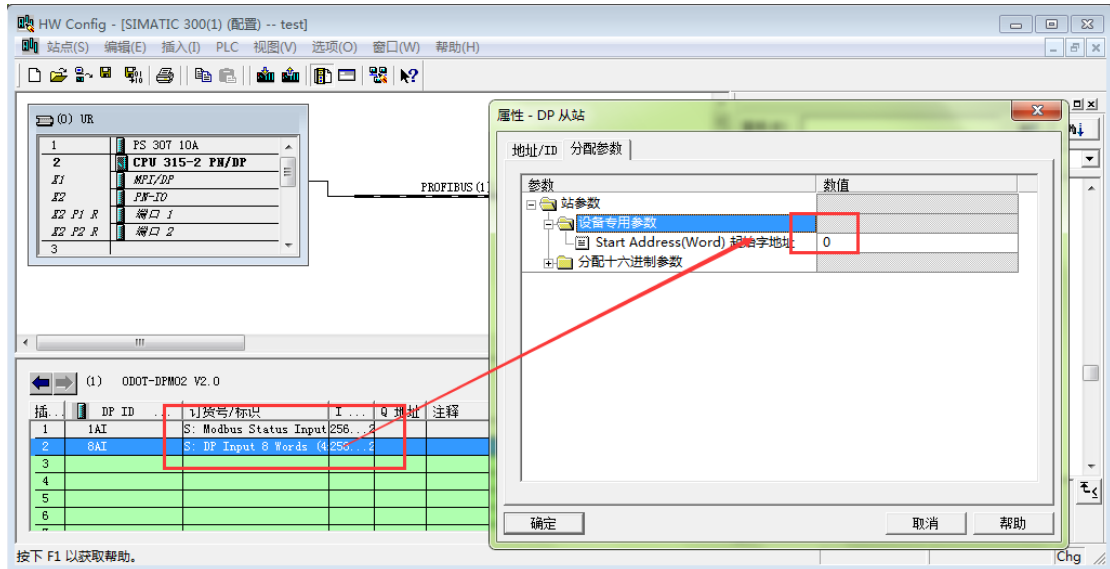
Insert an input module "DP Input 8 Words (3xxxx)" in No. 2 slot, and fill in the starting address of the Modbus 3xxxx zone.
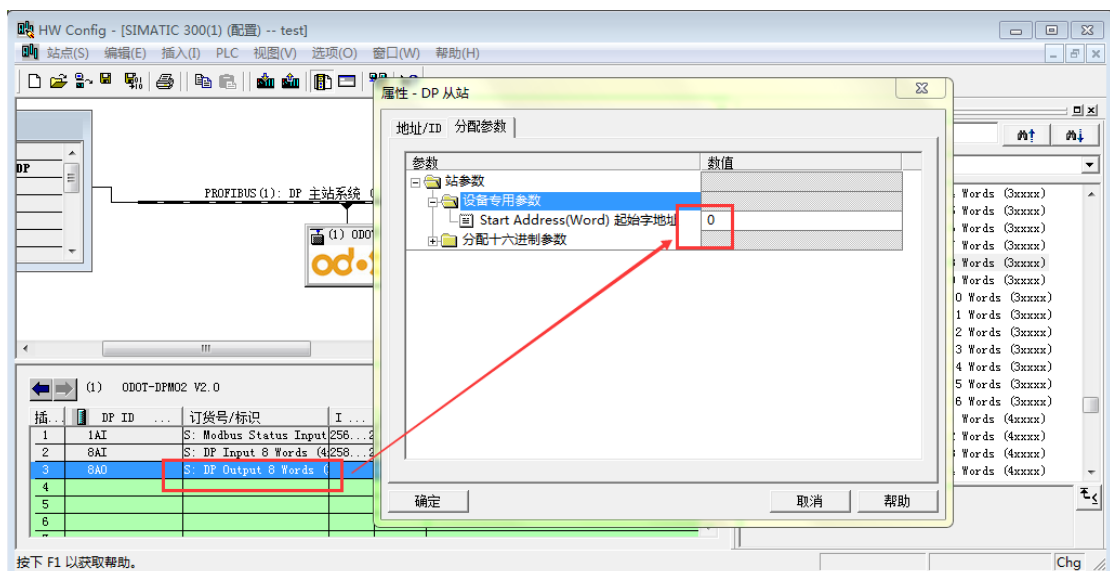
After saving and compiling, download the configuration program to PLC
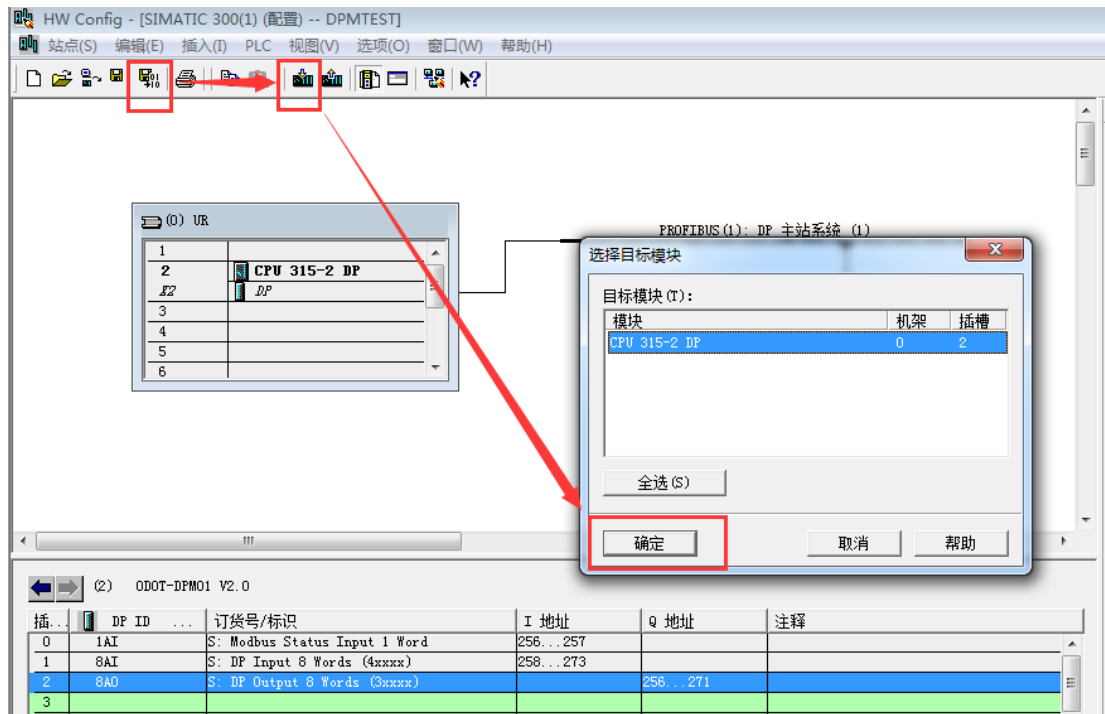
Right click on 1 and 2 slot, click "monitor / modify", and then select monitor to see DP input data. The data values in the blue blank are consistent with the data written by the Modbus Poll master station, as shown in the following diagram.
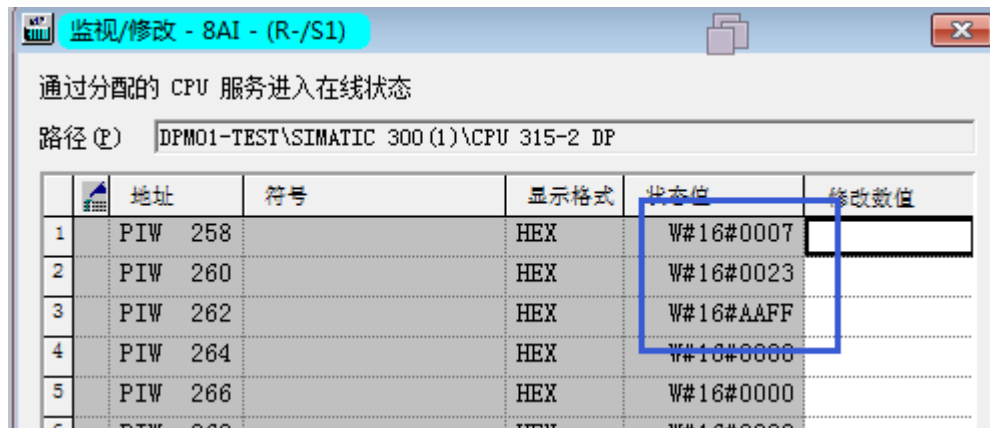
DP input data：
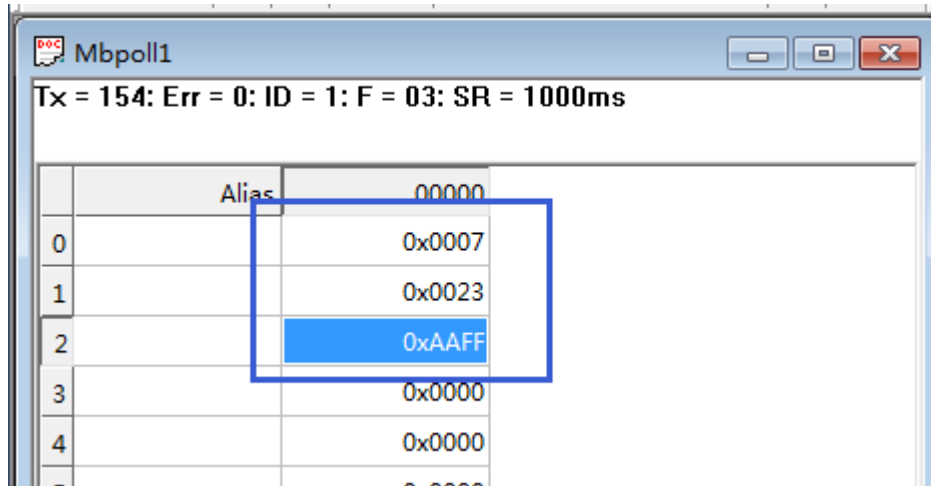
Modbus Poll master station input data：

18. Modify output value in DP output data, then click Modify button, as shown below.
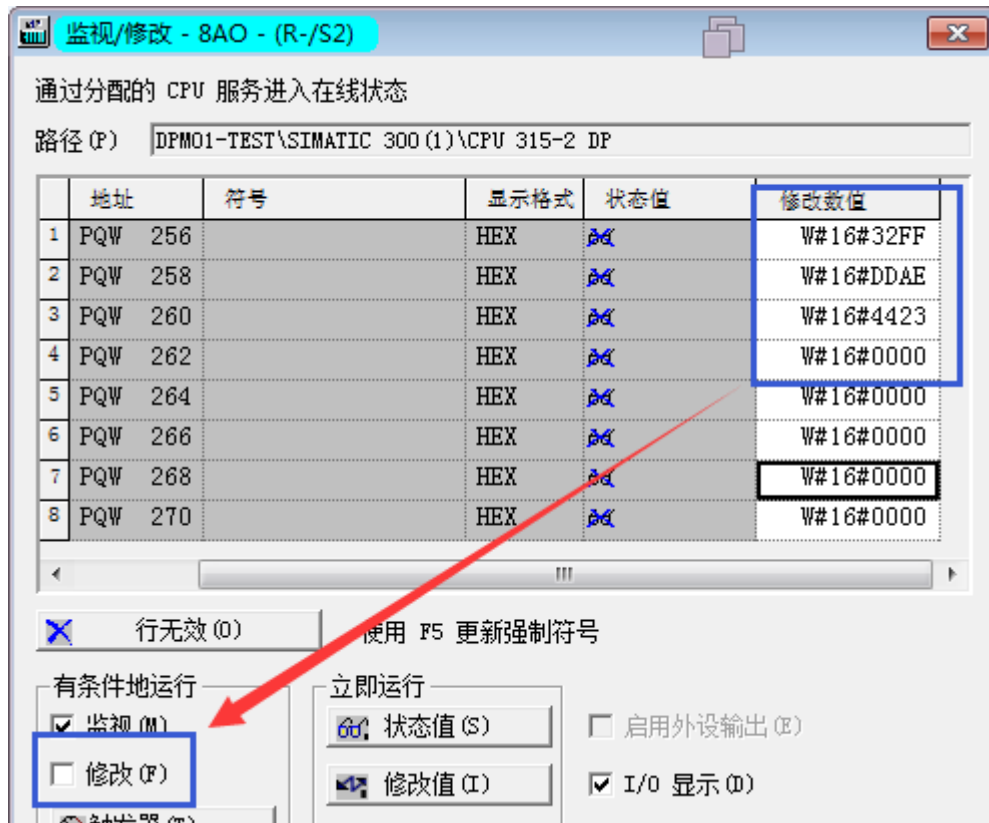
Read the data from Modbus slave station in Modbus Poll master station, which is consistent with the output value of DP, as shown in the following figure.
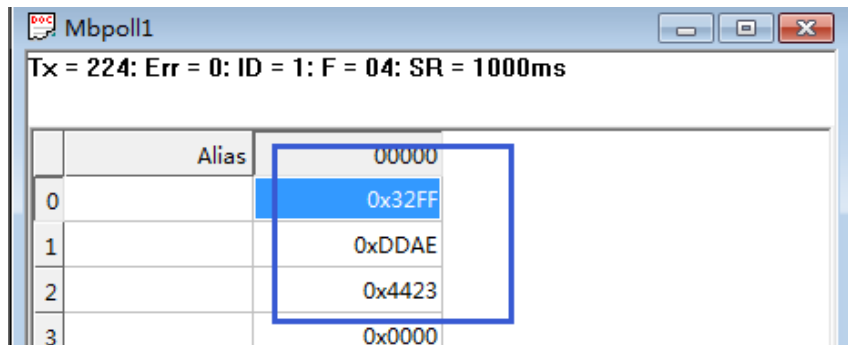
19. Modbus slave station state module

　　Modbus Slave State Module can only be used under the slave mode, from DP side can read slave status to judge the working state of Modbus slave station. The error code is 0 when the station is working normally. When the error occurs from the slave station, the error code will indicate the cause of the error. As shown below, 0x0402 indicates that when the 04 function read input register (3xxxx) area, return the "data address error". At this point, we need to modify the "starting address" for Modbus master station to read data.

Other error codes are shown in the following table：

Modbus slave station error code table

Error code	Fault description	Troubleshooting method
0x00	Slave station working normally	No
0x01	Illegal function code	Slave does not support the current function code, please read the slave manual to choose the function code module.
0x02	Illegal data address	Slave data beyond the address range, read to slave manual to revise the starting address or data length.
0x03	Illegal data value	Data length error, data length beyond the maximum allowed 125 (Word) or 2000 (Bit), modify the length
0x07	Parity error	Check parity, baud rate and stop bits, check the status of hardware connection.
0x09	CRC check fault	the slave response massage CRC calculation error, check the slave working state
0x0E	The response message length error	Increase the space between the receiving character

5. Modbus-RTU Brief introduction of protocol

对于您来说，您只需要了解Modbus有4个区对应的8条重要的功能码：4条读、2条写单个位或寄存器，2条写多个位或者多个寄存器。For you, you only need to understand the 8 important function codes of the Modbus with 4 zones: 4 read, 2 write single bits or registers, 2 write multiple bits or multiple registers.

(Address description using PLC address)

5.1．Modbus Storage Area

The controller (or Modbus device) storage area stored by Modbus is identified by 0XXXX, 1XXXX, 3XXXX and 4XXXX.

Storage area mark	Name	Data type	Read/ Write	Address of storage unit
0XXXX	Output coil	bit	Read/ Write	00001~0XXXX, XXXX：related to device
1XXXX	Input of discrete quantity	bit	Read only	10001~1XXXX, XXXX：related to device
3XXXX	Input register	byte	Read only	30001~3XXXX, XXXX：related to device
4XXXX	Input/Keep register	byte	Read/ Write	40001~4XXXX, XXXX：related to device

5.2. **Modbus Function Code**

Modbus message is relatively fixed, so you only need to know a little bit. After reading several messages, you will know its structure and ask for details when needed.

（1）Read output coil state

Function code：01H

Master station inquiring message format：

Address	Function code	Starting address High position	Starting address Low position	Coil quatity High position	Coil quatity Low position	CRC
0x11	0x01	0x00	0x13	0x00	0x25	xxxx

Function: read the slave station output coil 0XXXX state.

Notice: some devices' coil starting address is 00000, corresponding to the 00001 address in the device,deferred by turn.

For this example: read the output coil of 0X11 slave station, the register starting address is 0x13=19, the number of coils is 0x0025H=37；so the function of inquiring message is: to read 0X11 (17) slave station output coil 00019 to 00055, and there are 37 coils.

Slave station respond format：

Address	Function code	Bytes count	Coil state 19-26	Coil state 27-34	Coil state 35-42	Coil state 43-50	Coil state 51-55	CRC
0x11	0x01	0x05	0xCD	0x6B	0xB2	0x0E	0x1B	xxxx

Function: returned output coil 0XXXX state from device

（2）Read the state of the discrete-time input

Function code：02H

Master station inquiring message format：

Address	Function	Starting address High position	Starting address Low position	Coil quatity High position	Coil quatity Low position	CRC
0x11	0x02	0x00	0xC4	0x00	0x16	xxxx

Function: read the slave station input coil 1XXXX state.。

Notice: some devices' coil starting address is 10000, corresponding to the 10001 address in the device,deferred by turn.

For this example: read the input coil of 0X11 slave station, the register starting address is 0x00C4=196, the number of coils is 0x0016=22；so the function of inquiring message is: to read 0X11 (17) slave station input coil 10196 to 10217, and there are 22 coil's discrete input state.

Slave station response format：

Address	Function code	Bytes count	DI 10196-10203	DI 10204-10211	DI 10212-10217	CRC
0x11	0x02	0x03	0xAC	0xDB	0x35	xxxx

Function: return of the input coil 1 XXXX state from the machine

（3）Read output / hold register

Function code：03H

Master station inquiring message format：

Address	Function code	Register start address High position	Register start address Low position	Register quatity High position	Register quatity Low position	CRC

0x11	0x03	0x00	0x6B	0x00	0x03	xxxx

Function: read from the slave station to keep the register 4XXXX value.

Notice: some devices' register starting address is 40000, corresponding to the 40001 address in the device, deferred by turn.

For this example: read the keep register value of 0X11 slave station, the register quatity number is 0x0003; so the function of inquiring message is: to read 0X11 (17H) slave station's 3 keep register 40107—40109, and there are 22 coil's discrete input state.

;

Adress	Function code	Bytes count	Register 40107 High position	Register 40107 Low position	Register 40108 High position	Register 40108 Low position	Register 40109 High position	Register 40109 Low position	CRC
0x11	0x03	0x06	0x02	0x2B	0x01	0x06	0x2A	0x64	xxxx

Function: read the keep register' svalue returned from the slave station:(40107)=0x022B, (40108)=0x0106

（4）Read the input register

Function code：04H

Master station inquiring message format：

Address	Function code	Register starting address High position	Register starting address Low position	Register's quatity High position	Register;s quatity Low position	CRC

0x11	0x04	0x00	0x08	0x00	0x01	xxxx

Function: read the input register's 3XXXX value of slave station.

Notice: some devices' register starting address is 30000, corresponding to the 30001 address in the device,deferred by turn.

For this example: read the keep register value of 0X11 slave station, the starting address is 0x0008H, register quatity is 0x0001；so the function of inquiring message is: to read 0X11 (17) slave station's 1 input register 30008, the slave station's reply format.

Addre ss	Functi on code	Bytes count	Input register 30008 High position	Input register 30008 Low position	CRC
0x11	0x04	0x02	0x01	0x01	xxxx

Function：read the value returned from the slave staton to the input register 30008,（30008）=0x0101

（5）Forcibly setted single coil

Function code：05H

Master station's inquiring message format：

Addr ess	Functi on code	Coil address High position	Coil address Low position	Disconne ction sign	Disconne ction sign	CRC
0x11	0x05	0x00	0xAC	0xFF	0x00	xxxx

Function：Forcibly set the 0x01(17) slave station's 0XXXX coil value.

Coil's starting address 00000, corresponding to the 00001 address in the device,deferred by turn.

Disconnection sign=FF00，Set coil ON.

Disconnection sign=0000，Set coil OFF.

Example：Starting address is 0x00AC=172. Forcibly set the coil 0172 of slave station 17 to ON state.

Reply format：Return the original message to where it comes

Address	Function code	Coil address High position	Coil address Low position	Disconnection sign	Disconnection sign	CRC
0x11	0x05	0x00	0xAC	0xFF	0x00	xxxx

Function：Forcibly set coil 0172 of slave station 17 to ON state, then return the original message to where it comes.

（6）Reset the single keep register

Function code：06H

Master station inquiring message format：

Address	Function code	Register starting address High position	Register starting address Low position	Register quatity High position	Register quatity Low position	CRC
0x11	0x06	0x00	0x87	0x03	0x9E	xxxx

Function：Preset the single keep register 4XXXX value. Coil's starting address 40000, corresponding to the 40001 address in some device, deferred by turn.

Example：Preset single keep register 40135's value of slave station 17 to 0x039E

Respond format：return the original message to where it comes

Address	Function code	Register starting address	Register starting address Low	Register quatity High	Register quatity Low	CRC

		High position	position	position	position	
0x11	0x06	0x00	0x87	0x03	0x9E	xxxx

Function：Preset the single keep register 40135's value of slave station 17 to 0x039E, then return the original message to where it comes.

（7）Forcibly reset the multiple coil

Function code：0FH

Master station inquiring message format：

Address	Function code	Coil starting address High position	Coil starting address Low position	Coil quatity High position	Coil quatity Low position	Bytes count	Coil state 20-27	Coil state 28-29	CRC
0x11	0x0F	0x00	0x13	0x00	0x0A	0x02	0xCD	0x00	xxxx

Function：Forcibly preset the multiple continuous coil 0XXXX to ON/OFF state.

Notice: Coil's starting address 00000, corresponding to the 00001 address in some device,deferred by turn.

Example：Forcibly preset the multiple continuous coil of slave station 0x11, coil's starting address is 0x0013=19,coil quatity is 0x000A=10

So,this inquiring message's function is: forcibly preset the 10 coil's

value 00019—00028 of 0x11（17）slave station；CDH→00019-00026；00H →00027-00028；

Slave station's respond cormat:

Address	Function code	Coil starting address High position	Coil starting address Low position	Coil quatity High position	Coil quatity Low position	CRC
0x11	0x0F	0x00	0x13	0x00	0x0A	xxxx

（8）Preset multiple register

Function code：10H

Master station inquiring message cormat:

Address	Function code	Start register address High position	Start register address Low position	Register quatity High position	Register quatity Low position	Bytes count	Data High position	Data Low position	Data High position	Data Low position	CRC
0x11	0x10	0x00	0x87	0x00	0x02	0x04	0x01	0x05	0x0A	0x10	xxxx

Function：Preset multiple keep register's value 4XXXX of slave station

Notice：Keep register's starting address 40000, corresponding to the 40001 address in some devices,deferred by turn. 。

Example：Preset the multiple keep register's value of the slave station

　　0x11, register's starting address is 0x0087=135,coil quatity is

　　0x0002=2

So,this inquiring message's function is: preset the 2 keep register's value 0105H→40135; 0A10H→40136 of 0x11（17）slave station;

Respond format：

Address	Function code	Starting register address High position	Starting register address Low position	Register quatity High position	Register quatity Low position	CRC
0x11	0x10	0x00	0x87	0x00	0x02	xxxx

Sichuan Odot Automation System Co., Ltd.

Add: No.6 Hongsheng Road, Hi-Tech District, Mianyang, Sichuan, China

Tel: +86-0816-2538289

Zip Code: 621000
Email   sales@odotautomation.com
Web: www.odotautomation.com