Modbus (RS485)/PROFIBUS DP Gateway PM-127

User Manual

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PM-127
Modbus(RS-485)/PROFIBUS DP Gateway
User Manual

Table of Contents

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1 About This Document

1.1 General

This manual describes every parameter of the gateway PM-127 and provides using methods and some announcements that help users use the gateway. Please read this document carefully before using the gateway.

1.2 Important user information

The data and examples in this document can not be copied without authorization. Sibotech maybe upgrades the product without notifying users.

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The product has many applications. The users must make sure that all operations and results are in accordance with the safety of relevant field, and the safety includes laws, rules, codes and standards.

1.3 Terms

PROFIBUS DP: PROFIBUS DP protocol

RS485: A kind of hardware specification of serial interface

PM-127: Modbus (RS485) /PROFIBUS DP gateway

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2 About the Gateway

2.1 Product Function

The gateway PM-127 establishes communication between serials and PROFIBUS DP, and can connect multiple devices with Modbus RTU/ASCII (RS485) interface to PROFIBUS DP. Modbus/RS485 network devices can be converted to PROFIBUS DP network devices.

2.2 Feature

➢ **Widely used:** All Modbus RTU/ASCII protocol devices with RS485 port can be connected to PROFIBUS DP network through PM-127. Such as converters with Modbus protocol interface, motor startup protection devices, intelligent high and low voltage electrical equipments, power measuring devices, transmitter, and intelligent field measuring equipments and instruments and so on.

➢ **Easy implementation:** Users needn't know the technical details of PROFIBUS DP and Modbus, but refer to this manual and the application examples provided, complete configuration according to the requirements without complex programming, then can establish communication in a short time.

➢ **Transparent communication:** Users can establish data transparent communication between PROFIBUS DP and Modbus according to the mapping relationship between PROFIBUS DP data communication area and Modbus data communication area.

2.3 Technical Specification

[1] Act as a PROFIBUS DP slave at the side of PROFIBUS DP, while Modbus master, Modbus slave can be selected at the side of Modbus. The mapping of PROFIBUS DP and Modbus communication data area realize transparent data communication.

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[2] As a Modbus master , supports 01H、02H、03H、04H、05H、06H、0FH、10H function codes, It can be configured up to 48 Modbus commands.

[3] As a Modbus slave, supports Modbus register address 3 area(3xxxx), 4 area(4xxxx), 0 area(0xxxx) and 1 area(1xxxx); 3 area supports o4H function code, 4 area supports 03H、06H、10H function codes, 0 area supports 01H、05H、0FH function codes, 1 area supports 02H function code.

[4] PROFIBUS DP/V0 protocol, in accordance with JB/T 10308.3-2001: Measuring and control digital data communication industrial control system uses the third part of field bus: PROFIBUS standard.

[5] PROFIBUS DP slave, baud rate is self-adaptive, the range of supported baud rate: 9600bps~12Mbps.

[6] PROFIBUS input/output byte number can be set through Step7 freely, the maximum number:

　①Max Input Bytes ≤ 244Bytes

　②Max Output Bytes ≤244 Bytes

　③Max Data Bytes ≤488 Bytes

[7] Monitoring function: As a Modbus master, PROFIBUS could monitor the status of Modbus command;

　　　　　　　　As a Modbus slave, PROFIBUS could monitor the status of Modbus network.

[8] Modbus protocol connector is RS485, half-duplex. Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps. 8 bits, Parity check mode: None, Odd Even, Mark and space. Stop bit: 1, 2

[9] Power: 24VDC (11V-30V), 80mA (24VDC);

[10] Working circumstance temperature: -40℃~60℃, Humidity: 5%~95%;

[11] External dimensions:（Width）15mm*（Height）110mm*（Depth)15mm;

[12] Installation: 35mm DIN RAIL;

[13] Protection Level: IP20;

2.4 Electromagnetic Compatibility

High-frequency interference test (GB/T15153.1 classⅢ)

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Imposed place	Power input circuit–GND Between the power input circuits AC input circuit–GND	
Imposed waveform	The first value of peak Oscillation frequency 1/2 Decay time The frequency of duplicate Impedance outputted by the test equipment	2.5～3kV 1.0～1.5MHz ≥6μs More than 50/s 150～200Ω

Fast Transient Pulse Burst Test (GB/T17626.4 classⅢ)

Voltage peak	Power input and AC input circuit：2kV Weak current circuit：1kV
Repetition rate	5 kHz

Electrostatic discharge interference (GB/T 17626.2 classⅢ)

Imposed place	Usual use ,the parts touched by the operator
Voltage, current	6kV contact discharge, the first peak of discharge current is 22.5A
Times	More than 10 times with the space more than 1 second in every part
Polarity	Positive

Radiate electromagnetic field (GB/T 17626.3 classⅢ)

Radio frequency	150MHz, 400MHz, 900MHz
Test field strength	10 V/m

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Radiation method	Make the front of antenna touch devices, or near terminal, intermittently radiate radio wave

2.5 Attention

- ♦ To prevent stress, prevent module panel damage;

- ♦ To prevent bump, module may damage internal components;

- ♦ Power supply voltage control in the prospectus, within the scope of the requirements to burn module;

- ♦ To prevent water, water module will affect the normal work;

- ♦ Please check the wiring, before any wrong or short circuit.
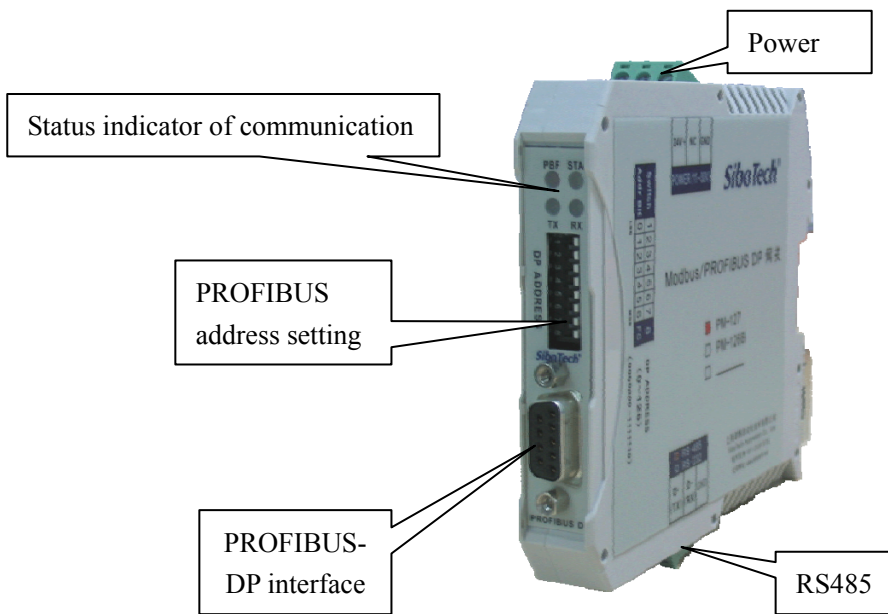
2.6 Related Products

Other related products in SiboTech: PM-160, PM-125 and so on.

If you want to get more information about these products, please visit SiboTech website: http://www.sibotech.net/en , or call the technical support hotline: +86-21-3126 5138.

3 Hardware Descriptions

3.1 Product appearance

Power

Status indicator of communication

PROFIBUS address setting

PROFIBUS-DP interface

RS485

3.2 Indicators

Indicator	Status	Description
STA (_Status indicator of PROFIBUS DP)	Green Blinking	PROFIBUS DP is communicating.
	Green Off	Be not communicating.
PBF (_Status indicator of PROFIBUS DP)	Always Red	PROFIBUS DP communication fails.
	Red Off	Communication is ok.
RX (_Status indicator of serial)	Green Blinking	Serial port is receiving data.
	Green Off	Serial has no data received.
TX (_Status indicator of serial)	Green Blinking	Serial port is sending data
	Green Off	Serial has no data sent.

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3.3 Configuration Switch
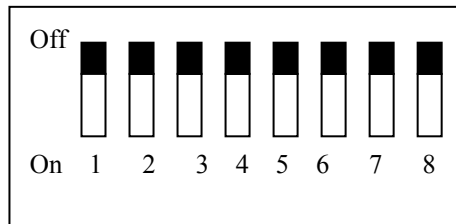
PROFIBUS DP address code switch:

图 1 拨码开关

1-7 bit PROFIBUS address code is the binary encoding from low to high(On is 1,Off is 0）

Note: The 7th bit is the highest bit of PROFIBUS address, the first bit is the lowest bit of PROFIBUS address. The high address to low address is arrayed from right to left.
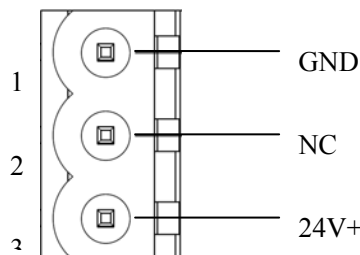
The 8th bit is useless in here.

If the bits 1, 3 and 5 are "On", and others are "Off", then the PROFIBUS DP address is "21".

3.4 Communication interface
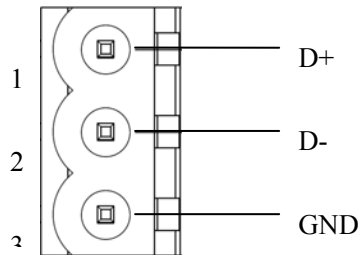
3.4.1 Power interface and RS485 interface

(1)Power interface

Pin	Function

1	GND
2	NC
3	24V+

(2)RS-485 interface

Pin	Function
1	D+, Conncet the RS485 data positive of user equipment
2	D-, Conncet the RS485 data negative of user equipment
3	GND

The 485 interface of PM-127 is standard, and we describe RS485's features of the product as follow:

◆ The basic characteristics of RS-485 transmission technology

①Network topology: Linear bus, there are active bus termination resistors at both sides.

②Baud rate: 1200 bps~115.2Kbps.

③Media: Shielded twisted-pair cable and also can cancel the shielding, depending on environmental conditions (EMC).

④Station number: 32 stations per subsection (without repeater), and can up to 127 stations (with RS485 repeater).

⑤Plug connection: 3-pin pluggable terminal.

◆ The main points on RS-485 equipments installation

① All the equipments be connected with RS-485 bus;

② The farthest two end of bus has a terminal resistance—120Ω 1/2W to ensure reliable operation of the network.

Serial interface uses 3-pin pluggable terminal and users can wire it according to the wiring instructions on the panel.

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3.4.2 PROFIBUS DP interface
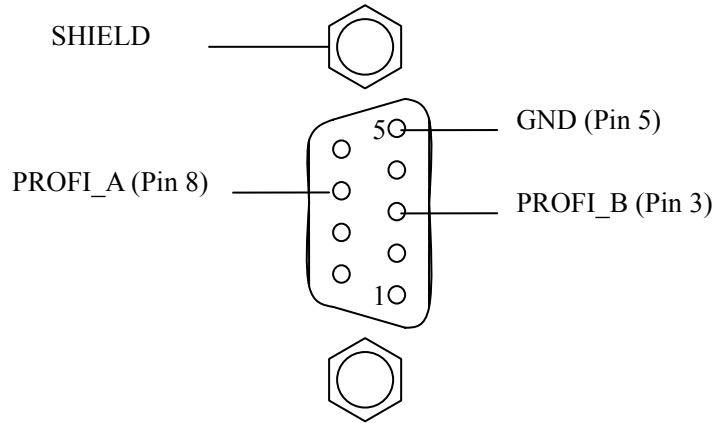
PROFIBUS DP interface with DB9 female connector, the pin is defined as follows:

Pin	Signal Description
3	PROFI_B，positive data（must be taken）
4	RTS
5	GND
6	+5V output
8	PROFI_A，negative data（must be taken）
Bolt	SHIELD，Shield of bus cable

PROFI_B（pin 3）,PROFI_A（pin 8）and SHIELD must be taken; RTS（pin 4）can be used to determine the transmission direction of some equipment; +5V（pin 6）and GND（pin 5）can be used in bus terminal and can provide power for fiber transceiver. The maximum output current of pin 5 and pin 6 is 80mA.

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4 Quick Start Guide

The follow steps will tell you how to configure PM-127 in short time:

1. Power on PM-127, then set PROFIBUS DP address of PM-127 according to the chapter 3.3 of this manual.

2. Register GSD file to PROFIBUS DP configuration software, the GSD file of PM-127 when PM-127 is Modbus master is different from the GSD file when PM-127 is Modbus slave, please register proper GSD files depending on your need.

3. Set PROFIBUS DP slave address in PROFIBUS DP configuration software. Configure Modbus communication rate and read/write commands according to your need. That is to say that mapping input and output of PM-127 to memory of PLC or other PROFIBUS master devices.

4. According to the instructions of RS485 interface in chapter 3, close the power and wire every pin of 3-pin terminal correctly.

5. According to the instructions of PROFIBUS DP interface in chapter 3, connect 3 pin and 8 pin correctly at least.

6. Connect Modbus devices to PROFIBUS DP, power on PM-127, and enter the normal mode of communication.

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5 PROFIBUS DP Master Configuration Interface

5.1 The Instructions of Parameter Setting

The parameters required to set in PROFIBUS DP master configuration interface: PROFIBUS DP slave property parameters, Module parameters of Modbus commands.

The property parameters of PROFIBUS DP slave: Modbus baud rate, serial parameters, response timeout, delay between polls and Modbus slave address (act as a slave).

Module parameters of Modbus command: When act as a master, Module parameters include: slave address, function code, start address and the number of data.

5.2 Steps of Setting Parameters

5.2.1 Create a new project

1 Open SIMATIC Manager　　　　, Figure 1:

Figure 1

2 Click "File", and then "New", create a new project; Figure 2:
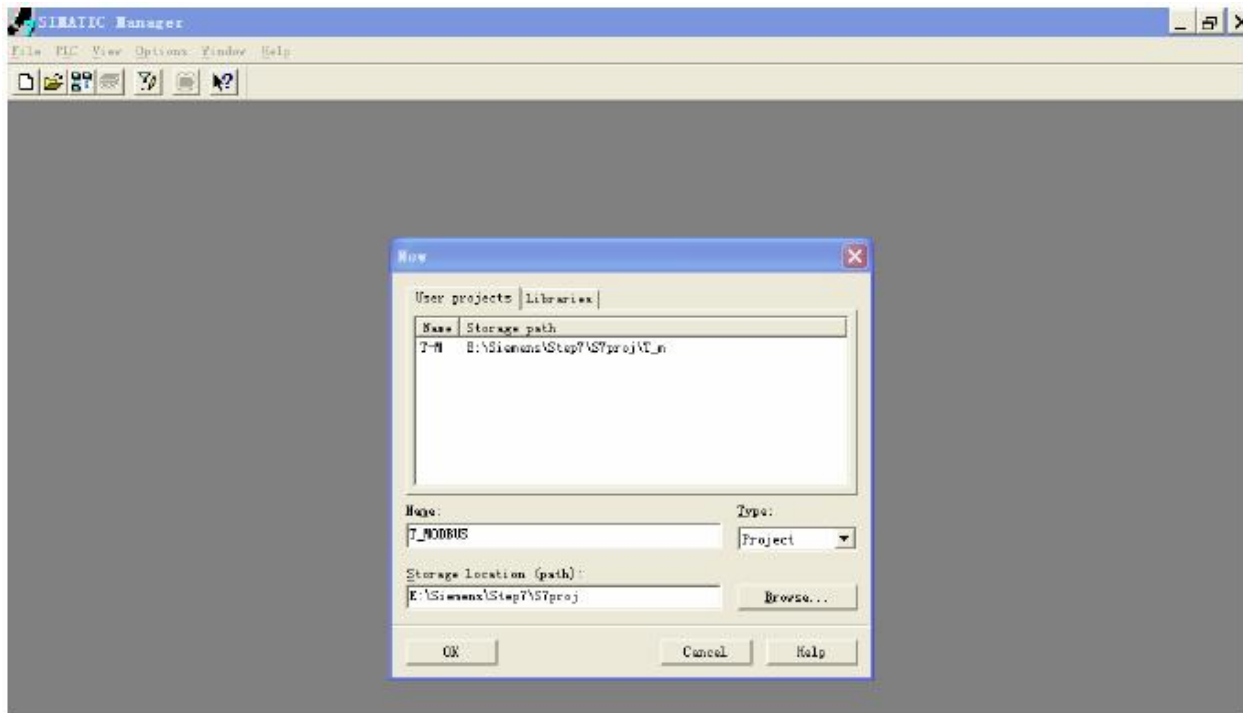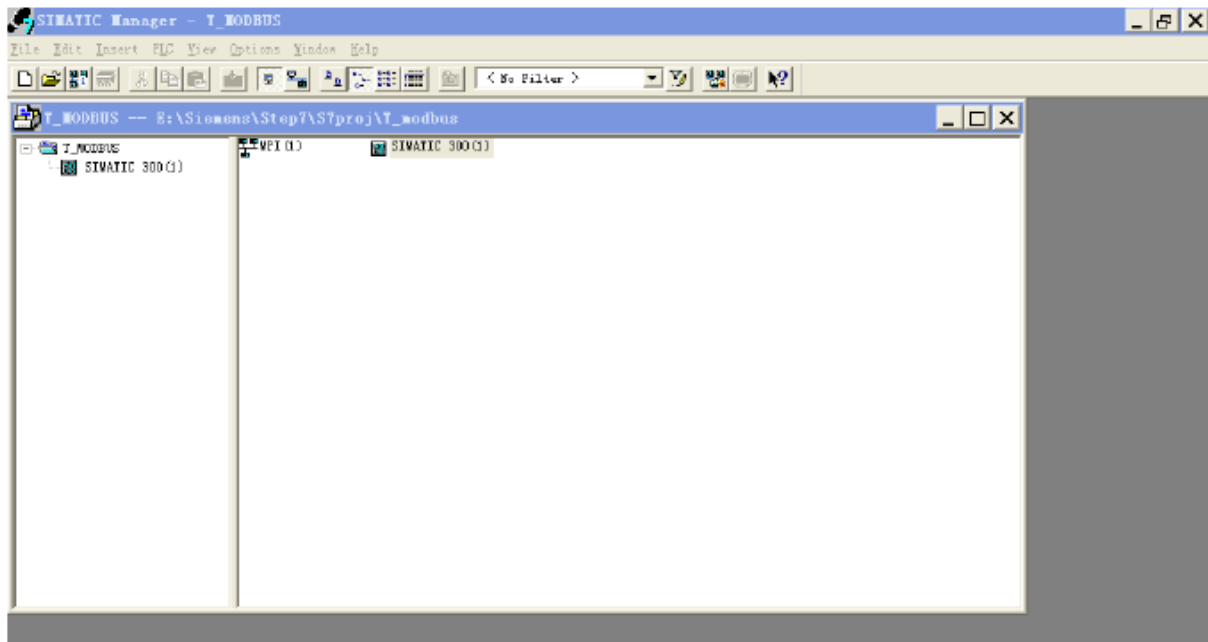
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Figure 2

3 Insert-> Station-> SIMATIC 300 Station, Figure 3:

Figure 3

4 Open SIMATIC 300(1) and then double-click Hardware, open S7 PLC hardware configuration, Figure4:
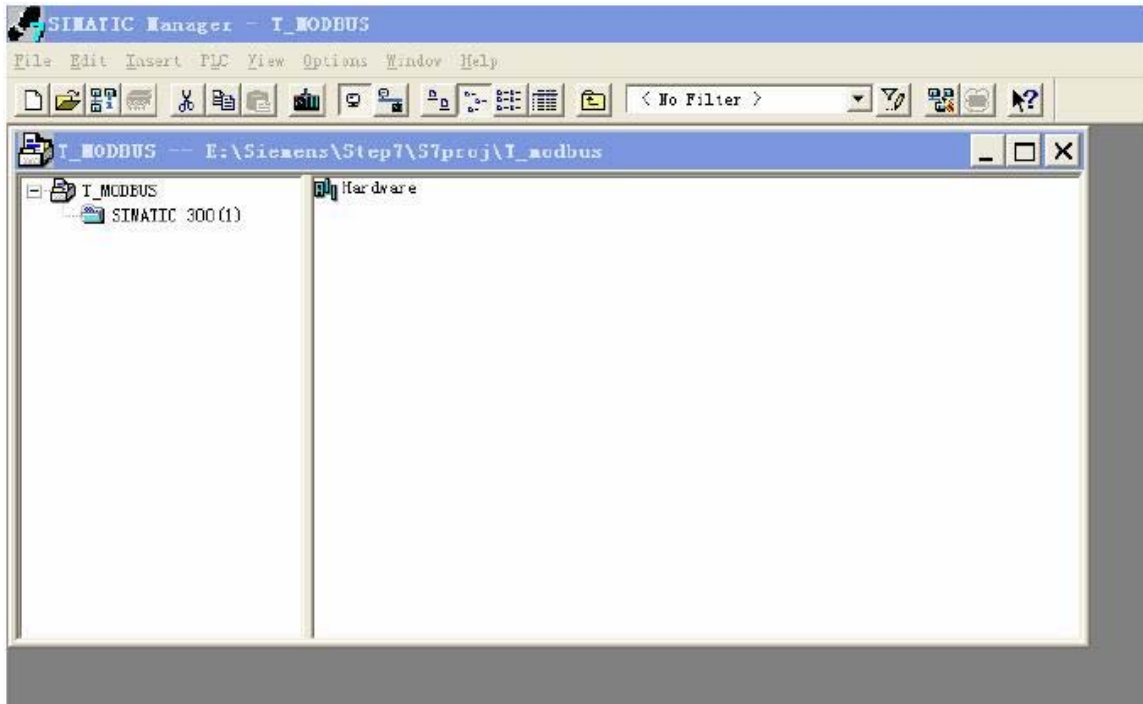
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Figure 4

5 The configuration interface is shown as Figure 5; Close the configuration window of the current project before registering GSD file.

Figure 5

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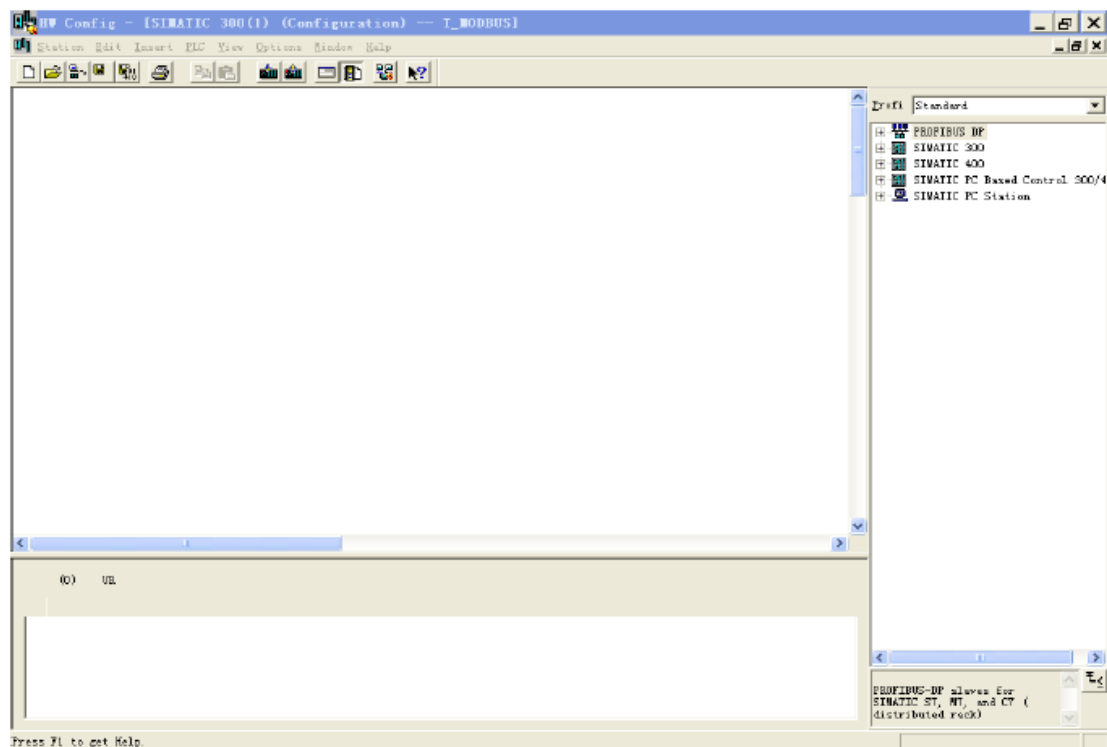
5.2.2 Register GSD file

The GSD file of PM-127 when PM-127 is Modbus master is different from the GSD file when PM-127 is Modbus slave. Please register proper GDS files according to the requirements. Copy the relevant *. gsd file of product we provided to the following path: **Step7\S7data\gsd**.

1. After closing the configuration window of the current project, click Options->Install GSD file, Figure 6:
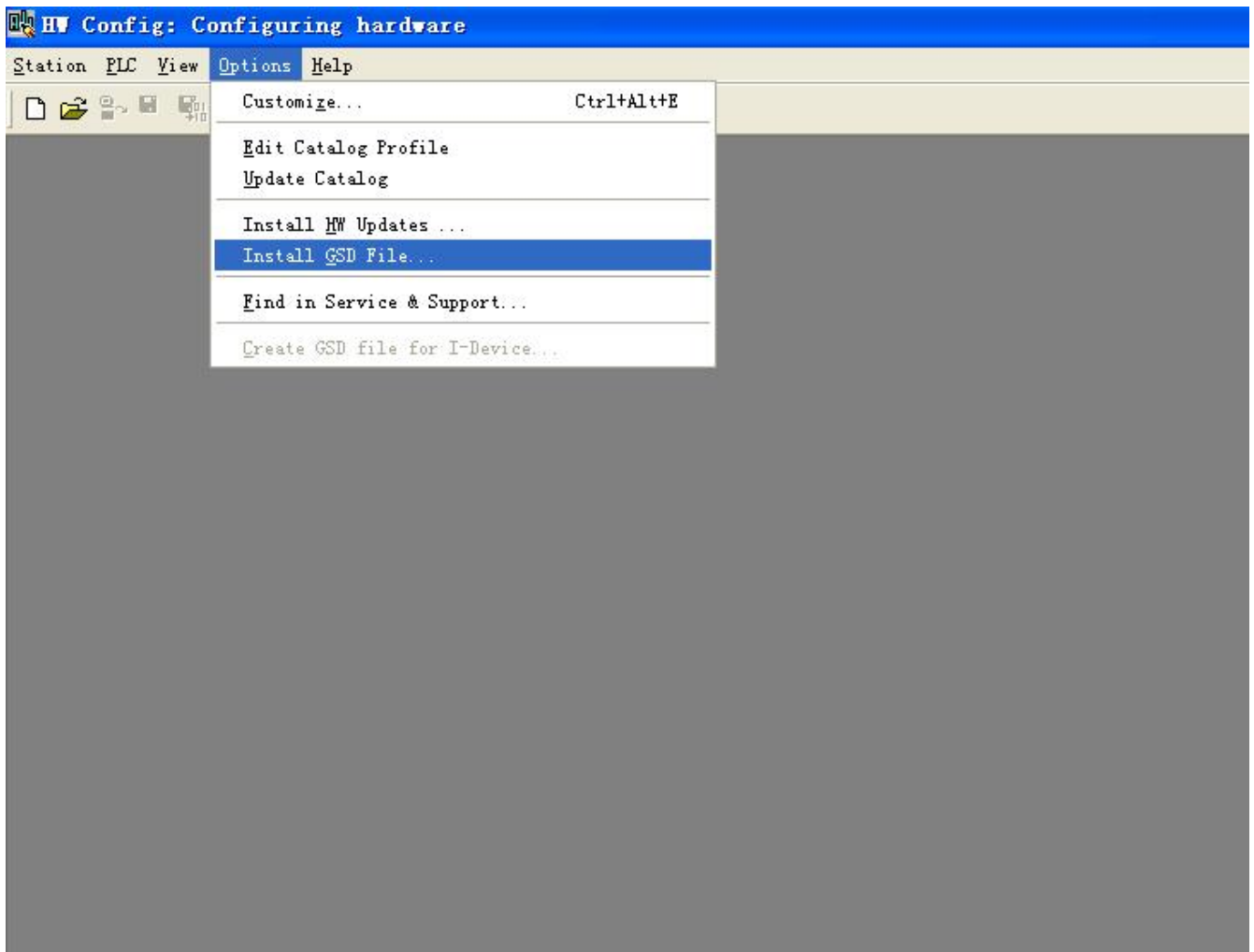
<p align="center">Figure 6</p>

2. The interface is shown as Figure 7, select PM127M22.gsd or PM127S22.gsd, click "Install", and click "Close" after registering completely, close the register window.
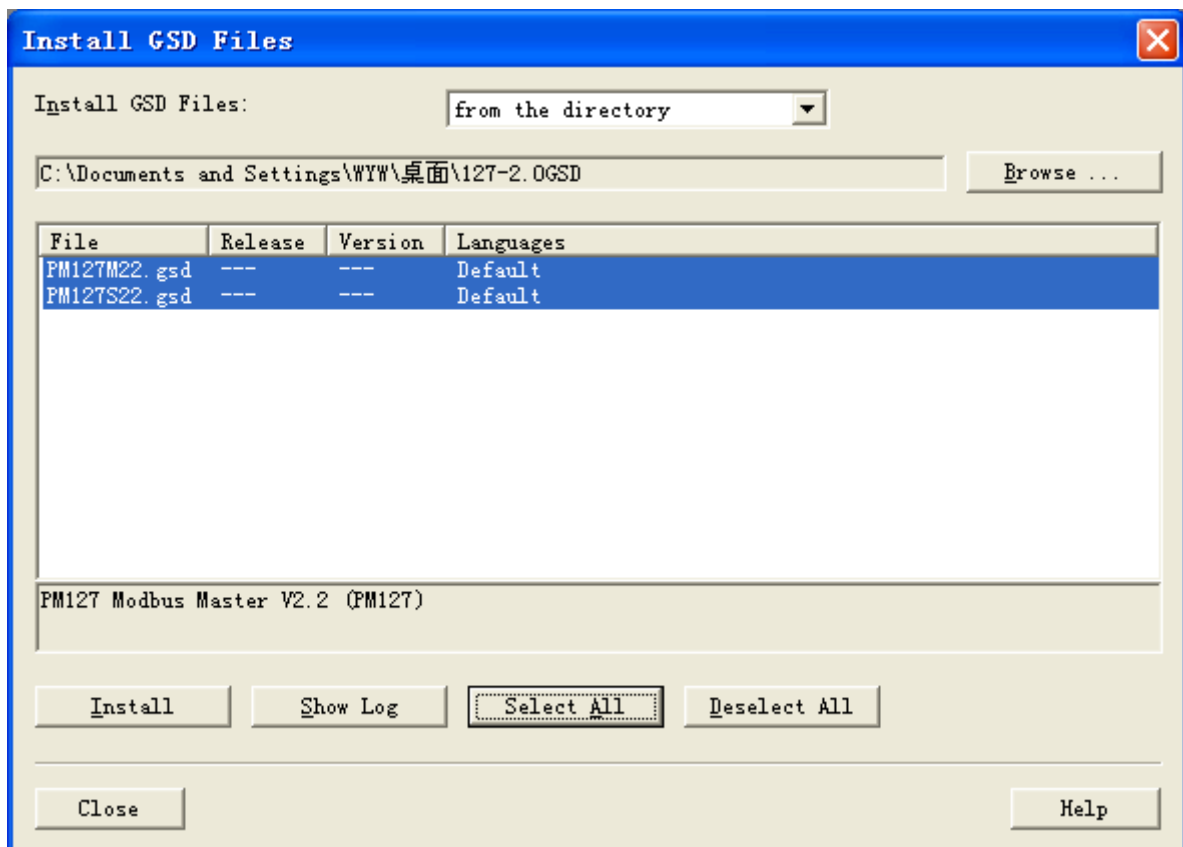
Figure 7

3. In the menu, select Options and then Update Catalog, update the registered devices in the device catalog, you

can find the registered device in the right window /PROFIBUS DP/Additional Field Devices/Converter/, Figure 8:

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Figure 8

5.2.3 Configuration setting

1. Open the configuration setting interface of the project you created, set PLC rack, double-click "Hardware Catalog\SIMATIC 300\RACK-300\Rail", Figure 9:

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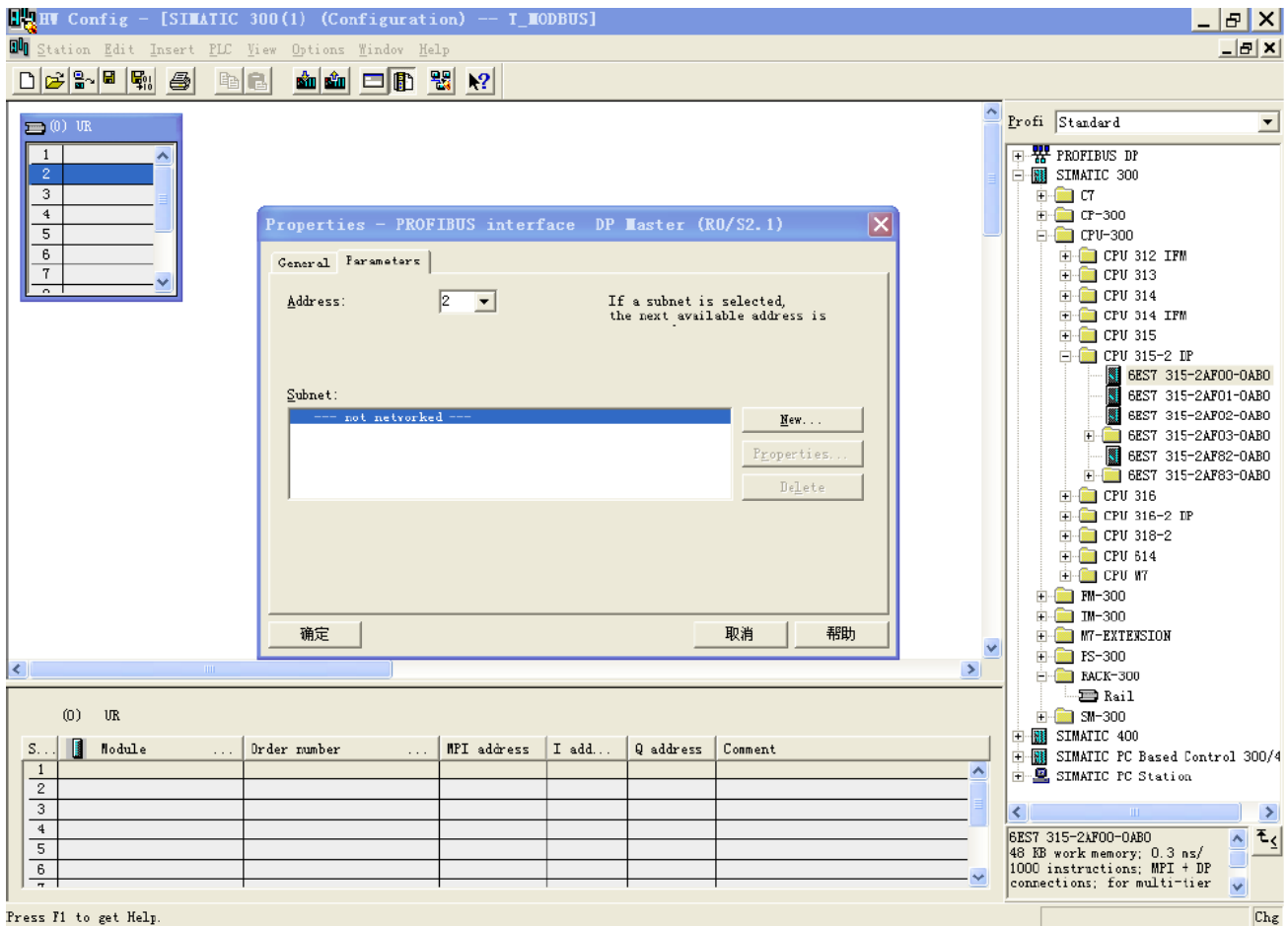
Figure 9

2. Set CPU module and select the corresponding device type and the occupied slots.

3. Create PROFIBUS DP network and set PROFIBUS DP network: Click New and then Network settings, select

DP; select a baud rate such as 187.5Kbps, then "OK". Double-click it, Figure 10:

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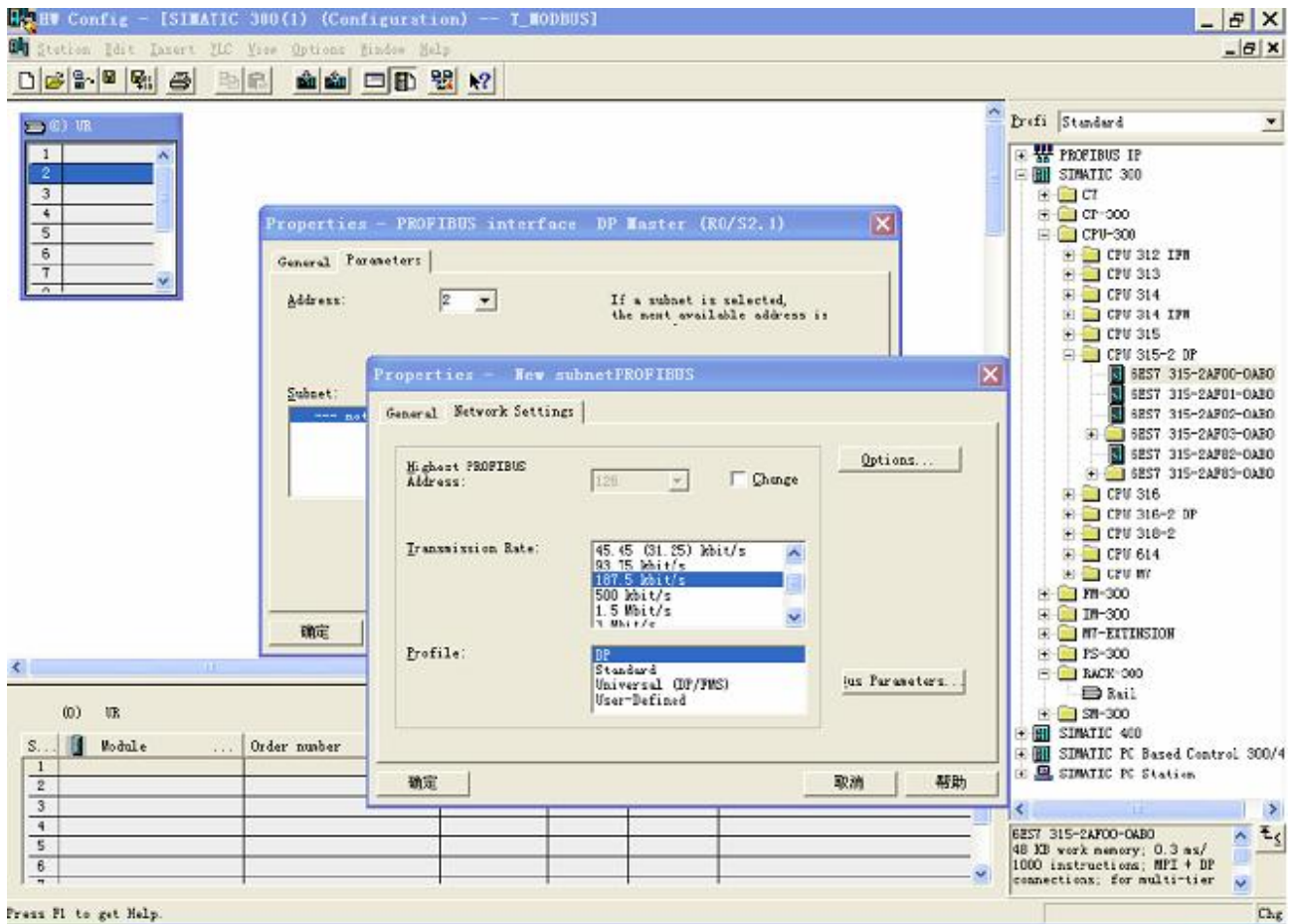
<div align="center">Figure 10</div>

4. Select a PROFIBUS DP master address, Figure 11:
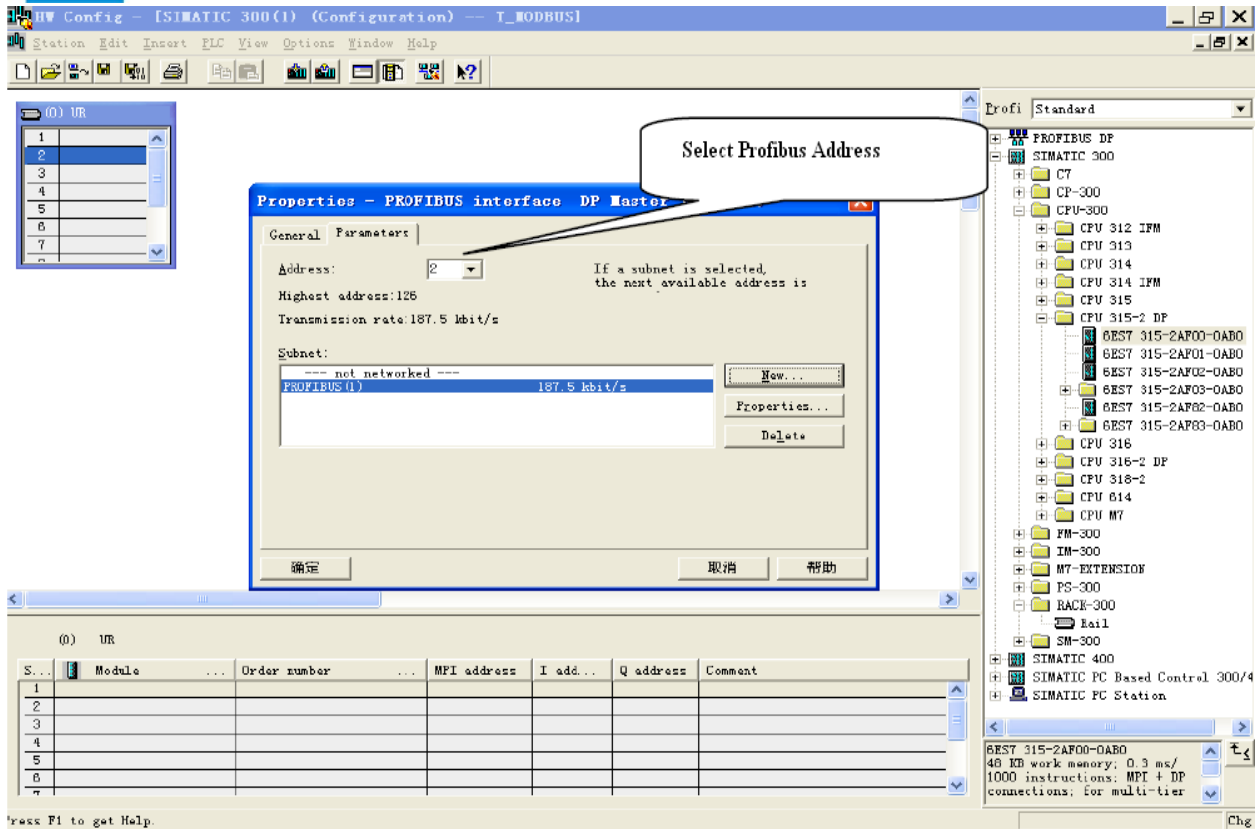
Figure 11

5. Put PM-127 slave into PROFIBUS DP network, and map the input and output data block into S7-300 or other controller's memory, Figure 12:
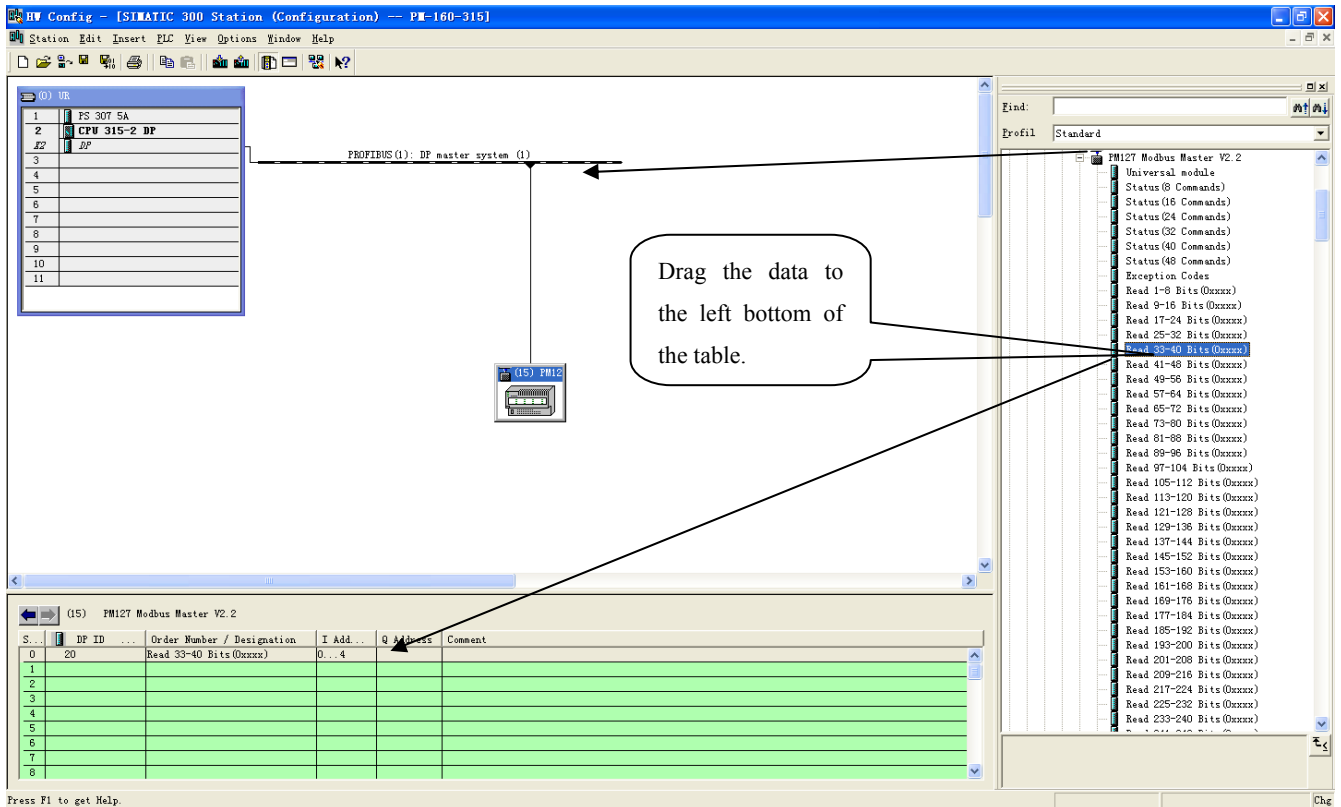
Figure 12

Operation is divided into two steps, the first step is dragging PM-127(PM-127 Modbus Master V2.2or PM-127 Modbus Slave V2.2) into the network configuration on the upper left, the mouse will change shape, and that is to say it can be placed. The second step is dragging data block into the data mapping table at the bottom left, mapping corresponding bytes to the PLC memory.

Remark: The address must be same with the settings of module switches!

6. Set PROFIBUS DP slave parameters and relevant Modbus parameters of Modbus commands, please reference to chapter5.2.4, save, compile and download into PLC.

5.2.4 Parameters setting

Before setting parameters, we should understand their own property parameters of PM-127 Modbus Master V2.2, PM-127 Modbus Slave V2.2 when they are PROFIBUS DP slave respectively and different Modbus parameters supported by each of them.

■ **PM-127 Modbus Master**

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After registering PM-127M22.gsd file completely, you can find the device with the name in the catalog, that is to say PM-127 act as a Modbus master at the side of Modbus.

✧ **PROFIBUS DP slave property parameter:**

In configuration interface, double click "PM-127 Modbus Master V2.2" in PROFIBUS DP network, property interface is shown as follow:
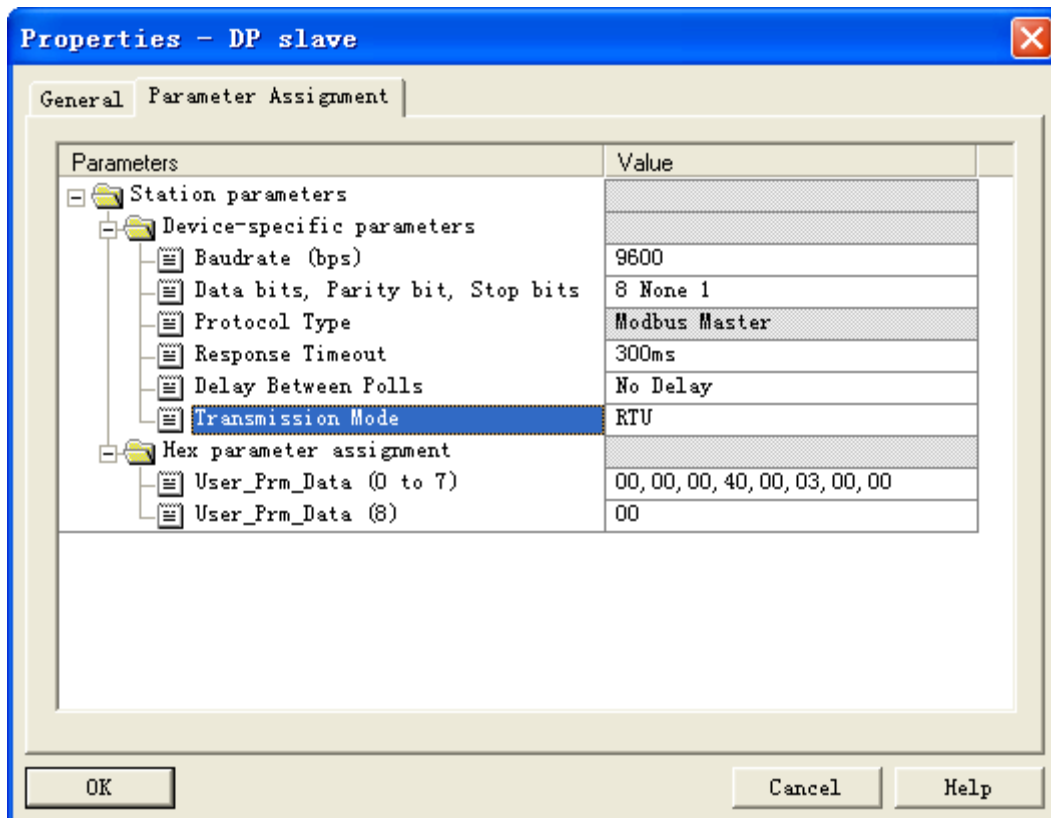
Configurable parameters include:

Baud rate (bps): Configure serial baud rate, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200bps can be selected;

Data bits, Parity bit, Stop bits: 8 None 1, 8 Odd 1, 8 Even 1, 8 Mark 1, 8 Space 1 and 8 None 2 can be selected;

Protocol Type: If what you drag to the PROFIBUS DP bus is "PM-127 Modbus Master", the parameter is "Modbus Master", If what you drag to the PROFIBUS DP bus is "PM-127 Modbus Slave", the parameter is "Modbus Slave".

Response Timeout: It is available when "Protocol Type" is Modbus Master, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1500, 2000, 3000, 4000, 5000ms can be selected.

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Delay Between Polls: It is available when "Protocol Type" is Modbus Master, No Delay, 50, 100, 150, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1500, 2000ms can be selected.

Transmission Mode: Set Modbus transmission mode, RTU or ASCII can be selected.

✧ **Module parameter**

In configuration interface, double-click Module that is dragged to the left bottom of the PM-127 relevant table, the interface is shown as follow:
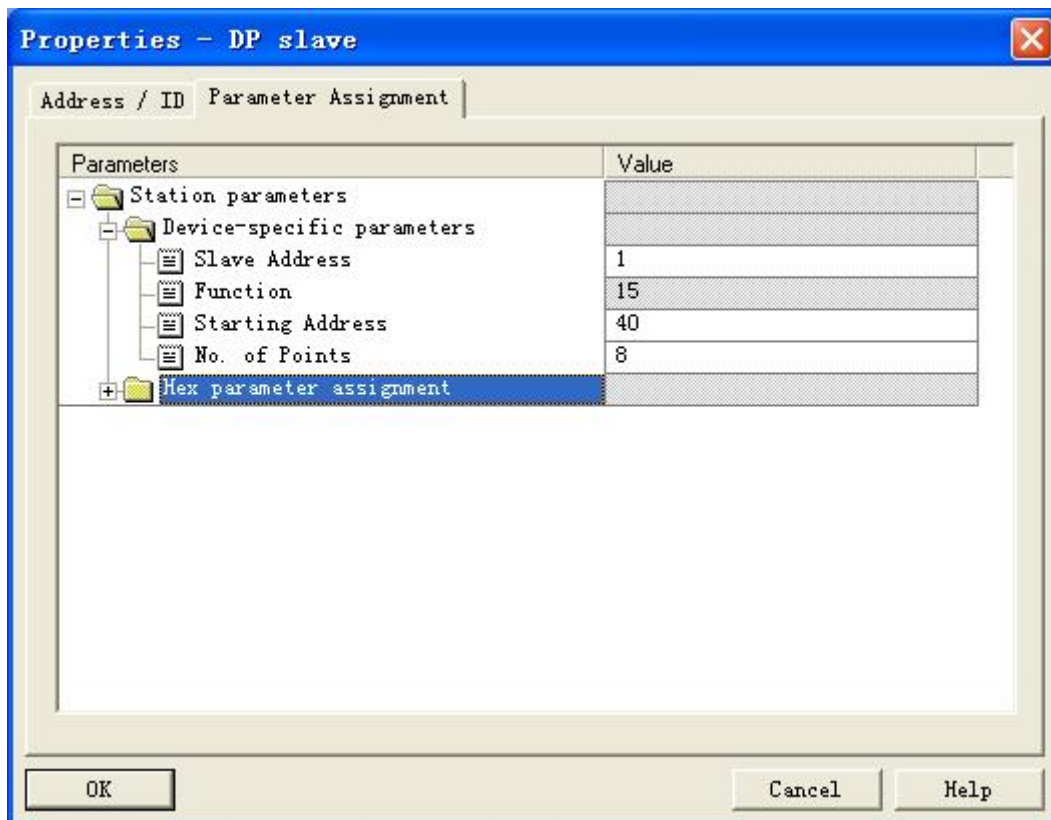
Configurable parameters include:

Slave address: Set Modbus slave address being connected with PM-127, 1 to 247 can be selected;

Function: Need not be set, every function code has its own module;

Starting Address: Set register starting address, 0~65535 can be selected;

No. of Points: Number of data, only those modules that relevant with 01H、02H、0FH function codes need to be set the number of data;

✧ **Modbus Command Modules**

The modules supported by PM-127 when PM-127 act as a Modbus Master include: Status Module, Read Module, Write Module

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Status Module: Status(8 Commands)～Status(48 Commands)、Exception Codes

As a Modbus master, PROFIBUS side can monitor the status of Modbus commands, and provide two kinds of method to monitor Modbus commands status:

Status(8 Commands)～Status(48 Commands): Select one kind status from 6, and every bit expresses the status of every Modbus command respectively. The value is 1 when response is correct, and when times of abnormal response, timeout or error up to 3 the value is 0. The count clears when response is right.

a) Status (8 Commands): Monitoring 8 commands

b) Status (16 Commands): Monitoring 16 commands

c) Status (24 Commands): Monitoring 24 commands

d) Status (32 Commands): Monitoring 32 commands

e) Status (40 Commands): Monitoring 40 commands

f) Status (48 Commands): Monitoring 48 commands

Exception codes: 1 word Module, high byte indicates Modbus command index 0~47, low byte indicates abnormal code or error code. When response is correct, error code is 0, when response abnormally or overtime or error, the highest bit of high byte is set to 1. Abnormal code come from devices, the error code is 0xFF when overtime or error.

Read Module: Read 1-8 Bits（0xxxx）～Read 249-256 Bits（0xxxx）, Read 1-8 Bits（1xxxx）～Read 249-256 Bits（1xxxx）, Read 1 Words（4xxxx）～Read 64 Words（4xxxx）, Read 2 Words（4xxxx）Consistent～Read 16 Words（4xxxx）Consistent, Read 1 Words（3xxxx）～Read 64 Words（3xxxx）, Read 2 Words（3xxxx）Consistent～Read 16 Words（3xxxx）Consistent

As a Modbus master, Modbus read command modules being supported by PM-127 are described before. Users can drag different modules according to different needs and make some simple relevant setting.

Write Module: Write Single Bits（0xxxx）～Write 249-256 Bits（0xxxx）, Write Single Words（4xxxx）～Write 64 Words（4xxxx）, Write 2 Words（4xxxx）Consistent～Write 16 Words（4xxxx）Consistent

As a Modbus slave, Modbus write command modules being supported by PM-127 are described before. Users can drag different modules according to different needs and make some simple relevant setting.

■ PM-127 Modbus Slave

After registering PM-127S22.gsd file completely, users can find the device named "PM-127 Modbus Slave"

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in the catalog, that is to say PM-127 act as a Modbus slave at the side of Modbus.

✧ **PROFIBUS DP slave property parameter**

In configuration interface, "PM-127 Modbus Slave V2.2" in PROFIBUS DP network, property interface is shown as follow:
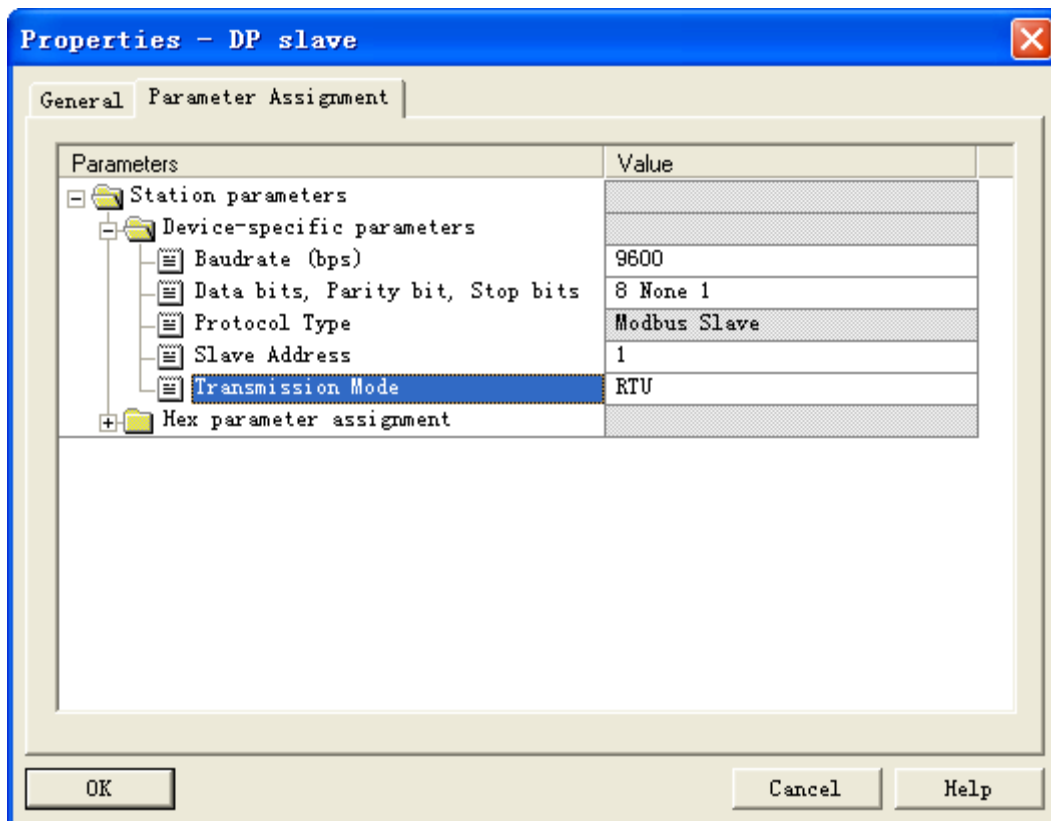
Configurable parameters include:

Baudrate(bps): Configure serial baud rate, 300、600、1200、2400、4800、9600、19200、38400、57600、115200bps can be selected;

Data bits: 8 bits

Data bits, Parity bit, Stop bits: 8 None 1, 8 Odd 1, 8 Even 1, 8 Mark 1, 8 Space 1 and 8 None 2 can be selected;

Protocol Type: If what you drag to the PROFIBUS DP bus is "PM-127 Modbus Master", the parameter is "Modbus Master", If what you drag to the PROFIBUS DP bus is "PM-127 Modbus Slave", the parameter is "Modbus Slave".

Slave address: It is available when "Protocol Type" is Modbus Slave, set Modbus address of PM-127, 1~247 can be selected.

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Transmission Mode: Set Modbus transmission mode, RTU or ASCII can be selected.

✧ **Module parameters**

In configuration interface, double-click Module that is dragged to the left bottom of the PM-127 relevant table, the interface is shown as follow:
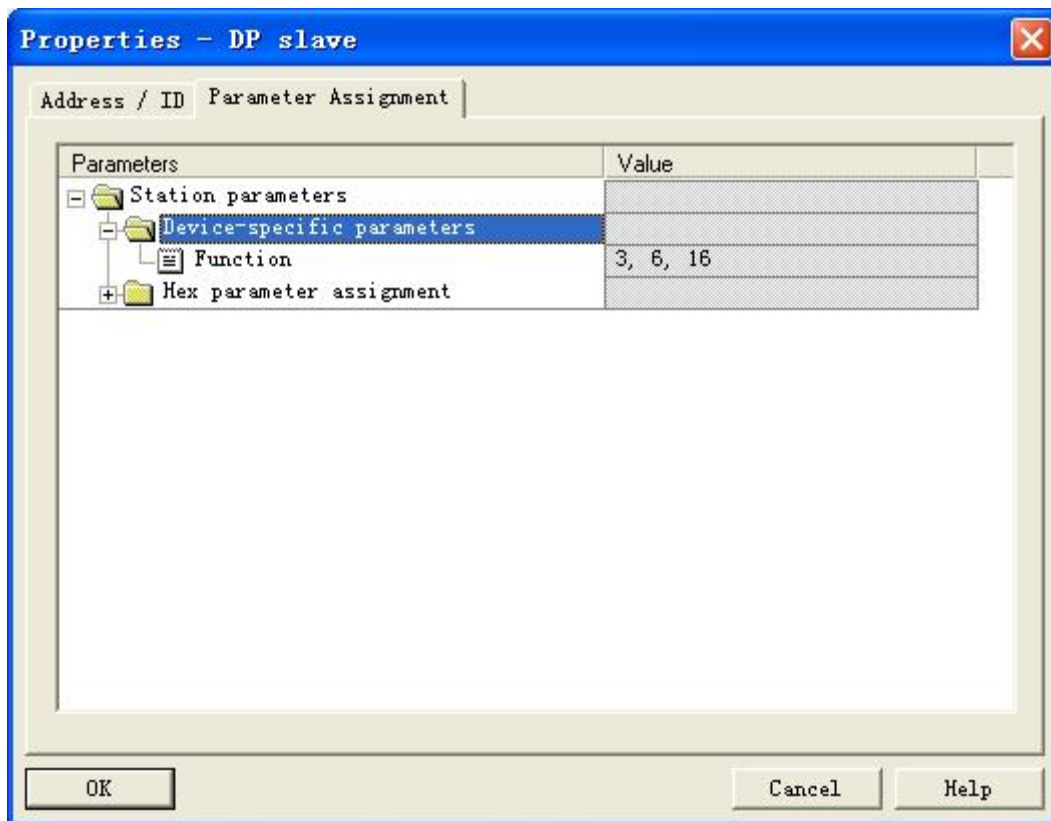
Function: When drag a Module, the "Function" has been made sure, it is to say that Functions supported by the Module include: 03H（3）, 06H（6）, 10H(16).

✧ **Modbus Command Modules**

The modules supported by PM-127 when PM-127 act as a Modbus Slave include: Status Module, Input Module, Output Module

Status Module: Status

As a Modbus slave, PROFIBUS side can monitor Modbus network status, and provide Modbus network status Module, it occupies 1bytes, the status byte adds 1 when receiving a correct request.

Input Module: 8 Bits Input（0xxxx）～128 Bits Input（0xxxx）, 1 Word Input（4xxxx）～64 Words Input（4xxxx）, 2 Words Input（4xxxx）Consistent～16 Words Input（4xxxx）Consistent

As a Modbus slave, Modbus read command modules being supported by PM-127 are described before. Users

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can drag different modules according to different needs and make some simple relevant setting.

Output Module: 8 Bits Input（1xxxx）～128 Bits Input（1xxxx）、1 Word Input（3xxxx）～64 Words Input

（3xxxx）、2 Words Input（3xxxx）Consistent～16 Words Input（3xxxx）Consistent

As a Modbus slave, Modbus write command modules being supported by PM-127 are described before.

Users can drag different modules according to different needs and make some simple relevant setting.

6 Working Principles of Modbus Master and Slave

6.1 Working Principle of Modbus Master

The data transmitting between Modbus of PM-127 Modbus Master and PROFIBUS is established by

mapping relation. PM-127 has two data buffer, one is PROFIBUS network input buffer, and the other is

PROFIBUS network output buffer. Modbus read commands read data and then write the data into input buffer for

PROFIBUS network reading. Modbus write commands get data from network output buffer, and then the data is

written into Modbus devices by writing commandss.
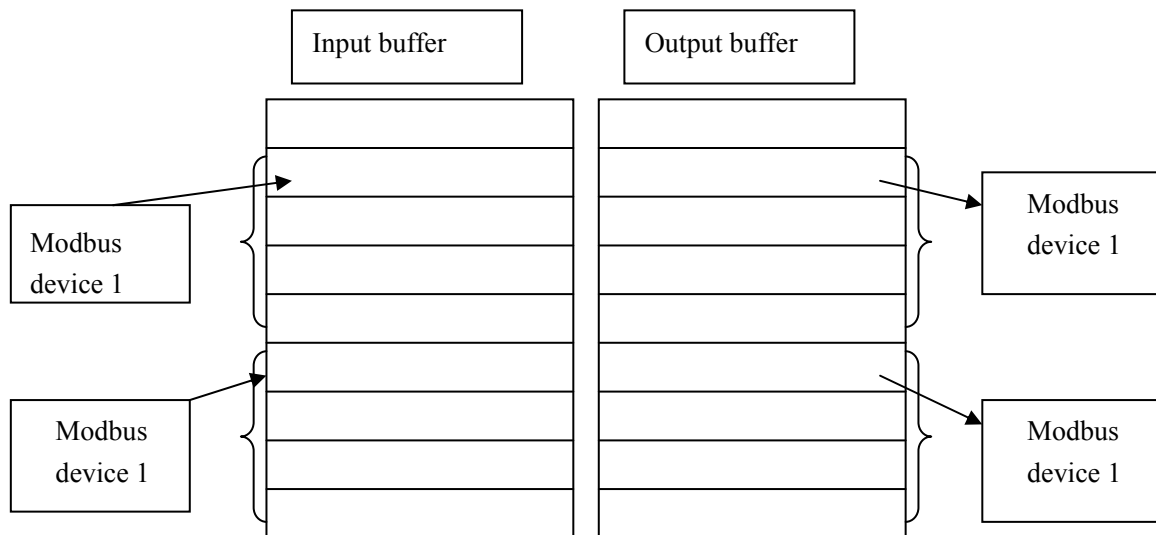
Support 01H、02H、03H、04H、05H、06H、0FH、10H function codes, users can configure 48 Modbus

commands Module.

6.2 Working Principle of Modbus Slave

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The data transmitting between Modbus of PM-127 Modbus Slave and PROFIBUS is established by mapping relation. PM-127 has two data buffer, one is PROFIBUS network input buffer, and the other is PROFIBUS network output buffer. Network input and output buffers are relative to PROFIBUS. Modbus write commands write data into network intput buffer for PROFIBUS network 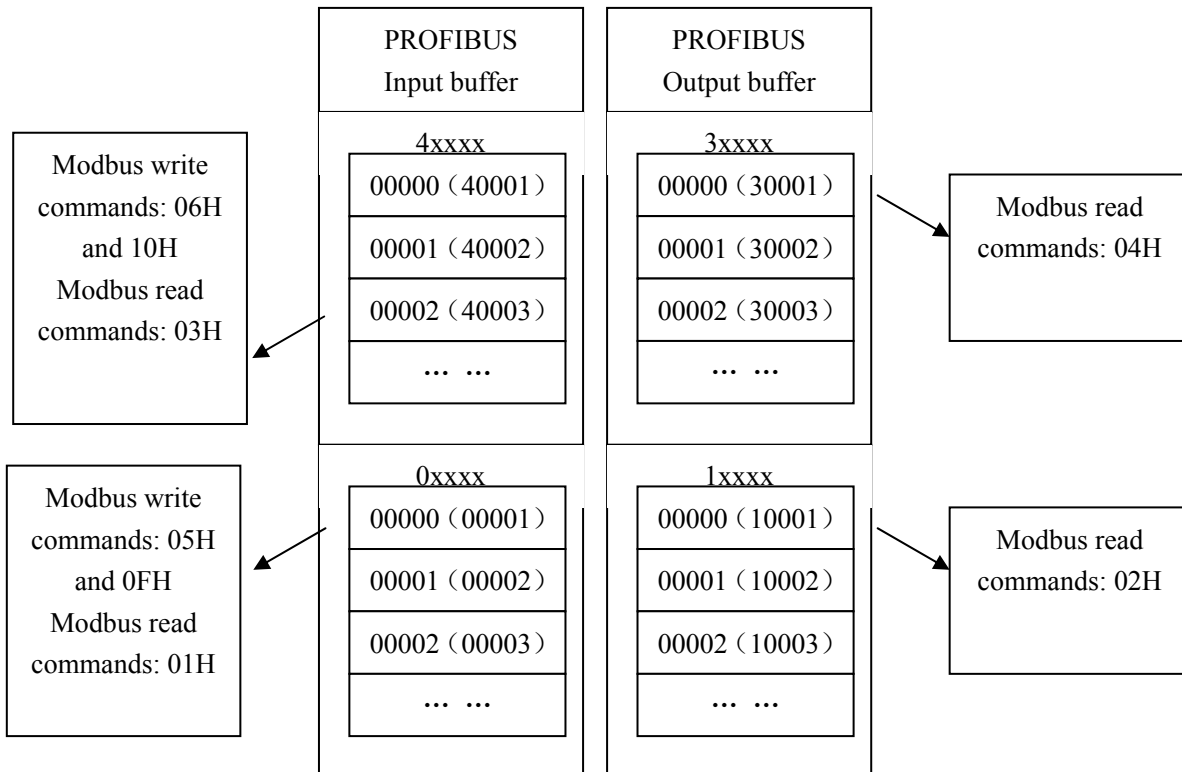reading. Modbus read commands read data from network output buffer, and transmit to Modbus master device through response messages.

Support Modbus register address 3 area (3xxxx), 4 area (4xxxx), 0 area (0xxxx) and 1 area (1xxxx); and 3 area supports 04H function code; 4 area supports 03H, 06H, and 10H function codes; 0 area supports 01H, 05H, and 0FH function codes; 1 area supports 02H function code.

PROFIBUS DP input buffer being relative to Modbus side is Modbus master output, mapping to Modbus holding registers 4xxxx (10H and 06H commands are used to write data, 03H command is used to read back data) and loops 0xxxx (0FH and 05H commands are used to write data, 01H command is used to read back data).

PROFIBUS DP output buffet being relative to Modbus side is Modbus master input, mapping to Modbus input registers 3xxxx (04H command is used to read data) and input bits 1xxxx (02H command is used to read data).

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7 How Step7 Read and Write Gateway Data

When PM-127 act as Modbus Master, Modbus command module of PM-127 that with total length as its consistent are shown as follow:

Read 2 Words（4xxxx）Consistent～Read 16 Words（4xxxx）Consistent, Read 2 Words（3xxxx）Consistent～Read 16 Words（3xxxx）Consistent, Write 2 Words（4xxxx）Consistent～Write16 Words（4xxxx）Consistent

When PM-127 act as Modbus Slave, Modbus command module of PM-127 that with total length as its consistent are shown as follow:

2 Words Input（4xxxx）Consistent～16 Words Input（4xxxx）Consistent, 2 Words Output（3xxxx）Consistent～16 Words Output（3xxxx）Consistent.

For Modbus command module that with total length as its consistent, users must apply "SFC 14" read data and "SFC 15" write data in Step 7 programming.

SFC 14

SFC 15

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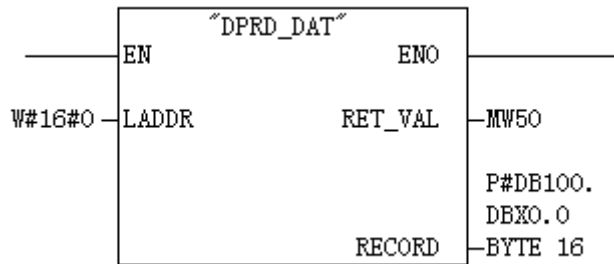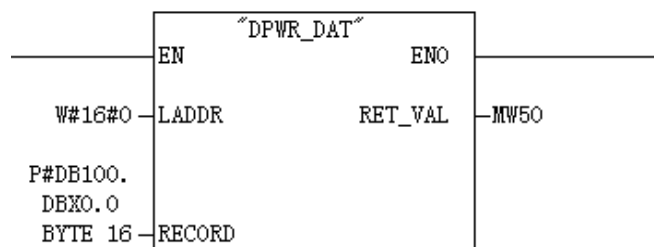
For other module which isn't module that with total length as its consistent, users can apply "MOVE" command read and write data in Step7 programming.

8 Installation

8.1 Machine Dimension

Size: 18mm (Width)*110mm (Height)*115mm (Depth)
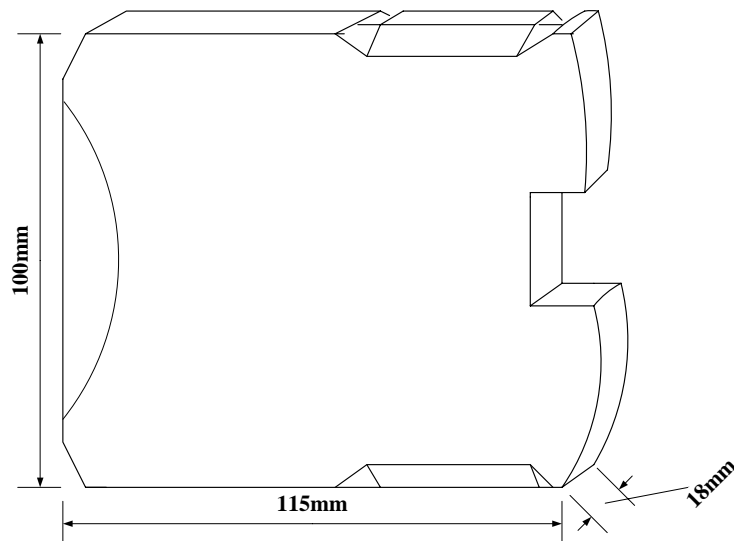
8.2 Installation Method

35mm DIN RAIL

①　　　　　　　　　　　②

沿箭头方向用力拉弹簧片　　　　　用力方向　　　　松开弹簧片
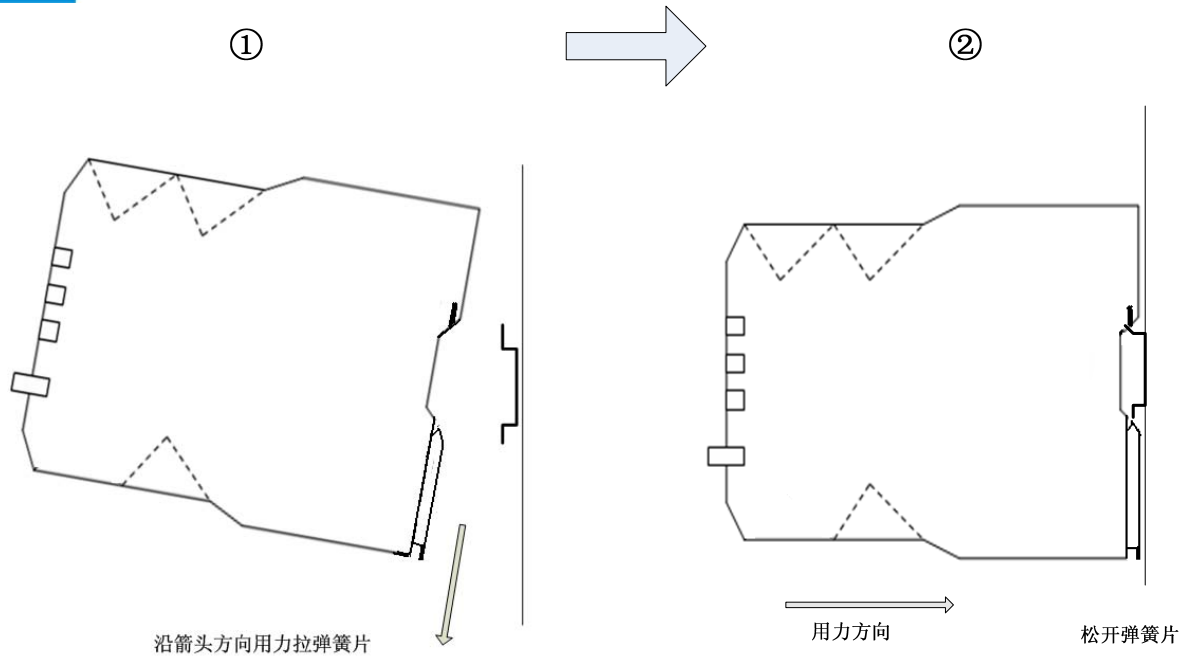
Appendix A: Modbus Protocol

Modbus-RTU Protocol:

Note: The equipments being connected with this product must have Modbus interface, and Modbus protocol of the equipments must be in line with the following rules. Our company provides customer-oriented services.

1 Description of protocol

Physical layer: transmission mode: RS485

Address: 0-247

Baud rate: Can configurate

Medium: STP

Transmission mode: Half-duplex mode

The connection is established throng one line with half-duplex mode, and that is to say that signals transmit through the only one line with opposite directions. Firstly, host computer find the only terminal and then the terminal transmits response signals on the opposite direction.

Protocol only allows the communication between host computers and terminals, while the communications between terminals are not allowed. Thus, they will not occupy communication line when they are in the status of being initialized and respond the polling signals which are transmitted to the local terminal only.

Format of a data frame: 1 bit start bit, 8 bits data and 1 bit stop bit.

Format of a data packet

Address	Function Code	Data	check code
8-Bits	8-Bits	N x 8-Bits	16-Bits

The protocol defines check code, data serial and so on in details, which are important contents when communicating specific data.

When data frames reach terminal, they access to the equipment through a simple entrance. The equipment delete the "envelop" of the data frame, and read the data. If there are no faults, the required tasks are executed. Then, it adds the data being generated by itself to the obtained "envelop", and return the data frame to the sender.

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The response data include: the address of terminal, the executed function, and the required data and a check code by executing the order. Any faults won't lead to respond successfully.

Address field

Address field is located at the beginning, composed of 8 bits (0-255). These bits indicate the address of the terminal being specified by users. The equipment will receive data from the host computer being connected with it. Every address of terminal must be the only one. Only the terminal being addressed will respond the polling with its address. When the terminal transmit a response, the response tell the host computer the terminal which is communicating with it.

Function field

Codes of function field show the function being executed by terminals which are addressed. Figure 1-1 lists all the function codes, their meanings and their initial functions.

Figure1-1 Function codes

code	meaning	action
03	Read data	obtain current binary value of single or multiple registers
06	Preset single register	Place one specific binary value into the single register
16	Preset multiple registers	Place specific binary values to a series of multiple registers

Data field

Data field includes data when specific functions are executed by terminals or data being collected when the terminal responds to query. The content of these data may be value of number, reference address or limit value. For instance, functional code indicates terminals read a register, data field, on the other hand, clearly show the register and the number of data to be read, the inside address, the type of data and different capacity of different computers.

Fault check code

The field allows checking the fault in the transmission between host computer and terminals. Sometimes, due to electrical noise and other interference, a set of data may change when transmitting from one equipment to another. The fault checking code can guarantee that host computer don't respond to the changed data in the transmission, which improves safety and efficiency of the system. The fault code apply 16 bit CRC.

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Note: The transmitting serial is always the same- address, functional code, data and the fault checking code relating to direction.

The fault checking

CRC field occupy 2 bytes, including 16 bits binary value. The value of CRC is calculated by transmitting equipment, and then added to the data frame, the receiving equipment calculate the CRC value again while receiving data. Then it is compared with receiving CRC value. If the two values are not the same, the fault occurs.

When calculating CRC, preset a 16-bit register to one firstly, and then calculate 8-bit bytes in the data frame with the current value of the register. Only 8 data bits of each byte participate in the generation of CRC. The initial bit, final bit and occasional odd and even bit don't influence the value of CRC.

The process of generating a CRC:

Preset a 16-bit register to 0FFFFH, and the register is named CRC register.

When generating CRC, exclusive each 8 bit with the content of the register, and then shift result to the low byte, the high bit is filled with zero, the LSB is shifted out and checked. If it is one, the register exclusives with a presetting fixed value. If the lowest bit is zero, there is no settlement.

The above settlement is repeated before executing the shifting 8 times. After finishing shifting the last bit, the next 8-bit byte has the same exclusive calculation with the register, and the another 8-time shifting is carried out. When all the bytes are settled, the final value is CRC value.

The process of generating a CRC:

Preset a 16-bit register 0FFFFH(all one), and name it CRC register.

Exclusive the first 8-bit byte in the data frame with the low byte in the CRC register, and restore CRC register. Shift CRC register to the right bit, fill the highest bit with zero, shift the lowest bit out and check them.

If the lowest bit is zero, repeat the third step (next shift)

If the lowest if one, exclusive CRC register with a presetting fixed value (0A001H).

Repeat the third step and the fourth step until shifting eight times, which settle the entire eight bit down.

Repeat the second step to the fifth step to deal with the next eight-bit until all the bytes are settled down.

In the end, CRC register value is the CRC value.

2 Functions of application layer

The first chapter has described the protocol and data frame. The processors of the software can use the

following methods establish their specific application program via protocols without fault.

The protocol in this chapter use the follow format as many as possible, the format is shown as table 2-1(digital is set in hexadecimal)

Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable	The high byte of the number of the variable	The low byte of number of the variable	The low byte of checking code	The high byte of checking code
03H	03H	00H	01H	00H	03H	55H	E9H

Table 2-1

Read Holding Registers (Function code 03)

Query

The Table 2-2 is an example that reading there collected data U1, U2, and U3 to the slave. The address of U1 is 0001H, the address of U2 is 0002H, and the address of U3 is 0003H.

Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable	The high byte of the number of the variable	The low byte of the number of the variable	The low byte of checking code	The high byte of checking code
03H	03H	00H	01H	00H	03H	55H	E9H

Table 2-2

Response

The response include: the address of slave, functional code, the number of the data and the CRC check.

The example table 2-3 is reading the response of U1, U2, and U3.

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Address	Functional code	The byte number of the variable	The high byte of the variable	The low byte of the variable	The high byte of the variable	The low byte of the variable	The high byte of the variable	The low byte of the variable	The low byte of checking code	The high byte of checking code
03H	03H	06H	01H	7CH	01H	7DH	01H	7CH	F9H	9BH

Table 2-3

2.2 Preset Multiple Registers (Functional code 10)

Query

The functional code 10 allows users changing the content of multiple registers. The device can be set 16 values from any starting address. The controller work with the mode of dynamic scanning, and it can change the content of the register anytime.

The Table 2-4 is an example changing the action and delay setting values of the monitor 1 and monitor 2 of the slave. The address of the action setting value of the monitor 1 is 2AH, and the delay setting value is 2BH. The address of the action setting value of the monitor 2 is 2CH, and the delay setting value is 2DH

Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable 节	The high byte of the number of the variable	The low byte of the number of the variable	The byte number of the variable	The high byte of the variable	The low byte of the variable	The high byte of the variable	The low byte of the variable	The high byte of the variable	The low byte of the variable	The high byte of the variable	The low byte of the variable	The low byte of checking code	The high byte of checking code

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03H	10H	00H	2AH	00H	04H	08H	07H	D0H	00H	0AH	07H	0D0H	00H	0AH	25H	7CH

Table 2-4

Response

The Table 2-5 is the response of changing the action and delay setting values of the monitor 1 and monitor 2.

Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable	The high byte of the number of the variable	The low byte of the number of the variable	The low byte of checking code	The high byte of checking code
03	10H	00H	2AH	00H	04H	EBH	8DH

Table 2-5

2.3 Preset Single Register (Functional code 06)

Query

The functional code 06 allows users changing the content of single register. Any single register of DAE system can use the order change the value. The controller work with the mode of dynamic scanning, and it can change the content of the register anytime.

The following example is changing the overload-action value Ir1. The address of Ir1 is 002EH.

Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable	The high byte of the variable	The low byte of the variable	The low byte of checking code	The high byte of checking code
03H	06H	00H	2EH	07H	0D0H	EBH	8DH

Table 2-6

Response

The normal response of preset single register is transmitting the receiving data after changing the value of the register.

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Address	Functional code	The high byte of the starting address of the variable	The low byte of the starting address of the variable	The high byte of the variable	The low byte of the variable	The low byte of checking code	The high byte of checking code
03H	06H	00H	2EH	07H	0D0H	EBH	8DH

Table 2-7