CANopen / Profibus-DP Gateway

PCO-150

User Manual

REV 1.5

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Table of Contents

1 About This Document

1.1 General

This document describes every parameters of the gateway PCO-150 and provides using methods and some announcements that help users use the gateway. Please read this document before using the gateway.

For further information, documentation etc., please visit the SiboTech website: http://www.sibotech.net/En/

## 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

- **CAN**: CAN bus is a kind of serial data communication protocol being developed by German BOSH from early 1980s for solving the data exchange method between modern car control and test instruments.
- **CANopen:** CANopen protocol is one of the standard being defined by CAN-in-Automation (CiA), CANopen defined application layer (Application layer), communication description (CiA DS-301), device description (CiA DSP-4XX) , all cable and port (CiA DSP-303) and so on. In OSI model, the relationship between CAN standard and CANopen protocol is shown as follow:
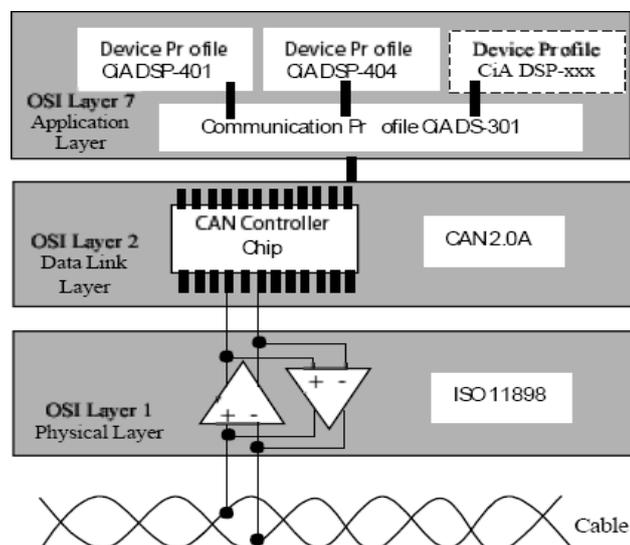
2 About the Gateway

2.1 Function

Connects multiple devices with CANopen slave interface to Profibus-DP network, and establishes communication between them.

2.2 Feature

➢ Support one CANopen master interface;

➢ CANopen interface has 1KV photoelectric isolation;

➢ Act as a **slave** at the side of Profibus-DP network, Profibus baudrate is self-adaptive, and up to 12M;

➢ PROFIBUS input and output bytes can be selected, the maximum number is:

①Max Input Bytes ≤112 Bytes

②Max Output Bytes ≤112 Bytes

2.3 Technical specification

[1] Communication baudrate:

➢ CANopen baudrate: 50kbit/s，100kbit/s，125kbit/s, 250kbit/s, 500kbit/s, 1Mbps

➢ PROFIBUS-DP baudrate is self-adaptive and can be up to 12M

[2] CAN: ISO 11898-compatible CAN interface is CAN2.0A type with an 11-bit identification

[3] DS-301 V.4.01 and CiA Draft Recommendation 303 compliant

➢ Support only expedited Download SDO and expedited Upload SDO

➢ The gateway support up to 14 TPDOs , 14 RPDOs. COB-ID of TPDO and RPDO has default value and users can use self-defining COB-ID. Default value of Transmit PDO: 384 + node address (0x180+node address) or 640 + node address (0x280+node address) or 896 + node address (0x380+node address) or1152 + node address (0x480+node address); Default value of Receive PDO: 512 + node address (0x200+node address) or 768 + node address (0x300+ node address) or 1024 + node address (0x400+ node address) or 1280 + node address (0x500+node address).

➢ Every CANopen node can has a self-defining COB-ID, but the COB-ID can not be conflicting with CANopen protocol.

➢ The gateway support up to14 TPDOs, 14 RPDOs, 28 upload SDOs and 28 download SDOs;

➢ Support NMT management, TPDO time-out reset and SYNC function；

➢ Support heartbeat only;

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[4] Work condition:

- ➢ Relative Humidity: 5% to 95%(No condensation)
- ➢ Temperature: -20℃ to 60℃, and the average of 24 hours can not beyond 45℃
- ➢ Height above sea level can not beyond 2000 meters
- ➢ Pollution level: 3

[5] EMC testing standard compliant

[6]Power: 24VDC (11V~30V), maximum 90mA (24V)

[7]Mechanical size: 125mm (H)*110mm (W)*40mm (D)

[8] Installation: 35mm rail

2.4 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.

2.5 Related products

Related products include:

PCA-100, ENC-310, ENC-311, ENB-302, PCO-150S and so on

More information about these products, please visit: http://www.sibotech.net/En/, or dial technical support line: +86-21-5102 8348

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3 External View
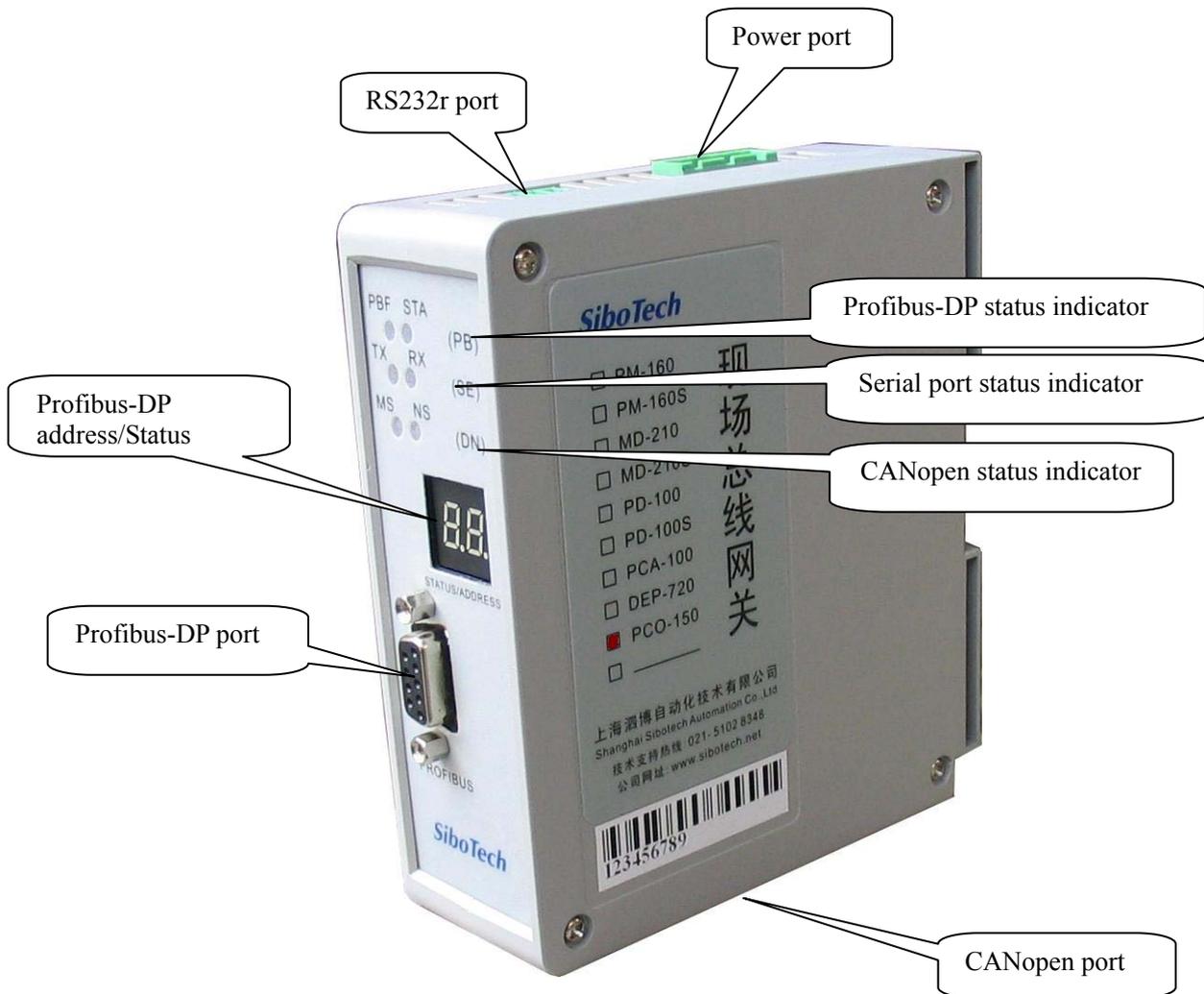
3.1 Indicators
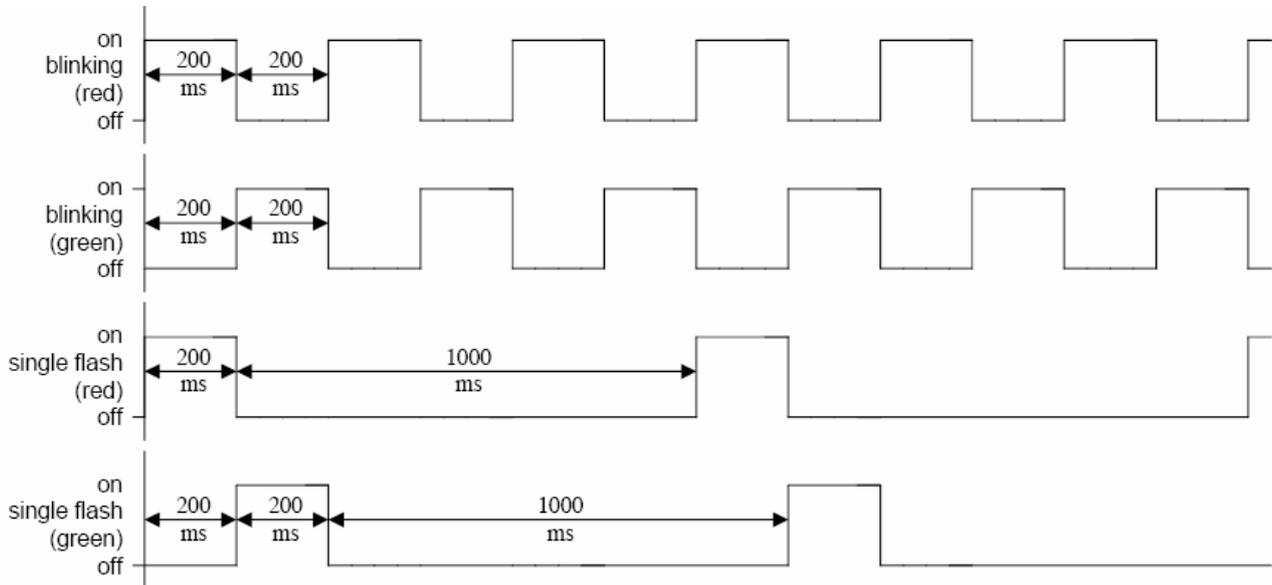
Indicators		Status	Description
Profibus Status	**PBF (red)**	On	Profibus-DP connection has not been established
		Off	Profibus-DP connection has been established
	STA (green)	Blinking	Exchanging data
		Off	Profibus-DP status is abnormal
Serial Port	**TX (red)**	Blinking	Serial port is transmitting data
		Off	Serial connection fails to establish or error
	RX (green)	Blinking	Serial port is receiving data
		Off	Serial connection fails to establish or error
CANopen-STATUS	**ERR (bicolor)**	Red on	The CAN controller is bus off
		Single flash (red)	At least one of the error counters of the CAN controller has reached or exceed the warning level (too many error frames)
		Orange on	The device is in state of configuration
		Red off	No error, the device is in working condition
	RUN (bicolor)	Green on	The device is in state of OPERATIONAL
		Single flash (green)	The device is in state STOPPED
		Blinking (green)	The device is in state PRE-OPERATIONAL
		Orange on	The device is in state of configuration

3.2 DIP switches

The 2-switch DIP switch in the bottom is used for setting operating mode of the device.
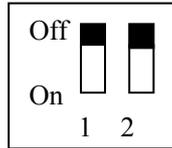

Status(1)	Status(2)	Description
X	On	Configuration mode
On	Off	Run mode with debug function
Off	Off	Run mode

Note: "X" is any state.

3.3 Rotary switch

The 2-code rotary switch in the left-side is used for setting the Profibus-DP address of the device.
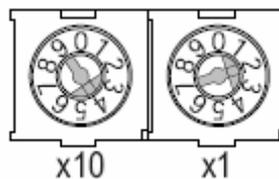
In this example, the Profibus node address will be 42 (4x10) + (2x1).

3.4 Connectors

3.4.1 PROFIBUS-DP connector

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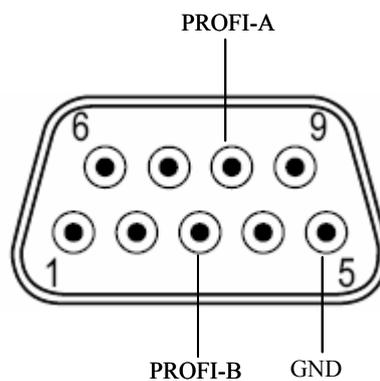
| DB9 pin	Function
3	PROFI_B, Data positive
5	GND (optional)
8	PROFI_A, Data negative

3.4.2 CANopen connector

5-pin connector：

GND　CAN-L　　CAN-H　+24V
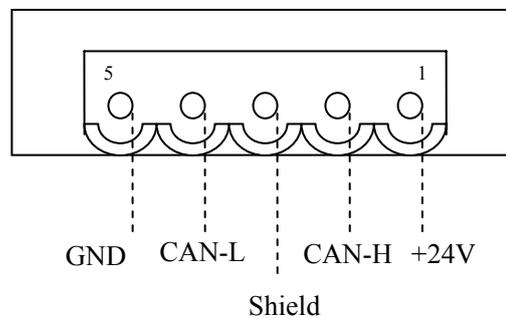
Shield

Open five-pin connector at the side of CAN:

| Pin	Connection
1	+24V (Optional)
2	CAN-H
3	Shield (Optional)
4	CAN-L
5	GND

Note 1: Connections of pin1 and pin 3 are optional, but connections of pin 2, pin 4 and pin5 are necessary;

Note 2: Pin 5, pin1 of CANopen interface interlinks V+, GND of power interface. You can only power on one of the two interfaces.

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3.5 Others

3.5.1Power interface
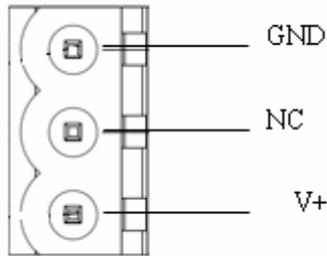
Note 1: V+, GND of power interface interlinks +24V, GND of CANopen interface. You can only power on one of the two interfaces.

3.5.2 RS232 interface
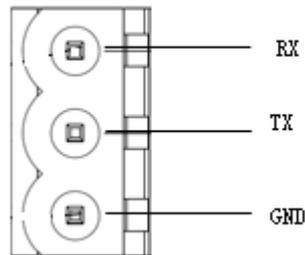
Note 1: Connect RX, TX and GND of the interface with RX (pin 2), TX (pin 3) and GND (pin 5) of PC, and then you can configurate PCO-150 through PC-123.

3.5.3 LED

In the configuration mode, LED display CF, when downloading configuration, LED alternates display "C" and "F";

LED displays Profibus-DP slave address when gateway is in run mode.

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4 Use Method

4.1 Quick start

1. This gateway has tow modes: configuration mode and run mode, you can select different mode through DIP switch. Dial "mode" DIP switch to "on", the gateway is in configuration mode, and dial "mode" DIP switch to "off", the gateway is in run mode;

2. Connect RS232 serial port to a PC and dial "mode" DIP switch to "on" then power on the module;

3. In the configuration mode, set CANopen baud rate, CANopen node ID, SDO commands, PDO commands and data mapping between CANopen and Profibus-DP through PC-123. (See section 4.3 for details).

4. Dial "mode" DIP switch to "off" state, configurate Profibus-DP address through rotary switch, power on again and the module go into run status.

5. In run mode, users can debug data in input and output buffer through dialing "debug" DIP switch to "ON" status. Users can see the data in debug interface of PC-123 through RS-232 interface; Users can use the function at the beginning of network communication, when the network is OK, please close the debug function, that is dial "debug" DIP switch to "off".

4.2 Hardware connection

1. In accordance with the PROFIBUS port instructions, properly connected with DB9, recommended standard Profibus-DP connector.

2. In accordance with the CAN port instructions, properly connected the 2, 4 pin at least.

3. Check all connections.

4. Dial configuration DIP switch to "RUN", power on the module, and the module go into run status.

4.3 Software configuration

Users can connect PCO-150 to a PC through RS-232 port, and configurate parameters of gateway through PC-123, including the gateway address at the side of CANopen, CAN baud rate, and input and output bytes.

See user manual of PC-123.

4.4 Run

4.4.1 Data exchange mode

Communication mode between CANopen and Profibus-DP is asynchronous mode, as shown below:
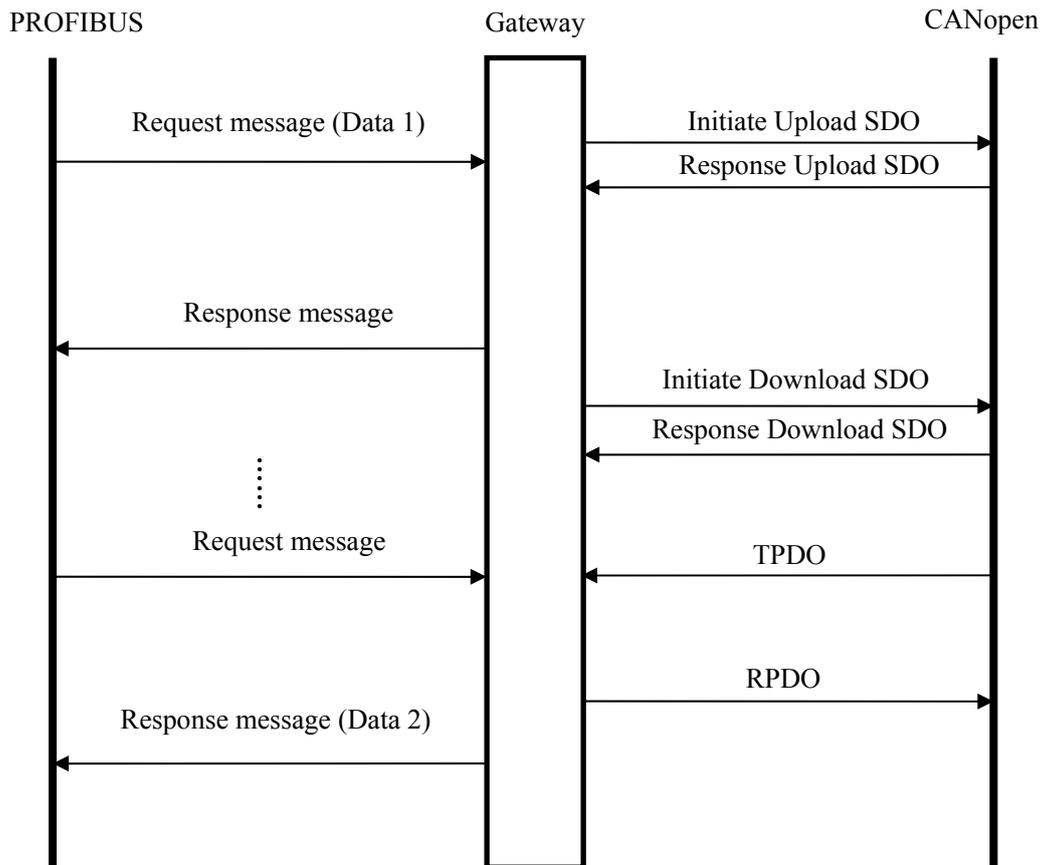
"Data 1" shows data transfer process from PROFIBUS to CAN; "Data 2" shows data transfer process from CAN to PROFIBUS.

PCO-150 run in CANopen network independently, and transmit parameters read/write commands of CANopen periodically according object dictionary, also transmit and receive PDO commands. If receive I/O request from Profibus-DP, respond with the latest CANopen data to realize the matching of network speed. This is asynchronous mode.

TPDO and RPDO apply producer/consumer mode, and often be used in occasion with high demand about speed; Upload SDO and Download SDO apply client/server mode, the mode can guarantee safety of data, and often be used in occasion with low demand about speed.

The data in output buffer of PCO-150 (Profibus-DP) is the data being transmitted to CANopen slave by RPDO commands and fast Download commands. Outputting mode of PCO-150 is change of status, when the

outputting data is changed, PCO-150 transmits corresponding commands (RPDO or Download SDO) to CANopen network; PCO-150 receives data through TPDO commands and Upload SDO commands configurating in configuration software PC-123 and save the data to input buffer.

When "Control & Status" is set to "Enable" in configuration software (PC-123), there are two bytes in the end of input and output buffer of PCO-150 showing status of CANopen slaves and controlling status of CANopen slave.

The last two bytes of input buffer (Profibus-DP) showing status of CANopen slaves. The first byte of the two bytes is address of CANopen slave and the second byte of the two bytes is status of CANopen slave (i.e. Pre-run status, run status, stop status and more information please refer to CANopen protocol). One moment in time the two bytes only show status of one CANopen slave, PCO-150 apply FIFO mechanism to save all the status of every CANopen slave to Profibus-DP input buffer.

The last two bytes of output buffer (Profibus-DP) control status of CANopen slaves. The first byte of the two bytes is address of CANopen slave, the second byte of the two bytes is command controlling CANopen slave (i.e. go into pre-run status, go into run status, go into stop status, reset node, reset application and reset communication, for specific command format, please refer to NMT of CANopen protocol).

4.4.2 Profibus-DP Data Module

Data modules of gateway are shown as follow:

Numner	Input	Output
1	112 bytes	112 bytes
2	96 bytes	96 bytes
3	48 bytes	48 bytes
4	16 bytes	16 bytes
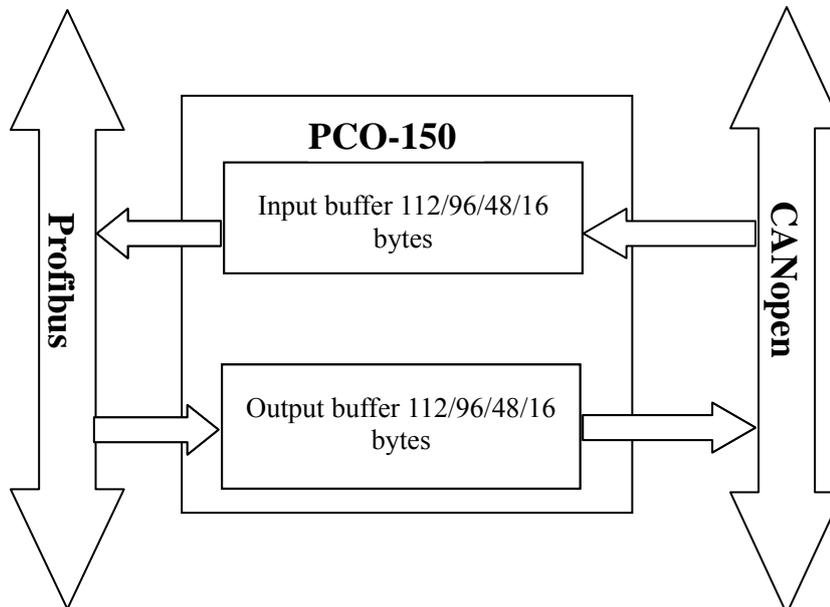
5 Step7 Read and Write Gateway Data

Data module of PCO-150 that with **total length** as its consistent are shown as follow:

96Byte In, 96Byte Out

16 Byte In, 16 Byte Out

When use "96Byte In, 96Byte Out", "16 Byte In, 16 Byte Out", users must apply "SFC 14" read data and "SFC 15" write data in Step 7 programming.
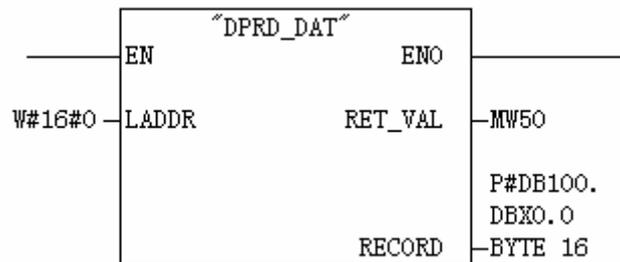
SFC14
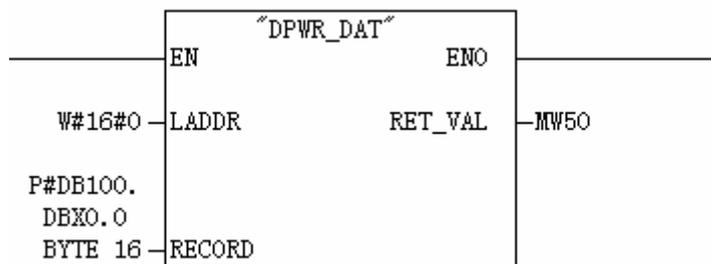
SFC15

Data module of PCO-150 that with **word** as its consistent is shown as follow：

112 Byte In, 112 Byte Out

When use "112 Byte In, 112 Byte Out", users can apply "MOVE" command read and write data in Step7 programming.

Data module of PCO-150 that with **byte** as its consistent is shown as follow：

48 Byte In, 48 Byte Out

When use "48 Byte In, 48 Byte Out", users can apply "MOVE" command read and write data in Step7 programming.

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6 Installation

6.1 Mechanical Dimension

Mechanical Dimension: 40mm (W)*125mm (H)*110mm (D)
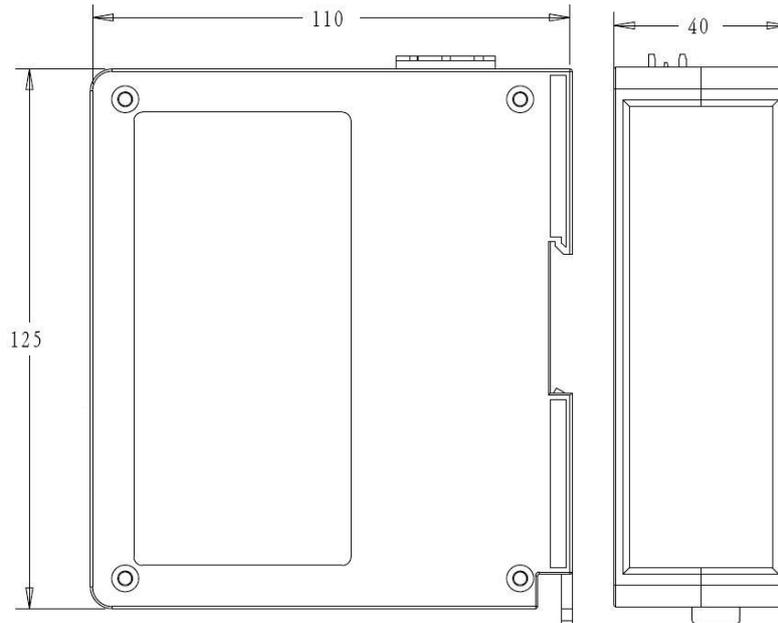
6.2 Installation

35mm DIN rail installation
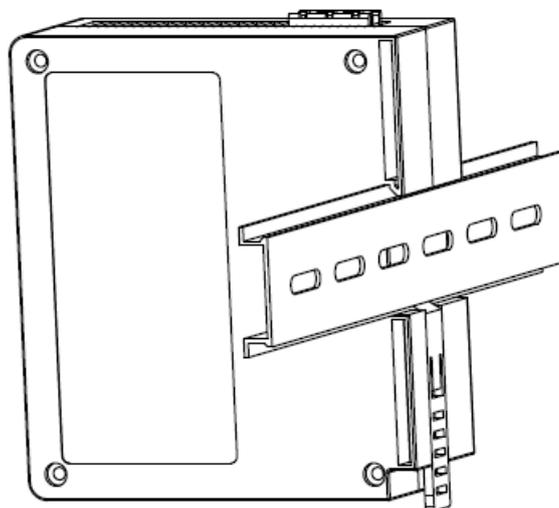
7 Failures and Suggestions

Number	Description	Suggestions
1	PBF（Profibus-DP Failure） always read	Profibus-DP connection fail
2	PBF（Profibus-DP Failure）read out	Profibus-DP connection OK
3	CAN-STATUS read light on in run status	CAN BUS OFF or error counter beyond alert value; Check CAN baudrate of gateway, and the baudrate must be the same with other nodes of CAN network
4	CAN-STATUS read light blinking in run status	Need a terminal resistance[1] on CAN network or there is no connection between gateway with CAN network
5	CAN-STATUS green light on but CAN transmit and receive data fail in run status	Need a terminal resistance[1] on CAN network or the node connected with gateway fail
6	CAN-STATUS read light blinking in run status occasionally	There is error frame form CAN network, will not affect communication
7	CAN-STATUS read light always blinking in run status and no data in Profibus-DP	Check the baudrate of all the nodes on the CAN network; If they are all the same, please change a low baudrate and try again
8	ERR and RUN lights blinking fast	Check Profibus-DP network

Note: Terminal resistance[1]

When communication distance is long or communication baudrate is high, users need a terminal resistance (120Ω/2W) in both terminals of communication lines.

Appendix: Using STEP7 Set Profibus-DP

The following show how to use STEP7 to configure PCO-150:

First of all, copy *. gsd file to the following path: ***Step7\S7data\gsd***

1. Open SIMATIC Manager ; Figure 1:
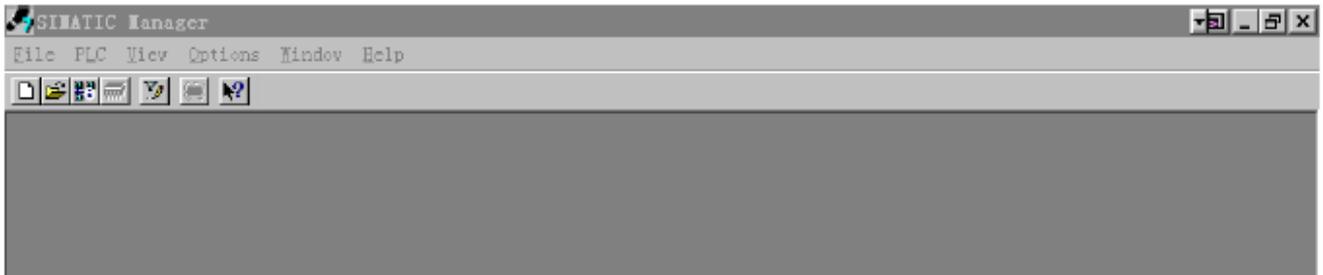
Figure 1

2. Click File->New, create a new project; Figure 2:
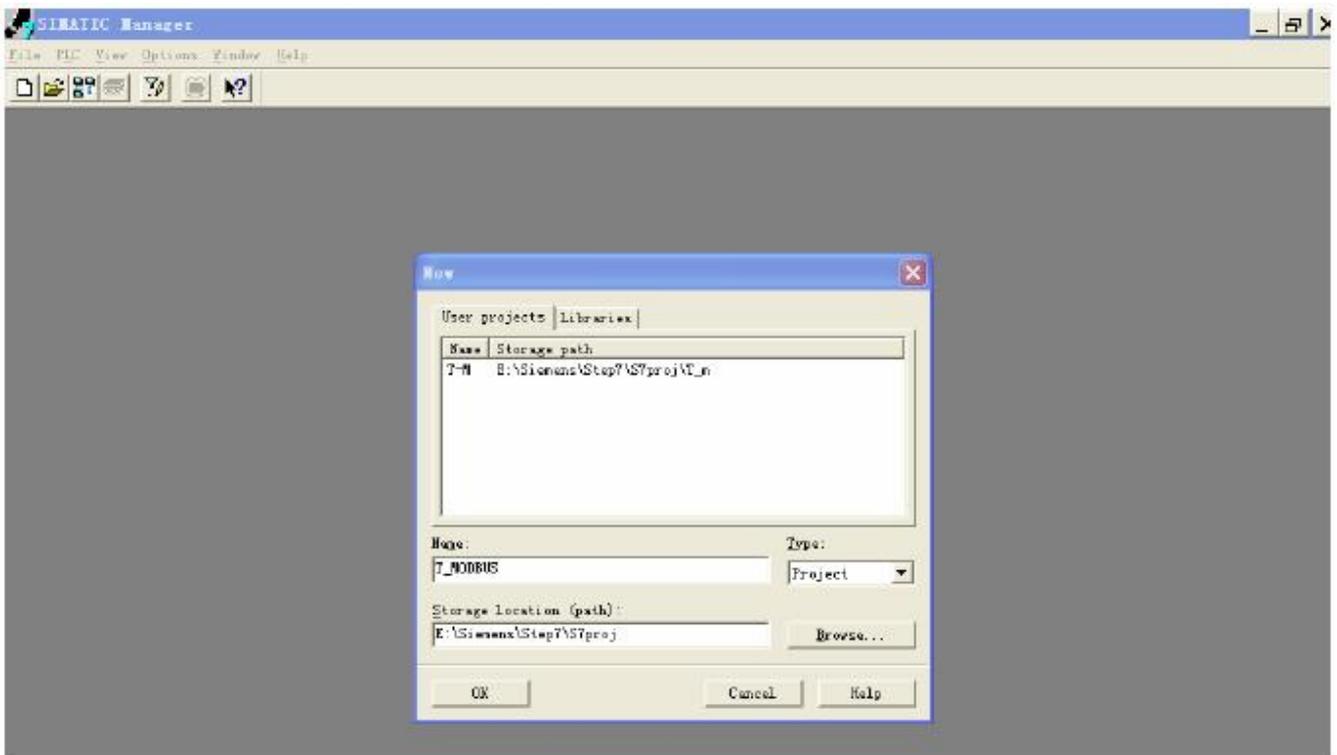
Figure 2

3. Insert->Station->SIMATIC 300 Station; Figure3:
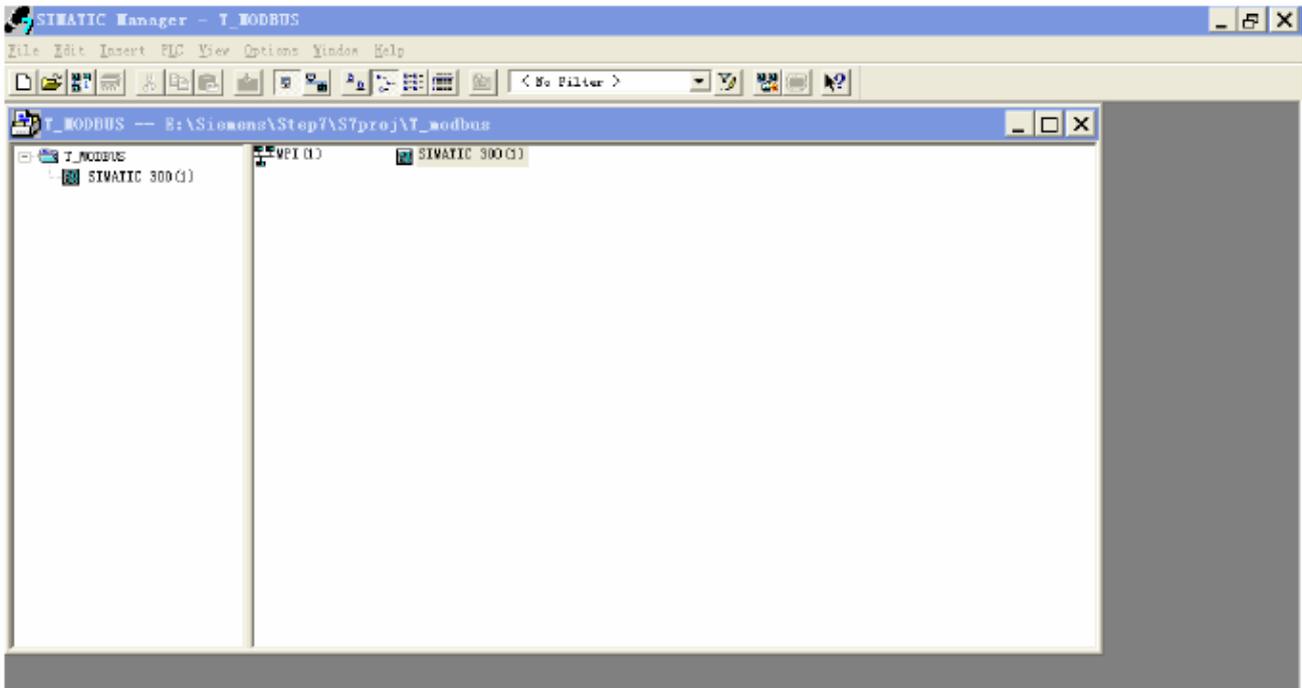
Figure 3

4. Open S7 PLC hardware configuration: SIMATIC 300(1)->Hardware, double-click; Figure 4:

Figure 4

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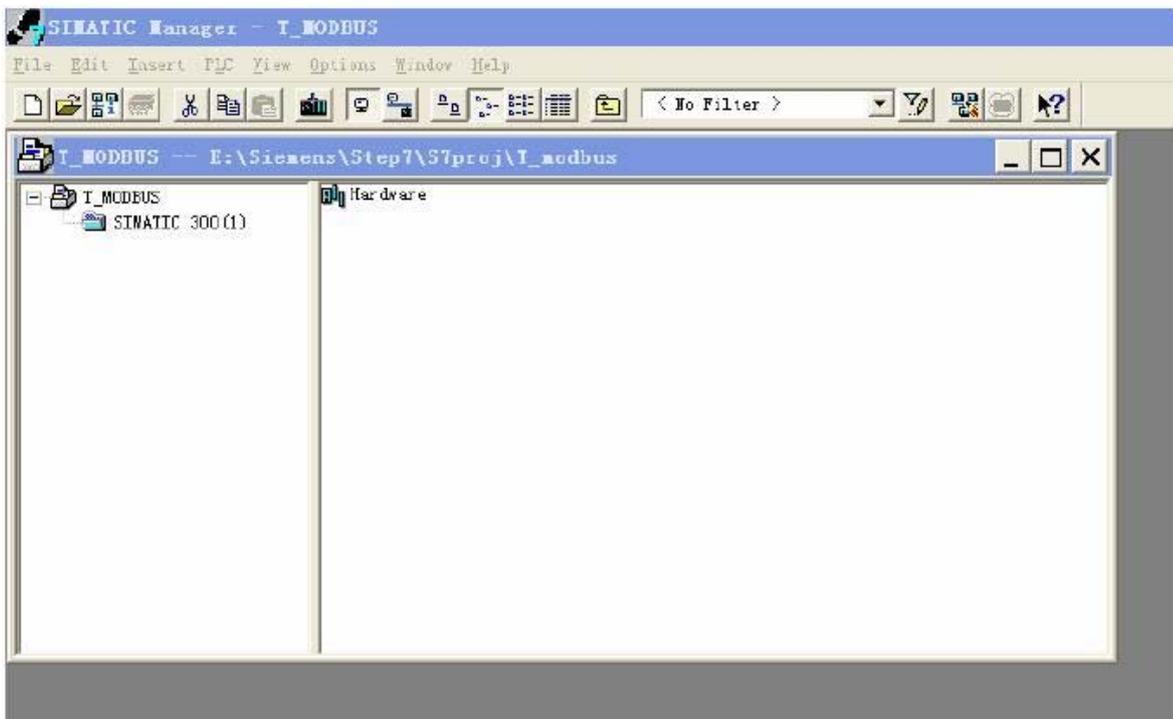
5．Click Option->Update Catalog, update GSD in device catalog.
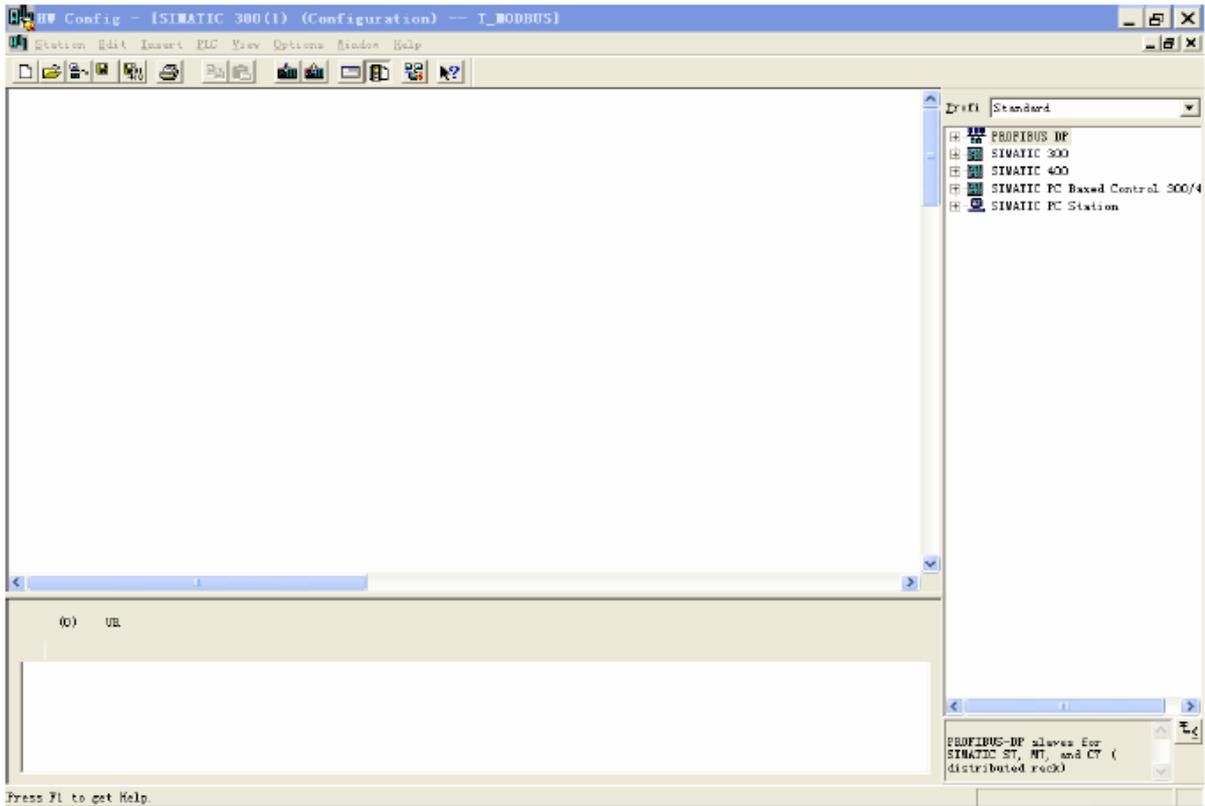
Figure 5

6. Here you can find your equipment in the right side of the window; Figure 6

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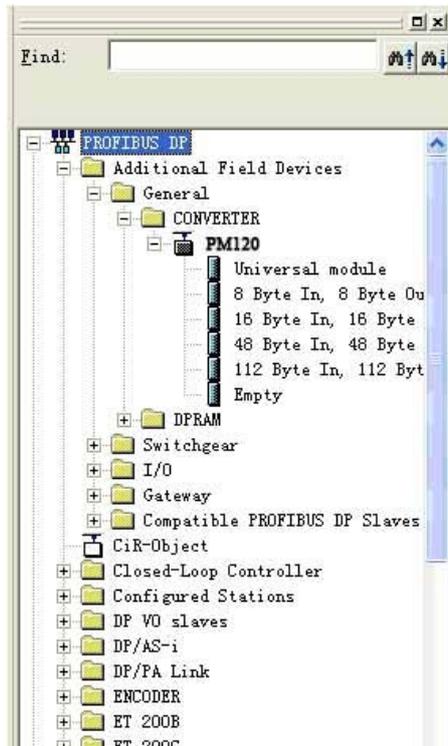
Figure 6

7.   Set PLC rack, click the "Hardware Catalog \ SIMATIC 300 \ RACK-300 \ Rail"; Figure 7:

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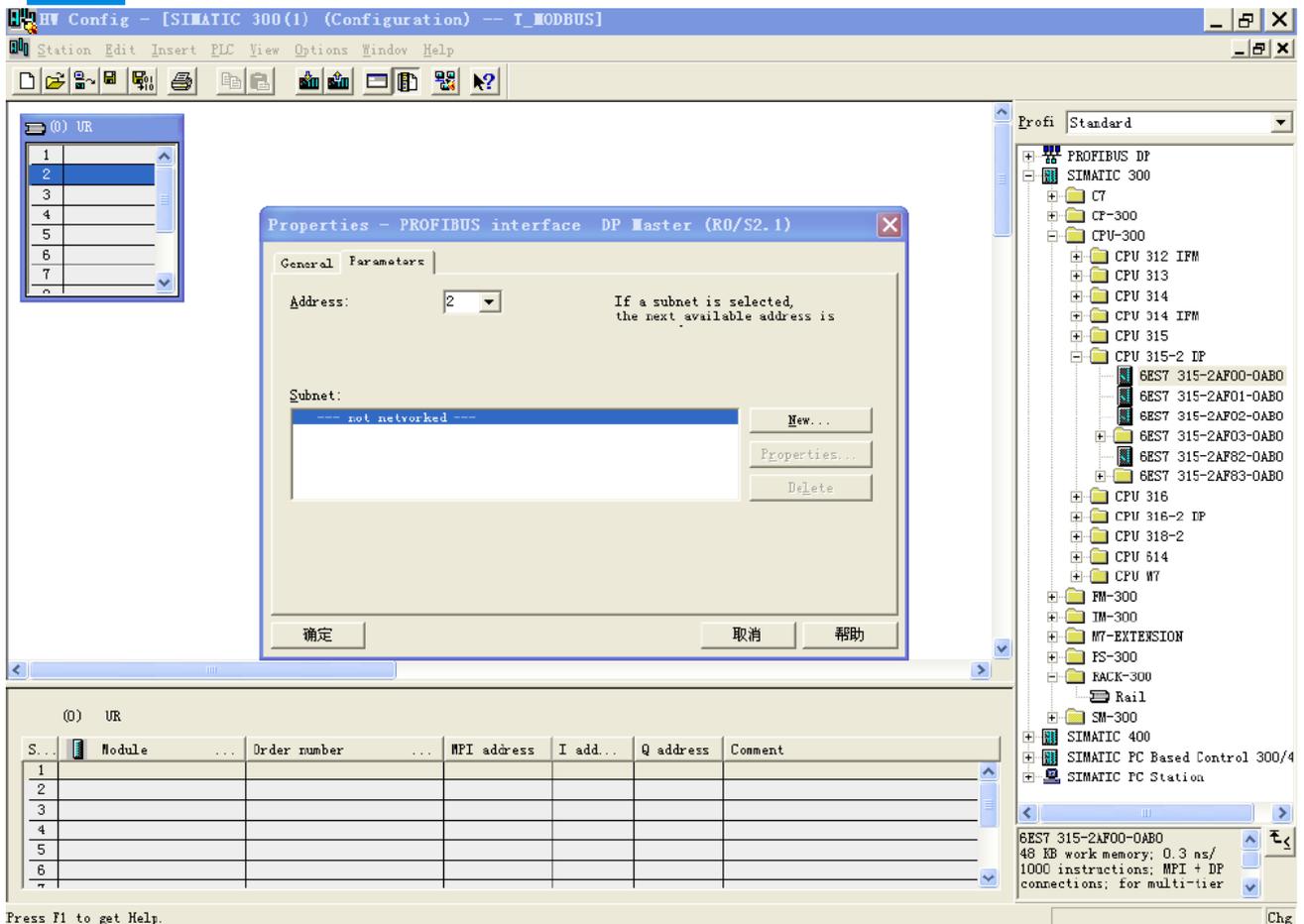
Figure 7

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

9. Create Profibus-DP network and set up Profibus-DP: Click New and then Network settings, select DP; select a baud rate such as 187.5Kbps, then "OK". Double-click it; Figure 8:

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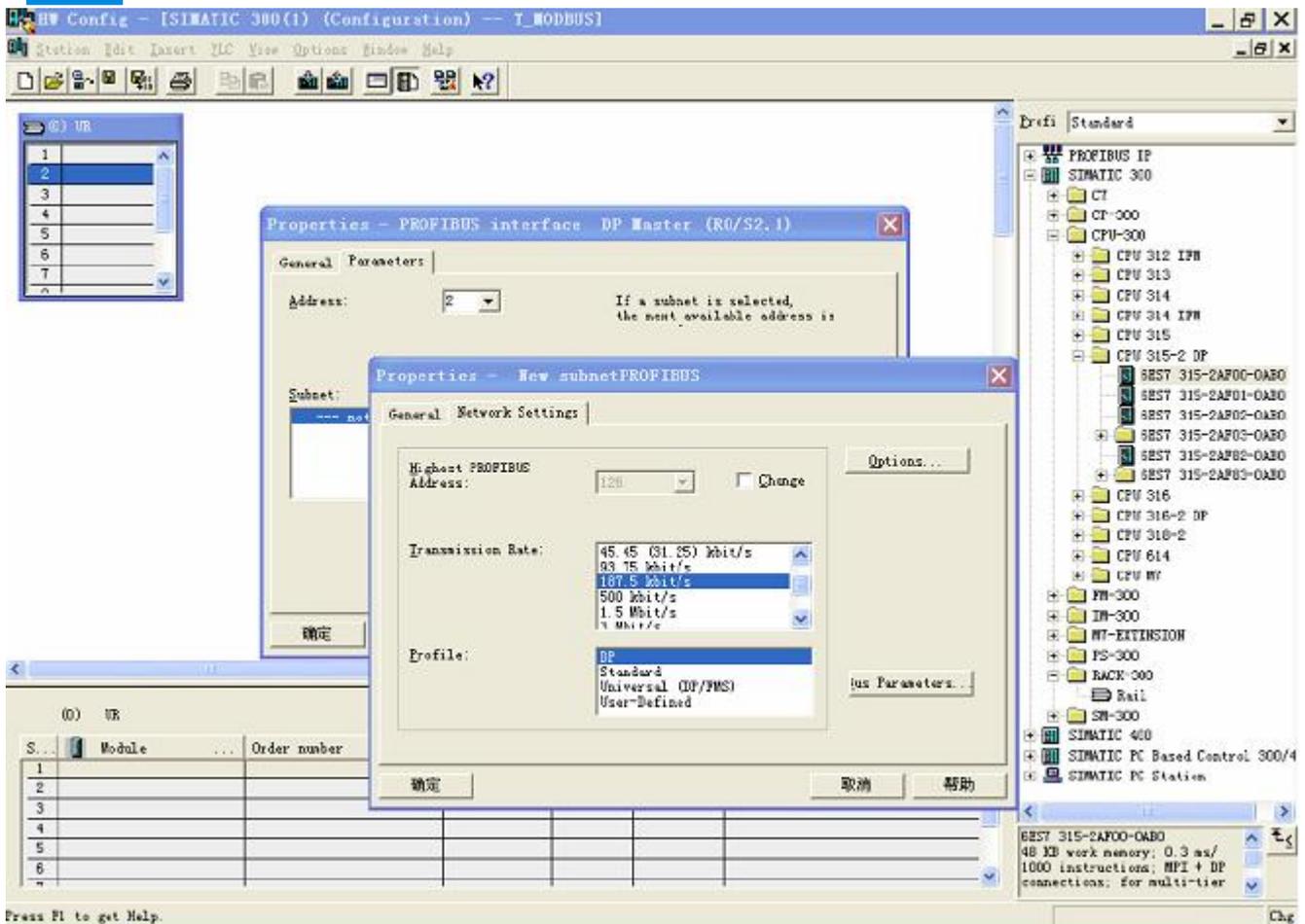
Figure 8

10. Select Profibus Master station address, Figure 9:

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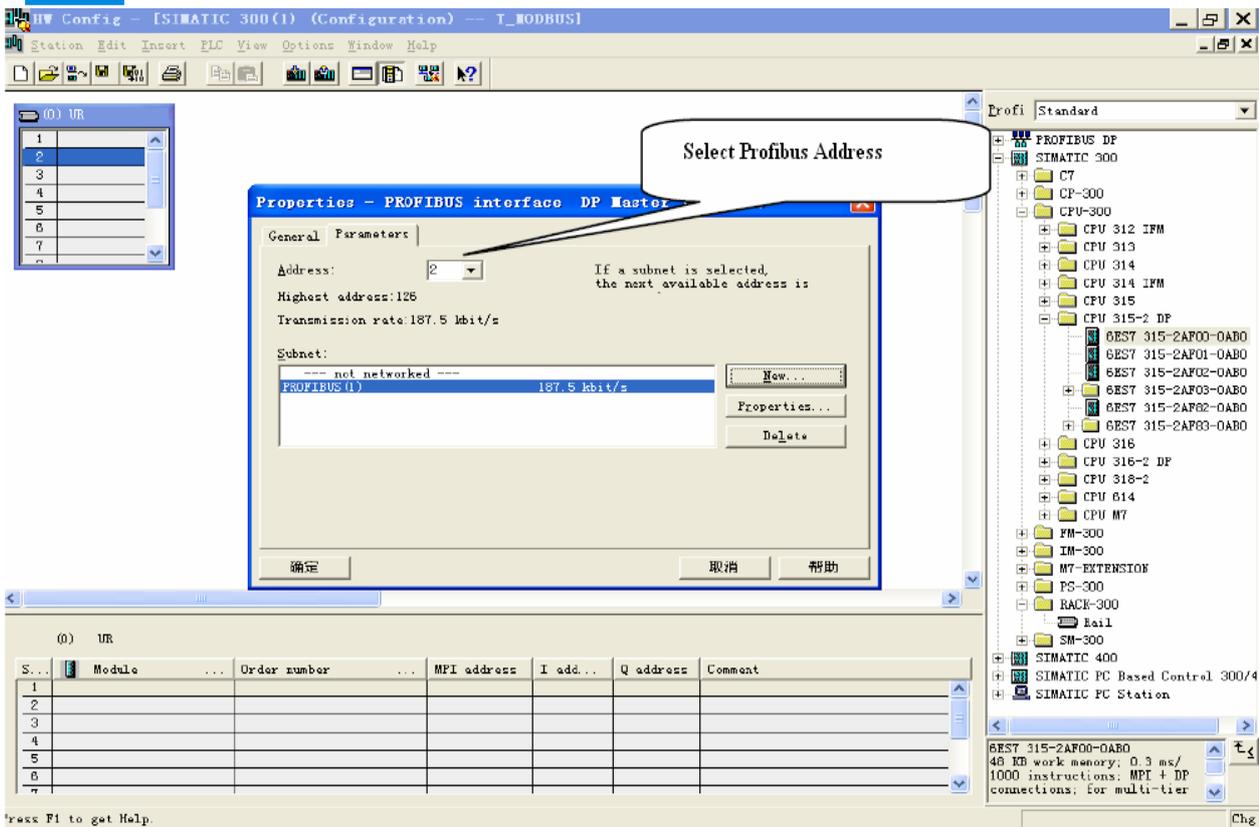
Figure 9

11. Drag PCO-150 to Profibus-DP network bus, and drag data modules to slots, that is mapping the input and output data module into master controller's memory. Figure 10:
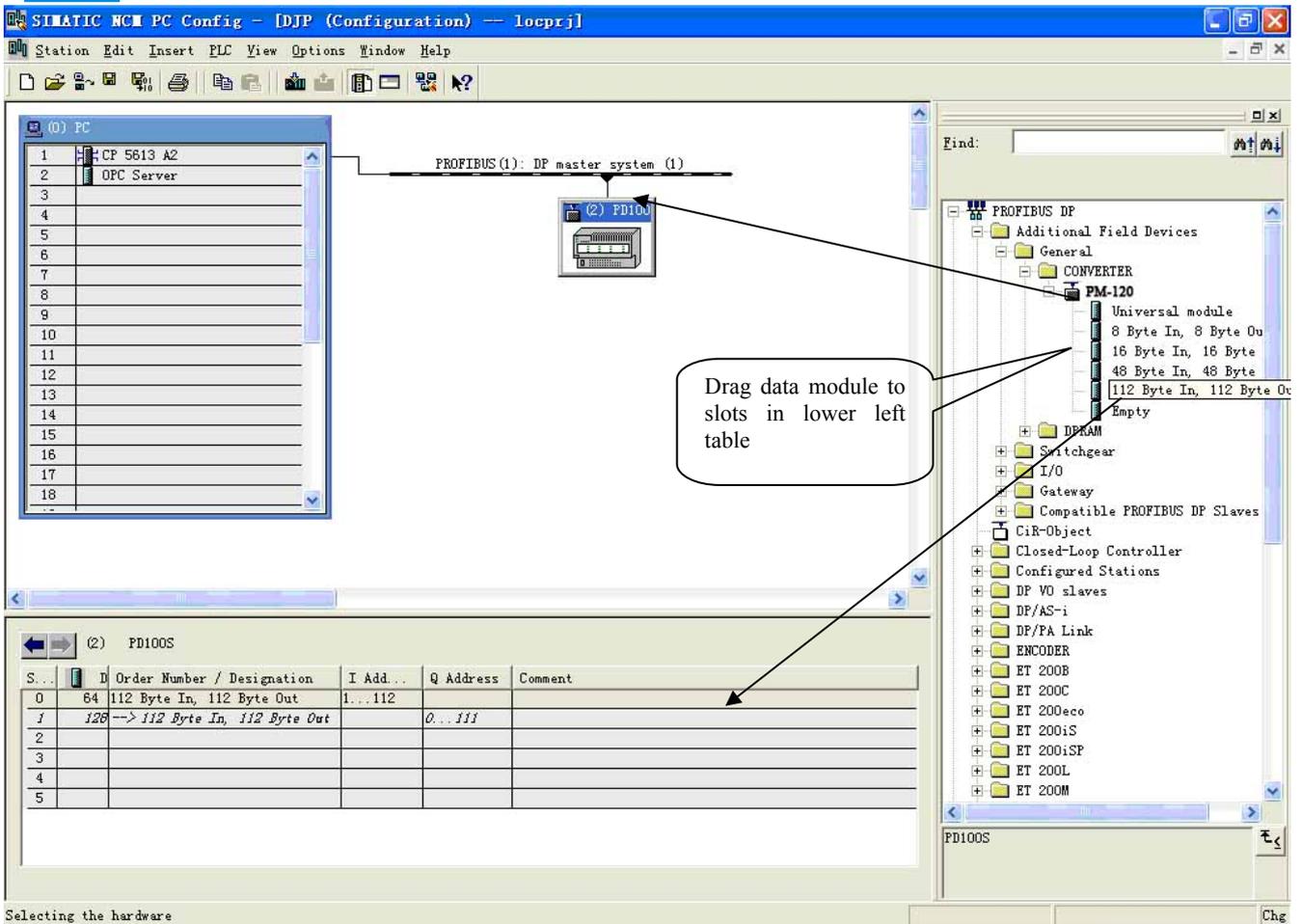
Figure 10

Operation is divided into two steps, the first step is dragging PCO-150 to Profibus-DP network bus, the mouse will change shape, and that is to say, it can be placed. The second step is dragging data module into master controller's memory.

Note 1: Users configure input and output bytes of PCO-150 through configuration softwarePC-123.If users select 48, and then drag "48 Byte In, 48 Byte Out" to the slots. The default is "112 Byte In, 112 Byte Out"。

Note 2: The Profibus-DP slave address must be in line with the settings of module DIP switch!

12. Compiler and download into PLC.

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