

PROFIBUS DP / Modbus TCP Gateway

EP-321MP

User Manual



REV 1.2

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1 Product Overview

1.1 General

This document describes every parameters of the gateway EP-321MP 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 cannot be copied without authorization. Sibotech maybe upgrade 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.

2 About the Gateway

2.1 Function

Connects Modbus TCP devices to PROFIBUS DP network, and establishes communication between them.

2.2 Features

- ◆ With an Ethernet interface (Modbus TCP master / Modbus TCP slave) and a PROFIBUS DP slave interface;
- ◆ Ethernet 10/100M adaptive;
- ◆ IP address conflict detection;
- ◆ Support DHCP, BOOTP and static setting;
- ◆ Support standard Modbus TCP master and slave protocol;
- ◆ I / O data monitoring capabilities;
- ◆ Easy-to-use configuration software EP-123

2.3 Technical specification

[1] PROFIBUS DP V0 protocol support, in line; JB / T 10308.3-2001: measurement and control of digital data communication in industrial control systems Part 3 of the fieldbus: PROFIBUS DP specification;

[2] PROFIBUS DP slave, baud rate adaptive, maximum baud rate of 12M;

[3] PROFIBUS DP input data up to 244 bytes of output data up to 244 bytes input + output data up to 488 bytes;

[4] As a Modbus TCP master Gateway, it can support up to Modbus TCP server access to 36 different IP or a different cell identifier;

[5] Gateway as a Modbus TCP master to support the function code: 01H, 02H, 03H, 04H, 05H, 06H, 0FH, 10H;

[6] Gateway as a Modbus TCP slave, up to 36 TCP connection;

[7] Gateway as a Modbus TCP slave, to support the function code: 03H, 04H, 06H, 10H;

[8] PROFIBUS DP interface the 1KV photoelectric isolation;

[9] Power supply 24VDC (11V to 30V), 160mA (24VDC);

[10] Operating temperature: -4 ° F to 140 ° F (-20°C~60°C), relative humidity 5% ~ 95% (non-condensing);

[11] External Dimensions (W*H*D): 1.57in*4.92in*4.33in (40mm* 125mm * 110mm);

[12] Installation: 35mm DIN rails;

[13] Protection class: IP20;

[14] Test standard: Complies with EMC test standards.

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

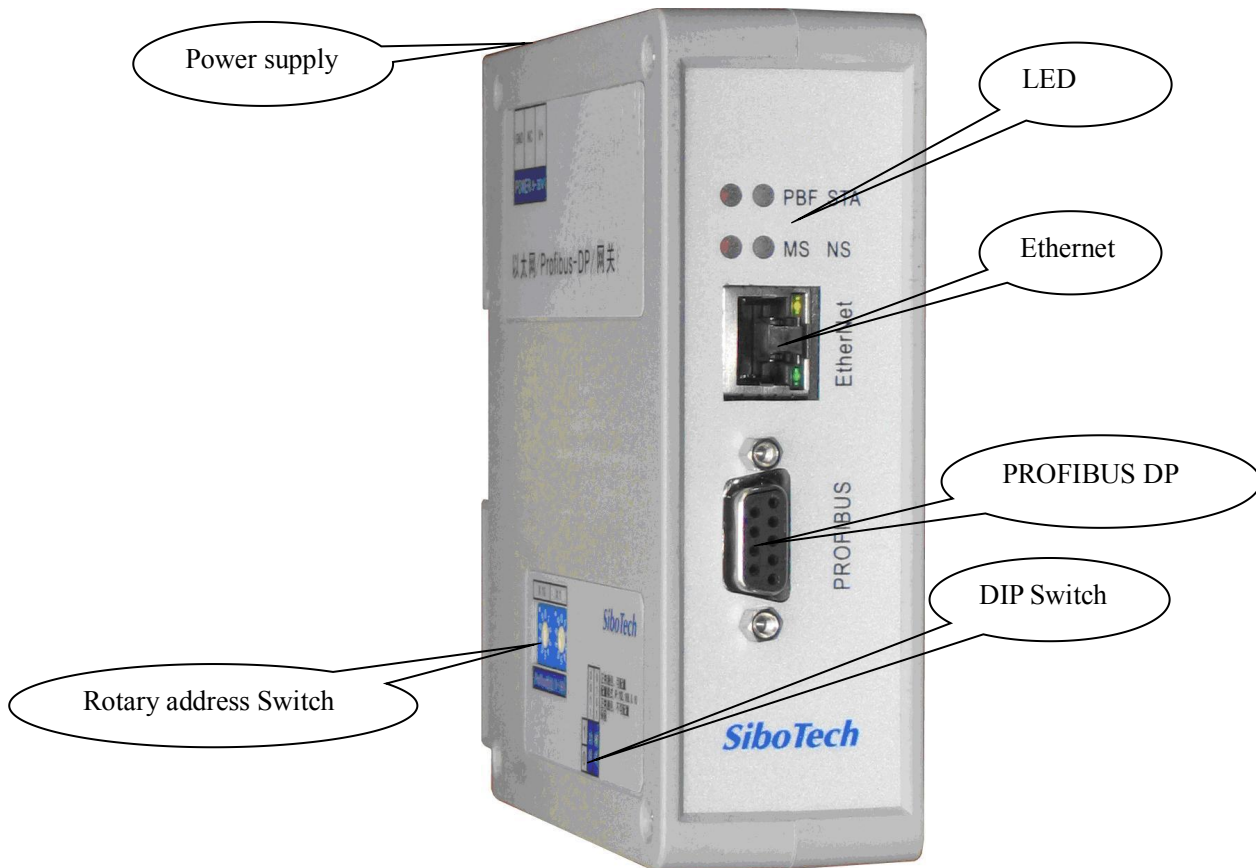
Related products include:

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

3 Hardware Description

3.1 Product Appearance



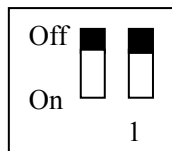
3.2 Indicators

Indicators	Status	Description
STA(green)	flash	PROFIBUS DP bus data is communicating
	Off	No data exchanging
PBF (red)	On	PROFIBUS DP connection has not been established
	Off	PROFIBUS DP connection has been established
MS	Flash(red)	DHCP or BOOTP status
	On (red)	IP confliction
	OFF(red)	Normal communication
NS	On(green)	Modbus TCP connection has been established
	Flash(green)	Modbus TCP connection is not established or disconnected
	OFF(green)	Modbus TCP is not started
MS, NS, and STA flashes once		Boot up
MS and NS ON		Configuration status

3.3 DIP Switch

3.3.1 Status Configuration Switch

The configuration switch is located on the button of the product. The function is listed below:



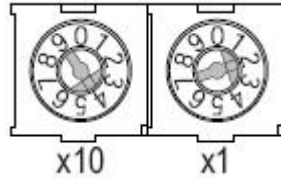
Status(1)	Status(2)	Description
Off	Off	Run mode, allow reading and writing configuration data
Off	On	Run mode, reading and writing configuration data are not allowed
On	Off or On	Configuration mode, IP address is 192.168.0.10 (fixed), this mode can read and write configuration data but cannot finish communication between Modbus TCP and PROFIBUS DP

Notes:

Restart EP-321MP (power off and power on) after resetting the configuration to make the configuration take effect!

3.3.2 PROFIBUS DP Address Setting Switch

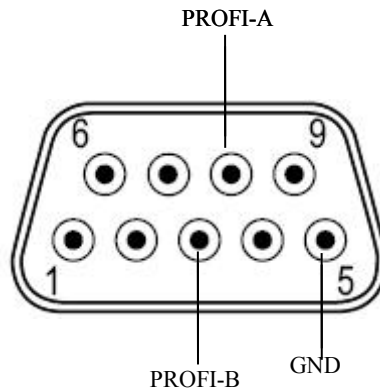
The 2-code rotary switch in the left-side is used for setting the PROFIBUS DP address of the device.



In this example, the PROFIBUS node address will be 42 ((4x10) + (2x1)).

3.4 Connectors

3.4.1 PROFIBUS DP Connector



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

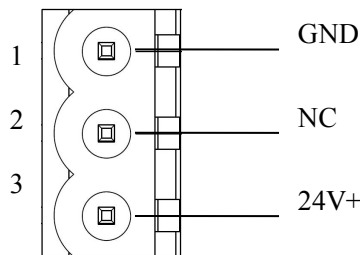
3.4.2 Ethernet Connector



RJ-45 port

pin	Signal Descriptions
S1	TXD+, Tranceive Data+, output
S2	TXD-, Tranceive Data-, output
S3	RXD+, Receive Data+, input
S4	Bi-directional Data+
S5	Bi-directional Data-
S6	RXD-, Receive Data-, input
S7	Bi-directional Data+
S8	Bi-directional Data-

3.4.3 Power Connector



Pin	Function
1	GND, Power ground
2	NC, not connected
3	24V+, 24VDC

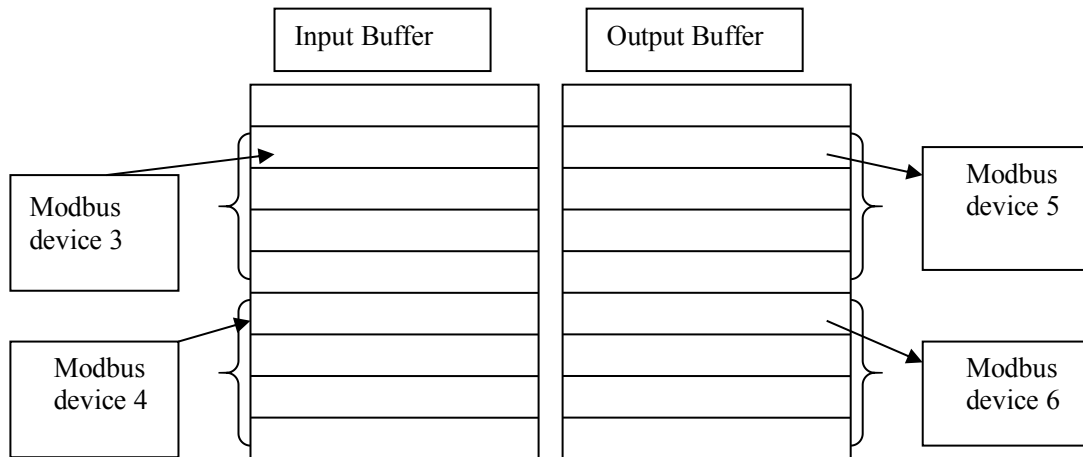


4 Modbus TCP master

4.1 Working Principle

The Ethernet port supports Modbus TCP master functions, as follows:

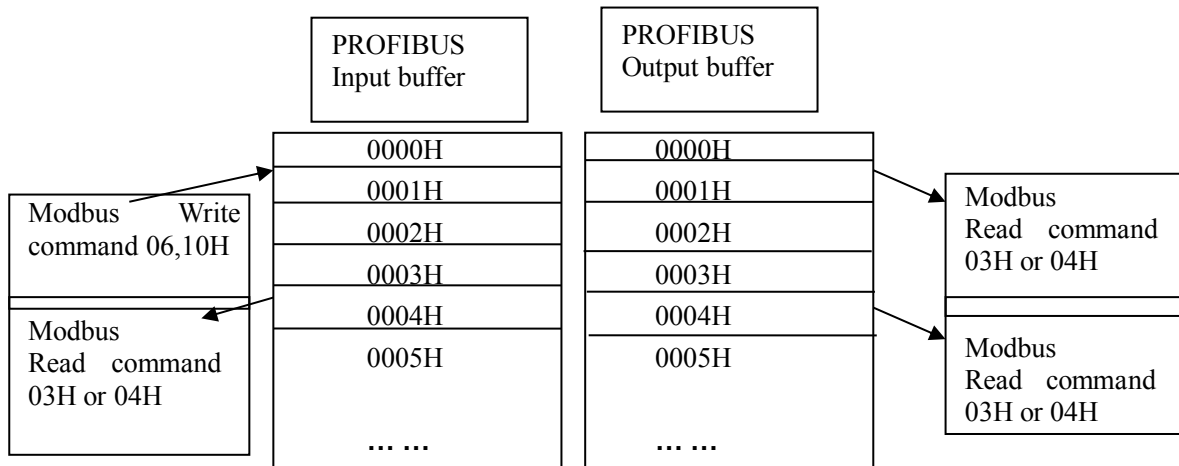
Data exchange of Modbus TCP and PROFIBUS DP of EP-321MP is set up through “mapping”. There are two data buffer areas, one is PROFIBUS DP network input buffer and the other is PROFIBUS DP network output buffer. When the gateway acts as Modbus TCP master, Modbus read commands will write the read data to the network input buffer for PROFIBUS DP accessing. Modbus write register commands get data from network output buffer and export to the Modbus TCP slave equipment through write command.



Modbus TCP can support up to 36 Modbus TCP slave nodes and 128 commands, each command reads a set of consecutive Modbus registers.

5 Modbus TCP Slave

5.1 Working Principle



Data exchange of Modbus TCP and PROFIBUS DP of EP-321MP is set up through “mapping”. There are two data buffer areas, one is PROFIBUS DP network input buffer and the other is PROFIBUS DP network output buffer. Network input and output buffer is all for PROFIBUS DP. When the gateway acts as Modbus TCP slave, Modbus write register command will write the read data to the network input buffer for PROFIBUS DP accessing. Modbus read command gets data from network output buffer and export to the Modbus TCP master equipment through response message.

The gateway acts as Modbus TCP slave, support function: 03H, 04H, 06H and 10H. Users can select 03H function code to read the data PROFIBUS DP master outputted or use 04H function code to read the data PROFIBUS DP master outputted.

Network input buffer is Modbus TCP master output at the Modbus TCP side. It is mapped to the Modbus holding register. Users can use No.3 command or No.4 command to read back. Users can select command No. in the configuration software.

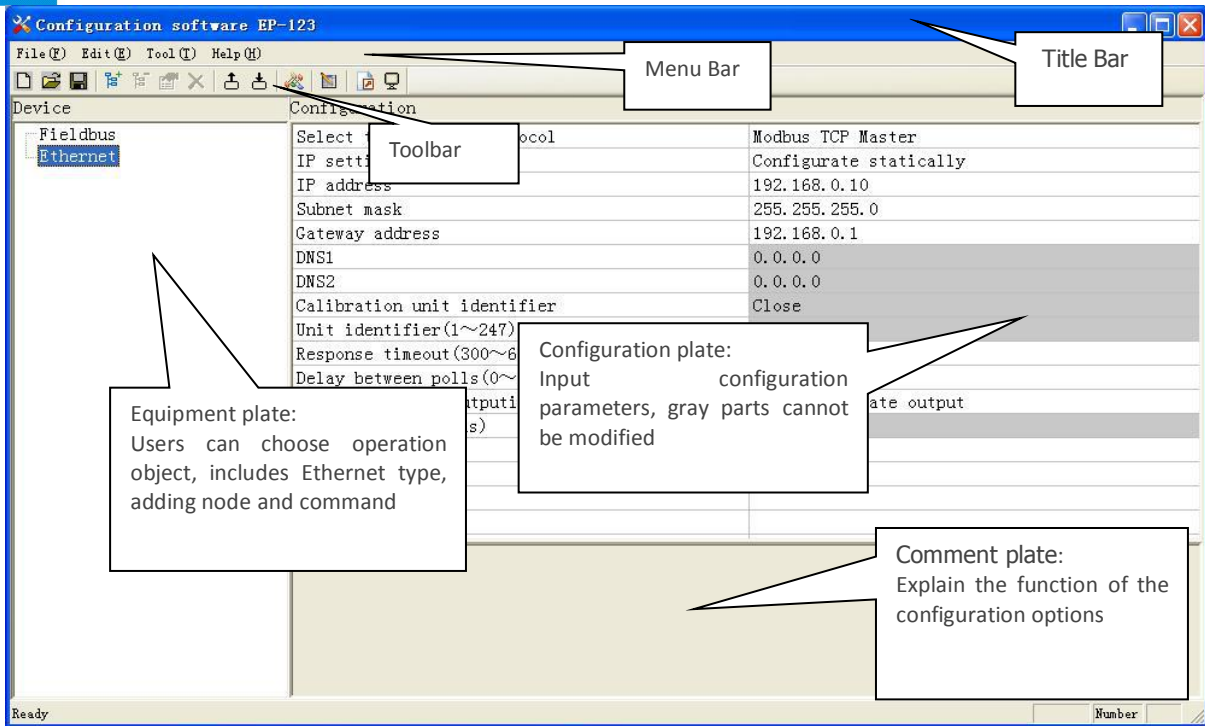
Network output buffer is Modbus TCP master input. It is mapped to Modbus input register. Users can use No.4 or No.3 function code to read data. Users can select command No. in the configuration software.

5.2 Network Status Monitoring

When the Gateway is a Modbus TCP slave, the gateway has the function of monitoring the network status.

When the Monitoring is enabled, the first word of input buffer is used as counter which record the number of TCP connections.

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Toolbar:


Toolbar as shown below:




The function from left to right is: New, Open, Save, Add Nodes, Delete Nodes, Add Commands, Delete Commands, Upload Config, Download Config, Conflict Detect, Auto Mapping, Export Xls and Monitor I/O data.

 New: Create a new project

 Open: Open a project


 Save: Save the project


 Add a node: Add a Modbus TCP slave


 Delete a node: Delete a Modbus TCP slave


 Add command: Add a Modbus command


 Delete command: Delete a Modbus command


 Upload: Upload the configuration form the gateway

 Download: Download the configuration into the gateway

 Conflict detection: To check whether there are some conflicts with configured commands in the gateway memory data buffer

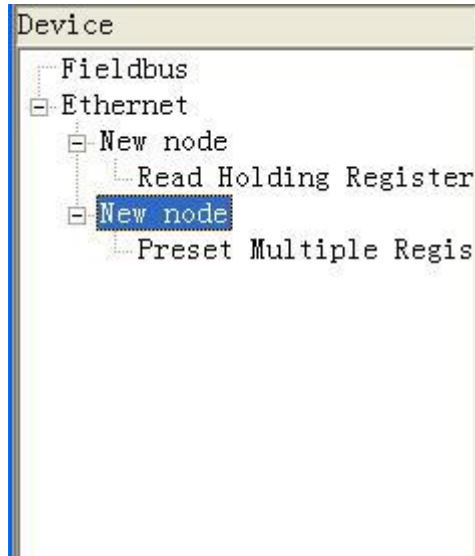
 Auto mapping: Used to automatically calculate the mapped memory address without confliction by each command

 Export Excel: Export the configuration into Excel

 Monitor I/O data : Monitor the gateway memory buffer data

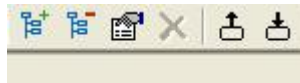
6.3 Equipment View Operation

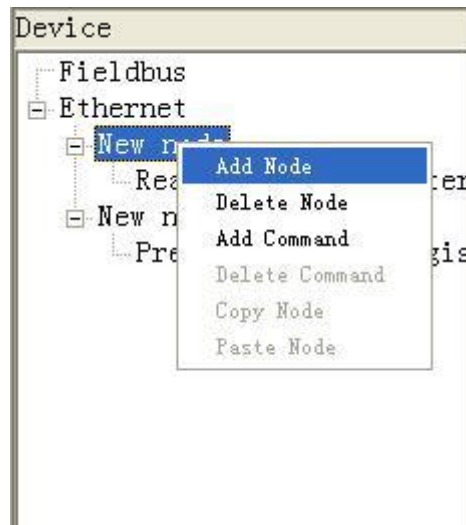
6.3.1 Equipment View Interface



6.3.2 Equipment View Operation Mode

For equipment interface, support three operation modes: edit menu, edit toolbar and right click edit menu.





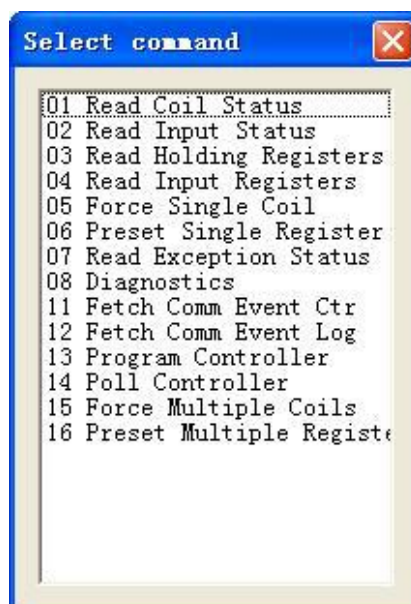
6.3.3 Equipment View Operation Types

1) Add node operation: Left click on Ethernet or existing nodes, and then perform the operation of adding a new node. Then there is a new node named "New node" under Ethernet.

2) Delete node: Left click on the node to be deleted, and then perform the operation of deleting the node. The node and all commands will be deleted.

3) Add commands: Left click on the node, and then perform the operation of adding command to add a command for the node. It will pop up the command selecting dialog box for users to choose. Shown as below:

Select the command: Double click command item

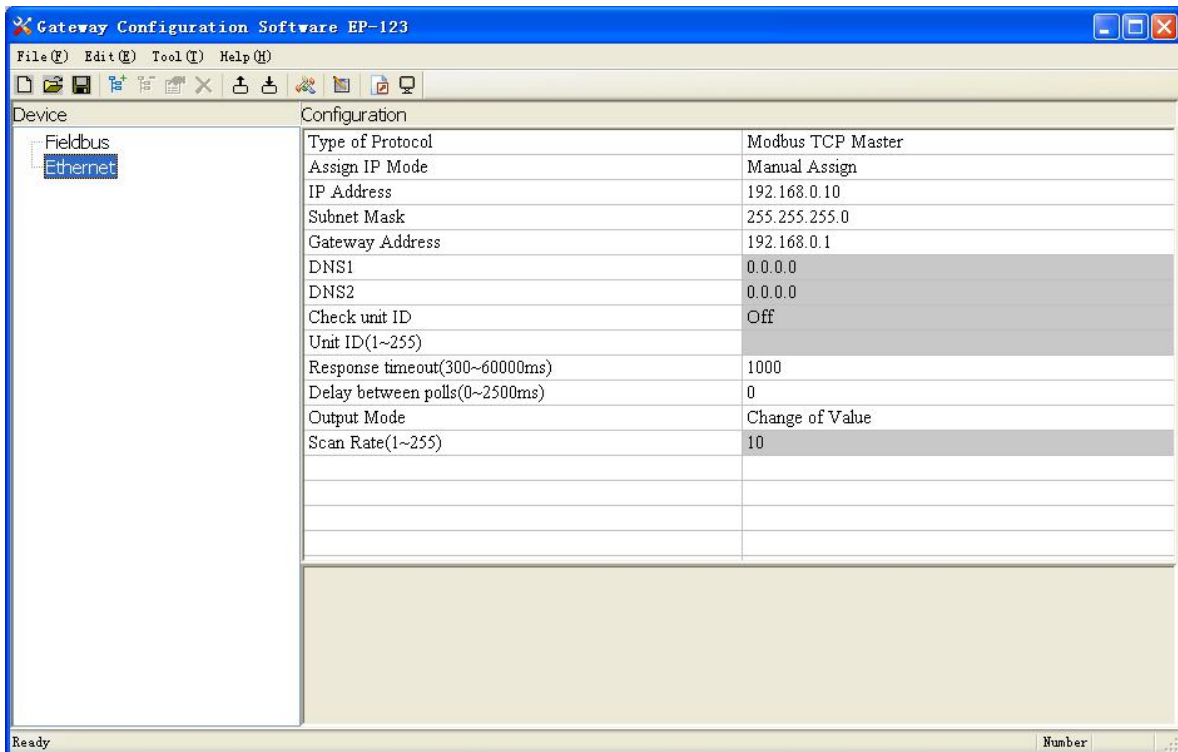


6.4.2 Ethernet Configuration Interface

Click Ethernet in configuration view interface; when choosing a different type of protocol, the configuration view interface and configurable items are different.

The protocol type selection: Modbus TCP master

Modbus TCP master configuration view is shown as follows:



The configurable items include: assign IP mode, IP address, subnet mask, gateway address, DNS1, DNS2, response timeout, delay between polls, output mode. As shown below:

Assign IP mode: Manual Assign, BOOTP and DHCP optional.

Response wait time: After the Modbus TCP master sent out commands, it waited for response from the slave.

Delay between polls: A Receive the right response after one Modbus command has been sent or sending next Modbus command after response timeout.

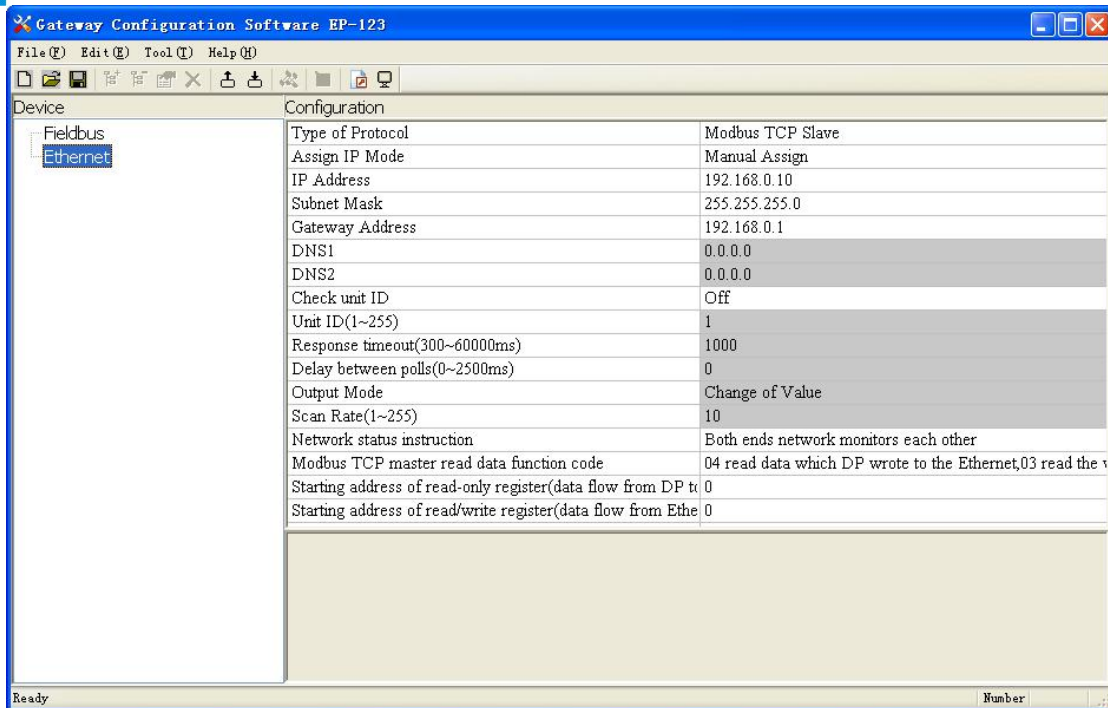
Output mode: Continuous output, disable output and change-of-value output can be selected.

The protocol type selection: Modbus TCP Slave

Modbus TCP slave configuration view is as follows:

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Assign IP Mode: Manual Assign, BOOTP and DHCP optional, default value is manual assign;

Check unit ID: open and close optional.

Unit ID (1~255): valid when "Check unit ID" is opened, 1~255 optional.

Scan rate: the ratio of slow scan cycle and fast scan cycle.

Network status indication: mutual surveillance of both ends, PROFIBUS DP monitors the network state of Modbus TCP, Modbus TCP monitor PROFIBUS DP network state and no indicating optional.

Modbus TCP master read data function code: "04H read the data DP sent to the Ethernet, 03H read back the written data", "03H read the data DP sent to the Ethernet, 04 read back the written data" is optional. Among them: "04H read the data DP sent to the Ethernet, 03H read back the written data" means that Modbus TCP master is using the 04H function code to read the output data from the PROFIBUS DP master to the Ethernet side, the use of 03H read back the written data of the PROFIBUS DP master; "03H read the data DP sent to the Ethernet, 04 read back the written data" means that Modbus TCP master is using the 03H function code to read the output data from the PROFIBUS DP master to the Ethernet side, the use of 04H read back the written data of the PROFIBUS DP master.

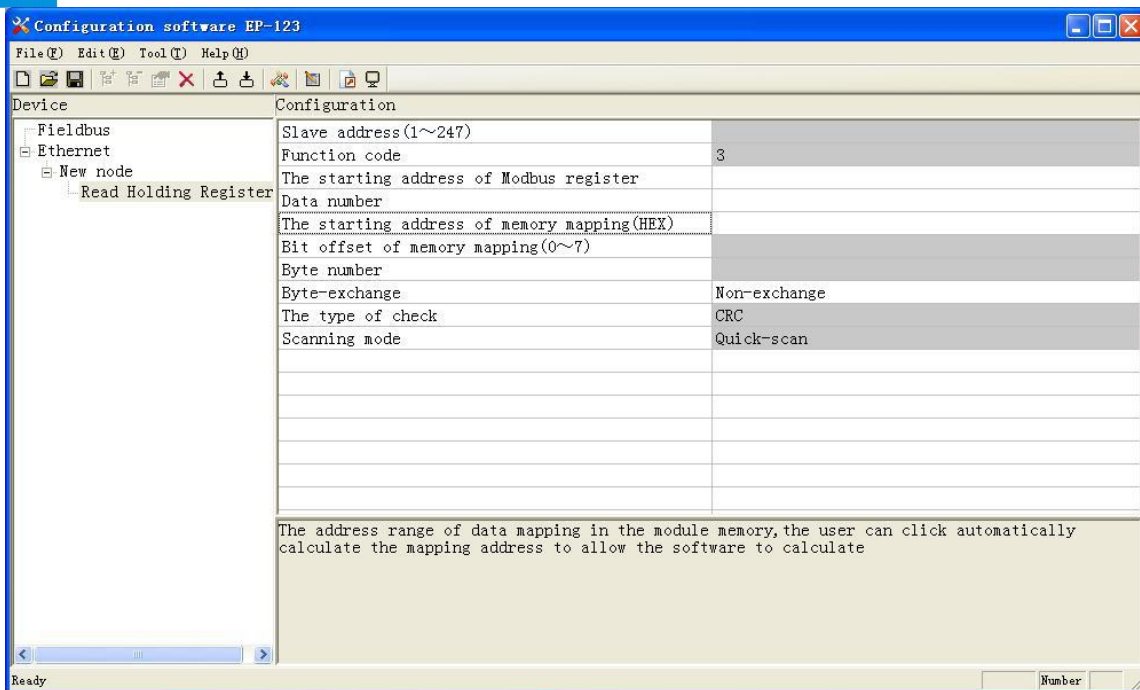
The first address of read-only register (data direction: DP to Ethernet): range 0 to 65535, default value of 0;

The first address of the read/write registers (data direction: Ethernet to DP),: range 0 to 65535, default value of 0.

6.4.3 Node Configuration Interface

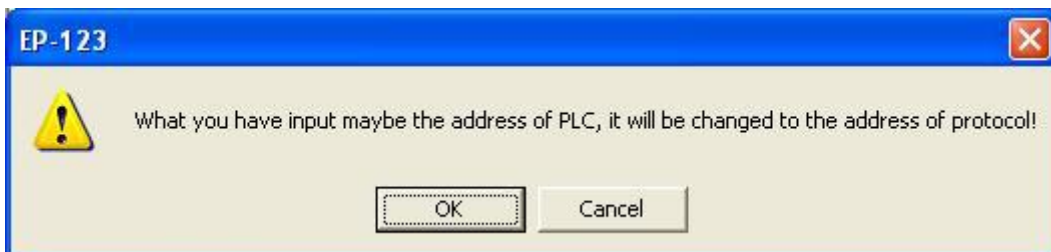
In the equipment view, click on the Ethernet, the protocol type is Modbus master, right-click on the "Ethernet", adding new nodes, the node configuration view interface displays the following:

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Modbus registers start address: Modbus start address of the station equipment in the register / switch / coils and other range is 0 ~ 65535;

Note: The configuration software EP-123, the entry refers to the address of the agreement, when the user input PLC address, it will pop up the dialog box below. After clicking OK, the PLC address users input will be converted into the protocol address.



PLC address and the corresponding protocol address for example the following table:

Command	Examples of PLC address	Corresponding protocol addresses
Coil Status	0001~00010	00000~00009
Input state	10001~10010	00000~00009
Holding Registers	40001~40010	00000~00009
Input register	30001~30010	00000~00009

For example: When Modbus command is configured as 03H (read holding register), when users input 40001 in this item (Modbus register starting address), it will pop up the dialog box after confirming. When clicking OK, PLC address 40001 will be converted into 0.

Data number: Register/switching value/coil numbers.

Memory mapping starting address (HEX): Data starting address in module memory buffer.

Address range that data is mapped in the module memory

Read command: 0x0000~0x00F3

Write command: 0x4000~0x40F3

Users can also use this area after write command is about local data exchange: 0x0000~0x00F3

Memory mapping bit offset (0~7): For the bit operation command, means the position where the start bit is in the byte, range 0~7

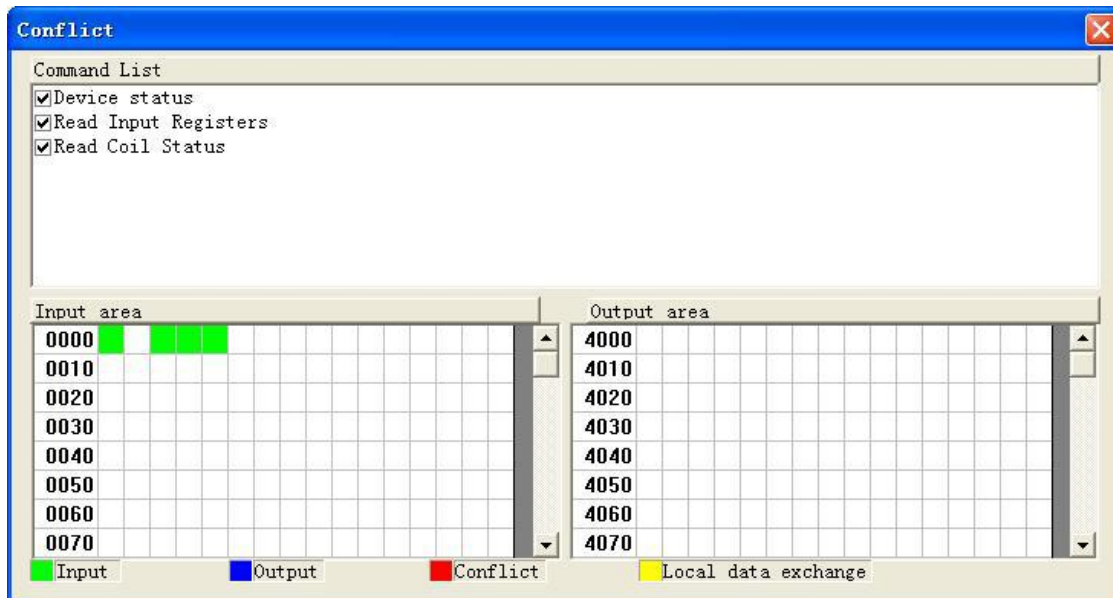
Byte swap: No swap, double byte swap and four-byte optional.

6.4.5 Comment Interface

```
The number of data:
Functional code(3, 4, 16): The number of register 1~122
Functional code(1, 2, 15): The number of switching value or loop 1 ~ 400
```

6.5 Conflict Detection

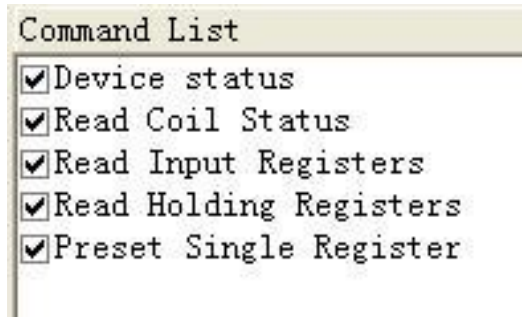
It is used to check whether there exists confliction in “memory mapping data”. If users find confliction, it can be adjusted in time. The interface is shown below:



6.5.1 Command List Operation

It shows configured command in the command list interface. Check box before each command is used to

check the position of this command in memory mapping area. Click one command and check the box, it will show the position where relevant commands occupy in the memory mapping area. Click the command again and uncheck the box, the command will not be shown in the mapping area. This function will be used for conflict detect among commands in memory mapping area.



6.5.2 Memory Mapping Area Operation

Memory mapping area divides into input area and output area.

Input mapping address range: 0x0000~0x3FFFF;

Output mapping address range: 0x4000~0x7FFFF.

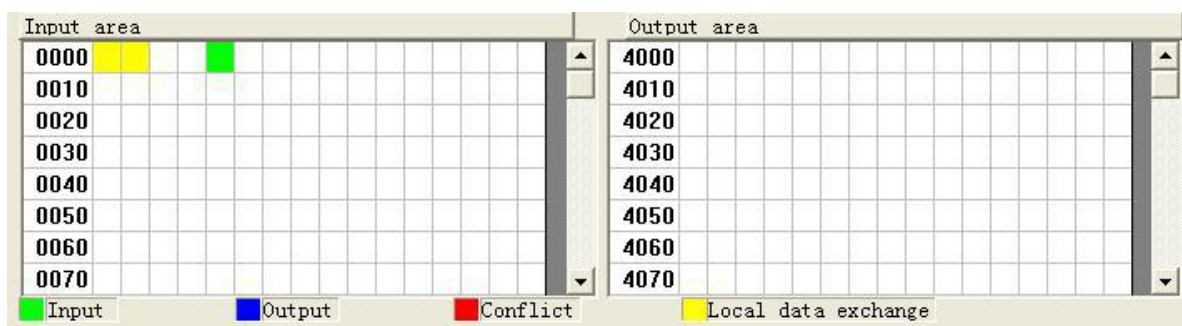
Each grid represents one byte address.

Green: read command is shown in input mapping area, it will be in green without conflict.

Yellow: Write command: When address mapping area is located in input area, it will be in yellow without conflict;

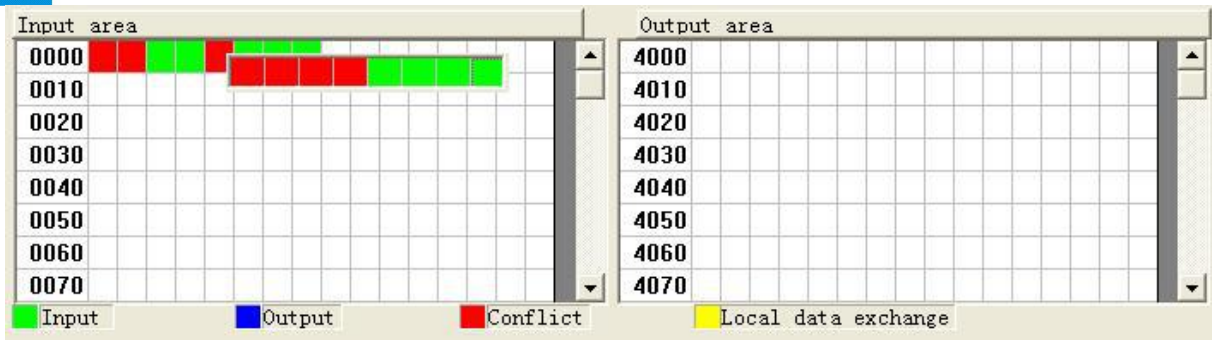
Blue: When address mapping area is located in output area, it will be in blue without conflict.

Red: In input area or output area, different command occupied on the same byte, this byte area will be in red.



For bit operation command, the above grid displaying meaning works the same.

Click input/output area grids, each bit of relevant byte in the grid will show whether each bit is occupied. As is shown below:



6.6 Hardware Communication

Hardware communication menu items are shown as follows:



6.6.1 Ethernet Configuration

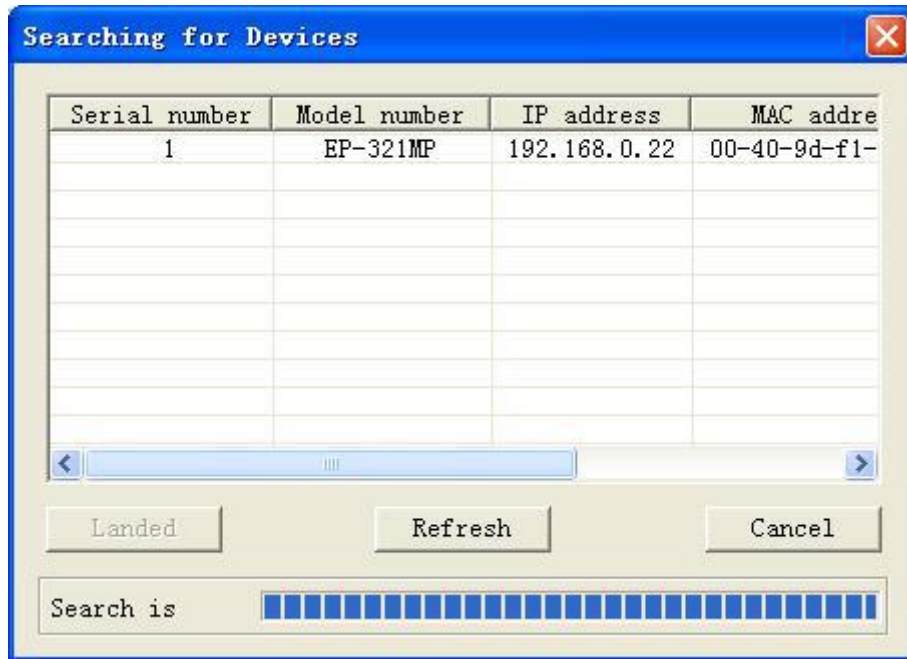
Here is the dialog of Ethernet configuration



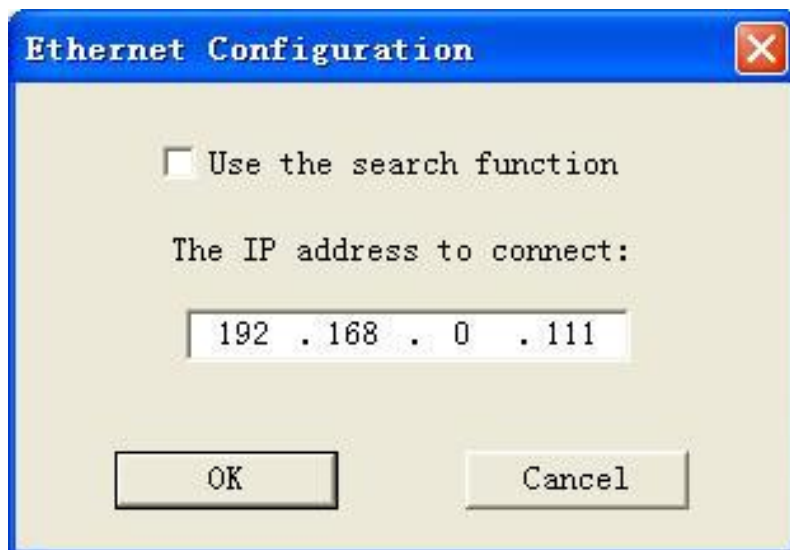
When “Use the search function” is checked, SST-EP-CFG will automatically search for the EP-321MP and

other identifiable hardware when communicating between software and hardware, then list the device in the list.

Users can select whether to use the search function. When users use search function, it will search all EP-321MP equipment when uploading and downloading the configuration. When users don't use the search function, users must appoint the IP address of equipment which needs to be connected. It will only list one device when uploading and downloading the configuration.



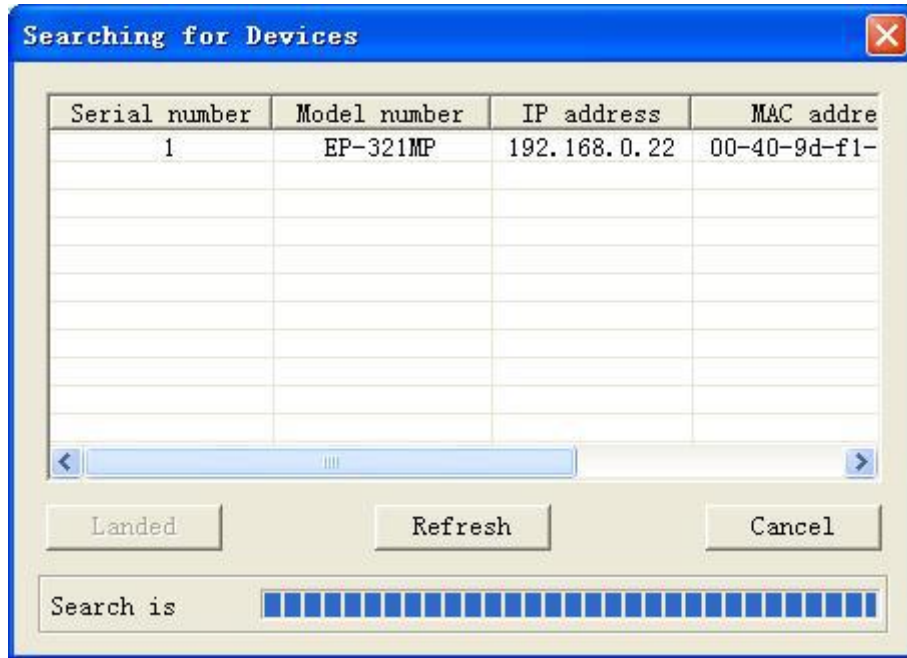
When disable searching, you must set the remote device IP.



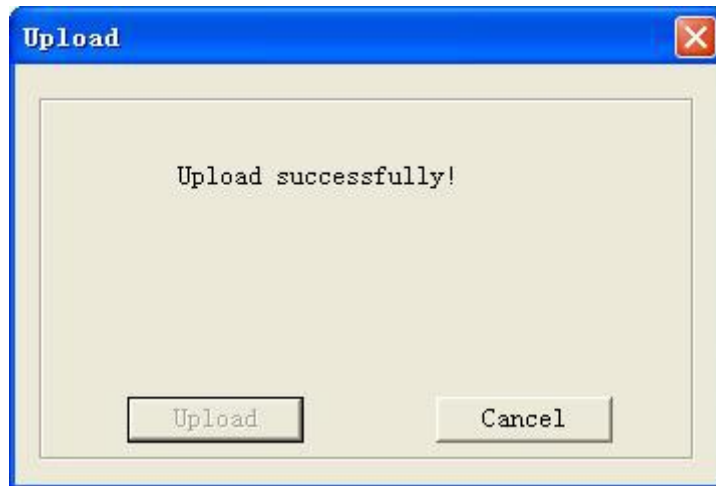
And then click OK button.

6.6.2 Upload Configuration

When select upload configuration, then the dialog window will be show as follow:

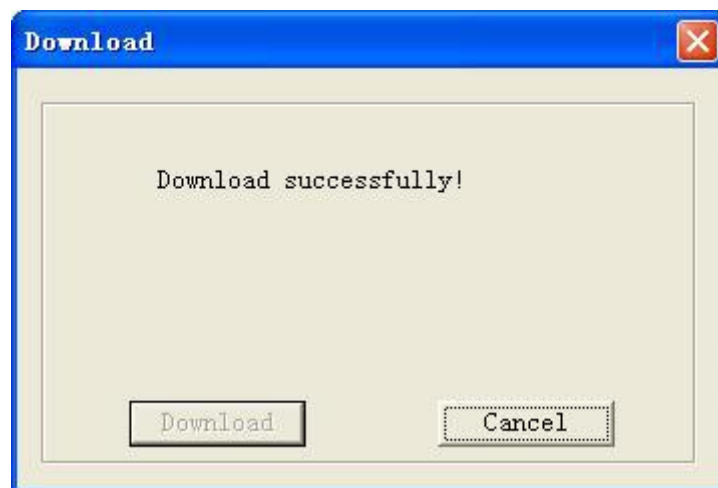
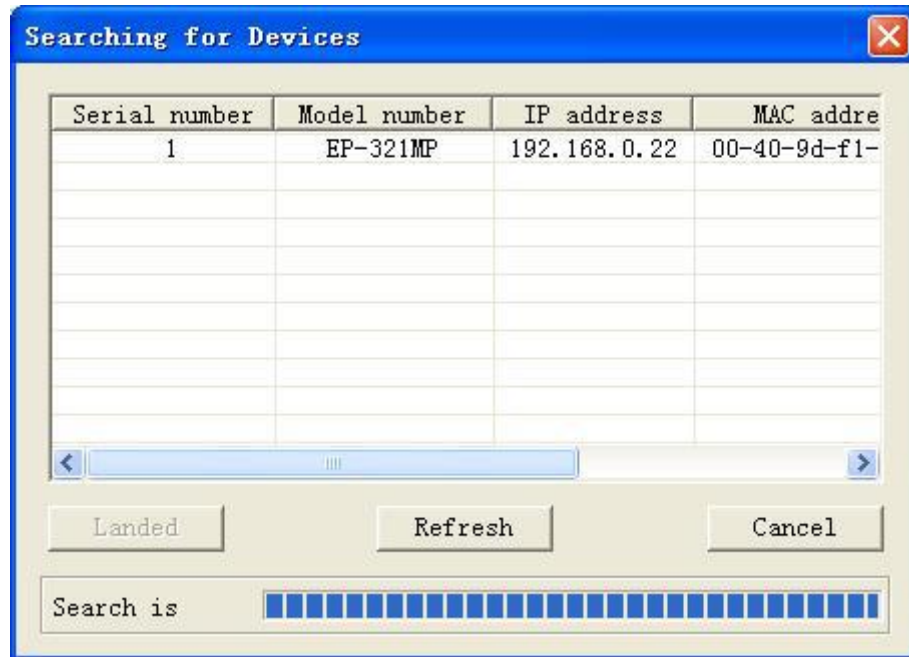


Then click “Landed” button. If upload the configuration is successful it will pump up the window as follow:



6.6.3 Download Configuration

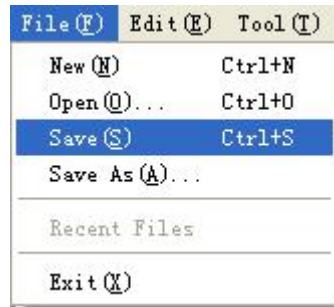
The operation of download configuration is the same as upload configuration:



6.7 Open and Save Configuration

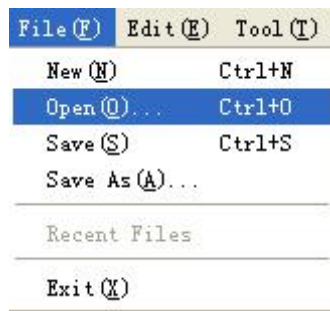
6.7.1 Save Configuration

Select “Save” and save the configured project as .chg file.




6.7.2 Open Configuration

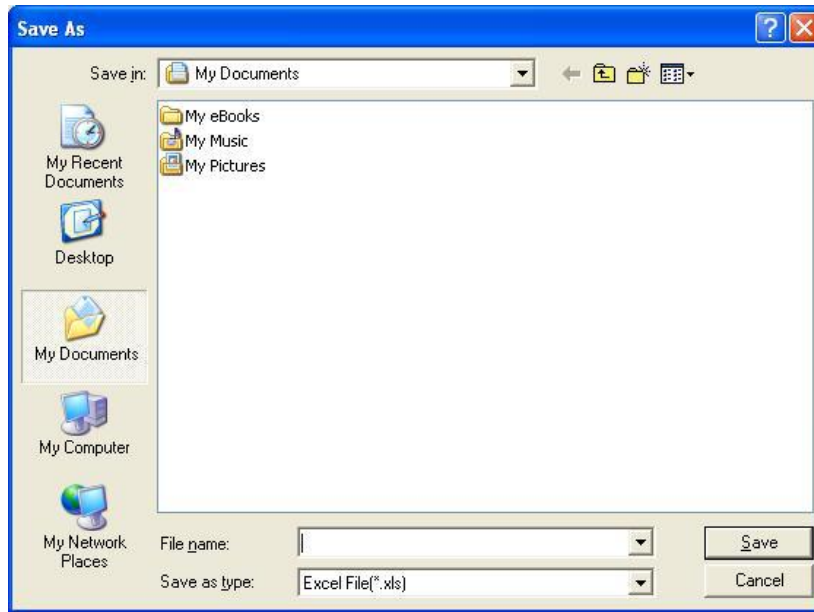
Select “Open” and open the saved .chg file.



6.8 Export EXCEL

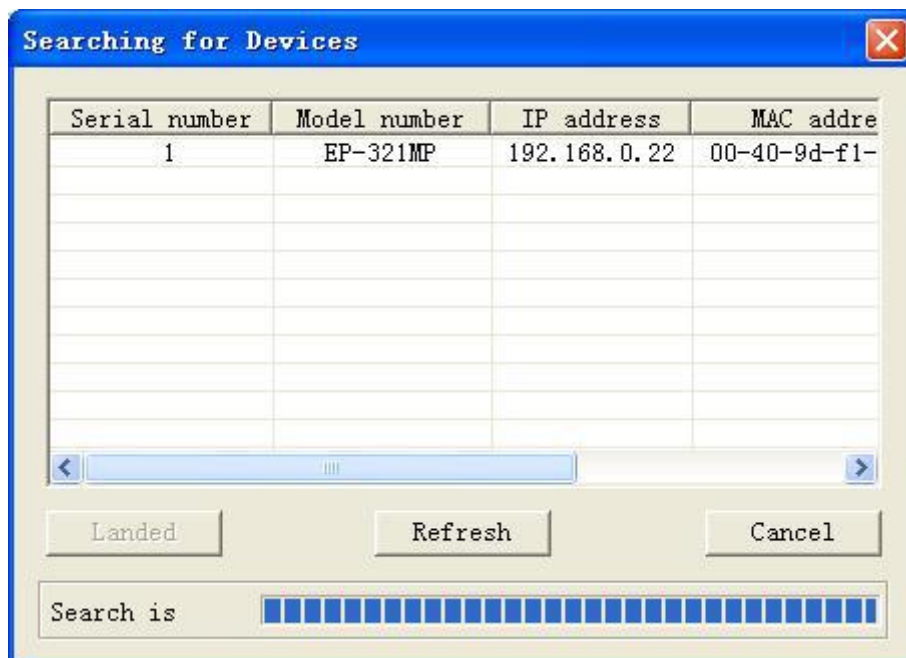
Excel configuration Excel file will help users to check the relevant configuration.

Select the export xls icon , export the configuration information to excel and save. Select the appropriate path, shown as below:

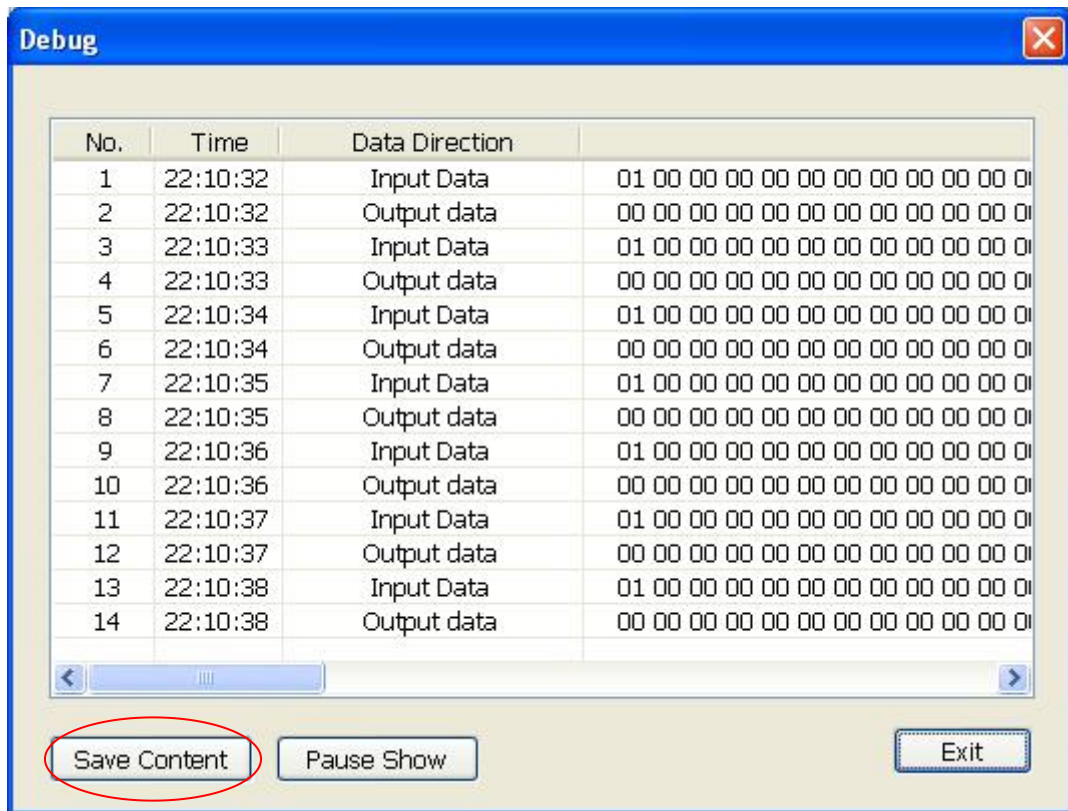


6.9 Monitor I/O Data

This function is used to monitor the buffer data, click “Debug” button on the toolbar and it will pop up the dialog box of searching equipment:



Click “Landed”, it will pop up the I/O data monitor dialog box below:



Click “Save Content” button can save relevant content to the PC hard disk. This button becomes “Stop saving”. If you want to finish saving, you can press “Stop saving” button. It can pause displaying buffer data by clicking “Pause Show”.

7. Application



8. Step7 Read and Write Gateway Data

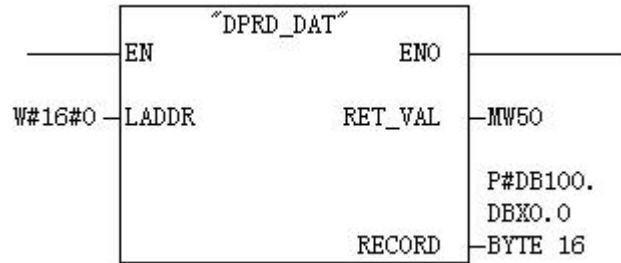
EP-321MP provides modules shown as follow. The maximum allowed number of modules is 64 in Step7. The maximum allowed number of input bytes is 244, the max number of output bytes is 244 and the aggregate of maximum number of input bytes and output bytes is 488.

Module	Consistent
4 Words Input, 4 Words Output	Word Consistent
8 Words Input, 8 Words Output	Word Consistent
24 Words Input, 24 Words Output	Word Consistent
56 Words Input, 56 Words Output	Word Consistent
1 Byte Input	Byte Consistent
1 Word Input	Word Consistent
2 Words Input	Word Consistent
4 Words Input	Word Consistent
8 Words Input	Word Consistent
16 Words Input	Word Consistent
32 Words Input	Word Consistent
64 Words Input	Word Consistent
2 Words Input Consistent	Total length Consistent
4 Words Input Consistent	Total length Consistent
8 Words Input Consistent	Total length Consistent
16 Words Input Consistent	Total length Consistent
1 Byte Output	Byte Consistent
1 Word Output	Word Consistent
2 Words Output	Word Consistent
4 Words Output	Word Consistent
8 Words Output	Word Consistent
16 Words Output	Word Consistent
32 Words Output	Word Consistent
64 Words Output	Word Consistent
2 Words Output Consistent	Total length Consistent
4 Words Output Consistent	Total length Consistent
8 Words Output Consistent	Total length Consistent
16 Words Output Consistent	Total length Consistent

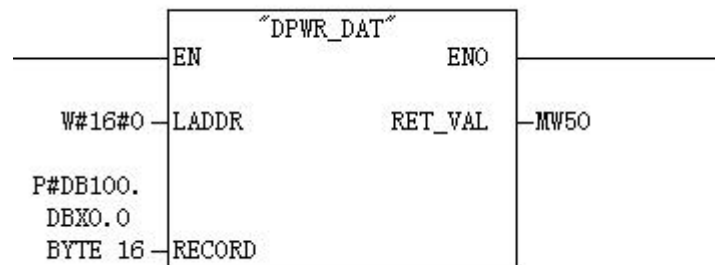
As is shown above, the data modules which EP-321MP supports include: Word consistency, Byte consistency and length consistency.

For the data modules that support Word and Byte consistency, you can use command “MOVE” to access the data during STEP7 programming.

For the data modules that support length consistency, user can take compression way to send and receive data. The compression way mainly uses “SFC 15” when sending and receiving uses “SFC 14”:



SFC14

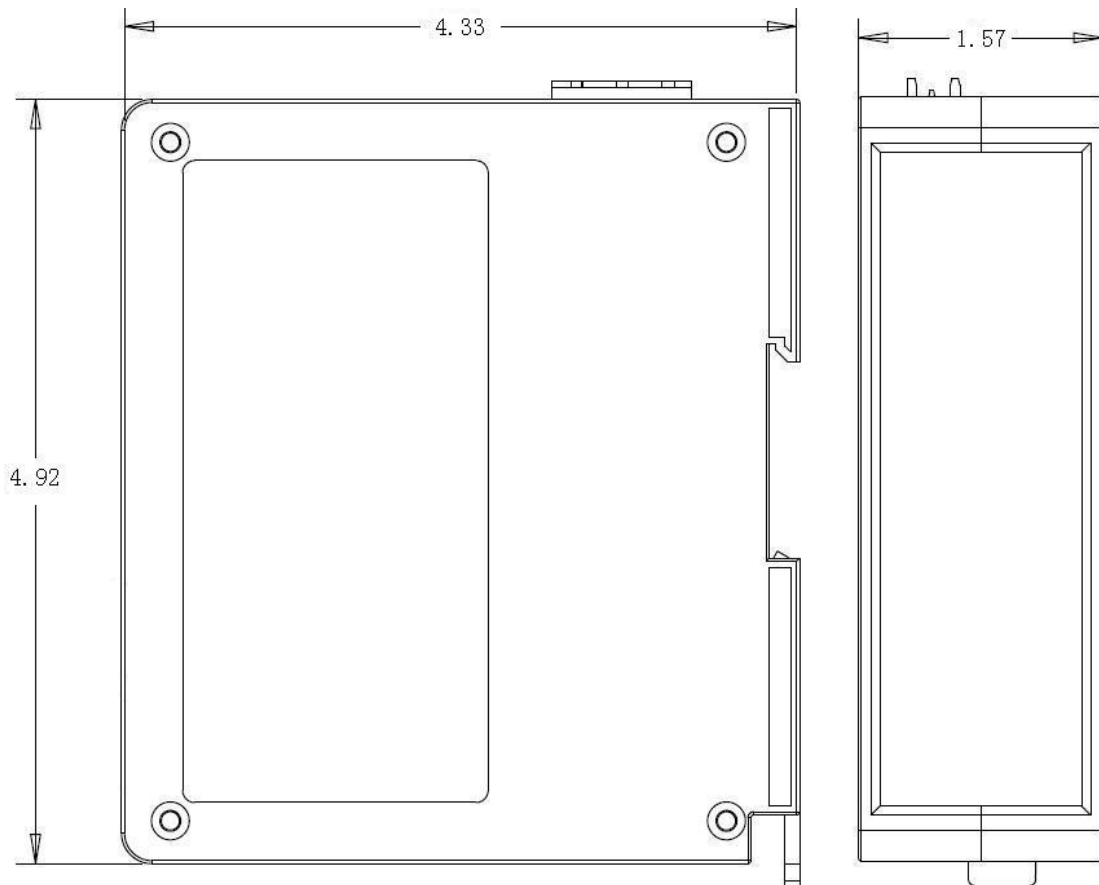


SFC15

9 Installation

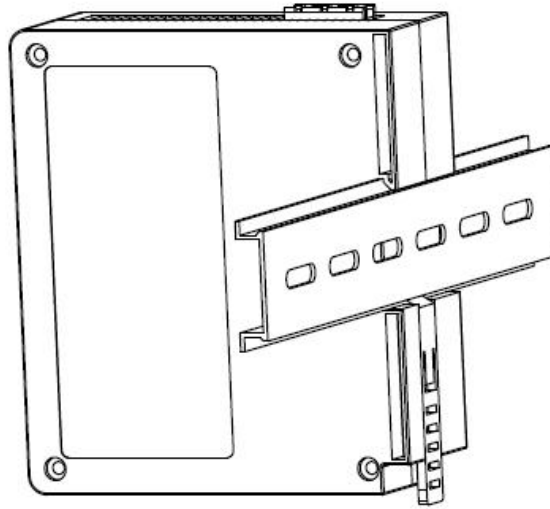
9.1 Mechanical Dimension

Mechanical Dimension: 1.57inch (width) * 4.92inch (height) * 4.33inch (depth)



9.2 Installation

35mm DIN rail installation





Appendix: Using STEP7 Set PROFIBUS DP

The following show how to use STEP7 to configure EP-321MP:

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

1. Open SIMATIC Manager  ; Figure 1:

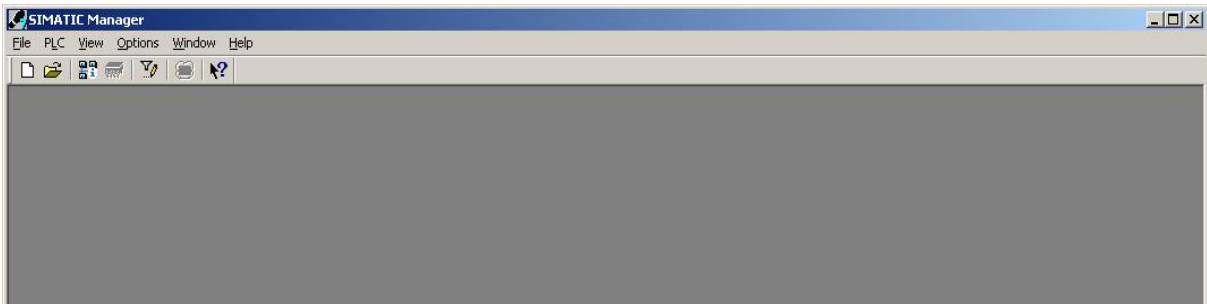


Figure 1

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

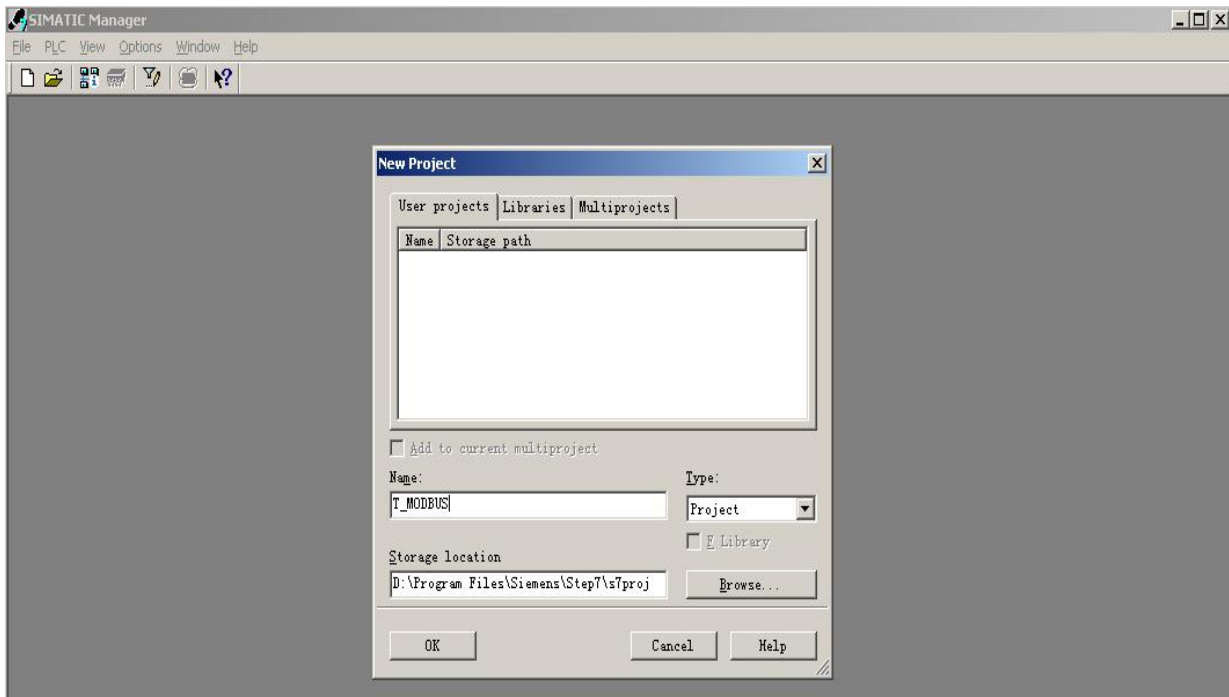


Figure 2

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

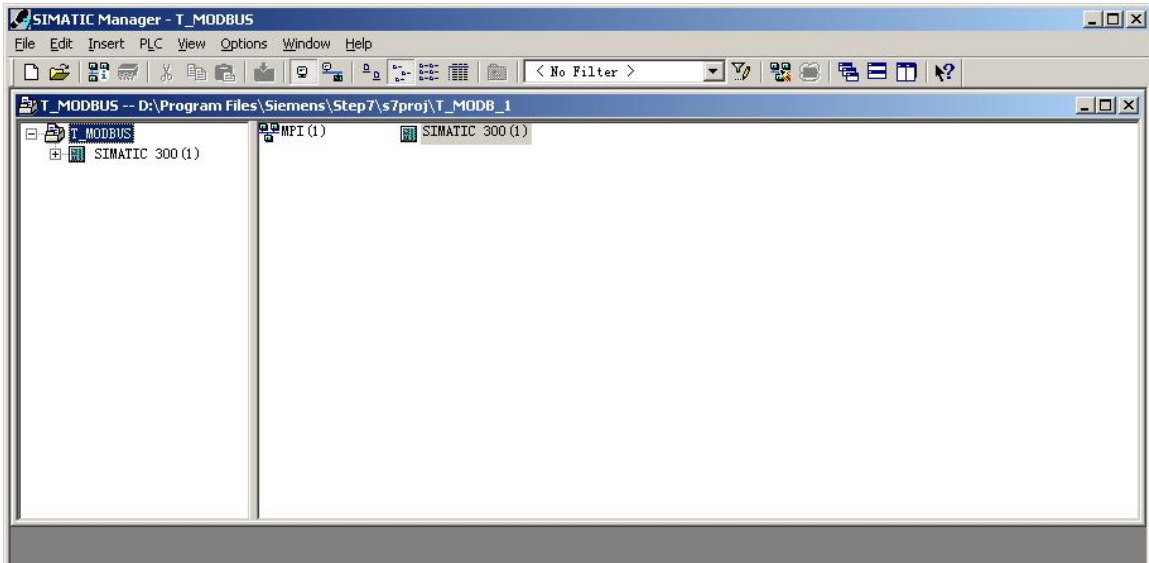


Figure 3

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

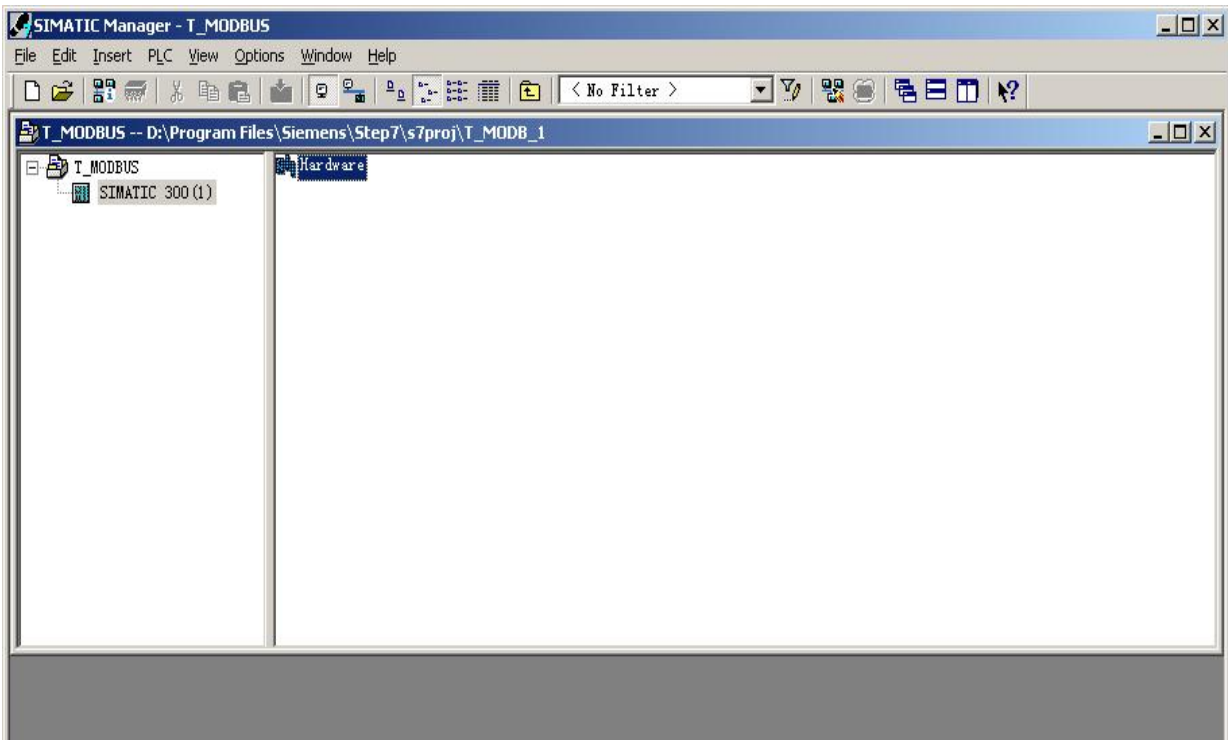


Figure 4

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

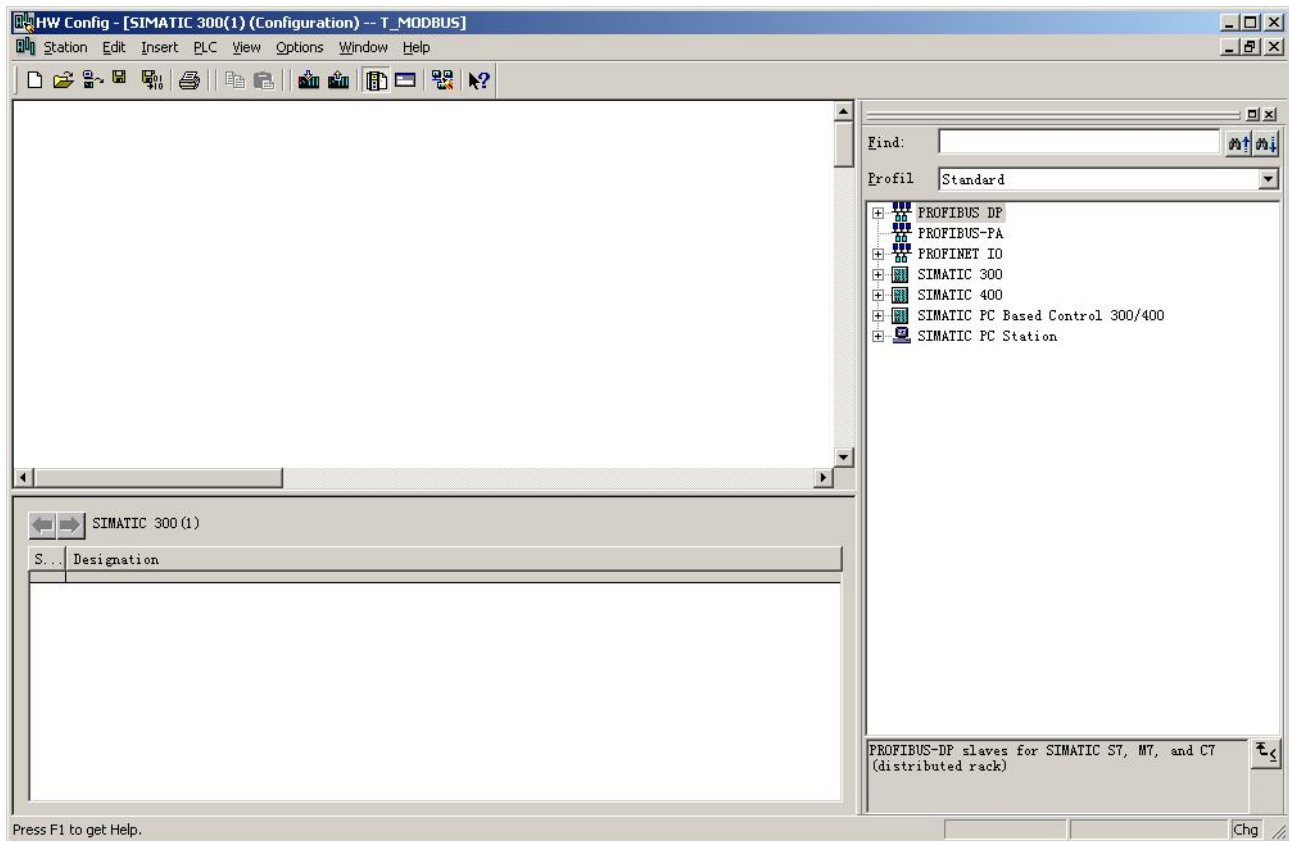


Figure 5

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

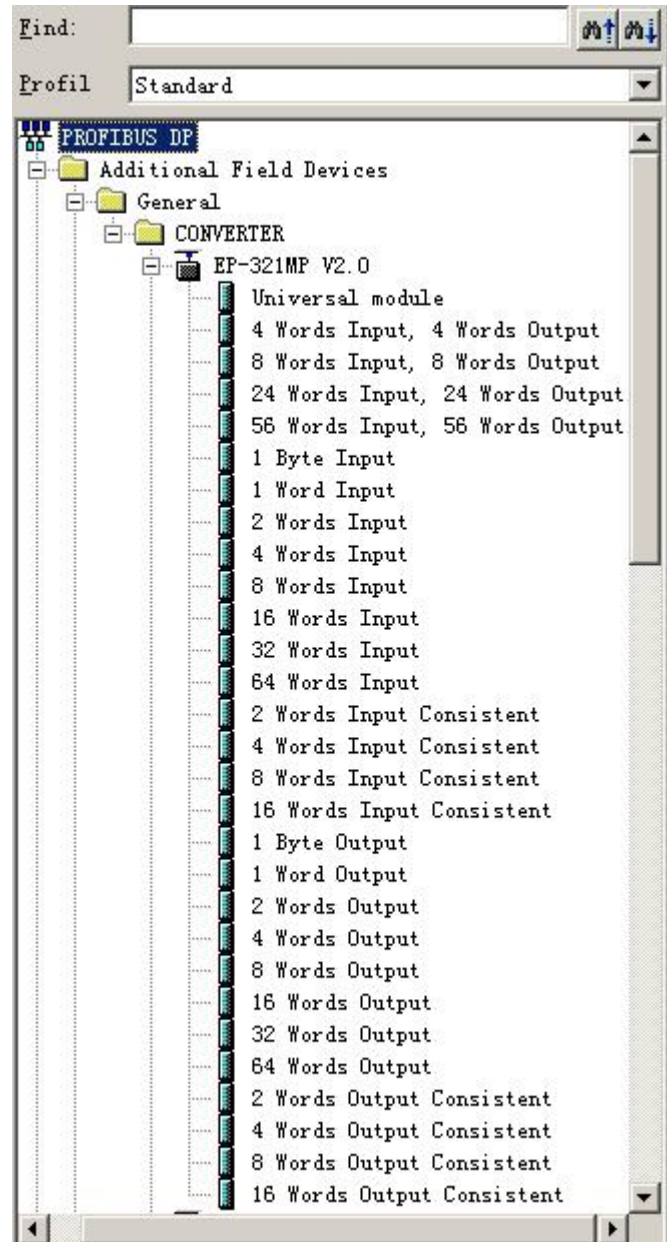


Figure 6

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

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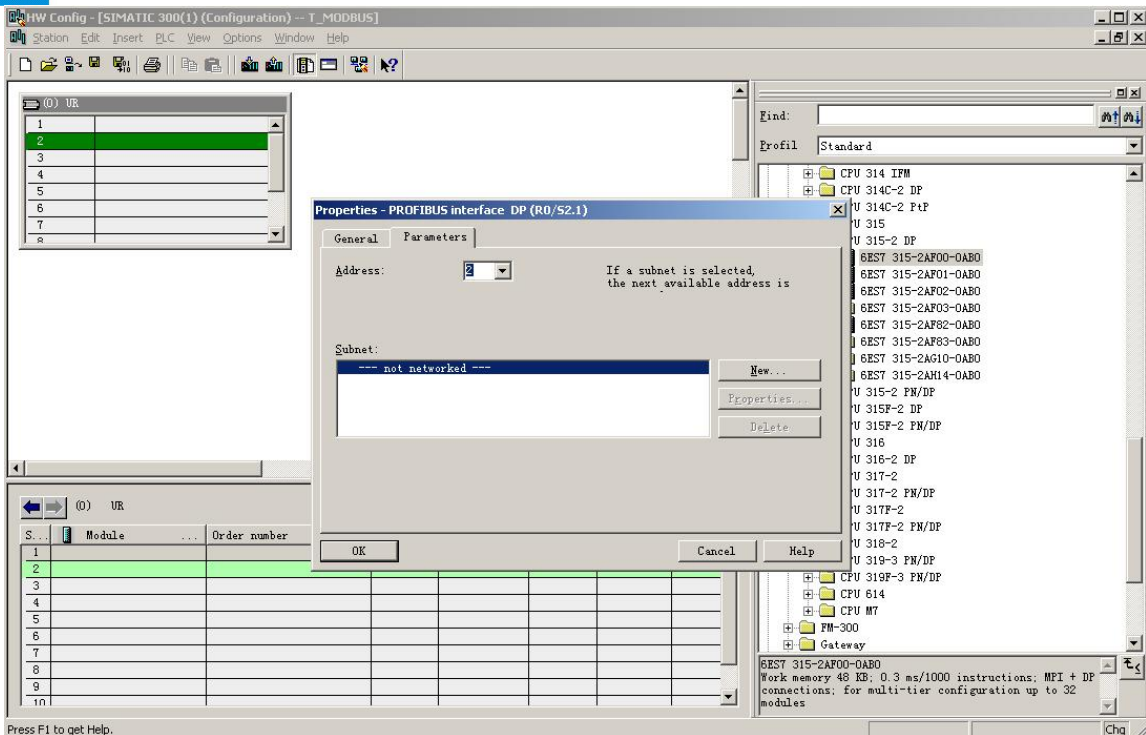


Figure 7

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:

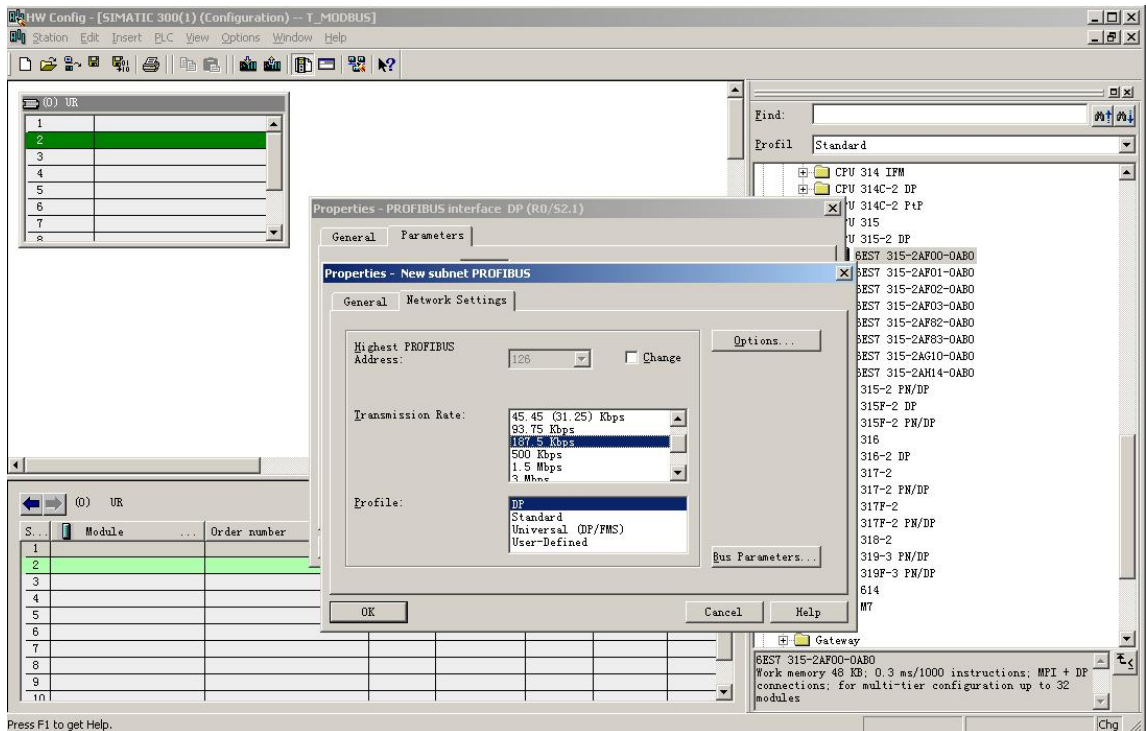


Figure 8

10. Select PROFIBUS Master station address, Figure 9:

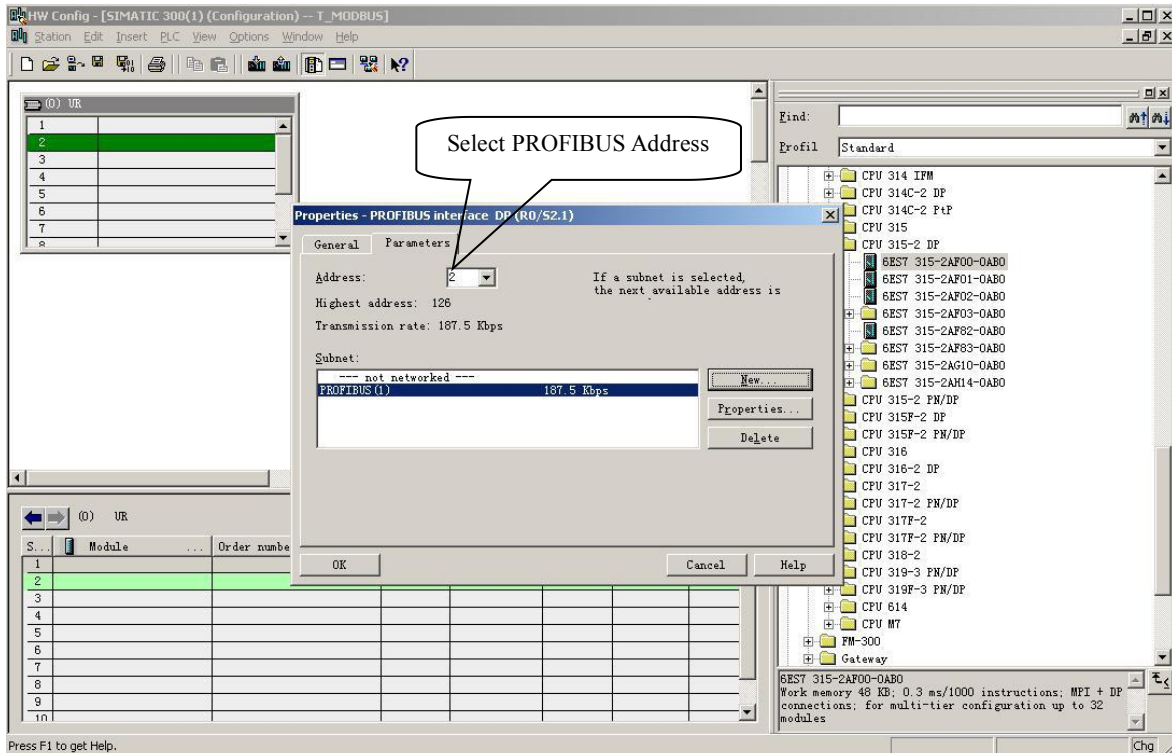


Figure 9

11. Drag EP-321MP 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:

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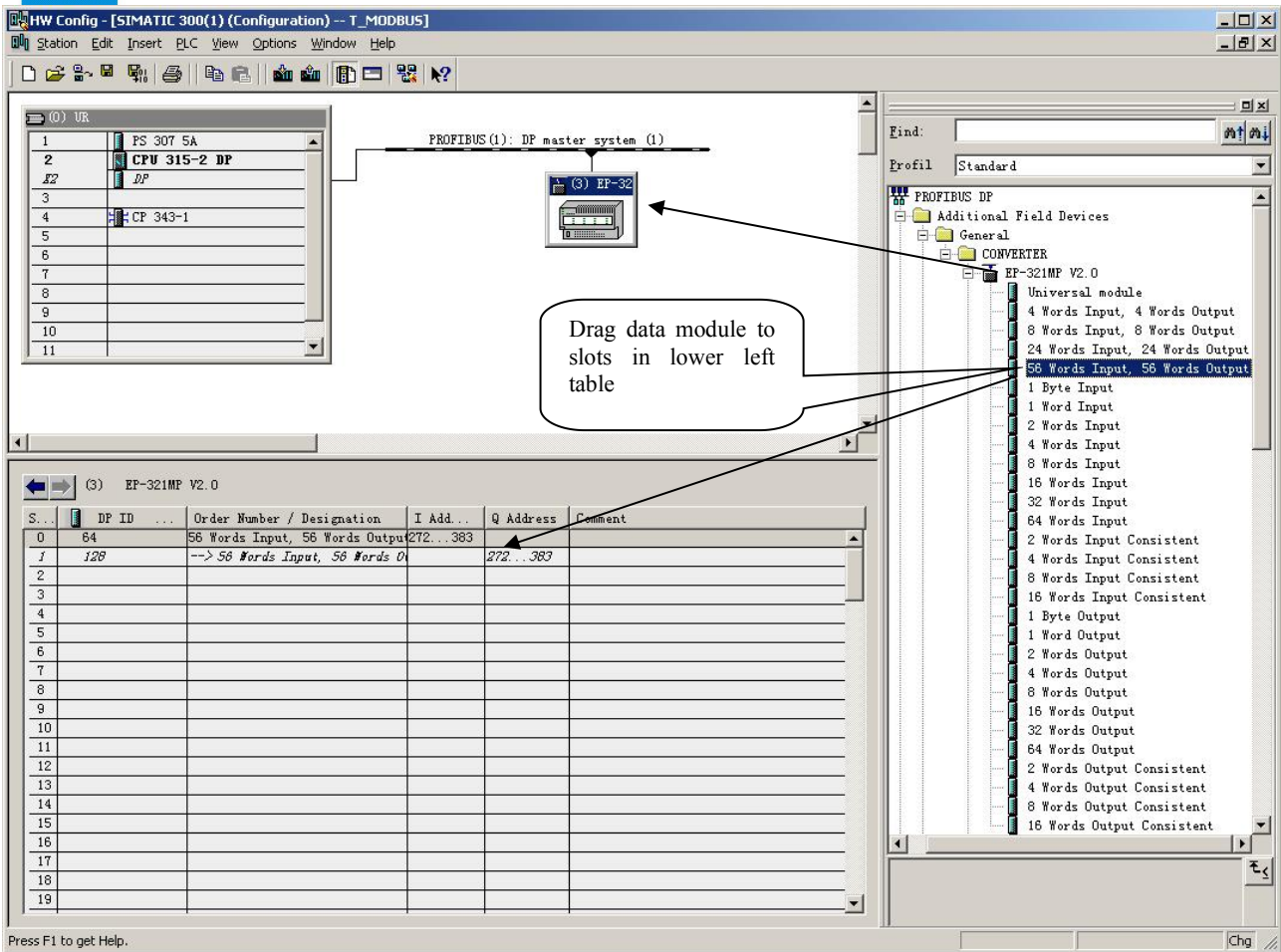


Figure 10

Operation is divided into two steps, the first step is dragging EP-321MP 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.

12. Compile and download into PLC.