L-mag—PROFIBUS
Communication Manual

July.23,2012

Content

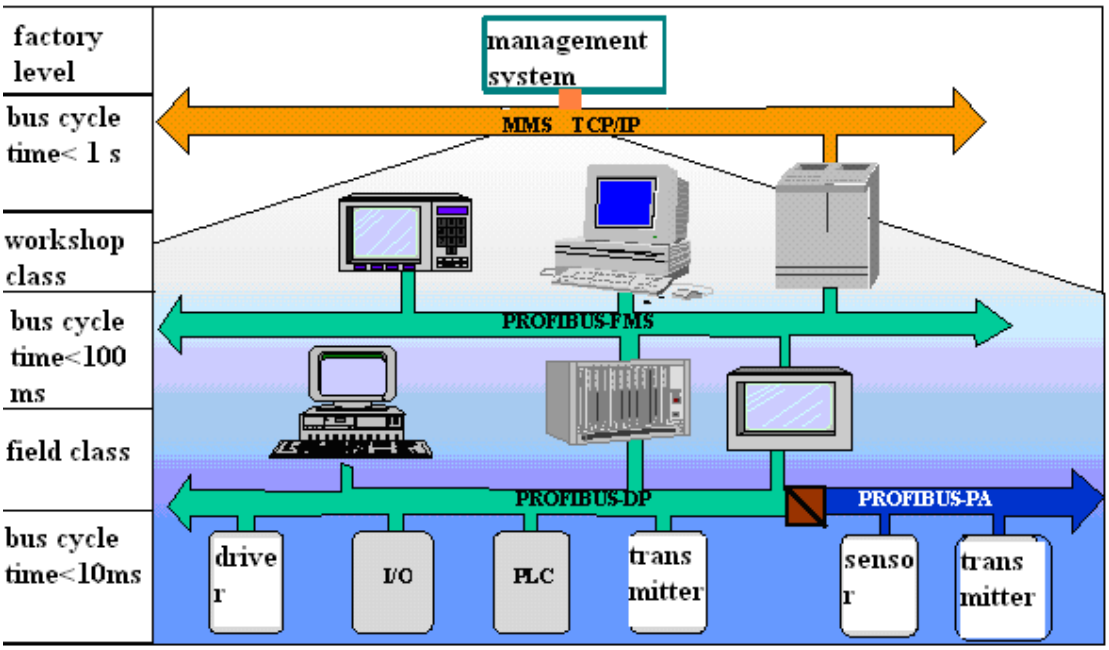
1 System Description

L_mag-PROFIBUS converter is a new product with embedded PROFIBUS function. This product can communicate with PROFIBUS master station (PC, PLC) via PROFIBUS fieldbus to achieve field meter remote monitoring and remote modification.
L_mag-PROFIBUS converter can monitor Instantaneous Flow, Instantaneous Flow Rate, Flow Percentage, Conductivity Ratio, Forward Cumulative Value and Reverse Cumulative Value via PROFIBUS fieldbus timely. Besides, the converter can also modify the parameters such as Meter Range, Upper Limit Alarming, Lower Limit Alarming, Small Signal Cut-off, Frequency Range, Flow Unit, Measurement Damping Time and etc.

1.1 Technical Indicate

1. PROFIBUS-DP/V0 protocol is in compliance with JB/T 10308.3-2001: Digital data communication for measurement and control—Fieldbus for use in industrial systems—Type 3: PROFIBUS specification.
2. Standard PROFIBUS-DP driver interface, Baud Rate is adaptive, and the minimum Baud Rate is 6M/12M.
3. Working environment temperature 50℃, humidity 95%.

2 PROFIBUS Communication Network and Wiring

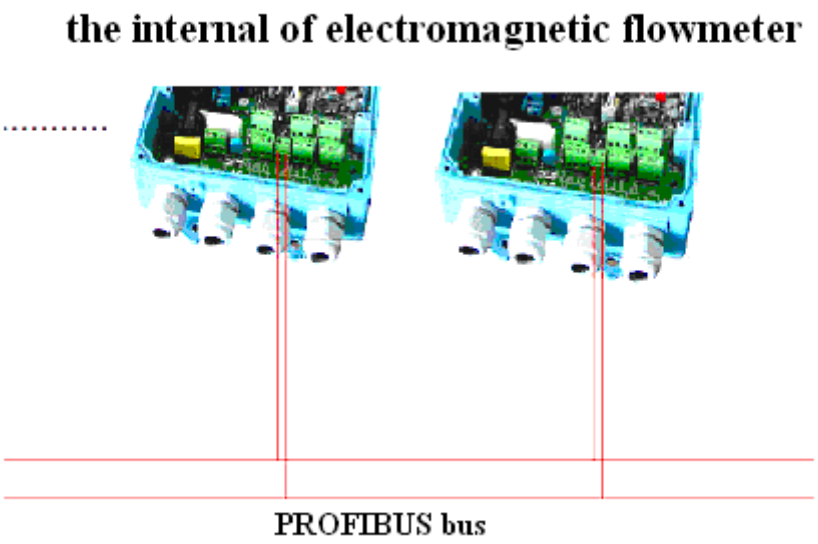


3 L_mag-PROFIBUS Parameter Setting and Terminals

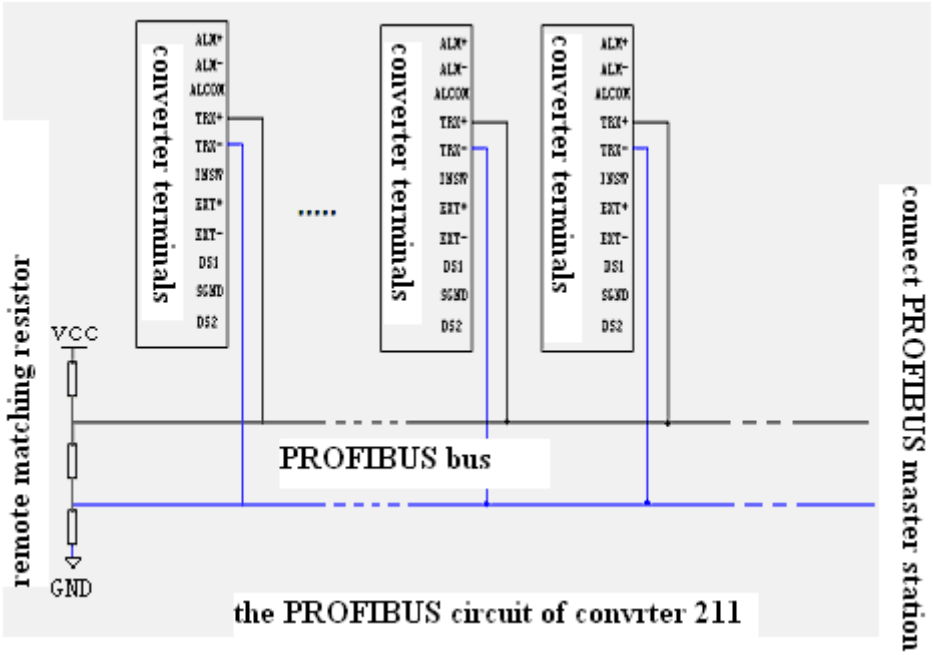
To realize L-mag—PROFIBUS converter function, before setting the parameters, mention the items below:

1. The address of the converter shall be larger than 10.
2. The Baud Rate of the converter is 9600 byte/s.
3. The communication method of the converter is 2.

211B converter wiring refers to the Figure below:



211 converter PROFIBUS communication method refers to the Figure below:



Electromagnetic converter terminals (TRX +, TRX-) are PROFIBUS communication interface. TRX + is A and TRX- is B. Because of the internal design of the electromagnetic converter, no additional distance matching resistor is required.

4 Register Definitions and Data Analysis

4.1 Register Definitions

L_mag-PROFIBUS Converters Variable Description:

Byte0—Byte3	Instantaneous flow	Floating-point
Byte4—Byte7	Instantaneous flow velocity	Floating-point
Byte8—Byte11	Percentage of flow	Floating-point
Byte12—Byte15	Conductance ratio	Floating-point
Byte16—Byte19	Integer part of forward cumulative value	Long integer
Byte20—Byte23	Fractional part of forward cumulative value	Floating-point
Byte24—Byte27	Integer part of reverse cumulative value	Long integer
Byte28—Byte31	Fractional part of reverse cumulative value	Floating-point
Byte32	Flow unit	
Byte33	Fractional part of cumulative value and cumulative unit	
Byte34	Alarming status	
Byte35	Data status	

On-board if DIP switch 2 is selected floating-point format, when the switch is on, it is WICC32 bit floating-point format, and when the switch is off, it is Siemens PLC floating-point format.

4.2 Date analysis

4.2.1 Floating-point Format

L-mag electromagnetic flow meter use MODBUS, and IEEE754 32-bit floating-point format is applied.
The format is as below, and takes instantaneous flow as an example.

BYTE4	BYTE3	BYTE2	BYTE1
S EEEEEEE	E MMMMMMM	MMMMMMMM	MMMMMMMM

S—sign of Mantissa ; 1= Negative number, 0 =Positive number.
E—Exponent; represents the difference of decimal number 127.
M—Mantissa; Low 23 bit, the fractional part.
When E is not all "0", and not all "1", Float and Decimal conversion formula is:

$$V = (-1)^S 2^{(E-127)} (1+M)$$

4.2.2 Instantaneous Flow

Type	BYTE3	BYTE2	BYTE1	BYTE0
Hex	C4	C1	60	00
Binary System	1100 0100	0001 1100	0110 0000	0000 0000

S=1: sign of Mantissa is 1 which means it is Negative number.
E=10001000: Exponent is 136.
M=001 1100 0110 0000 0000 0000, Mantissa is:

$$V = (-1)^1 2^{(136-127)} (1 + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{512} + \frac{1}{1024})$$

=-625.5

4.2.3 Cumulative Value

To fully express electromagnetic flow meter 9 cumulative value, integer part and fractional part of the cumulative flow are showed respectively. Long integer variable is used in integer part, and floating-point numbers is used in fractional part.

Integer part				
Type	BYTE16	BYTE17	BYTE18	BYTE19
Hex	00	00	70	71
Decimal System	28785			
Fractional part				
Type	BYTE23	BYTE22	BYTE21	BYTE20
Hex	3F	00	00	00
Binary System	0011 1111	0000 0000	0000 0000	0000 0000

S = 0
E = 01111110
M = 000 0000 0000 0000 0000 0000

$$V = (-1)^1 2^{(126-127)} = 0.5$$

V total = 28785+0.5 = 28785.5

4.2.4 Alarming

	BYTE34							
Data Bit	BD7	BD6	BD5	BD4	BD3	BD2	BD1	BD0

Definition	0	0	0	0	Excitation	Empty-pipe	Lower Limit	Upper Limit

4.2.5 Flow Unit

Original Date (Decimal System) = Byte32;
Definition of flow unit:

0	1	2	3	4	5
L/S	L/M	L/H	M3/S	M3/M	M3/H

4.2.6 Cumulative Value Unit

Original Date (Decimal System) = Byte33;
Definition of cumulative value unit:

0	Others
L	M3

5 Composition of PROFIBUS Master Station

According to PROFIBUS technical principle, the minimal system shall be consists of a PROFIBUS master station (Class I) and several PROFIBUS subsidiary stations.
Class I master station: Complete Bus communication control and management, complete periodic data access. PLC and PC can be used as Class I master station.
Class II master station: Complete non- periodic data access, such as data read and write, system configuration, fault diagnosis and etc. Class II master station includes operator workstation (such as PC plus graphics monitoring software), programming, HMI and etc.
Here the configuration and setting of Class I master station is introduced.

5.1 PC and Network Card (CP5611) Used as PROFIBUS Master Station

Network Card: CP5611
Configuration/Driving Software: SIMATIC NET V6.2, STEP 7 V5.2
Control Software: WINCC

Subsidiary Station provide: GSD file

1. CP5611 Network Card:

CP5611 Network Card is used for desktop programming and communications. This card has network diagnostic function, and the maximum communication speed of up to 12Mbit / s.

2. GSD file：

1) Each PROFIBUS Subsidiary Station or Class I Master Station needs to have a "device description file" called GSD file, which is used to describe features of the PROFIBUS-DP device.
2) GSD file includes all the defined parameters in the device, includes: applied Baud Rate, applied message length, input / output data quantity, meaning of the diagnostic data, and types of optional modules and etc.
3) GSD file is a text file, and can be edited in "Notepad".
4) No matter what kind of software configuration software is used, the device configuration shall be done based on GSD file.
5) PROFIBUS International Organization PI provides GSD file editing software, GSDEDIT.EXE. The software checks the GSD file format edited by users in accordance with the provisions of PROFIBUS technology standard format. The function "Help" can be used as a quick way to study GSD file technology.

3. Software needed to install in PC Master Station:

System requirement Win2000+SP4

1) Install SIMATIC NET V6.2
2) Install WINCC V5.1
3) Install STEP 7 V5.2
4) Copy GSD file

Copy SY_P_M.GSD and SY_P_H.GSD COPY to SIEMENS\Step7\S7DATA\GSD.

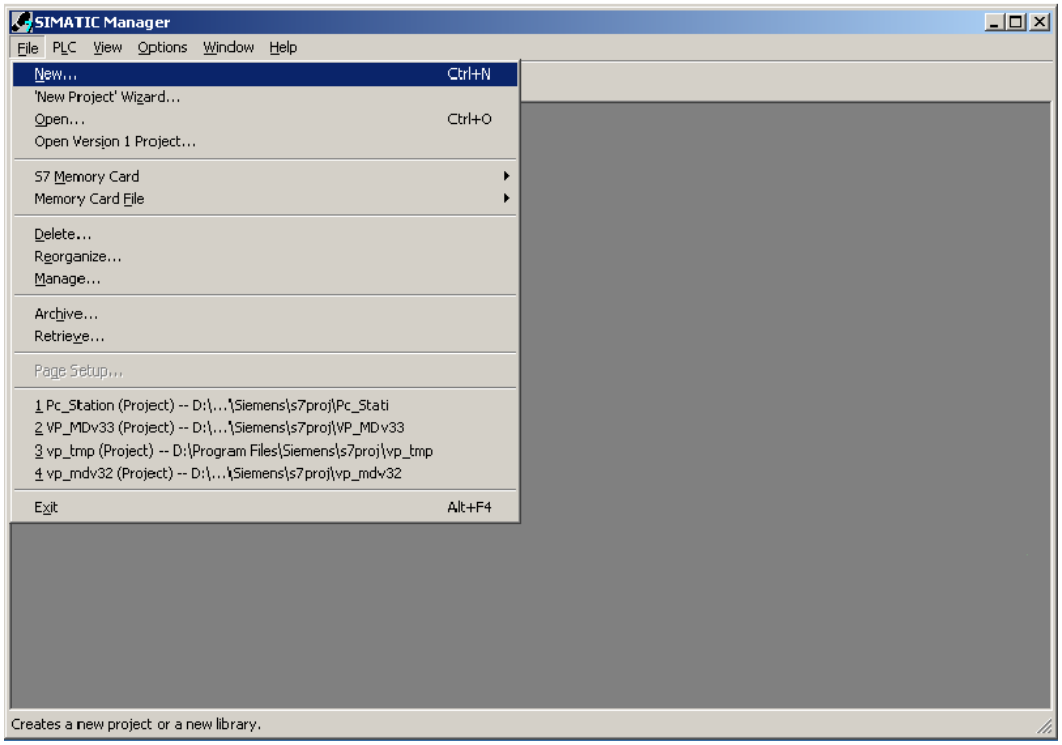
Copy SY_M.BMP and SY_H.BMP COPY to SIEMENS\ Step7\S7DATA\NSBMP.

4. Configuration of PC Master Station Software:

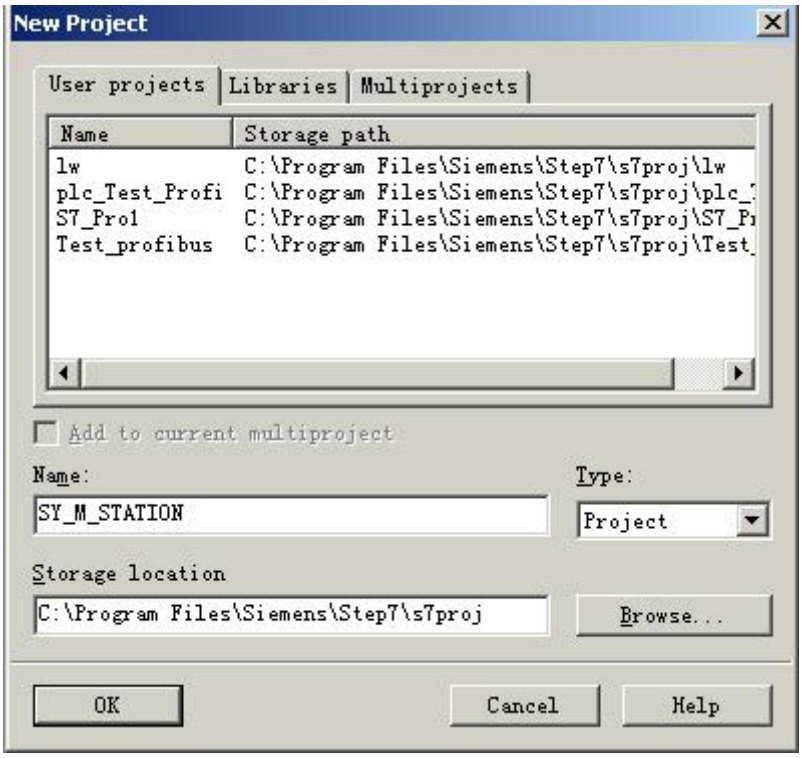
Example 1:

- Use GSD file:SY_P_M.GSD
- Icon file:SY_M.BMP
- Open Step7

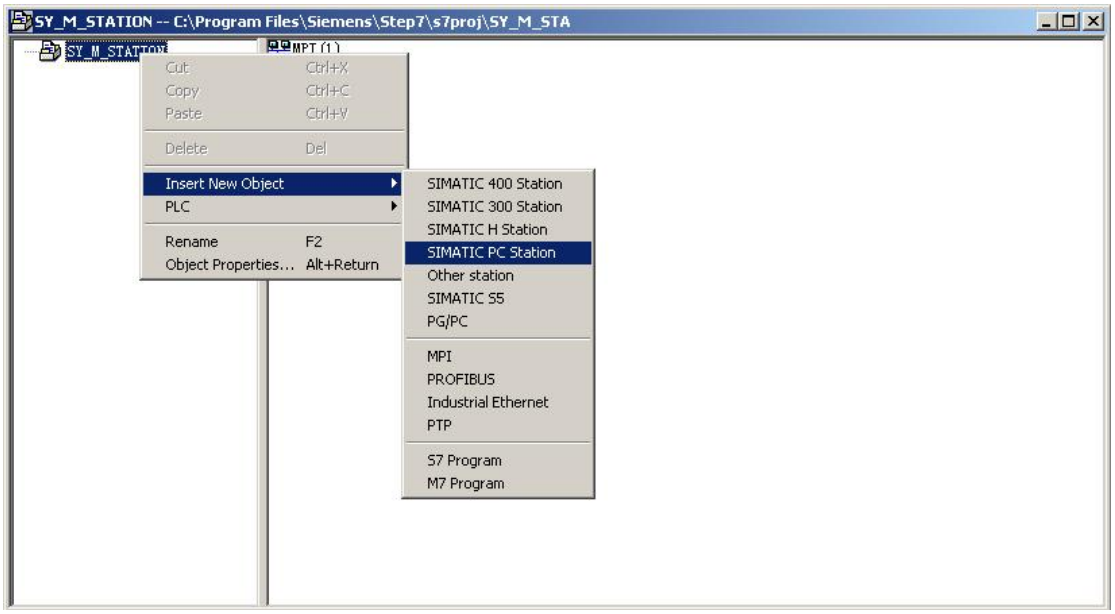
- Create a new project



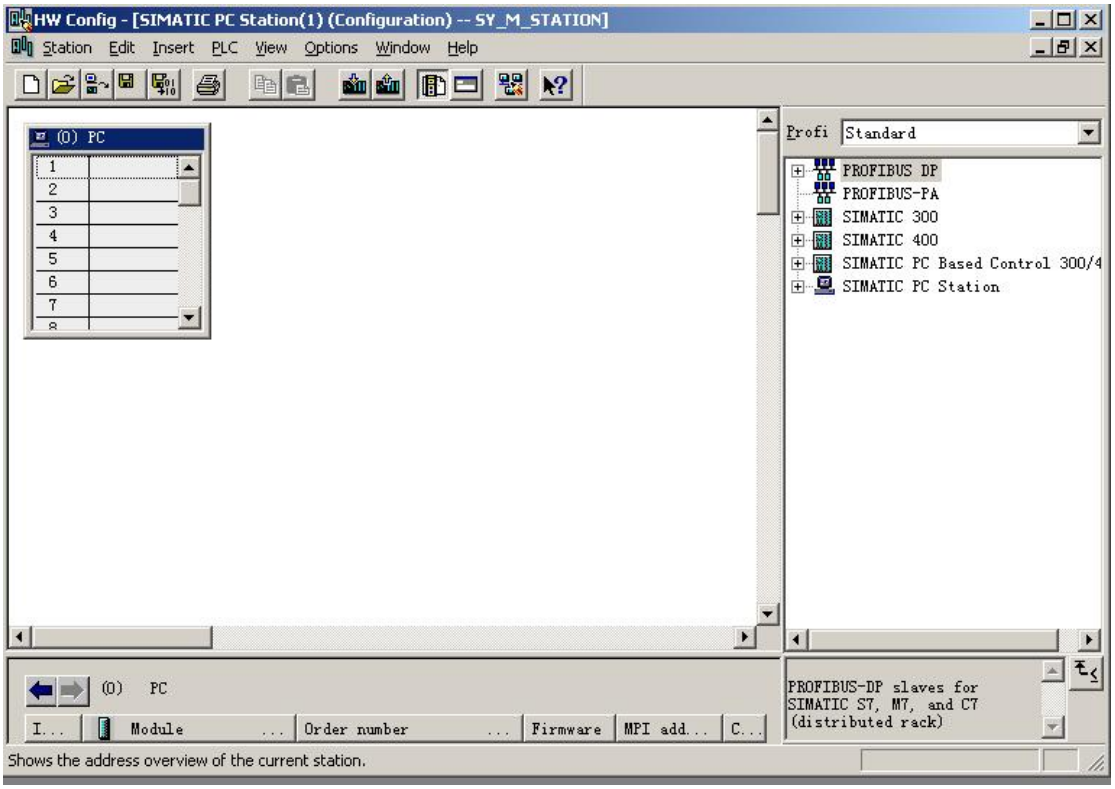
- Name the project: SY_M_STATION



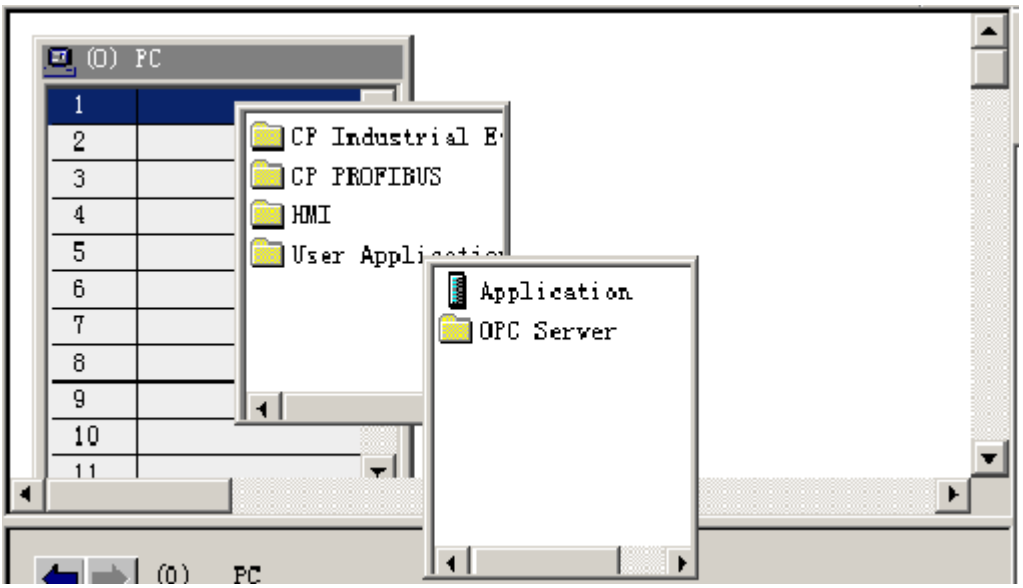
- Insert PC Station
- In SY_M_STATION click right pop-up menu and select SIMATIC PC Station



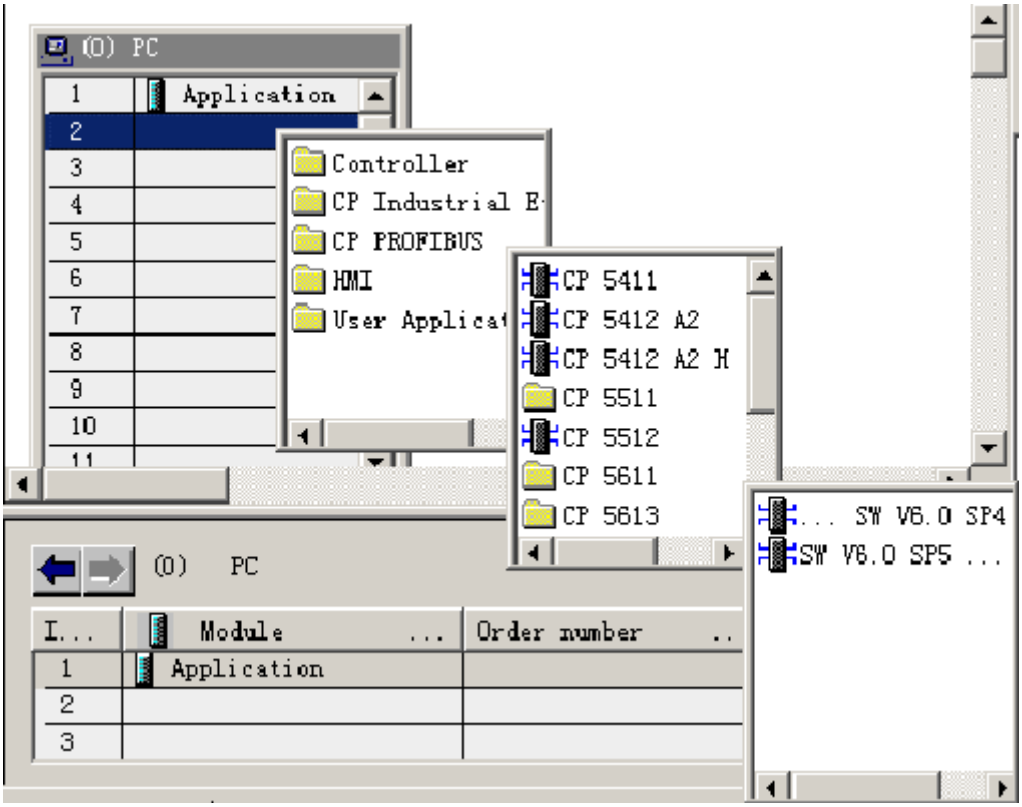
- Double click IMATIC PC Station (1), and SIMATIC PC Station (1) is the configured Station Name.
- Double click Configuration, and the interface shows below:



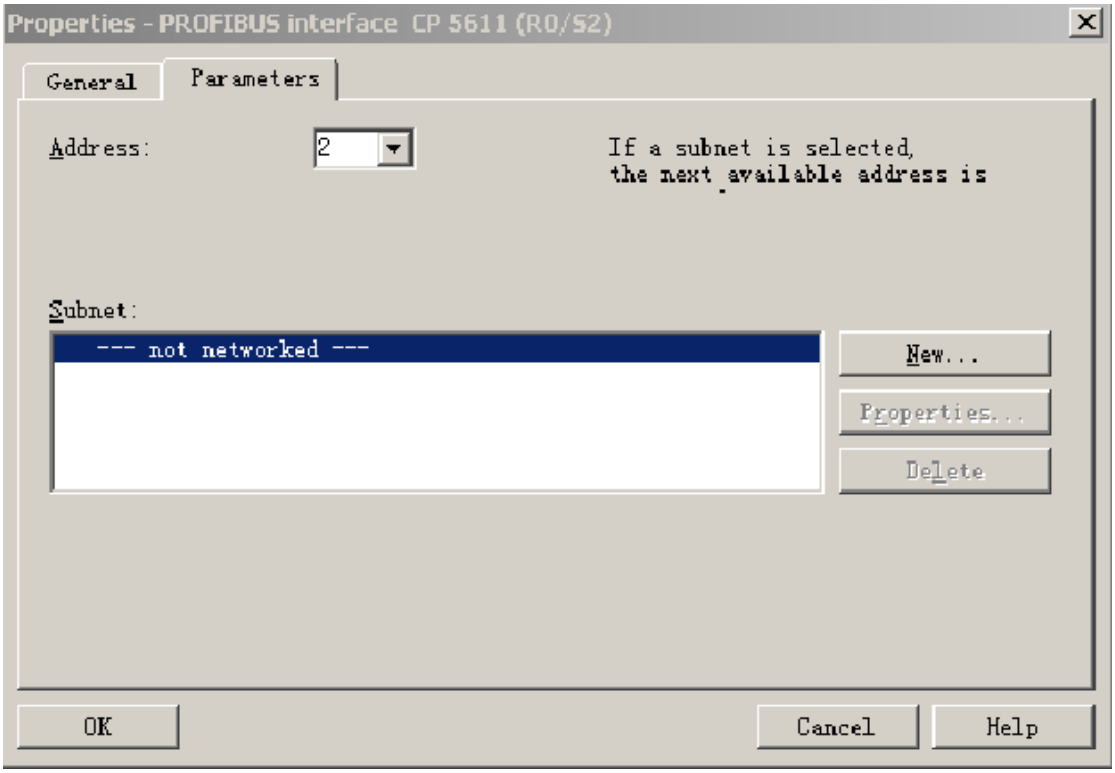
- According to the showed Figure, right-click on the mouse and select “Insert Object…”, choose Application.



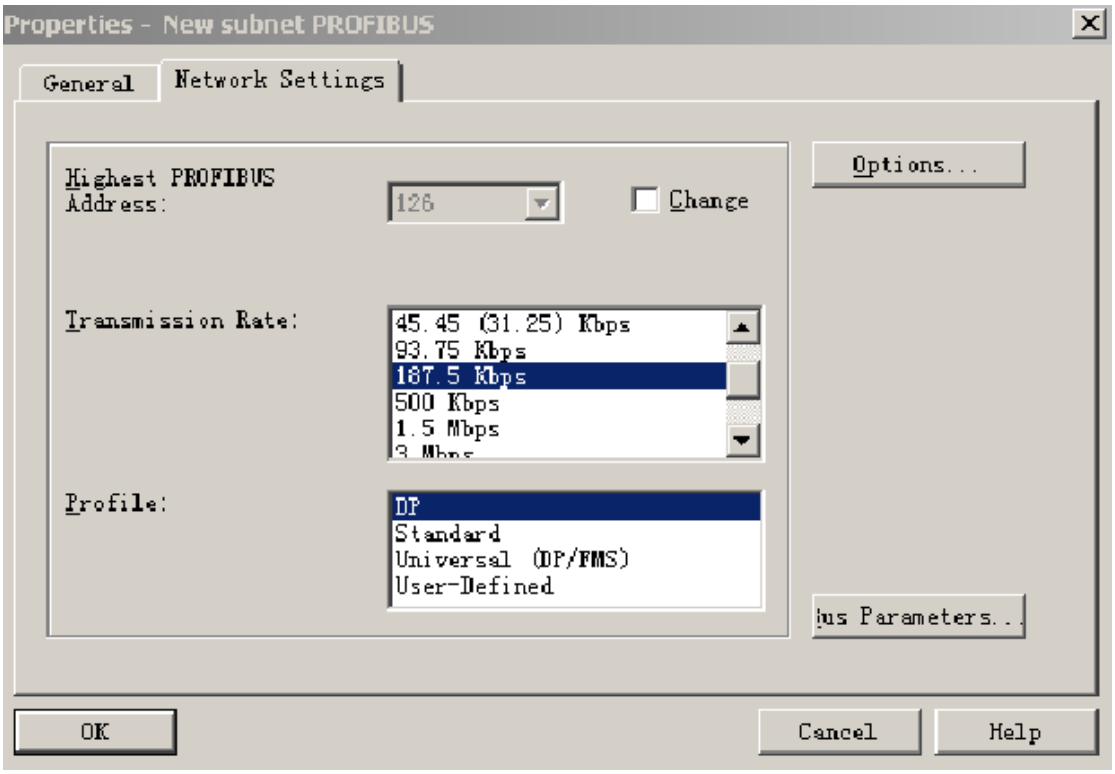
- Use the same way to configure the second slot of rack, select “CP PROFIBUS CP 5611 SW V6.0 SP5” as Figure shows.



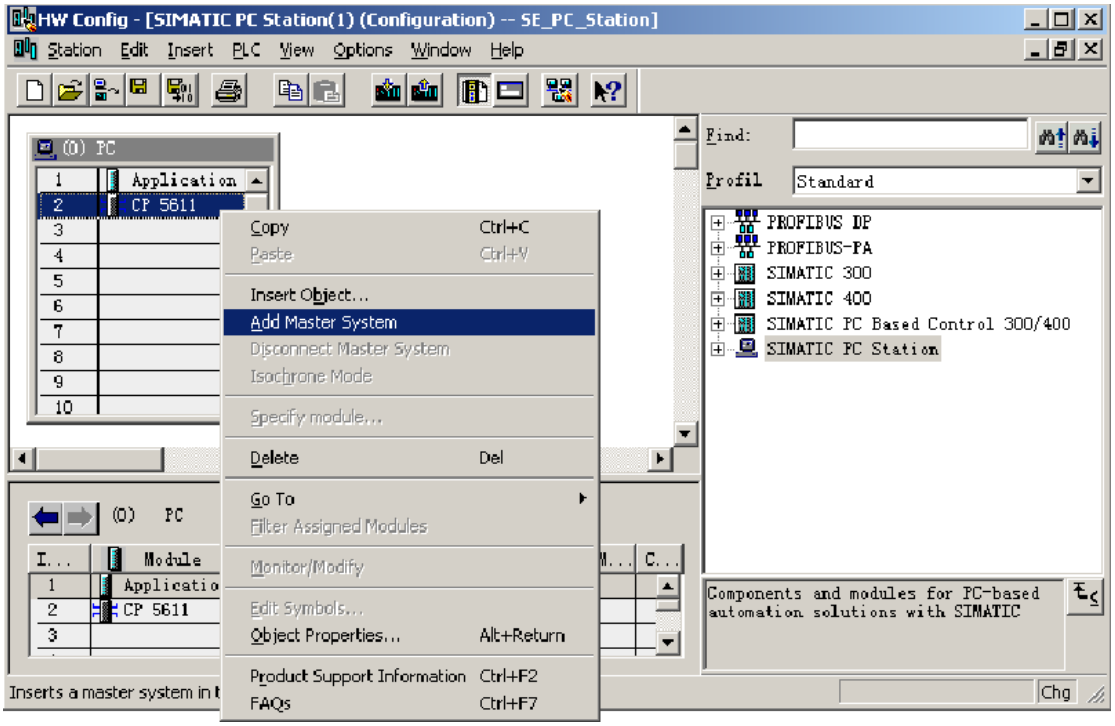
- Then pop-up window as shows in Figure below, Address is the master station address, usually the default is 2.



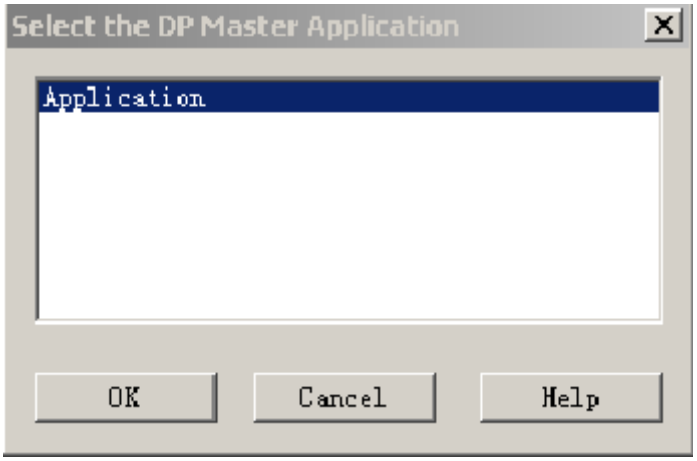
- Click "NEW" on the window to create a PROFIBUS network, the window shown as Figure below appears, select "Network Settings". Set Baud Rate to 187.5Kbps which is usually used, then press "OK" to exit current window.



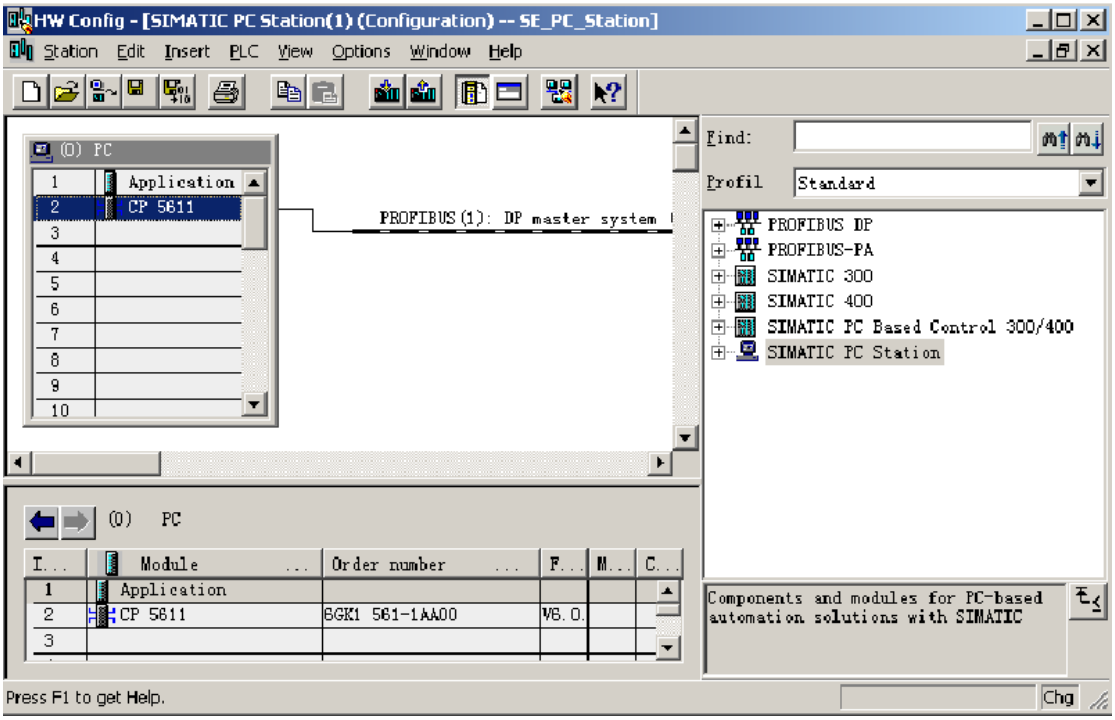
- Select CP 5611, and right-click mouse and select "Add Master System".



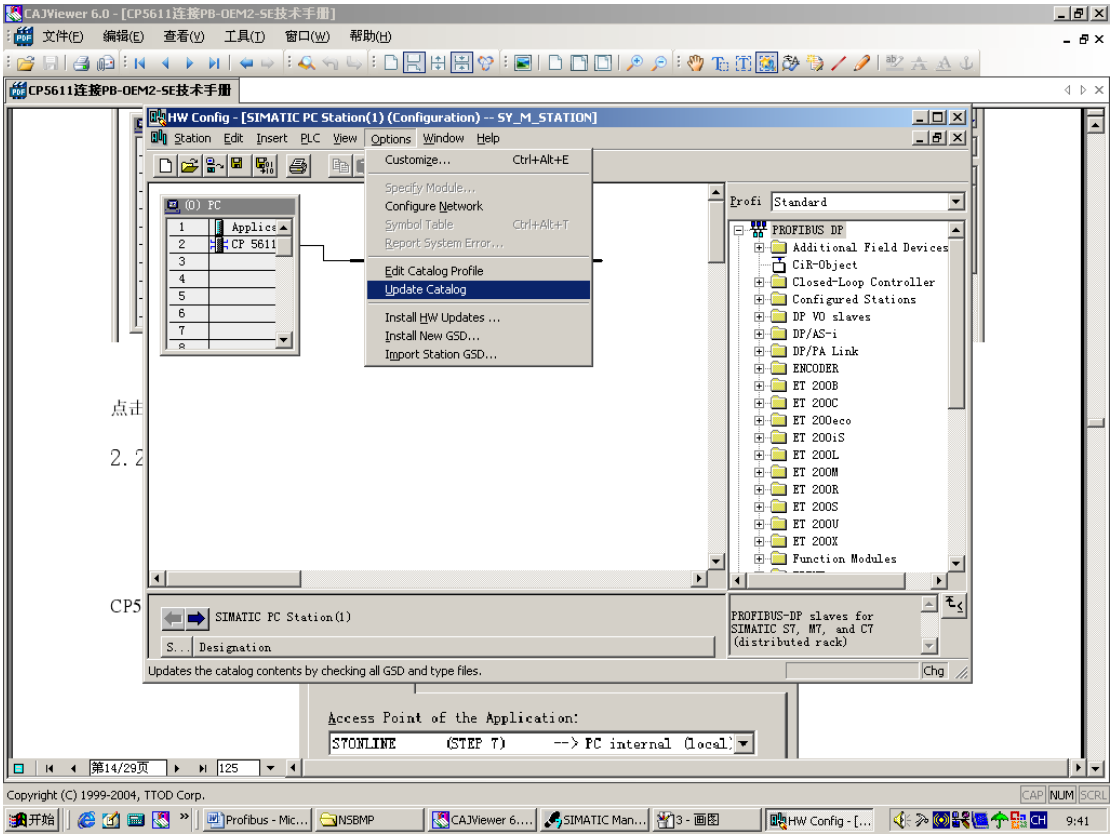
· Select “Application” and press “OK” to exit current window.



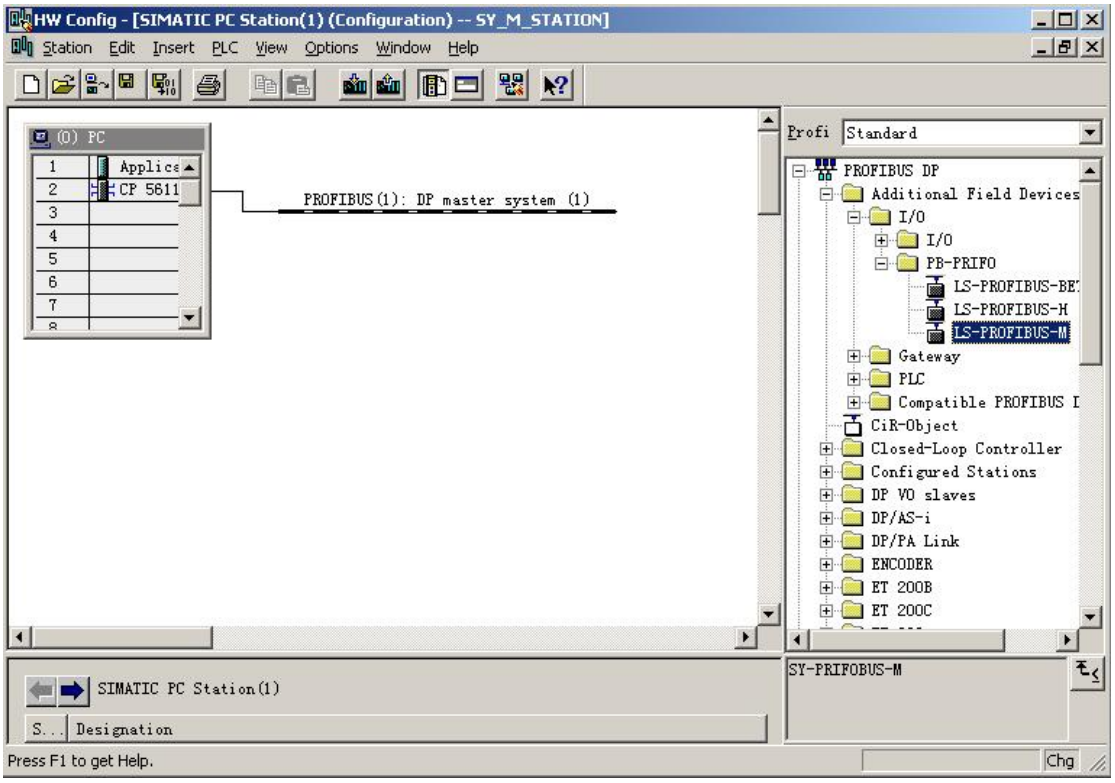
· Window shows up as Figure below



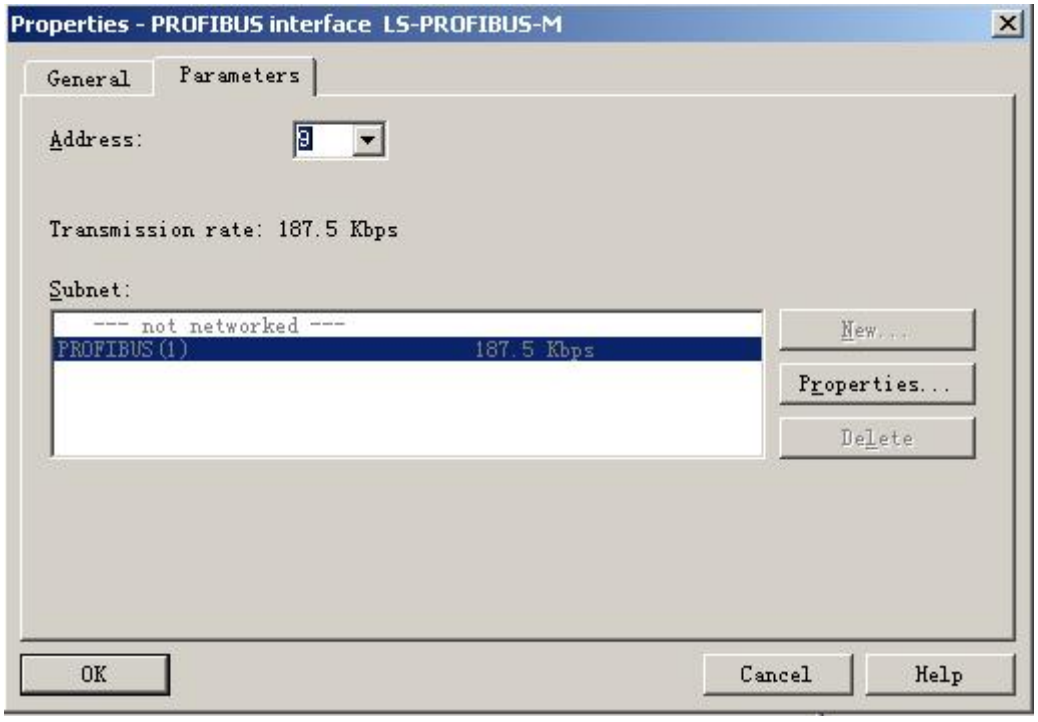
· Select main window "Options—Update Catalog" as showed in the Figure and update Catalog.



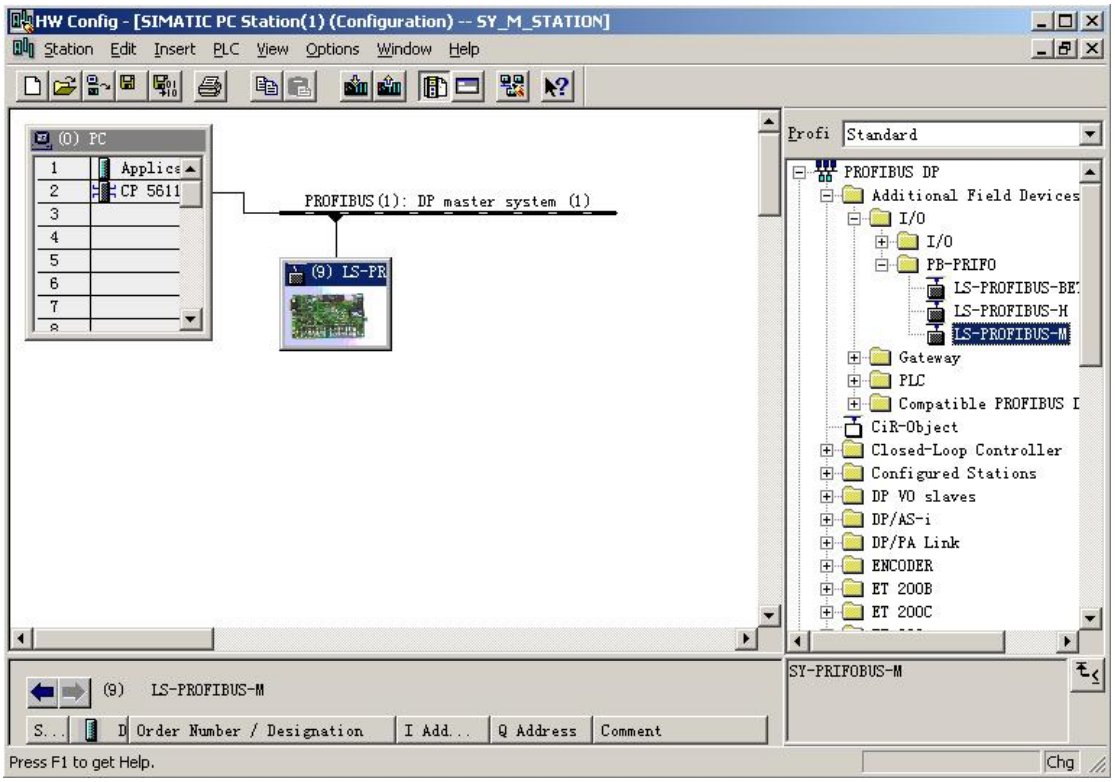
- The below Figure shows PROFIBUS network is expanded from CP 5611, click the network and select "LS-PROFIBUS-M" from the Catalog in the right part of the window, double-click on the product model.



- The address must be in consistent with the actual address of the subsidiary station device (in this case, it is 9).

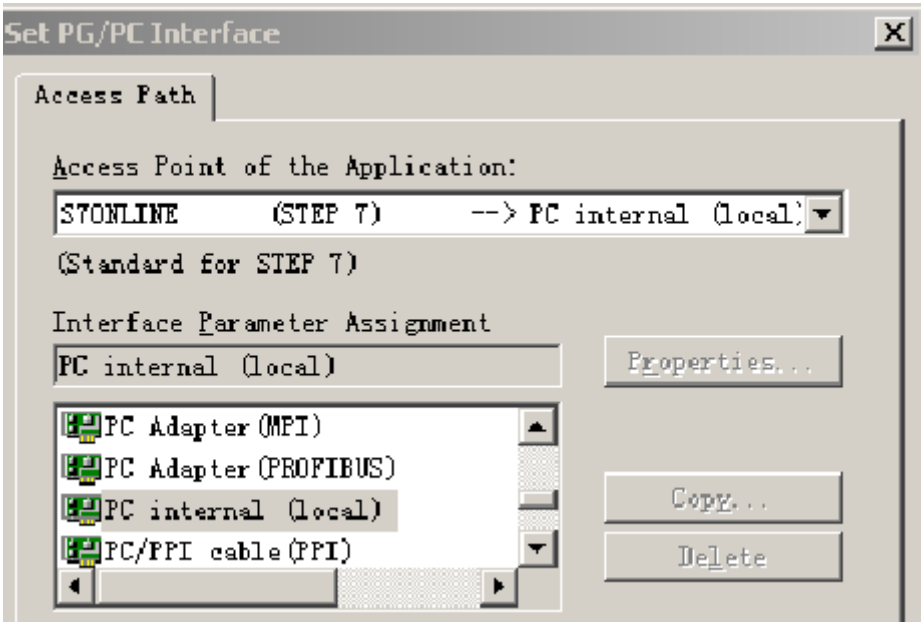


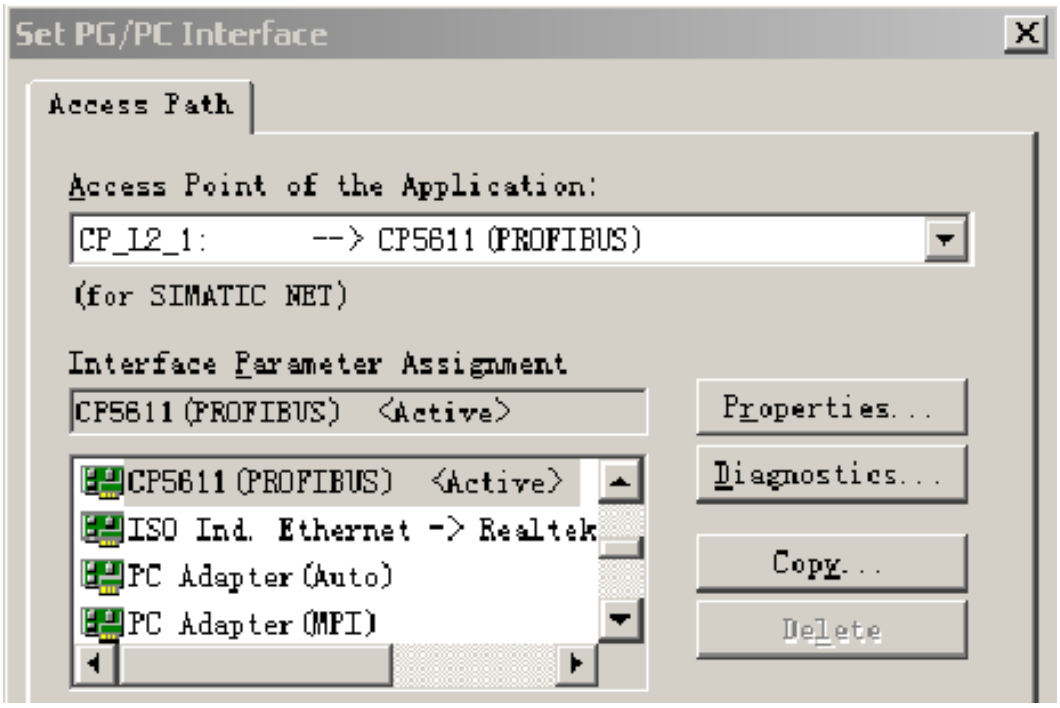
- Select “OK” to exit current window.



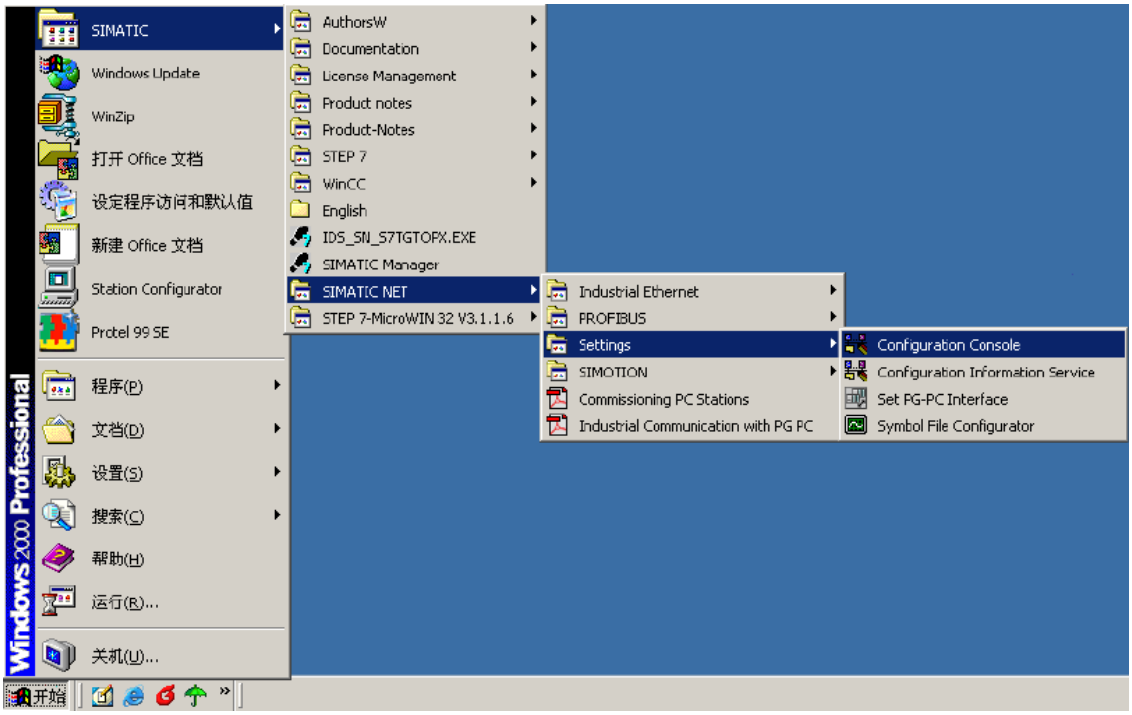
- Press  icon in Tool, save, compile, exit and complete Step7 configuration.

- Enter “Control Panel”, open Set PG-PC icon  , point S7ONLINE to PC internal, point CPL2_1 to CP5611(PROFIBUS)，and press "OK" to exit.

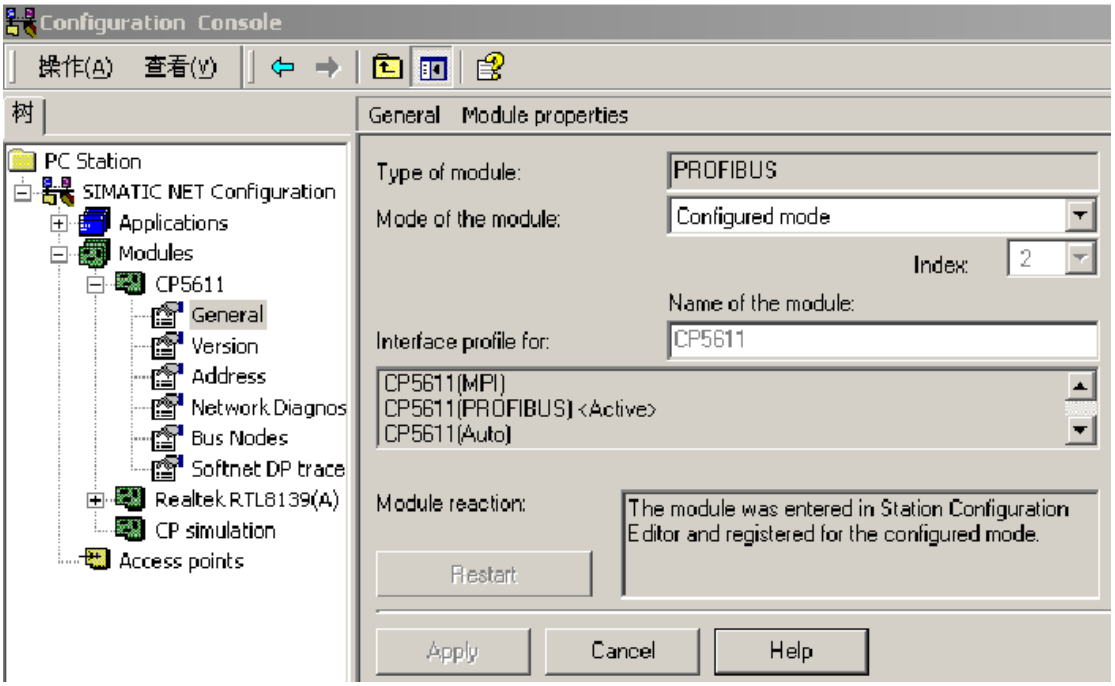




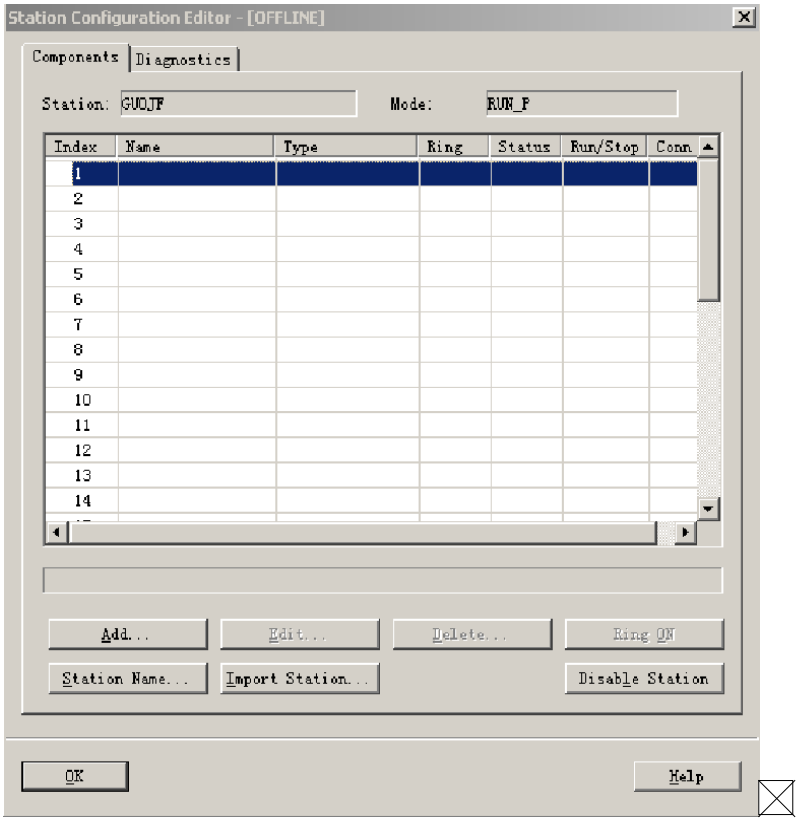
· Select Simatic Net configuration according to the Figure below.



· As shows in the Figure, CP 5611mode is “Configured mode”, and the configurations of Index and Step7 are the same, 2. Press “Apply” and exit configuration interface.

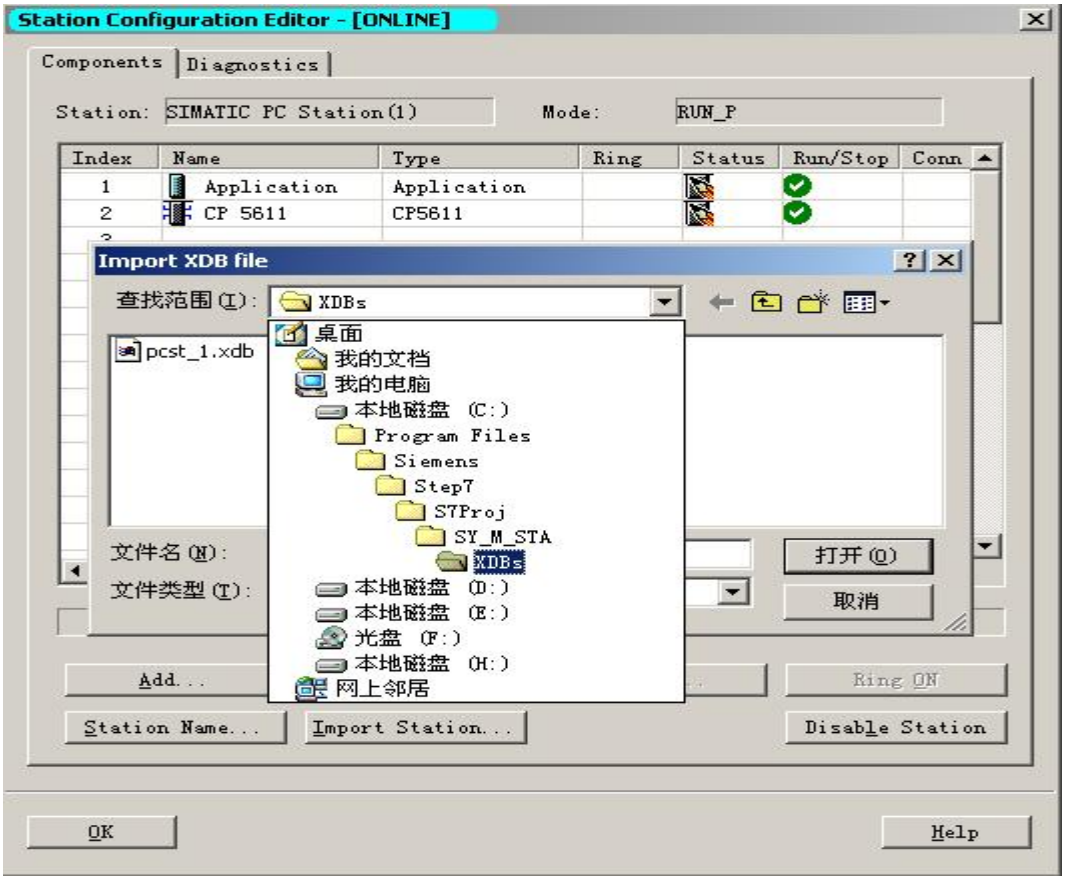


- Click on the desktop shortcut of Station Configuration, enter the virtual PC Station screen
- Select "Import Station", and make Step7 configuration import into a virtual PC Station. A dialog box will pop up, after confirmation click "Yes".

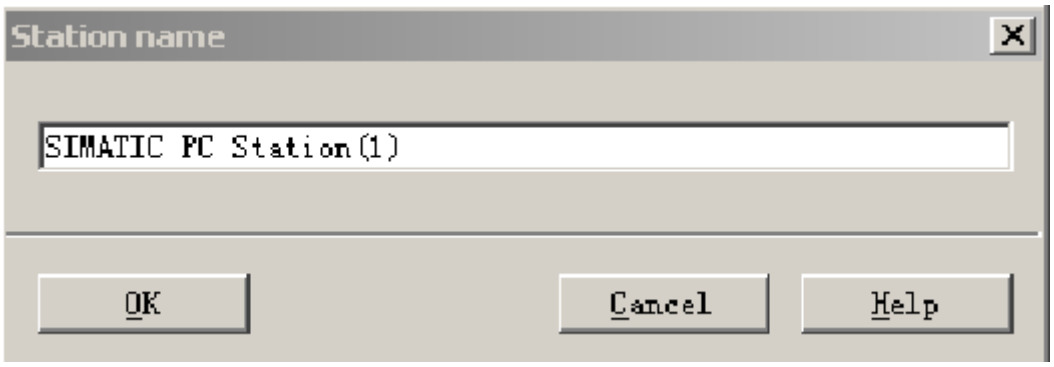


- Pop up a dialog box, select Step7 configuration. Step7 configuration is stored in the SIEMENS \ S7proj \ SY_M_STA \ XDBs, open file with xdb extension name in directory. In

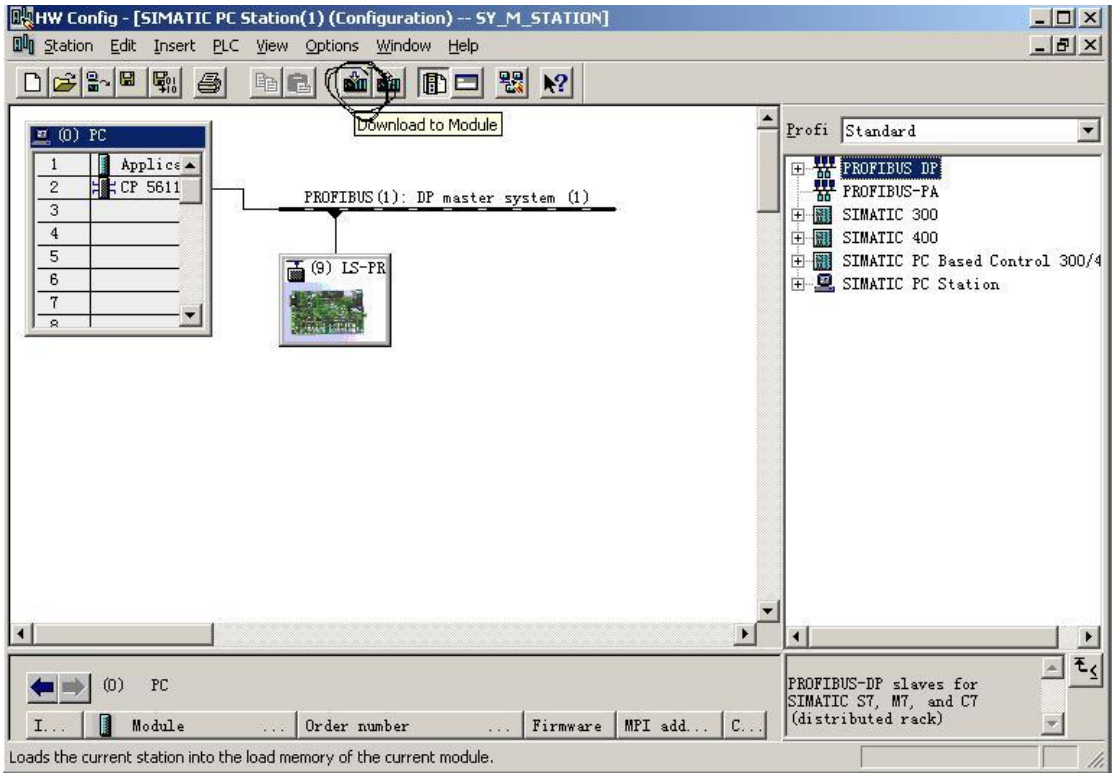
this case, it is pcst_1.xdb, and this file is Step7 configuration file, as shown in Figure below.



- "Station Name" is set up as a virtual PC Station name. The Name shall be consistent with Step7 configuration. In this case, the Station Name is SIMATIC PC Station (1) as showed in Figure below.



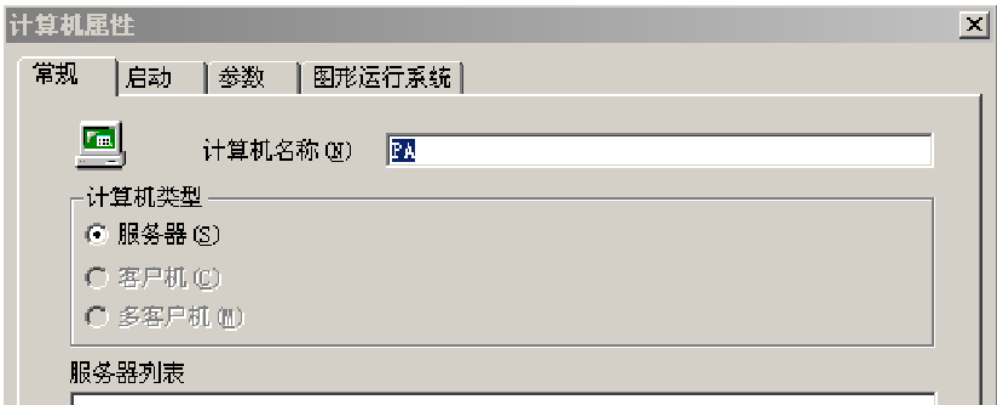
- Press "OK" to exit PC Station configuration window.
- Open Step7configration interface and download the configuration information into PC Station.



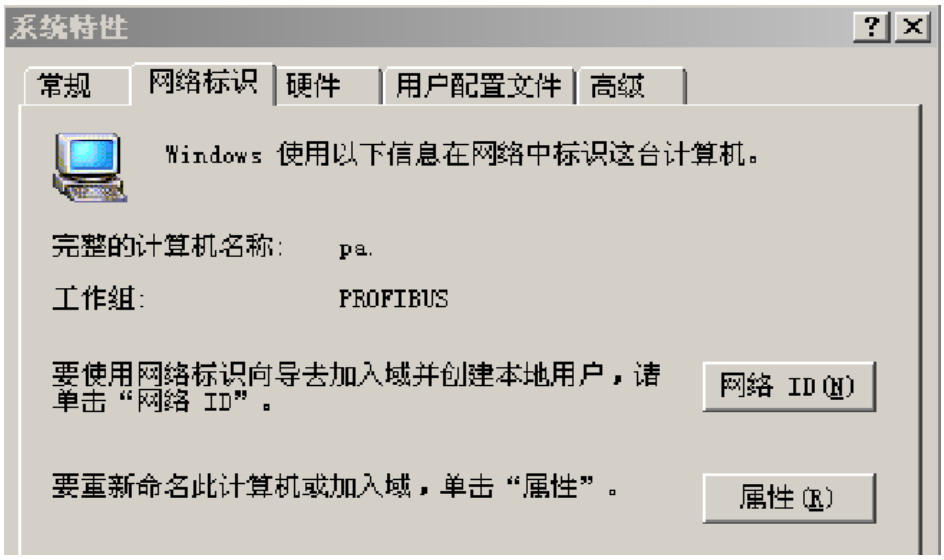
The hardware configuration and PC Station configuration are finished.

How to use WinCC:

- Run WinCC program, select main menu: File, New and dialog pop up, select user and click “Confirm”.
- Select the left tree list in the "computer", click the right mouse button in the pop-up menu, select "Properties", a "Computer List Properties" dialog box pop up, click the "Properties" and the dialog screen appears as shown in Figure below.



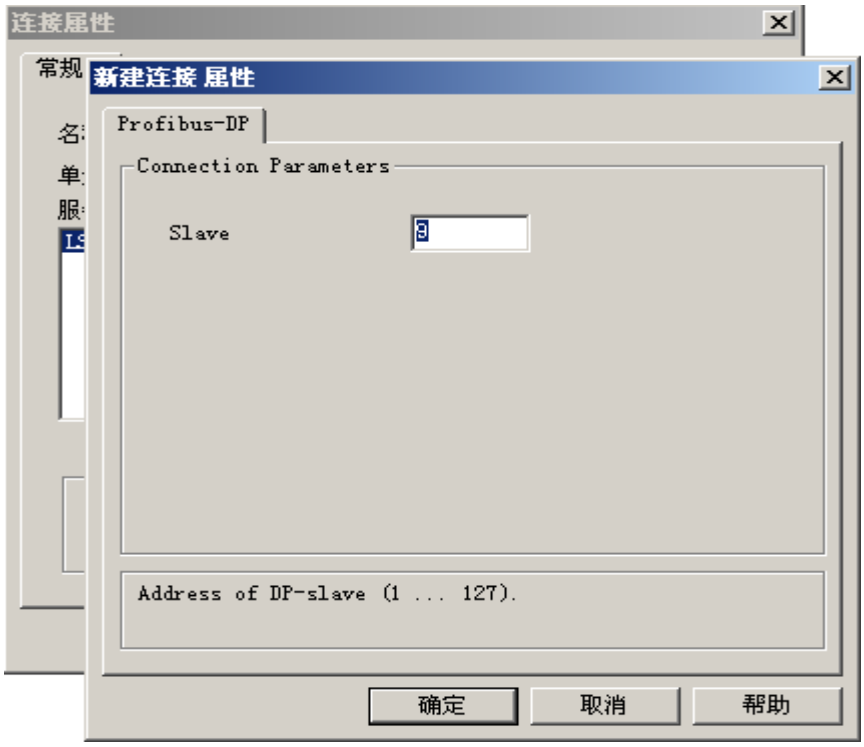
- "Computer Name" must be consistent with the local computer name. Local computer name can be found in the "Control Panel", "system" view, as showed below.



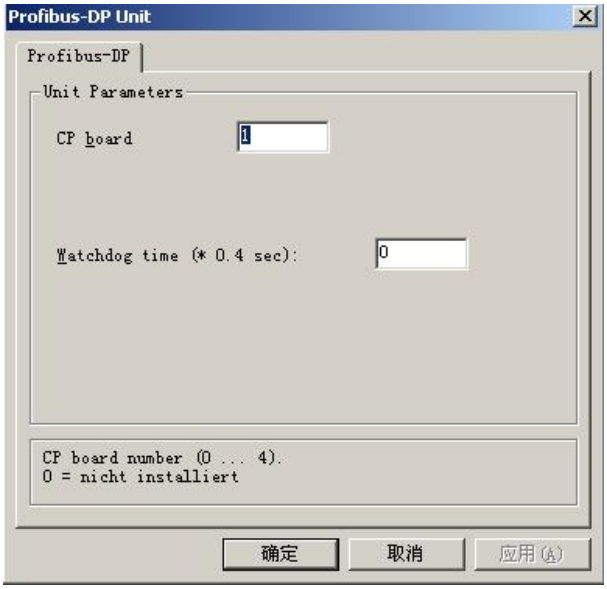
- Select the "Tag Management", right-click mouse, and select "Add new driver" in the pop-up menu. Select "PROFIBUS DP.CHN" files, the interface appears as showed in the Figure below. Right-click mouse, select "New Driver connection".

- The below interface appears and name the new connection named "New Connection", click "Properties" button.

- Screen appears as shown in the Figure below, fill in the subsidiary station number in dialog box and the station number must be set in consistent with the hardware setting, and in this case, it is set to 9.



- After completing the above setup, set cp5611 "System Parameters", select "System Parameters", as showed in the Figure below.



- Set new label group and labels. In this case, two groups are set: Input group and Output group. Input label and output label are set correspondingly.

int_1	浮点数 32 位 IEEE754	w0,by0,bi0,rt0,sw0
int_2	浮点数 32 位 IEEE754	w0,by4,bi0,rt0,sw0
int_3	浮点数 32 位 IEEE754	w0,by8,bi0,rt0,sw0
int_4	浮点数 32 位 IEEE754	w0,by12,bi0,rt0,sw0
int_5	浮点数 32 位 IEEE754	w0,by16,bi0,rt0,sw0
int_6	浮点数 32 位 IEEE754	w0,by20,bi0,rt0,sw0
int_7	浮点数 32 位 IEEE754	w0,by24,bi0,rt0,sw0
int_8	浮点数 32 位 IEEE754	w0,by28,bi0,rt0,sw0
int_9	二进制变量	w0,by34,bi0,rt0,sw0
int_10	二进制变量	w0,by34,bi1,rt0,sw0
int_11	二进制变量	w0,by34,bi2,rt0,sw0
int_12	二进制变量	w0,by34,bi3,rt0,sw0
int_13	无符号 8 位数	w0,by32,bi0,rt0,sw0
int_14	无符号 8 位数	w0,by33,bi0,rt0,sw0
int_15	二进制变量	w0,by35,bi1,rt0,sw0

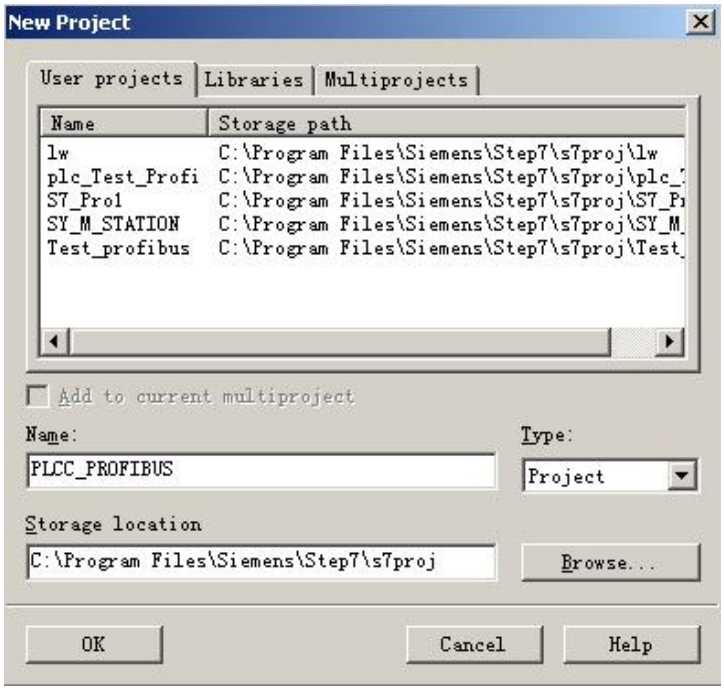
- Select Input group in the tree list, right-click mouse and select "New Tag" to setup appropriate variables.
- Select "graphics editor", right-click mouse and "Open" graphic editor. Select "input / output" in the right side of the "Object Palette", move the mouse to a blank panel, release the left mouse button and pop up a dialog. Select the yellow button on the right side of the variables in dialog box to specify the label for the domain. Refer to the Figure below.

- Refer to the steps above, setup the I/O domain of Input and Output.
- Click on the corresponding graphic editor to do graphic editor.
- After correctly completed CP5611 and PC Station configuration, program running can start. Click  icon to start the program running.
- Specific settings can refer WinCC engineering provided.

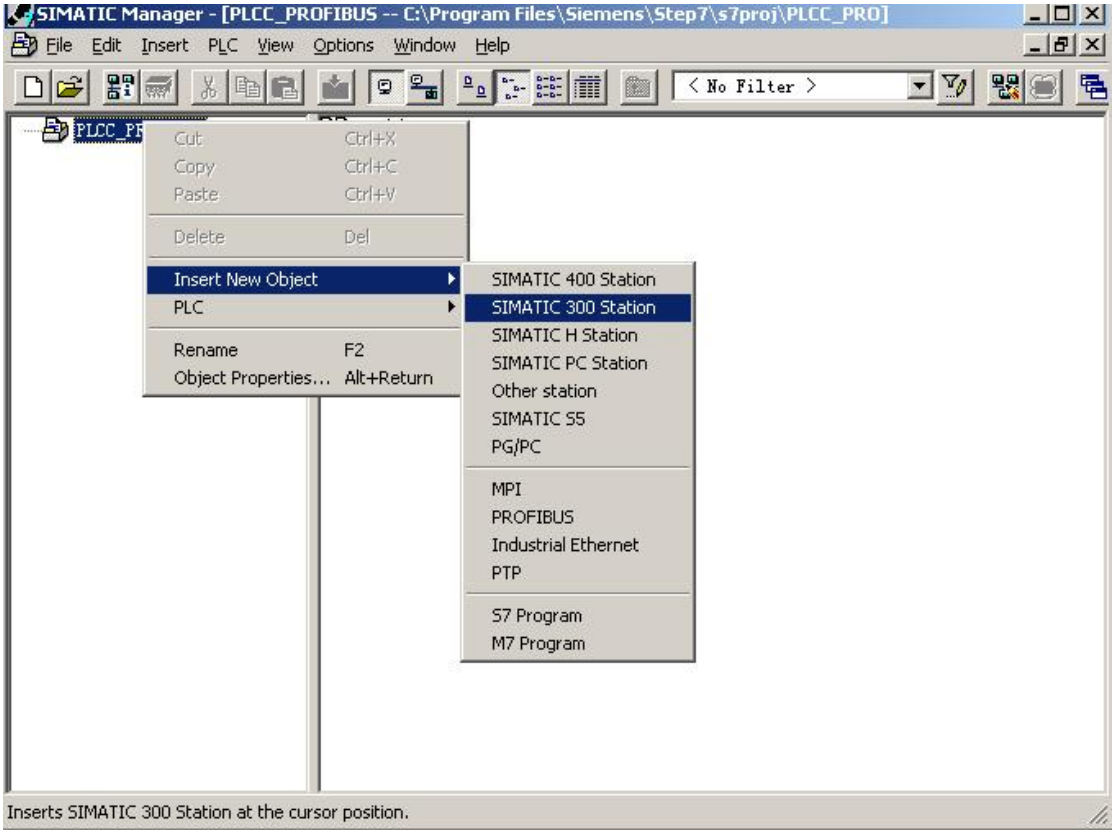
5.2 Use PLC as PROFIBUS Master Station(PC use WINCC and CP5611 Card to Complete Monitor）

In this case, PLC use S7-300 (Power supply: PS307 5A, CPU: CPU315－2DP).
It is to connect the DP on the CPU to the DP on PROFIBUS network, and connect to CP5611card on PC. CP5611 card is used to monitor MPI communication.

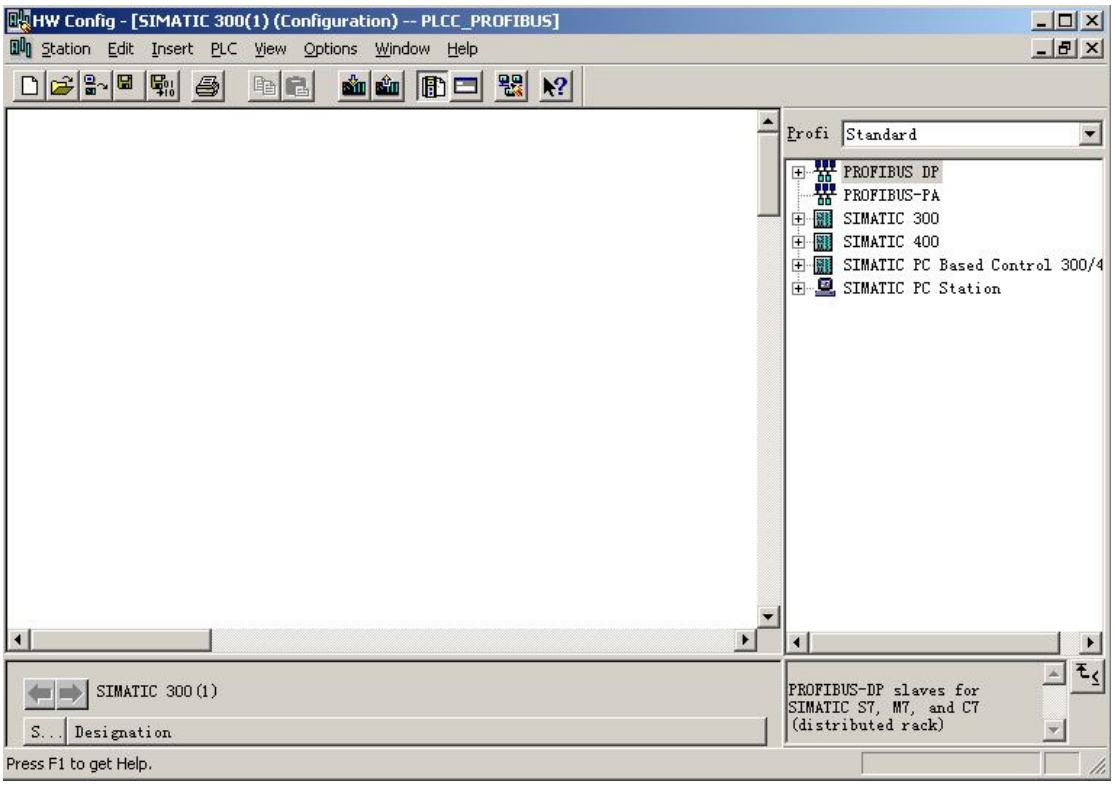
- Open Step7, setup a new project and name the new project “PLCC_PROFIBUS”.



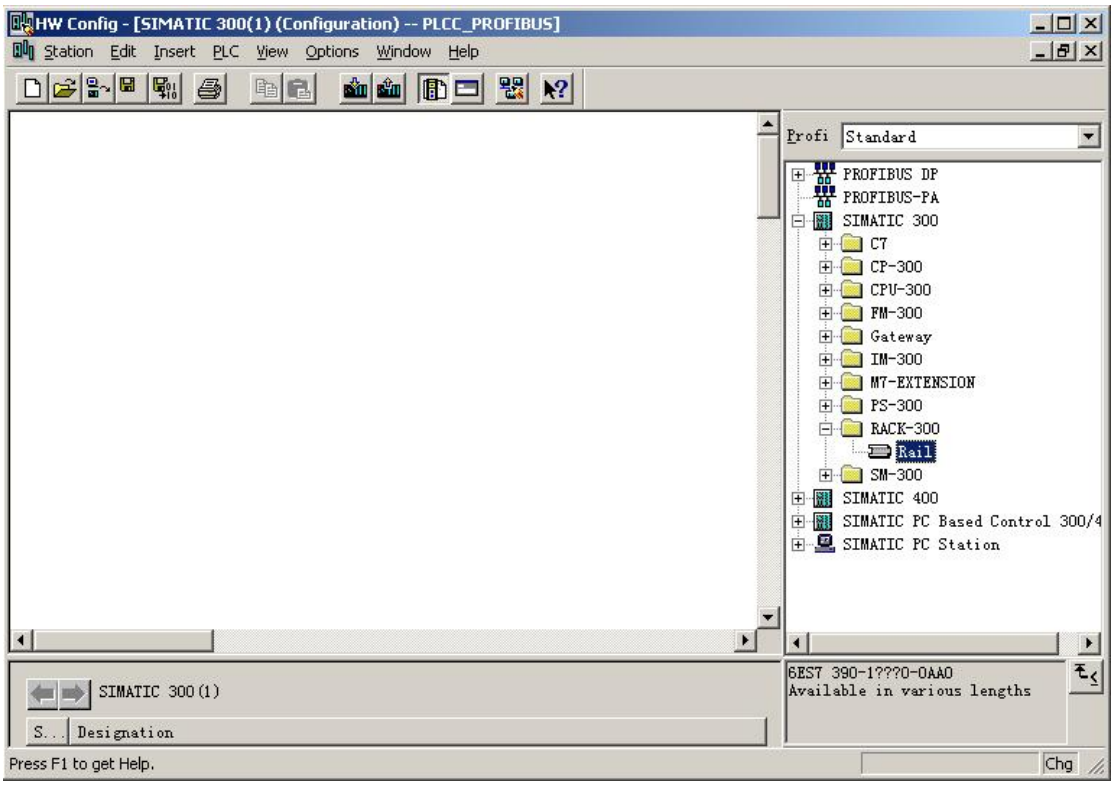
- In PLCC_PROFIBUS, right click pop-up menu, select SIMATIC 300 Station.



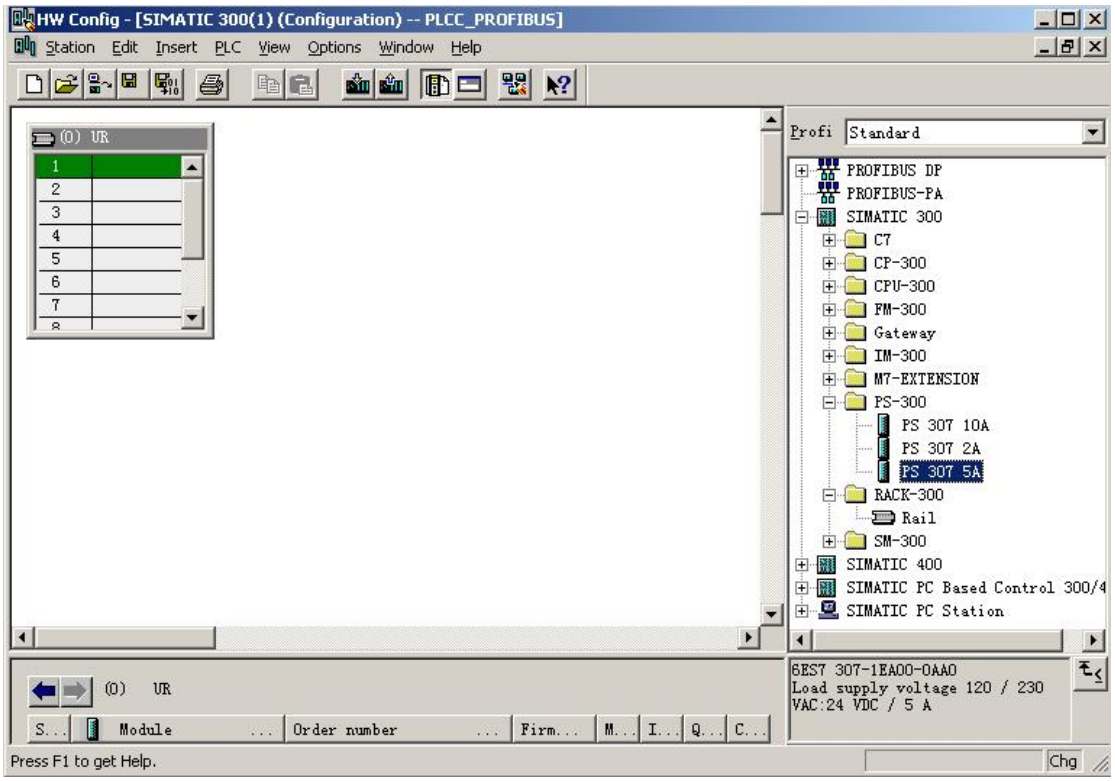
- Double click SIMATIC 300 Station (1), and SIMATIC 300 Station (1) is the Station Name.
- Double click hardware, the interface shows as below.



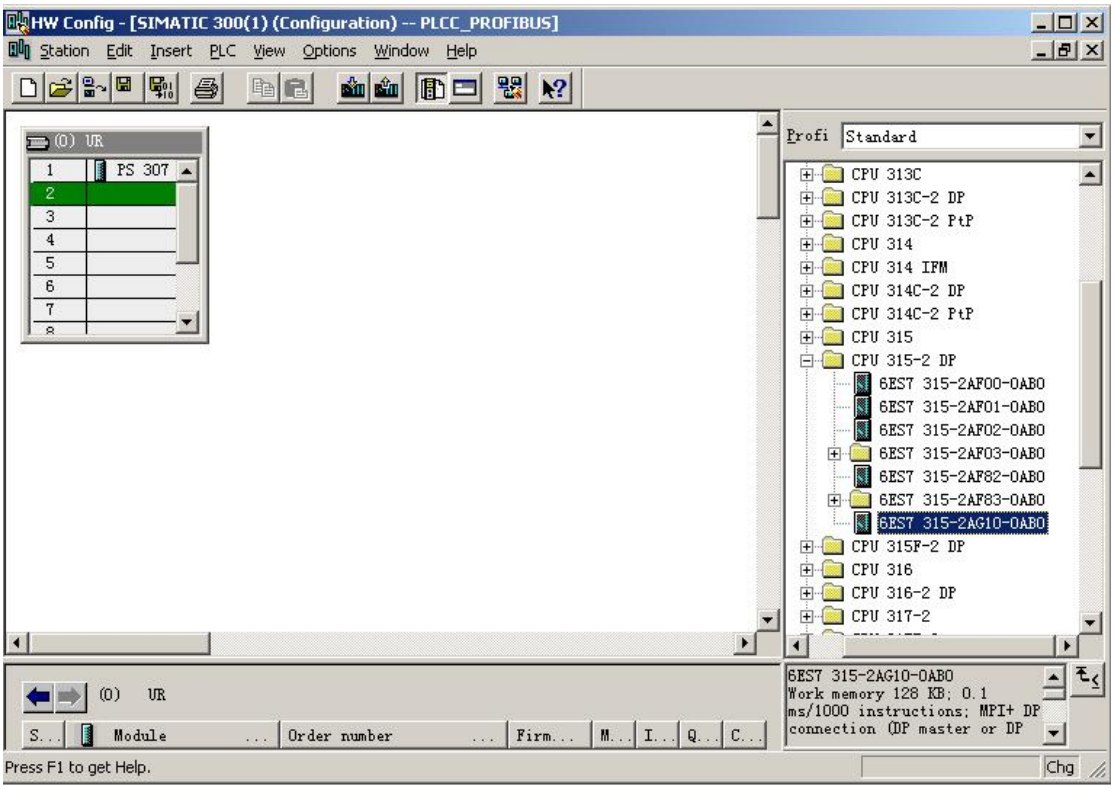
· Double click Rail in the Figure below.



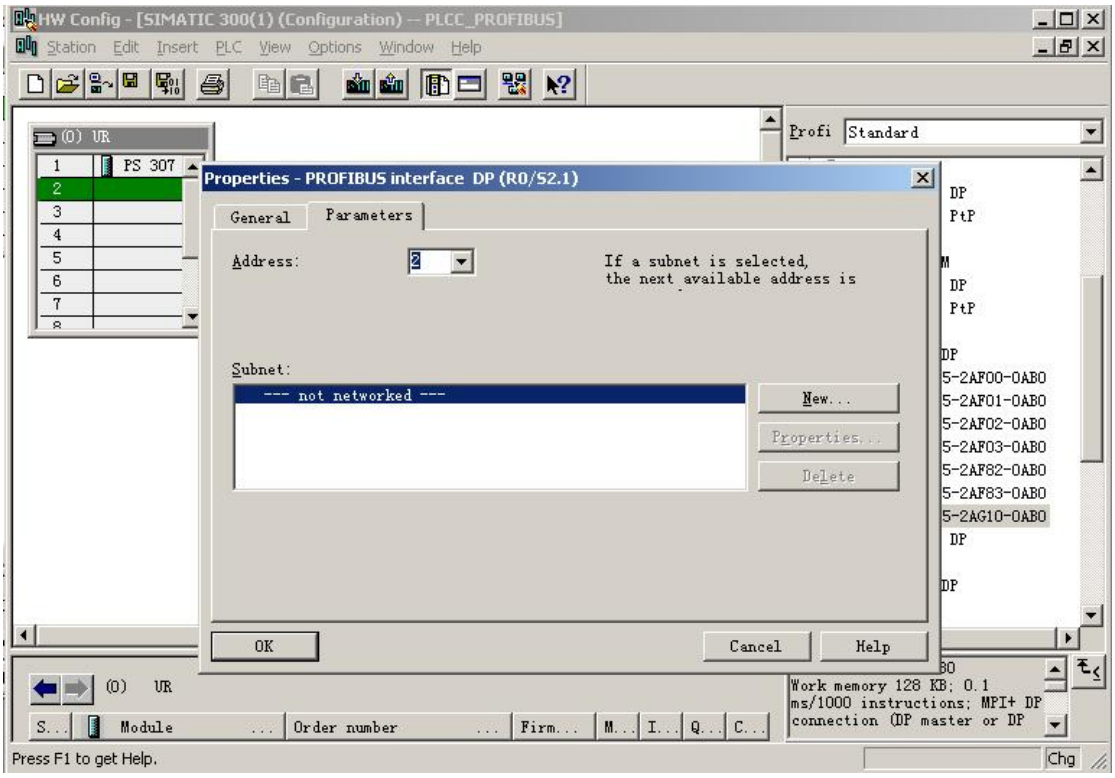
· Add power supply PS 307 5A to the first line of UR.



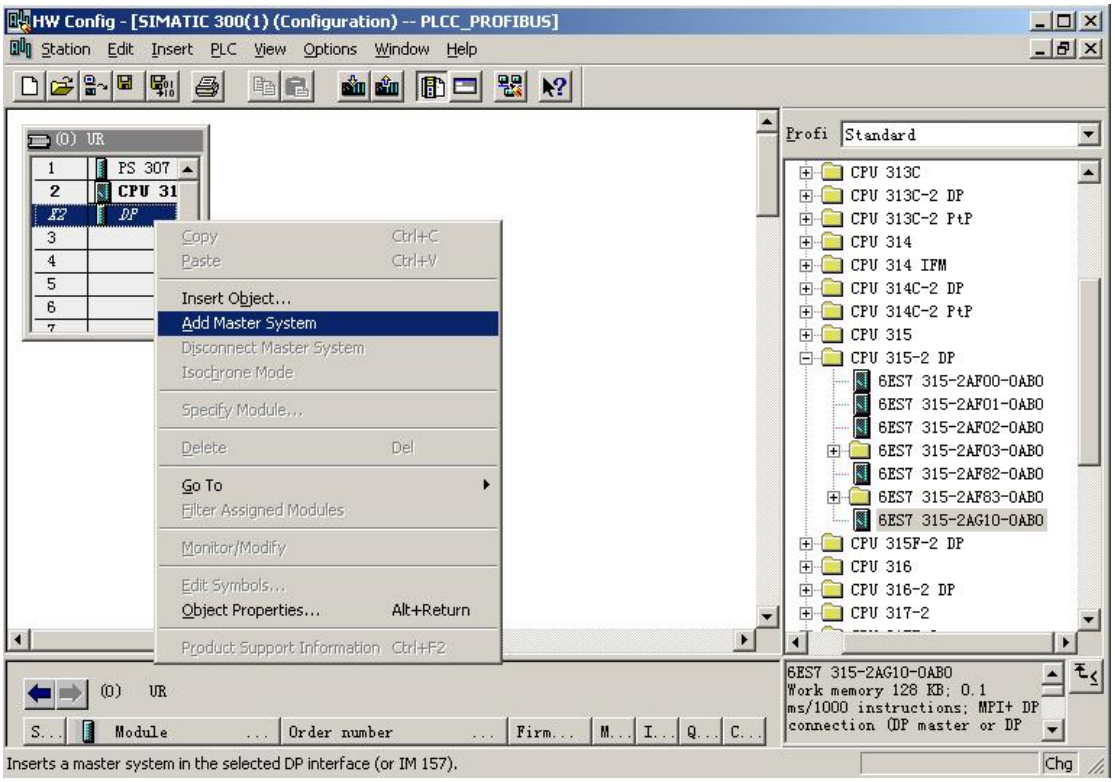
· Add CPU 315-2AG10-0AB0 to the second line of UR.



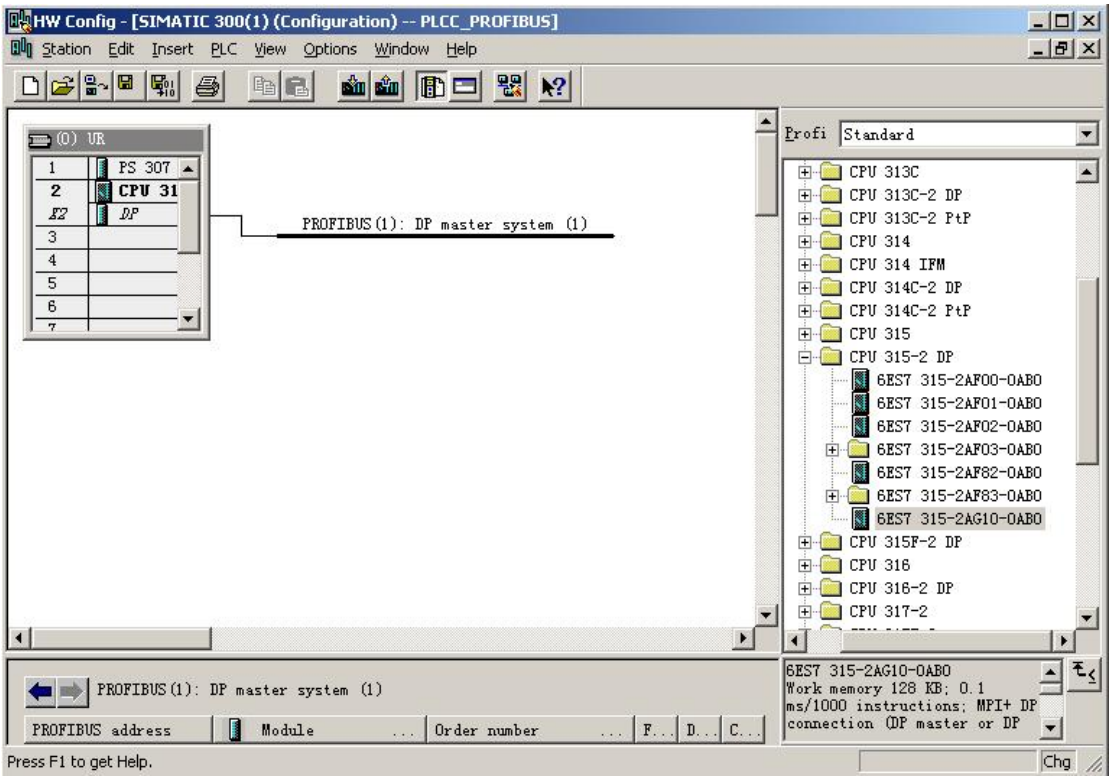
· The PLC master station address (default 2) can be set when the below interface appears and press “OK”.



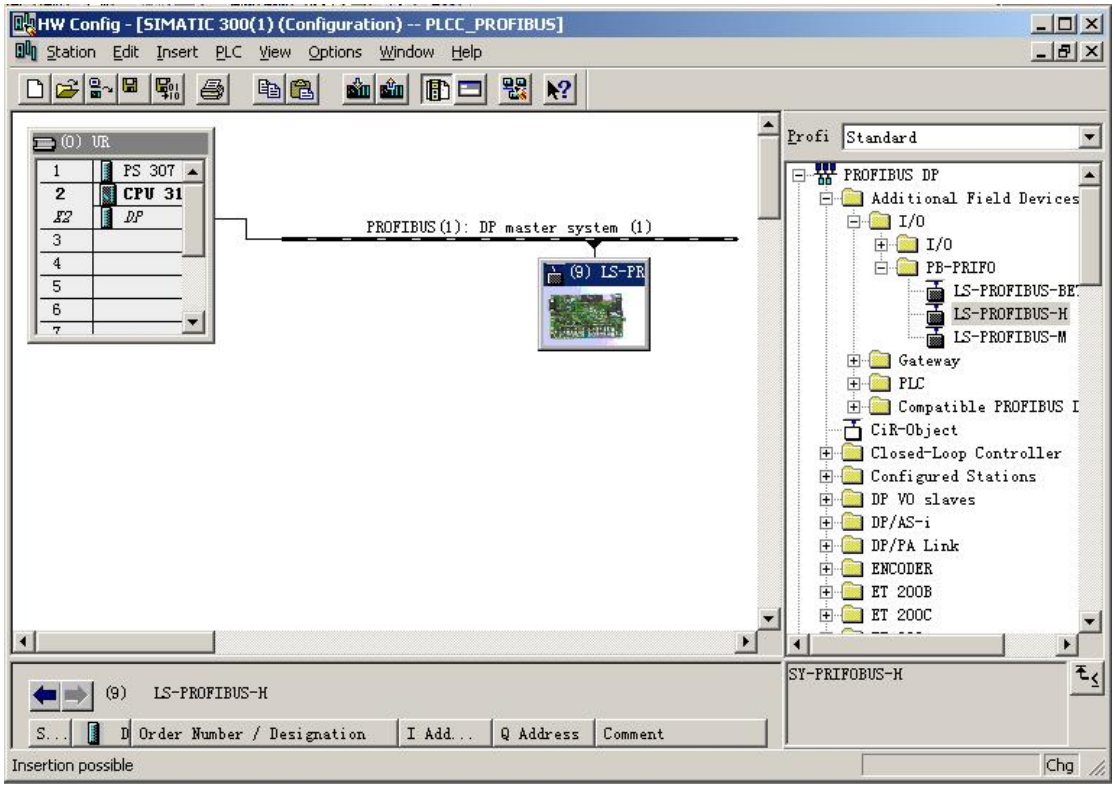
· In the UR list, right-click DP and select Add Master System.



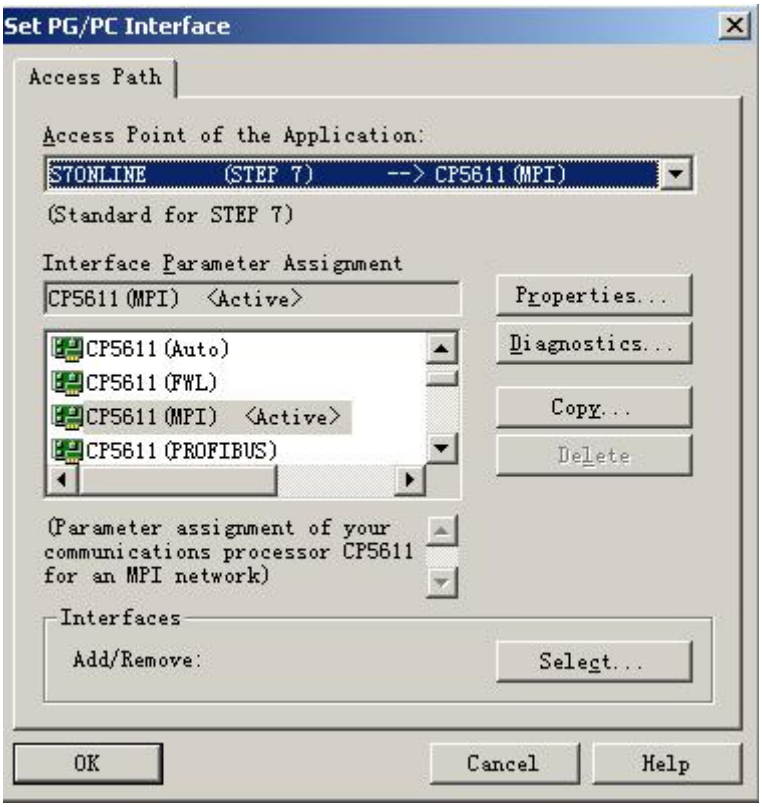
· The below Figure appears when the rate is set.

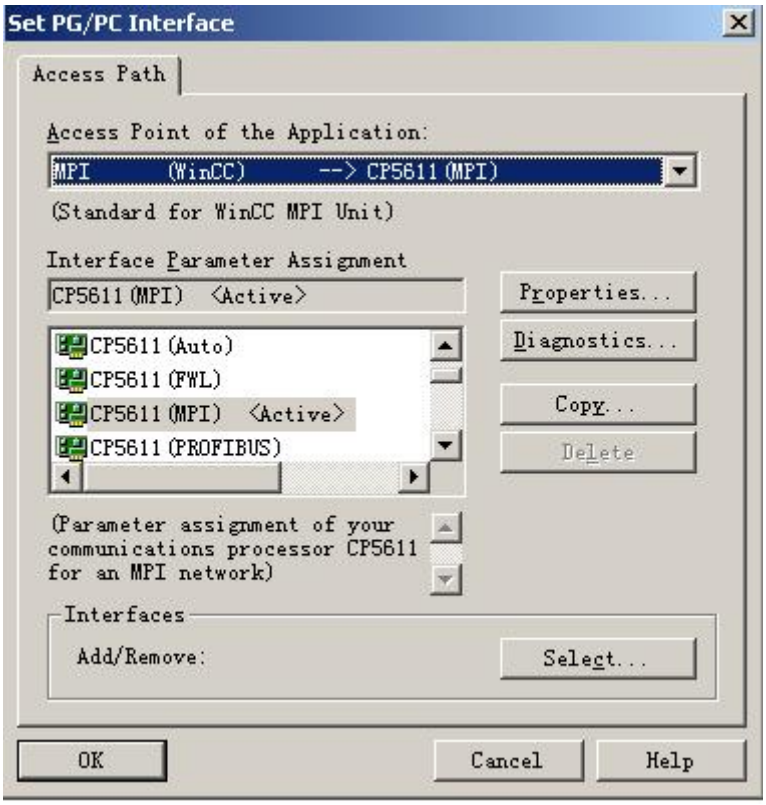


· Select the device that corresponding GSD file represents and save.



· Enter "Control Panel", open Set PG-PC, point S7ONLINE to CP5611 (MPI) and point MPI (WINCC) to CP5611 (MPI), then press "OK" to exit





- Download hardware configuration information into PLC.

Note:

- Because floating-point have positive floating-points and negative floating-points, if the

data received is not correct, the 4 bytes data can be reversed (reverse 0, 1, 2, 3 to 3, 2, 1, 0), the program is as below:

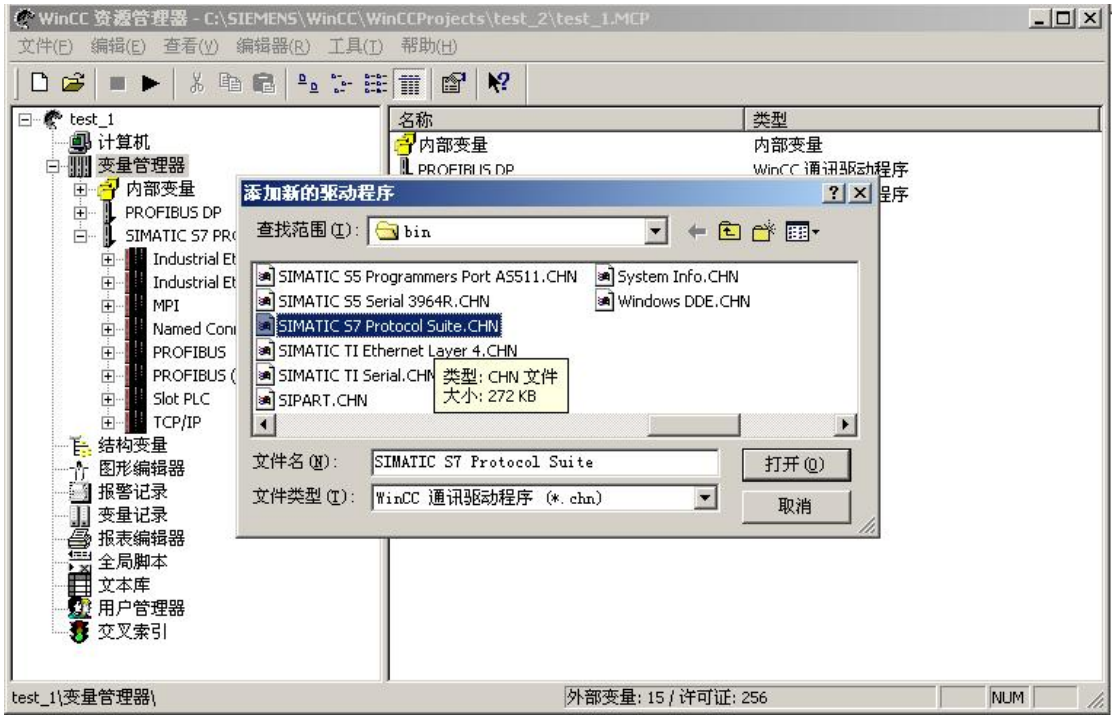
L	IB	0
T	MB	3
L	IB	1
T	MB	2
L	IB	2
T	MB	1
L	IB	3
T	MB	0

In the MB memory, 0-3 is floating-point.

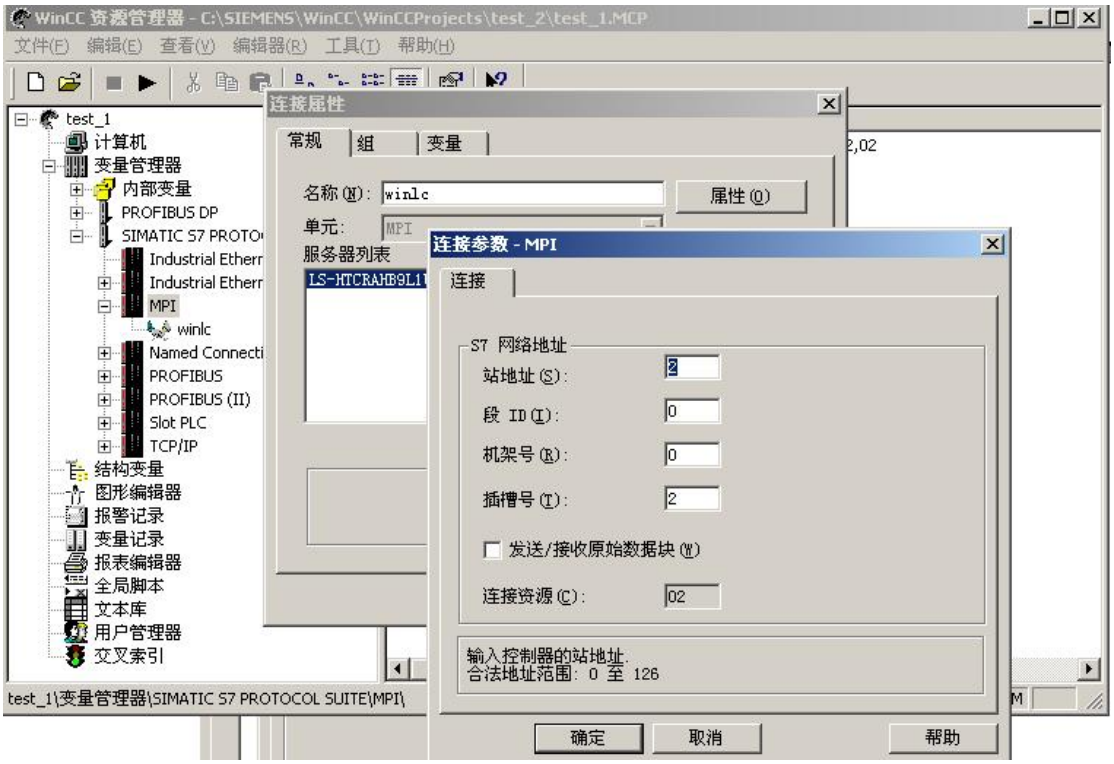
After finished hardware configuration and programming, PLC can communicate with meter. If needs to view the data, WinCC can use to monitor PLC data.

Use WINCC to monitor PLC master station data:

- Use WinCC to set up new project and on the Variable Manager, right click and select "Add new driver" in the dialog box, select "SIMATIC S7 Protocol Suite.CHN" as below Figure.



- Select MPI link properties – new link – properties – fill in PLC master station configuration (the configuration is in consistent with hardware configuration) as the Figure below.



· Add Variables (the address is related with PLC programming).

id0	浮点数 32 位 IEEE754	MD0
id4	浮点数 32 位 IEEE754	MD4
md200	浮点数 32 位 IEEE754	MD200
MD10	浮点数 32 位 IEEE754	MD10
MD	浮点数 32 位 IEEE754	MD14
IB0	无符号 8 位数	EB0
IB1	无符号 8 位数	EB1
IB2	无符号 8 位数	EB2
IB3	无符号 8 位数	EB3

· Finally, edit graphics to allow WinCC to monitor PLC.