

PROFIBUS DP/CAN Gateway PCA-100

User Manual

REV 4.0



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1 Introduction

1.1 About This Instruction

This document describes every parameter of the gateway PCA-100 and provides using methods and some announcements that help user to use the gateway. Please read this document before using the gateway.

This document improves on basis of the PCA-100 REV V3.4; it can apply to firmware version above V4.0 of PCA-100. This version can decide whether the working mode is 15-byte or 16-byte mode through the bit 8 of DIP switch. The 16-byte mode is compatible with PCA-100 (before V4.0).

1.2 Copyright

The data and examples in this manual cannot 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 Related Products

There are related products: PCO-150, ENC-310, ENC-311 and so on.

If you want to get more information about these products, please visit the Sibotech website: www.sibotech.net/en, or call the technical support number: +86 021-5102 8348.

1.4 Terms

PROFIBUS DP/V0 protocol, agreement; JB/T 10308.3-2001: Measuring and control digital data communication industrial control system uses the third part of fieldbus: PROFIBUS standard.



2 Product Overview

2.1 Function

Support connecting the devices with CAN (including CAN2.0A and CAN2.0B) to PROFIBUS DP bus, that is to say CAN bus network devices can be converted to PROFIBUS DP bus network devices. PROFIBUS DP interface of PCA-100 is slave. It supports using bit 8 of DIP switch to decide that the mode of PCA-100 is 15-byte mode or 16-byte mode.

2.2 Feature

- Wide application: Support connecting the devices with CAN bus interface to PROFIBUS DP bus;
- Easy to use: Complete network communication through simple operations in a short time;
- Powerful function: Support connecting with multiple CAN devices, support CAN2.0A/2.0B, and support the two modes working together;
- User can easily realize single read/write and periodically visit of CAN devices;
- Support receive confirm function, more complete and reliable data transmission.

2.3 Technical Specifications

[1] Communication rate:

- CAN baud rate: 1M, 500K, 250K, 125K, 100K, 62.5K, 31.25K, 20K, 10K
- PROFIBUS baud rate: Baud rate is self-adaptive and can be up to 12M

[2] Module provides PROFIBUS DP slave interface with 2.5KV photoelectric isolation and CAN interface

[3] Two types of input/output bytes number at the side of PROFIBUS are optional: 16 bytes input/output, 15 bytes input/output

[4] PCA-100 can buffer at most 200 CAN frame numbers

[5] Power: 24VDC (9V-30V)

[6] Working circumstance temperature: -40°F ~140°F (-40°C ~60°C), Humidity: 5%~95% (non-condensing)



PCA -100
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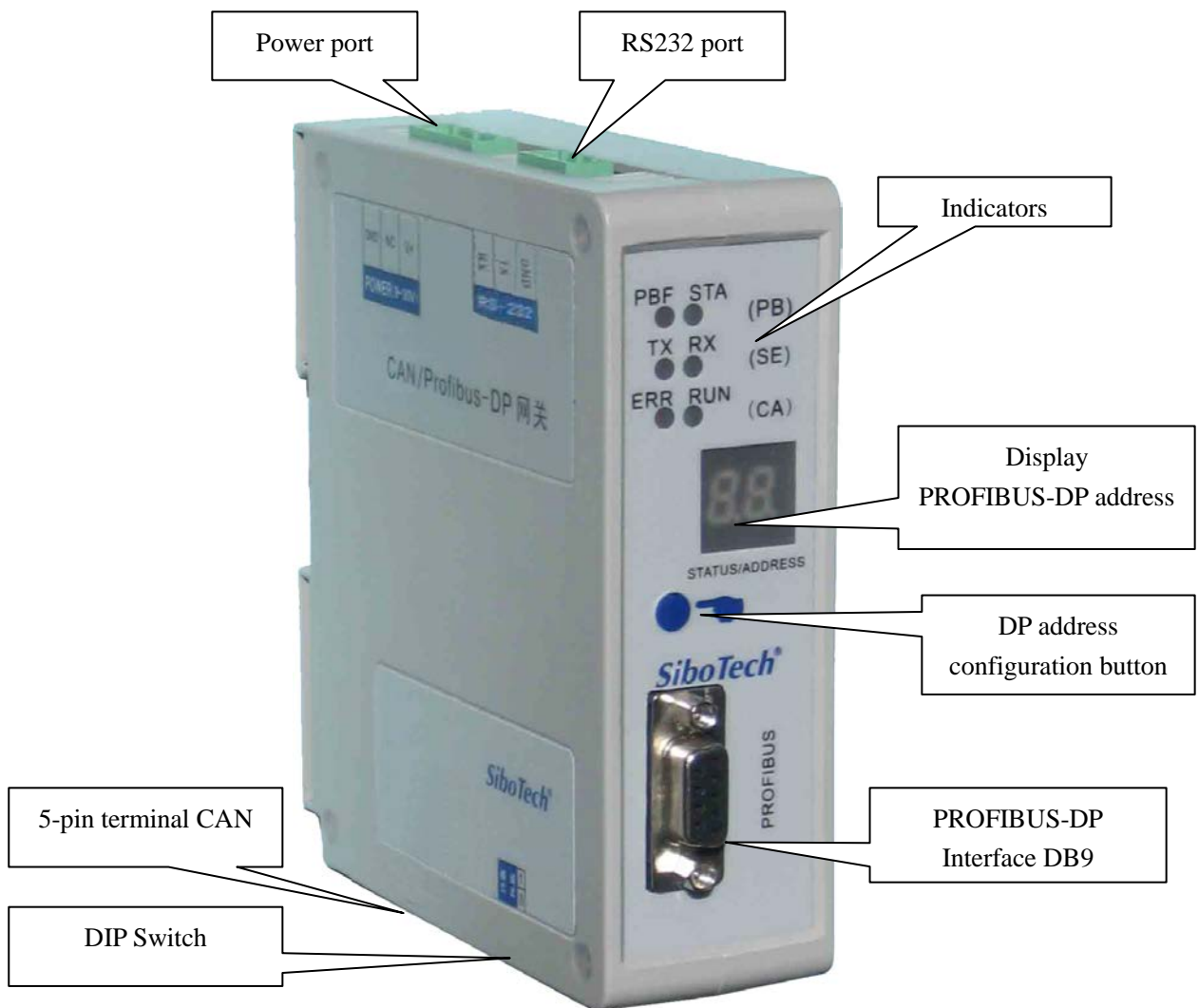
[7] External dimensions (W*H*D): 1.57 in*4.92 in*4.33 in (40mm*125mm*110mm);

[8] Installation: 35mm DIN RAIL

[9] Protection Level: IP20

3 Product Appearance

3.1 Product Appearance



Picture 1 Product appearance



3.2 Indicators

Indicator	Status	Instruction
PBF	Red on	PROFIBUS DP no connection or fails
	Red off	PROFIBUS DP port communicates normally
STA	Green on or off	No data transmission in PROFIBUS DP
	Green blinking	PROFIBUS DP data transmission
ERR	Red on	The gateway is in the CAN network offline status
	Red blinking	CAN network communication is not well or the gateway is in the CAN passive error status
	Green on	CAN communicates normally
RUN	Green blinking	CAN port data sending or receiving
	Green on or off	No data sending or receiving in CAN port
TX	Green blinking	Serial port data sending
	Green off	No data is sending
RX	Green blinking	Serial port data receiving
	Green off	No data is receiving

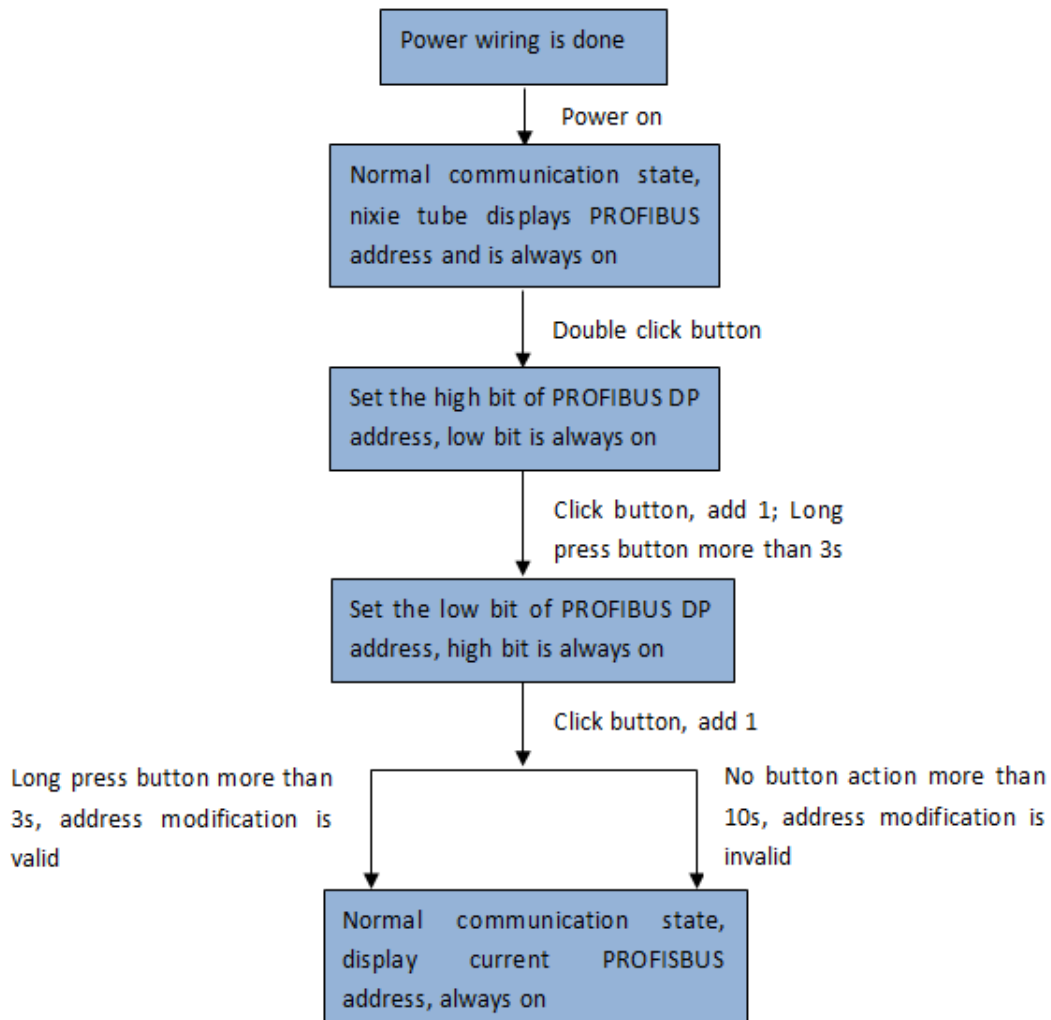
3.3 DIP Switch

3.3.1 Configuration button

The configuration button on the panel can set the PROFIBUS DP slave address.

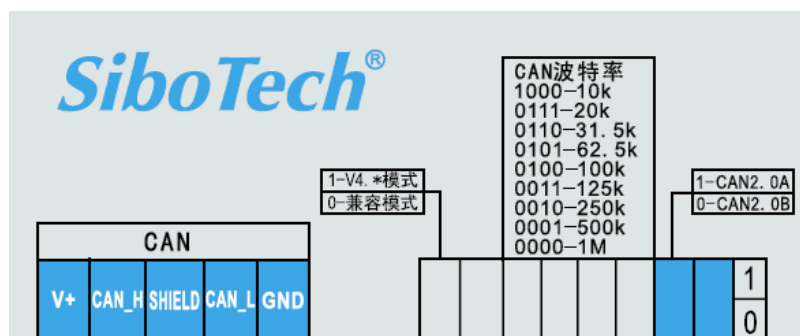
In normal working condition of PCA-100, nixie tube is always on and displaying the current PROFIBUS DP address. Quickly press (double-click) the button twice in succession, the high bit starts to flash, and the low bit is always on, click the button to add 1 to start setting the high bit of PROFIBUS DP address. Long-press the button for 3 seconds, the high bit is always on, and the low bit starts to flash. Click the button to add 1 to start setting the low bit of PROFIBUS DP address. At last, long-press the button again for 3 seconds, the address flashing three times shows that the address is set successfully. If no button action within ten seconds, the gateway exits the status

of setting address and continues to display the original address. The configurable range of PROFIBUS DP address is 0 to 99 (Decimal). PROFIBUS DP address setting method is as follow:



3.3.2 DIP switch

Use DIP switch to configure the input/output bytes, type of CAN frame, CAN baud rate.



First bit: Reserved.

Second bit: CAN2.0A/2.0B configuration; On (1) indicates CAN2.0A, Off (0) indicates CAN2.0B.

3rd bit to 6th bit: CAN baud rate configuration, bit6, bit5, bit4, bit3: 0000 indicates 1Mbps, 0001 indicates 500Kbps, 0010 indicates 250Kbps, 0011 indicates 125Kbps, 0100 indicates 100Kbps, 0101 indicates 62.5Kbps, 0110 indicates 31.5Kbps, 0111 indicates 20Kbps and 1000 indicates 10Kbps.

DIP switch configuration as follow:

Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Instruction
X	Off	X	X	X	X	X	X	CAN2.0B
X	On	X	X	X	X	X	X	CAN2.0A
X	X	Off	Off	Off	Off	X	X	1MbpsCAN baud rate
X	X	On	Off	Off	Off	X	X	500KbpsCAN baud rate
X	X	Off	On	Off	Off	X	X	250KbpsCAN baud rate
X	X	On	On	Off	Off	X	X	125KbpsCAN baud rate
X	X	Off	Off	On	Off	X	X	100KbpsCAN baud rate
X	X	On	Off	On	Off	X	X	62.5KbpsCAN baud rate
X	X	Off	On	On	Off	X	X	31.25KbpsCAN baud rate
X	X	On	On	On	Off	X	X	20KbpsCAN baud rate
X	X	Off	Off	Off	On	X	X	10KbpsCAN baud rate

Note: X indicates random number, On indicates “1”, Off indicates “0”.

Users can refer to the product surface paste.

7th bit: not used.

8th bit: ON (1) indicates PCA-100 works under 15-byte mode (firmware version above V4.0); Off (0) indicates PCA-100 works under 16-byte mode (compatible with firmware version under V4.0).

Note: After changing the DIP switch state, it is a must to restart the gateway (power off and on) and make the settings take effect.

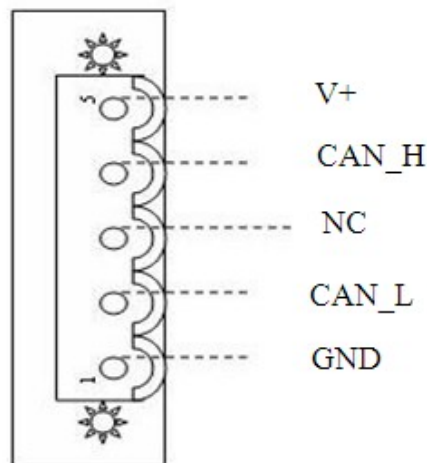
Remark: If the mapped data are multi-byte variable, then PROFIBUS DP high valid bytes send firstly and

CAN high valid bytes send firstly too. That is to say: MSB is of high priority.

3.4 Communication Port

3.4.1 CAN

5-pin connector



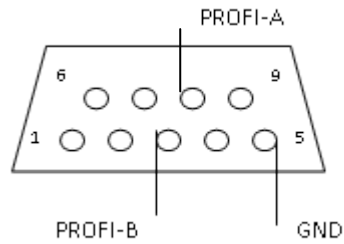
Pin	Wire
1 Pin	GND
2 Pin	CAN_L
3 Pin	NC (Not connected or shielding)
4 Pin	CAN_H
5 Pin	V+

Note1: In this gateway, V+ and shield (NC) can be wired or not be wired, but GND, CAN_L and CAN_H must be wired.

Note2: In this gateway, V+, GND of the port and 24+, GND of the power port are connected inside, so it is viable that external power connects one of the ports, not two ports at the same time, and you will suffer the consequences if connecting two ports.

3.4.2 PROFIBUS DP Port

DB9 connector



PROFIBUS DP interface use DB9 connector, the pin is defined as follows:

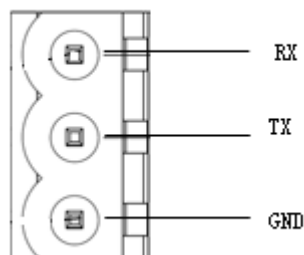
Pin	Signal Description
3	PROFI_B, positive data
5	GND
8	PROFI_A, negative data

3.5 Power Port



Note1: In this gateway, V+, GND of the port and 24+, GND of the power port are connected inside, so it is viable that external power connects one of the ports, not two ports at the same time, and you will suffer the consequences if connecting two ports.

3.6 RS232 Port





Remark: This port is used for product update and reading serial number, user can't use it.

3.7 Nixie Tube display

In normal condition of PCA-100, Nixie tube only displays PROFIBUS DP address. With configuration button, it will help user to change the PROFIBUS DP address and can rightly display the DP address, the details can refer to chapter 3.3.



4 Quick Start Guide

The follow steps will tell you how to usePCA-100 in short time:

- 1) According to the chapter 3, connect the CAN port and PROFIBUS DP port correctly.
- 2) Use the configuration button to configure PROFIBUS address, use DIP switch to configure baud rate of CAN2.0A, CAN2.0B and CAN and work mode that you need.
- 3) Import GSD file to PROFIBUS configuration software. (If you use Step7 software, please refer to appendix A)
- 4) Completing configuration, power to the gateway and run normally.

5 Use Method

5.1 Hardware Wiring

1. According to the CAN port instructions in chapter 3, properly wires every pin of 5-pin terminal.
2. According to the PROFIBUS port instructions in chapter 3, properly connects the 3, 5, 8 pin.
3. After configuring PCA-100 according to chapter 3, properly configured PCA-100, power on PCA-100 and enter into the mode of running.

5.2 Data Exchange way of 16-byte mode

Configuring data transmitting mode at the side of PROFIBUS DP, engineers can easily modify the corresponding location data. For example, modifying the second byte outputting from node 3 only need to modify the corresponding location parameter without complex PLC programming.

Note: Need to set the bit 8 of DIP switch to “OFF” when using 16-byte mode, and restart the gateway (Power off and power on).

PROFIBUS DP network output -> CAN

The meaning of 16 respective bytes is as follow: 16 bytes only can include one CAN frame.

Byte	0	1	2	3	4-7	8-15
Meaning	Single/repeat control	The data number of CAN frame including	Sequence Number	Reserved	Frame header and CAN frame mode control	CAN frame data

Explanation:

Byte 0 to byte 3 are controlling bytes

Byte 0: indicates sending this sequence number CAN frame once if it is zero, and it indicates sending this sequence number of CAN frame periodically if it isn't zero, the cycle value is decided by this byte value: period of transmission=the value of byte 0 * 10ms. For example, if the value of byte 0 is 10, the period of transmission is 100ms, that is to say sending the frame one time every 100ms.

Byte 1: indicates the data number of CAN frame including, the range is 0~8. If the number of data frame is

less than 8, the value is 0.

Byte 2: sequence number. The initial value of sequence number in output frame is non-zero (any value except zero), if the mode is single transmission mode, the number must add 1 when sending a new frame, the gateway will recognize that it is single transmission data, if the number reaches 255, the number will be 0 when adding 1. If the mode is periodical mode, the sequence number will not add 1. If you want to turn single sending mode to periodical mode, sequence number should add 1 once, and byte 0 is non-zero. If you want to turn periodical mode to single sending mode, sequence number should add 1, and the value of byte 0 is 0.

Byte 4 to 7 are CAN frame header and CAN frame mode control (29 bit CAN ID)

The format of byte 4 is as follow:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	Reserved	RTR	Reserved	The top five bits of frame header				

Bit 6: RTR, 0 stands for data frame, 1 stands for Remote frame.

Bit 0 to 4 of byte 4 to byte 7, CAN2.0A/2.0B frame header.

Byte 5:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	The second high 8 bits of frame header							

Byte 6:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	The second low 8 bits of frame header							

Byte 7:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	The lowest 8 bits of frame header							

Byte 8 to 15 are the frame data, the range of byte number is 0~8.

PROFIBUS DP network input <- CAN

The meaning of 16 respective bytes is as follow:

Byte	0	1	2	3	4-7	8-15
Meaning	0xFF	Data number of CAN frame including	Sequence number	no meaning (Any value)	Frame header and CAN frame mode control	CAN frame data

If PCA-100 has received new CAN frames from CAN network, the sequence number of input frame adds 1, user can decide whether to use these CAN frames according to requirements.

If sending one CAN frame, the sequence number is 10, use data frame of 2.0A working mode, ID=0x123, data is 01 02 03 04 05 06 07 08. One time sending, so the output format is as follow (hexadecimal):

00 08 | 0A| 00 | 00 00 01 23 | 01 02 03 04 05 06 07 08

Note:

1) The default initial value of single sending is 0, so the relevant byte is 0.

ID=0x123, the last bit aligns, the front omitting bits are replaced by 0, so the relevant binary form is 0000

0000 0000 0000 0000 0001 0010 0011, that is 0x00 0x00 0x01 0x23

5.3 Data exchange way of 15-byte mode

The main features of 15-byte mode are: When bit0 of PROFIBUS DP send control word is set to 0, once the bit6 of send control word of CAN turns over at the PLC side, then PLC will turn over the bit1 of PROFIBUS DP send control word. In this way, it indicates that data exchange process has happened in PLC. If both need to send data, turning over relevant data valid bit will realize that. When bit0 of PROFIBUS DP send control word is set to 1, CAN will send data to PLC after receiving one frame data regardless of whether PLC has got last frame data.

Note: When using 15-byte mode, you need to set bit8 of DIP switch to “ON”, and restart the gateway (power off and power on).

15-byte input/15-byte output

PROFIBUS DP network output-> CAN

The meaning of 15 respective bytes is as follow: 15-byte only can include one CAN frame

Byte	0	1	2	3-47
Meaning	Send timer	PROFIBUS DP sending control word	CAN frame Header and control	CAN frame data

Byte 0: When Bit 7 in PROFIBUS DP sends control word is 0, this byte has no meaning. Otherwise, CAN network will send out the data from PROFIBUS periodically according to the value of this byte. The setting range of this byte is 1~255, the rest is regarded as 1, timer unit is 10ms.

Byte 1: PROFIBUS DP send control word

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	Single/Repeat mode	Reserved	Reserved	CAN2.0A/B	Clear CAN offline counter	PROFIBUS DP data update label flag	PROFIBUS DP receive flag	PROFIBUS receive mode



Bit7: 0: single mode, determine whether it is the new data according to Bit 2's turning over.

1: repeat mode, now the gateway will set the time inside of sending timer as interval and send out the data received from PROFIBUS DP periodically.

Bit 6-Bit 5: Reserved

Bit 4: When the gateway is configured as CAN2.0B, this bit is valid, otherwise invalid.

1: CAN2.0A frame

0: CAN2.0B frame

Bit 3: Turning over indicates to clear the Offline counter of CAN, meanwhile to reset the CAN controller (Only works when it happens to Offline of CAN network)

Bit 2: Turning over indicates this frame data is valid, otherwise invalid.

Bit 1: When Bit 0 of PROFIBUS DP sending control word is 1, this bit is invalid. Otherwise, reversal of this bit indicates PROFIBUS DP side had participated in data exchange.

Bit 0: 1: Cover the input buffer area of PROFIBUS DP when CAN network has data.

0: CAN will not transmit the data to PROFIBUS DP side (PROFIBUS DP master) until Bit 1 of PROFIBUS DP sending control word starts to reverse.

Byte 2: Data bytes number, range 0~8, the rest is 8.

Byte 3

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	Reserved	RTR	Reserved	The highest 5 bits of frame header				

Bit 6 of byte 3: RTR, 0 indicates data frame, 1 indicates remote frame.

Bit 0~4 of byte 3 to byte 6: Frame header of CAN2.0A/2.0B.

Byte 4: The second highest 8 bits of frame header

Byte 5: The second lowest 8 bits of frame header

Byte 6: The highest 8 bits of frame header

Byte 7~byte 14: CAN data

PROFIBUS DP network input <-CAN

Byte	0	1	2-6	7-14

Meaning	Offline counter	CAN send control word	CAN frame header and control	CAN data sending
---------	-----------------	-----------------------	------------------------------	------------------

Byte 0: CAN is offline once, this value will add 1 until 255.

Byte 1:

CAN send control word

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	Bus status	CAN fetch PROFIBUS DP data flag	CAN receive buffer full flag	CAN data update flag	CAN2.0A/B	Reserved	Reserved	Reserved

Bit 7: 1: CAN is in the Offline status

0: CAN is in the Online status

Bit 6: The reversal of this bit indicates the gateway has got the PROFIBUS DP data.

Bit 5: 1: CAN receive buffer is full

0: Not full

Bit 4: The reversal of this bit indicates this frame data is valid, otherwise is invalid.

Bit 3: 1: CAN2.0A frame

0: CAN2.0B frame

Note: Valid when the gateway is configured as CAN2.0B

Bit 2-Bit 0: Reserved

Byte 2: Data bytes number, range 0~8, the rest is 8

Byte 3

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Meaning	Reserved	RTR	Reserved	The highest 5 bits of frame header				

Bit 6 of byte 3: RTR, 0 indicates data frame, 1 indicates remote frame.

Bit 0~4 of byte 3 to byte 6: Frame header of CAN2.0A/2.0B.

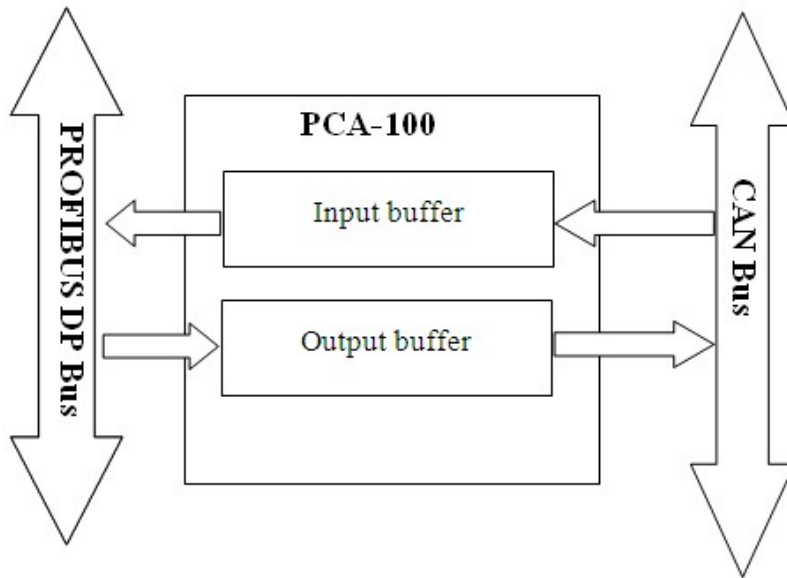
Byte 4: The second highest 8 bits of frame header

Byte 5: The second lowest 8 bits of frame header

Byte 6: The highest 8 bits of frame header

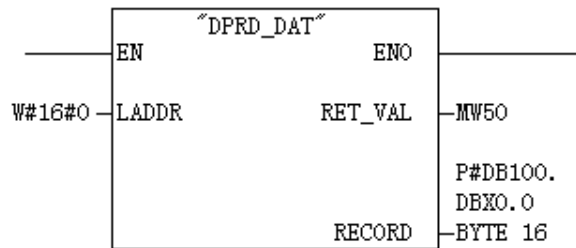
Byte 7~byte 14: CAN data

5.4 Working mode of PCA-100

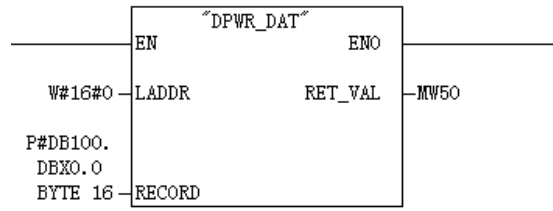


5.5 Step 7 Read and Write Data to Gateway

PCA-100 data consistency at the side of PROFIBUS uses “Total length” mode, so sending and receiving must apply packed way in Step 7 programming. Sending and receiving by packed mode mainly use SFC15 (packed sending) and SFC14 (packed receiving).



SFC14



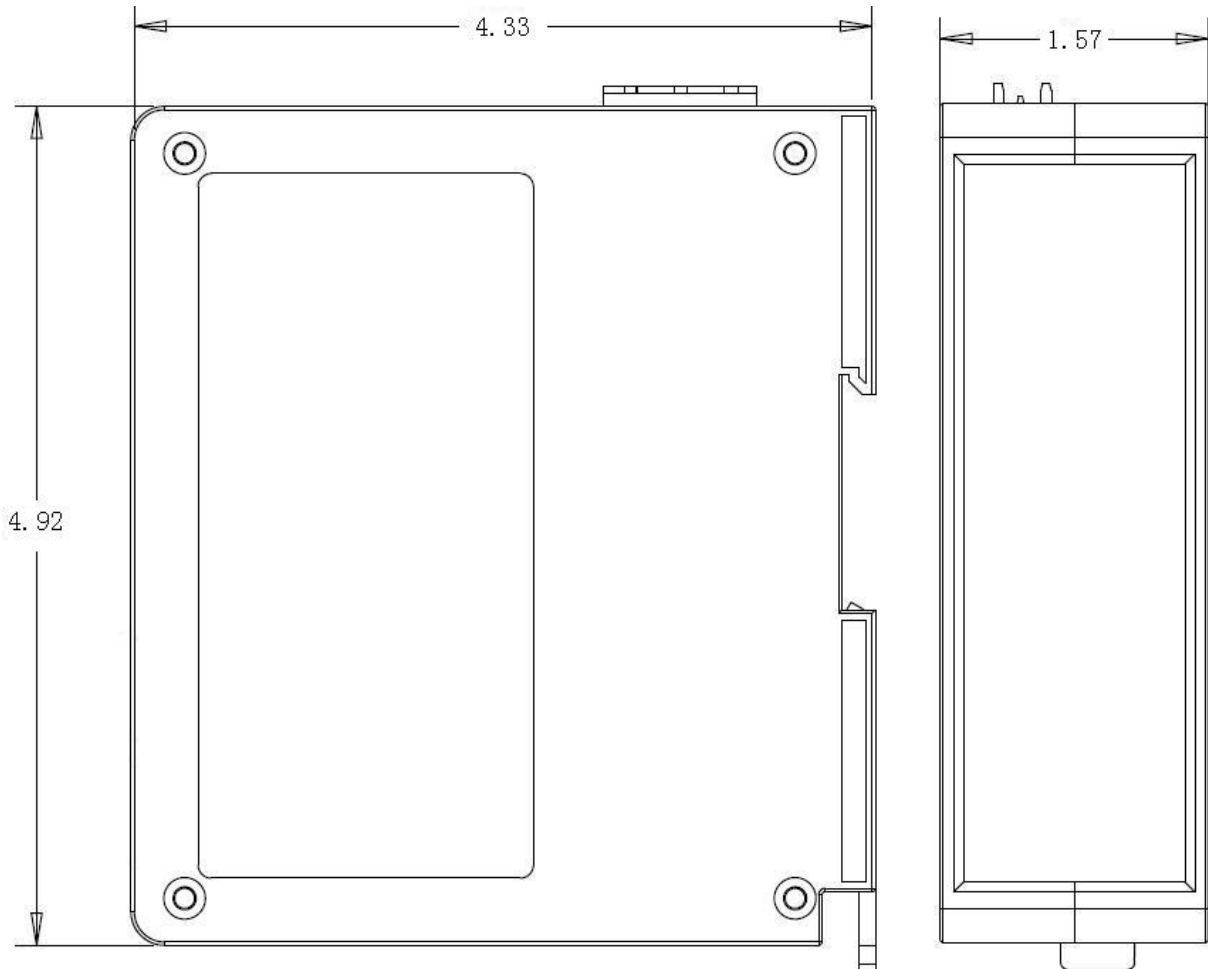
SFC15



6 Installation

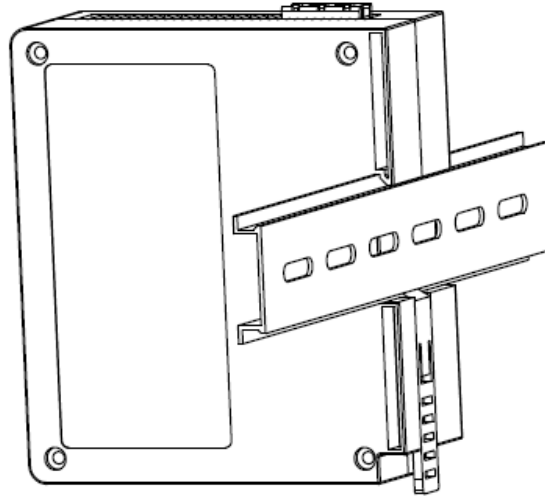
6.1 Machine Dimension

Size: 1.57 in (width)*4.92 in (height)*4.33 in (depth)



6.2 Installation Method

Using 35mm DIN RALL





7 Operation Maintenance and Cautions

- Prevent great pressure or it will damage the panel.
- Prevent collision or it may damage the inside elements.
- Supply voltage must be controlled within the range of manual demand to prevent the module burned.
- Prevent water or it will affect the normal work.
- Please check on the wiring before powering on. Make sure there is no wrong wiring or short circuit.



8 Troubleshooting and Suggestions

Number	Description	Explanation or suggestion
1	PBF (PROFIBUS DP Failure) Red on	PROFIBUS DP network communication fails.
2	PBF (PROFIBUS DP Failure) Red off	PROFIBUS DP network communication is OK.
3	ERR indicator red on or blinking at running mode	CAN bus is Off or error counter of send/receive beyond alert value. Check CAN baud rate of gateway and the baud rate must be the same with other nodes of CAN network. Configure terminal resistor ¹ for CAN bus.

Note:

1. Terminal resistance

CAN is a kind of differential level communication. There exists echo noise on the communication line when communication distance is long or communication baud rate is high. User needs a terminal resistor (120Ω/2W) in both terminals of communication lines.

Appendix A: Using STEP 7 to Configure PROFIBUS-DP

The following show how to use STEP7 to configure PCA-100:

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



1 Open SIMATIC Manager. Figure 1:



Figure 1

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

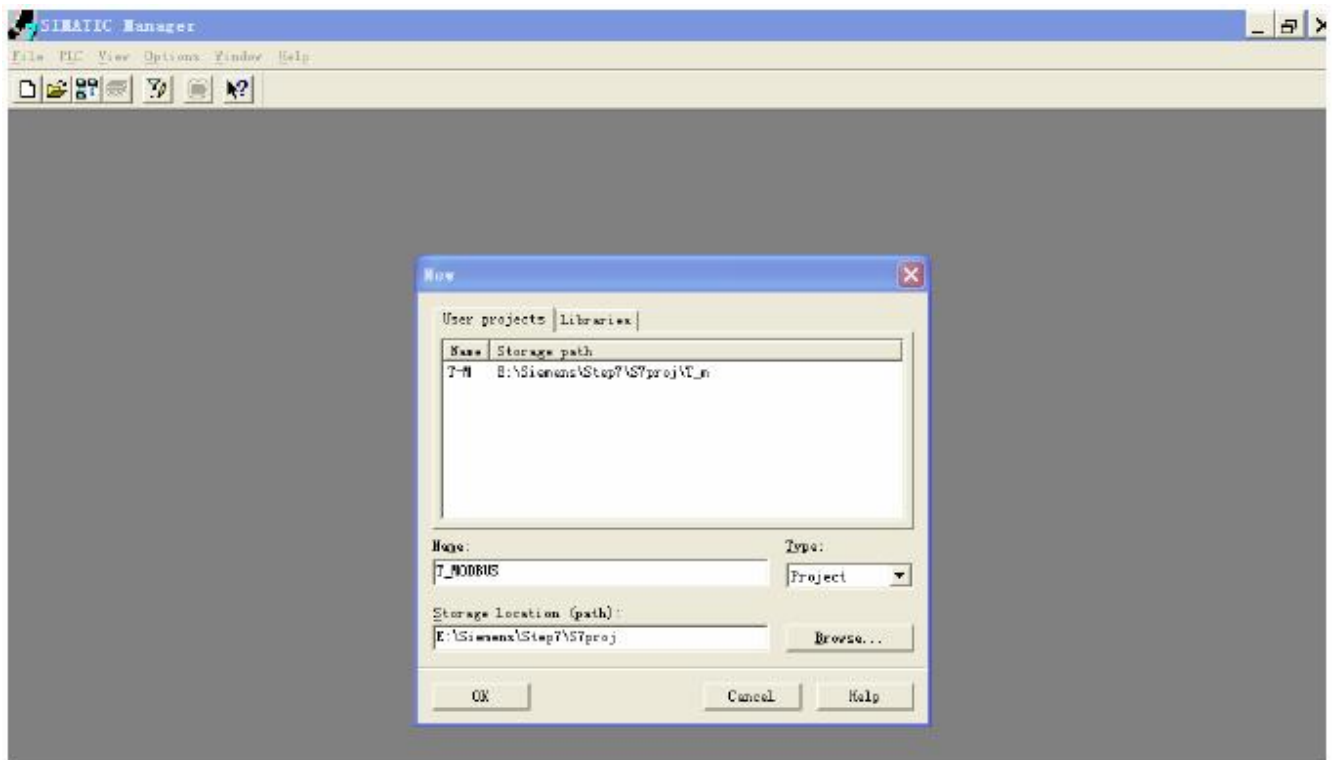


Figure 2

3 Click Insert->Station-> SIMATIC 300 Station; Figure 3:

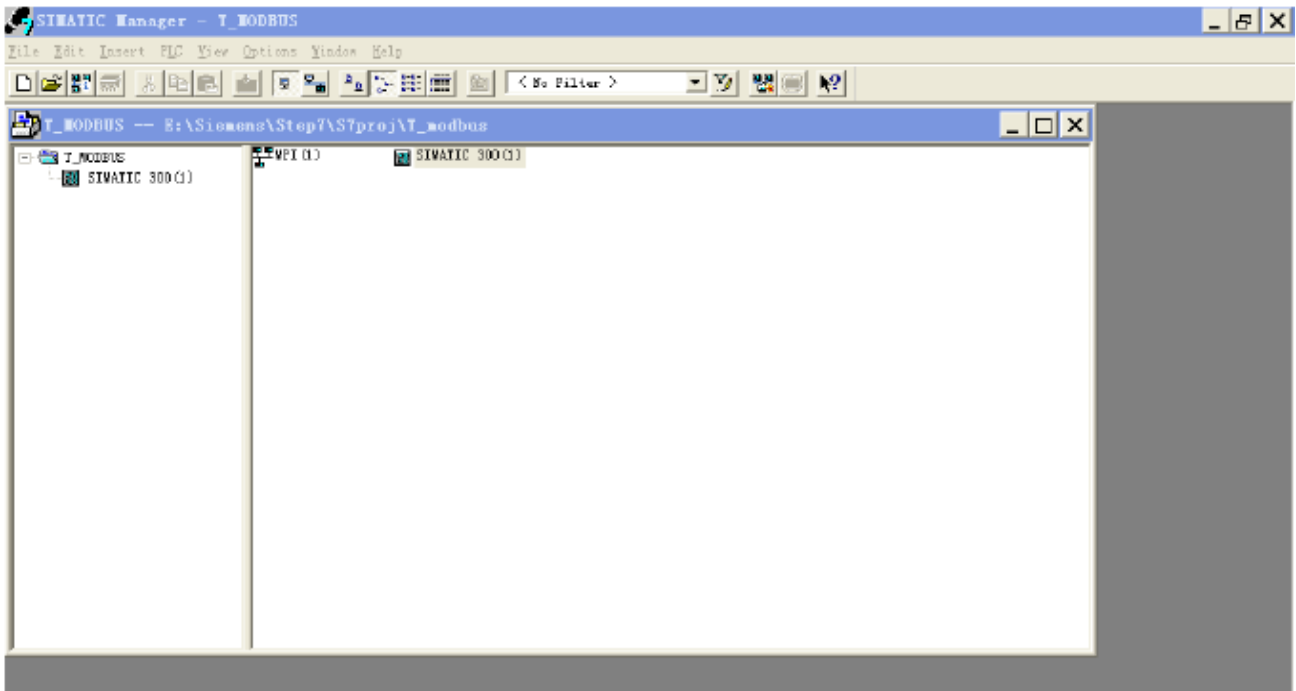


Figure 3

4 Open S7 PLC hardware configurations

Open SIMATIC 300(1) and then double-click Hardware; Figure 4:

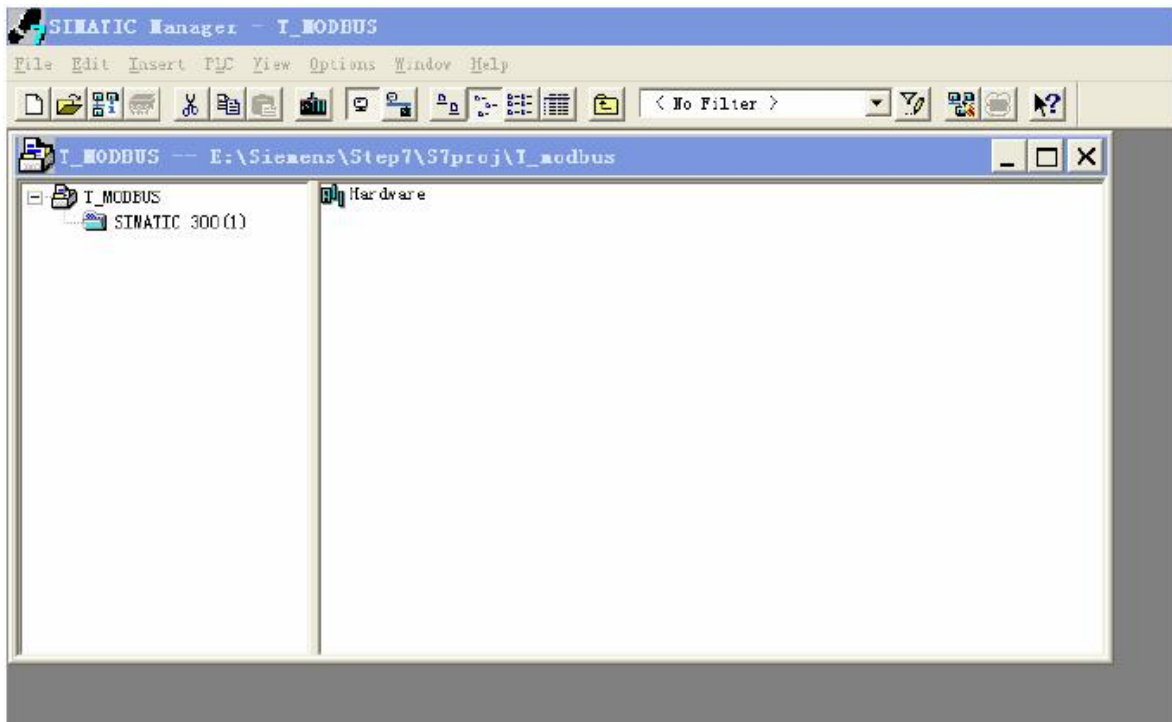


Figure 4

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5 In the menu, select Options and Install GSD file, Update GSD in the device catalog, Figure 5:

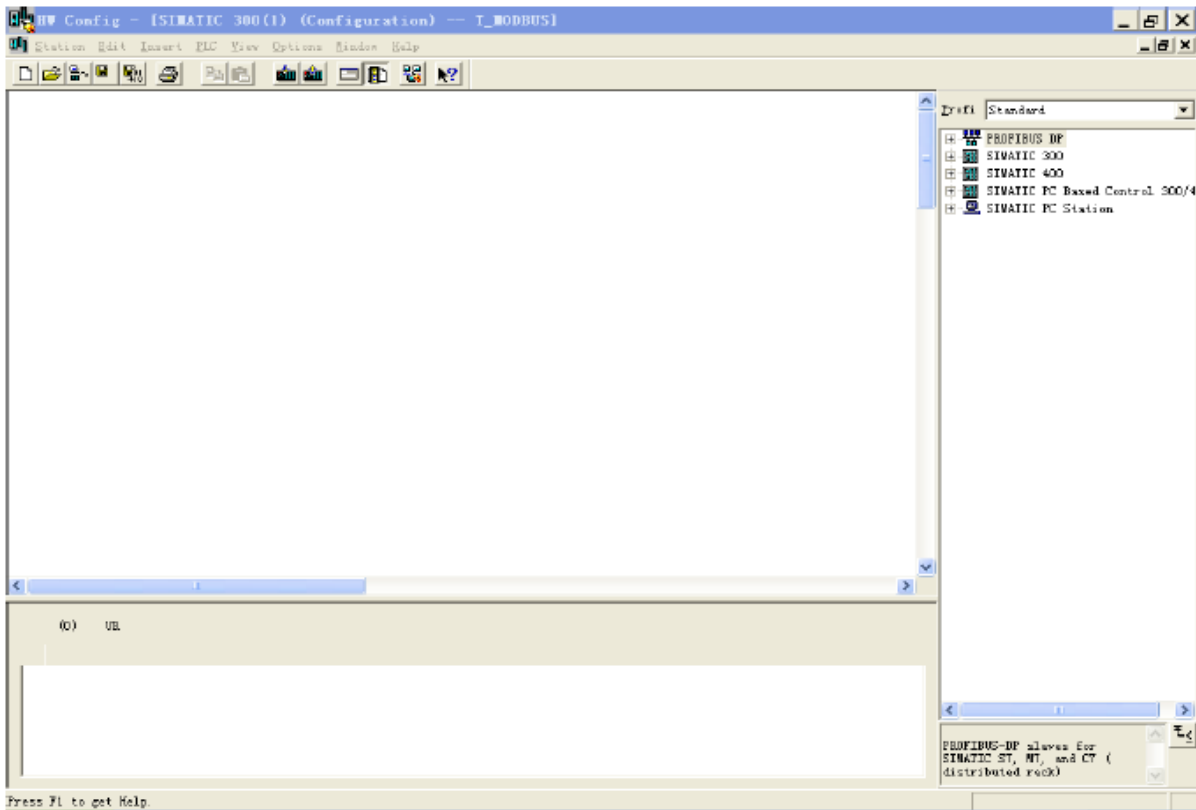


Figure 5

6 Here you can find your equipment in the right side of the window /PROFIBUS DP/Additional Field Devices/Converter/PCA-100/, Figure 6:

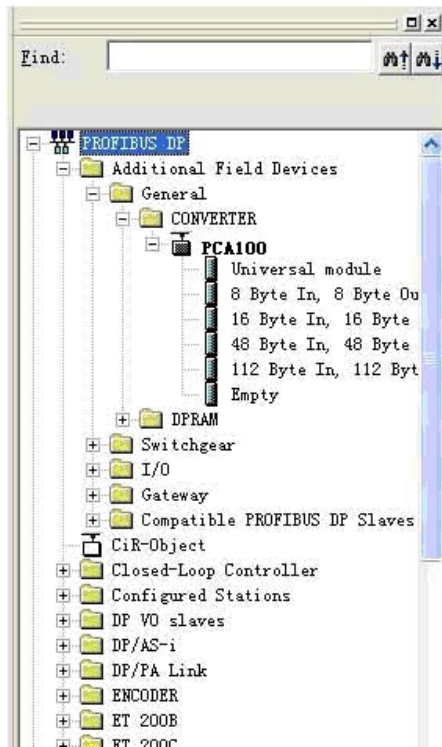


Figure 6

7 Set PLC rack, click the “Hardware Catalog\SIMATIC 300\RACK-300 \ Rail”, Figure 7:

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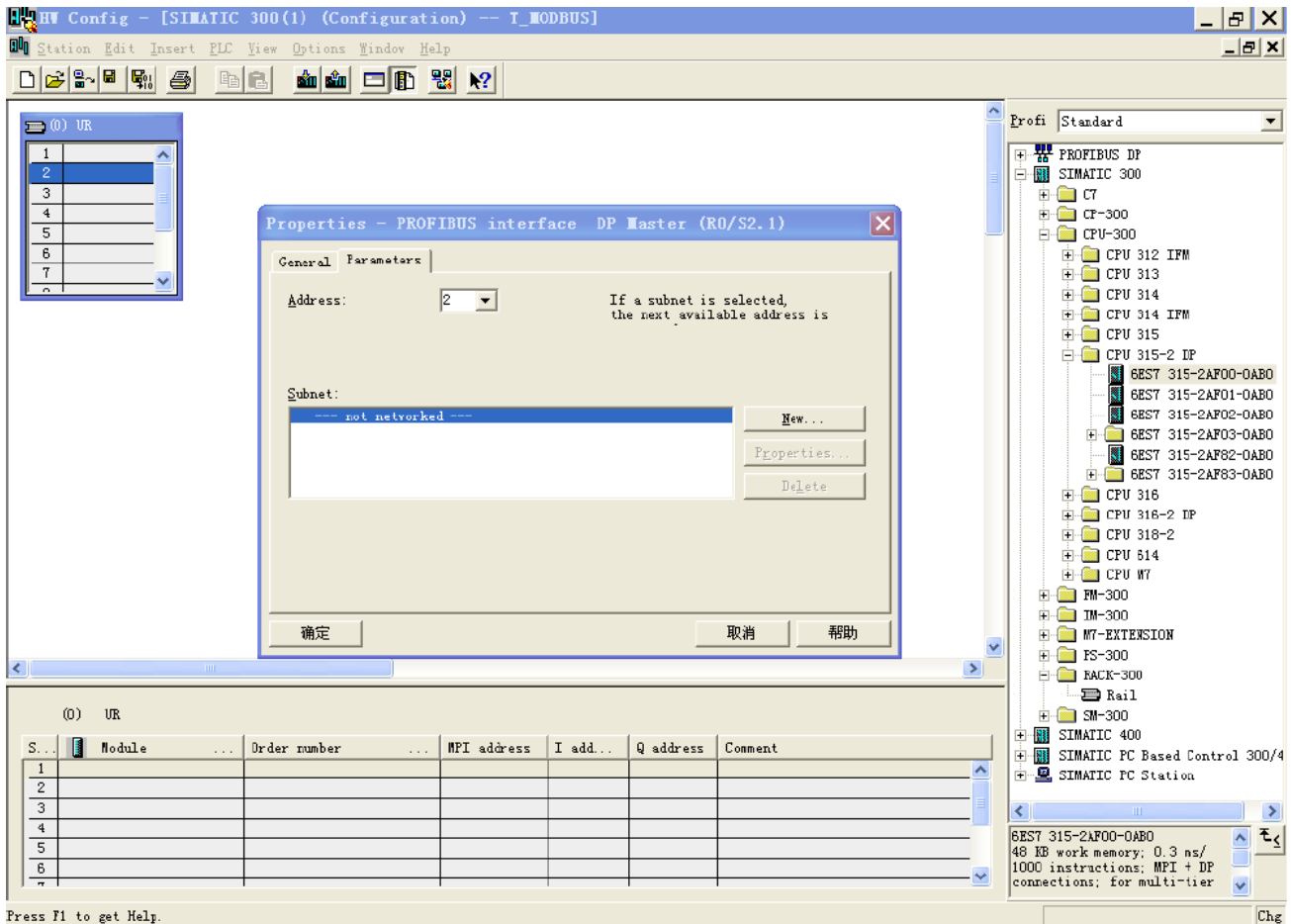


Figure 7

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

9 Create PROFIBUS DP network and configure 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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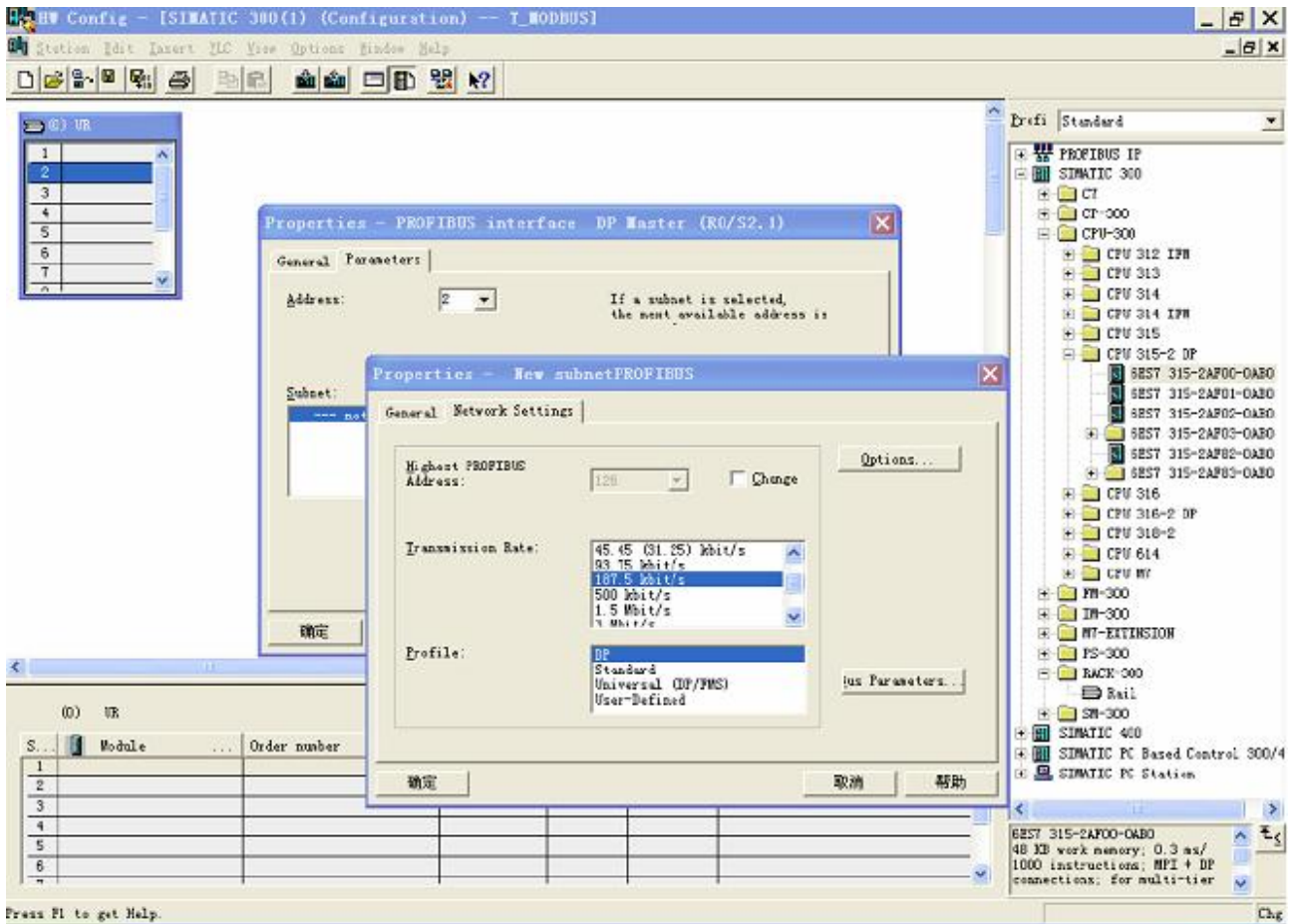


Figure 8

PCA -100 PROFIBUS DP/CAN Gateway User Manual

10 Select PROFIBUS DP Master address; Figure 9:

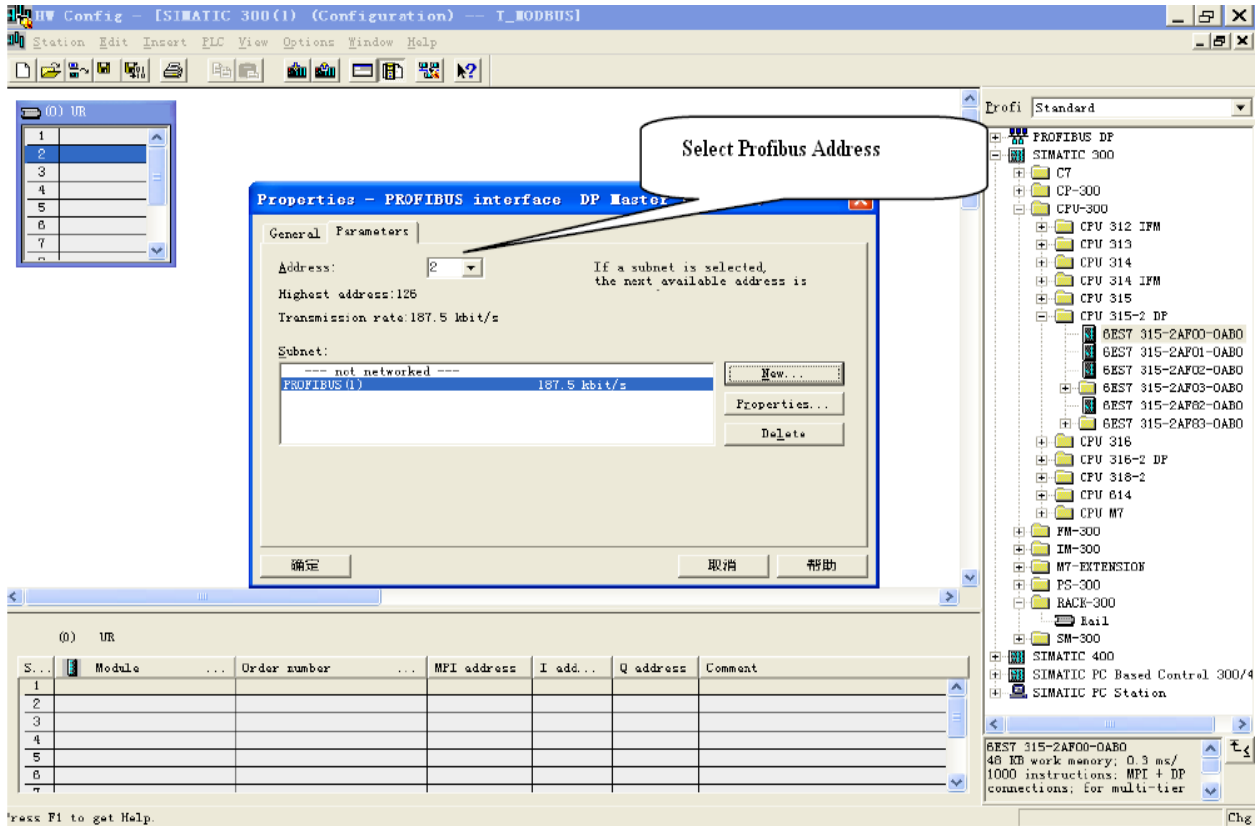


Figure 9

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11 Drag PCA-100 slave station configuration into PROFIBUS DP network, and map the input and output data block into S7-300 or other controller's memory, Figure 10:

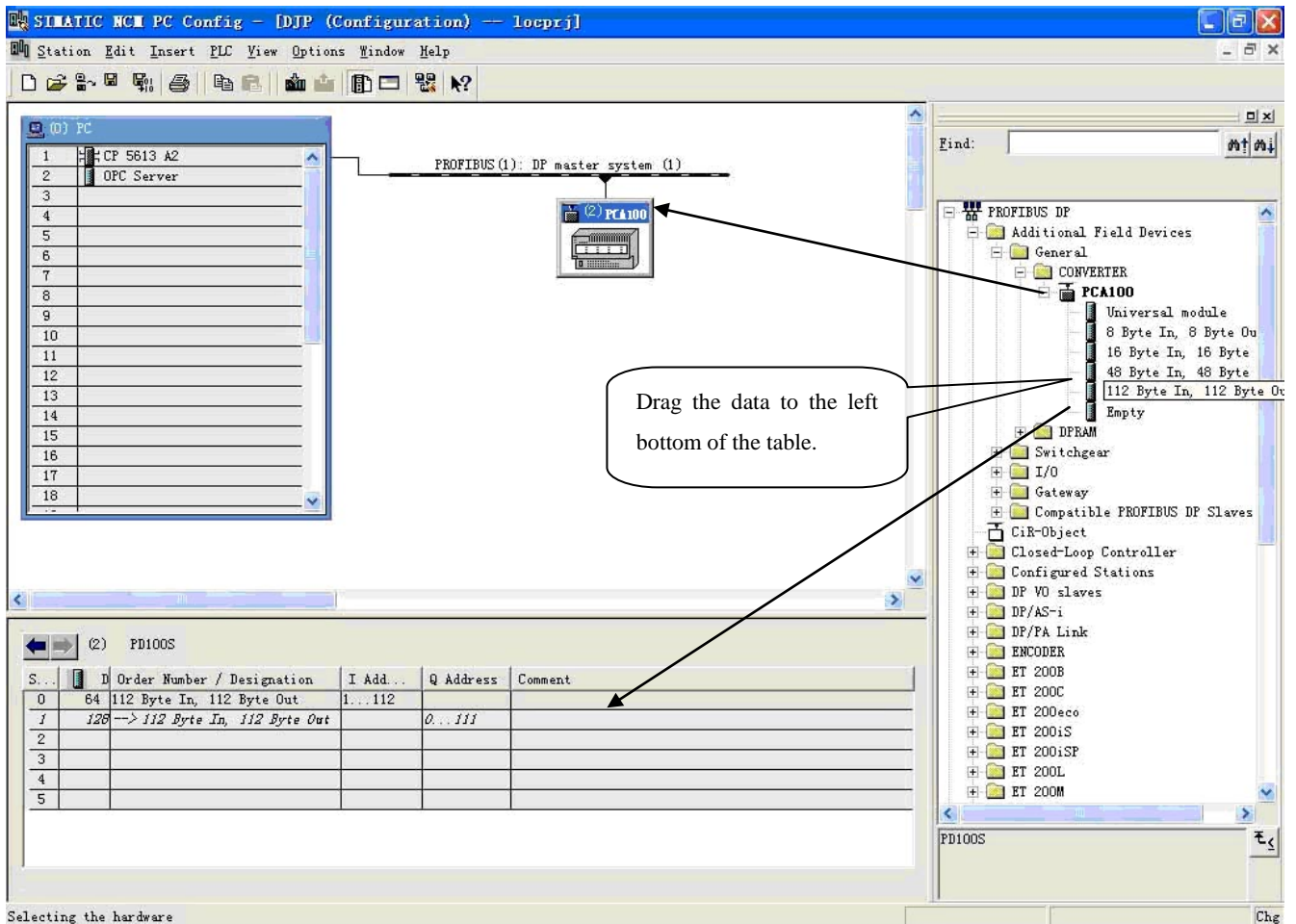


Figure 10

Operation is divided into two steps, the first step is dragging PCA-100 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, the table will change to green, and that is to say it can be placed, mapping relevant bytes to the PLC memory.

Remark1: User uses DIP switch to configure input/output bytes of PCA-100, if user configures 15 bytes input/output, drag "15 Byte Input & Output" to data mapping table. If the data block dragged to the table doesn't match the gateway configuration, PROFIBUS DP will not connect. If user does not modify the default configuration byte number, the maximum of factory configuration is "16 Byte Input & Output".

Remark2: The PROFIBUS DP slave address must be the same with display setting of the nixie tube



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(Configure through the setting button on the panel)!

12 Comply, download into PLC and configuration is done.