CANopen / PROFINET IO Gateway
GT200-PN-CO

User Manual

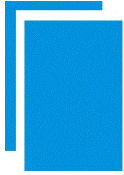## V 1.4

Rev A

SST Automation

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www.SSTAutomation.com

Important Information

Warning

The data and examples in this manual cannot be copied without authorization. SST Automation reserves the right to   upgrade the product without notifying users.

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

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Catalog

SST◍M

1 Product Overview

1.1 Product Function

GT200-PN-CO is a gateway that can realize data communication between PROFINET network and CANopen or CAN network. CANopen side of GT200-PN-CO can be a master or a slave. When acting as a master, it supports connecting multiple standard devices with CANopen slave interface to PROFINET network; While acting as a slave, it supports connecting CANopen master device to PROFINET network. CAN side of GT200-PN-CO supports CAN 2.0A and CAN 2.0B protocols. This gateway is a slave on the PROFINET side.

1.2 Product Feature

1.2.1 CANopen Mode

➢ Supports one CANopen interface;

➢ CANopen interface: 1KV photoelectric isolation;

➢ Supports two 10M/100M adaptive network ports. Supports half duplex and full duplex transmission;

➢ The gateway is a PROFINET IO slave on the PROFINET side;

➢ PROFINET input and output bytes can be set in STEP 7 or TIA Portal modeling software, the maximum number is:

Max Input Bytes+ Max Output Bytes≤768 Bytes

①Max Input Bytes ≤384 Bytes

②Max Output Bytes ≤384 Bytes

1.2.2 CAN Mode

➢ Supports two 10M/100M adaptive network ports. Supports half duplex and full duplex transmission;

➢ The gateway is a PROFINET IO slave on the PROFINET side;

➢ Supports bi-directional data transmission, also can only be used as CAN receiving or sending;

➢ Supports two run mode, basic and advanced. Basic mode is compatible with versions V1.4.

Advanced mode is the CAN frame filtering function for CAN ID, available for GT200-PN-CO V1.7 and above.

➢ Under the basic mode, each CAN frame in the PROFINET message is 16 bytes; Each PROFINET data contains up to 8 CAN frames;

PROFINET input and output bytes can be set in the STEP 7 or TIA Portal modeling software, the maximum number is:

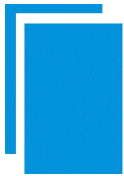Max Input Bytes+ Max Output Bytes≤256 Bytes

①Max Input Bytes ≤128 Bytes

②Max Output Bytes ≤128 Bytes

Supports only four combinations of input and output bytes:

Input Bytes	Output Bytes
16	16
32	32
64	64
128	128

➢ Under the advanced mode, three types of commands are supported, which are called "Producer Filtering ", "Consumer Filtering" and "Query/Response Filtering". The number of data per CAN frame supports 0 - 8 bytes.

Note: these three types of commands only specify the communication mode of the gateway, not the actual CAN protocol.

PROFINET input and output bytes can be set in the STEP 7 or TIA Portal modeling software, the maximum number is:

Max Input Bytes+ Max Output Bytes≤768 Bytes

①Max Input Bytes ≤384 Bytes

②Max Output Bytes ≤384 Bytes

Note: The advanced filter mode mentioned in the manual can be supported in the version V1.7 and above of GT200-PN-CO. The current version of GT200-PN-CO does not support the CAN filter mode.

1.3 Technical Specifications

[1] At PROFINET side GT200-PN-CO is a PROFINET slave;

[2] Supports standard PROFINET I/O protocol;

[3] PROFINET supports up to 32 slots, The maximum number of input bytes is 384 and the maximum number of output bytes is 384(The length available to the user is limited by the specific PLC and PDU size of the communication module). The length of input/output bytes can be set by STEP7 or TIA Portal;

[4] Supports the following module types:

   ➢ **Input 001 byte**

   ➢ **Input 002 bytes**

   ➢ **Input 004 bytes**

   ➢ **Input 008 bytes**

   ➢ **Input 016 bytes**

   ➢ **Input 032 bytes**

   ➢ **Input 064 bytes**

   ➢ **Input 128 bytes**

   ➢ **Input 256 bytes**

   ➢ **Input 512 bytes**

   ➢ **Output 001 byte**

   ➢ **Output 002 bytes**

   ➢ **Output 004 bytes**

   ➢ **Output 008 bytes**

   ➢ **Output 016 bytes**

   ➢ **Output 032 bytes**

   ➢ **Output 064 bytes**

   ➢ **Output 128 bytes**

   ➢ **Output 256 bytes**

   ➢ **Output 512 bytes**

   ➢ **Input / Output 001 byte**

➢ **Input / Output 002 bytes**

➢ **Input / Output 004 bytes**

➢ **Input / Output 008bytes**

➢ **Input / Output 016 bytes**

➢ **Input / Output 032 bytes**

➢ **Input / Output 064 bytes**

➢ **Input / Output 128 bytes**

➢ **Input / Output 256 bytes**

➢ **Input / Output 512 bytes**

[5] Supports CAN 2.0A and CAN 2.0B protocol;

[6] DS-301 V4.01 and CiA Draft Recommendation 303 compliant

■ CANopen master features:

➢ Supports maximum 8 bytes TPDO, 8 bytes RPDO, fast Download SDO and fast Upload SDO;

➢ Every CANopen node has default 4 TPDOs and 4 RPDOs. COB-ID of TPDO and RPDO has default value.

Default value of Transmit PDO:

384 + node address (0x180+node address)

640 + node address (0x280+node address)

896 + node address (0x380+node address)

1152 + node address (0x480+node address)

Default value of Receive PDO:

512 + node address (0x200+node address)

768 + node address (0x300+ node address)

1024 + node address (0x400+ node address)

1280 + node address (0x500+node address).

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

➢ Supports maximum commands No.:(100)

Max TPDO commands + Max RPDO commands + Max upload SDO commands + Max download SDO

commands≤100;

Max TPDO commands≤100;

Max RPDO commands≤100;

Max Upload SDO commands≤100;

Max Download SDO commands≤100;

➢ Supports NMT network startup, TPDO time-out reset and SYNC function, besides, it also supports function of PROFINET I/O controlling CANopen slave devices, etc;

➢ Supports Heartbeat and Guard life;

➢ Same command can be mapped to different input or output buffer address of PROFINET I/O;

■ CANopen slave features:

➢ Supports maximum 8 bytes TPDO, 8 bytes RPDO, fast Download SDO and fast Upload SDO;

➢ Every CANopen node supports up to 100 TPDOs, 100 RPDOs. COB-ID of TPDO and RPDO has default value or users can use self-defining COB-ID.

Default value of Transmit PDO:

384 + node address (0x180+node address)

640 + node address (0x280+node address)

896 + node address (0x380+node address)

1152 + node address (0x480+node address);

Default value of Receive PDO:

512 + node address (0x200+node address)

768 + node address (0x300+ node address)

1024 + node address (0x400+ node address)

1280 + node address (0x500+node address).

➢ Supports maximum commands No.:(100)

Max TPDO commands + Max RPDO commands≤100;

Max TPDO commands≤100;

Max RPDO commands≤100;

➢ Timeout clear function of RPDO and delay to start-up;

➢ Supports SDO visiting input and output data exchange area;

> Supports Heartbeat and Guard life;

■ CAN features:

> Supports CAN 2.0A and CAN 2.0B protocols;

> CAN interface supports Baud Rate: 10K, 20K, 50K, 100K, 125K, 250K, 500K and 1M;

For V1.7 and above product:

> Supports up to 200 CAN frames in the transmit buffer (FIFO) and up to 150 CAN frames in the receive buffer (FIFO).

> Supports timeout clear function of Consumer Filtering and Query/Response Filtering;

> Supports maximum commands No.:(60)

Max Producer Filtering + Max Consumer Filtering + Max Query/Response Filtering ≤60;

Max Producer Filtering ≤60;

Max Consumer Filtering ≤60;

Max Query/Response Filtering ≤60;

[7] Operating environment:

> REL Humidity: 5% to 95% (non-condensing)

> Work circumstance temperature: -40°F~122°F(-40℃ to 50℃)

> Pollution level: class 3

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

[9] Built-in electrostatic protection: 15 KV ESD; Communication interface isolation: 3KV;

[10] External dimensions (W*H*D): 1.0 in *4.0 in *3.6 in (25mm*100mm*90mm);
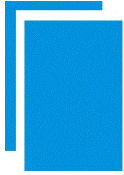
[11] Installation: 1.4 in (35mm) DIN RAIL;

[12] Protection level: IP20.

1.4 Related Products

The related products include: GT200-DP-CO, GT200-CO-RS and so on.

To get more information about related products, please visit SSTCOMM website: www.sstautomation.com.

1.5 Revision History

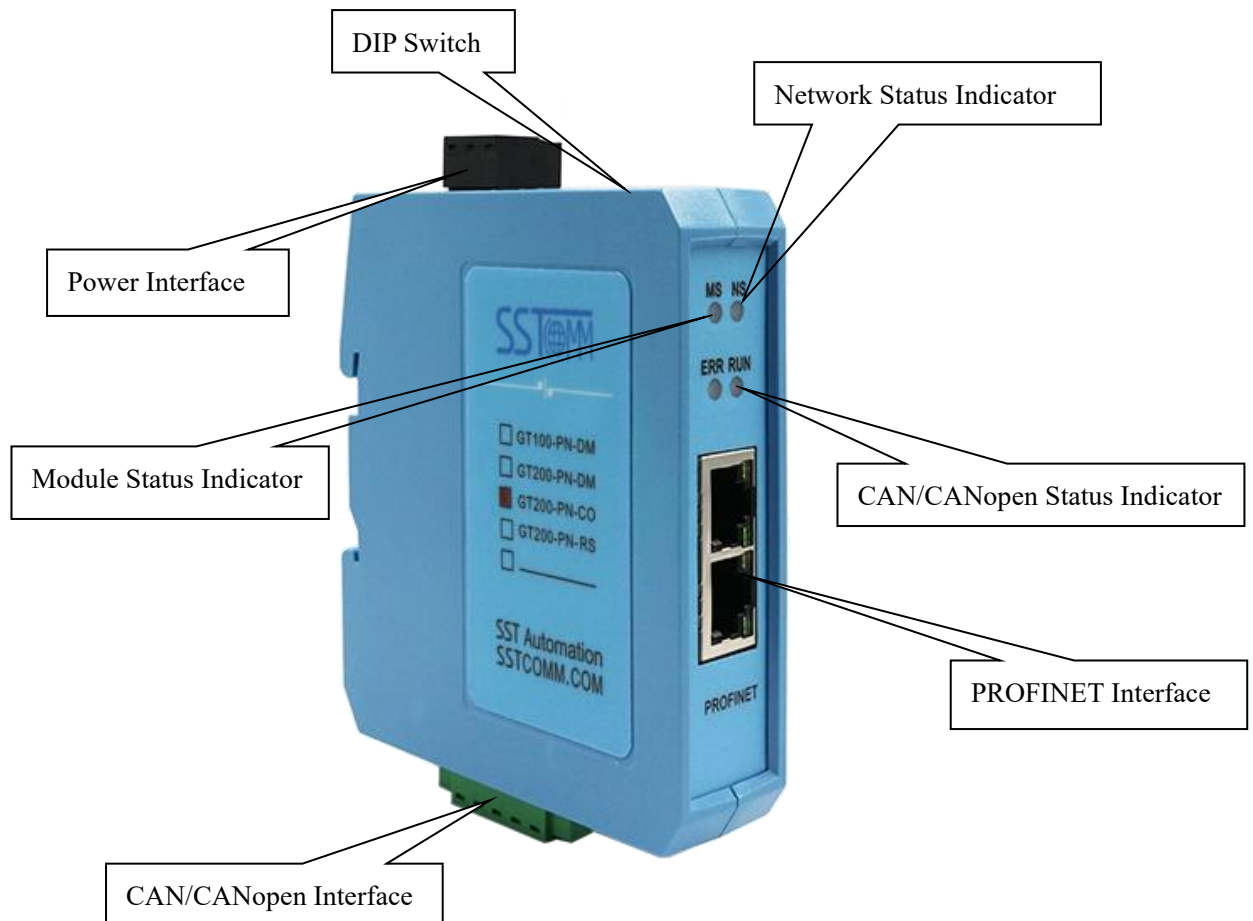| Revision	Date	Chapter	Description
V1.4	12/9/2020	ALL	New Release
V1.4 Rev A	5/5/2022	ALL	Update the technical parameters, the format

2 Hardware Descriptions

2.1 Product Appearance

Note: This picture is for reference only. The product appearance is subject to the actual product.

2.2 LED Indicators

| Indicators		Status	Description
CANopen Status	ERR	Green On	The CAN network is normal
		Red Blinking/On	Bus Off
		Red, Green and Off blinks alternately	The error counter of CAN controller reach or exceed alarm value
	RUN	Green On	Node is in the run state
		Green light on 200ms and off 1000ms alternately	Node is in the stop state
		Green light on 200ms and off 200ms alternately	Node is in the Pre-run state
CAN Status	ERR	Green On	The CAN network is normal
		Red Blinking/On	Bus Off
		Red, Green and Off blinks alternately	The error counter of CAN controller reach or exceed alarm value
	RUN	Green Blinking	Data sending and receiving
		Green Off	No data sending and receiving
MS		See below table	
NS		See below table	

Note: GT200-PN-CO is in the configuration state, the ERROR and RUN indicators blinks alternately in orange.

Module indicator and network indicator:

Module indicator MS	Network indicator NS	Description
Off	Red Blinking/On	Start-up state, waiting to initialize
Green on	Red/Green Blinking	Initialize complete, no connection with PLC
Green on	Green on	PLC has connected
Green Blinking/On	Red on	The network cable is disconnected or not connected
Other	Other	Undefined state

2.3 DIP Switch
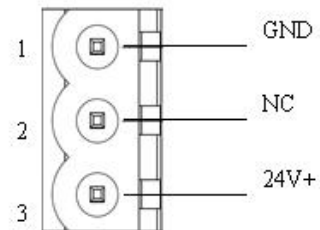
The DIP switch is used for setting operating mode of the device.
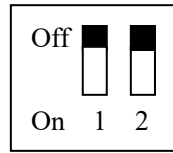
| Mode (Bit 1)	Function (Bit 2)	Description
Off	Off	Run mode, configuration enabled
Off	On	Configuration Mode
On	NA	The module enters the update program state (customers cannot use this state)

2.4 Interface

2.4.1 Power Interface

Pin	Function
1	Power ground
2	NC(Not Connected)
3	+24V DC

2.4.2 Ethernet Interface

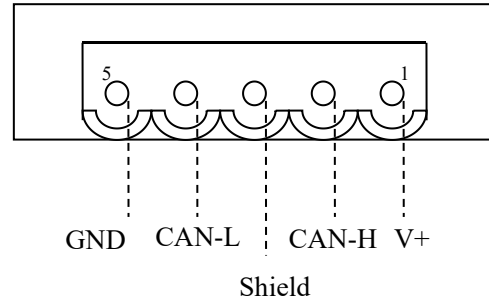The Ethernet interface is a RJ-45 socket. its pin (standard Ethernet signal) is defined as below:

Pin	Signal description
S1	TXD+
S2	TXD-
S3	RXD+
S4	-
S5	-
S6	RXD-
S7	-
S8	-

RJ-45 port
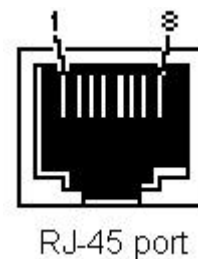
2.4.3 CAN/CANopen Interface

CAN interface of GT100-CO-RS uses 5-pin connector:

| Pin	Wiring
Pin 1	V+, 24VDC(optional)
Pin 2	CAN-H
Pin 3	Shield (optional)
Pin 4	CAN-L
Pin 5	GND, GND of 24V (optional)

Note:

(1) Here, shield port is optional. The CAN-L and CAN-H must be connected. Here pin 1 and 5 are connected to the pin 3 and pin 1 of power port internally (Chapter 2.4.1).

(2) Chapter2.4.1 and Chapter2.4.3 both contain power interfaces, and only one of them is required to connect. If two power interfaces are connected at the same time, the gateway will be burned.
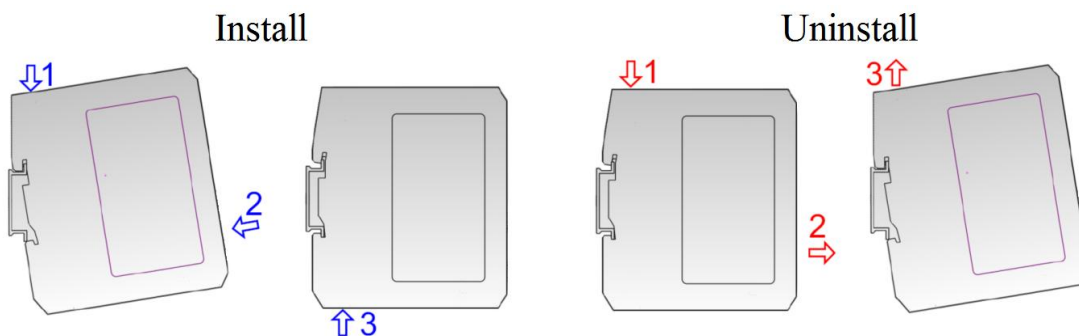
3 Hardware Installation

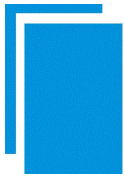## 3.1 Machine Dimension

Size (width * height * depth):
1.0 in * 4.0 in * 3.6 in (25 mm * 100 mm * 90 mm)
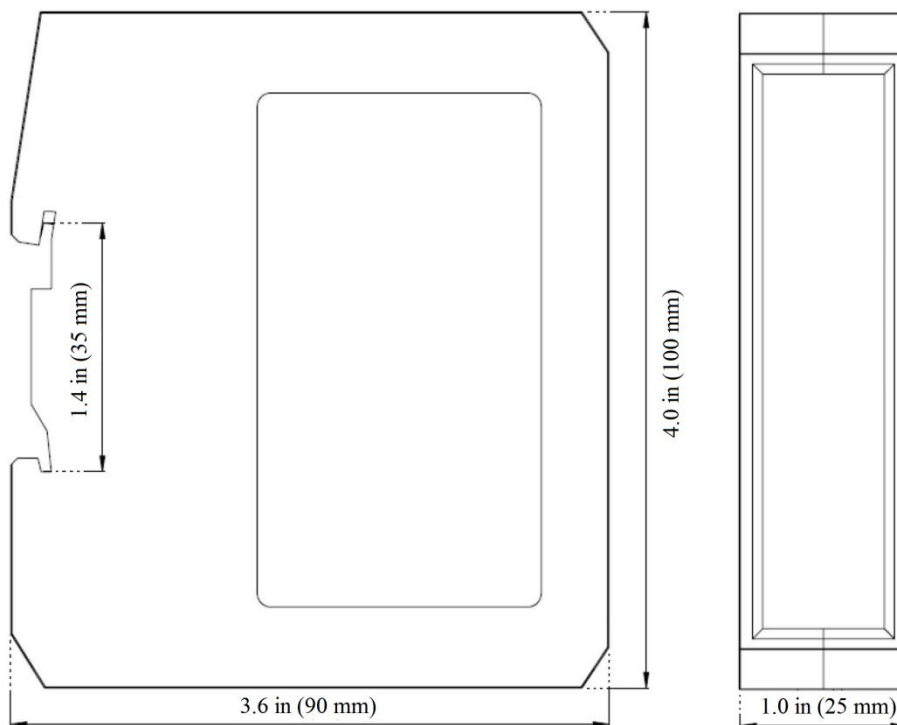
3.2 Installation Method

Using 1.4 in (35mm) DIN RAIL.

4 Quick Start Guide

4.1 Gateway Configuration

1 There are two modes: configuration mode and run mode. The gateway can enter different mode through DIP switch. Set "Function" bit of DIP switch to "on", the gateway is in the configuration mode, and turn off the "Function" bit, the gateway is in the run mode;

2 Power off the gateway, connect GT200-PN-CO and PC through Ethernet cable;

3 Power on, waiting network indicator of GT200-PN-CO to turn green blinking;

4 In the configuration mode, set CANopen baud rate, CANopen node ID, SDO commands (CANopen master mode), PDO commands and data mapping between CANopen and PROFINET IO through gateway configuration software SST-TC-CFG. (See Chapter 4.3 for details).

5 Click "Download" button on the toolbar to download the configuration to the gateway. When downloading configuration, it will prompt "Communication with PLC may be disconnected during downloading configuration";

6 Configure the modeling in STEP 7 or TIA Portal, including module, IP address of target device and device name;

7 Download the modeling configuration to the PLC;

8 Waiting for about 10s, GT200-PN-CO will establish PROFINET connection with the PLC.

Note: How to find out how many GT200-PN-CO devices are in the LAN, including MAC address, IP address and name of devices. Users can see Chapter 4.4 Change Device IP and Name for help.

Note: There are 3 necessary conditions which need to happen simultaneously when GT200-PN-CO is communicating with PLC:

    a)   The PROFINET device name must be the same as that of device in PLC modeling.

    b)   The PROFINET device IP address must be the same as that of device in PLC modeling.

    c)   The configuring module of PROFINET device (configuring through SST-TC-CFG) must be the same as that in PLC modeling.
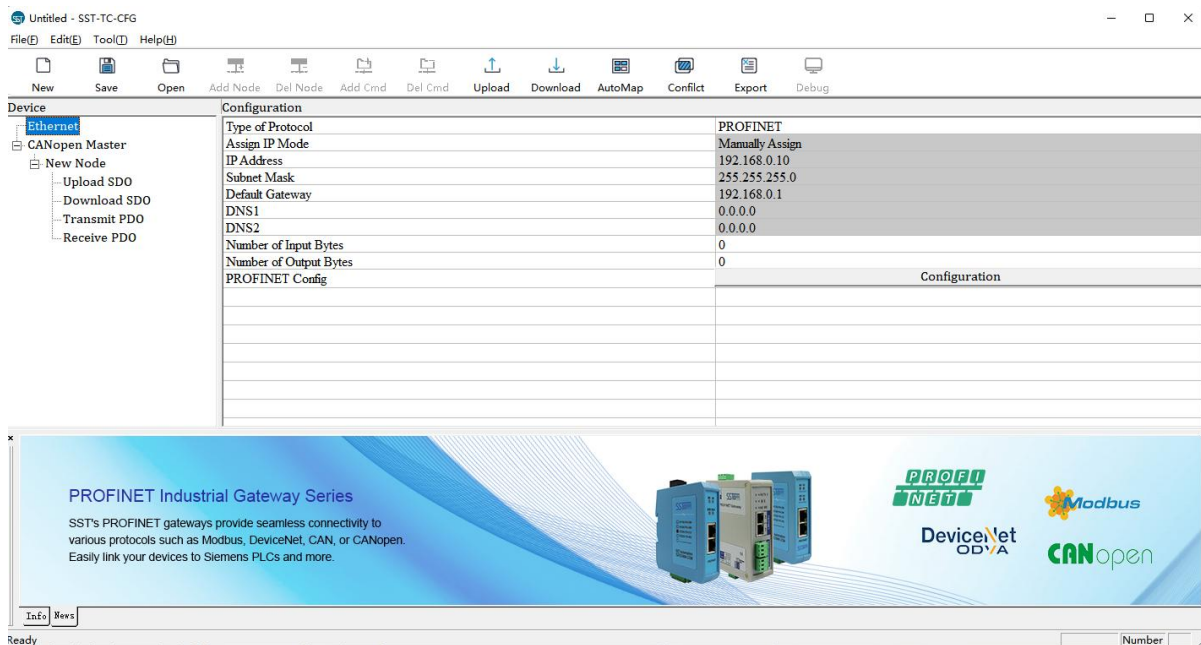
4.2 Software Configuration

Users need to install the gateway software SST-TC-CFG when configuring the gateway.

Users can use SST-TC-CFG to easily complete the configuration of GT200-PN-CO, including IP address, subnet mask, gateway address, device name, baud rate of CANopen port, node number, SDO number, PDO number, CANopen data To PROFINET data mapping, CAN protocol type, baud rate of CAN and protocol, and PROFINET data mapping.

After installation, double click the software icon to enter into the main interface of the software:


See for the detailed using method of the gateway configuration software SST-TC-CFG.

4.3 Run

The data conversion between PROFINET network and CANopne/CAN of GT200-PN-CO is established by "mapping". GT200-PN-CO has two data buffers, one is input buffer (384/128 bytes); the other is output buffer (384/128 bytes).

CANopen acts as a master

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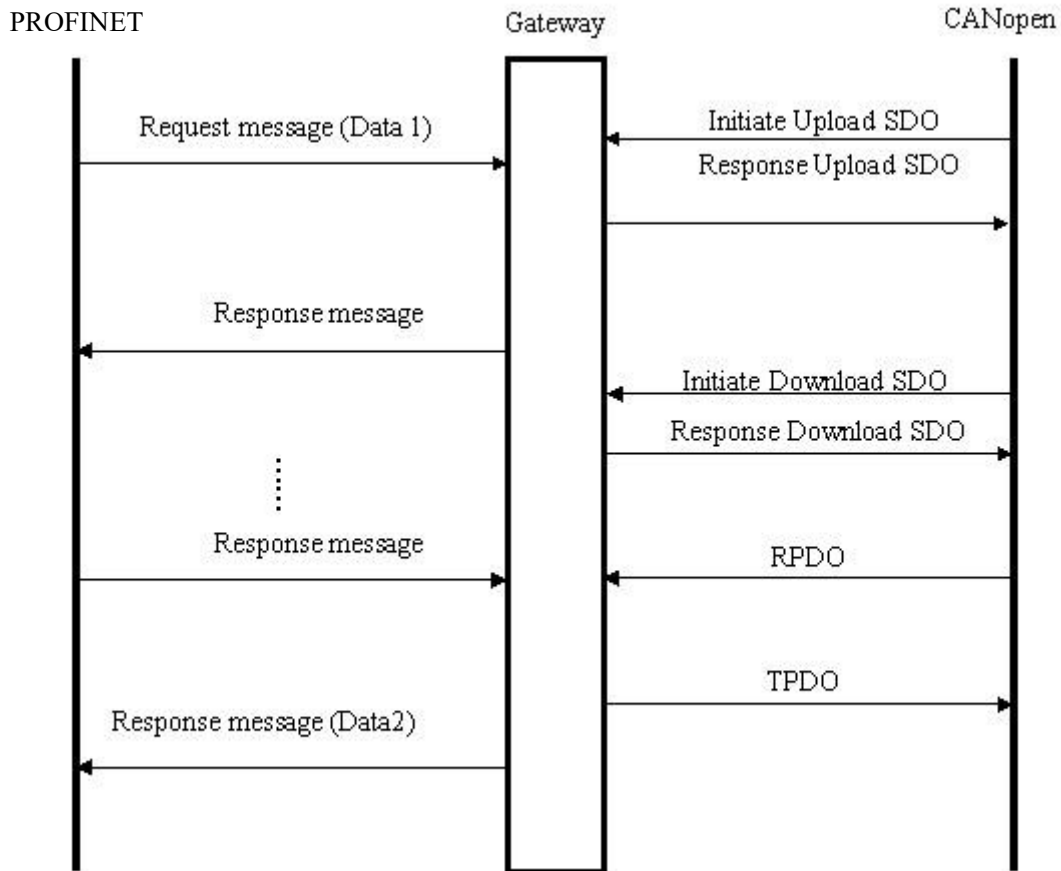
"Data 1" shows the data transfer process from PROFINET to CAN; "Data 2" shows the data transfer process from CAN to PROFINET.

The gateway runs in CANopen network independently, and transmits read/write commands of CANopen parameters periodically according object dictionary, also transmits and receives PDO commands. When receiving I/O request from PROFINET, the gateway will instantly respond with the latest CANopen data to realize the matching of network speed. This is what we called asynchronous mode.

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

The data in output buffer of GT200-PN-CO (PROFINET) is the data being mapped to RPDO or Download SDO commands of CANopen slave. Outputting mode of GT200-PN-CO is change of value, that is, until the PROFINET output data is changed, GT200-PN-CO transmits corresponding commands (RPDO or Download SDO) to CANopen network; For PROFINET input data, GT200-PN-CO receives data through TPDO or Upload SDO commands configured in the configuration software SST-TC-CFG and save the data to PROFINET input
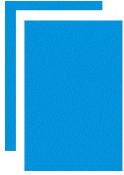
buffer.

When the "Control&Status" bit is "Enable" in configuration software (SST-TC-CFG), there are two bytes in the first of input and output buffer of GT200-PN-CO showing status of CANopen slaves and controlling status of CANopen slave.

The first two bytes of input buffer (PROFINET) shows the status of CANopen slaves. The first byte of this two bytes is address of CANopen slave and the second byte is status of CANopen slave (i.e. Pre-run status, run status, stop status, for detailed information, please refer to CANopen protocol). Only one slave status can be reflected at a certain time, GT200-PN-CO applies FIFO mechanism to save all status of every CANopen slave and output to PROFINET master in FIFO order.

The first two bytes of output buffer (PROFINET) is the status that PROFINET master controls CANopen slaves. The first byte of this two bytes is address of CANopen slave, the second byte 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).

CANopen acts as a slave

Communication mode between CANopen and PROFINET is asynchronous mode, as shown below:
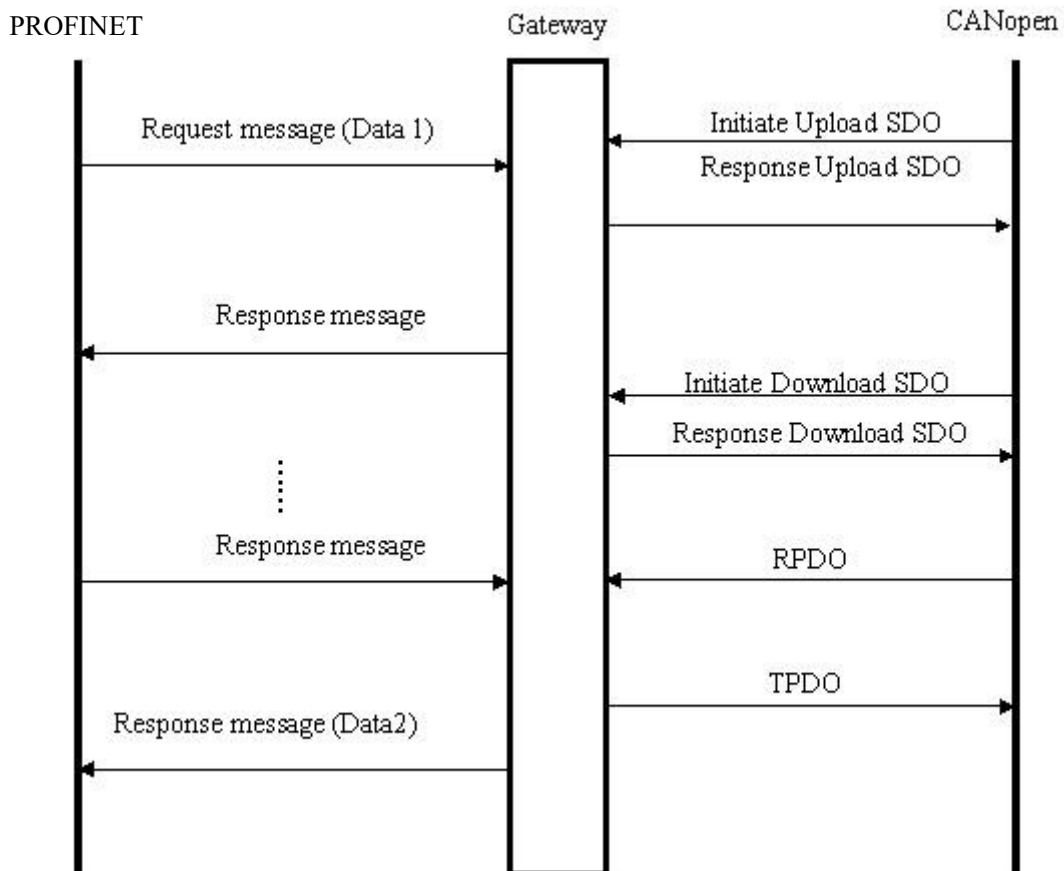
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TPDO and RPDO applies producer/consumer mode, and often be used in the occasion with high requirement about speed; Upload SDO and Download SDO applies client/server mode, the mode can guarantee safety of data, and often be used in the occasion with low requirement about speed.

CAN mode
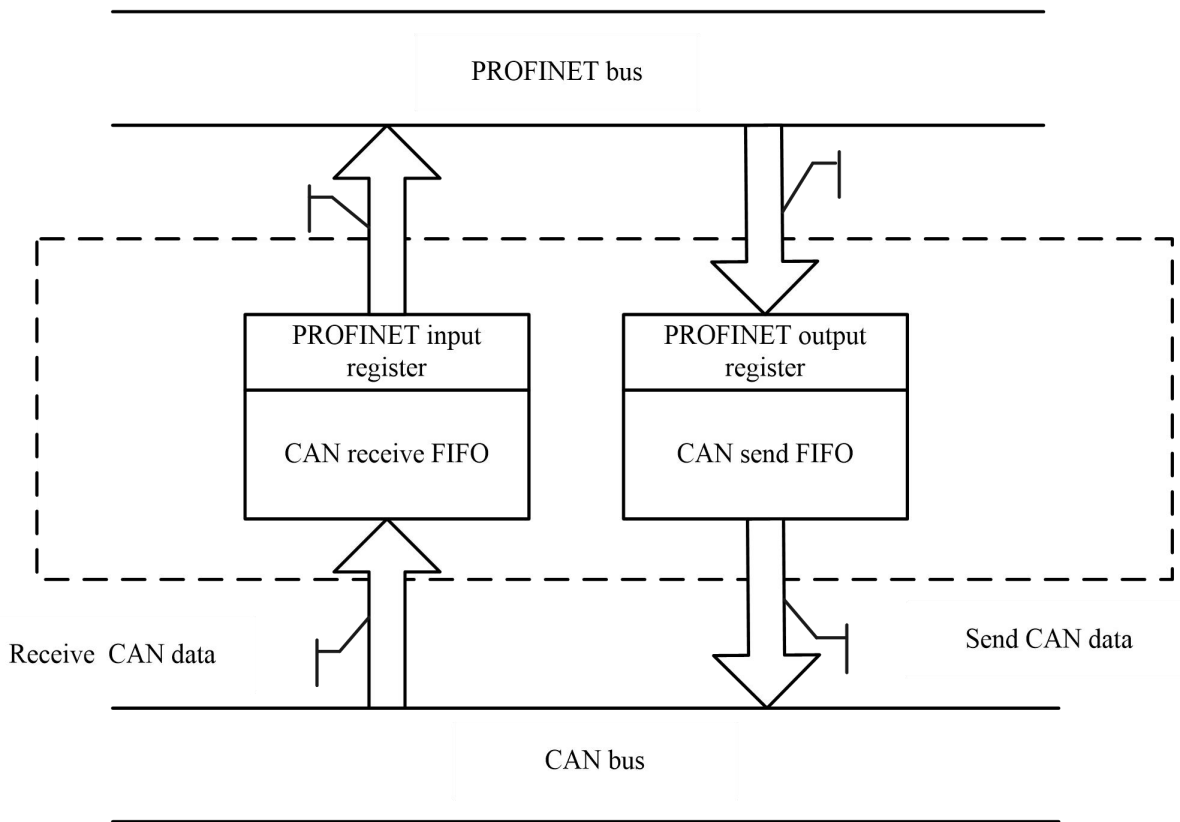
How to encapsulate 16 bytes into a CAN frame in PROFINET

➢   PROFINET input:

PROFINET inputs data (that is CAN side receives data). Each CAN frame in PROFINET must have a total of 16 bytes, otherwise it will return a PROFINET exception response.

Byte	0	1	2	3	4-7	8-15
Description	0xFF	Number of data contained in CAN frame	Sequence number	Reserved	Frame header and CAN frame	CAN frame data

If the GT200-PN-CO receives the CAN frame on the CAN network, the sequence number of the input frame is increased by 1. The customer can determine whether these CAN frames are needed according to their needs.

➢   PROFINET output:

PROFINET outputs data (sends CAN frame at CAN side). Each CAN frame in PROFINET must have a total of 16 bytes, otherwise it will return a PROFINET exception response.

Byte	0	1	2	3	4-7	8-15
Description	0xFF	Number of data contained in CAN frame	Sequence number	Reserved	Frame header and CAN frame	CAN frame data

➢ Byte definition description in PROFINET IO

1. Byte0 - Byte3 are control bytes

If the byte0 is zero, it means that the CAN frame of this sequence number is sent once; If the byte0 is not zero, it means that all CAN frames of this sequence number are sent periodically, The sending cycle is determined by the value of byte0, the sending cycle = the value of the byte0 * 10ms. For example, if the value of the byte0 is 10, the sending cycle is 100ms.

Byte 1, the number of data contained in the CAN frame, ranging from 0 to 8.

Byte 2, the sequence number. The initial value of the sequence number in the output frame is not zero. If it is single transmission mode, it must be increased by 1 every time a new frame is sent. In this way, the gateway treats this frame as a new single transmission data. The sequence number will become 0 if it reaches 255 and increase by 1. If the CAN frame is sent periodically, the sequence number may not be increased by 1.If you want to switch from single transmission mode to repeated transmission mode, the sequence number needs to be increased by 1, and the 0th byte is a non-zero value; if you want to switch from repeated transmission mode to single transmission mode, the sequence number needs to be increased 1, and the 0th byte is 0;

2. Byte4 - Byte7 are CAN frame header and CAN frame mode control (29bit CAN ID)

The format of the byte4 is as follows:

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Description	Reserved	RTR	Reserved	The highest 5 bits of the frame header				

Bit6 of the byte4: RTR. If RTR is 0, it means data frame, if it is 1, it means remote frame.

Bit0-Bit4 of the byte4, to the byte7, are the frame header of CAN2.0A/2.0B.

Byte5:

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Description	The second highest 8 bits of the frame header							

Byte6:

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Description	The second lowest 8 bits of the frame header							

Byte7:

Bit	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Description	The lowest 8 bits of the frame header							

PROFINET Slave

Presuming the input data length users have configured is N1, output data length is N2. GT200-PN-CO will periodically send the data within the address range of [0x0000, N1] to PROFINET network; When receiving data from PROFINET network, GT200-PN- CO will write the data to the address range of [0x0000, N2].

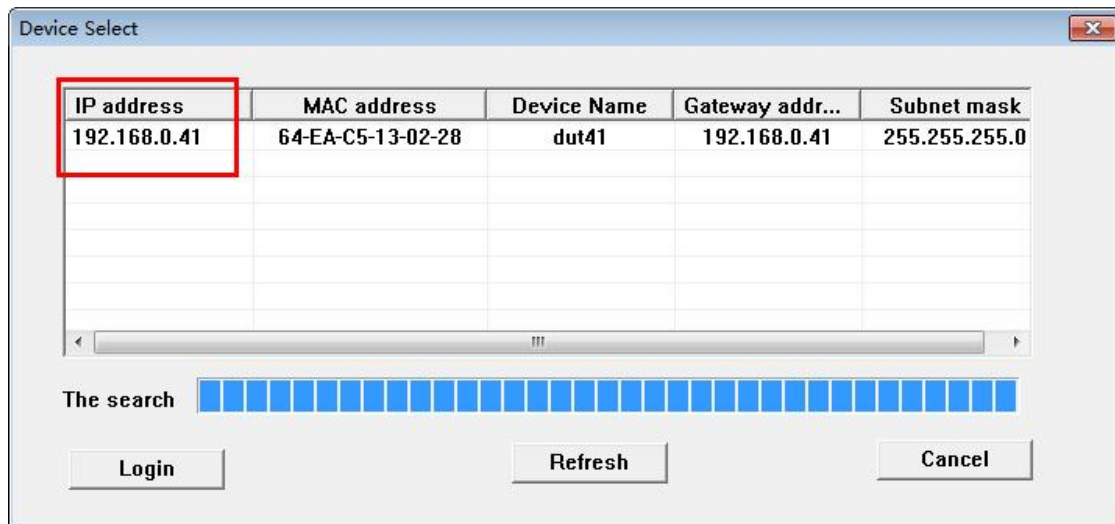# 4.4 Change Device IP and Name

4.4.1 Scan Devices on LAN

1. Open SST-TC-CFG, select "Tools" in the menu bar, as shown below
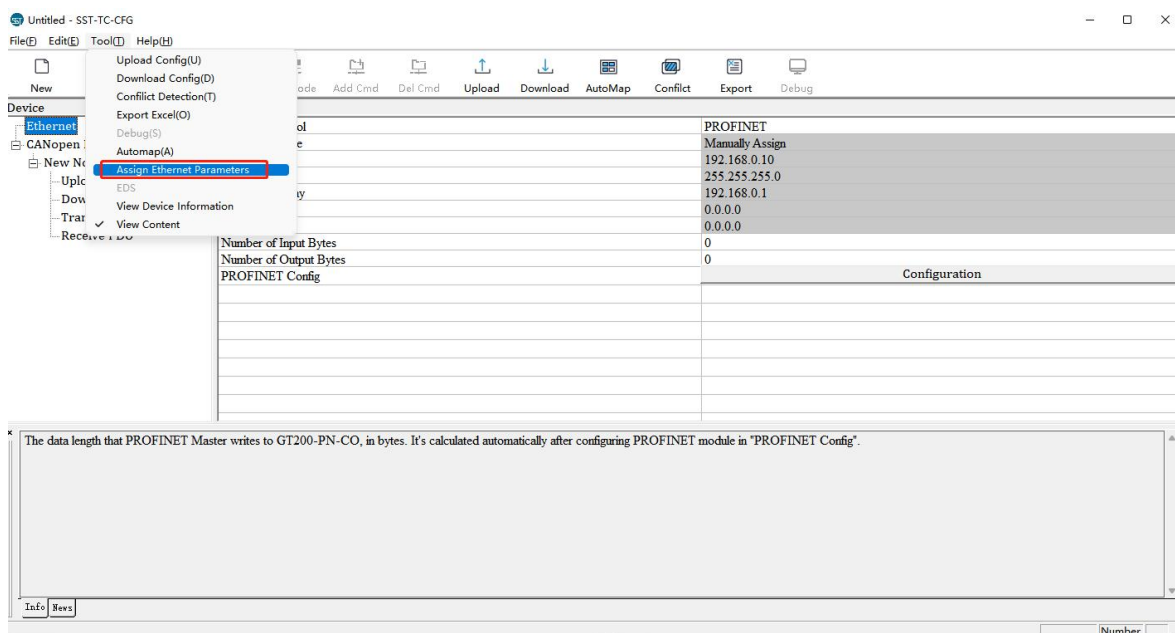
2. Click "Assign Ethernet Parameters", the following interface will appear

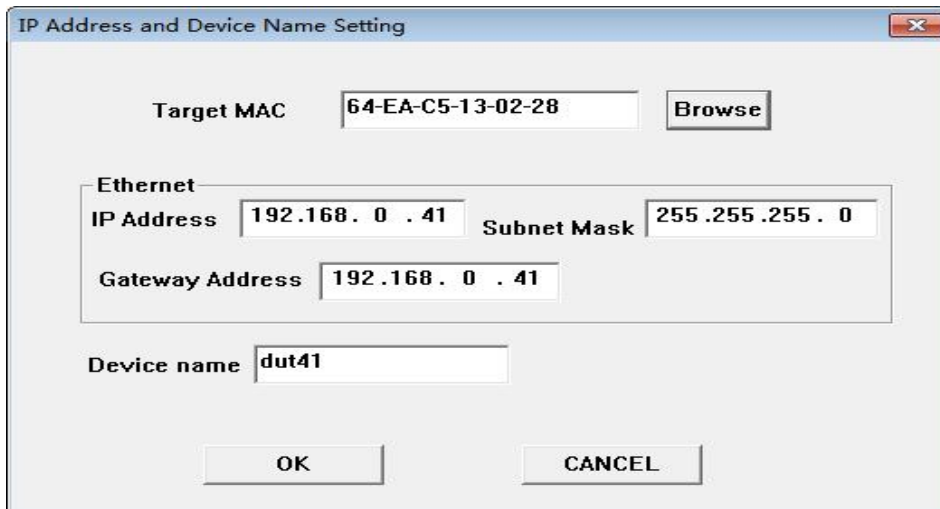3. Click "Browse" and a dialog box will be shown as below:

You can see that there is a device on the LAN, showing the it's "IP address", "MAC address", "Device Name", "Gateway address" and "subnet mask".

4.4.2 Change IP Info and Name

1. Follow the steps in 4.4.1 to search and log in, the interface displays as follows:
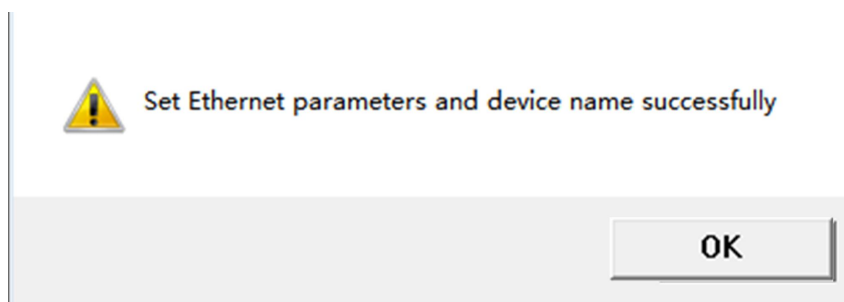
After logging in, the MAC address of the device will be displayed in the box on the right side of "Target MAC".

Modify IP address to "192.168.0.0.41", gateway address to "192.168.0.41", device name to "sst-100". The operation interface is as follows:
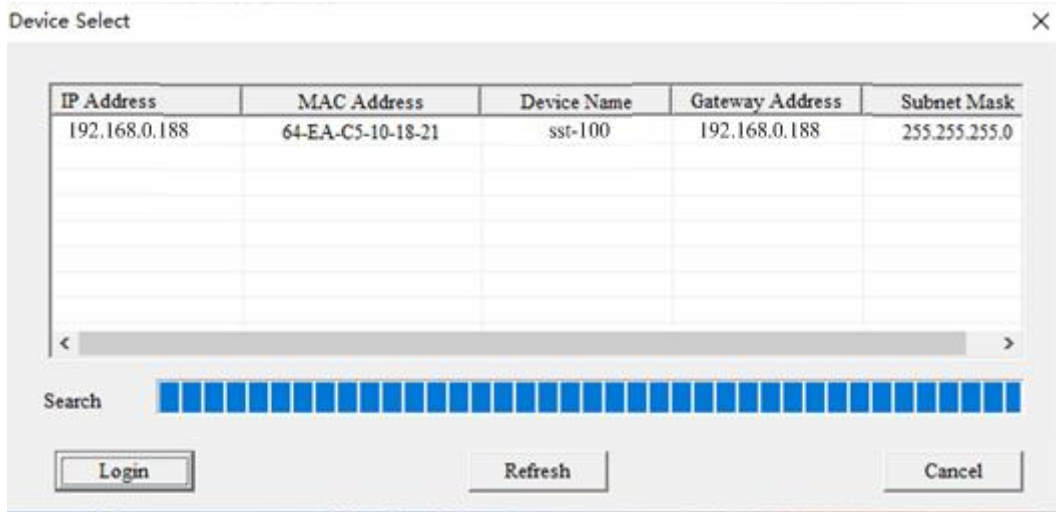

If the modification is successful, the following dialog box will appear：

Click "OK"

Click "Browse" again, as shown below:

You can see that the IP address of the device has been changed to "192.168.0.188" and the device name has been changed to "sst-100"

4.5 IP Address Conflict Resolution

According to the specification of PROFINET protocol, acting as a PROFINET slave, GT200-PN-CO must obey the rule that there can not be more than 1 PROFINET device which has the same IP address and Device name on the same LAN when connecting many GT200-PN-CO devices.

If the IP address and device name conflict, users can change IP address and device name of GT200-PN-CO according to Chapter "4.4.2 Change IP Info and Name" and make sure that other IP address and name are different (Notes: after changing is complete, some relevant changes should be taken in PLC modeling and users must ensure the IP address and name of GT200-PN-CO is the same with that of PLC modeling).

For example:

When IP address conflicts, the IP address, subnet mask and gateway address of GT200-PN-CO will be reset to "0.0.0.0". Now, users can not use "Upload" or "Download" to scan GT200-PN-CO and only use Chapter "4.4.1 Scan Devices on LAN" to scan the device, the scanning result is shown as below:
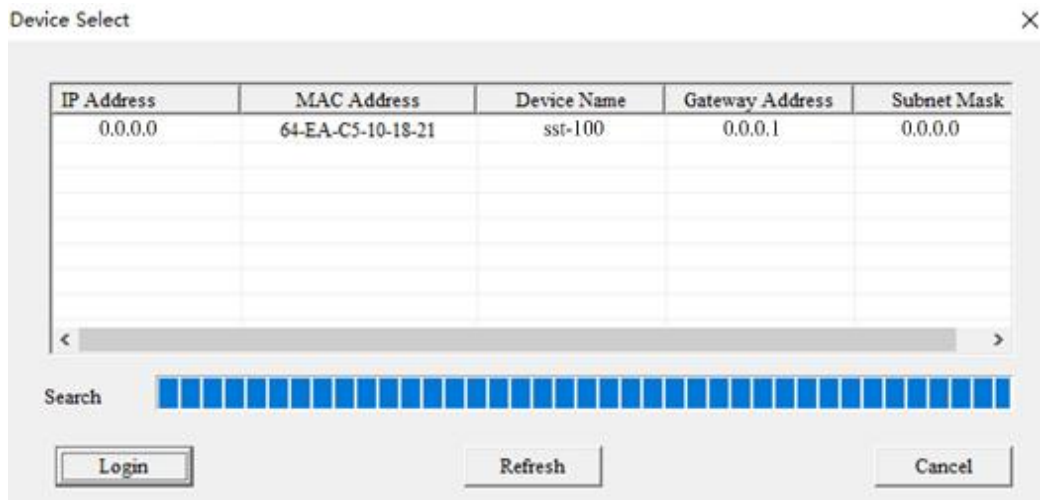
You can see the IP address is reset to "0.0.0.0", choose the device and log in, the dialog box is shown as below:

Set "IP", "Subnet" and "Gateway" to "192.168.0.18", "255.255.255.0" and "192.168.0.0" and you will see the below picture:

Click "OK".
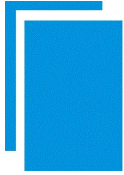
5 Software Instructions

SST-TC-CFG is the configuration software which can be used to configure GT200-PN-CO. It is based on

Windows OS. Download the software on www.sstautomation.com and run the setup program to begin the

installation. Please follow the prompts to install the software.

For detailed software content, please see "SST-TC-CFG Software Content". Or open the SST-TC-CFG, select

"Help" >> "Content" on the menu bar.